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# Antecedent of Brand Trust in Online Tertiary Education: A Malaysian and Singapore Perspective

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## Abstract

Trust decreases the perceived risk of using a service. Since online learners have no direct contact with the education providers, trust plays an important role in an online tertiary setting. However, there is a void of study of trust within the context of consumer-brand relation in tertiary education. In a review of the literature, hypotheses are developed that suggest that the antecedent of brand trust, operating as quality cues in online tertiary education are related to institutional and courseware design assurance factors, site (Web) quality and public awareness. A conceptual model summarizing the hypotheses is subsequently validated in an empirical study reported here.

**Keywords:** Online tertiary education, Quality cues, Brand trust

## 1. Introduction

Online tertiary education has not attracted as many students as had been expected in Singapore (Chung & Ellis 2003; Tan & Lambe 2002) and Malaysia (Alhabshi 2002). The main reason for the lack of enthusiasm in online learning in these two countries is the much preferred method of face-to-face teaching and learning. Although distance education has already taken root in both countries (as shown by the wide popularity of offshore degrees and twining programs), the quality of education via the electronic mode is in doubt. There is still a lack of confidence among students, parents and educators that education online could be an effective medium for imparting knowledge/skills.

In addition, the dramatic globalisation of the world economy over the last two decades has an impact on higher education. Where once universities competed for students, faculty and funds within a national context, today they compete internationally. The overall effect of this competition is an increasing variety of niche-oriented, multidisciplinary programs which are as attractive as possible to prospective students to increase enrolments (Stensaker 2005). Further, for many students today, their undergraduate degree is an investment that requires them or their families to incur debt before graduating (Moore 2004). With financial stakes increasing, even more importance is placed on the choice of university and transforms student from a passive participant to an active consumer who is paying for quality education that promises a better career prospect after graduation. However, there are varying degrees of attitude as to what actually constitutes quality in higher education by different groups of people (Barnett 1992; Bennett 2001).

Intrinsic and extrinsic cues are used to develop personal beliefs about a product's quality, and these beliefs in turn affect evaluation and choice (Kirmani & Zeithaml 1993). Intrinsic cues are inherent properties of the product and cannot be changed without altering the nature of the product itself (Zeithaml 1988). Within the context of online tertiary education, intrinsic cues would refer to the course programs characteristics or course contents. Extrinsic cues are product related but not part of the physical product (Kirmani & Zeithaml 1993). Price, brand name, level of advertising and warranty are examples of extrinsic cues to quality.

Despite the plethora of studies about tertiary education in the online mode, there is a void of study of trust as a quality cue within the context of consumer-brand relationship. This study addresses this void and aims to discover the antecedents of brand trust (operating as quality cues) in online tertiary education. Online tertiary education is defined as university's undergraduate and post-graduate education via the Web.

## 2. Conceptual model

Brand is commonly referred to as the name, term, design, symbol, or any other feature that identifies one seller's good/service as distinct from those of other sellers (Aaker 1996). Studies by Morgan and Hunt (1994), Fournier (1995) and Gurviez (1996) illustrate the importance of trust in developing a positive and favourable attitude, resulting in commitment to a certain brand in successful consumer-brand relationships. Consumer's trust in a brand contributes to a reduction of uncertainty in consumer purchases (Garbarino & Mark 1999; Gommans et al. 2001) and is believed to increase customer loyalty (Fullerton 2003; Narayandas & Rangan 2004). Since online learners have no direct contact with their education providers, trust plays an important role in this online tertiary setting.

Despite its importance, the concept of 'brand trust' has seldom been explicitly examined in education and consumer-brand literature. This is because diverse views in studying trust across difference disciplines have resulted

in various definitions, contributing to the lack of measurement consensus of the trust construct (Kramer 1999; Gefen et al. 2003; Delgado-Ballester & Munuera-Aleman 2001). For instance, economists view trust as either calculative (Williamson 1993) or institutional (Zucker 1986) while sociologists assess trust in terms of social relationships and social institutions (Granovetter 1985; Lewis & Weigert 1985). Psychologists define trust in terms of trustors and trustees and focus upon internal cognition (Deutsch 1962; Rotter 1967). Social psychologists consider trust as an expectation that is specific to a transaction and the person with whom one is transacting (Drawbaugh 2001; Johnson-George & Swap 1982). On the other hand, management and marketing strongly connote trust with the competence dimension of a relationship, that focuses on the belief that the partner has the required expertise to perform his/her activities, carry out his/her obligations or accomplish his/her promises (Mayer et al. 1995; Morgan & Hunt 1994). McKnight et al. (2002) argue that trust forms because of one's disposition to trust, one's institution-based trust, and cognitive processes of trusting intention and trusting beliefs. "Disposition to trust" refers to a tendency to be willing to depend on others. "Institution-based trust" means that one believes impersonal structures support one's likelihood for success in a given situation.

In the marketing literature, the term 'brand trust' is variously defined as the willingness of consumers (implies a propensity) to rely on the ability of the brand to perform its stated function (Chaudhuri & Holbrook 2001); as the confident expectations of the brand's reliability and intentions in situations entailing risk to the consumer (Delgado-Ballester & Munuera-Aleman 2001; Delgado-Ballester 2004) or simply described in terms of reliability and dependability (Dawar & Pillutla 2000). These definitions of brand trust suggest that an individual's propensity (a cognitive conscious inclination) to trust a brand's qualities or attributes is critical in consumer-brand relationships. This paper conceptualizes brand trust as an individual's propensity to place one's confidence in a brand's qualities or attributes in situations entailing risk to the consumer, and the following hypothesis is proposed:

*Hypothesis 1: Brand trust as a quality cue in online tertiary education is related to risk aversion, contingent on institutional assurance and courseware design factors.*

That is, the purchase of online tertiary education can be a risky venture because it involves costs and time to complete the course; the uncertainty that the course contents may not meet the skills/knowledge requirement of the student/society; and the lack of physical or human contact between the online learners and the education providers.

### *2.1 Institutional assurance factors*

Regular faculty evaluation and government recognition of online degrees (Chung & Ellis 2003) and course accreditation (Philips 2007) ensure the quality of online courses. This paper proposes that instructor quality (relevant qualification and motivated), and government recognition of online tertiary providers act as the institutional assurance attributes. Here, a motivated online instructor mean one having strong empathy with online learners (time-pressed, computing skills, sense of isolation). Given that strong research outputs are a common criteria for generating worldwide university ranking (Stensaker 2005), it is included as a institutional assurance factor as well.

### *2.2 Courseware design factors*

Lack of a minimum study period, low entry requirements and unspecified study materials are some of the characteristics of a 'certificate mill' (Philips 2007). A 'certificate mill' refers to the provision of education degrees for a fee. Previous academic records are deemed irrelevant by the 'certificate mill' and they promise a certificate (based on work experience) within 30 days after entry. In order to maintain trust in the online tertiary education system, this study proposes that courseware developed for online tertiary education must have certain minimum periods of study, and the same entry requirements and study materials as comparable classroom study.

*Hypothesis 2: Brand trust as a quality cue in online tertiary education is influenced by knowledge acquired through direct brand experience (website quality) and indirect brand experience (public awareness).*

According to Kania (2001), familiarity with a company or brand generates higher trust, unless a person has a negative perception of a brand. Similarly, a study undertaken by Cheskin Research & Studio Archetype (1999) also indicates a strong correlation between familiarity and trust. Brand familiarity is defined by Alba (1987) as the variable that reflects consumer's level of direct and indirect experiences with a product. Given that online tertiary education is a form of invisible purchase (no face-to-face contact with the providers) where the outcome of the purchase (satisfaction) can only be assessed after course completion, a users' positive experience (direct and indirect) with the brand is key in maintaining trust in this form of learning. This proposition is consistent with the argument that brand trust summarizes both the consumers' knowledge and experiences with the brand (Delgado-Ballester & Munuera-Aleman 2005; Garbarino & Johnson 1999).

### *2.3 Web site quality (direct brand experience)*

A brand experience is an individual's experience as she or he interacts with a brand (Landa 2006). Every interaction a person has with a brand contributes to his/her overall perception of the brand. This interaction ranges from visual

contact with a logo, newspaper advertisement, website, brochures to contacts with front-line staff of the brand (Berry 2000; Kaperefer 2004). Brand experience heightens individual's interest, loyalty and trust in a brand (Berry 2000; Delgado-Ballester et al. 2003; Landa 2006). This is because experience plays an important role in trust by making it possible to compare the realities of the firm with preconceived expectations (Mitchell et al. 1998). Since online learners have no direct human contact with the education providers, the only form of direct experience with an education brand is via the Web site. In fact, Web site quality is discussed as a main factor in engendering trust in the e-retailer (McKnight et al. 2002; Sharma 2007; Siau & Shen 2003).

Good structure/clarity of design, technical helpdesk and self-checking activities are influential factors in the market acceptance of online education (Chung & Ellis 2003). Site quality in this paper is taken to mean a well-designed web site that gives online learners up-to-date information (knowledge content), is easy to navigate, and shows necessary links to other relevant websites or provides an effective interaction with online learners.

#### *2.4 Public awareness (indirect brand experience)*

According to Chung and Ellis (2003), industry support (recognition of skills achieved), strong alumni network (mouth-to-mouth communication) and friends or family's opinions about online tertiary education are vital for its success. This paper intends to validate this argument in relation to brand trust.

### **3. Methodology**

#### *3.1 Questionnaire*

An interviewer assisted questionnaire where respondents rank the importance (as quality cues) in trusting online tertiary education with regards to institutional and course assurance factors, site quality and public awareness factors is utilized in this research. The questionnaire was pre-tested on a group of 20 Singapore and Malaysian students from the University of Otago, New Zealand. On average, it was found the questionnaire took between 10-15 minutes for the respondent to complete. The respondents were also asked for their opinion about the difficulty of completing the questionnaire. No problems were identified with understanding of the questions.

#### *3.2 Samplings*

The targeted sample was high school or junior colleges students. These students in their school uniforms are a common sight in the various shopping malls in these two countries. They are easy to identify and solicit responses from for the survey. To increase the randomness of this convenience sample, the malls were randomly selected in place and time over a two-week period. To ensure that all possible times were represented when students went to a mall, preliminary observations were taken to discover the time frame the mall had the largest concentration of students. The period from 1-6pm was observed to have greatest concentration of high school/junior college students in all randomly selected malls.

Interviewers were positioned at high foot traffic locations near mall entrances to intercept respondents. Interviewers used the number indicated by the minute hand of their watch to determine which person to intercept as they entered the mall. For example, if the minute hand was at two, then the second person entering the mall was approached to complete the questionnaire. If a student elected not to participate, the interviewer selected the next available person. Upon completion of each interview, the interviewer would check the minute hand on the watch to determine the next respondent. The number of interview rejections was approximately 10 percent. Eight hundred questionnaires were distributed between Singapore and Malaysia (Johore). Out of the 437 questionnaires returned, 210 were from Singapore and the balance from Malaysia. Survey respondents comprised 53% males and 47% females. The response data was normally distributed.

#### *3.3 Factorial validity and structural model test*

The 437 respondents, who completed the survey, met the primary requirements for factor analysis (i.e. 5:1 case/variable ratio, Coakes & Steed 2001). To test the fit of the data for factor analysis, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used. Tabachnick and Fidell (1996) recommend a correlation coefficient of at least 0.3, a KMO index of >0.6 and Bartlett's  $p < 0.5$  as appropriate for factor analysis. All four factor scales in the research hypothetical model were subjected to exploratory factor analysis using SPSS's Principal Component Analysis (PCA) using varimax rotation technique. PCA (varimax rotation) was initially chosen because of its ease of interpretation. For varimax, a simple solution means that each factor has a small number of large loadings and a large number of small loadings. This simplifies the interpretation because, after a varimax rotation, each original variable tends to be associated with one (or a small number) of factors, and each factor represents only a small number of variables (Pallant 2001)

All four factorial scales had a KMO index greater than 0.6 and Bartlett's  $p < 0.5$  indicating the fit of the data in these factor analysis. Factor analysis on all factor scales extracted one clear component each (Figure 1). Factor loadings ranged from 0.754 to 0.867 for the *course assurance* factor, from 0.798 to 0.825 for the *institutional*

assurance factor, and from 0.791 to 0.888 for the *site quality* (direct brand experience) factor. The *public awareness* factor (indirect brand experience) had loadings ranging from 0.806 to 0.893.

Structural Equation Modelling (SEM) using AMOS ver. 6.0 software on all factorial models showed that the discrepancy between the sample covariance matrix  $S$  and the population covariance matrix  $\Sigma(\theta)$  is minimal (that is,  $[S - \Sigma(\theta) = \text{minimum}]$ ). A structural model test (full model) on the 4-factor model used revealed a good-of-fit between the proposed model and the sample data (CMIN/DF=2.10, RMSEA=0.050, GFI= 0.962). A reliability test conducted showed good internal consistency with all factorial measurement scales (Cronbach's alpha > 0.7). These results confirmed that all the measurement scales used in the 4-factor model were statistically valid. The goodness-of-fit and reliability test statistics are presented in Figure 2.

#### 4. Findings and discussions

Homogeneity of variance tests between the samples from Singapore and Malaysia was not significant ( $p > .05$ ) for all variables. The t-value, degrees of freedom and two-tail tests of measured significance showed no significant differences apparent ( $p > .05$ ) between all measurement items. On this basis, there is not enough statistical evidence to reject the null hypothesis  $H_0: u_1 = u_2$  (means of the two groups are equal) at  $p = 0.05$ . Thus, no major differences between Singapore and Malaysia were found with all measurement variables.

##### 4.1 Institutional assurance factors and courseware design assurance factors

The SEM results (Figure 2) indicated that institutional assurance factors and courseware design assurance factors had regression weights of 0.88 and 0.64 respectively. The indicated importance of instructor's quality, university ranking and government recognition of online tertiary degree (institutional assurance factors) as quality cues could be interpreted as; a potential online graduate needing the assurance that their efforts and money spent with online tertiary education would be rewarded with public recognition; that quality instructors are available to encourage, mentor and motivate them to maintain their interest in their 'isolated' learning journey; and that the institution they enrolled in is highly regarded worldwide for its quality of teaching/research.

Similarly, the SEM model suggests the need of a minimum period of study, course entry requirements and study materials the same as classroom study (courseware design factors) used as quality cues could be interpreted as respondents viewing these factors as necessary to avoid falling into the 'certificate mill' trap. The importance of institutional and courseware design assurance factors suggest respondents try to reduce uncertainty (risks) of online tertiary education, since online education involves no direct staff contact. These research results support hypothesis one that brand trust as quality cue in online tertiary education is related to risk aversion, contingent on situational factor such as institutional assurance and courseware design.

##### 4.2 Site quality (regression weight=0.78) and public awareness factors

Site quality (regression weight=0.78) and public awareness factors (regression weight=0.71) also influence brand trust working as quality cues for online tertiary education. Thus, the hypothesis that brand trust act as a quality cue in online tertiary education and is influenced by knowledge acquired through direct brand experience (site quality) and indirect brand experience (public awareness) is also supported. This confirms McKnight et al. (2002), Sharma (2007) and Siau and Shen (2003) argument, that site quality is vital to engender trust in online commerce offerings. This study also replicates Chung and Ellis (2003) assertion that family and friend's opinions about an online degree; industry support in the form of employment and strong alumni network for word-of-mouth communication (public awareness) are also influential factors in the uptake of online tertiary education. This may be due to respondents being concerned that their investment in time consuming and costly education may be rejected by their community, if the education they undertake is not up to the quality expectations of their peers or society.

#### 5. Limitations and further research

There are several imitations with this study. First, the mall-intercept sampling design is more of a convenience than a probability sample (Murry et al. 1989; Zikmund 2000) although the large sample size ( $n=416$ ) improves its external validity. While this study tried to increase the randomness of the sample overall by randomly selecting the malls, and times to select the survey respondents, a comparison of the demographic variables collected in this research with a validation sample (collected in the same geographical areas) would be advisable to ensure the generalizability of the results to the resident population and to test the comparability and stability of the proposed hypothetical models (Hair et al. 1998; Spector 1992). However, a validation sample was not available for this study.

Second, by not focusing on a specific institution, the effect of an institution's micro environment (a university's perceived brand image, university's frontline staff service quality, corporate missions etc) and its brand positioning statement in relation to brand trust as quality cues in online tertiary purchase is unknown.

Finally, further research on the relationship between brand image, brand positioning statement and brand trust in online tertiary purchase is needed to provide insights of how brand affects student's decision-making process. For

the academic community, this is an area where little research has been done. For the university, research information on brand positioning is eagerly sought after, given the increasing pressure on universities to get fee-paying students to help fund itself (Göbbels-Dreyling 2003).

## 6. Conclusion

This study supports the argument that governmental support and industry collaboration are important for the propagation of online education. Brand trust as quality cues in online tertiary education is related to risk aversion (contingent on institutional and courseware design assurance factors) and knowledge acquired through direct brand experience and indirect brand experience.

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<p style="text-align: center;"><b>Component Matrix<sup>a</sup></b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th><th>Component 1</th></tr> </thead> <tbody> <tr> <td>Online instructor qualification</td><td>.825</td></tr> <tr> <td>Local government recognition of the overseas institution</td><td>.824</td></tr> <tr> <td>Online provider must have strong research output</td><td>.798</td></tr> </tbody> </table> <p>Extraction Method: Principal Component Analysis. a. 1 components extracted.</p> <p>a) Institutional assurance factors</p>		Component 1	Online instructor qualification	.825	Local government recognition of the overseas institution	.824	Online provider must have strong research output	.798	<p style="text-align: center;"><b>Component Matrix<sup>a</sup></b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th><th>Component 1</th></tr> </thead> <tbody> <tr> <td>Have minimum course period</td><td>.754</td></tr> <tr> <td>Same entry requirement as internal students</td><td>.866</td></tr> <tr> <td>Same learning materials as internal students</td><td>.867</td></tr> </tbody> </table> <p>Extraction Method: Principal Component Analysis. a. 1 components extracted.</p> <p>b) Courseware design factors</p>		Component 1	Have minimum course period	.754	Same entry requirement as internal students	.866	Same learning materials as internal students	.867
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	Component 1																
ease of navigation	.888																
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Figure 1. Factor analysis component scores from the 4-factor scale used in the proposed model

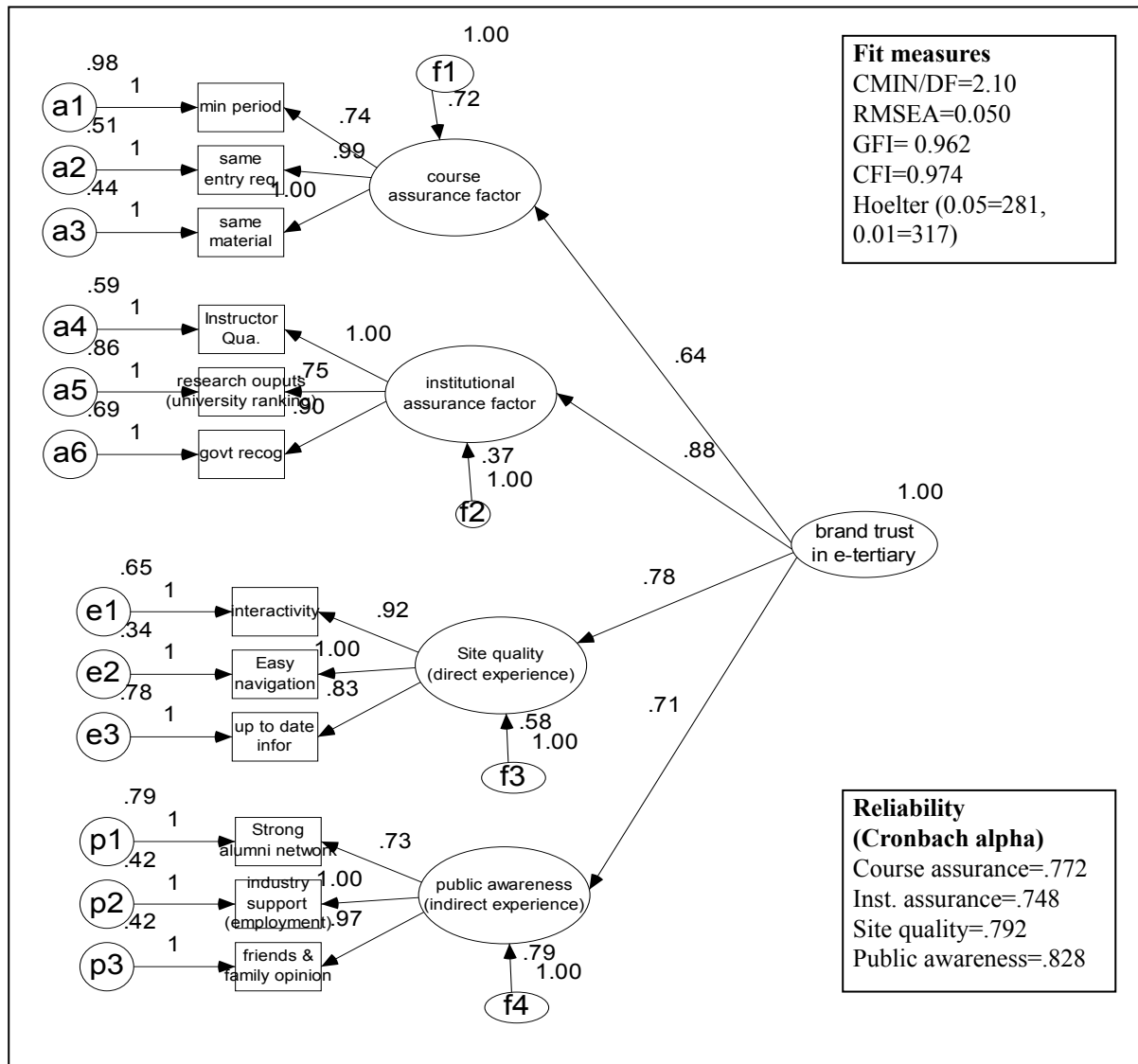


Figure 2. SEM statistics (unstandardised) of the proposed model

# An AATP Model Based on CTP for Two-stage Production System

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## Abstract

To realize that enterprise can quickly respond customer orders and ensure the reliability and optimization of the promise, in this article, we put forward a model of AATP (Allocated Available to Promise) based on CTP (Capacity to Promise). Aiming at some disadvantages in the quick response of order and comprehensive optimization, this model allocate future capacity to forecasted demands through considering market forecasted demands and comprehensively thinking over some restrictions such as enterprise object, material supply and capacity. The model establishes AATP for customer sales representative and offers the material requirement plan and the capacity requirement plan to ensure order promise. This model can support quick, reliable and optimized order promise decisions and realize synchronized procurement, production and sale for the enterprise.

**Keywords:** Capable to promise (CTP), Allocated available to promise (AATP), Two-stage production

## 1. Introduction

The economic globalization and the development of e-business make customer can select suppliers in the whole world with lower costs, and place order on the internet and require real-time response of the order form. If enterprises can not quickly respond customers' order, they may lose customers, and if enterprises can not deliver the goods in time, it will influence customers' loyalty, which also may lose customers (Stadtler, 2005, p.575-588). Therefore, the ability which can quickly respond customers' orders is the basic premise to acquire the core competition for enterprises. The order promise function connects with front-end customer demand management and back-end production and logistical system, offers ATP (Available to Promise) to synchronize procurement, production, distribution and sales, ensures enterprise can effective deploy supply chain capacity according to customers' demands, and offers powerful decision support to quickly respond order and realize profits.

In the mode of MTS (Make to Stock), the finished product inventory and the part that has not promised to customers in production plan are taken as ATP (Blackstone, 1998). With the transformation of production mode from MTS to MTO (Make to Order), researchers extend ATP and put forward CTP (Capacity to Promise) and AATP (Allocated Available to Promise). The former means to take the capability of material supply, production resource and transportation resource as the proof of order promise. And the later means to allocate planned promise capacity for different customers and products in advance. Taylor and Plenert put forward an approach for calculate ATP called as FCP (Finite Capacity Promising) (Taylor, 1999, p.50-56). The method of FCP supports a continuous monitoring of the resource capacity over the scheduled horizon and accordingly figure out the order due date. Jeong et al develop an ATP model for compute the promised delivery date and the unused capacity at shop floor level, and develop a heuristic algorithm which allocates customers' orders to unused capacity according to the customer specific due dates (Jeong, 2002, p.191-212). Xiong et al present a decision support system approach to compute ATP. They develop a heuristic approach to respond one specific order enquiry and several at a time, respectively (Xiong, 2006, p.332-346). Zhao et al take the Toshiba electric product supply chain as the application case, supported the ATP system though mixed integer programming model as viewed from the resource allocation, and made promise for all orders that arrive within a pre-determined batching interval and offered advices for production plans (Zhao, 2005, p.65-85).

Above articles mainly study the problem to establish demand allocation plan after actual orders arrive, but because arrived orders are just one part of demands, so the established ATP is just the local optimized plan. Though demand allocation plan can be established based on batching orders, so the plan can be improved to some extent, but some problems such as overlong order response time occur.

In this article, we take the order promise of two-stage production system as the research object, comprehensively consider constraints such as enterprise strategy, material supply, production resource and market demand, study the mapping model from low layer resources (material and production resources) to high layer resources (products), and offer decision supports for real-time order responses.

## 2. Description of the problem

According to the definition of ATP from APICS (American Production and Inventory Control Society), Customer

sale representatives process customers' orders and inquire whether the finished product inventory can fulfill the demands of order, and if the condition is fulfilled, so they accept the order, or else, inquire whether the main production schedule can fulfill the demands of order, and if the condition is fulfilled, so they accept the order, or else, they should compute CTP cooperating with production planning department, and if the capacity can fulfill the demands, they accept the order, or else, they will reject this order requirement. It is obvious that the order promise process mainly includes finished product inventory inquiry, main production schedule inquiry and CTP, and the computation of former two activities is mainly to inquire database, which is comparatively simple.

Under the strategy of MTS, enterprises arrange production according to plans, and the finished product inventory and main production schedule are fit to be as the reference of order promise. However, the enterprise adopting the strategy of MTO has no finished product inventory, and the main production schedule can not effectively support the order promise decision because the horizon of main production schedule has long time span, the planned objects are generally product variety, and the demand of customer order usually acquire appointed product and deliver time. Through analysis, we can see that MTO enterprises have three disadvantages to implement above order flow. First, because to compute CTP we need firstly acquiring the data of material availability (including raw material inventory, scheduled receipts, supply situation of suppliers, and work in process), resource availability (including resource capacity, load and so on), and order requirement information, but these information may be distributed in some departments such as sales, material planning and production site, so it has certain difficulties to exactly obtain these information, if we recollect all relative information to compute CTP when we accept an order, even the economy can not be feasible. Second, because arrived orders are only one part of requirements, so to allocate demands without the consideration of future order will make the plan of ATP has no comprehensive optimization. At last, this promise mode is to allocate order demands according to the strategy of FCFS (First Come First Serve), i.e. all orders enjoy same treatment without differences of order profit, customer importance, and though this strategy represents certain justice, but its results will induce decreases of profit margin, customer relationship and other performance levels.

Therefore, Dell and other enterprises have set up their order promise flow fit for their own enterprise production characters. Dell divides customers into three sorts including Transaction, Relationship and International Customer, and every big sort has smaller classification. The Relationship customers means middle and large sized enterprises which will purchase over millions dollars' products from Dell, and the sales profits from these enterprises are higher, and are the most important source of the whole profits of Dell. Dell adopts different demand allocation strategies for different types of customer. Dell takes the Relationship customers as its emphasis, which makes the sale from these customers enhanced from 50% of total sale in 1992 to 70% in 1997, and makes the Dell obtain compelling developments (Kraemer, 2000, p.5-21).

In this article, we establish the order promise mode shown in Figure 1 according to the order promise flow of Dell, which is called as AATP based on CTP. This mode decides quantum for various customers or products in advance, and when customer's order arrives, the customer sale representatives can quickly respond the customer order through the inquiry of AATP. The capacity promise computation in Figure 2 includes the AATP model base on CTP and algorithm engine, and under the triggers of time point or event, information such as enterprise strategy, product structure (including bill of material and product process route), factory structure (including production, transportation and various resources), capacity load (including released orders, planned orders receipts and equipment maintenance), material availability (including raw material inventory, scheduled receipts, supply restriction, work in process), predictive demands and confirmed orders will be updated to the AATP model based on CTP, and the algorithm engine will reallocate demands and educe AATP. Under the condition considering future demands, to implement order promise, the AATP model based on CTP will help to realize capacity optimization deployment, enhance customer service level and enterprise profitable aim for the enterprise. It's worth mentioning that when making order promise decisions, the material supply and production resources have been confirmed, so we can consider more details in the AATP model based on CTP, which is different with inventory plan models. In the following text, we take the two-stage production system as the object, and establish the AATP mathematical programming model based on CTP.

### **3. AATP model based on CTP**

#### *3.1 Hypothesis of the model*

(1) The system structure and flow of two-stage production are seen in Figure 2, which is composed by some assembly lines and some shop floors, produces various products, and completes the final assembly works on the assembly line. Components composing final products partly come from various shop floors, and others are outsourcing. All parts to produce component in the plant come from outsourcing.

(2) When adopting the strategy of MTO, the situation that produce stock goods beforehand in finished products will

not happen, and the subassembly can produce stock goods in advance.

(3) The purchase of material considers lead time, and has constraints of the least and the most purchase quantity.

(4) The production lead time of component and finished product should be considered. The production of components and finished products need occupying the capacity of shop floors or assembly lines.

(5) The transportation time from shop floors to assembly line will be ignored.

(6) The happening time points of the  $t$ 'th material requirement and the  $t$ 'th scheduled receipts are all at the beginning of the  $t$ 'th period. The  $t$ 'th finished product predictive demands and order requirements are fulfilled at the end of the  $t$ 'th period. The happening time points of planned order receipts in the  $t$ 'th period are all at the end of the  $t$ 'th period.

### 3.2 Mathematic model

#### 3.2.1 Model suffix set and suffixes

FNL: finished products.

CMP: components.

PRT: parts.

ITM: including all materials such as finished products, components and parts.

OUT: the components and part from outsourcing.

The suffix " $p, q \in \text{ITM}$ " denotes materials, and in specific situation, which means finished products FNL, components CMP, parts PRT or members of OUT.

FAB: shop floor.

MRG: assembly line.

PRD: all production units including FAB and MRG.

RES: machine tool and other production resources.

The suffix " $f \in \text{PRD}$ " denotes production unit, and in specific situation, which means members of FAB or MRG, and the suffix  $o \in \text{RES}$ .

DUR: planned period. The  $|\text{DUR}|$  denotes the total of planned periods.

The suffix " $t \in \text{DUR}$ " denotes the  $t$ 'th period in the plan.

#### 3.2.2 Model parameters

PRC<sub>p</sub>: the sales price of the finished product  $p$ .

HLDP: the inventory holding cost of unit quantity material  $p$  in unit time.

REQ1<sub>q,p</sub>: the quantity of component  $p$  needed to assemble unit finished products  $q$ .

REQ2<sub>q,p</sub>: the quantity of part  $p$  needed to produce unit component  $q$ .

LT<sub>f,p</sub>: the lead time to produce products or subassembly  $p$  in the production unit  $f$ .

BLT<sub>p</sub>: the purchasing lead time for outsourcing  $p$ .

RCPP<sub>p,t</sub>: the quantity of outsourcing  $p$  planned in the beginning of the  $t$ 'th period.

FAB\_CMP<sub>f,p</sub>: if it is in existence, so the component  $p$  can be produced by the shop floor  $f$ .

MRG\_FNL<sub>f,p</sub>: if it is in existence, so the product  $p$  can be produced by the assembly line  $p$ .

CAP<sub>f,o</sub>, RHO<sub>f,o</sub>, CCAP<sub>f,o</sub>: they respectively denote the production capacity, utilization rate and using cost of resource  $o$  in the production unit  $f$ .

PCAP<sub>f,o,t</sub>: load of the resource  $o$  in the production unite  $f$  during the  $t$ 'th period.

USGE<sub>f,o,p,m</sub>: the quality of the resource  $o$  in the production unit  $f$  needed to produce the unit product or component  $p$  during the  $t$ 'th period.

LLVL<sub>p</sub>, ULVL<sub>p</sub>: they respectively denote safety inventory and maximum inventory of part and component.

MINBUY<sub>p</sub>, MAXBUY<sub>p</sub>, CBUY<sub>p</sub>: they respectively denote the minimum purchase batch, the maximum purchase batch and the purchase price of unit quantity.

DEMP<sub>t</sub>, ORD<sub>p,t</sub>: they respectively denote the predictive demand quantity and confirmed order quantity of the finished product  $p$  during the  $t$ 'th period.

## 3.2.3 Decision variables

$atp_{p,t}$ : the ATP of the finished product  $p$  in the  $t$ 'th period.

$prod_{f,p,t}$ : the quantity of the product or component  $p$  planned by the production unit  $f$  in the  $t$ 'th period.

$inv_{p,t}$ : the inventory quantity of the material  $p$  in the initial of the  $t$ 'th period.

$buy_{p,t}$ : the purchase quantity of the outsourcing  $p$  in the initial of the  $t$ 'th period.

$ibuy_{p,t}$ : whether purchase  $p$  during the  $t$ 'th period, and it is a binary variable, 1 represents true and 0 represents false.

$rsu_{f,o,t}$ : the capacity of the resource  $o$  in the production unit  $f$  planned to be used in the  $t$ 'th period.

## 3.2.4 Objective function

The model takes the maximum profits as its aim, i.e.

$$\begin{aligned} \text{Max} \sum_{t \in DUR} ( & \sum_{p \in FNL} PRC_p atp_{p,t} - \sum_{p \in OUT} CBUY_p buy_{p,t} - \\ & \sum_{p \in ITM} HLD_p inv_{p,t} - \sum_{f \in PRD} \sum_{o \in RES} CCAP_{f,o} rsu_{f,o,t} ) \end{aligned} \quad (1)$$

## 3.2.5 Constraints equation

(1) The demand constraint of finished products: the ATP should fulfill the confirmed order quantity at least, and shouldn't exceed the predictive demand quantity.

$$\forall p \in FNL, \forall t \in DUR: ORD_{p,t} \leq atp_{p,t} \leq DEM_{p,t} \quad (2)$$

(2) Balance constraint of ATP: the ATP equals to the sum of planned output of all production units.

$$\forall p \in FNL, t \in DUR: atp_{p,t} = \sum_{f \in MRG} prod_{f,p,t} \quad (3)$$

(3) Balance constraint of part inventory: begin inventory + scheduled receipts + purchase quantity – wastage = end inventory.

$$\begin{aligned} & \forall p \in PRT, t < |DUR|: \\ & inv_{p,t} + RCP_{p,t} + buy_{p,t} - \sum_{f \in FAB} \sum_{q \in CMP} REQ2_{q,p} prod_{f,q,t+LT_{fq}-1} = inv_{p,t+1} \end{aligned} \quad (4)$$

(4) Balance constraint of component inventory: begin inventory + scheduled receipts + purchase quantity – wastage = end inventory.

$$\begin{aligned} & \forall p \in CMP, \forall t < |DUR|: \\ & inv_{p,t} + RCP_{p,t} + buy_{p,t} + \sum_{f \in FAB} prod_{f,p,t} - \\ & \sum_{f \in MRG} \sum_{q \in FNL} REQ1_{q,p} prod_{f,q,t+LT_{fq}-1} = inv_{p,t+1} \end{aligned} \quad (5)$$

(5) Component demand constraint: begin inventory + scheduled receipts + purchase quantity  $\geq$  wastage.

$$\begin{aligned} & \forall p \in CMP, t \in DUR: \\ & inv_{p,t} + RCP_{p,t} + buy_{p,t} - \sum_{f \in MRG} \sum_{q \in FNL} REQ1_{q,p} prod_{f,q,t+LT_{fq}-1} \geq 0 \end{aligned} \quad (6)$$

(6) The constraint of outsourcing lead time.

$$\forall p \in OUT, t < BLT(p): buy_{p,t} = 0 \quad (7)$$

(7) Purchase quantity constraint of outsourcing: the purchase quantity should fulfill the minimum and maximum purchase batch.

$$\begin{aligned} & \forall p \in OUT, \forall t \in DUR: \\ & ibuy_{p,t} \in \{0,1\} \\ & ibuy_{p,t} \leq buy_{p,t} \\ & ibuy_{p,t} MINBUY_p \leq buy_{p,t} \leq ibuy_{p,t} MAXBUY_p \end{aligned} \quad (8)$$

(8) Inventory capacity constraints: it needs the inventory is in the upper limit and the lower limit.

$$\forall p \in PRT \cup CMP, \forall t \in DUR: LLVL_p \leq inv_{p,t} \leq ULVL_p \quad (9)$$

$$\begin{aligned} & \forall p \in PRT, t \in DUR: \\ & LLVL_p \leq inv_{p,t} + RCP_{p,t} + buy_{p,t} - \sum_{f \in FAB} \sum_{q \in CMP} REQ_{q,p} prod_{f,q,t+LT_{fq}-1} \leq ULVL_p \end{aligned} \quad (10)$$

$$\begin{aligned} & \forall p \in PRT, \forall t \in DUR: \\ & LLVL_p \leq inv_{p,t} + RCP_{p,t} + buy_{p,t} + \sum_{f \in FAB} prod_{f,p,t} - \\ & \sum_{f \in MRG} \sum_{q \in FNL} REQ_{q,p} prod_{f,q,t+LT_{fq}-1} \leq ULVL_p \end{aligned} \quad (11)$$

(9) Lead time constraint of component production.

$$\forall f \in FAB, \forall p \in CMP, t < LT(f, p): prod_{f,p,t} = 0 \quad (12)$$

(10) Balance constraint of resource capacity.

$$\begin{aligned} & \forall f \in PRDS, \forall o \in RES, \forall t \in DUR: \\ & \sum_{p \in CMP \cup FNL} \sum_{m=1}^{LT(f,p)} USGE_{f,o,p,m} prod_{f,p,t+LT_{fp}-m+1} = rsu_{f,o,t} \end{aligned} \quad (13)$$

(11) Upper limit constraint of resource capacity.

$$\forall f \in PRD, \forall o \in RES, \forall t \in DUR: rsu_{f,o,t} \leq RHO_{f,o} CAP_{f,o} - PCAP_{f,o,t} \quad (14)$$

(12) Non-negative constraint.

$$\forall f \in PRD, \forall p \in CMP \cup FNL, \forall t \in DUR: prod_{f,p,t} \geq 0 \quad (15)$$

### 3.3 Model explanation

Model hypothesis: profits = sale – (purchase cost of material + inventory holding cost + using cost of production resource), and take the maximum profit as the object.

The constraint equation (8) introduces the variable  $ibuy_{p,t} \in \{0,1\}$ , so the model is the mixed integer programming problem. Most constraint equations in the model are obvious and have certain explanations, and we only simply explain the resource capacity balance constraint. Supposed that the lead time of the product p in the production unit f is  $LT_{fp}$ , so when the product p with unit quantity is in the m'th of production process ( $1 \leq m \leq LT_{fp}$ ), it needs occupying the quantity of the production resource o,  $USGE_{f,o,p,m}$ , and because in the t'th period of the plan, the product p in the m'th period will be produced, so the in the t'th period the quantity that this batch of product occupies the resource o is  $USGE_{f,o,p,m} \times prod_{f,p,t+LT_{fp}-m+1}$ , so we can educe the balance restriction equation of resource ability (13).

### 4. Application of the model

The AATP optimized model based on CTP under the strategy of MTO in this article has the ability to map the lower layer resources to the higher layer resources, and if we extend this model a little, it will solve many applied problems. For example, if defining the finished product in the model as the product that certain customer demands, so the computation results of the model can allocate ATP among different customers, and if taking the actual sales price subtracting non-key material stock costs and the manufacturing cost of non-key resource as the sales price in the model, so this model can be used to make the AATP plan only aiming at key material and key resources. Because this model takes the maximum profits as its aim, the phenomenon that the planned distribution quantity  $atp_{p,t}$  may be smaller may occur in the computation results, which will induce lower customer service level. We define the demand fulfillment rate of the product p.

$$s_p = \sum_{t \in DUR} atp_{p,t} / DEM_{p,t} \quad (18)$$

Add the constraint  $s_p \geq SRVC\_LVL_p$  in the model, so the demand fulfillment rate of the product p should exceed the requirement of  $SRVC\_LVL_p$ . Similar methods also can be used to balance line loads. Replace the making units such as shop floor and assembly lines in this model by the making unit in the global supply chain environment, and consider the transportation resource constraint, this model can offer decision supports for the order promise in the network environment of global supply chain.

Furthermore, when every period ends, through updating order data, demand prediction, material supply, inventory strategy, load, scheduled receipts and other information, reallocate the AATP of the next period, this model can implement rolling plans.



## 5. Conclusions and expectation

In this article, we establish an example of AATP based on CTP. In the example, three assembly lines and two shop floors compose the two-stage production system, produce four sorts of product, and compute the ATP in six periods. The model is developed through the optimized software Dash Xpress. The computation results show the AATP, planned production of various production unites, material requirement plan and capacity requirement plan of four sorts of products. Comparing with other order promise methods, the AATP model based on CTP can quickly respond customer orders and ensure the reliability and optimization of promise plan, and can identify outsourcing bottleneck through the material requirement plan, and identify the resource bottleneck through the capacity requirement plan.

However, in the actual applications of enterprises to support order promise decisions, following aspects should be noticed and studied. First, the product variety involved in actual enterprises may be thousands of sorts, and the demand prediction may be more complex, and the precise of demand prediction will influence the effects of this model to a large extent, so it is necessary to study the demand prediction problem under numerous products. Second, actual products have complex structures, the materials composed the product has ten thousands of sorts, and the manufacturing process has hundreds of procedures, which makes this model become the large scale optimization problem. So we should find out the solution technology for the large scale optimization problem. Third, this model needs acquiring relative information from the cooperative systems, and these cooperative systems are always heterogeneous, so it is a valuable study direction to acquire model input information from heterogeneous systems conveniently and timely.

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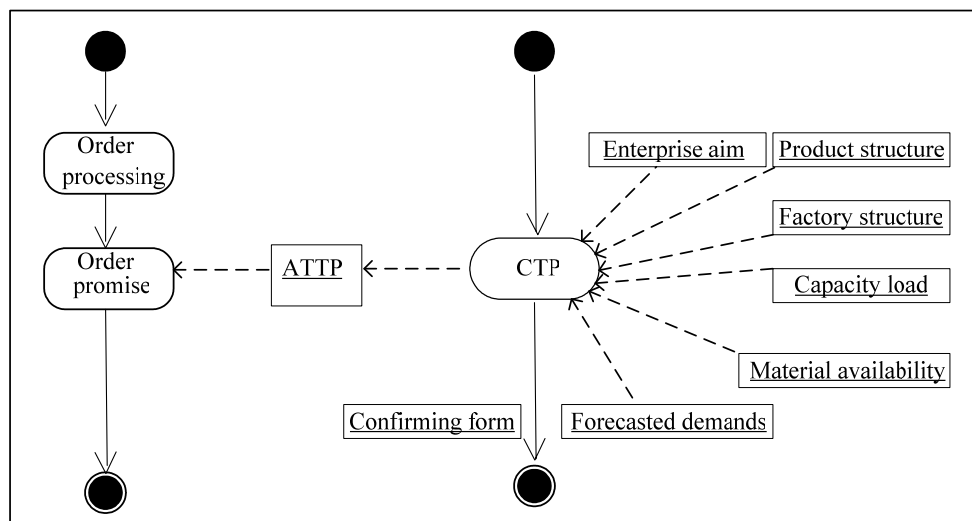


Figure 1. AATP Order Promise Mode Based on CTP

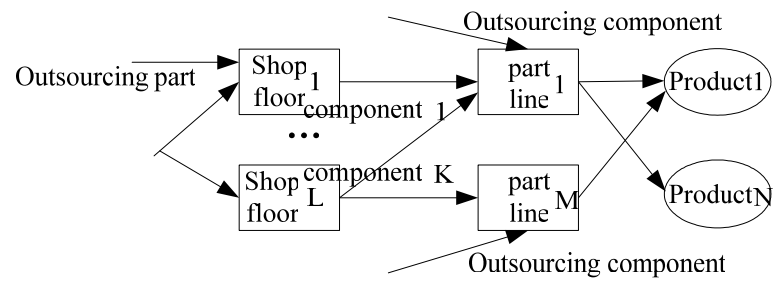


Figure 2. Sketch Map of Product Structure and Production Flow

# Analysis of HeXie Controllability and HeXie Observability of the Project Team

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## Abstract

Based on the frame of HeXie Management Theory, in this article, HeXie-state model of the project team system is studied, two attributes, HeXie controllability and HeXie observability in the HeXie state model, are put forward, and those attributes are analyzed and defined. Judgement rules of those two attributes are described. The HeXie controllability is used to measure the influencing function of the project management activity to the HeXie-state, and the HeXie observability is to measure the initial HeXie-state. To analyze the HeXie controllability and the HeXie observability can estimate the project management risk, compute the influence of management activity to the project team and the project performance, and help to optimize the organization and structure of the project team.

**Keywords:** HeXie Management Theory, Project management, HeXie-state, HeXie controllability, HeXie observability

## 1. Introduction

With continual development of information science, the economic form of human society is continually transforming from the commodity economy under the industrial society to the knowledge economy under the information society. This transformation makes the leading activity of the enterprise which gives priority to various innovational activities gradually develop, and the model of enterprise management will essentially change with that. Because most innovational activities of the enterprise are actualized by means of the form of project (Tavares, 2002, p.1-18), so innovational components in activities leaded by the enterprise are more, they more need better project management. Though the research to the project process management has initially formed complete system (John, 2005, p.688-704), but the relation between better project management and enterprise performance has not been clear (Kam, 2006). And according to the contingency theory, the project management must match with the environment with high uncertainty (Wang, 2006), so the analysis of the influence of the project management to the performance as viewed from the system is very necessary (Tavares, 2002, p.1-18).

The enterprise can be looked as the system composed by factors which are closely associated and dependent each other (Richard, 1999, p.583-600), and the economic activity, human resource, structure characteristic are the factors to compose this complex system. Some researches thought the coherence, interior matching and interaction degree among these factors are positive correlative (Robert, 1985, p.514-539). The project team is the subsystem of the enterprise system, and the resource, personnel and organizational character of the team are factors of the project team system. The HeXie Management Theory is to utilize the system idea to describe the influence of enterprise management to the enterprise performance (Tang, 2003, p.1485-1487). Base on the HeXie Management Theory, the HeXie degree of the project team, i.e. the response of the project team system to the management, describes whether the team fully exerts member enthusiasm, creationary conditions and environment, and the total HeXie of subsystem activity under member and the team, which can be concretely divided into structure HeXie degree, organizational HeXie degree, interior HeXie degree and exterior HeXie degree (Xi, 2002). These four sorts of HeXie degree constitute the HeXie-state of the vector form. In the implementing process of the project, the project management activity possesses changeable management ability, and the project team system correspondingly produces the changeable response of HeXie-state which is represented as the changeable performance of the project team (Wang, 2007, p.1129-1133 & Wang, 2007, p.117-121). Some researches thought that the relationship among management activity, HeXie degree response and team performance of the project team system can be abstracted as the HeXie-state model (Wang, 2007, p.191-195). In the HeXie-state model, the project management can be described as

the following process. The HeXie-state is the intrinsic attribute of the project team system, and the management (input) arouses the change of the HeXie-state, and the HeXie-state and project management decide the change of the performance (output) together.

In this article, we stress to discuss two attributes, the HeXie controllability and the HeXie observability in the HeXie-state model. The HeXie controllability is used to measure the influencing function of the project management activity to the HeXie state, and the HeXie observability is to measure the initial HeXie state.

## 2. The HeXie-state model of the project team

This article is based on the hypothesis that when the management ability changes some times, the HeXie degree response of the project team system also changes some times. The HeXie-state model of the project team system thought that the change of HeXie-state induced by the management was the process of differential movement, and the changes of team performance influenced by the management and the HeXie-state was the process of variable transformation (Wang, 2007, p.191-195). The HeXie-state model of the project team system based on the hypothesis

is  $L_s: \begin{cases} \frac{d\hat{x}(t)}{dt} = A(t)\hat{x}(t) + B(t)\hat{m}(t), \\ \hat{y}(t) = C(t)\hat{x}(t) + D(t)\hat{m}(t) \end{cases}$ , where, (1) the HeXie-state of the project team system at the time of  $t$  ( $t \geq t_0, t_0$  is

the initial time of the project) can be denoted as  $\hat{x}(t) = [x_1(t) \ x_2(t) \ x_3(t) \ x_4(t)]^T$ , and the interior state variables  $x_1(t), x_2(t), x_3(t)$  and  $x_4(t)$  respectively denote the structure HeXie degree, organizational HeXie degree, interior HeXie degree and exterior HeXie degree of the project team system at the time of  $t$ , (2) the project management at the time of  $t$  is denoted as  $\hat{m}(t) = [m_1(t) \ m_2(t) \ m_3(t)]^T$ , and the interior state variables  $m_1(t), m_2(t)$  and  $m_3(t)$  respectively denote the coherence of organizational mission and EOL (environment, organization and lead), the coherence of HeXie-Topic and EOL, and the coherence of HeXie and HeXie-Topic at the time of  $t$ , (3) the team performance at the time of  $t$  is denoted as  $y(t)$ , (4) at the time of  $t$ ,  $A(t)$  is the state keep matrix of the project team system which represents the influence of the HeXie-state to its change,

and  $B(t) = \begin{bmatrix} b_{11}(t) & b_{12}(t) & b_{13}(t) \\ b_{21}(t) & b_{22}(t) & b_{23}(t) \\ b_{31}(t) & b_{32}(t) & b_{33}(t) \\ b_{41}(t) & b_{42}(t) & b_{43}(t) \end{bmatrix}$  is the Management-Distribution-Matrix of the project team system which represents

the influence of the project management activity (the input of the project team system) to the change of HeXie-state ( $b_{ii}(t) \ i=1,2,3,4$  respectively represent the influences of the coherence of organizational mission and EOL (environment, organization and lead), the coherence of HeXie-Topic and EOL, and the coherence of HeXie and HeXie-Topic at the time of  $t$  to the structure of the HeXie,  $b_{2i}(t), b_{3i}(t), b_{4i}(t) \ i=1,2,3,4$  respectively represent the influences of the coherence of organizational mission and EOL (environment, organization and lead), the coherence of HeXie-Topic and EOL, and the coherence of HeXie and HeXie-Topic at the time of  $t$  to the organizational HeXie, the interior HeXie and the exterior HeXie), and the HeXie distribution matrix  $C(t)$  represents the influence of the HeXie-state to the team performance, and the control optimized matrix  $D(t)$  represents the influence of the input to the team performance.

Based on above HeXie-state model, in this article, we work out following definitions.

**Definition 1 (HeXie controllability):** Suppose that  $\hat{x}(t)$ , if the time of  $t_1$  ( $t \leq t_1 \leq T, T$  is the terminal time of the project,  $\Delta t = t_1 - t$ ) and  $\hat{m}(\varepsilon)$  ( $\varepsilon \in [t, t_1]$ ) exist and make  $\hat{x}(t_1) - \hat{x}(t) = \int_t^{t_1} A(\varepsilon)\hat{x}(\varepsilon)d\varepsilon + \int_t^{t_1} B(\varepsilon)\hat{m}(\varepsilon)d\varepsilon = R(t)$ , where,  $R(t)$  is the HeXie-state change anticipated by the manager,  $\hat{x}(t_1)$  is the anticipative HeXie-state, so the HeXie-state  $\hat{x}(t)$  of the project team system  $L_s$  is HeXie controllable in the stage of  $\Delta t$  when the project management is  $\hat{m}(\varepsilon)$ .

Some researches thought that the project team in the project lifecycle had five stages including establishment, adaptation, standard, effect and dismiss (Wang, 2007, p.117-121). For  $\forall \hat{x}(t)$ , if the time of  $\tau$  ( $t$  and  $\tau$  are in the same stage of the project lifecycle,  $\Delta t = \tau - t$ ) and  $\hat{m}(\varepsilon)$  ( $\varepsilon \in [t, \tau]$ ) exist and make  $\hat{x}(\tau) - \hat{x}(t) = \int_t^\tau A(\varepsilon)\hat{x}(\varepsilon)d\varepsilon + \int_t^\tau B(\varepsilon)\hat{m}(\varepsilon)d\varepsilon = \bar{R}$ , where,  $R(t)$  is the HeXie-state change anticipated by the manager and  $\hat{x}(\tau)$  is the anticipative HeXie-state, so the project team system  $L_s$  is HeXie controllable in the stage of  $\Delta t$ .

Definition 2 (HeXie observability): If the time of  $t_1$  ( $t \leq t_1 \leq T$ ,  $t_0$  is the initial time of the project and  $T$  is the terminal time of the project,  $\Delta t = t_1 - t$ ) exists and makes  $\mathcal{P}(t)$   $t \in [t_0, t_1]$  only confirm  $\mathcal{X}(t_0)$

and  $\mathcal{X}(t_0) = W_G^{-1}(t_1, t_0) \int_{t_0}^{t_1} (C(\tau)\Phi(\tau, t_0))^T \mathcal{P}(\tau) d\tau$ , where,  $\Phi(\tau, t_0) = \begin{bmatrix} \phi_{11}(\tau, t_0) & \phi_{12}(\tau, t_0) & \phi_{13}(\tau, t_0) & \phi_{14}(\tau, t_0) \\ \phi_{21}(\tau, t_0) & \phi_{22}(\tau, t_0) & \phi_{23}(\tau, t_0) & \phi_{24}(\tau, t_0) \\ \phi_{31}(\tau, t_0) & \phi_{32}(\tau, t_0) & \phi_{33}(\tau, t_0) & \phi_{34}(\tau, t_0) \\ \phi_{41}(\tau, t_0) & \phi_{42}(\tau, t_0) & \phi_{43}(\tau, t_0) & \phi_{44}(\tau, t_0) \end{bmatrix}$  is

the state transfer matrix of the project team system,  $\phi_{ii}(\tau, t_0)$   $i=1,2,3,4$  respectively represent influences of structure HeXie, organizational HeXie, interior HeXie and exterior HeXie at the time of  $t_0$  to the structure HeXie at the time of  $\tau$ ,  $\phi_{2i}(\tau, t_0)$ ,  $\phi_{3i}(\tau, t_0)$ ,  $\phi_{4i}(\tau, t_0)$   $i=1,2,3,4$  respectively represent influences of structure HeXie, organizational HeXie, interior HeXie and exterior HeXie at the time of  $t_0$  to the organizational HeXie, interior HeXie and exterior HeXie at the time of  $\tau$ , and  $W_G(t_1, t_0) = \int_{t_0}^{t_1} (C(\tau)\Phi(\tau, t_0))^T C(\tau)\Phi(\tau, t_0) d\tau$ , so the project team system  $L_s$  is HeXie observable in the stage of  $\Delta t$ .

Suppose that  $t_0^0, t_0^1, t_0^2, t_0^3$  and  $t_0^4$  are respectively initial times of five stages such as establishment, adaptation, standard, effect and dismiss, and if  $\tau_0, \tau_1, \tau_2, \tau_3$  and  $\tau_4$  ( $t_0^i$  and  $\tau_i$   $i=0,1,2,3,4$  are in the same stage of the project lifecycle,  $\Delta t_i = \tau_i - t_0^i$ ) exist and make  $\mathcal{P}(t^i)$   $t \in [t_0^i, \tau_i]$  only confirm  $\mathcal{X}(t_0^i)$  and  $\mathcal{X}(t_0^i) = W_G^{-1}(\tau_i, t_0^i) \int_{t_0^i}^{\tau_i} (C(\varepsilon)\Phi(\varepsilon, t_0^i))^T \mathcal{P}(\varepsilon) d\varepsilon$ ,  $\Delta t = \max(\Delta t_i)$ , so the project team system  $L_s$  is HeXie controllable in the stage of  $\Delta t$ .

### 3. Judgment rules of HeXie controllability and HeXie observability

Theorem 1: Suppose that  $\mathcal{P}(t)$  exists in the project team  $L_s$ , and if the time of  $t_1$  ( $t \leq t_1 \leq T$ ,  $T$  is the terminal time of the project) exists and makes that all four sorts of HeXie possess positive influences from the time of  $t$  to the four sorts of HeXie at the time of  $t_1$ , and three coherences possess positive influences to four sorts of HeXie, so the project team  $L_s$  is HeXie controllable.

First we prove the Lemma 1.

Lemma 1: Suppose that for the project team  $L_s$ , if the time of  $t_1$  exists and makes the matrix  $W_K(t_1, t) = \int_t^{t_1} \Phi(t_1, \tau) B(\tau) (\Phi(t_1, \tau) B(\tau))^T d\tau$  is positive definite, so  $L_s$  is HeXie controllable.

Prove: Suppose that the time of  $t_1$  exists and makes  $W_K(t_1, t) > 0$ , so  $W_K(t_1, t)$  is positive definite.

Suppose that  $\mathcal{P}(t)$  is the HeXie-state of  $L_s$  at the time of  $t$ ,  $\dot{m}(\varepsilon) = -(\Phi(t_1, \varepsilon) B(\varepsilon))^T W_K^{-1}(t_1, t) \Phi(t_1, t) \mathcal{P}(t)$ ,  $t \leq \varepsilon \leq t_1$ , so the expression of the solution of system state equation is  $\mathcal{P}(t_1) = \int_{t_0}^{t_1} \Phi(t_1, \tau) B(\tau) \dot{m}(\tau) d\tau$ , so  $\mathcal{P}(t_1) = \mathcal{R} + \mathcal{P}(t_0)$ . According to the definition, the project team  $L_s$  is HeXie controllable.

Next, we prove the Theorem 1.

Prove: To prove  $L_s$  is HeXie controllable, we must prove  $W_K(t_1, t_0)$  is positive definite. Because all four sorts of HeXie possess positive influences from the time of  $t$  to the four sorts of HeXie at the time of  $t_1$ , i.e.  $\phi_{ij}(\tau, t_0) > 0$ ,  $t_0 \leq \tau \leq t_1$ ,  $i, j=1,2,3,4$ , and since the time of  $t$ , all three coherences possess positive influences to four sorts of HeXie, i.e.  $b_{ij}(\tau) > 0$ , so  $\sum_{j=1}^4 \left( \sum_{i=1}^4 \phi_{ki}(\tau, t_1) b_{ij}(\tau) \right)^2 > 0$ ,  $k=1,2,3,4$ .

If  $\lambda_k = 2 \sum_{j=1}^4 \left( \sum_{i=1}^4 \phi_{ki}(\tau, t_1) b_{ij}(\tau) \right)^2$ , so  $\det(\lambda I - \Phi(\tau, t_1) B(\tau) (\Phi(t_1, \tau) B(\tau))^T) = 0$ , and  $W_K(t_1, t)$  is positive definite.

According to Lemma 1, the project team  $L_s$  is HeXie controllable.

Theorem 2: Suppose that  $B(t)$  of the project team  $L_s$  is the vector composed by following three parts, (1) the sum of influences of certain HeXie and the coherence of organizational mission and EOL at the time of  $\tau$  to four sorts of HeXie at the time of  $\tau$  and the time of  $t_1$ , (2) the sum of influences of certain HeXie and the coherence of HeXie-Topic and EOL at the time of  $\tau$  to four sorts of HeXie at the time of  $\tau$  and the time of  $t_1$ , (3) the sum of influences of certain HeXie and the coherence of HeXie and EOL at the time of  $\tau$  to four sorts of HeXie at the time of  $\tau$  and the time of  $t_1$ . If the time of  $t_1$  exists and makes four vectors can not transform reciprocally though linear transform, so  $L_s$  is HeXie controllably.

Prove: Above four vectors can not transform reciprocally through linear transform, i.e. various vectors are linear independent. Suppose that the matrix  $\Phi(t_1, \tau)B(\tau)$  is linear independent in  $[t_0, t_1]$ , but  $L_s$  is not HeXie controllable, so  $W_K(t_1, t_0)$  is non-positive definite, so for  $t_1 > t_0$ , the nonzero vector  $\bar{z}$  certainly exists and makes  $\bar{z}^T W_K(t_1, t_0) \bar{z} = 0 \Rightarrow \int_{t_0}^{t_1} \bar{z}^T \Phi(t_1, \tau) B(\tau) (\Phi(t_1, \tau) B(\tau))^T \bar{z} d\tau = 0$ . Because  $A(t)$  and  $B(t)$  are successive, so  $\bar{z}^T W_K(t_1, t_0) B(\tau) \equiv 0$ ,  $t_0 \leq \tau \leq t_1$ , which is ambivalent. So the hypothesis can not come into existence. According to the definition, the project team  $L_s$  is HeXie controllable.

In the same way, we can prove Theorem 3: if the time of  $t_1$  exists and makes the matrix  $C(\tau)\Phi(\tau, t_1)$  is linear independent in  $[t_0, t_1]$ , so  $L_s$  is HeXie observable.

#### 4. Conclusions

Based on the HeXie management theory, in this article, we analyze the HeXie controllability and the HeXie observability of the project team  $L_s$ . The theorem proved in the article shows that the problem of the HeXie controllability of the project team  $L_s$  is only decided by the state keep matrix  $A(t)$  and the Management-Distribution-Matrix  $B(t)$  of  $L_s$ , and the problem of the HeXie observability of the project team  $L_s$  is only decided by the HeXie-Distribution-Matrix  $C(t)$ . That indicates that the HeXie controllability and the HeXie observability are the essential attributes of the project team, which are confirmed when the project team is established, and don't depend on the project management.

In this article, we define the HeXie controllability and the HeXie observability and describe the judgment theorem. The HeXie controllability is used to measure the influencing function of the project management activity to the HeXie state, and the HeXie observability is to measure the initial HeXie state. These two attributes of the project team have important help to optimize the project management and elevate the structure of the project team, and have abroad application space. With the deepening of research, the matching degree of the HeXie-state and the stability of the management activity to the function process of the project team system are the direction for the future study.

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# A Practice Centred Approach to Understanding Social Learning and Knowledge Creation in a “Community of Practice”

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## Abstract

Communities of Practice (CoPs) in organisation science are often described as ‘the shop floor of human capital’ where learning and knowledge creation which underpins innovation evolves. Adopting the Bristol area geocaching community as a case study, this paper draws on the ‘practice turn’ in contemporary social theory to study the everyday interaction of the community members in their situated practice. Taking the geocaching community and their practice as a collective unit of analysis, the study employed the qualitative methods of ethnographic interviewing, participant observation and content analysis of archival internet forum logs of members to extend our understanding of the performative processes of social learning and knowledge creations in CoPs. A conceptual framework showing how the interactions among actors and their artefacts and reflexivity in practice could lead to learning and knowledge creation that stimulates innovation in a CoP is presented as a modest attempt to improve our understanding of the dynamics of a CoP renewal and sustainability.

**Keywords:** Community of Practice, Geocaching, Practice, Social learning, Knowledge creation

## 1. Introduction

Ever since the concept of CoP was introduced by Lave & Wenger (1991), it has received an unprecedented attention resulting in a burgeoning corpus of literature dedicated to studying their structures, dynamics and their effects on organisational performance (e.g. Wenger *et al* 2002; Lave, 1988; Boland & Tenkasi, 1995). By virtue of their ability to providing a platform for sharing ideas and providing support to community members, CoPs have been frequently identified with providing a unique context for learning and knowledge creation and often labelled as a major source of innovation. However, a deep epistemic gap exist between what learning, knowledge creation and innovation is and how these performative processes evolve in them to sustain and renew the community and the very practice that brought the actors together. Not surprisingly, Dougherty (1992:78) for example argue that if the numerous theories of knowledge creation and innovations are to be useful, “they need to speak to every day realities”.

In bridging this gap, the research draws on the ‘practice turn’ in contemporary social theory by moving from conscious ideas and values to the taken for granted sense of space and routines of actors as inscribed in the ways they enact their practice which leads to learning and knowledge creation. By employing a practice lens for this study, the main concern here is the every day routine activities and how they are enacted with respect to the practice of geocaching and the epistemological vision is to broaden our understanding on how these discrete activities as enacted in practice facilitates learning and knowledge creation which sustains and renew the CoP. Emphasis on the shared practice is synonymous to the thought of Heidegger as cited by Dreyfus (1991:25) when he argued that “*even when people act deliberately, and so have beliefs, plans, follow rules, etc., their minds cannot be directed toward something except on a background of shared practices*”. The article from a meta-theoretical level conceptualises the practice of geocaching as the object of the community of practitioners (Geocachers) and the practitioners as the subject of the object (Geocaching). Based on this, we dwell on the physical artefacts employed by actors, their habitual discourse they engage in practice and their ongoing interactions to develop a conceptual framework for thinking about of how the performative processes of learning and knowledge creation occur to facilitate the sustenance and renewal of the CoP.

## 2. Literature Review

A Community of Practice (CoP) refers to a group of people who share the same vision and work together in a concerted effort to achieve a particular aim. The notion that these stable and autonomous groups or communities are key to organisational performance has enjoyed a major affirmation in recent literature (Boud & Middleton, 2003; Saint-Onge & Wallace, 2003; Wenger *et al*, 2002; Duguid & Brown, 2001; Liedtka, 1999). The concept of CoP was first proposed by Lave & Wenger (1991:98) when they referred to it as the “*an activity system about which participants share understandings concerning what they are doing and what that means for their lives and for their communities. Thus, they are united in both action and in the meaning that action has both, for themselves, and for the larger collective*”. Drawing diverse CoPs ranging from Mayan midwives in Yucatec to Quartermasters in the US



navy, they showed how new members who are normally apprentices whose peripheral participation involving doing routine and simple aspects of the practice legitimizes them as members of the group. As they master the art and craft of the practice, their legitimacy increases within the group and socially, they move towards becoming fully identified with the practice.

Following a similar line of thinking, Brown & Duguid (2001:9) described such communities as “a group of interdependent participants providing a context within which members construct both shared identities and the social context that helps those identities to be shared”. Drawing on the ethnographic work of Orr (1996), they argued that these informal groups’ methods of solving problems remarkably differ from abstracted managerial accounts. This they showed how canonical steps and practices as outlined by management in manuals were inadequate for the everyday work of photocopier Technicians’ and that in order to carry out their work effectively, these service Technicians’ generated their own non-canonical practices through narratives and storey telling which they employ in their everyday work.

Intimately tied to the survival and renewal of a CoP is the performative processes of social learning and knowledge creation in practice. In this regard the value of a CoP and to a large extent its sustainability and renewal can be analysed and determined in terms of the intensity of social learning and knowledge creation that goes on in practice. The socio-cultural conception of learning as a collective participatory process of active knowledge construction emphasise context, interaction and situatedness (Greeno *et al*, 1992; Lave, 1998; Orr, 1996; Lave & Wenger, 1991). In short, learning in CoPs is about participation, interaction and situatedness at the expense solo learning which takes place in the ‘individuals head’. The idea of interaction among actors serving as the pivot supporting learning activities was re-echoed when Bronfenbrenner (1977:518) as cited by Salomon & Perkins (1988) asserted that “in ecological research, the principal main effects are likely to be interaction. For Wenger (2002:229) CoPs are the *“building blocks of social learning because they are the social ‘containers’ of the competences that make up such a system”* because actors are embedded in them and they provide the requisite context, interaction and situatedness that stimulate learning. As described by Salomon & Perkins (1988), there are four major perspectives on social learning. These, they conceptualize as the broad distinctive meaning or instances where social learning may occur. They concur the first mediation is akin to receiving instructions from a tutor or a mentor. Here, a learner does receive direct help from another agent. It therefore bothers on peer tutoring, collaborative, and cooperative learning. The next is learning as a result of participation in a social process of knowledge construction. Here the individual involved is seen as an *“integrated and highly situated system in which the interaction serves as the socially shared vehicle of thought”* (Salomon & Perkin, 1988.4).

Social mediation may also occur through cultural artefacts since they are culturally and historically situated. These artefacts can range from books to symbols and technical language. They often tacitly embody accumulated shared cultural understanding and carry the wisdom and assumptions that went into their design; they can serve as tools and sources of information that may contribute to learning. Another meaning of social learning occur when the focus falls on collective agency, emphasis is on the working collective which is a prerequisite for acquiring more knowledge, understanding and skills. Thus, through the ongoing collective learning processes, a CoP knowledge is generated shared, reused and accumulated (Murray & O’Mahony, 2007) and thus, become a repository of knowledge.

For this reason, Pan & Scarborough (1999:360) described knowledge as a product which is “socially constructed and embedded in social network and communities of practice”. Therefore as members of a CoP employ same artefacts, share similar mental models, views and interests (Wenger, 1998), the ongoing interactions among themselves and their artefacts serve as a vehicle for the sharing of the knowledge they have accumulated in their situated practices. As they share similar mental models, individual members existing knowledge structures are able to maximise and convert new knowledge assimilated from others into something meaningful (Ellis, 1965).

It is the accumulated knowledge and interactions that afford community members to reflexively challenge their chosen for granted assumptions and structures that constrain their actions in practice. Reflexivity as argued by Dery (1983) in effect enables members of the community to take a step back to reflect on their actions or consider alternative actions within a given frame of reference or a totally new frame of reference in practice and the punctuated equilibrium that characterise this reflexive process is akin to the mangle of *resistance* and *accommodation* that characterise a practice as described by Pickering (1993). The shared practice of a CoP therefore does not only provide context for activities but serves as the context in which arrangements exist for the transformation and renewal of CoPs. Extending the importance of practice as the generic site for social transformation, Schatzki (2001:2a) drawing on a Heideggerian-Wittgensteinian intuitions notes *“Practice accounts are joined in the belief that such phenomenon as knowledge, meaning, human activity, science, power, language, social institutions, and historical transformation occur within and are aspects or components of the field of practice”*. Practice so be, can be seen as a routinised phenomenon, susceptible to change, in a constant flux that is flexible and varied with respect to situated context.

While existing and emerging structures shape the practice of a CoP, it is the actors practices which in-turn constitutes and reproduce the structures (Sewell, 1992). In this sense, actors as intelligible human beings engaged in their practice can reflect on the activities that constitutes the practice and challenge some of the constraints imposed on their actions in practice in creative ways which then come to transform or reconfigure the very structures that enabled them to engage in the practice. It is this cyclical process of practice-structure transformations that sustains the performative processes of learning and knowledge creation efforts in a CoP that goes to renew the community and their practice across space and time.

### 3. Presenting the Conceptual Framework

As argued by Sewell (1992:27), human agents are capable of putting their “structurally formed capacities” to use which consequently transform their practices. Hence they should be viewed as *empowered* due to the fact that they have access to various resources they can employ in their practices. These resources range from (humans) i.e. both members and non-members of the CoP as well as non human entities which includes all the artefacts used in supporting, shaping, redirecting and sometimes used so induce the practice. The continuous interactions among actors and their artefacts are not mutually exclusive. The two forms of interactions are intrinsically embodied to form the ‘heart’ of the shared practice. Without the interaction among actors, the notion of a community doesn’t exist; likewise, without interaction with artefacts the shared practice that bounds the community is non-existent. By virtue of this, it is assumed “the shadow of the other is always implicated in the articulation of the other” (Chia, 1998:5). Moreover, putting the community’s structurally formed capacities developed through practice and experiences into re-usable knowledge which in turn drives and sustain their practice require reflexivity in practice. Reflexivity-in-practice here is about intelligibly challenging those constraints imposed by social structures and their taken for granted assumptions about reality. The sustainability of a CoP is built through ongoing reflexivity and interactions among members and their artefacts through a variety of mechanisms that may operate in combination or serially that result in learning and knowledge creation. Rather than assuming all CoPs serve as a site for learning and knowledge creation, four distinct dynamics as shown in figure 2 are distinguished that offer new insights into the interaction among actors and the mediating role of artefacts and reflexivity in practice in the evolution of learning and knowledge creation that renew and sustains a CoP. (See Figure 1)

#### 3.1 Learning and Knowledge Creation leading to innovation and renewal

For a CoP to be a site for the evolution of learning and knowledge creation which in turn stimulate innovations, the CoP must display what shall be referred inhere as ambidextrousness in practice. This implies, the actors will not only have to continuously interact with their artefacts, they will also have to actively engage and interact with members of the community so as to develop mastery and efficiency in enacting their practice. In addition to the interactions, Actors simultaneously will have to take a step back to reflective on their ‘doings’ and question their routine actions and explore alternative means intelligibly by challenge their own assumptions about their world. Reflection in practice is what triggers change and the change in turn triggers further reflections. It is only through these ongoing concurrent interactions and reflexivity or what is hereby referred to as the development of generative movements in practice can a meaningful learning, knowledge creation and innovation can be sustained.

#### 3.2 Theoretical visions and mirages based on pure imaginations:

Actors on the other hand may frequently engage in reflecting on their practice by challenging some of their taken for granted assumptions, but do not actively interact with the artefacts embodied in the practice nor interact with other members of the community. In such a scenario, theoretical visions and mirages based on pure imagination (akin to academic fundamentalism) are expounded and they have no practical value to the CoP or the society as a whole.

#### 3.3 Community in a morphostatic state

This third scenario is where continuous interaction among actors and their artefacts are sustained but the actors fail to reflect on their practice by questioning their own values and beliefs. Here the learning that takes place in the community will be purely single-loop learning (refinement in conduct without change in underlying beliefs) which require no reflections hence has an infinitesimal contribution to make when it comes to creating value or creating knowledge required to sustain and advance the practice. Here, the community will not evolve as the actors are entrapped in their taken for granted assumptions. It will assume a perfect adaptation state and resisting change, thus becoming what is herein referred to as morphostatic state as opposed to being *becoming*.

#### 3.4 Dysfunctional Community on the verge of extinction

Finally, actors in a CoP may not continuously engage and interact among themselves and their artefacts. They miss out on the opportunity of mastering their practice and sharing of ideas and insights. Not all, they may not engage in reflecting on their practice making them dehydrated of ideas and insights. In such a scenario, the community

basically becomes dysfunctional and is the verge of extinction. On the balance of probability such a CoP may not survive for long and will ultimately die out within the shortest possible time.

#### 4. Brief Historical Review of Geocaching

Since its inception, Global Positioning System (GPS), a location based technology had been mostly employed for navigation and military purposes. Those signals available for public use had a degradation feature called Selective Availability (SA) turned on resulting in a decrease in its accuracy to 50m without differential correction. In 2000, the then President of the United States, Bill Clinton allowed the removal of the SA was used for the intentional degradation of signals available to the public (www.geocaching.com, 2007). This was aimed to “*encourage acceptance and integration of GPS into peaceful civil, commercial and scientific applications worldwide; and to encourage private sector investment in and use of U.S. GPS technologies and services*” (The White House, 2000). As GPS signals became available to the civilian populace around the world, GPS enthusiasts who were members of “Internet news groups, suddenly teemed with ideas about how the technology could be used” (www.geocaching.com, 2007). One of the resulting applications that came up was geocaching. The basic idea behind geocaching is that participants create a cache, hide it at an interesting place so others may employ the GPS technology devices to locate the cache. The fact that people involved in geocaching are constantly searching for these hidden treasures has resulted in geocaching been frequently described as a hi-tech version of treasure hunting and participants described as “Human search engines”.

In this recreational sport, a box containing small gifts, toys, key rings or coins is hidden at a public location that might be of interest to other people e.g. as a result of its history, beauty or landscape. More often, the box will also contain a small log book in which finders of the cache will have to log their visits with a short message. The cache hider then publishes the co-ordinates of the location on the community’s web page (www.geocache.com) sometimes with clues and other relevant geographic information about the cache location. A puzzle may also have to be solved to get the exact location co-ordinates of a given cache. Armed with this information and a personal GPS, cache hunters set off to find the hidden treasure. On entering the ‘waypoint’ the GPS shows the approximate location of where the cache is hidden. After locating the cache, the ‘hunters’ then return to the geocaching web page to log their find and write their experience as well as any other comments about the treasury which could be read by community members.

There are various forums on the community’s web page where member interact and share their geocaching experiences. Apart from the online contact with members of the community, people frequently organise what they call *Event cache* where interested community members attend, to socialise, share ideas and go on group cache hunting expeditions. Apart from the GPS device, other interesting artefact also employed in geocaching is the *travel bug*. These are special metal tugs usually attached to a hitchhiker and have a unique tracking number. They are created specifically to go on a travel expedition. The bugs are often named, have a travel aim and a supporting personal page on the geocaching web page (Peters, 2004). Most travel bugs are normally hidden near airports (*travel bugs hotels*) and a geocacher going on holiday or a business travel on finding the cache is instructed by the cacher creator to take it with him and place it in the country where he is going. A typical travel bug placed in the United State had the following description: (See Figure 2)

Today, there are over four million people actively engage in the sport with thousands of local interest groups littered all over the world (www.geocaching.com). The fast growing nature of the sport in recent times has resulted in the proliferation of books that seek to explain the nitty-gritty’s of the sport and how to get involved (e.g. McNamara, 2004 ;Peters, 2004 ;Shermann, 2004). The popular press has also taken a major role in popularizing the sport by publishing news articles on the emerging trends in the sport as well as the ‘inside-out’ of the activities underpinning it (e.g. Claire, 2007; Daily Herald, 2007, Einbeck-live, 2007; The Index, 2007). However, an infinitesimal scholarly work has concentrated on this technology enabled sport. For example, Chavez *et al* (2004) in a small scale exploratory study developed a demographic picture of current geocachers. They found, a large majority of the people who are actively engaged in the sport are white males with some College education. O’Hara (forthcoming:4) in an exploratory study to understanding the practices and motivation of geocachers found that the idea of walking with other people and the possibility of exploring different places are some of the major incentives that motivate people to go geocaching. The study noted that “*Geocaching has many notable parallels with what is being offered in the shifting trends in location based computing as supported by sites such as mscope.com*”. In extending our understanding of the evolution of the geocaching community of practice and the art of geocaching as a practice, I draw on the Scholarly work in the contemporary turn to practice to conceptualise the technology enabled sport of geocaching as a practice.

## 5. Conceptualising Geocaching as a Practice

The selection of geocaching as a practice to serve as the empirical context for this study was theory driven and based on the premise that geocaching is a *materially mediated* nexus of activities. It embodies capacities such as know-how and dispositions and has materially mediated arrays of human activities which are centrally organised around shared skills and practical understandings (Schatzki, 2001). Figure 2 shows the evolving nexus of activities mediated by artefacts which makes up the practice of geocaching. (See Figure 3)

There are basic rules and guidelines that are to be followed in enacting these activities. For example a geocacher will have to seek permission before hiding a cache at any public place. There are also distinct customs and shared practices of writing a message in a cache visitors log book, recording ones finds on the internet etc, etc. Membership therefore requires the acceptance of these distinctive customs and shared practices. However, these shared activities of the community of geocachers are not governed by a given set of ideas, theories or laws- one of the major attribute or dimension of what constitutes a practice as advocated by Barnes (2001). Notwithstanding this, in making sense of these social activities making up the practice of geocaching, the activities is not understood as a mere building block of practice which are supposed to be enacted just for sake of the practice but their enactment are goal oriented and are based on experience and intelligibility of actors.

Tsoukas (1998:54-55) drawing on the classical thesis of the theory of morality as advanced by McIntyre (1985) identified what he referred to as the “four crucial features” of a practice. These features include:

(a) “A practice is a complex form of social activity that involves the cooperative effort of human beings; it is coherent and, therefore, bound by rules and it is extended in time”. Here, he goes on to explain that practices are institutionalised and that the underlying logic is that: “although practices alone are articulate forms of social action, if they are to be sustained, they will inevitably become institutionalised”.

(b) “Every practice establishes a set of what MacIntyre calls ‘internal goods’, meaning goods that can not be achieved in any other way but by *participating* in the practice it self”. The idea here is very similar to the literal saying that ‘the proof of the pudding is in the eating’. It behoves on an actor to fully participate and engage in a practice in order to appreciate and share in the collective practice and understanding of the practice. By contrast an external good is something that can be achieved without participating in a practice e.g. money, fame etc. He concurs that “where as the achievement of internal goods benefits potentially the whole community who engage into a particular practice.

(c) “Participating in a practice necessarily involves attempting to achieve standards of excellence operative in the practice at the time. Unless one accepts the standards of the practice into which one has entered and the inadequacy of his/her performance *vis-à-vis* those standards, he/she will never learn to excel in that practice”.

(d) “Every practice has its own history which is not only the history of the changes of technical skills relevant to the practice, but also a history of the changes of the relevant ends to which the technical skills are put”.

Taking the four crucial points in order, the idea of individuals taking personal responsibilities for the safe transfer and movements of key artefacts like *travel bugs* and *geocoins* along as well as the maintenance of caches, are just few examples of the cooperative efforts of actors in working together to sustain the shared understanding of their practice. With regard to the second feature, the creation of caches “which is an integral part of the caching experience” (O’Hara, Forthcoming: 8), the analytical skills required in solving puzzles to find location co-ordinates, the sometimes laborious activity of searching, and the associated thrill in finding a cache and exploring novel locations all together can never be achieved except by participating in the practice of geocaching. While an individual may enjoys this experience during his hunting expedition, the person who hid the treasure also enjoys all the thrills involved in preparing and hiding the cache, as well as being able to share his view about a particular location with an unknown person. This implies the “internal goods” delivered by geocaching does not benefit an individual alone but rather, the community of geocachers by continuing the advancement of the generic social aspect of the practice.

The third factor is very similar to the observation made by Barnes (2001:20) on the scope of practice when he claimed that “to engage in practice is to exercise power”. The power possessed by the community whether or not it is exercised or manifested is one that endures and asuch acts counterfactually by actualising its effect in an open system when actors interact based on their shared practice. Thus, Barnes asserts that ordinary members of a given practice “take a theoretical perspective in orienting to each others practice”. Orienting oneself to others will therefore require accepting the collective standards of the practice and making conscious efforts to achieving and maintaining them as espoused by the practice so as to become a competent member of the community. This is an intrinsic part of geocaching as O’Hara (2007) found out the collection of cache find serve as a demonstrable record of what one has achieved with reference to other people. The desire to achieve more in some instances drive people

to set targets for themselves which then invariably serves as an additional incentive for them to excel in their practice.

The fourth factor which is concerned with historicity can be understood well by tracking the evolution of geocaching. Geocaching has its own history dating back to when the US government made GPS signals available for civilian when the first cache was hidden by Dave Ulmer on May 3<sup>rd</sup> 2000 (Peters, 2004) to its current status as a global sport. The continuous transformation of the skills required to participate since its inception, as a result of the continuous improvements in its associated artefacts, the incremental improvement and understanding of the shared practices, implies that geocaching as a practice is in a constant flux of transformation. The activities underlying the practice are dynamic and the continuous expansion of their scope to meet local context by individuals and groups is a testimony that geocaching is never static but in the constant process of *becoming*.

## 6. Research Methodology and Methods

A qualitative single Case based approach was adopted for the study and the empirical research site was the Bristol area geocaching community. According to Yin (1994:13) a case study is an *“empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident and relies on multiple sources of evidence”*. It is ideal for a study of situations where the variables of interest will be far more than what data elucidates. Kim (2006) argues the qualitative case study approach *“seeks to uncover meaning by analyzing rich, non-numerical information in a context of a particular case or multiple cases”*. More importantly, it comprehensively *“satisfy the three tenets of the qualitative method: describing, understanding, and explaining”* (Tellis, 1997). The approach provided the unique opportunity to understand the actors lived experiences as well as their inherited knowledge which enabled the research to probe further into what disposes them to enact the practices they do, uncover when and how they do them as well as their aim in their entirety without necessarily isolating them from their context (Hartley, 1994).

Although numerous voluntary practices exist, the single case of geocaching was selected because it provided the right setting and access to the phenomenon under study while representing a very special case of a CoP existing beyond the boundaries of organisations. Unlike traditional organisational based CoPs where working in the firm is the only means by which actors can secure membership, it is a ‘network’ where membership does not require a potential actor to belong to a specific firm, a professional or elite group. It is open to anyone who is interested in taking part in the practice. Its ‘voluntary’ nature therefore requires actors to solely bore the cost of securing the requisite resources needed to successfully engage in the practice as well as all the associated risk that comes with the enactment of the practice. It also differs remarkably from the numerous evolving virtual communities (e.g. the open software CoP) in that, apart from members interacting with one another online, they also frequently meet “face to face” to engage in some activities related to their practice, exchange notes, share ideas and enhance their individual social capital. The practice of geocaching (geocaching CoPs) can therefore be seen as a new evolving hybrid form of CoPs which combines the strategic features of both traditional and virtual CoPs. Furthermore, Geocaching as a practice in which members engage in outside the confines of their respective organisations is hereby conceptualised as a peripheral CoP capable of providing unique insights and explanations for emerging patterns which can serve as a potential threat or opportunity for organisations. It is anticipated the use of this special case should allow the elucidation of particular insights that may allow the making of inferences about other CoPs (Siggelkow, 2007).

The qualitative data collection techniques employed included ethnographic interviewing, participant observation and content analysis. In all three key *active* (Note 1) geocachers aged between 22 and 45 were interviewed. Archival online logs of the community members with respect to their geocaching activities were used for the content analysis. A single cache event which attracted fifteen (10) geocachers in the Bristol area was attended where the participant observation was done.

### 6.1 Ethnographic Interviews

As argued by Chia (2000:515) *“language is that prevailing means for codifying and hence rendering ‘articulable’ that realm of sense-experience which actively resists codification and representation, it must be our first port of call in our search for a deeper understanding of the meaning and effect of discourse in an organisation”*.

Guided by this dictum, the first technique used to collect data was an Ethnographic interview (Fielding & Fielding, 1986) a hybrid form of qualitative interview. The technique is quite similar to the qualitative interviewing which (Alvesson, 2003) described as *“relatively loosely structured and open to what the interviewee feels is relevant and important to talk about”*. In this type of interviewing, *“questions are considered, rephrased and analysed with interviewees so that they can discuss how they experience their work world and what kind of things are meaningful to them”* (Dougherty 2004:40). It is capable of providing detailed rich account of experiences as well as aiding *“the microscopic recording of face to face interaction”* (Knorr-Cetina, 1981:42). Unlike other forms of research

interviews which typically requires respondent to give a specific answer to a posed question, it provided a unique methodological tool that allowed participants to express their thoughts, feelings and describe their interpretive schemes while capturing such narratives contextually. Thus, allowing “the ‘voices of the field’ to tell their own stories in unexpurgated fashion” (Hollinshead & Maclean, 2007:1563 citing Czarniawski, 1998).

After a participant was re-introduced to the background and aims of the research, interviews typically began with questions probing when and how they got into the hobby of geocaching as well as their number of finds. This was aimed specifically to selectively reactivate the respondents past patterns of thought and action, which invariably would be routinely incorporated in their current practice of geocaching (Emirbayer & Mische, 1998). While the interviews were being tape recorded, mental notes were simultaneously being made which enabled the further probing of participants to shed more light on important events. On the average, the interviews lasted for an hour and half. The data obtained from the ethnographic interviews were at a latter date transcribed and analysed.

### 6.2 Content Analysis of Archival Electronic Logs

The use of actors electronic logs in this study was informed by two major reasons. First, it was used to check for the authenticity of some of the assertions made during the ethnographic interview by the three research participants. Secondly, since the internet was a major medium through which geocachers interact among themselves, it was the only ideal means to capture at least exactly they discuss and share among themselves. So in this case, the electronic texts as logged by the participants on the UK discussion forum represented factual information and to some extent the participants communicative intentions in a complex, rich, and opaque manner. The logs were therefore thought to have specific elements whose defining features link them to a form of situated communicative act that drives learning, knowledge creation and subsequent group innovation process. In this regard Hank (1987:678) argued that “whether we read a text, fiction, parody, prayer, or documentary is a generic decision with important consequences for interpretation”.

In doing this two famous and most active geocachers in the Bristol area (Valliant King and Captain GoreTex) as reported by participants in the work of Ohara (2007) were used as the starting point to analyse some of the conversations that go on at the geocaching web page. These two actors profile pages on the geocaching websites were visited and their forum post link were used to track the available records of all their logs and contributions on the different UK forum pages. Three major discussions they have participated in were copied and analysed by reviewing the entire logs of others who have contributed to the topic or subject under discussion. In the words of Hanks (1987:669) these discourses displayed what he referred to as an “*emergent forms of representation, produced by local actors, in an apparent attempt to set at least some of the terms by which their social world would be regimented*”.

Although there was a significant stylistic continuities across these texts, the challenge inherent in the textual analysis of the research participants logs was the masking of the possible heterogeneous cognitive abilities of the actors and identifying prior experiences and discourse in which participants have earlier on engaged in that resulted or contributed to them writing the text in question in that particular context. The major question posed by this heterogeneity also concerned how the individual participants texts hang together as a coherent whole and the causal link between them and the phenomena under consideration. The electronic logs as analysed here, were seen as a product of the practice of geocaching, and the recurrence of identifiable discourse features in them as capable of extending our understanding of the relation between the linguistic form of such texts and the broader social and cultural world in which they were produced. The electronic text as employed in this study was aimed at showing how they effectively contribute to the transformation of the linguistic habitus, discourse and practices which can be the relevant drivers of knowledge creation, learning in a CoP. In this sense, these documentary texts were used as a strategic tool to assert transparency and supports “claims about the ‘native’s point of view’ and the validity of the authors interpretation” (Fine, 2003:42). While this may reflect a dynamic means of mapping the researched situated thinking paths in practice, I do not proclaim this as an ‘objective’ means to capturing the research participants thoughts and actions.

### 6.3 Participant Observation

Participant observation as a method was employed to see how the research participants engage in the actual and situated activities underlying the practice of geocaching. It was used to unearth if applicable, some tacit rules that has never been observed nor codified in the learning and knowledge creation literature. In the words of Becker (1958:652) the participant observation was “*aimed at understanding groups in their situated activities rather than demonstrating relations between abstractly defined variables*”. The social context for the participant observation was a cache event code named “urbanite” which was organised by one active geocacher at Yate in Bristol. At the beginning of the event when I was introduced as a researcher to the group by the organiser, it was clear to see some

aroused anxiety among some participants as they felt some form of intrusion and were very curious about the research intention. However, as they found out I share their interest and was part and parcel of the community, those feelings begun to diminish instantaneously and they started to show great interest which facilitated my transition from a passive position to an active 'member-researcher', thus becoming part of the context being observed. This mutual habitation evolved gradually during the course of the event. After exchanging pleasantries, we formed a group of three made up of at least three members. I was in a group made up of three males and a female. Armed with our location coordinates and hand held GPS devices, we set off to search for the hidden caches placed in the area specifically for the event.

## 7. Research Findings

Members of the community as competent practitioners who continuously engage in the practice are very much conversant with the routines and the actual praxis underlying their practice. Being competent here implies each actor understands the technical language that frequently characterise geocaching discourse and capable of contributing meaningfully during interactions. However, because the practitioners are geographically dispersed, their situated context of practice may differ and as a result each actor may have developed some rational strategies for coping with mundane and minute problems they might encounter in practice. Thus, all actors at any point in time may function simultaneously as a facilitator and a student during group interactions. This assumption was reinforced when an interview participant said:

*"I also like the emerging community spirit on the internet which is a bit peculiar because it is the internet community that literally goes to the field. Every body on the web page has gotten some experience of the geocaching world."*

An example of the ambivalent nuances of social learning and knowledge creation as a result of interaction among actors were captured from the participant observation when the person with the highest number of finds at the cache event narrated his systematic and robust way of profiling all hidden caches in the Bristol area that enabled him to find caches as easily as possible. However, his desire to be the first-to- find a cache has never materialised. At this point, a participant stepped in to lecture the group on the exact times new caches are published online, so members can note and get to the nearest cache before someone else get there. By listening with rapt attention to the various accounts as narrated by the actors from multiple perspectives, members of the group then start to engage in scenario thinking a key aspect of social learning and may come to learn better understand and appreciate what, in other circumstances, may be perceived and dismissed as irrelevant or contingent on their situated practices. At the cache event, it was observed most of the people attended to meet and make friends with people who share their interest and identity. However, as a bulk of the conversations that went on were centred on the practice of geocaching. The conversations predominantly were centred on fantastic and magnificent failures and successes chalked in their practice. These failures and successes were exclusively communicated through stories and tales. This was how the actors by virtue of their interaction shared their experiences and swapped notes on good practice. For example, one participant told of how he and his family got approached by two secret agents because their actions looked suspicious:

*"They came out to us and say, are you looking for a small bug? Well it's underneath the bush here; you are the third group of people coming to look for it today. Can you please get it and kindly leave the park because we have a VIP coming here in half hour"*

Another recalled how he forgot to take enough batteries before setting out for treasury hunting, only for his hand held GPS to go flat in the woods. The implicit ideas behind the telling of those stories were to give other participants the opportunity to learn new ideas and skills in enacting their practices correctly. It also shows how interactions with artefacts, in this case technical tools serve as social mediators of learning. While some tools such as the batteries and maps may do so as simply as information sources, others such as the geocoins and travelling bugs may serve as mediums for symbolic communication. As argued by Salmon & Perkins (1998:11), these tools may provide a "means to act upon the world and as cognitive scaffolds that facilitate such action". They go on to conjecture that "some tools not only enrich ones cognition but actually transform it". In Variance with individual learning whereby the dominant modes of social configuration is a teacher to learner, the social learning that took place in the CoP was well equivalent to peers working together in a classroom setting to facilitate learning among themselves. The idea is like working together to actively construct a solution or accomplish a particular task. This was characterised by ongoing intensive interaction among the various actors coupled with rich feedbacks delivered in real time, highly personalised and situationally contingent guidance and encouragement. For example, in response to an actor who thought the actions of other geocachers in his area were basically impeding his quest of becoming a First-to-find, a respondent writes:

*"Understand your frustration. There will always be a local First-to-Find(FTF) hound its unavoidable I wish that occasionally they would sit back and let someone else get the odd FTF but they don't operate that way for some its a matter of principle to try every time for the FTF and bookmark each one etc. But if they stay back its not a race is it? Same as members only for the FTF hardly a fair race when half the runners are not included and members have access to instant notification anyway. My advice is this look for patterns, do you release in the week? Well if they work nights or from home or have a mobile job you are just playing into their hands. Do they go out normal caching on the weekend? Which is their favourite day? We try to get our caches released late Friday or Saturday night so that as many people as possible will see them ready for Saturday / Sunday morning. A note to the reviewer usually yields results. Release your caches in batches at the same time no one can be in two places at the same time can they? Also don't log TB's into caches before they are released anyone watching them (and now you have mentioned you are releasing new caches I can bet any TB's you have in your possession are being watched) will see the cache name and a link to it on the bug page".*

Another respondent in contributing to this very subject in question wrote:

*"Yet another thread where someone's getting all excited about how someone else plays their game. To be fair though, I've been the newbie going home with the look of delight on my face after FTF one of Mrs B's caches and I've also sent some caches in for approval on a Friday night - just to give everyone who works in the week a fair crack at finding them. It's a bit of a non-issue for me really - I can see both arguments. If you make a big deal out of being FTF though, and how many FTFs you have, you can't expect people not to go out and try to be first. It'd be a bit like football and keep passing the ball around until everyone has a chance to score."*

In the first instance, the actors comments highlights how views as advanced within a given group are deeply embedded in a cultural context. It is a significant observation that the content and direction of the discourse as developed here typifies an emergent and some how haphazard process as opposed to a deliberate design aimed at explicitly encouraging learning. This non moderated evolutionary process however allows and encourages actors to publicly share some of their tacit assumptions which can challenge other actors to reflect on their situated practices.

Another distinctive way through which actors interactions facilitated learning within the practicing community was the accuracy of the information related to feedbacks given to members about the cause and effect relationships between individuals' or group actions and outcomes. This in a way provided the actors an opportunity to reflect on their actions and consider alternative actions within a given frame of reference or a new frames of reference (Dery,1983). Thus, the rapid feedback supported both single and double loop learning (Argyris,1983). For example, a participant in a quick response to another member having problems in locating some caches draws on her own repeated, ritual confirmation in practice to explain how an immediate routine activity could be executed correctly.

*"In my area most new caches are found by either of 2 local cachers, I think the reason has more to do with the fact that they have already done most of the caches around here and as soon as they see a local cache they will go to it irrespective of whether they are first or not. Both are experienced cachers who often iron out teething problems, but whatever cache I go for it is still the first time I have found it, yes it is nice to get to a cache first but it's also horrid if you take the kids out, drive nearly an hour (real local caches don't exist) start to do a multi end up with a DNF then find out the setters have made a mistake on the cache page If you really want to give others a chance politely email the usual FTF's and ask them to wait"*

Some of the ongoing learning and knowledge creation that follows the reflections that may occur on receipts of feedback was characterised by re-examination and changing of values as evidenced in the articulation of intelligibility. Highlighting this case is the suggestion made by a participant in reply to an earlier online log.

*"Forgive me if I am totally wrong but I was under the illusion that ALL caches set for events had to be 'permanent' (min life expectancy - 3 months) caches in order to pass the criteria for publication on GC.COM. I will get it right next time round!"*

Constitutes a collective learning system whose performance depends on the extent to which its actors are prepared to share, create and consume knowledge.

From a particular problem solving situation, an actor writes:

*"Over the last few months, the server has been regularly crashing. The whole box just freezes, with nothing in any log file that I can find. It happens when the machine runs out of physical memory and seems independent of how much swap I have, or where I put it. I can no longer update people's stats because that process uses more memory than is in the box. So, I've taken a couple of days off work, during which time the site will be down while I try to get to the bottom of what's happening. First step is to re-image the server back to the official 1and1 system, which will*



*take several hours. If that cures the problem, it's just a matter of bringing the various sites back up. If not, I guess I refer it to landl as a potential hardware issue."*

The above quote shows that the social learning and knowledge creation processes in the CoP was also not linear as depicted in the existing management literature. In practice, it required continuous reflection and exploration of new ideas and insights punctuated by both failures and successes in practice. As argued by Spinosa (2002) all practices regardless of the explicit intentions of actors over time undergo transformations leading to the addition of new practices to the core ones. While the additional evolving practices developed here are shaped by the ongoing interactions and reflections that occurred in practice, the resulting core practices in turn shapes future interactions and reflections which sustains the practice. This represents the innovations that occur in CoPs. For example, a participant draws our attention to some of the new core practices that has evolved in the geocaching community:

*"There is this "caching trash out" which is an American programme, the idea is if you are geocaching then you should tidy up, so you go out with a bin bag during caching and pick up debris and waste in the caching area."*

In this case, the practice of geocaching is seen to have been elaborated to cover the advent of a new era of global environmental awareness. The actors here are basically dealing with environmental problems simply by engaging in the practice of geocaching. So as the skills of geocaching become habitual, they continuously draw the actors to recognize things relevant to their skills or practice which they would have historically pass over. Another way to understanding how innovation stimulated in practice provides the possibility of elaboration can be seen in the way Heidegger as cited by Spinosa (2002:208) conceptualized practice as "bringing things into their own this way". thus *"practices tends towards a refinement whose goal is to understand better how such product that draws people not only to use it but also to understand better how such products are an important part of their lives"*. The emphasis here is on the possibilities of the practice as induced by constraints and enablement and how their worthily purpose has a tendency to impact on the lives of the actors. So for example a participant in expatiating on how he has drawn on the practice to improve his tourism experience claimed:

*"You find the hidden part of a community which the tour guide may not tell you about. We do geocaching in Bristol even as we stay here for over six years, we conceive ourselves as very new to the area. We also go geocaching when we are on holidays, sometimes in America, Ireland and recently the Isle of White because you find out the other hidden parts including monuments, places where battles took place which the tour guide may not tell you about and if the geocachers has placed them correctly, then there is always a good reason for a geocacher to be there."*

When the research participants were asked whether they felt the practice of geocaching can have any commercial application or implication on society as a whole, the response was sharp and instructive as illustrated in these two separate extracts:

*"I think geocaching could be good for team leadership. It should be a good way to teaching how to work in a team especially when companies go for "away days."*

*"City councils should plant their own caches in say another city. Say Bristol plants caches in Birmingham that give information about the city of Bristol and Birmingham planting caches in Bristol that give information about Birmingham."*

These explicit statements imply the participants by virtue of the current engagement in the practice of geocaching are continuously engaged in the exploration of their "activity-place space". They emphasise how the shared practice of the community allows actors to take a step back to reflect on their practice and afford them to develop creative ideas, insights, processes and new ways of thinking that could enhance and sustain the practice.

## 8. Conclusion

The conceptual framework as presented in this paper is aimed at extending our understanding of the mechanism and dynamics between the interactions and reflexivity that goes on to sustain the performative processes of learning and knowledge creation which sustain a CoP across space and time.

The ongoing interactions among actors and their artefacts evidently set the pace for the survival of the CoP. However, it was the ongoing reflexivity in practice on the part of the actors that served as a catalyst for the transformation of the opportunities resulting from the dynamic interactions among the actors and their artefacts in their situated practice. In practice of geocaching turned to be patterned and meaningful and asuch can be concurrently conceived as both structures and material (Swidler, 2001). While the structures shape the CoP's practices, it is the actors practices which in-turn constitutes and reproduce the structures (Sewell, 1992). In this sense, actors as intelligible human beings engaged in their practice can reflect on the activities that constitutes the practice and challenge some of the constraints imposed on their actions in practice in creative ways which then come to transform or reconfigure the very structures that enabled them to engage in the practice. It is this cyclical process

of practice-structure transformations as aided by reflexivity in practice that results in the renewal of the community and their practice.

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### Notes

Note 1. Active Geocachers are those who have upgraded premiership status on [www.geocaching.com](http://www.geocaching.com) and have created a cache within the past 2months with at least 10 finds to their name

Continuous Interaction among Actors and their Artefacts in Practice		
	Yes	No
Reflexivity in Practice	Yes <i>Learning and Knowledge Creation Leading to Innovation</i>	<i>Theoretical Visions and Mirages based on Pure Imaginations</i>
	No <i>Community in a Morphostatic State</i>	<i>Dysfunctional Community on the Verge of Extinction</i>

Figure 1. Integrative Framework for Learning, Knowledge creation in a CoP.

**Name:** All American Pastime  
**Released:** Thursday September 25, 2003, by Seal Rock George  
**Origin:** Oregon, United States  
**Recently Spotted:** In the geocache: Danielle's Delight  
**Current goal:** The All American Pastime travel bug wants to celebrate baseball. Visit stadiums; meet players (young and old); share in the thrill of wood hitting the ball, the smells, the sounds, and the memories.  
**About this item:** Please take this bug if you are willing to take the responsibility to move this along. Take pictures of yourself with it, or pics of where it travels-and load them onto this site. Also take a few minutes and share your own base ball stories with us. In other words, just have fun with this-but don't keep it too long-there are others who want to share the fun! Also, attached to this bug is an American Cancer Society Relay for Life tag. If you're interested in helping fight cancer (travel bugs hate cancer), you can contact the ACS using the info on the tag.  
**Recent sightings:** Monday, September 29, 2003 Seal Rock George placed it in Danielle's Delight by Gone Bananas."

Figure 2. A Travel bug

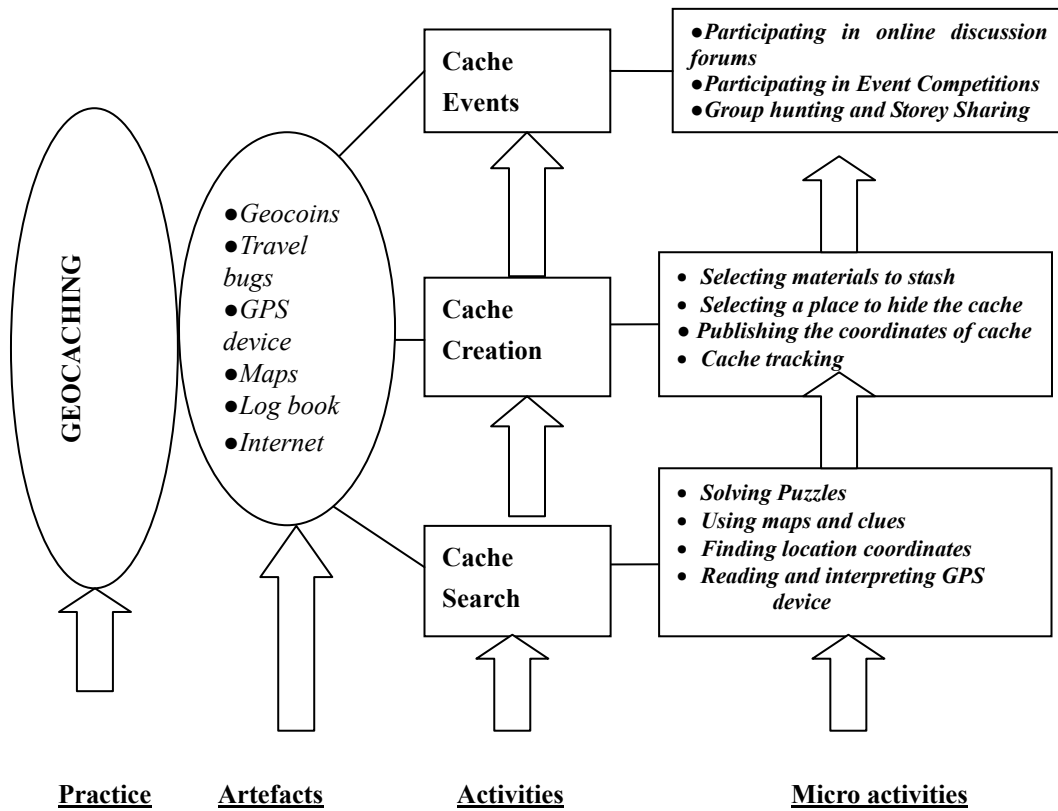


Figure 3. Mapping the Activities under the Practice of Geocaching

# Study on the Dynamic Efficiency of Listed Household Appliances Companies Based on the Malmquist-DEA Model

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## Abstract

Based on data from 16 listed household appliances companies, we use the Malmquist-DEA model to estimate the dynamic change of the total factor productivity (TFP) in the household appliance industry from 2002 to 2006, and analyze the scale efficiency and the input congestion level of household appliance industry. The results show that the TFP of household appliance industry was improved slightly, and the technical progress was obvious, but the pure technical efficiency and the scale efficiency were declining, and the input congestion degree was higher.

**Keywords:** Data Envelopment Analysis (DEA), Malmquist index, Household appliances industry, Efficiency, Input congestion

## 1. Introduction

China has become the world household appliance production country, and formed a series of famous domestic brands, but its development of the household appliance industry still has many problems such as low industry concentration and excessive competition, so it is very important to scientifically evaluate the efficiency of the household appliance industry, find out problems and constitute relative policies for the healthy development of China household appliance industry.

There are many evaluation methods to evaluate company performance and management efficiency, which can be divided into two sorts, parameter method and non-parameter method. The parameter method needs to set up specific efficiency frontier function and measure various parameters through samples when it is used to measure the efficiency level of the enterprise. Though this method considers the distribution of random error, but the specific function form will influence the result of the efficiency. The parameter method mainly includes stochastic frontier approach (SFA), distribution free approach (DFA) and thick frontier approach (TFA). The non-parameter method mainly includes linear programming method such as data envelopment analysis (DEA). The non-parameter method doesn't need to set up the frontier production function, doesn't bring system warp because of inaccurate function estimation, but it doesn't consider the random errors induced by data problem (such as extreme value) and measured error, and cannot expediently test the markedness of the result (Zhu, 2006, p.51-62). Farrell et al used DEA and Translog to measure the cost efficiency of the bank, and the research result showed that both have same relationship (Farrell, 1957, p.253-281). Seiford and Thrall's research showed that DEA was effective to estimate efficiency frontier (Seiford, 1990, p.7-38). However, Wheelock and Wilson thought that static CCR and BCC model only implemented landscape orientation analysis to samples in same term, and they couldn't analyze the efficiency change of DMU in different terms, but the Malmquist productivity index method was to use panel data and the concept of distance function to beg a productivity index which could be as portrait analysis, which could compensate deficiencies of static CCR and BCC model and complete the analysis.

Based on above analysis, in this article, we take 16 listed household appliance companies as samples, use the Malmquist-DEA model to estimate the dynamic change of the total factor productivity (TFP) in the household appliance industry from 2002 to 2006, and analyze the scale efficiency and the input congestion level of household appliance industry.

## 2. Mathematical model

The Malmquist index method is defined according to the input-output distance function put forward by R.W. Shephard, and it was put forward by Christensen and Caves (Christensen, 1970, p.19-50 & Caves, 1982, 1393-1414), and further developed by Fare et al (Fare, 1992, p.158-160). General TFP index based on input under the condition of multi-input and multi-output can be denoted by the Malmquist productivity index.

### 2.1 The definition of the Malmquist index

The distance function is the reciprocal of Farrell technical efficiency, which can be looked upon the proportion that the production point  $(x, y)$  is compressed to the ideal minimum input point.  $X_j = (x_{1j}, x_{2j}, \dots, x_{mj})$  and

$Y_j = (y_{1j}, y_{2j}, \dots, y_{sj})$  respectively represent the input vector and the output vector, and considering the changeless returns to scale (CRS) and input set on the production frontier with input strong disposability (shortened as CS input set), the distance function based on CS input set can be denoted as

$$D^t(y^t, x^t) = 1/F^t(y^t, x^t|C, S) \quad (1)$$

To get the Malmquist index, supposing that the input and output data in t and t+1 terms are respectively denoted by  $(x^t, y^t)$  and  $(x^{t+1}, y^{t+1})$ , the Malmquist index is

$$M^t(x^{t+1}, y^{t+1}, x^t, y^t) = \left\{ \left[ \frac{D^t(x^{t+1}, y^{t+1})}{D^t(x^t, y^t)} \right] \left[ \frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^{t+1}(x^t, y^t)} \right] \right\}^{1/2} \quad (2)$$

## 2.2 The decomposition of the Malmquist index

The Malmquist productivity change index can be decomposed as the technical efficiency change (TEC) and the technical change (TC) (Fare et al. 1992), and its computation formula is as follows

$$\begin{aligned} M^t(x^{t+1}, y^{t+1}, x^t, y^t) &= \left\{ \left[ \frac{D^t(x^{t+1}, y^{t+1})}{D^t(x^t, y^t)} \right] \left[ \frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^{t+1}(x^t, y^t)} \right] \right\}^{1/2} \\ &= \frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^t(x^t, y^t)} \left[ \frac{D^t(x^{t+1}, y^{t+1})}{D^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D^t(x^t, y^t)}{D^{t+1}(x^t, y^t)} \right]^{1/2} \\ &= TEC(x^{t+1}, y^{t+1}, x^t, y^t) TC(x^{t+1}, y^{t+1}, x^t, y^t) \end{aligned} \quad (3)$$

The Malmquist productivity index (TFP index) denotes that the change degree of total productivity from t term to t+1 term for the enterprise.  $M > 1$  represents the ascending productivity and  $M < 1$  represents the descending productivity.

The technical efficiency change (TEC) denotes the technical efficiency change degree from t term to t+1 term for the enterprise, which indicates the degree of efficiency chase.  $TEC > 1$  denotes the technical efficiency reduces the difference with the optimal DMU, and  $TEC < 1$  denotes the technical efficiency increases the difference with the optimal decision making unit (DMU).

The technical change (TC) denotes that the technical change degree from t term to t+1 term, which represents the movement of production frontier between two terms and indicates the degree of technical advancement or technical innovation.  $TC > 1$  denotes the technical advancement, and  $TC < 1$  represents the technology possesses recessionary tendency.

When returns to scale are changeable, the technical efficiency index can be decomposed as the pure technical efficiency index and the scale efficiency index. The pure efficiency index reflects the difference of technical level operation between the present production point and the production frontier of scale returns change, and the scale efficiency reflects the difference between the production frontier of changeless scale returns and the production frontier of change scale returns.

The improvement of technical efficiency and the enhancement of technical level are the headspring to increase TFP. The Malmquist productivity index is bigger than 1, which indicates the enhancement of TFP level. In three sorts of index to compose Malmquist productivity index, if one certain index is bigger than 1, which indicates it is the headspring to increase TFP, whereas, it is the root to reduce TFP.

## 2.3 Using the DEA model to solve the distance function

The key to compute Malmquist index is to beg the distance function, and we can utilize DEA to find out the distance function, which can avoid the problem of system warp when selecting the form and variable of the boundary production function, and effects of non-technical factors such as unreasonable price system on the distance function, and it is very good method (Yu, 2004, 827-831).

The distance function is the reciprocal of the Farrell technical efficiency, so we can translate the solvent of distance function into the solvent of efficiency function. Suppose that in J DMUs, the input vector of DMU<sub>j</sub> in t term is  $X_{jt} = (x_{1,jt}, x_{2,jt}, \dots, x_{m,jt})$ , and the output vector is  $Y_{jt} = (y_{1,jt}, y_{2,jt}, \dots, y_{s,jt})$ , so when returns to scale are changeless, the relative efficiency of DMU<sub>j</sub> based on input can be solved by the following linear programming.

$$[D^t(y^t, x^t)]^{-1} = F^t(y^t, x^t) = \min \theta$$

$$s.t \begin{cases} \sum_{j=1}^J \lambda_{j,t} x_{j,t} \leq \theta x_{j,t} \\ \sum_{j=1}^J \lambda_{j,t} y_{j,t} \geq y_{j,t} \\ \lambda_{j,t} \geq 0, j = 1, 2, K, J \end{cases} \quad (4)$$

$$[D^t(y^{t+1}, x^{t+1})]^{-1} = F^t(y^{t+1}, x^{t+1}) = \min \theta$$

$$s.t \begin{cases} \sum_{j=1}^J \lambda_{j,t} x_{j,t} \leq \theta x_{j,t+1} \\ \sum_{j=1}^J \lambda_{j,t} y_{j,t} \geq y_{j,t+1} \\ \lambda_{j,t} \geq 0, j = 1, 2, K, J \end{cases} \quad (5)$$

$$[D^{t+1}(y^t, x^t)]^{-1} = F^{t+1}(y^t, x^t) = \min \theta$$

$$s.t \begin{cases} \sum_{j=1}^J \lambda_{j+1,t} x_{j,t+1} \leq \theta x_{j,t} \\ \sum_{j=1}^J \lambda_{j+1,t} y_{j,t+1} \geq y_{j,t} \\ \lambda_{j,t+1} \geq 0, j = 1, 2, K, J \end{cases} \quad (6)$$

$$[D^{t+1}(y^{t+1}, x^{t+1})]^{-1} = F^{t+1}(y^{t+1}, x^{t+1}) = \min \theta$$

$$s.t \begin{cases} \sum_{j=1}^J \lambda_{j+1,t} x_{j,t+1} \leq \theta x_{j,t+1} \\ \sum_{j=1}^J \lambda_{j+1,t} y_{j,t+1} \geq y_{j,t+1} \\ \lambda_{j,t+1} \geq 0, j = 1, 2, K, J \end{cases} \quad (7)$$

To further measure the pure technical efficiency and scale efficiency of the household appliance industry, we need to measure the distance function under the condition of changeable returns to scale. Adding the restriction condition of  $\sum_{j=1}^J \lambda_{j,t} = 1$  in the formulas (4) and (7), we can obtain the distance function  $D^t(y^t, x^t)$  based on the (V, S) input set.

### 3. The empirical analysis of dynamic efficiency for listed household appliances companies

#### 3.1 The setup of model variables and the selection of sample data

In this article, we select 16 listed companies which mainly manage household appliance as samples and take their year reports from 2002 to 2006 as reference data (data from [www.jrj.com](http://www.jrj.com)). These listed household appliance companies include Hisense, Chunlan, Aucma, Xiahua, Little Swan, Haier, Kelong, Meiling, Konka, Changhong, Ningbo Fuda, Meidi, Shenzhen Huafa, S Sam Sung, Gree and Soyea Technology.

According to scholars Ye, Shiqi, Yan, Caiping, and Mo, Jianfang's research, the selection of DEA index should follow the principle of objective, simplification, association and diversity, and the smaller and better indexes should be as the input indexes and bigger and better indexes should be as the output indexes in the evaluation by DEA (Ye, 2004). According to above principles, in this article, we select total assets, sum of employee, main business cost as input variables, and select net profit and main business income as output variables. First, we utilize 5 years' panel data to figure out the Malmquist productivity index which can reflect the dynamic efficiency change, and judge the



change of TFP and the resources of this change. Second, we adopt the BBC model to compute the technical efficiency, the pure technical efficiency and scale efficiency of various companies from 2002 to 2006, and judge returns to scale and the input congestion degree of various companies. We use the software of DEAP2.1 to solve involved linear programming problems.

### 3.2 Analysis of empirical results

#### 3.2.1 Analysis of Malmquist productivity index

Table 1 shows the total schema of efficiency change of 16 companies from 2002 to 2006, and various indexes in the table take data of 2002 as the basic and all efficiency indexes in the that term are 1. The TFP indexes in the following four years are respectively 0.895, 1.219, 1.269 and 0.981, which mean is 1.08. In 2002-2003, the TFP index declined, and the TFP index ascended in 2003-2005. TFP index in 5 years was still slightly ascended.

TFP can be decomposed as TEC and TC. As viewed from the reason to influence the TFP change, the declined reason of TFP in 16 listed companies comes from retrograde technology and reduced efficiency. In 2003-2005, though the technical efficiency is still decrease, but the influence of technical advancement is very obvious, which induces the rise of TFP, and the technical advancement makes the total production possibility boundary move forth, and the technical research and development developed by the country and the household appliance industry can explain that. In 2005-2006, the decrease of TFP mainly came from the retrograde technology, and though the technical efficiency had been improved to a certain extent, but the influence of retrograde technology was very obvious. As viewed from five years' situation, the TFP slightly ascended, the technical advancement was obvious, but the technical efficiency descended.

TEC can be decomposed as PE and SE under changeable returns to scale. From Table 1, we can see that except that the SE in 2004 and the PE in 2006 are bigger than 1, others are all smaller than 1. That indicates in the sampling term, except for the contribution of technical advancement to TFP, PE and SE decrease the enhancement of TFP. The PE equal value of five years is 0.971 and the SE equal value of five years is 0.987, which indicates that 16 listed companies had not achieved the state with optimal scale, the input-output proportion should be optimized, and the input factor utilization rate presents the declined tendency.

As viewed from various household appliance enterprises, from Table 2 in 16 listed companies, the number of company which TFP ascends is 11, the number of technical advancement is 15, and the number of descended efficiency is 8. The technical advancement of household appliance enterprise is marketable, but the efficiency drop is very obvious, and the TFP presents ascending tendency as a whole. In recent years, most household appliance enterprises develop large-scale technical research and development, which improves the technical advancement of the household appliance industry, but in this industry without high concentration, the competition is always very intense. After China joined WTO, the household appliance enterprise would directly face the competition from international industrial monopolization, which would seriously influence the enhancement of technical efficiency in the household appliance industry.

In Table 2, the number of the household appliance enterprise with reduced PE is only 6, the number of reduced SE is 6, the PE and SE of other enterprises are stable, and the enterprise with reduced efficiency seriously influence the efficiency change, which induces the PE and SE of 16 listed companies all are in the descending tendency in five years. And the descending of PE and SE would directly influence the change of the technical efficiency index.

As viewed from Malmquist productivity index and its decomposition result, the TFP of household appliance enterprise continues to enhance, the technical advancement is marketable, but the problem of deficient efficiency still exists. Next, we will analyze this problem from two aspects such as returns to scale and input congestion degree.

#### 3.2.2 Analysis of returns to scale

From Table 3, the values of technical efficiency, PE and SE in 2002-2006 all present the tendency of first descending and then ascending to different extents, which is similar with the conclusion showed by the Malmquist index. In five years, the proportion of the company with changeless returns to scale basically accords with the tendency of first decrease and then increase, the number of the company with the degressive returns to scale basically accords with the ascending tendency, and the number of the company with the increaseing returns to scale basically accords with changeless. The proportions of the company in the stage of changeless returns to scale in five years are respectively 56.25%, 56.25%, 43.75%, 31.25% and 43.75%. Only the proportions of the company in the stage of changeless returns to scale in 2002 and 2003 exceed 50%, which indicates that the companies which achieve the reasonable production state of scale returns are relative less. The transformation of total scale returns stage in the household appliance industry influences the total scale efficiency, which induces the total scale

efficiency in five years presents descending tendency.

From the situation of scale return of 16 companies showed in Table 4, we can see that in five years, the companies which always are in the descending state of scale returns in four years include Ningbo Fuda and Meidi, the company which always are in the descending state of scale returns in three years is Chunlan, and the degression of scale returns of these companies indirectly influences the scale efficiency situation of the whole industry. Hisense, Little Swan, Haier, Shenzhen Huafa, and Soyea Technology are in the optimal state of scale returns all along in five years.

### 3.2.3 Analysis of input congestion

As Table 5, totally speaking, the input congestion degree of 16 listed companies presents ascending tendency. In 2002, the input congestion degrees of total capital, main business cost and sum of employee respectively achieve 1.7%, 0.00% and 0.41%, but these numbers in 2006 respectively are 0.38%, 0.38% and 4.71%. The input congestion degree of employee sum in 2004 achieves 16.73%, and the input congestion degree of main business cost in 2005 achieves 11.44%. So years of 2004 and 2005 are two years with high input congestion degree, and the degree has descending tendency in 2006. To analyze the reason of high input congestion degree in 2004 and 2005, we list input redundancy situation of 16 listed companies in 2004-2005 in Table 6.

From Table 6, the large-scale increase of employee input congestion degree in 2004 is mainly induced by the input redundancies from Kelong, Changhong and Konka. The large-scale increase of input congestion degree of main business cost in 2005 is mainly induced by the large-scale increase of main business cost from Kelong, Changhong and Xiahua. At the same time, according to Table 6, the congestion degree of input factors by other companies in these two years can offer certain decision-making references for the company.

## 4. Conclusions

In this article, we adopt 80 panel data of 16 listed household appliance companies from 2002 to 2006, and utilize the Malmquist-DEA model to empirically analyze their TFP, technical efficiency, returns to scale and input congestion. Following conclusions can be obtained. The TFP of 16 listed companies was improved slightly, and technical advancement was marketable, but the PE and SE basically presented descending tendency and the input congestion degree was higher.

In 2002-2006, the TFP of 16 listed companies was improved slightly, and the reason mainly is that the technical advancement in the household appliance industry was marketable, but the efficiency change index presented descending tendency. In recent years, China takes up with the technical innovation in the household appliance industry, and many household appliance enterprises increase technical input to develop the product with high technical content, which improve the industrial technical level, but the industrial environment with low industrial concentration and excessive competition still influences the factor distribution efficiency of the household appliance industry.

Through the decomposition of technical efficiency change index, we find that in five years, PE and SE presented descending tendency to different extents, and the quantity of the company which was in the optimal state of scale returns decreased and the quantity of the company which was in the descending state of scale returns increased, which influenced the scale efficiency of the household appliance industry. The reason of that problem may be that many accumulative problems such as low industrial concentration and excessive competition can not be solved essentially, so for the future development of China household appliance industry, the key is to distribute factors reasonably, enhance factor utilization rate and enhance the management level and scale economy.

As viewed from the analysis of input congestion degree, the input congestion degree in five years presented ascending tendency, and years of 2004 and 2005 were two years with high input congestion degree, and the redundant input factors were mainly represented in the main business cost and employee quantity. The increase of main business cost was mainly influenced by the price rise of energy, materials and upper fittings.

The DMU selected in this article is China household appliance making enterprise which can reflect the production frontier of China household appliance industry. If we want to truly evaluate China household appliance industrial efficiency and obtain more accurate analysis, we should bring transnational household appliance companies into the analysis system, which may open out more contents on the deeper layer. Furthermore, though DEA has many advantages but Wu, Wenjiang had pointed out the general model of DEA still had limitations (Wu, 2002), so the further work of this article is to study how to more scientifically and reasonably select index system, and add decision-maker's favor information into the DEA model as the restrictive condition for more reasonably evaluating the dynamic efficiency of DMU.

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Table 1. Malmquist productivity index and decomposition results from 2002 to 2006

Year	TEC	TC	PE	SE	TFP
2002	1	1	1	1	1
2003	0.984	0.91	0.991	0.993	0.895
2004	0.932	1.308	0.931	1.001	1.219
2005	0.87	1.46	0.895	0.971	1.269
2006	1.056	0.929	1.074	0.983	0.981
Mean	0.958	1.127	0.971	0.987	1.08

Note: EF represents the change index of technical efficiency, TE represents the technical change index, PE represents the efficiency index of pure technology, SE represents the scale efficiency index and TEP represents the index of TFP.

Table 2. Analysis of Malmquist productivity index from data of 16 listed household appliances companies

Company	TEC	TC	PE	SE	TFP
1	1	0.991	1	1	0.991
2	0.926	1.024	0.924	1.003	0.948
3	0.842	1.081	0.847	0.994	0.911
4	1.002	1.074	1.008	0.994	1.076
5	1	1.099	1	1	1.099
6	1	1.267	1	1	1.267
7	0.987	1.254	0.982	1.004	1.237
8	0.995	1.141	0.995	1	1.135
9	0.871	1.113	0.873	0.998	0.97

10	0.922	1.217	0.923	0.999	1.122
11	1.002	1.146	1	1.002	1.149
12	0.953	1.054	1	0.953	1.004
13	1	1.172	1	1	1.172
14	0.854	1.11	1	0.854	0.949
15	1	1.168	1	1	1.168
16	1	1.163	1	1	1.163
Mean	0.958	1.127	0.971	0.987	1.08

Table 3. The number of the company which was in different stage of scale income in each year and their efficiency estimation results

Year	Scale income state and enterprise quantity			values of efficiency parameter		
	-	drs	irs	crste	vrste	se
2002	9	3	4	0.955	0.96	0.994
2003	9	5	2	0.942	0.955	0.987
2004	7	4	5	0.883	0.895	0.988
2005	5	5	6	0.795	0.824	0.96
2006	7	4	5	0.833	0.878	0.953

Note: “-” in the table represents the scale income is changeless, “drs” represents the scale income decreases by degrees, “irs” represents the scale income increases by degrees, “crste” represents the technical efficiency, “vrste” represents the pure technical efficiency, and “se” represents the scale efficiency.

Table 4. Returns to scale of 16 listed household appliances companies from 2002 to 2006

Company	No.	2002	2003	2004	2005	2006
Hisense	1	-	-	-	-	-
Chunlan	2	drs	-	drs	irs	drs
Aucma	3	irs	irs	irs	irs	drs
Xiahua	4	irs	irs	irs	irs	irs
Little Swan	5	-	-	-	-	-
Haier	6	-	-	-	-	-
Kelong	7	drs	drs	irs	irs	irs
Meiling	8	irs	-	drs	irs	irs
Konka	9	irs	drs	irs	irs	irs
Changhong	10	-	drs	irs	drs	irs
Ningbo Fuda	11	drs	drs	drs	drs	-
Meidi	12	-	drs	drs	drs	drs
Shenzhen Huafa	13	-	-	-	-	-
S Sam Sung	14	-	-	-	drs	drs
Gree	15	-	-	-	drs	-
Soyea Technology	16	-	-	-	-	-

Table 5. Situations of input congestion of 16 listed household appliances companies

Year	Assets		Costs of main businesses		Sum of employees	
	$S_1^-$	%	$S_2^-$	%	$S_3^-$	%
2002	0.085	1.70%	0	0.00%	0.029	0.41%
2003	0	0.00%	0	0.00%	0.245	3.04%
2004	0.159	2.18%	0	0.00%	1.732	16.73%
2005	0.123	1.76%	0.487	11.44%	0.457	5.08%
2006	0.027	0.38%	0.02	0.38%	0.524	4.71%

Table 6. Situations of input congestion of 16 listed household appliances companies from 2004 to 2005

Company	No.	2004			2005		
		Assets	Costs of main businesses	Sum of employees	Assets	Costs of main businesses	Sum of employees
Hisense	1	0.00	0.00	0.00	0.00	0.00	0.00
Chunlan	2	0.41	0.00	0.00	0.94	0.00	0.00
Aucma	3	0.15	0.00	0.00	0.91	0.00	0.00
Xiahua	4	0.00	0.00	0.00	0.00	3.08	0.00
Little Swan	5	0.00	0.00	0.00	0.00	0.00	0.00
Haier	6	0.00	0.00	0.00	0.00	0.00	0.00
Kelong	7	1.99	0.00	13.20	0.00	2.16	5.51
Meiling	8	0.00	0.00	0.00	0.00	0.00	0.00
Konka	9	0.00	0.00	5.91	0.00	2.56	0.56
Changhong	10	0.00	0.00	8.61	0.00	0.00	1.24
Ningbo Fuda	11	0.00	0.00	0.00	0.12	0.00	0.00
Meidi	12	0.00	0.00	0.00	0.00	0.00	0.00
Shenzhen Huafa	13	0.00	0.00	0.00	0.00	0.00	0.00
S Sam Sung	14	0.00	0.00	0.00	0.00	0.00	0.00
Gree	15	0.00	0.00	0.00	0.00	0.00	0.00
Soyea Technology	16	0.00	0.00	0.00	0.00	0.00	0.00
Mean		0.16	0.00	1.73	0.12	0.49	0.46
Degree of input congestion		2.18%	0.00%	16.73%	1.76%	11.44%	5.08%

# Use of Land in China: Government Regulation Financing Dependence and Policy Orientation

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## **Abstract**

The policy for use of land is one of important components in the economic reformation in China. Beginning from the present situation of Chinese policies for use of land, this paper has taken Zhejiang province as a representative example to make an analysis, finding that there are many problems in Chinese present policies for use of land, pointing out that the future reformation should focus on solving three issues, including the dual land-system, the government regulation and financing dependence, and the imperfection of relevant legal system. Conclusions in this paper are meaningful in deepening Chinese policies for use of land.

**Keywords:** Use of land, Government regulation, Financing dependence, Policy orientation

In June, 2006, The Ministry of Land and Resources P.R.C publicized a research report on the use of national land. This report says that from 1996 to 2004, in less than ten years, the farmland in China has been reduced more than 100,000,000 Chinese units of area. During the same period, amounts of land have been roughly used or even wasted. This report also shows that till late 2004 in the scope of state's town programming, 1,079,300 Chinese units of area have been left unused, 842,400 vacant, 2,034,400 authorized but no supply, and the total of the three sorts of land have reached 3,956,100 Chinese units of area. This surprising report does have made us worried about the speed-up processes of industrialization, urbanization, and marketization in China.

## **1. The evolvement and present situation of Chinese policies for use of land**

The reformation and evolvement of Chinese land policy are always accompanied with the reform of economic system. Here there are four typical stages that arouse attentions. At the first stage in 1986, The Law of Land Administration of the P.R.C has been issued and the National Land Management Authority of P.R.C has been founded, forming a new system for an integrated administration of towns, counties, lands, and governments. At the second stage from late 80s in last century, relevant articles in The Constitution and The Law of Land Administration of the P.R.C have been amended, entering the system reform of profitable use of lands and the process of market allocating land resources. At the third stage in 1998, The Law of Land Administration of the P.R.C has been completely amended and The Ministry of Land and Resources P.R.C has been founded. The administration of land has begun to be transformed toward the regulation of use. After entering the new century, the country's documents No.[2004]28 and No.[2006]31 indicates that the administration of land has begun to be transformed from the specialized resources management toward the participation in macro-control.

Chinese present policies for use of land have ten characteristics. 1. Protection for farmland, especially for arable land, is the fundamental national policy of China. Although the domain of China is large, the farmland per unit is small considering the large population and the quality of arable land is poor. Considering the strategy of Chinese grain safety, the protection for land should not only improve the quality of arable land to increase the production of grain per unit, but also guarantee the quantity of farmland. 2. The regulation on use of land. According to the fundamental land policies established by The Law of Land Administration of the P.R.C, the base of the regulation is the classification of use of land, the gist the overall layout, the key the approval of transforming farmland into construction land, the carry-out practice the allocation of land supply, and the guarantee the land registration. 3. The compensation policy for the occupation of farmland. If the farmland is used for non-agricultural purpose, the organization that occupies the farmland should take the responsibility of cultivating a new piece of farmland in equal quantity and quality, according to the "occupation-equal-to-cultivation" principle. If the organization fails to cultivate a new piece of farmland or what it has cultivated does not meet the requirement, the organization should pay costs for cultivating a similar piece of farmland. 4. The policy for controlling the quantity of total land supply in construction. Control the quantity of total land supply in construction strictly according to the overall layout of land-use and the practical needs in local construction. Set up index restriction and annual plan index control (the control index for farmland transformation and the control index for farmland occupation). 5. The policy for collective supply of urban construction. It is the city government that controls the land supply for construction. In one city, all the land for new construction should be confiscated and supplied by the city bureau of land

administration. Besides, the land for new construction in the urban administrative regions and all “gardens and districts” should be brought into the land-supply channel of city government. 6. The policy for profitable use of land. Except for the use of land based on laws or administration, all other kinds of uses of land should be paid back. The profitable use of land can be realized through four ways, namely selling, renting, investing, and sharing. The law allows four fields to occupying land for free. The first is the land for state administration and military affairs. The second is the land for fundamental urban facilities and public causes. The third is the land for energy, transportation, irrigation works, and other fundamental facilities supported by the state. The fourth is the land for other uses set by laws and administrative regulations. The Ministry of Land and Resources of P.R.C constitutes the Direction for Use of Land to make this issue more specific and definite. 7. The policy for publicly remising the right of using the land. Land for commercial services or industry must be remised by bidding publicly. The remising process by agreement must be publicly noticed and the result has to be publicized. 8. The policy for periodically renewing and publicizing the benchmark for land price. Set up and update the benchmark for land price in time. In principle, the benchmark for land price should be updated every three years and be made adjustment according to the changes of market. The essential contents of the benchmark for land price should be publicized at appointed place or media in proper forms and can be inquired by people freely. 9. The policy for land registration and registration query. The right of land works after registration. The registration of land property can protect the legal right of land obtainers. Except for the field of state secrecy, the land registration should meet the requirement of public query. 10. The policy for land participates in the macro-control, guarding the two gates of “land” and “credit”. Applying the policy for land to the macro-control is a special choice made by the central government considering the unique land system in China, the special state situation, and the specific development stage. It has the feature of transition economy.

The recent reform on Chinese land policy has gained greater progresses. But these progresses are still insufficient. Certain problems in the aspects of land policy and practice are waiting for resolution. Studies show that China’s present policy for use of land still faces these main problems as follow. A dual system exists in the policies for rural land and urban land. The state monopolies the primary market of urban land. The occupation for land is not equal to the compensation. Farmers are powerless in the aspect of land property. Local government depends too much on profits from remising land and land-related financing. The ratio of farmland reduction is hard to decrease. The legal frame for use of land is imperfect.

In recent years, the speed-up growth of economy and urbanization is keeping up with the market openness and the fundamental reform on the policy for use of land set by Chinese government. Presently, China has taken some important measures in order to enhance the control of farmers and citizens over their land, decreasing the ratio of farmland reduction, and improving urban assets capability of market transaction. At the same time, there are also some vital challenges in the fields of land policy and system.

## **2. Case analysis on the land market in Zhejiang province of China**

In the following analysis, we choose Zhejiang province as a sample for its recognized success in executing the policy for use of land, by which we can probe into the problem of land uses in China. Here we take the year 2004 as the cross section in researches.

Zhejiang has a dense population in a relatively small land area. The average land area per capita in Zhejiang is 0.24 hectare, being one fourth of the national average and one thirteenth of the world average. The imbalance between people and land is serious. Fortunately, the diverse uses of land in Zhejiang province and its interactive development among the local economies contribute to its leading development of provincial economy in China.

(1) The rapid economic development in Zhejiang province causes the vibrancy of land market. In the year 2004, Zhejiang province remised 13,619 pieces of land and the total area reached 18,018.4 hectare, including a newly-remising area of 14,531 hectare. According to the situation of remising land, most of the remising operations are based on agreements. The remising-land by agreements is 11293 pieces, occupying a proportion of 82.9 percent, reaching an area of 14,004 hectare, including a newly- remising area of 12,046 hectare which respectively occupies 77.7 percent of the total remising land 82.9 percent of the newly-remising land. The remising-land by bidding is 246 pieces and the total area in bidding reaches 315.5 hectare, including a newly-remising area of 218.8 hectare. The remising-land by auction is 1,128 pieces and the total area in auction reaches 1,679.8 hectare, including a newly-remising area of 1,041.3 hectare. The remising-land by listing is 952 pieces and the total area reaches 2,019.2 hectare, including a newly-remising area of 1,224.9 hectare. The remising-land by bidding, auction, and listing occupies 17.1 percent of the total remising-land, the relevant area 22.3 percent of the total, and the newly-remising area 17.1 percent of the total.

Table 1 indicates that the transactions are frequent in the land market in Zhejiang province in 2004 and the ways of transaction are changed from initial agreements toward bidding, auction, and listing. But the three new ways merely

occupy a lower proportion of the total. The number of 20% indicates that there is a long way for the development of land transactions.

(2) The prices for different pieces of land are various and the return from land increment is prominent. In 2004, the total income in land-remising reached 87,430,000,000 Yuan and the net profit was 13,560,000,000 Yuan. The total average price of remising-land was 4,852,000 Yuan per hectare and the total average profit was 752,000 Yuan per hectare. In the aspects of prices and profits in different remising ways, the average price of remising by agreements was 1,677,000 Yuan per hectare and the average profit was 161,000 per hectare. The average price and average profit in bidding respectively reached 27,482,000 Yuan and 5,148,000 Yuan per hectare, what are respectively 16 times and 32 times of that by agreements.

According to the table 2 and the price and profit of different pieces of land, the price of land for residence was the highest, reaching 14,540,000 Yuan per hectare. In the next place, the price of land for commercial services reached 13,010,000 Yuan per hectare. The land for industrial or special uses was in general at lower prices, being almost equal to one tenth of price of land for residence. The profit of land was similar to the price. The average profit of land for residence was 2,550,000 Yuan per hectare and that of land for commercial services was 2,260,000 Yuan per hectare, higher than ten times of price of land for common uses.

Table 3 shows that the land system of combining bidding, auction, and listing can help to escape from a black-box operation to a great degree in the land transaction, except for the land for public facilities, constructions, and special uses. The open, fair, and equitable policy for land can regulate the land market and save land in its uses, improving the using efficiency of land.

(3) The remising-land is chiefly centered on the land for industrial and mining storages and residence. In the uses of remising-land, most of them are used for industrial and mining storages, reaching an area of 12,951 hectare, occupying 71.9 percent of the total remising-land. Secondly, the land for residence reached an area of 3,453 hectare, occupying 19.1 percent of the total remising-land. Thirdly, the land for commercial services reached an area of 1,313 hectare, occupying 7.3 percent of the total remising- land. All the land for the three kinds of uses occupied 98.3 percent of the total remising-land.

In 2004, the officially-allotted land reached an area of 8372 hectare in Zhejiang province, being equal to 46.5 percent of the total remising-land. The officially-allotted land chiefly focused on the transportation (occupying a proportion of 25.6 percent), the government subsidized residence (occupying a proportion of 17.5 percent), and the public facilities and constructions (occupying a proportion of 36.8 percent).

According to the way of remising land in the table 4, the land for industrial and mining storage is chiefly remised by agreements, occupying a proportion of 99.6 percent. The land for commercial services and residence is chiefly remised by bidding, auction, and listing, respectively occupying a proportion of 86.3 percent and 80.6 percent. All these numbers indicate that the land for businesses is mainly remised by bidding, auction, and listing. The way of remising becomes market-oriented step by step.

Studies show that the development of land market is a process, in which the planning economy was destroyed and replaced with the market economy. This process stands for a path of the government- guided obliged system's transfer and evolvement. Although the land market in Zhejiang has achieved a fast development, many factors, such as the effects of former system, the duality of land market, and the participation of government in land operations, contribute to the mal-development of land market. This problem can be identified in two aspects.

In the first place, the rent-seeking and monopoly of government causes its malfunction. And the competition for interests between sections leads to the market malfunction. It is the dual land system in rural area and city and the monopoly of government over the primary land market in city that causes the dual prices of land, distorting the function of market. According to the land system in China, the state and collectivity possess the land and the government at different levels manages the land in practice. In the process of land conversion, the duality of land system directly leads to problems as follow. The owners and users of rural land can not make transactions in land market and can not gain profits from the value increment of land in city. The land compensation obtained by them is far less than the values of land in city, what is usually used for constructions and businesses. Because the rural land can be acquired at a lower price by government regulations, it fosters a unique environment in which land is used inefficiently, cities are expanded roughly, and farmland is reduced greatly. The local government can obtain a huge income out of the budget by means of confiscating the land, forming the "land finance", what causes an excessive dependence of the local government on the land-confiscation income from and the land-related finance. As a result, it will lead to the land reserve system's functional dissimilation. Due to the different prices in the dual price system of land, lots of rent-seeking activities appear what provide possibilities for corruption.

In the second place, the administration system and legalization frame for land fail to deal with the new situations and



problems in development. Although the reformation has made certain progresses in the aspect of defining the rights and obligations of land-users and the state, the reform still has been performed in two aspects, namely the urban land and the rural land. Besides, the administration system and legalization frame for land are either in conflict with each other or imperfect. On one hand, the government participates in the market as not only the sole supplier of land but also the intermediary. The dualism of government leads to the loose restriction on land confiscation. On the other hand, the value of land is determined by its position in one city, instead of the purpose of compensation. However, the compensation standard for land confiscation is associated with the multiple of average agricultural productivity per year in last three years. As the rural land is confiscated for commercial uses, the compensation for farmers will be far less than the income obtained by the government from the final user.

### **3. The government regulation and financial dependence: analysis on the characteristics of policies for land**

Zhejiang is one of provinces that have powerful economy in China. It has already achieved a higher urbanization with a proportion of 54 percent. The increase of cities in this province is driven by its highly-speeded-up growth of industry and commerce. Inversely, the fast increase of cities also contributes to the high growth of industry and commerce. The typical feature of city increase is the upsurge of large urban centers that covers the whole province but not focuses on one or two regions. The investment in real estate is also at a high level in Zhejiang province, what reflects the relatively- higher and constantly-growing purchase power of urban residents.

The case proves an excessive dependence of the local government on the land-remising income and the land-related financing. The monopoly of government on the primary market of land serves as the stimulation for the government severely depending on the land-remising income which can be used to make up the regular finance budget capital and to expand the city. At the same time, the local government becomes more and more dependent on the confiscated land that can be used as the guaranty in form of land reserve by the local government to apply for bank loans. Both the two activities encourage the local government to confiscate the farmland regardless of potential risks, causing the irrational increase of cities.

The income of the local government includes two key parts. One is the budget income that is the return of various fees and taxes. And some are directly coming from the land and the real estate. The other is the out-of-budget income. And most are related with the land and the real estate.

Taxes and fees on the land and real estate are complicated and restricted by bugs in the taxation system. They may be collected only in transactions or they are just fixed at any occasion. Meanwhile, they are usually estimated according to costs, without regarding to the current values of assets in market. Therefore, they can not provide the local government with sufficient assets-based property taxes. In contrast, in many other countries the market-value-based property taxes are the main resources of finance income for the local government. In China, considering that most of families do not pay any kind of tax for their houses, the excessive land confiscation becomes unavoidable. On the other hand, the local government's out-of-budget income is extremely huge and most are coming from the profits of the bureau of land reserve. In many cases, the out-of-budget income from the bureau of land reserve may be equal to or even exceed the local government's total budget income.

The monopoly of the state on land supply, and the excessive dependence of the local government on land confiscation for the sake of finance income make the local government involve in this field that has less risks and more investment opportunities. The greatest risk faced with the local government is that it is not the local government who finally determines the position of land in need. It is enslaved to the fluctuation of ratio, especially the huge loans generated from the land's "market-value" evaluation that is made by the institution of land reserve and development authorized by the local government in fact. The principles in the property market are greatly distorted due to the inspiration of local government, no matter what it is an institution or an individual. As a result, the land in counties or the land possessed by collectivities is encouraged to turn into urban land or state-owned land as much as possible.

The income of the local government from this field has potential changeability. Once the elements that affect the demand of market change greatly, this income will be influenced negatively. Besides, the limits of land resources for expansion, the fluctuation of ratio, and all relevant fields surpass the control of the local government apparently. However, all these factors can exert potential effects on the behavior of local government. Moreover, although both the finance budget capital and the out-of- budget capital are under the examination and supervision, the later capital is in short of auditing and transparency in its management and expenditure.

### **4. The review of documents and research conclusions**

As far as the theories and policies for use of land are concerned, two viewpoints gain attentions in China's academic field. According to the first viewpoint, the thoughts of irrationality, uncertainty, and flexibility are vital revolutions of human epistemology and methodology brought by scientific and technological development. Because of the

gradually-increased uncertainty, irrational factors, and behaviors in the application of land policies, the former theories of land fail to meet the needs of reality due to its unilateral rationality, certainty, and rigidity. Step by step, the distance between theories and practices becomes larger. This issue is especially serious in the transition economy of China. Therefore, experts suggest that in the field of using land, we should keep on absorbing the latest achievements in science and technology, making up and improving the theories of rationality, certainty, and rigidity by the programming theories of irrationality, uncertainty, and flexibility, and constructing and perfecting the ideology and methodology of land using and programming. By this way, it can benefit the innovation of theories land using and programming, and the effective combination of programming and reality, what can help to avoid the separation of programming from reality to a great degree. According to the second viewpoint, the theories of land using and programming can be divided into three levels based on the practice of land use in China, namely the political economy-related fundamental theory, the general theory, and the subjective theory. The general programming theoretical system for use of land includes two parts, namely the horizontal part and the vertical part. Vertically, this system has three levels. The top level is theory of coordination and systematic cooperation that directly guide and affect the detail of the whole use and programming of land. The middle level is theory of dominating conditions that control the key problems in the process of using land. The bottom level is the cybernetics that directly manages the land-using structure and balance in detail. Horizontally, this system is an open ring. The theory of coordination is the core of the ring. The theory of dominating conditions reflects the coordination in general and it is an expansion of conditions. The cybernetics is specific methods for coordination, and the application of theory of conditions. In a series of rings, it is possible to add new theories considering the specific regional features and the requirements of times. Therefore, this theoretical system has a strong self-adapting mechanism.

Arnott, R.J. and J.E.Stiglitz (1979), Ades, A.F. and E.L. Glaeser (1995), Henderson Vernon (1997), Black,D, J.V. Henderson (1999), Andretsch,D.B., M.P. Feldman (2003) have made empirical researches on the policies for land and the urbanization issue in developing countries. They have agreed that the policies for land can exert vital effects on the urbanization in one country. An important problem emerged in the process of the government in developing countries pursuing urbanization by applying policies for land is that the unclear property right causes an accumulation of land property that is similar to the "original accumulation". As a result, more problems appear. Therefore, they suggest that the property clarity is the key for the effective application of land policies.

According to Grossman and Hart's (1986) definition of ownership, the ownership of an enterprise or certain assets is a control right in essence. It is a control over the residual rights, namely the residual control rights instead of the residual claim rights in a traditional sense. The residual income rights are derived from the residual control rights. After losing the farmland, farmers are allowed to share a part of income from the value increment of land. For example, as the local government confiscates a piece of farmland in one region, they will sign a contract to force the land users to provide the village or farmers with some interests. But the village has no right to determine the non-agricultural use of the land. Since the ownership is a kind of control right and farmers have no control right over the non- agricultural use of the farmland, the ownership of the farmland used for non-agricultural purpose does not belong to the rural collectivity. The non-agricultural construction land must be state-owned. And the state-owned land includes the urban land, and the part of rural land that has been turned into state-owned one. Along with the great increase of non-agricultural construction, the state speeds up the confiscation to the rural land. In the confiscation, no matter how much the confiscate land is, no matter where the confiscate land is, and no matter what the price of the confiscate land is, farmers have no right to say anything. It is determined by the local government in behalf of the state. After the confiscation, the government will remise the usufruct of the land to land users. No matter how the land-remising is realized by agreements, bidding, auction, listing, or renting, it is operated by the local government on the state's behalf. Therefore, concerning with the non-agricultural uses of farmland, the state has the ownership in practice.

However, Glease and Retal's (2005) studies are more proper for the situation in China. According to their empirical researches, Korea, Singapore, and other new-developed industrial countries have not fostered perfect property system during their fast development of economy from late 60s to 90s in last century. But all these "property-short" countries have achieved the prosperity of economy. Why the system and property were not as important as what we have thought? A metric empirical research shows that the property right is not the most important factor at the stage of economic growth. The effect of property right on economic development is merely at the second order. In contrast, the human resources, social capitals, and the level of marketization are the most basic factors in economic development. As the degree of marketization is improved, courts and legislatures will replace guns and costs of transactions will become less. As a result, it is possible to achieve the property clarity.

Since late 70s in last century, China has experienced a profound economic and social transform accompanied with

the conversion of economy system from planning economy to market economy. The issue of land has been associated with this transform in many important ways. Some land-related decisions ----- how to allocate, use, regulate, administrate, and finance in the field of land, will exert vital effects on the future of China economy and social development. Chinese government has been convinced of the importance of land policies in achieving the expected aims in economic and social fields. Fortunately, the recent policies for land in China are basically proper for the fast-changed environment. However, in the aspects of land policies and practices there are still some issues deserved to be resolved immediately, which is the vital task that should be solved by Chinese land policies.

Firstly, the dualism of rural and urban land system, and the monopoly of the state on the primary urban land market cause a severe economic distortion and an irrational growth of cities. At the times of unprecedented growth of cities and integration of urban and rural economies, the most important feature of China's land policies is the sharp different measures for urban land and rural land. As a matter of fact, the rural land and the urban land have to follow different authority systems and are managed by different agencies and laws. As a result from the division of rural land and urban land, the government becomes the sole intermediary to turn rural land into urban land. It is the government who has an exclusive right to confiscate the rural land and remise it to city users. Under the present legal system, all the rural land has to be confiscated firstly by the city government and then be allocated in urban users by different ways before the rural land entering the urban market. Recently, along with the speed-up process of urbanization, China's present land policies are questioned more and more. The question focuses on two aspects. The first is the unfairness to the users of rural land. The present policies are not good for the owners and users of rural land, because these policies directly make it impossible for them to obtain profits from the value increment of their rural land in the urban land market. The second is that they have no right to sell their land in the market. Moreover, the land compensation that was paid for farmers is merely associated with the land's agricultural productivity, usually being several times of its agricultural value, which is far less than its values as it is used for other purpose in city. This fact should be changed in the future.

Secondly, the local government depends too much on the land-transfer income and the land-related financing. The monopoly of government on the primary market of land serves as the stimulation for the government severely depending on the land-remising income which can be used to make up the regular finance budget capital and to expand the city. At the same time, the local government becomes more and more dependent on the confiscated land that can be used as the guaranty in form of land reserve by the local government to apply for bank loans. Both the two activities encourage the local government to confiscate the farmland regardless of potential risks, causing the irrational increase of cities. The monopoly of the state on land supply, and the excessive dependence of the local government on land confiscation for the sake of finance income make the local government involve in this field that has less risks and more investment opportunities. The greatest risk faced with the local government is that it is not the local government who finally determines the position of land in need. It is enslaved to the fluctuation of ratio, especially the huge loans generated from the land's "market-value" evaluation that is made by the institution of land reserve and development authorized by the local government in fact. Although it is impossible to get relevant data of the loan, it is doubtless that the loan is huge and it may cause a serious problem in the national credit institution. Besides, although the land reserve is popular in local regions, there are no relevant laws or principles to regulate this issue in China. It is the local government who approves the land reserve action. Therefore, an adjustment to politics is urgent.

Thirdly, the legal frame of land is incomplete. Although the reformation has made certain progresses in the aspect of defining the rights and obligations of land-users and the state, the reform still has been performed in two aspects, namely the urban land and the rural land. In 1982, the Constitution classified the land in China into two systems, which started a dual system for land management and use in China. According to the Constitution in 1982, the urban land is state-owned and the rural is collectivity- owned. In 1988, the Amendment of Constitution made it clear that the land usufruct can be transferred legally. It means the land usufruct can be separated from the land ownership. As far as the rural land is concerned, the Law of Land Administration amended in 1998 guarantees an individual farmer with a contracted-ownership of thirty years. And this reform has been enhanced and deepened due to the Law of Rural Land Contract in 2002. In essence, this law has improved the position of a farmer's right for land contracts and made it become a property right in a sense. According to this law, these rights of farmers should be changed in thirty years at least. As far as the urban land is concerned, the urban land is owned by the state. But the legal base for urban land's usufruct market has been formally established. As a matter of fact, the Real Property Law passed recently has concerned with integrating all present legal progresses in this field and extending them further.

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Table 1. The pieces and area of remising-land in Zhejiang province in 2004.

	Agreement	Bidding	Auction	Listing	Total
Pieces of remising-land	11293	246	1128	952	13619
Proportion (%)	82.9	1.8	8.3	6.9	100
Area of remising-land (hectare)	14004	316	1679	2019	18018
Proportion (%)	77.7	1.8	9.3	11.2	100
Newly-remising land (hectare)	12046	219	1041	1225	14531
Proportion (%)	82.9	1.5	7.2	8.4	100

Data resource: From data issued by Bureau of Statistics of Zhejiang Province.

Table 2. The price and profit of remising-land in Zhejiang province in 2004.

	Agreement	Bidding	Auction	Listing	Total
Total income (100 million Yuan)	234.9	86.7	314.2	238.5	874.3
Average price (10 thousand per hectare)	167.7	2748.2	1870.3	1181.1	485.2
Total profit (100 million Yuan)	22.6	16.2	55.6	41.2	135.6
Average profit (10 thousand Yuan per hectare)	16.1	514.8	331.1	203.5	75.2

Data resource: From data issued by Bureau of Statistics of Zhejiang Province.

Table 3. The price and profit of land for different uses in Zhejiang province in 2004 (10 thousand Yuan, 10 thousand Yuan per hectare).

Project	Average price	Income	Profit	Average profit
Land for commercial services	1301.44	1708601.19	297100.71	226.30
Land for industrial and mining storage	148.38	1921574.07	169689.97	13.10

Land for public facilities	531.85	26330.24	876.46	17.70
Land for public construction	410.22	66773.86	9284.57	57.04
Land for residence	1453.55	4993290.64	875227.26	254.78
Land for common commercial houses	1510.59	4715517.42	831872.3	266.49
Land for government subsidized residence	400.71	56272.16	8991.31	64.03
Land for other houses	1279.09	221501.06	34363.65	198.44
Land for transportation	182.71	11884.92	615.09	9.46
Land for irrigation facilities	446.85	13069.43	2601.47	88.94
Land for special uses	91.50	1188.55	109.97	8.47
Total	485.21	8742712.9	1355505.5	75.23

Data resource: From data issued by Bureau of Statistics of Zhejiang Province.

Table 4. The land-remising situation in Zhejiang province in 2004.

Project	Remising by agreement (hectare)	Proportion of remising-by-agreement (%)	Remising by bidding, auction, and listing (hectare)	Proportion of remising-by-bidding, auction, and listing (%)	Area of remising-land (hectare)
Land for commercial services	179.73	0.137	1133.12	0.863	1312.85
Land for industrial and mining storage	12896.87	0.996	53.90	0.004	12950.78
Land for public facilities	45.42	0.917	4.09	0.083	49.51
Land for public construction	140.05	0.860	22.73	0.140	162.78
Land for residence	667.83	0.194	2767.42	0.806	3435.25
Land for common commercial houses	516.31	0.165	2605.34	0.835	3121.64
Land for government subsidized residence	111.84	0.796	28.60	0.204	140.43
Land for other houses	39.68	0.229	133.49	0.771	173.17
Land for transportation	65.05	1.000	0.00	0.000	65.05
Land for irrigation facilities	0.68	0.023	28.57	0.977	29.25
Land for special uses	8.36	0.643	4.63	0.357	12.99
Total	14003.97	0.777	4014.47	0.223	18018.44

Data resource: From data issued by Bureau of Statistics of Zhejiang Province.

# Market Microstructure: Rationality as Defined by the Economic Maxims and Rationality as Defined by Fama, Efficient Market Hypotheses and Opportunity to Beat Share Markets

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## Abstract

This paper reviews the theory of market microstructure rigorously with the objective to relate it to the rationality as defined by the economic maxims and as defined by Fama, efficient market hypotheses and to infer what the theory has to say about the opportunity to beat the stock markets. It was found that the concept of rationality as defined by the economic maxims is inherent in dealer's optimization problem, multiple provider of liquidity and the information based model. While the concept of rationality as defined by Fama is embedded in the later development in information based model that considers private information as another source of risk for non informed investors. Efficient market hypotheses is linked to the dealer's optimization problem and information based model.

**Keywords:** Market microstructure, Inventory based model, Information based model, Rationality and Abnormal Return.

## 1. Introduction

The approach taken in writing this paper is to deliver an aerial view of the market microstructure theory without losing sight of its developments. Nevertheless, to commensurate with the title of this paper, the theory was reviewed to attain the following four objectives:

- (1) To examine whether the concept of rationality as defined by the economic maxims (Marschak, 1950) is embedded in the market microstructure theory or not.
- (2) To examine whether the concept of rationality as defined by Fama (1965) is presence in the market microstructure theory is not.
- (3) To examine whether the concept of the Efficient Market Hypothesis theory of Fama (1965, 1970, 1991) exists in the market microstructure theory or not.
- (4) To infer what the theory says regarding the opportunity to beat share market consistently.

At the end of this article, it is believed that better understanding of the followings would be achieved.

- (1) Definition of the market microstructure theory
- (2) The dimensions in trading mechanism
- (3) The basic models in the market microstructure theory
- (4) The paradigms in the base models
- (5) The development of the theory

## 2. Market microstructure theory and trading mechanism

Microstructure theory focuses on how specific trading mechanisms affect the price formation process (O'Hara, 1995). According to this theory, there are four dimensions in trading mechanism. The four dimensions are players, place where the trading occurs, rules and the operation of a specific mechanism. Players encompass, first, customers who submit orders to buy or sell. Second, brokers who transmit orders not for themselves but for customers. Third, there are dealers who do trade for their own account. In some markets, dealers also facilitate customer orders and so are often known as broker/dealers. Fourth, there are specialists, or market makers that quote prices to buy or sell the asset. Since the market maker generally takes a position in the security while

waiting for an offsetting order to arrive, the market maker also has a dealer function. As for the second dimension of trading mechanism, for share markets, the most common place where trading occurs is the stock exchange. The rules which is the third dimension of trading mechanism dictates what can be traded, who can trade, when and how orders can be submitted, who may see or handle the order, how orders are processed and how price are set. Whereas, there are different operations for different mechanisms, which means the fourth dimension that is the operation of specific mechanisms varies across nations. Thus, the literatures on microstructure theory basically look at how the components of the dimensions mentioned earlier affect the stock price. This microeconomic perspective was gain by the advocate of microstructure theory after being inspired by a research done by Demsetz (1968) who says trading incurs explicit cost from charge levied by a particular market and implicit cost from 'price of immediacy' that occurs because there exist two categories of buyers and sellers. The first categories is immediate buyers and sellers who are willing to trade immediately and the second categories is non immediate buyers and sellers who want to trade but not at the given time,  $t$ . The implication is that if number of immediate buyers differ from immediate seller at the given time,  $t$ , then either the immediate buyers (sellers) have to wait for non immediate seller (buyers) to arrive, or the immediate buyer (seller) can offer higher (lower) price to induce the non immediate seller (buyer) to trade at the given time,  $t$ . Since the spread that is the price concession depends on the numbers of traders, volume could affect the price of immediacy and thus the market price. His work proposes that the behavior of market which governs the behavior of price could be understood by examining the structure and organization of the market, which becomes the central issue in microstructure theory. It was later noticed that similar idea to the research done by Demsetz (1968) had been earlier proposed by Williams (1938) who emphasized that the market price is determined by the marginal opinion. He says:

*"Always some would-be buyer will be excluded from ownership because to them the price will seem more than expected dividends can justify. These buyers will stand with cash in hand, waiting for some present owner to change his mind and sell out to them at their price. If this happens, then the quotation will fall to their figure, but if they change their own minds, then the price will rise to whatever they must bid to dislodge stock from the least optimistic present owner."*

(pg. 12)

He then concluded that the bid and asked prices reflect the least optimistic owner and the most optimistic non owner respectively.

Market microstructure theory is encompassed of two basics model that is inventory based model and information based model (Dominguez, 1999). Each of the theories is discussed in section 2.1 and section 2.2 respectively. Inventory based model is further divided into another three research paradigms or models which are order arrival and market making, dealer's optimization problem and multiple provider of liquidity. The affiliation of the market microstructure to the rationality as defined by the economic maxims could be seen from the dealer's optimization problem, multiple provider of liquidity and the information based model. While the affiliation to the rationality as defined by Fama (1965) could be seen from the later development in information based model that considers private information as another source of risk for non informed investors that they include as additional risk premium in their required rate of return. Efficient market hypotheses, on the other hand, could be linked to the dealer's optimization problem and information based model. The opportunity to beat share market consistently could also be inferred from the inventory based model.

### 2.1 Inventory based model

Inventory based model is concerned with the way the nature of order flow and the market-clearing protocol affect the behaviour of price. The inventory model examines the problem faced by the market maker and/or dealer when orders to buy or sell are not always balanced in the selected time period which produce risk or cost for the market maker and/or dealer that require them to take certain actions that later influence their bid ask spread.

#### 2.1.1 The three paradigms in the inventory based model

The assumptions that are shared by all the three paradigms are investors trade for liquidity, and the investors' utilities and risk preference are left unspecified. The term 'trade for liquidity' is however clearly spelled out by Stoll (2003) who shows the term means the traders trade to smooth consumption or to adjust the risk-return profiles of their portfolios. They buy shares if they have excess cash or have become more risk tolerant, and they sell shares if they need cash or have become less risk tolerant.

The first paradigm or model is known as order arrival and market making looks at how nature of order flow determines security prices set by the market maker. The initial effort was set up by Garman (1976) who assumes that the market maker is a monopolist whose roles is to only provides liquidity that is the market maker takes a purely non speculative position or in short, it could be said that the market maker is a risk neutral monopolists in a

world that information asymmetric does not exist. The market maker also is assumed not to be permitted to borrow either shares to bail him out when order of buy require him to sell number of shares more than what he has in his inventory, or money to bail him out when order of sell require him to buy value of shares that is more than the cash he has in his hand, and has never been exposed to the idea of buffering in inventory. Therefore, the uncertainty that is inherent in the order arrival exposed the market maker to the chances of being a failure or bankruptcy that happen when market maker runs out of money to buy shares or runs out of stock to sell. To avoid a sure probability of failure or bankruptcy that is equal to one, the market maker will set a lower price (pay less) when buying shares and set a higher price when selling shares (sell less) to prevent depleting the shares to zero while increasing the cash inventory. These act of the market makers lead to a positive gap between the bid and ask spreads. However, since the market maker is assumed as risk neutral, the gap between the bid and ask price or size of the spread remain constant. Nevertheless, according to Amihud & Mandelson (1980), another assumption in Garman (1976) that says the market maker is allow to set prices only at the beginning of trading is quite unrealistic since in actual market settings prices continually evolve. Hence, a more realistic approach is to relate the changes in dealer's prices to the changes that happen over time in his inventory position. However, they specified that the market maker is exposed to the idea of buffering in inventory which have two implications. First, the market maker will have his own preferred inventory position. Second, the preferred inventory position implies that the inventory position of the market maker is bounded above and below that eliminates the failure or bankruptcy issue. They figured out that the optimal bid and ask prices are monotone decreasing functions of the dealer's inventory position which simply means even though the gap between the bid and ask price or size of spread remain constant, the placement of the spread could change. The explanation is when the dealer's inventory increases (decreases), he will create situation that deter (encourage) sell order that he must fulfill by the act of buying by decreasing (increasing) the bid price but at the same time he encourages (deters) buy order that he must fulfill by the act of selling by decreasing (increasing) the ask price by the same amount.

In the second paradigm or model that is dealer's optimization problem, the risks that the market maker or dealer face is defined in a lot detail compared to the first model. A formal analysis of this dimension of the dealer's problem in one period (two dates) model was undertaken by Stoll (1978) who states that market maker or dealer is a trader who is willing to alter his own portfolio away from desired holdings to fulfill the trading desires of other traders. Hence, unlike the first model, the market maker or dealer share the same risk adverse characteristics inherent in traders, which means the differences between the bid and ask price (size of spread) should no longer be constant to compensate them for taking risk. The market maker or dealer is also free to borrow or lend at risk free rate. The last sentence becomes the basis for Stoll (1978) to state that the market maker's risk of bankruptcy is zero. Nonetheless, similar to the order arrival and market making model, he still assume the market maker or dealer is a monopolist but he added another important assumption that is the market maker has a fix belief about the intrinsic value of the asset. In his model, he considers a two-date (one period) model in which the expected utility of terminal wealth is maximized by the market maker. It is this objective of market maker that requires the rationality as defined by the economic maxims to be upheld. His main point is that the risk-bearing abilities of the monopolist market maker or dealer will influence the size of spreads set by the market maker or dealer. Hence, the difference in the size of spread between markets is due to the difference in the risk-bearing abilities of the market makers or dealers. Even so, his work does not explain how phenomena like differences in size of spreads during the same trading day in the same share. According to him, the risk-bearing abilities is first influenced by the dealer's wealth with greater initial wealth increase the risk bearing abilities and hence reduce the price (size of spread) charged by them and the risk preferences where greater risk aversion reduce the risk bearing abilities and thus increase the price (size of spread) charged by them. Then he said that the risk faced by the market maker, which has inverse relationship with the risk bearing abilities, is first depends on the transaction size; the larger the transaction size, the more it will moves away from the market maker or dealer preference level translating into higher price (size of spread) charge by the market maker or dealer. Second, the characteristics of the share measured by its variance and correlation with other securities also affect the risk faced by the market maker or dealer and thus is translated in the price (size of spread) charge by the market maker or dealer. From his acknowledgment that variance and correlation are the proper measurement of risk for security, which is the brainchild of Markowitz (1952, 1959), it could be implies that the theory of efficient market hypotheses which provide the theory to support that price changes are random which is required to validate the usage of variance and correlation in measuring risk of security, must also be upheld in this model. Lastly, the risk faced by the market maker or dealer also arise from trading with individuals who know more about the share than the dealer, which mean unlike the order arrival and market making model, the asymmetric information exists. To overcome the weakness of this study that use a single period model, Ho & Stoll (1981) employs a finite horizon (T period) dynamic programming approach to characterize the dealer's optimal pricing theory. This time horizon enables them to explain how the size of spread that to them



represent both the risk neutral and the risk adjustment elements is determined by the market maker or dealer. It is in this research that, at last, what determines the risk neutral spread is mentioned. According to them, this risk neutral spread depends on the slopes (or elasticities) of the supply and demand curves, in which greater elasticity reduce the size of risk neutral spread. As for the risk adjustment, it depends on the time horizon, longer time horizon expose the market maker or dealer to higher risk associated with bearing inventory and portfolio risk which lead to increment in the spread size. However, this research has few restriction like the order placed are all market orders, the inventory is liquidated at some known point in the future which means the dealer's prices will exhibit deterministic trend since spreads would be largest in the morning and would narrow steadily throughout the day, there is a fixed true price where intrinsic value is used for the share, and the last restriction is that the order arrival is assumed to possess Poisson distribution that preclude the possibility that some traders know more about the future movement of price which means this model disregards the existence of informed and non informed trader. These restrictions are relaxed by O'Hara and Oldfield (1986) in their research that involve a discrete-time multiperiod framework that differ from Amihud & Mandelson (1980) and Ho & Stoll (1981) who use continuous-time multi period framework. The implication of their model is that the market maker faces a series of mini-auctions during the day, rather than a stream of transactions. As the number of trading rounds becomes arbitrarily large, the trading process approximates that of a continuous double action. In a continuous double auction, securities can be bought or sold at any time during the day, not necessarily at designated periods as in a straight forward auction. At each auction, markets are cleared, prices and inventory levels change, and at the end of the trading day, excess inventory must be liquidated or stored overnight at cost. Bid and ask prices are set so as to maximize the present expected value of trading revenue less inventory storage costs over an infinite horizon of trading days.

Multiple provider of liquidity is the third paradigm or model under the inventory based model that do not share the common belief that the dealer is the sole provider of liquidity in the market held by all the models mentioned before. Cohen, Maier, Schwartz & Whitcomb (1981) say that there is another channel for liquidity to arise besides being provided by the market maker; the limit order. A limit order specifies a price and a quantity at which a trade is to transact. Specifically, limit orders specify a price to sell (buy) above (below) the current bid (ask) price and await the movement of prices to become active. Thus, when the market is rising, the upward price movement triggers limit orders to sell while when the market is falling, the downward movement triggers limit orders to buy which clearly describe not only how limit order provide liquidity to the market but also if the probability for the limit orders to be executed over the next trading period is one, then it would be better for the trader to use the limit order since it provides better price to the traders. Unfortunately, according to them, even though the market bid or ask price depends on the last previous market bid or ask and hence is a Markov process, the probability is always less than one since there is a jump in the change of market order price due to the existence of transaction cost that prohibit traders to trade continuously. Hence, traders will submit limit order when the size of the spread is large which shows that there is a large gap between the volume of shares the market maker has and the volume of market order placed. It is this limit orders by the traders that provide liquidity which will move the disparity between the volume of shares the market maker has and the volume of market order placed to become closer and eventually reduce the size of the spread. When the size of the spread is small, traders will submit market order since it is guaranteed to be executed and this create demand for liquidity that is translated into bigger size of spread. In short, it could be concluded that the size of spread depends on the behaviour of traders. It is however, important to note that even though the size of the spread is large, in a thin market, limit execution will still remain low describing larger size of spread as a characteristic of thinner markets. Next, a research done by Ho & Stoll (1983) using one period model includes not only limit orders, but also includes two market makers that could trade directly with the public or between them in an interdealer market. They highlighted that even though the interdealer market means that a dealer can lay off an unwanted position by trading at another dealer's quote, this trading would not occur when there are only two market makers. The reason is the trading between them could be easily done only if one of them feels they are carrying excess inventory, and abiding the law of supply is willing to offer a lower ask price while the other one who feel they are short of inventory and abiding to the law of demand is willing to offer a higher bid price. However, Ho & Stoll (1983) assumes that the objectives of dealers is to maximize their utility, there is perfect information regarding each dealer's inventory and wealth positions, and each dealer is aware that they are monopolists on their side of the market. Similar to the dealer's optimization problem model suggested by Stoll (1978), it is the assumption that dealers maximize their utility that relates this model of Ho & Stoll (1983) to the rationality as defined by the economic maxims. The implications of the assumptions made by them are first, the dealers with better position to buy (sell) will quotes the lowest bid price (the highest ask price) he can and second, the prices quoted by each of them can not improve the utility any of the two traders and they therefore would rather waits to cross their position against a market order. Hence, the market spread is then essentially the monopoly

spread, with the size of the spread depends on the inventory positions of the dealer on each side of the market. This research, nevertheless, inspired ones to think that whenever the number of market makers is more than two in perfectly competitive market, the law of demand and supply will be abided by the market makers. Thus, at first, those market makers whose inventory is not at their preferred level will narrow the size of their spread while the dealer that trade with them which logically should be the dealer who offer the best price either the highest bid or the lowest ask will then be less willing to do the same type of trade with other dealer and thus widen their spread. In this case, the spread reflects factors relating to the supply of liquidity.

Generally, one simple implication of the inventory based model is if a dealer is in long (short) inventory, he will prefer to sell (buy). Thus, this inventory effect should cause the security price to be mean reverting. Researches along this line had been done by Madhavan & Smidt (1991) who found little evidence of inventory effects in equity markets, Manaster & Mann (1992) who found little inventory effects in future markets and Lyons (1993) who found evidence of inventory effects in foreign exchange markets but little evidence of inventory effects in equity or future markets.

Eventhough under dealer's optimization problem which is one of the inventory based model states that asymmetric information create additional risk to the market dealer and is later charge as cost that is reflected in the bid ask spread, it does not clearly explain the reason and the working mechanism on how this risk is translated into their prices. This weakness is overcome by the information based model. Note however that the remark that asymmetric information cost is reflected in the bid ask spread implies that *theoretically*, strong form of efficient market hypotheses is irrefutable.

## 2.2 Information based model

The information based model is inbred by a short paper written by Bagehot (1971). Bagehot is actually a pseudonym used by Jack Treynor who differentiated the notion trading gain from the market gain and states there are three players in the market that is a market maker, informed investors who possess private information that could affect an asset's value and non informed investors who do not possess the private information.

The definition of private information is given by Fama (1970) as any information that any investor or groups have monopolistic access. Fama (1970, 1991) then listed the possible parties that could have the monopolistic access to information as corporate insider (Scholes, 1969) who sometimes have monopolistic access to information about their firms, security analysis (Lloye-Davis & Canes, 1978; Stickel, 1985 & Liu, Smith & Syed, 1990) and professional portfolio management (Jensen 1968, 1969; Ippolito 1989) since they operate in the securities markets every day and have wide-ranging contacts and associations in both the business and financial communities, and NYSE specialists (Neiderhoffer & Osborne, 1966). Specialists are the only person who have access to the list of unexecuted buy and sell limit orders which consists important information about the likely future behavior of prices that could be used as a basis of a profitable trading rule to generate monopoly profit. When the specialist is asked for a quote, he gives the prices and can give the quantities of the highest buy limit and lowest sell limit orders on his book, but he is prevented by law from divulging the book's full contents leaving them the opportunity to create monopolistic profit which had been quoted by Neiderhoffer & Osborne (1966).

*"It should not be assumed that these transactions undertaken by the specialist, and in which he is involved as buyer or seller in 24 per cent of all market volume, are necessarily a burden to him. Typically, the specialist sells above his last purchase on 83 percent of all his sales, and buys below his last sale on 81 percent of all his purchases."*

Neiderhoffer & Osborne (1966, pg. 908)

Recent paper written by Julian & Shang (2004) added another two parties in the list of possible parties who have monopolistic access to firms' information. First, it is the temporary insiders or constructive insiders that include outside auditors, lawyers, investment bankers and so on that are temporarily retained by the corporation but have access to material non-public information. Second, it is anyone who possesses material non-public information regarding a tender offer from an insider that come to be known as the misappropriation theory in the parlance of insider trading jargon.

According to Bagehot (1971), market gain means when the market goes up (down), in general most investors will gain (loss) while trading gains is the difference between the market return and the trading cost which includes information cost. In a setting where private information exists, this information creates cost to the market maker who is assumed not to possess the private information but must always quote prices to buy and sell. Hence, the market maker transferred the information cost to the other investors known as non informed investors. Thus, the non informed investors will on average lose relatively to the market over time. The reason is the market maker who must always quote the bid and ask price realizes that he will lose when dealing with the informed investors who will buy (sell) when they know the current ask(bid) price is too low (high). Therefore, the market maker is aware

that he is always on the losing part when dealing with these informed investors. Hence, the market maker will offset losses with gains derived from the non-informed investors. However, Bagehot (1971) does not really explicitly show how this cost will influence the size and placement of the spread.

The effort was first, however, made by Copeland & Galai (1983) using a static one trade framework. In addition, they assume that there is a single risk neutral market maker, the market maker has unlimited capital, the possibility for the market maker to be bankrupted is none and the market maker faces a short time horizon that provides a convenient way to specify how information per se without inventory-carrying effects affects prices. Additional assumptions made in their model are share price is exogenous to the market, the informed investors trade with the objective to maximize gain while the non-informed investors trade for liquidity. It is further assumed that traders are chosen to trade probabilistically, and that once selected, a trader may trade at most one unit of the asset; if a trader desires to trade further, he must return to the pool of traders and wait to be selected again to trade. Hence, the probability of the existence of informed investors in the population of investors is denoted by  $\pi_1$  while it is  $(1 - \pi_1)$  for the non-informed investors. The probability of the non-informed investors will buy, sell, do not buy or sell is denoted by  $\pi_{BL}$ ,  $\pi_{SL}$  and  $\pi_{NL}$  respectively. The expected loss of the market maker from trading with informed investors is  $(P - P_A) + (P_B - P)$  while the expected gain of the market maker from trading with non-informed investors is  $\pi_{BL}(P_A - P) + \pi_{SL}(P - P_B) + \pi_{NL}(0)$  where  $P_A$  denotes ask price,  $P_B$  denotes bid price and  $P$  denotes the true value of an asset. Since the market maker does not know whether an order comes from the informed or non-informed investors, he weights his expected gains and losses by the probability of informed and uninformed trading. In short, the objective function of a market dealer is to maximize  $-\pi_1[(P - P_A) + (P_B - P)] + (1 - \pi_1)[\pi_{BL}(P_A - P) + \pi_{SL}(P - P_B) + \pi_{NL}(0)]$  which implies that the placement and size of bid and ask price is a function of a market maker's maximization problem. In addition, the elaboration thus far also shows that as long as there is positive probability of the existence of informed investors who possess private information, the bid-ask spread will always be larger than zero even though other factors affecting the bid-ask spread like risk aversion, market power of the market maker and the inventory effects that are mentioned in the inventory-based model do not exist which will also hold even if there is more than one market maker in the share market that are competing against each other since the only adjustment that has to be made to the above equation is equaling the profit of market maker to zero. The last assumption that traders are chosen to trade probabilistically, and that once selected, a trader may trade at most one unit of the asset; if a trader desires to trade further, he must return to the pool of traders and wait to be selected again to trade is required to commensurate with the efficient market theory that says the equilibrium price reflects all the past information, publicly available information and private information. The reason is to attain the strong form of market efficiency at the equilibrium, informed investors must be compensated in terms of higher profit for seeking the private information and informed traders profit from trading if prices are not at full-information levels, and so any informed trader will prefer to trade as much and as often as possible. Since such behavior would quickly indicate the information of the informed, the market maker would quickly or instantly adjust prices to reflect this information leaving minute profit to the informed investors that might discourage the informed investors from gathering the private information leading to only, at most, semi-strong market efficiency.

Note also that the informed investors could only gain from the private information that guides them to take either buying or selling position if the direction of subsequent price movement in the market is in the same direction with the earlier position taken by the informed investors. This requirement is fulfilled by the action taken by the market makers. Before elaborating the mechanism that guides the mentioned action taken by the market maker it is important to highlight that the difference between the mechanism that led to equilibrium price that reflects the strongest form of informational efficiency mentioned by Fama (1965) and the information-based model of market microstructure theory is that in the latter, market makers who set bid and ask price exist in the market setting. Hence to achieve equilibrium, this bid or ask price of a share must eventually (the word eventually is here to reemphasize that it is a gradual process) reflect the intrinsic value of a share after incorporating private information that indicates low value (high value) held by the informed investors in order to ensure the act of selling (buying) by them will stop when the bid price (ask price) is equal to the new value. Nevertheless, the important conclusion from the information-based model is the theory of efficient market hypotheses prevails. The same elaboration also justifies the act of Fama (1970) to state the inexistence of cost as a sufficient but not necessarily condition to attain informational efficiency in share market. Thus, the implicit assumption in the model of Copeland & Galai (1983) that the market maker has a fixed belief regarding the true value of an asset is rather absurd since it does not only mean the impossibility of achieving the equilibrium but also the market maker even though is aware of the existence of informed investors who know better the true price of an asset, he does not protect himself by adjusting his beliefs about the value of the share, conditional on the type of trade that occurs. To be more precise, Copeland & Galai (1983) missed the fact that the trade itself could reveal the underlying information and so affect the behaviour of prices. Glosten & Milgrom (1985) highlights that the predominance of informed traders on one side

of the market that is either on buying or selling will eventually lead the market maker to learn their information and assimilates it in his new belief regarding the asset true price that causes his price to change until it converge to the expected value of the asset that commensurate with the given information, echoing the concept in efficient market hypotheses theory. This is the point where market microstructure theory starts focusing on how the market maker learns information from the order flow and assimilates it into his price. Even though there are various models trying to capture this new focus by using different market setting, they all rely on the Bayesian learning model, a published work in 1764, named after Bayes, the person who discovers the learning model and was a minister in United Kingdom. His work was published in 1764. The usefulness of this theorem in the financial market especially in share market is undeniable as Jacob Bernoulli (1713) states that unlike games of chance where priori probability theory is a complete substitute for information, information is never complete in the share markets. Bayes actually made an advance in statistics by demonstrating how better-informed decisions could be made by mathematically blending new information into old information that show the theorem actually focuses on the frequent occasions when people have sound intuitive judgments about the probability of some event and want to understand how to alter those judgments as actual events unfold. Therefore, the primary application of the theorem in share markets under the information microstructure literature is in the usage of new information that is type of trade order whether it is a buy or a sell in determining the expected value of a share conditional on sell order (buy order) that become the bid (ask) price set by the market maker. When the market maker intend to set his buying price (bid price) which becomes the selling price of the investors, the probability of high (low) value is determined by the probability of selling (selling) done by investors conditional on high (low) value. Then the sum of the high value times the probability of high value and the low value times the probability of low value becomes the bid price set by the market maker. To set his selling price (ask price) which becomes the buying price of the investors, the probability of high (low) value is determined by the probability of buying (buying) done by investors conditional on high (low) value. Similar to setting his bid price, the market maker will then take the sum of the high value times probability of high value and low value times probability of low value as his ask price.

Thus far, it has been shown that information based model substantiates that informational efficiency stock markets is attainable. Interestingly, though, there is a more recent model in information based model that requires investors to be rational as defined by the economic maxims and as defined by Fama (1965). This recent model was developed by Easley & O'Hara (2004) that relates information cost that exists due to asymmetric information between informed investors and non informed investors, to the cost of capital. According to them, information structure that is the relative degree of private information to public information in information content of a company affects the cost of capital of the company's share. They explained that investors who realize that they might engage trading with informed traders that expose them to additional risk will require higher rate of share return by including additional premium known as information risk translated as higher cost of capital for the issuer. The higher rate of share return is required because diversify cannot eliminate the additional risk arise from adverse selection, that has to be borne by investors lack of private information. Not to hold any share is not a way to solve this problem since higher utility of investors who do not possess private information could be achieved by holding some risky assets. Additional risk borne by investors when trading with informed investors had actually been mentioned by Kindleberger (1978). He pointed that informed investors initially exaggerate the upswings and the falls that trap the noninformed investors to buy high and sell low which later cause them to be victims of euphoria. The act of exaggerating the upswings and the falls by informed investors has been confirmed by a research done by Julian & Shang (2004). Their research found that countries with more prevalent insider trading have more volatile stock markets, even after controlling the underlying fundamentals that is volatility of real output and of monetary and fiscal policies and maturity of the market. The maturity of the market need to be controlled since it may be reasonable to expect a young market to be more volatile than a long established and highly liquid one since the average experience and skill of the investors and of the market regulators may improve with market maturity. In their model, Easley & O'Hara (2004) assumed that the distribution of payoffs from a share is normal and all investors have CARA utility which parallel to the assumptions made by Markowitz (1952, 1958) that justify the suggested idea proposed by Markowitz (1952, 1958) that mean-variance is the proper objective function of investors to be applied in their model. The usage of variance implies that the distribution of the payoffs of a security must be normal which could only be true if the payoffs of the security are independently distributed or random which is theoretically back up by the efficient market hypotheses which emphasizes that investors are rational as defined by Fama (1965). Therefore, information model of market microstructure theory concludes that the theory of efficient market hypotheses prevails and of this reason, the later model development in information model of market microstructure theory assumes efficient market hypotheses prevails.

On the opportunity to beat the market, it is possible according to the informational based model of market microstructure since the price adjustment is not instantaneous echoing the idea of Alexander (1961):

*“These facts are believed to generate trends rather than instantaneous jumps because most of those trading in speculative markets have imperfect knowledge of these facts, and the future trend of prices will result from a gradual spread of awareness of these facts throughout the market. Those who gain mastery of critical information earlier than others will, accordingly, have an opportunity to profit from that early knowledge”.*

(pg. 71).

As it was mentioned earlier, bid and ask price is conditional expected value. Hence, the price at each point reflects all publicly available information but not necessarily all private information. The implication is informed traders earn a return to their information and prices at equilibrium are only semi strong efficient until prices adjust completely to the private information. The nature of the adjustment time is mentioned by O’Hara (1995):

*“In both microstructure paradigms, prices eventually converge to new-information values, but, since this adjustment takes place in the limit, the actual adjustment time can be infinite.”*

(pg. 153).

The last seven sentences in the quotes rise the opportunity to even beat the market consistently. Notice however that this opportunity may be impeded by the fact that under market microstructure theory, the market maker is categorized as non informed investor which contradicts with what is mentioned in Fama (1970) where he used the result of research done by Niederhoffer & Osborne (1966) as evidence. Nonetheless, Madhavan (2000) highlighted that examination on the relationship between changes in market maker inventory levels and subsequent price rises done to determine whether market maker might have better information than the average trader or not in NYSE shows that the correlation is negative, suggesting that market maker do not possess information superior to that of the average trader. Madhavan (2000) added that additional evidences come from studies showing market makers earn less per round trip trade than the quoted spread. This means that market maker purchases tend to be followed by declines in the ask prices while sales are followed by increases in bid prices, the opposite of what one would expect if market makers were informed. Hence, Madhavan (2000) concluded that the maintain assumption seems to be reasonable reopening the possibility of consistently beating the market.

In another research done along the informational model of market microstructure theory that looks at the distribution of order arrival of informed and uninformed traders by Easley, Engle, O’Hara & Wu (2000) found that the distribution of order arrival of both informed and uninformed traders are time varying. They also stated that uninformed traders tend to move in herd but to avoid informed traders. The fact that uninformed traders move in herd opens the possibility of beating the market for reasons mentioned in Behavioral Finance. This opportunity is augmented by their finding that shows the surge in trading activities is caused mainly by the arrival of uninformed traders which mean investors do not have to be superior traders as defined by Fama (1970) to have the opportunity to beat the market consistently.

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# Research on the Social Demand for Business Management Talents

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## Abstract

In order to deepen the reform on the education and cultivation of business management major, explore a new mode for cultivating graduate talents, and improve the major's teaching and cultivating quality, we make a special research on the social demand for business management talents.

**Keywords:** Business management, Graduate, Talent cultivation

In order to explore a new mode for cultivating business management talents, we perform a special research on the social demand for business management talents. This research includes two parts, namely the feedback information from employers, and the cultivation information from higher colleges. Thereof, the research on employers chiefly focuses on the social demand for business management talents (take Shandong province for example), including employers' wanting positions, demand suggestions, stresses on graduates' quality, evaluations on employed graduates, suggestions for talents' cultivation, and so on. The research aims at improving the teaching level and the talents' cultivation quality for business management major, and exploring a new mode for cultivating business management talents today.

## 1. The feedback information from employers

This research has been done in August, 2007, and it has chiefly focused on enterprises and public institutions in Shandong province. Thereof, the former accounts for 14.3 percent, and the later 50 percent. They account for 64.3 percent of all samples. Besides, samples with employees between 101 and 200 account for 35.7 percent, and samples with employees between 51 and 100 account for 21.4 percent. In general, these samples meet the requirements of research questionnaire and can reflect employers' demand for business management talents.

### 1.1 Enterprises' demand for business management talents

Data in the research show that 35.7 percent of employers take in graduates, 64.3 percent does not necessarily take in, and none takes few. Considering the number of graduates employed by them, 43.7 percent of employers take in graduates from 1 to 10, 52 percent from 11 to 20, and 4.3 percent beyond 20. Considering the sources of graduates, key universities and common colleges account for 42.9 percent of graduates respectively, and higher vocational colleges account for 14.2 percent. Considering the employing way, data show (see Figure 1) that the employment situation of business management graduates is better.

### 1.2 Enterprises' requirements for business management graduates' quality

As researching the number of graduates needed by employers, data show that, from the higher to the lower, marketing accounts for 64.3 percent, logistics management 35.7 percent, business administration 28.6 percent, tourism management 14.3, electronic business 7 percent, and engineering management 7 percent. It proves that enterprises have an urgent need for practical talents and newly-emerged specialty talents. Employers chiefly take in graduates who major in practical specialties, and secondly the theoretical researches. Proportions of the two types are respectively 71.4 percent and 28.7 percent. It proves that employers lay more stresses on graduates' practical spirits and talents, which can also be indicated by employers' requirements for new workers. Graduates who have serious working attitudes and responsibilities, and better comprehensive qualities, account for 42.9 percent of newly-taken-in employees. Also, in the evaluation on business management graduates, 21.4 percent of employers feel satisfactory, 74.3 feel common, and 4.3 unsatisfactory.

What kind of factors will be taken into consideration as employers take in new employees? 82 percent of employers emphasize work experiences firstly, 72.4 percent secondly specialties, and thirdly study experiences and degrees. Seldom consider the family background. The percent is merely 10%. It shows that employers lay more stresses on graduates' practical abilities instead of other aspects. On the other hand, students should improve their specialty levels and practical abilities in order to meet employers' requirements.

### 1.3 Enterprises' evaluation on business management graduates in work

Managers in enterprises are chiefly business management talents and technologists. Each accounts for 50 percent.

And, only 11.6 percent of business management talents employed by enterprises are engaged in professional work, and 80 percent non-professional but related work. Thereof, 50 percent work in operational level, 39 percent in middle management level, and less than 10 percent in top management level (see Figure 2). It indicates that graduates have to experience a practice stage, by which they can possess relatively higher comprehensive quality. In work, employers' evaluations on graduates are similar. At the very beginning, they behave terrible. After a period of practice, 70 percent of graduates are competent in work. 12 percent of graduates become involved in the environment quickly. But 18 percent have grand nose but puny abilities. Their work quality is poor (see Figure 2).

#### *1.4 Employers' requirements for graduates' comprehensive quality*

In this research, we probe into graduates' comprehensive quality. It includes five subjects, and each subject has three or five items. Data show that business management graduates behave better in thoughts, work attitudes, and specialty knowledge. The statistical data are as follow (see Table 1).

#### *1.5 Other aspects*

Almost all employers have to face a talent lose issue. But reasons are different. Thereof, the main reason is the unsatisfied salary. 76 percent of talents change their jobs for this reason. A failure of social relationship in work environment and a greater pressure in work account for larger percents, respectively 42.5% and 44.5%. Besides, further studies and families may lead to lose of talents.

Employers praise highly on the cultivation of business management talents in Shandong University of Finance. According to their opinion, business management graduates in this university have better comprehensive qualities. They also put forward some constructive suggestions that chiefly focus on two aspects, namely enhancing practices and innovation abilities.

### **2. The cultivation of business management talents in higher colleges**

This research has been done in August, 2007. And the objects in this research are higher colleges in which business management talents are cultivated. 50 questionnaires have been given out, and 45 have been taken back. The effective ratio is 90 percent. The result can reflect the talent cultivation mode in universities and colleges.

#### *2.1 The scale of business management specialties in colleges and universities*

In the 45 questionnaires, all colleges and universities have majors related with business management. Thereof, all have the business management major, 90 percent marketing, 80 percent accounting, 75 percent human resource management, 60 percent tourism management, 60 percent logistics management, and 55.8 percent electronic business (see Table 2).

This table shows that the scale of business management is relatively large and the level should be further improved.

#### *2.2 The mode of cultivating business management talents in colleges and universities*

Among these colleges and universities that have majors related with business management, 66.7 percent agree that the cultivation goal should focus on practical talents, and 33.3 percent on theoretical experts. During the graduate period, none of colleges or universities emphasize on cultivating theorists. Meanwhile, 53.3 percent of colleges and universities lay stresses on cultivating students' comprehensive qualities, then on serious work attitudes and responsibilities. It indicates that colleges and universities are practical.

For the issue of curriculum arrangement, 73.2 percent of colleges and universities think that most courses are reasonable but less unreasonable. Only 13.4 percent think totally reasonable or unreasonable. For the proportions of different courses in total learning periods, opinions are centered in four points. 70 percent of colleges and universities think that common basic courses should occupy merely 10 percent of total learning periods. 44.4 percent think that basic specialty courses should occupy 30 percent of total learning periods. 44.4 percent think that specialty courses should occupy 30 percent of total learning periods. 62 percent of colleges and universities think that common selective courses should occupy 10 percent of total learning periods. It indicates that colleges and universities lay more stresses on cultivating students' basic abilities and specialty abilities.

For teachers' teaching ways and assessments, 66.7 percent of teachers in colleges and universities are top managers in enterprises. The percent is same for teachers who have management experiences. 46.2 percent of teachers are graduated from normal universities (see Figure 3). In the teaching ways, mutual communication accounts for 57.8 percent, class presentation 44.4 percent, and case teaching 35.5 (see Figure 4). The assessments are chiefly closed examination (65%), thesis (29%), and case discussion (3%) (see Figure 5).

Apparently, the teaching way is chiefly class presentation, being short of practices and mutual activities. This should be noticed by colleges and universities. They should pay more attentions on exploring new teaching ways.



Data show that the single assessing way can not reflect students' qualities completely. It is necessary to find out new assessing ways to form a set of complete evaluation system.

For the practice courses and case studies, 51.1 percent of colleges and universities agree with the combination of theories and practices. For the ways of cultivating students' practice abilities, 53.3 percent of colleges and universities emphasize on taking in enterprises' top managers as part-time teachers, 46.7 percent choose to take enterprises as practice bases and send students there periodically, 35.5 percent case studies, 33.3 percent software-simulated teaching, 31.1 percent arrange specialty teachers to guide students in subjects researches, and 13 percent hold on a forum of entrepreneurs and invite them to deliver lectures (see Figure 6). Meanwhile, for the ways of college students participating in social practices, most (46.7%) are based on volunteer organizations. It indicates that practices should be emphasized in cultivating business management talents, which can improve students' practice quality by multiple ways.

### 2.3 Colleges and universities' expectations for graduates

Among these colleges and universities, 37.8 percent think that the employment situation of business management graduates is better (optimistic and very optimistic), 36 percent think it normal, and 24.2 percent pessimistic. And 53.4 percent colleges and universities think that the greater pressure in employment is from too-much stresses on theoretical knowledge. But some (31.1 percent) also think that the pressure is coming from too-much graduates.

For the issue of business management graduates' positions in enterprises most are practical. The Figure 7 as follow reflects their attitudes rightly.

### 3. Conclusions and countermeasures

According to analysis above, the graduates cultivated by colleges and universities fail to meet the employers' requirements in a sense. On one hand, enterprises demand for comprehensive talents who possess practical abilities and innovation abilities. On the other hand, lots of factors contribute to the weakness of colleges and universities in cultivating students' practice abilities and innovation abilities. As a result, amounts of graduates become unemployed after graduation. In general, graduates and enterprises hold different opinions toward the issue of employment difficulty. Graduates pay more attentions on knowledge by which they can improve themselves, possess stronger competitiveness, and win in employment competition. Therefore, it is urgent to reform the mode of cultivating business management talents. Based on researches above the author puts forward these suggestions as follow.

Firstly, emphasize quality education and improve students' technologies and abilities comprehensively.

Colleges and universities should lay more stresses on quality education, creating a nice environment, including practices and knowledge, for college students starting a career. In daily education, focus on cultivating students' innovation abilities. In special, abilities of social communication, leadership decision, and organization management should be emphasized in practices in colleges and universities.

Secondly, enterprises should provide with more opportunities and trainings for graduates.

Enterprises prefer to employ talents with high comprehensive qualities. However, although they possess work experiences, it is hard for enterprises to cultivate them with a sense of corporate acceptance. And it is relatively easy for them changing jobs. In contrast, it is easy for the first-year graduates generating a sense of acceptance and responsibilities. After a period of training and cultivation, they will become talents soon. Therefore, enterprises should have a long-term eye, giving more opportunities and trainings for graduates.

Thirdly, for graduates, they should have self-confidence. And they should hold a belief that they will success sooner or later. Besides, they should accept enterprises' cultures and ideas. And they should have right values. Once entering an enterprise, one must do his best. Believe in this idea and culture, and use it regulate one's behaviors and improve the loyalty to the enterprise. That is the base for a college student fitting into an enterprise quickly. Find one's position in an enterprise. Self development should be in accord with enterprise's development. And both are mutual dependent. A graduate should hold this idea that no matter where the enterprise develops toward, he or she must contribute necessary qualities and abilities to the enterprise. Only when a graduate possesses something that is valuable for enterprises, he or she can realize the values of life.

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Table 1.

Subject	Item	Satisfied	Relatively satisfied	Not satisfied	Unsatisfied	Unclear
Thoughts	Politics consciousness	60	40	0	0	0
	Social responsibility	50	50	0	0	0
	Morals	60	40	0	0	0
Work attitudes	Professional morals	70	30	0	0	0
	Dedicated spirits	70	30	0	0	0
	Team spirits	60	40	0	0	0
Basic knowledge	Knowledge structure	40	60	0	0	0
	Foreign language level	60	40	0	0	0
	Computer technology	50	50	0	0	0
Specialty knowledge	Theoretical level	60	40	0	0	0
	Specialty level	50	50	0	0	0
Work ability	Adaptable ability	20	80	0	0	0
	Psychological quality	30	70	0	0	0
	Practice ability	20	80	0	0	0
	Verbal expression	20	80	0	0	0
	Innovation ability	20	80	0	0	0
	Social ability	50	50	0	0	0
	Organization management ability	60	40	0	0	0
Comprehensive evaluation		80	20		0	0

Table 2.

Major	Business management	Marketing	Accounting	Human resource management	Tourism management	Logistics management	Electronic business
Number	45	40	36	34	27	27	25
Proportion (%)	100%	90%	80%	75%	60%	60%	55.8%
Proportion of key majors in province	44.5%	17.8%	11.1%	6.7%	2%	2%	2%

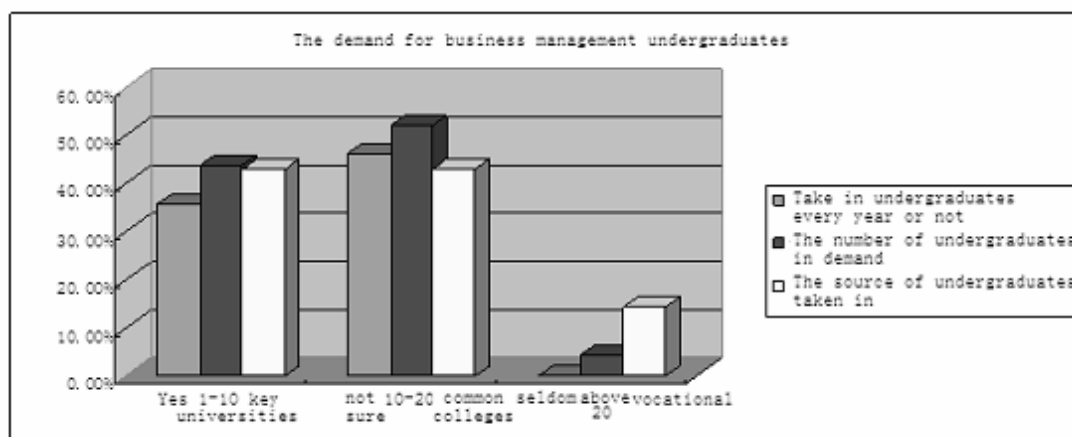


Figure 1. The Demand for Business Management Graduates

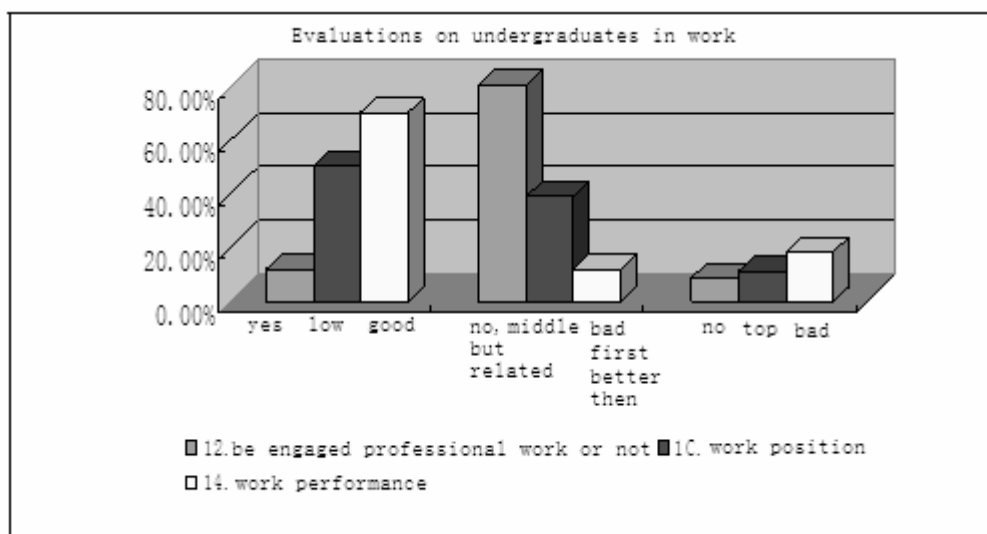


Figure 2. The Evaluations on Graduates in Work

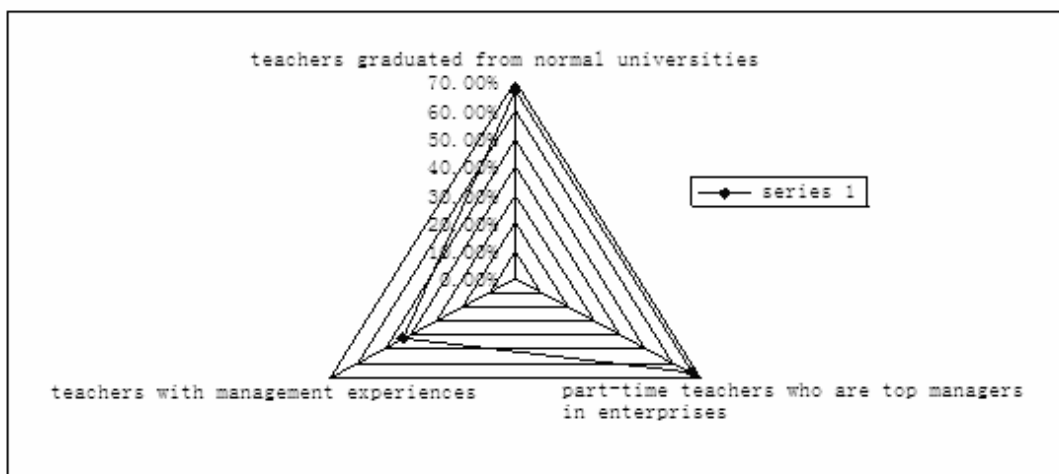


Figure 3. The Sources of Teachers.

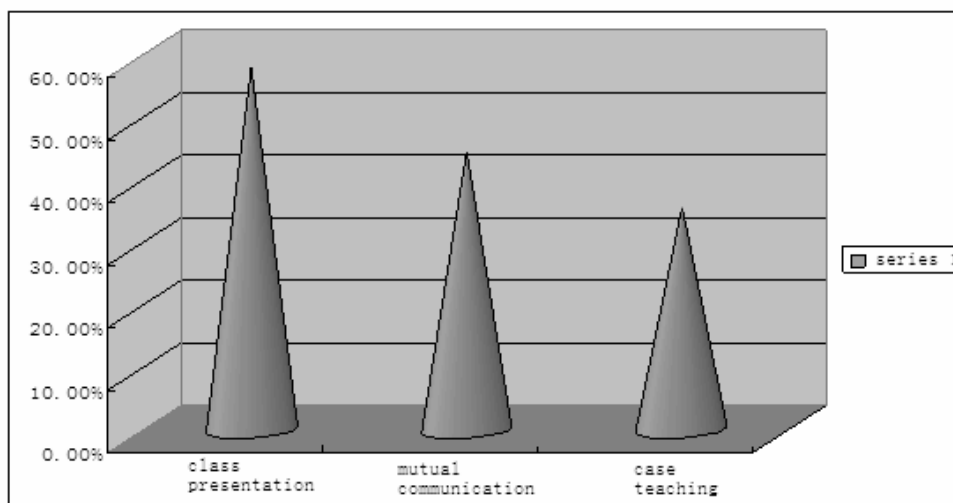


Figure 4. The Teaching Way for Majors Related with Business Management.

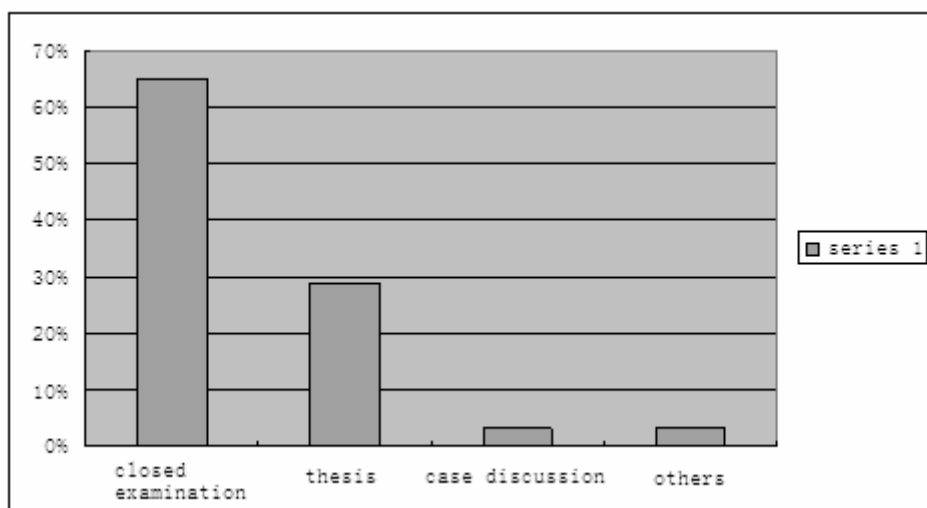


Figure 5. The Proportion of Assessing Way.

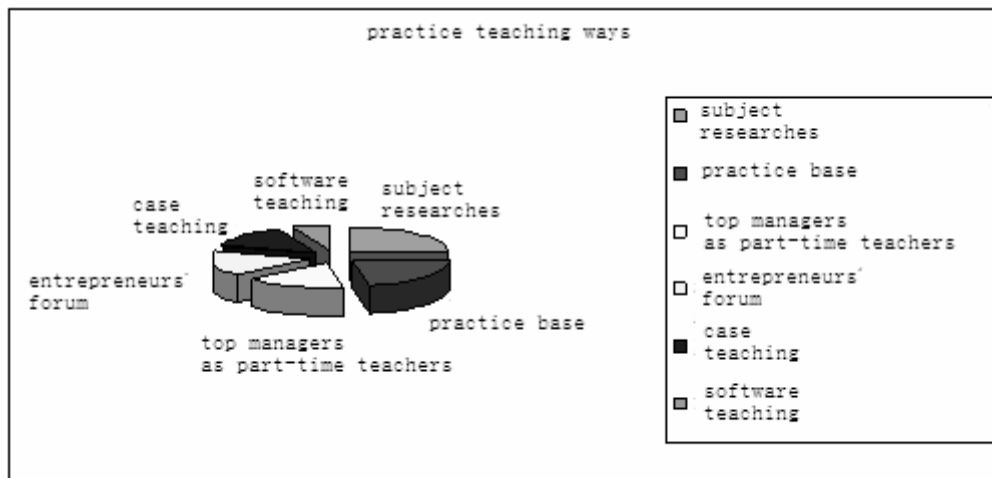


Figure 6. The Ways of Practice Teaching.

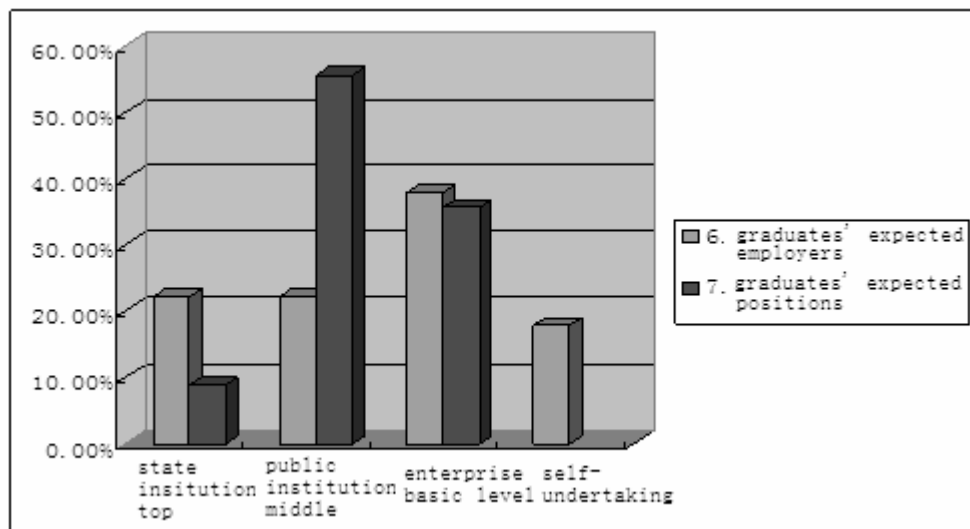


Figure 7. Colleges and Universities' Expectations for Business Management Graduates.

# On Choices of Innovation Strategy of Chinese Pharmaceutical Enterprises from Perspective of “Wise Pig Game”

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## Abstract

“Wise Pig Game” is a classical model of modern game theory. Just like the piglet in the model, the pharmaceutical companies of China is gambling with the global pharmaceutical companies and growing cautiously. In this game, the “piglet” not only has to survive, but also should shoulder the heavy responsibility of promoting our national pharmaceutical industry. Therefore, it is very important to choose the right direction of developmental strategy. Through analysis of the model, this paper establishes the choice of innovation strategy for China pharmaceutical enterprises.

**Keywords:** Wise pig game, Pharmaceutical enterprises, Innovation

Along with the evolving economic globalization, world economy becomes more changeable. Global industrial structure faces up with new adjustment and upgrade. Since 80s in last century, the world pharmaceutical industry dominated by multi-national pharmaceutical giants has experienced world-shaking changes, driven by the economic development, the technological progress, and the increasing pharmaceutical market in world. In order to establish the position in world competition, and grasp world market, and allocate resources in a global scope, multi-national pharmaceutical giants keep on engineering their organizational structures by merge and purchase, seeking for technological innovation, and investing more in new medicine's research and development. As a result, the competitive pattern in global pharmaceutical industry changes a lot. Under the environment with fierce competition in global pharmaceutical market, China's pharmaceutical enterprises began to perform strategic transformation and technological reform in order to sustain their existence and development. This paper will discuss the options of innovation strategies for China's pharmaceutical enterprises based on a classic mode in game theory.

## 1. Wise pig game

This theory was a typical game case advanced by Nash, the founder of non-cooperative game theory and the winner of Nobel Prize for Economics (Weiyang Zhang, 1996). There is one button on one side of the sty and output of food and crib on the other side. Press the button once, ten-unit food will enter the crib. But this action will consume certain labor that equals to the consumption of two-unit food. Every pig has to make decision on whether wait beside the crib for food or press the button.

The problem is that the button and the crib locate on different sides of crib respectively. As the pig that pressed the button run to the crib, the other pig has already begun to eat food. If the big pig waits for food, as the big pig has eaten nine-unit food, the small pig would eat only one-unit food. If they came at the same time, the big pig can eat seven-unit food and the small pig three-unit food. If the small pig waits for food, the small pig can eat four-unit food and the big pig six-unit food. Use the net food eaten by big pig and small pig to reflect the won of them. Then the “wise pig game” can be expressed by the won matrix as follow (Table 1).

The result of this game is determined by the big pig's judge on the small pig's behavior. If the small pig presses the button, the big pig would like to wait beside the crib and eat the nine-unit food. If the small pig chooses to wait the big pig will press the button and then come back to eat four-unit food, what is better than waiting in hunger. For the small pig, situation is very clear. No matter how the big pig acts, the best choice is to wait beside the crib. Therefore,

equilibrium of this game is: the big pig presses the button and come back to eat food, and the small pig just waits for food ----- coexistence.

Therefore, the Nash equilibrium of “wise pig game” is that the big pig presses the button and the small pig waits for food. The wise small pig gains the best result. If the small pig fails to judge the situation correctly and chooses to press the button, it may suffer from a great loss that equals to -1 payment.

## 2. Theoretical inspiration

This game theory has profound inspiration: choosing the right game strategy according to the specific situations and the rivals' conditions is extremely important. The technological innovation strategy of enterprises is a game with competitors in market in essence. In general, most pharmaceutical enterprises in China are small. Even for China's state-owned large enterprises, considering the size, the production output, the capital investment, and the technological level, they are merely small pigs comparing with the large pharmaceutical companies in developed countries and the multi-national companies. The common enterprises in China are almost piglets.

The technological innovation and new medicine research and development, and accompanied market benefits in one industry are equal to the “press-button” and the “food”. These enterprises form this mode. So they should obey the industrial and similar game rules. However, under present situation, China's pharmaceutical enterprises are merely “small pigs” or even “piglets”. In this mode, their strategy is nothing but wait. Considering the pharmaceutical industry, the strategy is imitation. To imitate medicine is the base for China's pharmaceutical enterprises' survival at present. Domestic pharmaceutical enterprises can sustain existence and development by imitation in medicine production. At the same time, the imitation can help to save costs in research and development. However, in the pharmaceutical industry, the ratio of return of “big pig” and “small pig” in equilibrium is not 1:1 but N:1. Therefore, under this equilibrium, the distance between “big pig” and “small pig” will become larger.

The inspiration of this mode is more than the point mentioned above. If China's pharmaceutical enterprises prefer to follow others all the time, they will never grow strong and compete with world pharmaceutical companies. Therefore, being bigger and stronger is the goal of China's pharmaceutical enterprises. However, imitated innovation can not help “small pigs” grow well. Considering China's condition, because small- and medium-enterprises are limited in sizes, capitals, and abilities of research and development, a few of powerful enterprises can choose to perform self-innovation in their advantage fields and imitated innovation in disadvantage fields. They can combine three innovation strategies, namely self-innovation, imitated innovation, and cooperative innovation organically (Hong Wang, 2006, p124-126).

## 3. Choice of strategies

### 3.1 Self-innovation

In contrast with the introduction of technology and the imitation, self-innovation is kind of creative activity. It possesses the exclusive property right of unique core technology and can help to realize the value of new products. In other words, the core technology used in self-innovation is generated from the internal technological breakthrough in enterprises, getting rid of dependence on the introduction of technologies and the technological imitation. The core technology is obtained by self strengths and independent research and development activities. The essence is to grasp the initiative right of the core ring of innovation and master the property right of core technology. The fruits of self-innovation include scientific discoveries, technologies, products, and brands with independent knowledge property right (Wei Zhang. & Xuanliang Zhang, 2006, p956).

#### 3.1.1 Improve pharmaceutical enterprises' consciousness of self-innovation

Pharmaceutical enterprises should realize that innovation is urgent. In history, from the introduction of technology and the imitated innovation, to the self-design and the self-innovation, most technologically lagged-behind countries, especially developing countries, usually take it as an effective way to develop technologies. If China pursues to become strong in pharmaceutical field, it is a must to improve pharmaceutical enterprises' ability of self-innovation. Only by cultivating a core competence by self-innovation, can China's pharmaceutical enterprises achieve sustainable development and hold an invincible position in world pharmaceutical market.

#### 3.1.2 Create favorable environment and mechanism to improve the ability of self-innovation

China should create a system frame for pharmaceutical enterprises' self-innovation, constructing an enterprise-dominated, market-guided, and production-study-learn-combined system for technological innovation, forming a fundamental mechanism frame for self-innovation. Government should ensure effective policy supply for pharmaceutical enterprises' technological innovation, adjust the financial supportive policy for pharmaceutical enterprises, perfect the purchase policy, and give priority of buying new technologies and products with own property right. Invest more in pharmaceutical enterprises' self-innovation. Build up relatively normative capital

market and venture mechanism as soon as possible. Perfect the investing and financial mechanism and the service system for pharmaceutical enterprises' technological innovation. For example, construct and perfect a multi-level innovation mode and form a multi-participated investment system in which the government shoulder the responsibility of guidance, enterprises are the subjects, banks provides with loans, and social capitals and introduced foreign capitals serve as capital complement, and by which pharmaceutical enterprises can obtain amounts of capitals. As far as the short of patents, the government should provide with policy support for enterprises' property protection, and help to enhance the system of protecting property right in enterprises. Enterprises can improve their self-research and development ability by enhancing the professional techniques of researchers and technologists and improving the scientific and technological management mechanism (Xiaoqin Xu. & Hongyan Yang, 2007, p108-110; Yafei Luo. & Yucan Jiao, 2007, p71-77). Perfect and improve a service-support system for enterprises' self-innovation ability. Create a favorable environment for "small pigs" becoming "big pigs".

### 3.1.3 Emphasize the three stages of self-innovation

(1) Construct a strong base for initial innovation. Initial innovation, namely the basic original innovation, is the source of self-innovation. A successful initial innovation is determined by a series of special factors, including deep scientific accumulation, nice international cooperation, creative academic team, flexible innovative techniques, and fair performance-evaluation mechanism. For powerful "big pigs", it is not hard to create the conditions for initial innovation. But for China's pharmaceutical enterprises, namely "small pigs", it is not easy to obtain necessary elements and conditions for initial innovation. Therefore, the government should provide with support in fields of technologies and capitals to help enterprises to create their core technologies and core competence.

(2) Drive the breakthrough innovation fully. As we enhance the construction of initial innovation, we should emphasize the mutual cooperation between pharmaceutical industry, and source of innovation and technologies, improving the research and development of common technologies in pharmaceutical industry, driving the development of important substitute in dragon enterprises in pharmaceutical industry, and achieving the successive and breakthrough innovation in enterprises.

(3) Continue to deepen the secondary innovation. As "small pigs", China's pharmaceutical enterprises have to choose the technological innovation mode scientifically, and combine technological innovation and the introduction of technologies effectively, in order to improve their self-innovation abilities. Based on self-innovation, they can introduce foreign latest technologies. And in this process, they should emphasize the consumption and assimilation of technologies instead of purchase, applying the new technologies to their production.

### 3.2 Imitated innovation

New medicine's research and development is expensive, and has a longer term and higher risks. In 1999, Glaxo Wellcome invested 11.7 percent of income in R&D, Roche 17.36 percent, Merck 16.84 percent, and Novartis 18.13 percent. In contrast, the percent is merely about 1 percent or so in China's pharmaceutical enterprises (Sino Trust, 2005). It will cost ten years and 300 million dollars to develop a compound into a medicine that can enter the market, what is not easy for China, a developing country. Data show that during the twelve months before June, 2006, the sales of global medicine increase by 5.9 percent, reaching 580 billion dollars. The sales of imitated medicine increase by 8.9 percent, reaching 54.8 billion dollars. In 2006, the sales of invalid patent medicine reaches 23 billion dollars, and in 2008 the number will exceed 80 billion dollars (Weizhong Shen, 2007, p59-60), which means unpredicted opportunities for the production of non-patent medicine. For China's enterprises, it is a great chance to develop imitated medicine and enter the global pharmaceutical market.

#### 3.2.1 Step on the imitation road with China's characteristics

Beginning from imitated innovation, China's pharmaceutical enterprises should insist on the combination of imitation and innovation, and aim at manufacturing products with "higher technologies, better curative effects, higher added values, and new forms", and decreasing the costs of products. Emphasize the high-tech research and the new-form research of imitated medicine, which can consume less material and possess higher quality, being safe and effective. China's pharmaceutical enterprises should take references from foreign countries' advanced experiences, speeding up the development of the self-innovation by developing "me too" medicine, which is a shortcut from imitation to innovation. Continuous and small-scope process innovation, such as the improvement of techniques, has higher maneuverability no matter what it is cost or technology. Besides, they can develop their own technologies by tracing some products with invalid patent and energetic vitality and steering clear of a series of crafts and technologies with valid patents (Jie Tan. & Yan Cheng, 2006, p104-107).

Meanwhile, China's pharmaceutical enterprise should focus their advantage strengths on several most profitable products, instead of "wide farm, less income". According to the increasing effect of scale economy, enterprises should perform best in a few kinds of products. Collect enterprises' advantage resources to drive the sales of several



products, realizing the leap from quantity accumulation to quality improvement. The increase of sales can enlarge the production scale, decrease production cost, and gain more spaces for benefits, which can improve the economic effect and increase the investment in research and development.

### 3.2.2 Problems that should be noticed

(1) Construct a perfect information management system and obtain useful information timely and rightly. Affordable pharmaceutical enterprises should build up an information net system for technological research and development that can help to collect information from relevant researching programs, fruits, and institutions, and relevant regulations, laws, and patent materials in other countries. Construct a perfect information net system that can collect, process, analyze, transfer, and communicate information and an effective feedback mechanism for evaluation of innovation, what can provide with information support for the whole process of enterprises' technological innovation. Besides, pharmaceutical enterprises should be good at using exterior strengths to obtain information, such as obtaining needed information through relevant special consulting agency and information service institution. Especially for small pharmaceutical enterprises that are not capable of constructing their own information net system, they can sign special or long-term contracts for information provision with special consulting agency and information service institution, which can ensure that enterprises can obtain sorts of latest trends and specialized knowledge that relate with technological innovation.

(2) Deal with the relationship between imitation and copy properly. Pharmaceutical enterprises' imitated innovation is to absorb others' successful experiences and lessons by learning from their innovative thoughts and activities, introduce and interpret the core technologies and technological secrets, and make improvement. Input main strengths in middle- and later-production rings, such as art design, quality control, cost control, and marketing and produce more competitive products, gaining more spaces in market. In contrast, copy is to take others' technologies and products directly, without any improvement in products' forms, production crafts, and even marketing channels, which is an invasion to others' knowledge property.

### 3.3 Cooperative innovation ----- merge and purchase

No matter what it is self-innovation or imitated innovation, the two kinds of innovation can be realized by merge and purchase. Merge and purchase mean the investors, such as enterprises and financial institutions, obtain other enterprises' part or all stocks or assets by certain channels and payment ways in order to achieve certain goals, which can make investors practically control or completely control other enterprises' business management (Xingmin Yin, 1999). Merge and purchase is a main way for cooperative innovation. In the long run, the cooperation after pharmaceutical enterprises' merge and purchase will undoubtedly inspire innovation. According to Henderson's investigation on 25% of world new medicine in middle 90s in last century (Henderson, 1996, p32-59), large pharmaceutical enterprises possess more advantages in research and development. The efficiency of R&D programs in large pharmaceutical enterprises is higher than that in small pharmaceutical enterprises. The advantage of large pharmaceutical enterprises comes from the economy of scale. Large pharmaceutical enterprises can make best use of exterior resources and interior accumulated knowledge capitals with higher efficiency. And the economy of scale makes large pharmaceutical enterprises greater specialization under the same cost.

Data show that the number of enterprises' merge and purchase activities has increased from 73 in 2003 to 84 in 2004, once every week in average (Hai Huang. & Zhifeng Wang, 2007, p1117-1120). To occupy advantage resources is the goal of enterprises' merge and purchase activity. Enterprises invest more time and energy in advantage resources.

#### 3.3.1 The form of merge and purchase

(1) Horizontally merge and purchase. Enterprises in one merge and purchase action belong to one industry and produce similar products. The important economic meaning of horizontally merge and purchase is the economy of scale. Marshall defined the so-called economy of scale as a decrease of production cost and a increase of return per unit in certain enterprise due to enlarging production scale (Yi Wang, 2001). Merge and purchase and reengineering can bring about the obvious effects caused by the economy of scale and together with specialization and advantage complement, what can generate scale benefits in production, marketing, and R&D accordingly. By merge and purchase, enterprises can complement and adjust their assets in order to meet the requirement of optimal scale economy and minimize the business costs. Besides, enterprises can realize the deepening production, use uniform production procedure, reduce the intervals between production rings, and make best use of productivity, as they sustain their general product structure. At present, China has thousands of pharmaceutical enterprises. And most of them are small- and medium-enterprises. Only 300 of them are large enterprises. Although the concentration rate  $CR_4$  of China's pharmaceutical industry increases from 7.2 percent in 1998 to 9.5 percent in 2003, it is lower comparing with that of foreign countries. In 1983, the concentration rate  $CR_4$  of England's pharmaceutical industry is 35 percent, and in 1991 the number of Germany's pharmaceutical industry is 28 percent (Diquan Cao. & Ke

Chang, 2002, p14). Therefore, China's pharmaceutical industry has a wider space to increase the concentration rate. Enterprises' merge and purchase and reengineering can help to obtain the sustainable scale benefits, especially in fields of marketing, brands, and R&D, what is an excellent way to get rid of the position of "small pig" in game.

(2) Vertically merge and purchase. Enterprises in one merge and purchase action locate in different stages of production and circulation. They connect with each other by materials' production, supply, processing, and sale. By means of vertically merge and purchase, large enterprises can completely control all stages of materials' production and sale. It is an essential way for large enterprises to construct a vertically control system. The aim is to decrease the transaction costs in market and enhance the monopoly over market (Yi Wang, 2001). That is why most pharmaceutical enterprises prefer to the vertically merge and purchase strategy.

(3) Mixed merge and purchase. The horizontally merge and purchase, and the vertically merge and purchase happen at one action. Or enterprises in one merge and purchase action belong to different and non-related industries. This action generally happens as enterprises in one industry try to enter other profitable industry. And mixed merge and purchase usually relates with enterprises' multiple strategy. In fact, the profitable pharmaceutical industry has become an ideal investment field for many powerful investors.

### 3.3.2 Problems that should be noticed

(1) The boundary of enterprises' size. Many problems should be noticed in merge and purchase process. One of problems that deserve more attentions is the size of enterprise that is reached by merge and purchase and is most effective. According to the concept of scale economy discussed in classic theories of economics, the enterprise has an optimal size, namely the critical point of scale economy and non-scale economy. Only when the enterprise is on the critical point, can it gain profits by enlarging the size. Otherwise, it can not gain profits by enlarging the size. Therefore, it is necessary to consider the boundary of enterprise size. The boundary of enterprise size is the balance point between the transaction cost in market and the exchange cost in enterprise. According to the three dimension of transaction and the three contract backgrounds advanced by Williamson, an economist, three factors determines the boundary of enterprise size, namely the frequency of transaction, the asset specificity, and the contract environment. The three factors determine the transaction costs of different economic organizations. By comparing the costs and the benefits, we can theoretically get the optimal size of enterprise, which can help the enterprise to achieve its optimal size by merge and purchase (Shuzhen Chu, 2004, p156). Therefore, pharmaceutical enterprises should control their boundaries of size in merge and purchase, avoiding the non-scale economy caused by too-large size.

(2) Construct modern enterprise system. After the merge and purchase action, enterprises should construct a uniform management system for organizational management, employees' performance evaluation, finance management, products' research and development, marketing and sales, and customer service, in order to guarantee the general management and operation in enterprises.

(3) Invest more in research and development after the merge and purchase action. The government can drive enterprises to invest more in medicine research and development by taxation policy. The national taxation should permit enterprises to take expenses in research and development as costs, what can reduce the new medicine's value-added tax and income tax after entering the market. Pharmaceutical enterprises should emphasize more on the cultivation of scientific and technological talents after the merge and purchase action by forming a "research and development alliance" with science & technology research institutions and colleges (Hai Huang. & Zhifeng Wang, 2007, 1117-1120).

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Table 1. Won matrix.

Big pig \ Small pig	Press button	Wait
	Press button	Wait
Press button	5, 1	4, 4
Wait	9, -1	0, 0

(In every decision, the first number stands for the won of big pig and the second the won of small pig.)

# The Theoretical Link between Capital Account Liberalization and Currency Crisis Episodes

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## Abstract

The paper investigates theoretical background if countries with unregulated capital flows are more vulnerable to currency crises. In order to solve this question properly the paper considers sequence, precondition of the Capital Account Liberalization process and different generation of currency crisis models. Furthermore, theoretical studies pointed that the speed and sequence of the CAL process needs to be adequate for the country financial development and financial liberalization.

**Keywords:** Currency crises, Capital account liberalization, Exchange rate

## 1. Introduction

The topic of capital account liberalization (henceforth CAL) and currency crisis episodes is an important issue for today's emerging market economies in the current era of multinational financial integration, the technology progress and development of international organizations such as the IMF, EU and OECD. Nevertheless, the CAL process is not a new issue; a similar situation occurred in the era of globalization from 1870-1914 when the capital flows were free of any restrictions.[1] However, at that time money could not be transferred with the press of a button from one part of world to another in one second. Today, the debate about the relationship between CAL and the currency crisis phenomena has become a heated one. This is due to the fact that in the last two decades, the increase of the intensity of the CAL process has been accompanied by an increase of currency and banking crises phenomenon, particularly in developing countries. [2] Many countries imposed or were tempted to impose controls on international capital movement in fear of the economic disruption that may accompany capital flows (e.g. Malaysia, Chile) [3] These capital controls have different forms, and their efficacy in promoting or deterring currency crisis episodes or economic growth is questionable and much debated. [4] Furthermore, at present, the macroeconomic empirical analysis and theoretical implications have not found conclusive evidence demonstrating that CAL increases the risk of a currency crisis.

All the points which are mentioned above suggest that there is room for another analysis which will try to find a theoretical link between capital account liberalization and the risk of currency crisis. In order to explain that free movement of capital reduces a country's vulnerability to currency crisis, three aspects need to be considered. Firstly, the aspects of capital account liberalization will be discussed. Starting with the way in which capital flows are allocated to different categories and how these categories can be imprecise. In particular, the analysis of categories' imperfection is important because many capital account regulations are based on capital flows classification. Next, I will investigate the reasons for capital control and the effects of capital control on the real economy with special consideration of capital control efficiency. And then, I concentrate on the sequence and precondition of the CAL process. Secondly, I will analyse the various theoretical models that attempt to describe the mechanism of a currency crisis or predict the moment of a successful currency attack on the exchange rate. Lastly, I will summary my theoretical observations about the relationship between CAL and the Currency Crisis will be presented in third section of this chapter.

## 2. Capital Account Liberalization

### 2.1 Capital flows

Capital flows can be distinguished in terms of their original maturity. The IMF developed a three-way division to separate international capital flows into Foreign Direct Investment (FDI) (long-term investments) [5], Foreign Portfolio Investment (FPI) (short-term investments) [6] and other investments (see Fig. 1.). There are short term and long term assets and liabilities based on whether a contractual maturity is less than or equal to one year or more than a year. However, in the case of the development of the financial instrument, in particular options and swaps, the original maturity is now of relatively little importance. [7]

It is an often heard statement that FDI flows tend to be more stable compared to FPI (Stiglitz (2000), Liccheta (2006)). [8] The theoretical model of Albuquerque (2003), Itay and Razin (2005) supported this view that FPI

flows create macroeconomic volatility as the reason of higher default risk of FPI than FDI. In empirical analysis, Lipsey (1999), and Itay and Razin (2005) shown that direct investment flows have been the least volatile source of international investment for majority of countries. However, Lipsey (1999) found an exception to this. The United States has flipped back and forth from being the dominant net supplier of FDI to being a dominant net recipient of FDI and back to being a dominant net supplier of FDI again. Itay and Razin (2005), and Wyplosz (2001) established that the differences in volatility between FPI and FDI flows are much smaller for developed economies than for developing economies. Moreover, portfolio investments are frequently maligned for causing a crisis (e.g. the Mexico Peso) due to their short-term investment horizon creating financial market volatility (Neely (1996), Rodrik and Velasco (1999)). However, an empirical study by Durhan (2003) found that FPI does not correlate positively with macroeconomic volatility, but the result indicates the negative indirect effect of “other foreign investment” through macroeconomic volatility. Other authors (Singh (2002), Zywiecka (2002), Kregel (1996)) suggest that FDI can also be responsible for macroeconomic instability and have a negative impact on a country’s balance of payments. In particular, FDI creates a time profits of foreign exchange outflows (e.g. dividend payment or profits repatriation) or FDI was made in production of export goods. [9] In summary, it is very complicated to provide an unambiguous answer to the question ‘What kind of capital is better for a country and causes less distributions in macroeconomic-currency stability?’. Moreover, there are problems in distinguishing between short or long run capital flows (FDI or FPI).

## *2.2 Capital controls*

There are three main questions: firstly why capital control exists, and secondly, whether it is true that capital control has an impact on real economic variables such as interest rate, capital flows etc and, thirdly, how market participants avoid capital regulation.

Starting with the general reason for the existence of capital controls; the increase of capital flows across borders and the origin of the global capital market carry the risk of negative turbulences (e.g. investors animal spirits, boom-bust cycles, procyclical natura of capital and capital flight). To navigate this risky global environment, some countries impose certain kinds of control on capital [10], arguing that these controls help limit volatile short-term capital flows (sudden capital reversal), avoid balance of payments crises, exchange rate volatility and the spread of economic shocks. In addition, this domestic policy instrument provides greater independence of interest rate policy and has altered the maturity of capital flows (Saxena and Wong (1999), Dooley (1996), Summers (2000)). The pioneers of this line of thought were Tobin (1978) and Dornbusch (1986). Tobin proposes imposing uniform tax on all foreign exchange transaction to discourage very short-term capital flows. Dornbusch (1986) suggests the adoption of measures such as a dual exchange rate system. In contrast, capital controls themselves may have a destabilizing effect on exchange rates or the economic situation. Firstly, the implementation of capital control restriction may lead to herding behaviours or financial panic. These irrational investors’ behaviour can cause a net capital outflow and increased financial instability. Secondly, new capital restriction can be regarded as a signal of inconsistently designed government policies that render a country more vulnerable to currency crises (Glick, Reuven and Hutchison (2000)). Lastly, capital control regulation gave the power to the bureaucrats. It can lead to economic misallocation, corruption and rent seeking activities and then to economic instability (Eichengreen (2001)).

All the effects described above lead us to ask an open question about the effectiveness of capital control. The effectiveness depends on different factors concerning the countries themselves as well as the issue of time. These factors can change exogenously or as the results of domestic policy. The set of factors includes the “international in scope” factors, a domestic “structural” nature (i.e. slowly changing), macroeconomic factors, and factors related to the design of the restrictions themselves. The “international in scope” factors includes the state of technology and the international legal environment. The second set of factors, which operate at a domestic structural level, are efficiency of the bureaucracy, “structural” factors e.g. financial reform, trade integration and increase of FDI. A third set of factors is the size of the domestic incentives motivating inflows or outflows. Finally the effectiveness of restrictions is very likely to depend on the design of the restrictions themselves (Montiel (2003)). These factors determine whether laws controlling capital flows are on the book than whether the laws are enforcer, or they are enforced, whether they effectively stem the flows of capital. In this case the efficiency of capital control can be considered from two perspectives.

Firstly, if capital control has any effective effects on domestic policy and its impact are according to policy makers intensions (e.g. limit volatile short-term capital flows or interest rate, changing the composition of capital flows). The second case analysed how foreign or domestic residence can circumvent capital control regulations. Unfortunately, in the first case, the unambiguous answer was found neither for the empirical cross-country analysis (see Table 1) nor single country studies (e.g. the Chile case, Malaysian case (1998-2001)). [11]

In the second case, the channels through which foreign or domestic resident can circumvent capital control regulations are similar to the circumvention of corporation taxations and profit transfer, especially for multinational corporations. According to Eiteman, Stonehill, and Moffett (2006), Montiel (2003) the main way of avoiding capital controls are identified: transfer pricing [12], overinvoicing of import, underinvoicing of export, creating unrelated exports, use of payment leads and lags to effectively lend and borrow abroad [13], changing of trade credits condition, unbundling of Capital Service Payments [14], Fronting Loans [15] and Special Dispensation (creation of centre profit of multinational corporations).

Some empirical literature has tried to present the problem of avoiding capital control regulations. Mathieson and Rojas-Suarez (1993) suggest that capital controls had lost effectiveness in the 1980s with the liberalization of exchange and trade controls. They identified channels of evasion such as under- and over-invoicing, transfer pricing policies, and leads and lags. Desai, Foley and Hines (2004) analysed the impact of capital control of FDI investment by using American affiliate-level data makes for the period 1982-1997. According to their results, American multinational firms circumvent capital controls by adjusting their reported intra-firm trade, affiliate profitability and dividend repatriations. The evidence indicates that the same affiliates have a 4.7 percent lower reported profit rates than do comparable affiliates in countries without capital controls.

### *2.3 The preconditions and sequencing of Capital Account Liberalization*

As shown above, capital controls have a tendency to become more ineffective over time, creating their own costs and distortions (Summers, (2000)). These effects encourage individual countries to continue the process of CAL. Since the late 1960s, several developed countries have pursued gradual CAL and in the 1990s many developing countries took this path but more rapidly and often adopting a deeper approach, the so-called "big bang" (Schneider (2000), Griffith, Gottschalk and Cirera (2000)). The gradual approach is mainly connected with the orthodox, laissez-faire concept which required reforms in the real economy and financial system before opening the capital account (Singh (2002)). Since the Latin American and Western European financial crashes in the 1990s, a gradualist approach has won over. More economics heads move into this approach. However, some researchers have advocated rapid CAL, given its positive impact on capital inflow and domestic financial development (Johnston and Ryan (1994)). Specifically, after the Asian crisis in 1997 there was big break in economic thinking about rapid methods of CAL (Singh (2002), Stiglitz (2004)). Two important questions were raised about what sequencing of capital regulation should have been taken (order and speed of capital account restriction removal) and what pre-liberalization conditions should be met before opening the capital account.

#### *Sequencing of capital regulation removal*

The sequence of CAL can have different order or pattern. Some researchers believe that the capital account should be liberated following the liberalization of the current account and the domestic financial system. Others have suggested that there should be simultaneous liberalization of the current and capital account (McKinnon (1993), Saxena and Wong (1999)). In practical view, the IMF and OECD liberalized the capital flows by using a type of two-step procedures (the IMF's Articles of Agreement and OECD Code Liberalization). The first step included liberalization of direct investment, long-term capital movements and trade transactions. The second considered the liberalization of short-term financial transactions and inter-bank market (Griffith, Gottschalk and Cirera (2000), IMF (2005)).

#### *Pre-liberalization reforms*

Several studies have a sceptical view of the importance of the sequencing of capital regulation removal and underline the role of adequate institutional safeguards. They point out that institutional safeguards must be in place before an economy can benefit fully from free access to international capital markets (Mathieson and Rojas-Suarez (1993), Kaminsky and Schumukler (2003), Kawai and Takagi (2003)). The adequate institutional safeguards were based on capital account pre-conditions. It is necessary for countries to meet these preconditions before capital account liberalization is possible:

1. Sound macroeconomic policy framework: macroeconomic policy and fiscal consolidation are consistent with the choice of the exchange rate regime (Saxena and Wong (1999), Schneider (2000)),
2. Independent monetary policy based on indirect policy tools and flexibility in exchange rate management. This involves multiple exchange rate regimes into floating unified rate systems (Schneider (2000), Singh (2002)). However, governments must ensure that inflation, the current account balance and foreign exchange reserves are maintained at acceptable levels before the movement towards capital account convertibility (Schneider (2000)),
3. Strong domestic financial and banking system: strong supervision and prudential regulations covering capital adequacy, good lending standards and asset valuation, effective loan recovery mechanism, transparency,

disclosure and accountability standards, and provisions ensuring that insolvent institutions which are dealt with promptly financial collapse. (Fisher (1997), Prasad, Kenneth, Wei and Kose (2003)). In addition it is important to offer some incentives for sound corporate finance practices in order to avoid high leverage and excessive reliance on foreign borrowing (Kawai and Takagi (2003)),

4. Accurate and comprehensive data disclosure, including information on central bank reserves and forward operations (Saxena and Wong (1999)).

In summary, both conceptions of CAL: preconditions or sequencing of liberalization) could be adopted simultaneously, as Johnston and Ötör-Robe's (1999) modernized approach to managing the risks of cross-border capita flows suggests.

### 3. Currency Crisis-Theory

There are main five different kinds of theoretical models are examined that endeavour to describe the mechanism of currency. The first generation of Krugman's (1979) and Salant and Henderson's (1978) models concentrated on inconsistency between domestic economic conditions (wrong macroeconomic fundamentals and exchange rate commitment causes a currency crash. Then the second generation models analyse the psychological game between investors and government which might root to multiple equilibriums. In this line of models, there are self-fulfilling currency crisis models (Obstfeld (1986)) and pure speculative models such as contagion effects models (Gerlach and Smets 2000, Eichengreen, Rose and Wyplosz (1997) and Masson (1998)) or herding behaviour models (Binkchamadani and Shami (2000), Calvo (1998), Mendoza (2000)). In contrast, the third generation model is based on the microeconomics fundamentals and explores three main areas: financial market inefficiency (James and Stoker (1994), Mishkin (1996)), the fragility of the banking system (Chang and Velasco (1998 a,b), McKinnon and Huw (1996), Kaminsky and Reinhart (1999) a company's balance sheet and the effects of monetary policy in the currency crisis (Krugman (1999 a), Aghion, Bacchetta and Banerjee (2001)). The last group of models, the so-called Sudden Stop models (Mendoza (2001), Hutchison and Noy (2004)) were developed by basing on the herding behaviour models (Calvo (1998)) and concentrate on the fact that sudden capital reveals are in unpredicted moments. The analysis of the reason for the occurrence of a currency crisis will point the indicators responsible for currency crisis and simultaneously influenced by the CAL process.

#### 3.1 The first generation models

The first generation models are based on the balance-of-payments, stresses that crises are caused by, and weak economic fundamentals such as excessive fiscal and monetary expansion. The money is created only through government deficit; conversely, government deficit will be financed by printing money. [16] If, in any period, expansion of domestic credit is too large to be absorbed by the demand for real balances, equilibrium in the money market is achieved through adjustment of the exchange rate by offsetting movement in central bank foreign exchange reserve stock so as to hold the exchange rate regime. It causes the depletion of foreign exchange reserve, when the process is continued, so that the outcome is fundamental disequilibrium rather than purely transitory events. Since foreign exchange reserves systematically decline, market agents may doubt the ability of the central bank to control the fixed exchange rates system. [17] Eventually, reserves fall to a critical threshold at which the rational agents may initiate speculative attacks on the foreign exchange reserve of the central bank, eliminating the authorities' remaining foreign assets and causing the collapse of the exchange rate [18] (see Fig. 2).

Seminal studies in the field carried out by Krugman (1979) and Salant and Henderson (1978), have led to numerous other researchers addressing this issue. Several authors have extended and simplified Krugman's paper, namely Dornbusch (1987), Flood and Garber (1986), Flood, Garber and Kramer (1996). [19]

#### 3.2 The second generation model

After the European currency crisis experience in 1992-1993, it was impossible to fully understand the reason for the crisis in the terms of the first generation model. Most countries did not have any problems with the divergence between fiscal policy and exchange rate policy. In this context, some authorities state that changes in the exchange rate regime can be caused by reasons other than a depletion of official international reserves. In that case a crisis can happen without a significant change in macroeconomics fundamentals. Instead, economists have pointed out that the adverse consequences of policies such as higher interest rates or other key economic parameters (for example, unemployment levels or GDP etc.) have forced governments to maintain exchange rate parity. Simultaneously, it gave room to the development of the market agents' formation of expectation about exchange rate policy and then might lead to bad equilibrium such as self-fulfilling currency crisis. The first pioneer of the model of the self-fulfilling currency crisis even before the European crisis in 1992-1993, was Obstfeld (1986). [20] The expansion of this model can be found in other studies including Obstfeld (1994, 1996), Ozkan and Sutherland (1995), Reisen (1998) and Krugman (1996). Most of these authors pay less attention to the role of fundamentals in creating

balance-of payments crises; they also point to the importance of other economic variables that may help predicting those crises. Since most of the solutions the models provide do not apply to the steady state, they became the basis for a body of literature on speculative bubbles, sun-spot equilibrium and consider nonlinear behaviour rules by one or more agents. This led to multiple solutions and then to self-fulfilling solution. The models of self-fulfilling currency have two main assumptions: firstly, the government is the active agent of the market and wants to maximize an objective function. Secondly, economic policies are not predetermined but respond instead to changes in the economy. Economic agents take this relationship into account in forming their expectations about the policy. The policy represents a kind of trade-off between the benefits of and the costs of maintaining a credible exchange rate peg. For instance, the degree of commitment of the central bank to defend the peg is dependent on the level of reserve. The weaker the commitment of the central bank the higher the probability that the speculative attack will be successful. Additionally, there is the psychological game which takes place between the market agents and authorities. The market agents create expectations about the future policy and then start the actions that affect some of the variables (e.g. interest rate, unemployment, loss of trade competition). [21] This variety of factors may affect the authority's objective function that could be used as the indicator of a currency crisis. In these circumstances, the possibility of a multiple equilibrium can be created and the economy may move from one equilibrium to another without a change in the fundamentals. [22]

The other line of second generation models suggests that crises may occur as a consequence of pure speculation against the currency, as agents follow herding behaviour (Calvo and Mendoza (2000) and Binkhchadami and Sharma (2000)) and/or foreign exchange markets are subject to contagion effects (Gerlach and Smets (1995), Eichengreen, Rose and Wyplosz (1997), Masson (1998) and Ahluwalia (2000)). [23] In Obstfeld's and Reisen's models, neither of them predicted crises by changes in the economic fundamentals through the market agent's expectations. The crisis is the consequence of a pure speculative attack on a currency.

With regard to herding, this can be presented into two different ways. Firstly, when all agents have different pieces of information, it can be rational for individuals to base behaviours on the behaviours of others because of the cost of information. This is especially the case when there are many small investors in the economy. They cannot rely on their own individual information due to the high costs involved so they will base their behaviour on the behaviours of other market players, mostly those who have good reputations. In this situation, market investors will take decisions based on limited information and will therefore be more sensitive to rumours. This causes an ineffective distribution of the financial market decisions and moves the market to a crisis outcome (Calvo and Mendoza (2000)). Secondly, the incentive structures within which portfolio managers operate may make it not very costly to be wrong along with everyone else, with incentives to stand out against the crowd being insufficient. This is mostly the case when the advantages of investment (the case of the manager's salary in investment firms) depend on their competitors behaving similarly (Binkhchadami and Sharma (2000)). In other words the salary of the manager will not decrease so much if the other investors on the market make the same mistake.

There is a possibility of contagion effects where two variants are present. The first variant is the spill-over effect (trade linkages). [24] The crisis in one market may affect macroeconomic fundamentals in another country, market via the loss of competitiveness of the countries associated with devaluation of currency. This situation can result if the said countries are main trading partners. Generally, a successful attack on the exchange rate in one country leads to its real depreciation, which improves the competitiveness of the country's merchandise exports. This produces a trade deficit in the second country and a gradual decline in the international reserves of its central bank. This causes the other country to become more vulnerable to an attack and a currency crisis (Gerlach and Smets (2000), Eichengreen, Rose and Wyplosz (1997)).

The second variant is monsoonal effects (Eichengreen, Rose and Wyplosz (1997) and Masson (1998)). This effect is linked with multiple-equilibrium and suggests that a crisis in one country may raise the probability of a crisis in another country because the currency crisis in one country is like a signal which encourages a self-fulfilling speculative attack. Certainly a crisis in one country may conceivably trigger a crisis elsewhere for reasons unexplained by the macroeconomic fundamentals, perhaps because it leads to shifts in market sentiment or changes in the interpretation given to existing information. However, there can be another variance connected with the political nature of the devaluation decision when a policy is interested in enlarging political integration with its neighbours (e.g. the European crisis 1992-1993). In this context, devaluation in one of the neighbouring countries may increase speculation against the domestic currency.

### 3.3 Third generation model

At the end of the 1990s, in particular, after the structural financial crisis in Asia, a third generation model of currency crisis started developing very quickly. For the reason that the Asian countries brought incontrovertible



experience that if something does not work in the micro fundamentals of an economy that could cause a currency crisis. [25]

The third generation models concentrated on three main microeconomic aspects related to currency crisis such as the fragility of the banking system (McKinnon and Huw Pill (1996), Chang and Velasco (1998 a,b,c) and Kaminsky-Reinhart (1999), financial market inefficiency (moral hazard or the problem of asymmetrical information) (Stoker (1994), Mishkin (1996) and Krugman (1998)), companies' balance sheets and the effects of monetary policy during/before the currency crisis episodes (Krugman (1999 a, b), Aghion, Bacchetta and Banerjee (2000, 2001)).

The first issue addressed in the development of third generation models was the fragility of the banking system and financial market inefficiency. The classical views of the first generation model suggest that currency crises arise as a result of inconsistencies between inflationary fiscal policy and the exchange rate peg. This causes the depletion of international reserves and finally the collapse of the exchange rate regime. [26] As the models show, the authorities cannot directly finance the fiscal deficit by printing money but it is clear that the problem of financing expansive fiscal policy by printing does not disappear especially in most developing countries. However, modern variants of the first generation model, the so-called twin banking-currency crisis model, explain how this problem can change in a currency crisis, again, via the banking system. This framework stresses the fact that currency crises are often part of broader financial crises, where the two elements interact with one another, giving life to what have been called the "twin crises" (McKinnon and Huw Pill (1996), Chang and Velasco (1998 a, b, c), Stoker (1994), Mishkin (1996) Kaminsky-Reinhart (1999). [27]

Stoker (1994) and Mishkin's (1996) models concentrated more on the financial aspects of asymmetric information and moral hazard than twin model effect. However, more recently, a thoroughly worked-out attempt to model the financial fragility aspect of a currency crisis was carried out by Chang and Velasco (1998 a, b, c). This study addresses the issue of the financial intermediaries and commercial banks collecting funds from depositors and then allocating investment in order to maximize their profits and that of the depositors also. The banking system, in so doing, will improve social welfare. Additionally, the exchange rate regime and authorities' credit policy increase this effect so that the whole economic mechanism is intended to maximize social welfare. In an open economy, the banks play another active role in generating large capital inflows to the economy through, for instance, the banking system where domestic and foreign investors borrow money from abroad at a low interest rate and then invest in the domestic market where yields are higher. At the same time, though, there is one caveat, which is the risk of a sudden reversal of capital flows and of a bank run. In other words, international illiquidity [28] of the domestic financial system plus financial liberalization is at the centre of the problem. To the same extent, we do not have to implicitly assume that holders of the bank's liabilities, domestic depositors and foreign creditors, all remain confident in the bank. This means that depositors will attempt to withdraw their deposits in the short run, and that foreign creditors will not roll over their initial credit in the short run so that the bank will not be able to honour all of its commitments. There certainly seems to be a lack of confidence that leads to a banking crisis raises that can be caused by a shift in expectations. For example, if agents expect devaluation, early withdrawals will be beneficial. This can generate financial panic in domestic and foreign investors and at the same time foreign creditors will demand repayment from the domestic banks. If the domestic banks do not have enough domestic deposits in liquid form that is in the world asset it raises the possibility of self-fulfilling bank run. Long-term investments of the domestic bank will yield little if they have to be liquidated prematurely. In a closed economy, the central bank can protect against market panic by acting as a lender of the resort. With a fixed exchange rate and open economy the central bank can play the same role because a run against the intermediaries generates pressure on the peg and then increases demand for foreign exchange reserves. As long as the central bank holds the exchange rate, the regime will stabilise the banking system. Everything depends on the size of the central bank's reserves. On the other hand, to help domestic banks, the central bank can pursue a different expansionary policy and keep interest rates from rising. But, in this case, private agents will use the additional domestic currency to deplete the central bank's reserves. Therefore with limited international reserves, eventually, the central bank will abandon the peg. This shows how a financial crisis can transfer to a balance of payments crisis.

A further implication of the Chang and Velasco (1998) model suggests that financial liberalisation allows the domestic bank to obtain cheaper borrowed capital, and promotes a lending and investing boom in the domestic economy that causes a consumption boom, increase in current account deficit and increased financed the borrowing abroad. As the current account deficit continues to widen, financial markets will need more foreign capital to feed the trade deficit (boom-bust cycles) (McKinnon and Huw (1996), Kaminsky and Reinhart (1999) [29]. The lending boom converges levels gradually in inflation. There is marked cumulative real exchange rate appreciation. [30] Cumulative real exchange rate appreciation will generate the expectation of exchange rate depreciation on the

market. According to Chang and Velasco's model (1998), the capital inflows become outflows and cause the collapse of the banking system which then leads to a currency crisis.

The problems of balance sheet firms have been dealt with in practical discussions, while the issue has been neglected in the currency crisis literature. However, more recent models (Krugman (1999 a, b) and Aghion, Bacchetta and Banerjee (1999, 2001)) increasingly address this topic and have found a link between all three micro economic aspects: the fragility of the banking system, asymmetrical information (moral hazard) and company balance sheets. Krugman's (1999 a) model presents an elegant simplification of the model of Aghion, Bacchetta and Banerjee (1999, 2001). Aghion, Bacchetta and Banerjee's (1999) model addresses the issue in a similar manner to Krugman's (1999a) model. These models state that a currency crisis can happen both under fixed and flexible exchange rate pegs, as the primary source of a crisis is the deteriorating balance sheet of private firms. This is because these balance sheets play a key role in the crisis itself. These models suggest that entrepreneurs can borrow in domestic currency from domestic consumers or in foreign currency from foreign lenders. Indeed, in these models it is mix short-term debt, denominated in domestic currency and long-term debt denominated in foreign currency. The amount that domestic entrepreneurs can borrow from foreigners or domestic banks to finance investment depends on their wealth; the entrepreneurs' wealth is therefore the fundamental variable that determines investment and output (Bernanke and Gertler (1989)). However, the wealth of each individual entrepreneur depends on the level of such borrowing in the economy as a whole; because the volume of capital inflow affects the terms of trade and hence the valuation of foreign currency- denominated debt (for example, inflows cause real appreciation of the exchange rate and decrease the value of foreign debt).

Any real shock in the economy such as productivity, or, such as fiscal or expectation shocks, can cause a decrease in capital inflows that will have adverse effects on the balance sheets of domestic entrepreneurs (Aghion, Bacchetta and Banerjee (2001)). Though the arbitrage in the foreign exchange market which implies that the currency must depreciate in the current period. If people start to believe that the currency will depreciate, it may indeed depreciate (Blanchard (1979)), but an explosion in the domestic currency value of dollar debt has a disastrous effect on firms. The increase in foreign currency repayments and fall in their profits then reduce their ability to borrow and then investment and output in a credit-constrained economy. A further reduction of capital inflow reduces the demand for the domestic currency and leads to depreciation. Generally speaking, the financial crisis cycles started to close circle, nevertheless, it is one of the possibilities multiple equilibrium in these models. [31]

Moreover, fragility in the banking and financial sector will make the whole system more susceptible to collapse by reducing the amount of credit available to firms (Stiglitz and Furman (1998), Radelet and Sachs (1998), Velasco (2001)) [32]

### 3.4 Sudden –Stop Model

Calvo (1998) was a pioneer in defining the empirical regularities of the so-called sudden stop phenomenon. These sudden stop episodes hit emerging markets in the 1990s (Asian crisis 1997-1998, Russian Crisis 1998, Mexican crisis 1994). The sudden stop phenomenon is essentially defined as an abrupt reduction of the capital inflows to a country and up to time of abrupt reduction that have been receiving large volumes of foreign capital Calvo (1998). This definition of Sudden Stop event was widened by Mendoza (2001), Mendoza and Smith (2002) and Hutchison and Noy (2004). These authors consider the effect of large downward adjustments in domestic production after a sharp reversal in capital inflows and collapses in asset prices and in the relative prices of non-tradable goods relative to tradable ones.

There are no perfect measures of the sudden stop effect. The traditional sudden stop indexes are based on changes of international reserve and net capital flows (current account balance changes) Calvo, Izquierdo and Mejia (2004). [33] The sudden stop event is defined as episodes when gross inflows drop off considerably and remain modest for a full year. In contrast, Rothenberg and Warnock (2006) and Mendoza (2006) regarded the sudden stop index as net capital flows in preference to gross capital flows. In addition, Rothenberg and Warnock (2006) indicated the episodes of sudden as very strong inflows of capital for the following two years. This definition allows us to distinguish the sudden stop episodes from the episode of sudden flight. [34]

The sudden stop phenomenon involves a reversal in capital inflows associated with a currency and balance of payments crisis (Calvo (1998), Rodrik and Velasco (1999), Calvo, Izquierdo and Talvi (2002), Kaminsky (2003), Hutchison and Noy (2004)). There are three mechanisms through which a sudden stop in international capital flows may bring about a currency and balance of payments crisis. The first two channels were built on the financial friction of the "great depressions" model. The first channel is based on the Keynesian hypothesis of price or wage stickiness and its connection with an external financing premium (Bernanke, Gertler and Gilchrist (1999)). The second channel is the so-called Fisherian analysis of debt-deflations driven by collateral constraints. [35] This

analysis was introduced by Kiyotaki and Moore (1997) and then developed by integrating forms of imperfect credit markets, by Mendoza (2001). Essentially, these two approaches investigated the effect of a fall in credits, attributable to the sudden stop in capital inflows, combined with an external financing premium, a “financial accelerator”, reducing aggregate demand and causing a fall in output. [36] Conversely, Mendoza’s approach to Bernanke, Gertler and Gilchrist’s and Moore’s (1997) Sudden Stop models is quite different. This analysis focuses on an excess volatility phenomenon and explains the abrupt economic collapses of Sudden Stops as a typical phenomenon nested within the co-movements of regular business cycles. The model also emphasizes the interaction of uncertainty, risk aversion and incomplete contingent-claims markets in forming the transmission mechanism linking financial frictions to the real economy. This analysis is in line with the models developed by Aiyagari (1993) and Aiyagari and Gertler (1999), where precautionary saving and state-contingent risk premium play a key role in driving business cycle dynamics. [37] In addition, Mendoza (2001) introduced policy uncertainty” and “involuntary contagion” as explanatory variables in Sudden Stops model. Finally, the third mechanism is the analysis of existence the multiple equilibria most of which were developed as part of the second and third generation model (Calvo (1998), Rodrik and Velasco (1999) and Aghion, Bacchetta and Banerjee (2001)). However, in this case, as Rodrik and Velasco (1999) suggest, excessive short debt can leave borrowing countries vulnerable to sudden shifts in lenders’ or investors’ expectations, which can in turn become self-fulfilling of a currency crisis. However, the reason for the shift in the economy to a bad equilibrium might be the sudden capital reversal.

#### **4. The Link between the regulation of capital control and currency crisis events**

Neoclassical theory is based on the concept of allocative efficiency. In that case CAL should improve the efficiency of capital investment by removing the distortions (e.g. monopolization of market). CAL works in the same way as the liberalization of the domestic market (Fischer (1997), Summer (2000)). In addition, the supporters of neoclassical theory and the CAL concept argue that capital flows are similar to the trade between time periods (temporal borrowing and lending) and to the trade between countries. They term these capital flows as “intertemporal trade” and argue that trade liberalization is beneficial for the economy across jurisdictions under argument for competitive markets (Fischer (1997), Summer (2000)). In the case of allocative efficiency, the CAL process will improve the diversification of the investor’s portfolio (by reducing the portfolio risks or increasing the purchase of lower risk equity), increase the efficiency of saving allocation and then smooth the consumptions in response to shocks and increase economic growth [38] (Fischer, (1997), Liccheta (2006), Gourinchas, Jeanne (2002), Prada, et al. (2003)). All these improvements will have a positive influence on macroeconomic stabilization and financial markets strength (Fig 3).

Certainly, CAL optimists recognize that the CAL process can be linked to the risks of market overreaction. Nevertheless, they argued that if capital movements are mostly appropriate then the currency crises do not blow up with any reason rather started as the rational reaction to policy mistakes or external shocks (Fisher, (2003: 4)). Therefore, market overreactions are caused by the lack of precondition reforms or wrong sequences of CAL reforms. The economists mainly consider the currency crisis described by the first generation models (Krugman (1979), Salant and Henderson (1978)) or the simple version of “twin models” (McKinnon and Huw (1996), Chang and Velasco (1998 a,b,c)) where bad macroeconomic fundamentals or weak banking supervision allowed the economy to crash in an almost predictable way. However, the currency crisis described as second generation models (Obsfeld (1986, 1994, 1997)) recognized to special factors (e.g. unemployment levels, interest rate levels, GDP) can be considered here as well. The self-fulfilling expectations of investors were caused mainly by some economic problems (e.g. high unemployment levels). On the other hand, this assumption about precondition reforms CAL becomes an incentive for good policies or reforms (e.g. independence of monetary policy or property rights). This effect also reduced the probability of a currency crisis. (Gourinchas and Jeanne (2002), Eichengreen (2001), Klein and Olivei (2001)) (see Fig. 3).

However, the other side of the debate about CAL and currency crises was of the opinion that it is not a direct causal link between CAL and the incidence of a crisis, but there is evidence to believe that liberalization increases the probability of a crisis (Stiglitz (2000), Charlton and Stiglitz (2004), Williamson and Mahar (1998), Singh (2002), Dollar and Kraay (2001)). They arrived at this conclusion from the wrong neoclassical paradigms: those financial and capital markets are essentially the same as the goods-services markets. The theory ignores important aspects that undermine the main neoclassical assumptions (such as full information, rational agents’ behaviour, distortions etc.). [39] They found reasons why CAL can lead to economic instability macroeconomic instability and banking booms and then to a currency crisis (the lack of neoclassical theory) (see Fig. 3).

These reasons might be divided into main two categories. The first group of reasons consist of animal spirits [40], the procyclical nature and volatility in capital flows, self-fulfilling expectations, the systemic risk though contagion from one economy to other, momentum trading [41] and the sensitivity of international markets to

changes in information (financial panic). (Stiglitz (2000), Singh (2002)). This group is mainly linked to the indicators of sudden stop models (Mendoza (2001), Hutchison and Noy (2004)) and second generations models which are based on the assumption of pure speculation against the currency such as herding behaviour models (Calvo and Mendoza (2000) and Binkchamadani and Shami (2000)) and contagion effects models (Gerlach and Smets (2000), Eichengreen, Rose and Wyplosz (1997) and Masson (1998)). After that, the second category of reasons for instability can be regarded in the perspective of third generations models and banking/financial fragility- the main authors in this field being James and Stoker (1994), Mishkin (1996), Chang and Velasco (1998 a,b,c), Kaminsky and Reinhart (1999) or Companies' balance sheet models (Krugman (1999 a,b), Aghion, Bacchetta and Banerjee (2000, 2001). In this categories of reason are financial panic, boom-bust cycles [42], increased the competition among banks following liberalization and the short-terms of leading players and momentum trading. However, financial panic and momentum trading are important in analysing both second and third generation models of a currency crisis (Stiglitz (2000), Charlton and Stiglitz (2004), Chari and Henry (2002) (see Fig. 3).

All these phenomena connected relation between CAL and currency crisis episodes are intensive during the process of liberalization the capital flows. Nowadays a few practical sides of these phenomena are presented. First example is that the liberalization of capital flows increases the number of investors and availability of new foreign assets which might raise the problem animal spirit effects (e.g. adverse selection, risk of asymmetric information, moral hazard, financial panic) (Mishkin (1996)). Foreign investors might have less knowledge about domestic markets than domestic ones. At the same time, domestic investors can have problems with information about new foreign assets. However, access to information about a new situation will entail additional costs for both kinds of investor, which can drive them into patterns of irrational behaviors (Banerjee (1992), Calvo and Mendoza (2000), Binkchamadani and Sharma (2000). Additionally, the CAL process exposes the country to short-term debt/ short-term capital (e.g. East Asian countries before 1998) which make a country more vulnerable to sudden changes in market sentiment and financial panic (Rodrik and Velasco (1999), Gruszczynski (2002), Uri Dadush, Dasgusta and Rata (2003)). In terms of CAL and the banking system, for example, CAL might increase the fragility of the banking system. The managers of foreign-owned banks may suffer from the poorer knowledge of the behaviour of borrowers. Consequently, foreign-owned banks may face more problems resulting from information asymmetries than domestic-owned banks (Mc Kinnon and Huw (1999)) In addition, the increase of capital flows can exacerbate the efficiency of financial supervision by monetary authorities and can lead to a banking crisis by increasing the amount of bad credit in a foreign currency for firms or individual-domestic financial dolarization (Chang Velasco (1998a,b), Kaminsky and Reinhart (1999), Demirguc-Kunt and Detragiache (1998)).

Moreover, these opponents to the CAL process also suggest that the link between the liberalization of the financial system and economic and financial crises is closer in developing countries than in developed countries (Arteta, Eichengreen and Wyplosz (2001), Singh (2002)). There are several reasons which help explain this situation. Firstly, developing countries are more suspected to economic distortions such as economic shocks or weak legal framework. Secondly, most developing countries have a small economy so that CAL process influenced negatively on efficiency of the monetary policy. [43] This means that developing countries have fewer tools to protect against the speculation attacks. Lastly, it is sometimes very difficult to implement any preconditions reforms in developing countries (see Fig. 3.).

On the whole, it is difficult to obtain an unambiguous answer about the sign in the relation between CAL and Currency Crisis Episodes. As has been discussed, there are two main ways in which this link can be considered. Moreover, as discussed in first part of this chapter, capital control might be efficient (e.g. the Malaysian case) but in the long-term market, players always find a way to avoid this restrictions. Furthermore, there are always problems what kind of capital control regulation should be imposed on different categories of capital flows. As we have seen, both categories of capital (FDI and FPI) bring volatility of balance of payments (Singh (2002)). On the other hand, it is sometimes relatively easy to transfer FDI to FPI by foreign investors (e.g. foreign companies can take the credit in domestic bank and in the case of domestic problems, they transfer it to head office.

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## Notes

- Note 1. See among others Bordo (2007), Henry (2006), Summer (2000) and Stiglitz and Charlton (2004).
- Note 2. Griffith-Jones, Gottschalk and Cirara (2000) found that three countries (Korea, Mexico and the Czech Rep.) from the six emerging countries that joined the OECD and liberalized their capital flows in the 1990s, had a large and costly crisis shortly after they joined.
- Note 3. See Kawai and Takagi (2003), Kapla and Rodrik (2001), Charlton and Stiglitz (2004), Cowan et al (2005).
- Note 4. See Le Fort and Lehman (2003), Glick, Reuven and Hutchison (2000), Eiteman, Stonehill and Moffett (2006).
- Note 5. The IMF proposed the following definitions of FDI. A foreign investor owns at least 10 % of the ordinary shares or has a right to 10% percent of the votes in the General Assembly of shareholders in an incorporated enterprise or the equivalent an unincorporated enterprise. The FDI reflects the aim of obtaining a lasting interest by a resident entity of one economy (direct investor) in enterprises that are resident in another economy (direct investment enterprises). The lasting interest implies the existence of a long-term relationship between the direct investor and the enterprise and a significant degree of influence on the management of the enterprise (Duce (2003: 5). The emphasis is on whether the purchase is made with a view to controlling the firm or not controlling investors' interests (effective voice in the management). But there is opened question how the 10% voice in the General Assembly can be effective. In this context the 10% criterion is somewhat arbitrary (Lipsey (1999: 5), Gökkent (1997:10)).
- Note 6. The FPI is strictly connected with a portfolio diversification process and obtaining high-fast capital gains. FPI is considered as transactions when a non-resident holds less then 10 percent of the shares of an enterprise plus

all investment in debt securities (e.g. bonds, debentures, notes, money market or debt instruments, financial derivatives or secondary instruments)

Note 7. A good example can be a bond maturity in twenty years is long term, but during its life, it may change hands numerous times or the herding practice of corporations Gökent (1997: 10), Cowan and De Gregorio (2005:12), Pawlik (2003: 4).

Note 8. As a result of the smaller cost of pulling out for lenders, the short-term debt whereas liquidating foreign direct investment may involve selling plant and machinery, and selling stocks or bonds during a crisis usually involves a loss for the sellers. (Dadush, Dasgupta and Ratha 2000).

Note 9. Zywiecka (2002: 20), Devereux (2006: 28).

Note 10. Capital controls is a government policy of restricting local residents from acquiring foreign assets (capital outflow) and/or restricting foreigners from acquiring local assets (capital inflow). This domestic policy instrument can be divided into two categories: administrative restriction (direct control) and market restriction (indirect controls). Administrative regulations are mainly legal regulations. Examples of these include: legal permission of a risky financial transaction, limits imposed on the amount of a firm's stock a foreigner can own, limits imposed on a citizen's ability to invest outside the country, the amount of foreign capital residents may hold, banking obligations for the controlling and monitoring of capital flows. The purpose of market restrictions is to discourage an investor from making a risky financial transaction. The market restriction increases the cost of this transaction e.g. uniform tax, require reserve level, capital gain tax Gruszczynski (2002).

Note 11. De Gregorio et al. (2000), Gallego et al. (1999), (2003), Galbis (1996), Cowan et al. (2005), Gallego et al. (1999), Kawai and Takagi (2003), Lopez-Mejia (1999), Edison, Klein, Ricci and Slok (2002), Charton and Stiglitz (2004).

Note 12. This is the financial transactions between the subsidiary and the parent company for purchasing raw materials, services and intellectual property from the parent.

Note 13. The parent may serve to transfer profits temporarily between the subsidiary and the parent. For example, if the subsidiary buys supplies from the parent and pays for them in advance, this serves as a loan from the subsidiary to the parent. If the subsidiary sells supplies to the parent and the payments are delayed (lagged) then this also serves as a loan from the subsidiary to the parent.

Note 14. The return on a foreign investment is composed of compensation for a variety of services from the parent company; i.e.: management fees, payment for technical expertise, royalties and license fees, payment for proprietary knowledge and intellectual property.

Note 15. The loans from the parent company may also carry an interest charge above the cost of debt capital that serves to transfer profits to the parent. The subsidiary could also make loans to the parent, perhaps at below-cost interest rates; this would be an effective way of transferring funds from the subsidiary to the parent. If a country's regulations on the transfer of capital prohibit loans from a subsidiary to a parent company, but allow the transfer of funds to financial intermediaries, then a fronting loan may be used to achieve a transfer of capital from the subsidiary to the parent. The subsidiary deposits funds in a bank which serves as collateral for a loan to the parent company. The interest on the parent company's loan is offset, at least in part, by the interest received on the subsidiary's deposit.

Note 16. Goldberg (1994) "Predicting exchange rate crises Mexico revisited", *Journal of International Economics*, 36, pp. 414.

Note 17. Krugman (1979) "A model of balance of payment crises", *Journal of money, credit and banking*, Vol. 11, No. 3, pp. 315.

Note 18. It is clear that speculative attack on the government's reserves can be viewed as the process by which investors change the composition of their portfolios, reducing their domestic currency holding and increasing that of foreign currency. A currency crisis is a natural outcome of maximizing behaviour by investors.

Note 19. On the whole, these economists describe the same process - that an exchange rate crisis can take the form of either a discrete devaluation of a controlled exchange rate or a switch to a floating rate accompanied by a sharp speculative attack on central bank holding of foreign exchange reserves.

Note 20. Obstfeld model suggested that speculative attack is the opposite of the canonical model and represents an entirely rational market response to persistently conflicting internal and external macroeconomic targets. There exist circumstances in which balance-of-payments crises may indeed be purely self-fulfilling. Clearly, such crises are apparently unnecessary and lead to the collapse of an exchange rate that would otherwise have been viable.

The crisis does not reflect irrational private behaviour, but an indeterminacy of equilibrium that may arise when agents expect a speculative attack to cause a sharp change in government macroeconomic policies. Even though a crisis is not inevitable, agents believe that the central bank will respond to crises by embarking on a program of heightened inflation. The belief that the authorities will ratify crises makes it unprofitable for any individual speculator to hold domestic currency while a run is taking place.

Note 21. There are three main reasons which indicate a speculative attack: the perceived benefit of maintaining the exchange rate regime; the benefits of abandoning the peg and feedback from expectations of abandonment of the peg to the costs of defending it. The last two reasons for speculative attacks were especially analysed in the works of Obsfeld (1994, 1996) and Reisen (1998). According to these articles, markets expect devaluation, makes the endogenous variables as domestic interest increase, thus creating an incentive to devalue.

Note 22. There exist two equilibrium: the first one features no attack, no change in fundamentals and indefinite maintenance of the peg; the second one features a speculative attack followed by a change in fundamentals which validates, ex post, the exchange-rate change which speculators expect will take place. (Eichengreen, Rose and Wyplosz (1997: 13)) Two main lines can be seen in this kind of model. The first emphasises the reinforcing effects of the action of economic agents in determining the movement from one equilibrium position to another. The second line underlines the role of expectation by considering the strategic complementarities of the action of economic agents in determining the final outcome (Esquivel and Larrain (1998: 4-5).

Note 23. Sometimes the contagion and hedging effect should not be added to the second-generation models and by many economics authorities put them to the special category such as financial market in efficiencies. However, despite this, I decided to use in my theoretical presentation the same way as Kaminsky, Lizondo and Reinhard (1997) and Esquivel and Larrain (1998). After developed the third generation models that mostly depends on the microeconomics fundamentals it can suggest that contagion and hedging effects should be considered as the second generation models due to the fact that they present the some kind game between the investors and government as well.

Note 24. Masson (1998) "Contagion: Monsoonal effects, spillovers and Jumps between Multiple Equilibria", *IMF Working Paper*, pp. 5.

Note 25. In most crisis economies, governments have enjoyed surpluses and increasing foreign exchange reserves as well as low unemployment and booming exports. On the other hand there have been government failures, such as the fact that the financial sectors in these countries were not well-regulated. It also appeared that while growth had slowed, some signs of excess capacity had appeared in 1996 (Krugman (1998, 1999 a, b), Furman and Stiglitz (1998), Chang and Velasco (1998 c), Velasco (2001)).

Note 26. Krugman (1979), Dornbush (1987), Flood, Garber and Kramer (1996), Flood and Garber (1986).

Note 27. The twin banking-currency crisis model relies on Diamond and Dybvig's dilemma (1983), where we find two possible outcomes of the market agents: one in which agents have confidence in the solvency of financial intermediaries, and one in which lack of confidence leads to a run. Both equilibria involve self-fulfilling expectations because banks fail if, and only if, there is a run. Furthermore they concentrate on the asymmetrical information problems (adverse selection and moral hazard) in the financial market when with later are poorly supervised and monetary authorities act as lenders of the last resort. The asymmetrical information problem results in financial markets being unable to efficiently channel funds to those who have the most productive investment opportunities and therefore causing the banking system (Mishkin (1996: 17).

Note 28. The key issue is a mismatch of assets and liabilities: a country's financial system is internationally illiquid if its potential short term obligations in foreign currency exceed the amount of foreign currency it can have access to on short notice (Change Velasco (1998 c).

Note 29. Kaminsky and Reinhart (1999) "The twin crises: the cause of banking and balance-of-payments problems", *The American Economics Review*, 89, (3), pp.475.

Note 30. This conclusion is taken from Dornbush's overshooting model (Dornbush (1987)).

Note 31. This story of currency crises pointed out two well-known and significant facts. Firstly, a country goes into a crisis where firms hold a lot of foreign currency as denominated debt (the measure of aggregate foreign currency exposure is the ratio of claims to liabilities with respect to BIS banks). It is striking that all the countries which had a ratio higher than 1.5 experienced a serious crisis in the 1990s. The second fact is that there are substantial and persistent deviations from the purchasing power parity that require large changes in the relative price of tradeable and non-tradeable commodities. (Krugman (1999a), Aghion, Bacchetta and Banerjee (1999)).

Note 32. The expansionary monetary policy is assumed not to be inflationary since prices are stickling in short run. Velasco (2001 :12)

Note 33. Calvo et al. (2004) first built the sudden capital reversal measure  $\Delta C_t$  where  $\Delta C_t = C_t - C_{t-12}$  and then  $C_t$  is defined to be a 12-month moving sum of lagged values of capital flows proxy  $P_t$ . The capital flows proxy is computed by subtracting monthly changes in international reserves from the quarterly current account balance. The sudden stop episode is indicated when in the first month  $t$  that  $\Delta C_t$  falls one standard deviation below its mean. The episode ends if  $\Delta C_t$  again exceeds one standard deviation below its mean. The additional assumption is that within the episode, there must be at least one time  $t$  when  $\Delta C_t$  falls at least two standard deviations below its mean.

Note 34. In accordance with Rothenberg and Warnock (2006), nearly the half of the currency crisis episodes that were recognized as sudden stops by previous definition of Sudden Stop episodes. In the traditional model sudden flight is defined when local investors are given information to enable them to foresee a negative shock to the local market. These investors then shift money to global markets. In this case the net inflows will decline, but the decline is prompted not by global investors. True sudden stops might occur if global investors sell emerging market assets when they receive a negative signal that could well originate from the actions of other global investors. Both types of episodes are associated with a sharp decrease in net capital inflows, however, so Rothenberg, Warnock decided to use the gross flows.

Note 35. Hutchison and Noy (2004) "Sudden Stops and the Mexican Wave: Currency Crises, Capital Flow Reversals and Output Loss in Emerging Markets" Working Paper 0413, University of California, Santa Cruz, pp. 11.

Note 36. Mendoza (2001) Credit, prices, and crashes: Business cycles with a sudden stop. *NBER Working paper* No. 8338, 2001, pp.12.

Note 37. Mendoza (2001) Credit, prices, and crashes: Business cycles with a sudden stop. *NBER Working paper* No. 8338, 2001 pp. 13.

Note 38. In more detail, the link between economic growth and CAL might be regarded from two important perspectives: investments increase and savings increase. The effect of CAL might cause the direct implications or indirect implications of investment/saving conditions improvements. However, both effects work in the same direction to decrease the cost of capital and increase the efficiency of diversification of the investment portfolio. The direct effect is generally linked with price of capital such as interest rates, price of market stocks and cost of inter-company loans. (Henry (2003), Stulz (1999)). When a country liberalizes their regulation of capital control their interest rate should have flattened to the international interest rate; at the same time the additional inflows of foreign capital to the stock market should cause an increase in market stock prices. In the context of multinational corporations, the transfer of investment capital between different subsidiaries will be less expensive after CAL resulting in more capital stock being available for future investments (Desai, Foley and Hines (2003)).

Note 39. Beginning with the assumptions that large numbers of them are of questionable validity in, specifically, developing countries, Rashit (2001) has pointed that the benefits of open capital markets predicted in the neoclassical theory rests on three key assumptions: capital and labour resources are fully employed everywhere, capital flows themselves do not adversely affect macroeconomic stability and international capital movements are determined by long-term returns on investment in different countries. Few of these assumptions, however, are likely to hold in developing countries. And the other aspects are the distortions. For instance the restrictions on capital flows are certainly distortional but this may be optimal in the presence of the other distortions (Stiglitz and Charlton (2004)). Such distortions are pervasive in developing countries. Industrial policies are often implemented to protect and promote domestic industries; where the economic institutions are often weak and are limited in their ability to enforce competition law, property rights, and international macroeconomics instability often connected with informational asymmetries or in the context of economics shocks. In addition, the model of perfect functioning markets is even less relevant when one considers that liberalization often takes place in perspective of contemporaneous economic shocks (Stiglitz and Charlton (2004)).

Note 40. The animal spirits argued that capital flows have little to real economic activity; in this context CAL has no effect on investments, output or any other real variable and mainly consider the impact of information on the behaviours of investor.

Note 41. This strategy prescribed the buying of assets whose prices have been increased and selling assets whose prices have been falling, (Prasad, Rogoff, Wei and Kose (2003)).

Note 42. Boom-bust cycles following capital inflows imply an initial surge in investment and asset bubbles, followed by capital outflows and recession.

Note 43. This conclusion is based mainly on the Mundell-Fleming model. This model argued that there is inconsistency between the policy of simultaneous currency pegging and CAL for a small open economy. Any attempt by the central bank to raise the domestic interest rate above the world rate (plus a risk premium) will invite foreign capital inflows, while any attempt to lower the domestic rate below the world rate will lead to capital outflows. On the other hand, if there is a change in the world interest rate, the domestic rate has to change accordingly (Saxena and Wong (1999)).

Table 1. Empirical cross-country analysis about the efficiency of capital control

Empirical studies	Volume of capital flows	Composition of capital flows
Mathieson and Rojas-Suarez (1993) (developing countries)	●	~
Johnston and Ryan (1994) (OECD countries)	↑	↑
Montiel and Reinhart (1999) (15 developed and developing countries)	↑	↑
Lopez-Mejia (1999) (Chile, Colombia, Malaysia)	●	↑
Edison and Warnoc (2003) (developing countries)	~	
Campion and Neumann (2004) (Latin American countries)	●	↑↑

Note:↑↑↑- strong up-way impact (rise of interest rate, less volatility of exchange rate, decreases of capital flows, less “hot capital”)↑↑- medium positive impact↑- small positive impact ↓- negative impact (decrease of interest rate) ~ no impact , ●-the study did not analyse the effect of capital control on this variable

Source: Mathieson and Rojas-Suarez (1993), Johnston and Ryan (1994), Montiel and Reinhart (1999), Lopez-Mejia (1999), Edison and Warnoc (2003), Campion and Neumann (2004).

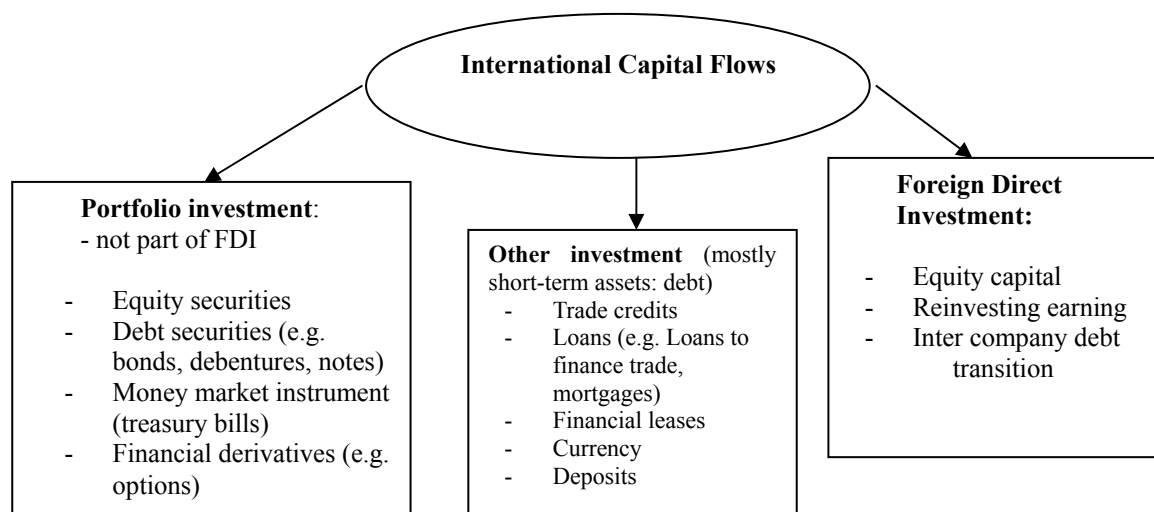


Figure 1. International capital flows classification according to the investment instrument used (OECD, IMF)

Sources: IMF. *Balance of Payments Manual*, Washington, DC, 1993.

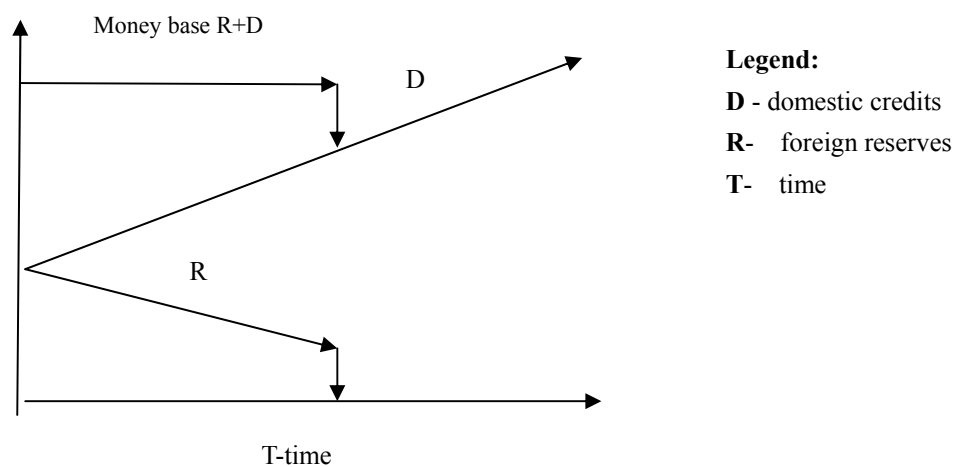


Figure 2. Domestic credit (D) and foreign reserves in first generation models

Source: Flood Robert, Garber Peter and Cramer (1996), Collapsing Exchange-Rate Regimes: Another liner examples, *Journal of International Economics*, 41, 227.

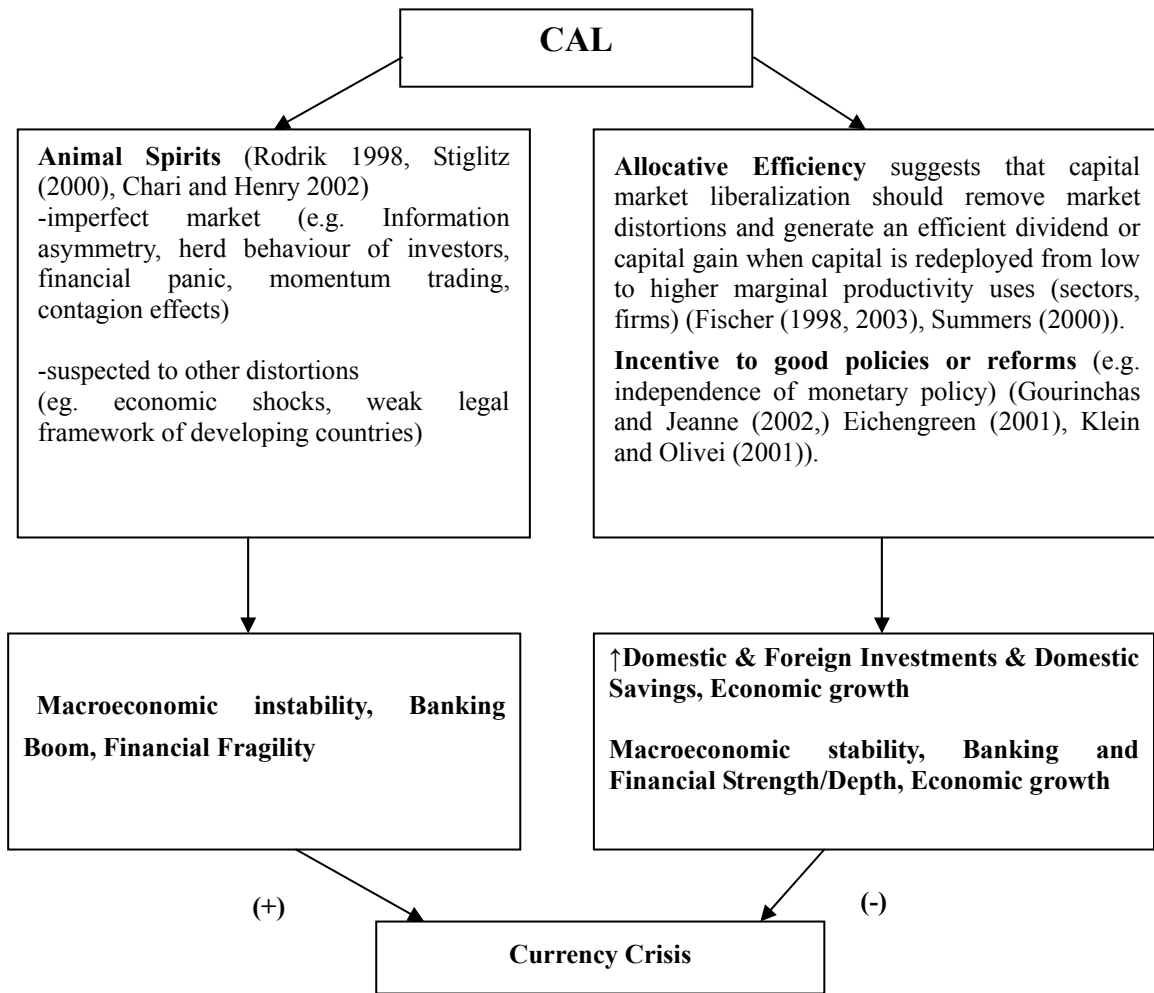


Figure 3. CAL and Currency Crisis from a theoretical perspective

Source: My own analysis based on Chari and Henry (2002), Stiglitz (2000), Rodrik (1998), Eichengreen (2001), Gourinchas and Jeanne (2002), Klein and Olivei (2001), Charlton and Stiglitz (2004), Singh (2002)).



# Analysis of the Risk of Enterprise Merger as Viewed from Merger Motivation

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## Abstract

Five merger waves with large scale in the world have fully promoted the growth and grandness of enterprises. However the failure ratios of enterprise merger are very high. In this article, based on the analysis of enterprise merger motivation, we further deeply analyze the risk of enterprise merger in order to enlighten China enterprises which blindly implement mergers.

**Keywords:** Merger motivation, Risk, Economy of scale, Economy of scope

Since the beginning of the 20th century, five merger waves with large scale in the world have fully promoted the growth and grandness of enterprises. Almost all present world large enterprises grow up through merger. At present, though some enterprises in China adopt merger to make them stronger and larger as soon as possible, but we thought many lessons of enterprise merger in China and foreign countries shouldn't be forgotten. Experiences of US show that at least above half merger activities are unsuccessful. Whereas, following the history of western enterprise merger, based on the analysis of enterprise merger motivation, we further deeply analyze the risk of enterprise merger in order to enlighten China enterprises which blindly implement mergers.

## 1. Motivation of enterprise merger

The history of western enterprise merger has experienced the developmental process from main horizontal merger to main vertical merger and to main mixed merger. Last two merger waves happened in 1980s and 1990s had presented the tendency of diversification, and three types had not been differentiated clearly. Though western scholars have abroad and deeply studied the problem of enterprise merger, but up to now, there has not formed a systematic theoretic frame. Here, following the history of western enterprise merger, we mainly analyze the main motivation of enterprise merger.

### 1.1 Effect of scale economy

The so-called scale economy means that under appointed technical conditions, the average cost of unit product will decrease with the increase of output scale. The effect of scale economy mainly roots in following aspects. First, with the increase of output scale, the fixed costs are apportioned on more outputs, i.e. the unit change costs are not changed, and the unit average cost will decrease with the increase of outputs. Second, with the increase of output scale, the labor division becomes more laborative, and when people repeatedly do one job, it will accumulate their experiences and enhance their labor skills, accordingly enhance the labor productivity. Third, the increase of enterprise scale can enhance the credit level of enterprise and the market status of enterprise, and enhance the ability of bargaining of enterprise with suppliers and consumers. Fourth, with the increase of enterprise scale, "reserve with large scale" can be saved. In the industrial production, because of demands of equipment fault and scheduled servicing, appropriate equipment reserve must be possessed to ensure continual production process and replace those equipments with faults or scheduled servicing. However, the reserve equipments needed are not changed with enterprise scale in certain scope. One large enterprise which needs several certain special equipments is same to one small enterprise which only uses one that special equipment, and they both only need one suit of reserve equipment to ensure continual production. In practice, some enterprises implement horizontal merger in order to obtain effect of scale economy to large extents.

### 1.2 Transaction cost

The so-called transaction cost means the cost that needed to be paid for organizing transaction through market mechanism, which includes payouts of money, time and energy. The general transaction cost can be divided into two sorts. One is the negotiating cost which including searching cost, information cost and bargaining contract paid for signing transaction agreement. And the other is the contract cost, which means the cost paid to prevent that one party breaks contract or agreement items. About the reason of transaction cost, Williamson had analyzed that from three aspects. One is human limited rational thinking, i.e. because people will be influenced by incomplete information and knowledge absence, so they can not objectively and exactly analyze and judge things, which make that both transaction parties can not sign a complete contract beforehand to end both actions. Second is human opportunism

action, i.e. the action that people may harm others' benefits to actualize their own avail maximum. The existence of incomplete contract will further prick up human opportunism action. Third is the capital specialty, i.e. the capital can be used for different aims and different users when it doesn't influence capital values. When one party of transaction or both parties have high mutual dependences in one transaction activity or are in each other's control, such transaction has high capital specialty. The high capital specialty makes the party who possesses special capital is difficult to quit transaction, because the special capital always possesses lower values when it is used in other aspect. Obviously, interior market transaction (i.e. vertical merger) can fully save transaction cost. In practice, some enterprises implement vertical merger just in order to save transaction cost to large extents.

### *1.3 Effect of scope economy*

The effect of scope economy means the situation that the cost induced by that the enterprise offers multifold products or services (including no vertical merger) at the same time is lower than the cost induced by that the enterprise produce every product or service. The production of scope economy effect roots in that one or several resources such as technology, product line, sales channel, brand, reputation, management and culture can be shared by multifold products or services at the same time. In practice, some enterprises implement relative mixed merger just in order to obtain scope economy effect to large extents.

### *1.4 Diversifying risks*

When the enterprise provides multifold non-relative products or services, differences of lifecycle, dependent resources, used technology, involved segment market, national policy changes and influences of international market fluctuation that products or services are in make risks are diversified in different products or services. In practice, some enterprises implement non-relative mixed merger just in order to diversify risks to large extents.

### *1.5 Enhancing enterprise core competition*

For last merger waves happened in 1980s and 1990s, their main motivations of merger are to enhance enterprise core competition. Since 1970s, the information technology has advanced rapidly, the environment faced by enterprise is more complex, and even those large enterprises occupying leading status in the market may be confronted with powerful competition from some nameless small enterprise or other national enterprises. Under this background, more enterprise mergers are to consider merger effect as viewed from enterprise development strategy, which aim is to obtain core competition for long-term development of enterprises.

### *1.6 Managers' motivations*

To pursue the maximum of individual avail, enterprise managers are inclined to rapidly enlarge enterprise scale through merger. Because of rapid increase of enterprise scale can not only enhance managers' incomes, but also enhance managers' social status, so large enterprise always possesses strong risk resistance ability and have larger guarantees of right and occupation. In practice, after merger some enterprises can obtain managers' supports just because of that.

## **2. The risk of enterprise merger as viewed from merger motivation of enterprise**

After we analyze the motivation of enterprise merger mainly following the history of enterprise merger, and as viewed from the motivation of enterprise merger, the risk of enterprise merger mainly roots in following several aspects.

### *2.1 Not all horizontal mergers can produce the effect of scale economy.*

(1) The effect of scale economy only exists in special industry. Characters in these industries include that the fixed cost proportion is high, and the increase of scale can make fixed costs apportion on more outputs. However, in some sporadic industry, special skills are predominant resources of enterprise, such as cooks' cooking skill in the restaurant industry, consultants' knowledge in the consultation industry and so on, and these industries almost have no effect of scale economy. That can explain why the first merger wave with large scale which takes horizontal merger as the main contents in western history is mainly centralized in auto manufacturing, steel, petroleum, chemical industry and other traditional industries. Further speaking, because of technical advance, the fixed cost has been reduced largely, but those traditional industries with high fixed costs make the horizontal merger effect based on the effect of scale economy abate largely. Long-term practices of Japan Toyota Company proved that the special technology and management mode adopted by the enterprise are important reasons to form expensive fixed costs, and new technology and management mode can fully reduce or avoid many fixed costs. Since 1980s, Toyota reduced daily management expenses in auto assembly process through decreasing products in making, mechanical assembly times and overhead expenses of batch production, and the application of CAD also largely reduced fixed costs and direct costs in the design process of new autos.

(2) The production of scale economy effect has certain range. When certain enterprise has achieved optimal scale, the horizontal merger can not reduce fixed costs apportioned by unit product.

(3) When the enterprise scale is larger, the labor costs are always higher. The data of US National Statistics Office showed that the company with over 500 employees paid more 35% of salaries than small company averagely, because workers in large company were easier to establish labor union and had stronger negotiating ability than small company.

(4) With the increase of scale, the labor division becomes more laborative. Though it is propitious to enhance labor productivity, but laborative division makes workers engage single and repetitive works for long-term, inevitably produce boring emotions, reduce production efficiency and enhance demission ratio.

(5) The horizontal merger is easy to be restricted by management. Because of the limitation of management extent, the management layers certainly will be increased, which not only increases overhead expenses, but also easily induce information distortion and reduce communication efficiency.

*2.2 When the vertical merger save transaction costs, it can not only increase communicating costs of interior organizations, but can reduce the flexibility of the enterprise.*

(1) The horizontal merger makes enterprise transform from original production of single product to the production of relative product, which makes enterprise not only lose efficiency predominance produced by specialty, but also increase communicating costs to retain balances of production ability in relative products. When the expense of one transaction organized by interior "authority" pattern is more than the expense organized by market mechanism, the horizontal merger not only can't reduce costs, but can increase costs. All outsourcing activities, net organization and so on abroad exist in world enterprises fully explain that.

(2) Facing complex market demand and drastic market competition, enterprise must continually properly adjust its products or services. However, horizontal merger largely enhance the exit bulwark of enterprise and certainly will reduce the flexibility of enterprise.

*2.3 When fixed merger produces the effect of scope economy and diversify risks, it also increases the complexity of management.*

(1) Relative mixed merger may induce negative cooperative effect. For example, once problems occur in certain product sharing same brand, it will produce chain-react and influence other relative products.

(2) Non-relative mixed merger makes enterprise enter a new domain, and the production management processes in different domains possess large differences, which makes management become complex. If the manager is not familiar with this new domain, he cannot diversify risks but can prick up risks.

(3) The enterprise culture integration after merger is very difficult. Many researches found that the differences of enterprise culture are the main reasons to induce failures of merger. The enterprise culture is a sort of important soft resource for the enterprise, and a sort of value view and action criterion formed in long-term production and management practice, and both parties of merger have inevitability to enterprise culture integration. However, because enterprise culture possesses speciality and stability, both parties always can not accept other's enterprise culture. When the enterprise cultures of both parties can not be integrated effectively, whether on individual layer or organizational layer, conflicts will occur and friction costs will increase.

#### *2.4 Experimental material*

Generally speaking, the core competition of enterprise is a suit of special skill and technology that the enterprise provides additive values to consumers, which has characters that cannot be simulated, cannot be replaced and cannot flow. The cooperative effect after merger can produce special skill and technology to enhance the core competition of the enterprise. But after merger, if both parties can not implement effective integration in aspects such as management, culture and so on, the motivation to enhance the core competition likely become a fine desire. Furthermore, with rapid increases of enterprise scale after merger, the enterprise market share enhances largely, and the enterprise may face risks coming from anti-monopolization of the government.

### **3. Experimental material and parameter enactment**

From above analysis, at least we can obtain following two revelations.

First, the merger is a very complex work. Good merger motivation can not always bring good merger effect.

Second, though the merger is the main approach for the growth of the enterprise, but the risk of the merger is very high. Whether adopting merger or not, especially when facing domestic or international merger waves, enterprise must be serious, and can not blindly adopt merger measures only for going with the times.

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# Study on the Selection Method of PPP Mode in the Domain of Public Infrastructure

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## Abstract

In this article, we list and compare specific investment and financing modes in the domain of public infrastructure, put forward main factors which influence the mode selection, establish the index system for the mode selection, and finally bring the method of fuzzy comprehensive evaluation into the specific mode selection under the concept of PPP (Public Private Partnerships) to strive for the quantification of the qualitative analysis.

**Keywords:** PPP, Mode selection, Fuzzy comprehensive evaluation

The infrastructure is the establishment or institution which can directly provide common conditions and public services for the production department and people living. The infrastructure has many characters such as antecedence, foundation, non-trade, impartibility and so on, and it possesses three functions including improving economic development, changing social and economic structure, and increasing employment and enhancing people living standard in the process of economic development and modernization. However, limited financing ability always perplexes public institutions which construct and manage infrastructures. Therefore, to improve the marketization of the investment and financing in the domain of public infrastructure is the important content to deepen the investment system reform of China. The introduction of PPP mode can not only help the government to solve problems existing in the domain of the public infrastructure, but also is propitious to the development of the private economy.

## 1. The investment and financing mode of PPP

Through many years' practice and theoretic developments, PPP produces many specific modes, and some modes also produce some aberrance forms. For the specific investment and financing mode, according to the degree that two cooperators participate in the project, the time of the cooperative term, and the ownership of the project, we can divide the mode into three types including the outsourcing type, the franchise type and the privatization type. Generally, the project of the outsourcing type is invested by the public departments, and the private departments contract one function or several functions (such as service contract and O&M) in the whole project, or take on the construction task (such as DB) of the infrastructure according to the agreement. In the project of the outsourcing type, the degree that the private department participates in the project is limited, so they take on few tasks, and the cooperative term is relative short. But in the project of the privatization type, the investment, construction and management of the project all are assumed by the private department (such as BOO), and the ownership of the project also belongs to the private department, and the public department only takes on corresponding supervisory responsibilities. The project of the franchise type is between the outsourcing type and the privatization type, and both cooperators take on project risks together and share project incomes, and the ownership of the project belongs to the public department.

The privatization master E.S. Sawas showed main types of PPP by means of the series form which is seen in Table 1. The most upper mode on this series is the perfect public mode, and the lowest mode is the perfect private mode. In this article, we will combine these two sorts of classification method.

From Table 1, we can see that the public degree from upper to lower is lower and lower and the private degree is higher and higher, and the upper arrowhead denotes the perfect public evaluation 1.0, and the lower arrowhead denotes the perfect private evaluation 0. From upper to lower, the evaluation is smaller and smaller, which shows the public degree decreases and the private degree increases, and the table lists 11 representative specific modes including familiar LBO, BTO, BOT and BBO.

## 2. The application of the fuzzy comprehensive evaluation method in the PPP investment and financing mode selection

### 2.1 Influencing factors of PPP investment and financing mode selection

The mode selection of PPP investment and financing is influenced by many factors, and the government of the

infrastructure and the private cooperator are the most primary factors. Specifically speaking, the goods attribute of the public infrastructure, the conscientiousness and concepts of the government and the private cooperator's object have decisive functions in the model selection of the specific investment and financing of the public infrastructure. Whether a certain public infrastructure project adopts which investment and financing mode should be decided by the comprehensive compare of these influencing factors.

### 2.1.1 Goods attribute of public infrastructure

Non-competition is that the increase of customer can not bring the increase of production cost. In another words, the non-competition of public goods means the social marginal cost induced by the increase of customer is zero, and for the consumption of public goods, every one can obtain same benefit without interference. Taking a broadcaster as an example, the broadcast possesses typical character of non-competition, and A's listening doesn't foreclose B's listening.

Non-exclusion means that once the public goods is provided to some people, so others cannot be stopped profiting, or at least expensive costs should be expended to stop others profit. Taking the national defense as an example, if the national defense is provided in a country, it is impossible to exclude the national defense protection of any people who lives in this country.

Pure public goods possess complete characters of non-competition and non-exclusion. But in actual economy, the specific attribute of the product is complex, and many goods are between the public goods and the private goods, which can be called as quasi-public goods. The quasi-public goods can be divided into the crowded public goods and the public goods with exclusive price. The crowded public goods mean that after more customers are absorbed, overabundance or crowded people will decrease public goods that present customers profit. When the crowded point is achieved, the marginal cost of one extra customer is not zero. For example, the crowded road which increases one user will decrease present users' profits, because it will make the traffic slow and increase the risk of traffic accident. The public goods consumption with exclusive price has the character of non-competition, but it can exclude others from the technology. For example, these products such as school, hospital and public establishment can be priced, but their supplies will induce the character of positive exterior.

To sum up, the social product takes the competition and exclusion as standards, which can be divided into two sorts including pure public goods, pure private goods, crowded public goods, and the public goods with exclusive price. Differences among four sorts are showed in Table 2.

Obviously, because degrees of competition and exclusion are different, so the investment and financing modes of public infrastructure with different characteristics should have differences. To general quasi-public goods, because their degrees of non-exclusion and non-competition are very high, so they will induce deficient supply in the free competitive market, and to these public projects, the supply of the government is the best choice. However, the service outsourcing with high public degree can be selected, and the service of this type of establishment can be contracted with professional company to fully utilize its advanced technology or management experience and enhance the service level of the public establishment. To the club goods which degree of non-competition is higher than its degree of non-exclusion (such as toll road), LBO or BTO with middle public degree are the effective selection for this type of public infrastructure. But to crowded goods (such as urban road, public sewerage system and so on), because of their strong non-exclusive character and obvious competition of consumption, they are more close to private goods, so the BBO mode with high private degree can be adopted.

### 2.1.2 Consciousnesses and concepts of the government

As a sort of theory or a sort of mature management idea, the urban management was first put forward in western countries with early and quick urbanization course. The urban management is to take city as the largest state-owned capital, exert the means of market economy to centralize, recombine and operate natural capitals (such as soil), human function capitals (such as road and bridge) and relative extended capitals (such as naming rights of bridge and road), implement the marketization way of urban construction which depends the city to maintain, construct and improve city, realize the new concept and new mode of urban construction that the city can improve, accumulate and increase itself under the condition that the government gradually decreases investments. Dalian, Qingdao, Zhuhai and Sanya are those typical cities. If the government can develop and innovate in advanced concept with urban management, it can enhance the utilization degree of private capital and decrease the system bulwark in the infrastructure industry in the aspects of public infrastructure construction and service supply, and make private departments can not only enter these domains, but gradually develop their activity range and participation degree, so the financing mode with high private degree can be realized. By contraries, if the government can not liberate its idea, still is tied in those traditional concepts, and dares not to use private capitals, so it can only adopt the financing mode with high public degree.

### 2.1.3 Private cooperator's object

Because various investment and financing modes of PPP have obvious differences in aspects of project term, risk distribution, income obtainment and so on, different anticipant objects of private departments will also influence their modes and degrees to participate in the project. For example, the cooperator which emphasizes short income and has advantages of technology and management may more favor modes of management contract, service agreement or "turn-key", and may worry BOT and BOO which have long project term and have not obvious short income. In addition, because the project of public infrastructure has high requirement for the capital, the scale of the private capital will influence its participation degree.

To sum up, under the mode of PPP, the investment and financing mode selection of PPP is decided by many factors. Therefore, we should comprehensively consider these influencing factors, compare various cooperative modes, and select more reasonable investment and financing mode to achieve both cooperators' anticipant objects.

### 2.2 The method of fuzzy comprehensive evaluation

Fuzzy phenomenon means that some things have no specific attribute standard, can not be classified definitely, and present fuzzy characters. The selection of PPP investment and financing mode also has fuzzy characters. In this article, we divide selection modes into five classes from big to small evaluation, but because the standard of every class is difficult to be assumed, so this sort of classification with human subjective consciousness has fuzzy character. Factors influencing risks also have fuzzy character, so they can not be evaluated by one mark. Considering above factors, we adopt the fuzzy evaluation method to comprehensively evaluate the PPP investment and financing mode selection of infrastructure project. The analysis process of the fuzzy comprehensive evaluation method is described as follows.

(1) Confirm the evaluation index set  $X$ .  $X = (x_1, x_2, \Lambda, x_n)$ .

(2) Utilize AHP method to confirm the index weight set  $A$ .  $A = (a_1, a_2, \Lambda, a_n)$ .

(3) Confirm the evaluation set  $Y$ .  $Y = (y_1, y_2, \Lambda, y_n)$ .

(4) Confirm the standard subjection degree  $U$ .  $U = (u_1, u_2, \Lambda, u_m)$ .

(5) Establish the fuzzy estimation matrix  $R$  to the estimation object. 
$$R = \begin{bmatrix} r_{11} & r_{12} & \Lambda & r_{1m} \\ r_{21} & r_{22} & \Lambda & r_{2m} \\ \Lambda & \Lambda & \Lambda & \Lambda \\ r_{n1} & r_{n2} & \Lambda & r_{nm} \end{bmatrix}.$$

Where,  $r_{ij}$  represents the percent that the number of the people who makes the  $j^{\text{th}}$  class evaluation occupies the total number of all surveyed people on the  $i^{\text{th}}$  index to the estimation object.

(6) Compute the fuzzy comprehensive subjection degree set  $B$ .

(7) Implement second fuzzy comprehensive evaluation according to the estimation result of the first factor.

(8) Compute the comprehensive subjection degree,  $P = B \cdot U^T$ .

The comprehensive subjection degree is the total estimation mark to the estimation object, and according to this mark, we can objectively evaluate many estimation objects.

### 2.3 Application case

Taking the construction of certain urban subway project, we actually apply this evaluation mode, invite relative experts to mark this project, comprehensively consider various factors according to the computation result of the model, and select appropriate investment and financing mode.

#### 2.3.1 The confirmation of index weight

Aiming at specific situation of this project, after relative experts analyze selection factors of this project, we divide index factors into three sorts including the object layer, the factor layer and the sub-factor layer according to the connotation of various index factors and mutual associated degree among indexes. The object layer is the PPP investment and financing mode selection. The factor layer includes factors from three aspects such as infrastructure, government and private cooperator. The sub-factor layer includes 8 indexes. The index system of the mode selection is shown in Figure 1.

Here, we need to confirm 3 factors and each weight of 8 indexes to evaluate the PPP mode selection. We adopt the AHP method to confirm the weight of the index. The process includes two steps. First, we ask for questionnaires from experts and consult some authorized persons' opinions for the PPP investment and financing mode selection,

and respectively establish the factor layer and the estimation matrix of various sub-factor index layers. Second, we exert the software of Excel to figure out eigenvalues and eigenvectors of various matrixes, and obtain weights of the factor layer and various sub-factor index layers which is shown as follows (the computation process of original data is omitted).

$$A = (a_1, a_2, a_3) = (0.42, 0.28, 0.3)$$

$$A_1 = (a_{11}, a_{12}, a_{13}, a_{14}) = (0.3, 0.2, 0.2, 0.3)$$

$$A_2 = (a_{21}, a_{22}) = (0.5, 0.5)$$

$$A_3 = (a_{31}, a_{32}) = (0.44, 0.56)$$

Where,  $A$  represents the index weight of the factor layer (the object layer), and  $A_i$  represents the index weight of the factor layer,  $i = 1, 2, 3$ .

### 2.3.2 Factor evaluation standard set

#### (1) The first class fuzzy comprehensive evaluation.

After we obtain weights of all influencing factors (which have been listed in this article) by means of the AHP method, we need to confirm estimation standards of various factors. According to influencing degrees of listed factors to the PPP investment and financing mode selection in the infrastructure domain, we divide the estimation standard into five classes including very high (0.9), high (0.7), general (0.5), low (0.3), and very low (0.1).

The evaluation class set  $Y = (\text{very high, high, general, low, very low})$ .

Confirm the standard subsection degree of the evaluation set  $U = (0.9, 0.7, 0.5, 0.3, 0.1)$ .

Invite the expert evaluation group to evaluate various sub-factors in the factor layer, and obtain the comprehensive evaluation class weight set of various sub-factors (the computation process of original data is omitted).

From  $R_{11} = (r_{111}, r_{112}, r_{113}, r_{114}, r_{115})$ , we can obtain  $R_{11} = (0, 0, 0, 0, 1)$ .

Where,  $R_{11}$  represents the evaluation class weight of the first index under the first factor,  $r_{111}$  represents the percent that the number of the people who makes the first class evaluation (i.e. very high) occupies the total number of all surveyed people on the first index under the first factor to the estimation object. Obviously, all experts think that the private goods attribute of infrastructure should have small evaluation ( $r_{115} = 1$ ). And only as viewed from this index, we should select the PPP investment and financing mode with low evaluation and very high private degree, such as BOT, BBO and so on.

In the same way,  $R_{12} = (1, 0, 0, 0, 0)$ ,  $R_{13} = (0, 0.1, 0.56, 0.34, 0)$ , and  $R_{14} = (0, 0, 0.29, 0.71, 0)$ .

Integrating evaluation classes and weights of various indexes under the first factor, we can obtain the fuzzy

evaluation matrix  $R_1 = \begin{bmatrix} R_{11} \\ R_{12} \\ R_{13} \\ R_{14} \end{bmatrix}$ , and in turn compute and we can obtain the fuzzy evaluation matrix under the second

factor,  $R_2 = \begin{bmatrix} R_{21} \\ R_{22} \end{bmatrix}$ .

Where,  $R_{21} = (0, 0.23, 0.66, 0.11, 0)$  and  $R_{22} = (0, 0, 0.37, 0.63, 0)$ .

The fuzzy evaluation matrix under the third factor is  $R_3 = \begin{bmatrix} R_{31} \\ R_{32} \end{bmatrix}$ .

Where,  $R_{31} = (0, 0.26, 0.55, 0.19, 0)$  and  $R_{32} = (0, 0, 0.64, 0.33, 0)$ .

#### (2) The second class fuzzy comprehensive evaluation.

The second class fuzzy comprehensive evaluation is to evaluate all factors of the factor subset, i.e. it is obtained by the computation through the formula  $B_i = A_i \cdot R_i$  ( $i=1,2,3$ ).

So the second class fuzzy comprehensive evaluation set is  $B_1 = A_1 \cdot R_1 = (0.3, 0.2, 0.2,$



$$0.3) \cdot 0.3) \cdot \begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0.1 & 0.56 & 0.34 & 0 \\ 0 & 0 & 0.29 & 0.71 & 0 \end{bmatrix} = (0.2, 0.02, 0.199, 0.281, 0.3).$$

In the same way,  $B_2 = A_2 \cdot R_2 = (0, 0.115, 0.515, 0.37, 0)$  and  $B_3 = A_3 \cdot R_3 = (0, 0.1144, 0.6004, 0.2852, 0)$ .

(3) The third class fuzzy comprehensive evaluation.

The third class fuzzy comprehensive evaluation is to implement comprehensive evaluation among various sorts, and

the third class fuzzy comprehensive evaluation set is  $B = A \cdot \begin{bmatrix} B_1 \\ B_2 \\ B_3 \end{bmatrix} = (0.42, 0.28,$

$$0.3) \cdot \begin{bmatrix} 0.2 & 0.02 & 0.199 & 0.281 & 0.3 \\ 0 & 0.115 & 0.515 & 0.37 & 0 \\ 0 & 0.1144 & 0.6004 & 0.2852 & 0 \end{bmatrix} = (0.084, 0.07492, 0.4079, 0.30718, 0.126).$$

So the comprehensive subjection degree of this project is  $P = B \cdot U^T = 0.436748$ .

This subway project finances by means of PPP, and the result of the quantitative analysis using the fuzzy comprehensive evaluation method shows that it can adopt the mode with high private degree such as LBO, BTO, and even BOT. The final mode selection should certainly comprehensively consider other factors, but this method can quantify qualitative selection and offer scientific references to select investment and financing mode for the government and the private cooperator. And this article still has some advantages in the establishment of the index system which needs to be further improved.

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Table 1. PPP series

government department	↑	1.0	Perfect public
state-owned enterprise		0.9	
service outsourcing		0.8	
operation maintenance outsourcing		0.7	
cooperation organization		0.6	
Tenancy construction management		0.5	
construction cession management		0.4	
construction management cession		0.3	
periphery construction		0.2	
purchase construction management		0.1	
Construction possession management	↓	0	Perfect private

Table 2. Characteristics of four sorts of goods and their supply modes

Goods type	Basic characteristic	Supply mode	example
Pure private goods	Consumption alone Without exterior character Exclusivity of low cost	Supply by the market Charge from consumers	Foods Costume Auto
Public goods with exclusive price (club goods)	Consumption alone With exterior income when it is produced or consumed Exclusivity of low cost	Supply by the government or the market financed by the government	Toll road Hospital Post and telecom
Crowded public goods	The income of collective consumption is decided by the crowded degree Possible exclusivity	Supply by the government or the market financed by the government	Highway and bridge Comfort station
Pure public goods	The income of collective consumption is not decided by the crowded degree Exclusivity of high cost	Supply by the government Government investment	National defense Common Highway Lighthouse

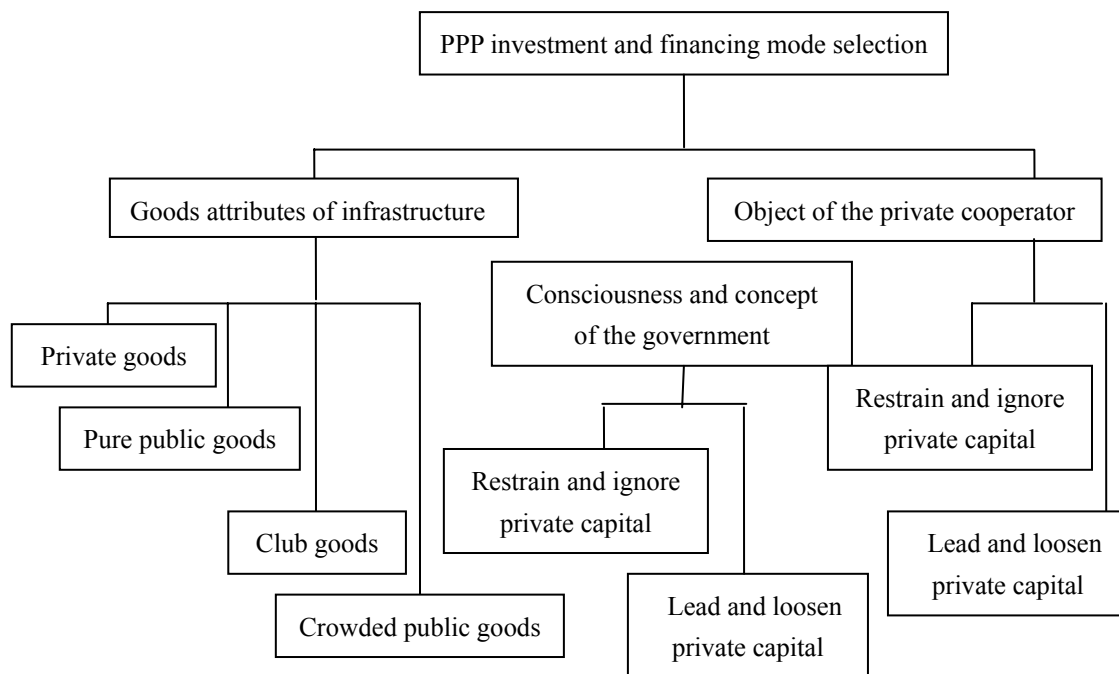


Figure 1. The Index System of PPP Mode Selection

# Fiscal Policy, Institutions and Economic Growth in Asian Economies: Evidence from the Pedroni's Cointegration Approach

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## Abstract

This paper investigates the relationship between fiscal policy, institutions and economic growth in Asian between 1982 and 2001 through the application of Pedroni's Cointegration approach. It examines three different channels through which fiscal policy can affect long run economic growth in Asia. The first channel is when components of fiscal policy affects the real per capita GDP and the second channel is when the institutions included in components of fiscal policy affects the real per capita GDP. The third channel is when institutions interact with aggregate of government expenditure and aggregate of fiscal policy affects the real per capita GDP. The Pedroni Cointegration result establishes a long run relationship between fiscal policy, institutions and economic growth. We find positive and statistically significant impact of health and education expenditure, aggregate of government expenditure, aggregate of fiscal policy and institutions on real per capita GDP. We also find that the defence expenditure, distortionary taxation and budget balance are significantly and negatively related to real per capita GDP. Furthermore, we find that aggregate of government expenditure and aggregate of fiscal policy variables interact with institutions variable and have a potential impact on long-run steady-state levels of growth.

**Keywords:** Economic growth, Fiscal policy, Institutions, Panel cointegration, FMOLS

## 1. Introduction

In the debate on economic policy, fiscal policy is predominantly viewed as an instrument to mitigate short-run fluctuations of output and employment. By a variation in government spending or taxation, fiscal policy aims at altering aggregate demand in order to move the economy closer to potential output. Fiscal policy was neither a cause of the crisis nor a critical determinant of economic growth. Nevertheless, its role in both the pre-crisis and post-crisis period in Asian countries has been seen as crucial, primarily in terms of its contribution to economic growth.

There are large differences among the Asian countries in their levels of living and other circumstances, as well as the policies that they have pursued. Larger government size is likely to be an obstacle to efficiency and economic growth because the taxes necessary to support government expenditures distort incentives to work and to invest, absorb funds that otherwise would have been used by the private sector in profitable investment opportunities, generally reduce efficient resource allocation, and hence reduce the level of output. In addition, government operations are often carried out inefficiently, and the regulatory process imposes excessive burdens and costs on the economic system. Thus, countries with greater government expenditure as a proportion of output should experience lower economic growth. These arguments, together with the debt crises experienced have led many countries to start a mass deregulation of market and privatization of public enterprises. Based on the above argument, and as we mentioned earlier, Keynesian economics predicts government expenditure should lead to economic growth.

When looking at the growth performance in the Asian countries in recent decades, two observations are noteworthy. First, growth has declined and become stagnant significantly since 1985. Secondly, government expenditure does not inhibit the full exploitation of the growth potential of Asian economies. There is a broad consensus that these developments in fiscal policies contribute to the relatively weak growth performance in the Asian countries.

Fiscal positions vary significantly across countries and sub regions. Significant fiscal deficit and accumulation of public debt are relatively new phenomena for most Asian economies. However, expenditure growth outpaced revenue growth in many Asian economies, leading to persistent budget deficits and high indebtedness. Weak fiscal positions have left little room for further fiscal expansion in most Asian economies when faced by economic slowdown. Moreover, measuring fiscal policy has always posed a difficult challenge.

The Asian economies provide a sample large enough to allow for some generalization but small enough for analysis in sufficient detail to account for the complexity of law and legal institutions within economies. The rules of institutions histories of the Asian economies have common characteristic and important differences, and they are received entire legal systems from the West. Asian countries differed from each other in terms of initial conditions, the institutional context, and government policies. These differences have led many to argue that there is no single Asian recipe for success. It is plausible that many of these differences account for the variation in economic performance in the region as well. Of course, it is well recognized that institutions have played a key role in most Asia's success. But do institutional differences also explain why some countries in Asian countries have done better than others?

The objective of this study is to examine the long run relationship between the components of fiscal policy, institutions and economic growth in Asian countries. Thus, this study aims at filling a gap in research devoted solely to investigating the relationship between fiscal policy and economic growth using of newly developed methods of panel cointegration by Pedroni (2004 and 2001) and panel FMOLS estimator (Pedroni, 1996 and 2000).

This paper is organized as follows. Section 2 contains a brief literature review. In section 3, the model is applied to the thirteen Asian economies. Section 4 presents empirical results and the last section concludes.

## 2. Review of Related Literature

The most recent empirical literature, mainly based on panel data regressions, shows that economic growth is significantly affected by fiscal policies, although there remains some lack of agreement on the sign of the effects. On the other hand, Caselli *et al.* (1996) found robust positive contribution of the government expenditure ratio (net of defence and educational expenditure) to growth. In a similar way, Kneller *et al.* (1999) found that public expenditure and taxation only affected growth if they were productive and distortionary, respectively; productive government expenditure was found to positively affect growth, whereas distortionary taxation was found to be harmful for growth. With this distinction they argued that both sides of the government budget should be considered in estimating the impact of fiscal policy on growth, as their financing offset the growth-enhancing effects of productive expenditure. Gerson (1998) and Tanzi and Zee (1997) surveyed the theoretical and empirical literature on the effect of fiscal policy variables (tax policy, public expenditure policy, budget policy) on economic growth. They concluded that fiscal policy variables influenced economic growth through their impact on the determinants of growth.

There are researchers of international econometric studies in recent years which have found a powerful negative effect of taxation on long-term GDP growth; Cashin (1995) studied 23 OECD countries over the 1971-1988 period. He found that 1% point of GDP increase in tax to GDP ratio lowers output per worker by 2%. Engen and Skinner (1993) found that 2.5% point increase in tax to GDP ratio reduces GDP growth by 0.2% to 0.3%. Bleaney *et al.* (2001) found that 1% of GDP increase in distortionary tax revenue reduces GDP growth by 0.4% points.

Devarajan *et al.* (1996) investigated the relationship between the compositions of public expenditure and economic growth. Their empirical results suggested that expenditures that were normally considered productive could become unproductive if there was an excessive amount of them. Landau (1997), Barro and Sala-i-Martin (1995), Hansson and Henrekson (1994), Chen and Gupta (2006), and Gbesemete and Gerdtham (1992) studied the impact of government expenditure for human capital – education and health – on economic growth. They found that government expenditure in education, health, and other services have an effect on economic growth.

Rodrik (1997) found that an index of institutional quality [drawn from work by Knack and Keefer (1995) and Easterly and Levine (1997)] did exceptionally well in rank-ordering East Asian countries according to their growth performance. Vijayaraghavan and Ward (2001) examined the relationship between institutional infrastructure and economic growth rates across 43 nations between the years 1975-90. Security of property rights, governance, political freedom and size of government were the indicators used in the study, facilitating identification of the most important institutions that account for the observed variations in economic growth rates among nations. Results indicated that security of property rights and sizes of government were the most significant institutions that explained the variations in economic growth rates.

There are many non-economic factors interact with the economic growth process. For example, institutional economics in the tradition of North and Thomas (1973) and North (1990) examine the link between economic

development and institutions while there is a tradition in political science since Lipset (1959) that explains political institutions and democracy in terms of economic development. Foellmer (1974) is the first contributor in which the problem of stochastic interaction was explicitly treated. He showed that if the characteristics of agents, for example their preferences are random but dependent on those of others, the effect of large numbers of agents is not enough to eliminate uncertainty at the aggregate level. Many have argued that it is enough to look at the behaviour of the average agent since the law of large numbers will wash out the effects of the random interactions between agents. Minier (1998) focuses on both direct effects of democracy on growth and indirect influences of democracy on growth through education and the rule of law.

### 3. Empirical Model

As follows Hoeffler (2002), in the Solow model growth in output per worker depends on initial output per worker [ $y(0)$ ], the initial level of technology [ $A(0)$ ], the rate of technological progress ( $g$ ), the savings rate ( $s$ ), the growth rate of the labour force ( $n$ ), the depreciation rate ( $\delta$ ), and the share of capital in output ( $\alpha$ ). Thus, the model predicts that a high saving rate will affect growth in output per worker positively, whereas high labour force growth (corrected by the rate of technological progress and the rate of depreciation) will have a negative effect on growth in output per worker. The basic Solow model is

$$\ln y(t) - \ln y(0) = \ln y(0) + \ln A(0) + gt + \frac{\alpha}{1-\alpha} \ln(s) - \frac{\alpha}{1-\alpha} \ln(n+g+\delta) \quad (1)$$

where  $y(t)$  denotes the logarithm of output per worker in period  $t$ .

In the augmented version of the Solow model investment in human capital is an additional determinant of growth in output per worker

$$\begin{aligned} \ln y(t) - \ln y(0) = \ln y(0) + \ln A(0) + gt + \frac{\alpha}{1-\alpha-\beta} \ln(s_k) + \frac{\beta}{1-\alpha-\beta} \ln(s_h) \\ - \frac{\alpha}{1-\alpha} \ln(n+g+\delta) \end{aligned} \quad (2)$$

where  $s_k$  and  $s_h$  denote the proportion of output invested in physical and human capital, respectively.

Equations (1) and (2) have for example been used as the framework for empirical analysis by Mankiw *et al.* (1992), Islam (1995) and Caselli (1996). In this section, a simple model is set out that provides an organizing framework for thinking about the ways in which the elements and components and aggregate of government expenditure and components and aggregate of fiscal policy affect growth. Therefore, we adopt the framework introduced by Mankiw *et al.* (1992), Demetriades and Law (2006), Ghura and Hadjimichael (1996), Hoeffler (2002), and Knight *et al.* (1993). This study provides a growth model from the conventional growth accounting framework and the production function below takes the standard neoclassical form with a minor modification which includes human capital in the Cobb-Douglas production function:

$$Y(t) = K(t)^\alpha H(t)^\beta [A(t)L(t)]^{1-\alpha-\beta}, 0 < \alpha < 1. \quad (3)$$

where  $Y$  is real output at time  $t$ ,  $K$  and  $L$  are the stocks of physical capital and labour, respectively, at time  $t$ ,  $H$  is the stock of human capital,  $A$  is a similar measure for physical capital, and  $\alpha$  and  $\beta$  the share of capital and human capital on output.  $A$  is a labour-augmenting factor reflecting the level of technological development and efficiency in the economy and the subscript  $t$  indicates time. This equation states merely that at any moment, the total output of the economy depends on the quantity and quality of physical capital employed, the quantity of labour employed, and the average level of skills of the labour force. Output can only increase if  $K$ ,  $L$ ,  $A$ , or  $H$  also increases, and perpetual increases in output per worker can only occur if the stock of capital per worker or the average quality of labour or of capital also increases perpetually.

The steady-state output per worker or labour productivity ( $y^*$ ) grows according to the following equation:

$$\ln\left(\frac{Y}{L}\right)^* = A_0 + \theta \ln P + \frac{\alpha}{1-\alpha-\beta} \ln s_k + \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+\delta) \quad (4)$$

The above equation introduces a set of variables ( $P$ ) which is assumed as exogenous that could affect economic growth in the long run. With the introduction of endogenous growth theory,  $P$  is no longer assumed as exogenous. The endogenous treatment of  $P$  allows us to suggest a possible set of explanatory variables. This model differs from neoclassical production functions in two important categories of variables namely technology related variables and policy related variables. The key assumption about productivity growth here is that a typical developing country

purchases technology knowledge abroad from various suppliers. What technology will be purchased depends on the price of foreign technology as well as trade and exchanged rate policies that impact the final cost of the imported technology (Ramirez and Nazmi, 2003). In our model, we concentrate on policy related variables and we introduce government expenditure and fiscal policy is included as a proxy for policy related variables.

Therefore, we proposed the **Basic Model**:

$$\ln Y_{it} = \beta_0 + \beta_1 GOVPOL_{it} + \beta_2 \ln S_{kit} - \beta_3 \ln(n + g + \delta)_{it} \quad (5)$$

where  $Y_{it}$  is real GDP per capita,  $GOVPOL_{it}$  is a control variables of government expenditure and fiscal policy variables,  $S_{kit}$  is the savings in physical capital,  $(n + g + \delta)$ :  $n$  is the rate of labour growth,  $g$  is the rate of technology growth or technological progress and  $\delta$  is the rate of depreciation. The addition of  $g$  and  $\delta$  is assumed to be constant across countries and over time, following Islam (1995), Mankiw *et al.* (1992) and Caselli *et al.* (1996), technological progress and the depreciation rate were assumed to be constant across countries and that they sum up to 0.05. The natural logarithm of the sum of population growth and 0.05 was calculated for  $\ln(n + g + \delta)$ .  $\beta_0$  is a constant term and  $\beta_1, \beta_2$  and  $\beta_3$  are estimated parameters in the model.

As with studies of the impact of health, education and defence expenditure on economic growth, some dispersion of results is a natural outcome of differences in data sets and specifications. Given the above discussion and Equation (5), the proposed empirical **Model 1** is as follows for the effect of components of government expenditure on economic growth:

$$\ln Y_{it} = \beta_0 + \beta_1 \ln he_{it} + \beta_2 \ln ee_{it} + \beta_3 \ln de_{it} + \beta_4 \ln FP_{it} + \beta_5 \ln S_{kit} - \beta_6 \ln(n + g + \delta)_{it} + \varepsilon_{it} \quad (6)$$

where  $Y_{it}$  is real GDP per capita,  $he_{it}$  is a government expenditure on health to GDP,  $ee_{it}$  represents government expenditure on education to GDP,  $de_{it}$  is a government expenditure on defence to GDP,  $FP_{it}$  is an aggregate of independent fiscal policy variables as a share of GDP (obtained by summing up public sector wages and salaries, expenditure on other goods and services, transfers and subsidies, interest payment on government debt, capital expenditure (minus government expenditure on health, education and defence), tax revenues, non-tax revenue, and grant),  $S_{kit}$ , and  $(n + g + \delta)$  are as defined earlier in Equation (5),  $i$  is a cross-section data for countries referred to, and  $t$  is a time series data,  $\varepsilon_{it}$  is an error term. The constant is denoted  $\beta_0$  while  $\beta_1 - \beta_6$  are the coefficients showing how much a unit increases in each individual variable will affect the growth rate in economic growth.

From Equation (5) also, we proposed empirical **Model 2** for the effect of fiscal policy on economic growth as follows:

$$\ln Y_{it} = \beta_0 + \beta_1 \ln dt_{it} + \beta_2 \ln bb_{it} + \beta_3 \ln GE_{it} + \beta_4 \ln S_{kit} - \beta_5 \ln(n + g + \delta)_{it} + \varepsilon_{it} \quad (7)$$

where  $dt_{it}$  is a distortionary taxation as a share of GDP (obtained by taxes on income and profit + social contribution + taxes on payroll and + taxes on property),  $bb_{it}$  represents budget balance as a share of GDP [obtained by (tax revenue + nontax revenue + grants) – (current expenditure + capital expenditure (minus government expenditure on health, education and defence))],  $GE_{it}$  is an aggregate of independent government expenditure variables as a share of GDP (obtained by summing up the government expenditure on health, education, and defence),  $Y_{it}$ ,  $S_{kit}$ ,  $(n + g + \delta)_{it}$ ,  $i$ ,  $\beta_0 - \beta_5$  are as defined earlier in Equation (5).

Rearranging Equation (6) and Equation (7), it yields an estimation equation for the relationship between components of government expenditure, component of fiscal policy, aggregate of independent government expenditure variables, aggregate of independent fiscal policy variables, institutions and economic growth as follows:

### Model 3

$$\ln Y_{it} = \beta_0 + \beta_1 \ln he_{it} + \beta_2 \ln ee_{it} + \beta_3 \ln de_{it} + \beta_4 \ln FP_{it} + \beta_5 \ln INS_{it} + \beta_6 S_{kit} - \beta_7 \ln(n + g + \delta)_{it} + \varepsilon_{it} \quad (8)$$

### Model 4

$$\ln Y_{it} = \beta_0 + \beta_1 \ln dt_{it} + \beta_2 \ln bb_{it} + \beta_3 \ln GE_{it} + \beta_4 \ln INS_{it} + \beta_5 \ln S_{kit} - \beta_6 \ln(n + g + \delta)_{it} + \varepsilon_{it} \quad (9)$$

Model 3 and Model 4, where  $INS_{it}$  is an institutions indicator which is obtained by summing up the five indicators (corruption, bureaucratic quality, rule of law, government repudiation of contracts, and risk of expropriation).

In order to examine the interaction effects between aggregate of independent government expenditure variables and institutions and aggregate of independent fiscal policy variables and institutions on economic growth, Equation (8) and Equation (9) is extended to exclude the components of government expenditure and components of fiscal policy and include an interaction term as follows:

#### Model 5

$$\ln Y_{it} = \beta_0 + \beta_1 \ln GE_{it} + \beta_2 \ln FP_{it} + \beta_3 \ln INS_{it} + \beta_4 \ln(GE_{it} * INS_{it}) + \beta_5 \ln S_{kit} - \beta_6 \ln(n + g + \delta)_{it} + \varepsilon_{it} \quad (10)$$

#### Model 6

$$\ln Y_{it} = \beta_0 + \beta_1 \ln GE_{it} + \beta_2 \ln FP_{it} + \beta_3 \ln INS_{it} + \beta_4 \ln(FP_{it} * INS_{it}) + \beta_5 \ln S_{kit} - \beta_6 \ln(n + g + \delta)_{it} + \varepsilon_{it} \quad (11)$$

Model 5 and Model 6, where  $(GE_{it} * INS_{it})$  and  $(FP_{it} * INS_{it})$  are interactions between the aggregate of independent government expenditure variables and institutions and the aggregate of independent fiscal policy variables and institutions.

#### 3.1 Panel Unit Root Tests

We start with LLC which found that the main hypothesis of panel unit root is as follows:

$$\Delta y_{it} = \Phi_i y_{i,t-1} + \sum_{L=1}^{p_i} \rho_{i,L} \Delta y_{i,t-L} + \varepsilon_{i,t} \quad m = 1, 2, \dots \quad (12)$$

where  $y_{it}$  refers to variable  $\ln rgdpc_{it}, \ln he_{it}, \ln ee_{it}, \ln de_{it}, \ln ge_{it}, \ln fp_{it}, \ln INS_{it}, \ln s_{kit}, \ln(n + g + \delta)_{it}, \ln(GE * INS)_{it}, \ln(FP * INS)_{it}$  and  $\Delta$  refers to the first difference. The hypothesis test is  $H_0 : \Phi_i = 0$  for existence of unit root whereas  $H_a : \Phi_i < 0$  for all  $i$  for non-existence of unit root. As  $p_i$  is unknown, Levin, Lin and Chu (LLC) suggest a three-step procedure in the test. In the first step, obtain the ADF regression which has been separated for each individual in the panel and generate two orthogonalized residuals. The second step requires an estimation of the ratio of long run to short run innovation standard deviation for each individual. The last step requires us to compute the pooled  $t$ -statistics.

Im, Pesaran and Shin (1997) denoted IPS proposed a test for the presence of unit roots in panels that combines information from the time series dimension with that from the cross section dimension, such that fewer time observations are required for the test to have power. Since the IPS test has been found to have superior test power by researchers in economics to analyze long-run relationships in panel data, we will also employ this procedure in this study. IPS begins by specifying a separate ADF regression for each cross-section with individual effects and no time trend:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \quad (13)$$

where  $i = 1, \dots, N$  and  $t = 1, \dots, T$

IPS uses separate unit root tests for the  $N$  cross-section units. Their test is based on the Augmented Dickey-fuller (ADF) statistics averaged across groups.

Finally, Maddala and Wu (1999) denoted as MW developed a test based in the probability values of all root unit individual tests. An alternative approach to panel unit root tests uses Fisher's (1932) results to derive tests that combine the  $p$ -values from individual unit root tests. The statistic is given by

$$-2 \sum_{i=1}^N \log(\pi_i) \rightarrow \chi^2_{2N} \quad (14)$$

where  $\pi_i$  is the  $p$ -value of the test statistic in unit  $i$ , and is distributed as a  $\chi^2(2N)$  under the usual assumption of cross-sectional independence. When the Fisher test is based on ADF test statistics, we must specify the number of



lags used in each cross-section ADF regression. Maddala and Wu (1999), showed that it is more powerful than the  $t$ -bar in IPS test.

### 3.2 Panel Cointegration Tests

The next step is to test for the existence of a long-run relationship among real per capita GDP growth rates and the independent variables using panel cointegration tests suggested by Pedroni (1999, 2004). We will make use of seven panel cointegrations by Pedroni (1999, 2004), since he determines the appropriateness of the tests to be applied to estimated residuals from a cointegration regression after normalizing the panel statistics with correction terms.

Pedroni (1999, 2004) proposes the heterogeneous panel and heterogeneous group mean panel test statistics to test for panel cointegration as follows:

#### 3.2.1 Panel $v$ -statistic:

$$T^2 N^{3/2} Z_{\hat{v},N,T} = T^2 N^{3/2} \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \quad (15)$$

#### 3.2.2 Panel $\rho$ -Statistic:

$$T \sqrt{N} Z_{\hat{\rho},N,T-1} = T \sqrt{N} \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (16)$$

#### 3.2.3 Panel $t$ -Statistic (non-parametric):

$$Z_{tN,T} = \left( \hat{\sigma}_{N,T}^2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (17)$$

#### 3.2.4 Panel $t$ -Statistic (parametric):

$$Z_{tN,T}^* = \left( \hat{s}_{N,T}^2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^* \Delta \hat{e}_{i,t}^* \quad (18)$$

#### 3.2.5 Group $\rho$ -Statistic:

$$TN^{-1/2} \tilde{Z}_{\hat{\rho},N,T-1} = TN^{-1/2} \sum_{i=1}^N \left( \sum_{t=1}^T \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{t=1}^T (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (19)$$

#### 3.2.6 Group $t$ -Statistic (non-parametric):

$$N^{-1/2} \tilde{Z}_{tN,T-1} = N^{-1/2} \sum_{i=1}^N \left( \sum_{t=1}^T \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{t=1}^T (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (20)$$

#### 3.2.7 Group $t$ -Statistic (parametric):

$$N^{-1/2} \tilde{Z}_{tN,T}^* = N^{-1/2} \sum_{i=1}^N \left( \sum_{t=1}^T \hat{s}_{i,t}^{*2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \sum_{t=1}^T \hat{e}_{i,t-1}^* \Delta \hat{e}_{i,t}^* \quad (21)$$

where

$$\hat{\lambda}_i = \frac{1}{T} \sum_{s=1}^{k_i} \left( 1 - \frac{s}{k_i + 1} \right) \sum_{t=s+1}^T \hat{\mu}_{i,t} \hat{\mu}_{i,t-s}, \quad \hat{s}_i^2 = \frac{1}{T} \sum_{t=1}^T \hat{\mu}_{i,t}^2, \quad \hat{\sigma}_i^2 = \hat{s}_i^2 + 2\hat{\lambda}_i,$$

$$\hat{\sigma}_{NT}^2 = \frac{1}{T} \sum_{t=1}^T \hat{L}_{11i}^2 \hat{\sigma}_i^2, \quad \hat{s}_i^{*2} = \frac{1}{T} \sum_{t=1}^T \hat{\mu}_{i,t}^{*2}, \quad (\hat{s}_{N,T}^{*2} = \frac{1}{N} \sum_{i=1}^N \hat{s}_i^{*2})$$

$$\text{and } \hat{L}_{11i}^2 = \frac{1}{T} \sum_{t=1}^{k_i} \hat{\eta}_{i,t}^2 + \frac{2}{T} \sum_{T=1}^T \left( 1 - \frac{s}{k_i + 1} \right) \sum_{t=s+1}^T \hat{\eta}_{i,t} \hat{\eta}_{i,t-s}$$

where the residuals  $\hat{\mu}_{i,t}$ ,  $\hat{\mu}_{i,t}^*$ , and  $\hat{\eta}_{i,t}$  are obtained from the following regressions:

$$\hat{e}_{i,t} = \hat{\gamma}_i \hat{e}_{i,t-1} + \hat{\mu}_{i,t}, \quad \hat{e}_{i,t} = \hat{\gamma}_i \hat{e}_{i,t-1} + \sum_{k=1}^{K_i} \hat{\gamma}_{i,k} \Delta \hat{e}_{i,t-k} + \hat{\mu}_{i,t}^*, \quad \text{and } \Delta y_{i,t} = \sum_{m=1}^M \hat{b}_{mi} \Delta x_{mi,t} + \hat{\eta}_{i,t}$$

### 3.3 Fully Modified Ordinary Least Squares (FMOLS) Estimation

In this section we adopt FMOLS procedure from Christopoulos and Tsionas (2003). In order to obtain asymptotically efficient consistent estimates in panel series, non-exogeneity and serial correlation problems are tackled by employing fully modified OLS (FMOLS) introduced by Pedroni (1996). Since the explanatory variables are cointegrated with a time trend, and thus a long-run equilibrium relationship exists among these variables through

the panel unit root test and panel cointegration test, we proceed to estimate the Equation (6) to Equation (11) by the method or fully modified OLS (FMOLS) for heterogenous cointegrated panels (Pedroni, 1996, 2000). This methodology allows consistent and efficient estimation of cointegration vector and also addresses the problem of non-stationary regressors, as well as the problem of simultaneity biases. It is well known that OLS estimation yields biased results because the regressors are endogenously determined in the  $I(1)$  case. The starting point OLS as in the following cointegrated system for panel data:

$$y_{it} = \alpha_i + x'_{it}\beta + e_{it} \quad (22)$$

$$x_{it} = x_{i,t-1} + \varepsilon_{it}$$

where  $\xi_{it} = [e_{it}, \varepsilon'_{it}]$  is the stationary with covariance matrix  $\Omega_i$ . The estimator  $\beta$  will be consistent when the error process  $\omega_{it} + [e_{it}, \varepsilon'_{it}]'$  satisfies the assumption of cointegration between  $y_{it}$  and  $x_{it}$ . The limiting distribution of OLS estimator depends upon nuisance parameters. Following Phillips and Hansen (1990) a semi-parametric correction can be made to the OLS estimator that eliminates the second order bias caused by the fact that the regressors are endogenous. Pedroni (1996, 2000) follows the same principle in the panel data context, and allows for the heterogeneity in the short run dynamics and the fixed effects. FMOLS Pedroni's estimator is constructed as follow:

$$\hat{\beta}_{FM} - \beta = \left( \sum_{i=1}^N \hat{\Omega}_{22i}^{-2} \sum_{t=1}^T (x_{it} - \bar{x}_t)^2 \right)^{-1} \sum_{i=1}^N \hat{\Omega}_{11i}^{-1} \hat{\Omega}_{22i}^{-1} \left( \sum_{t=1}^T (x_{it} - \bar{x}_t) e_{it}^* - T \hat{\gamma}_i \right) \quad (23)$$

$$\hat{e}_{it}^* = e_{it} - \hat{\Omega}_{22i}^{-1} \hat{\Omega}_{21i}, \quad \hat{\gamma}_i = \hat{\Gamma}_{21i} + \hat{\Omega}_{21i}^0 - \hat{\Omega}_{22i}^{-1} \hat{\Omega}_{21i} (\hat{\Gamma}_{22i} + \hat{\Omega}_{22i}^0)$$

where the covariance matrix can be decomposed as  $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i$  where  $\Omega_i^0$  is the contemporaneous covariance matrix, and  $\Gamma_i$  is a weighted sum of autocovariances. Also,  $\hat{\Omega}_i^0$  denotes an appropriate estimator of  $\Omega_i^0$ . In this study, we employed both the within-dimension and between-dimension panel FMOLS test from Pedroni (1996, 2000). An important advantage of the between-dimension estimators is that the form in which the data is pooled allows for greater flexibility in the presence of heterogeneity of the cointegrating vectors. Specifically, whereas test statistics constructed from the within-dimension estimators are designed to test the null hypothesis  $H_0 : \beta_i = \beta_0$  for all  $i$  against the alternative hypothesis  $H_A : \beta_i = \beta_A \neq \beta_0$  where the value  $\beta_A$  is the same for all  $i$ , test statistics constructed from the between-dimension estimators are designed to test the null hypothesis  $H_0 : \beta_i = \beta_0$  for all  $i$  against the alternative hypothesis  $H_A : \beta_i \neq \beta_0$ , so that the values for  $\beta_i$  are not constrained to be the same under the alternative hypothesis. Clearly, this is an important advantage for applications such as the present one, because there is no reason to believe that, if the cointegrating slopes are not equal to one, which they necessarily take on some other arbitrary common value. Another advantage of the between-dimension estimators is that the point estimates have a more useful interpretation in the event that the true cointegrating vectors are heterogeneous. Specifically, point estimates for the between-dimension estimator can be interpreted as the mean value for the cointegrating vectors. This is not true for the within-dimension estimators (Pedroni, 2001).

### 3.4 Data and Choice of Variables

The data set consists of a panel of observations for thirteen Asian countries for the period 1982-2001.<sup>1</sup> Annual data are collected from the World Development Indicator (World Bank CD-ROM 2005), Asian Development Bank (ADB, 2004), and The Government Finance Statistics (GFS, various years). Following Demetriades and Law (2006), the data set on institutional quality indicators employed from the International Country Risk Guide (ICRG). The first three variables are scaled from 0 to 6, whereas the last two variables are scaled from 0 to 10. Higher values indicate 'better' rating for institutional quality and vice versa. The scale of corruption, bureaucratic quality and rule of law was first converted to 0 to 10 (multiplying them by 5/3) to make them comparable to the other indicator. The institutions indicator is obtained by summing up the above five indicators.

## 4. Empirical Results

Table 1a and Table 1b report the results of the LLC, IPS, and MW panel unit root tests for the data on health expenditure (*he*), education expenditure (*ee*), defence expenditure (*de*), distortionary taxes (*dt*), budget balance (*bb*), aggregate of independent government expenditure variables (*GE*), aggregate of independent fiscal policy variables (*FP*), institutions (*ins*), saving rate (*s<sub>k</sub>*), population growth rate ( $n + g + \delta$ ), aggregate of independent government expenditure variables in institutions (*GE\*ins*), and aggregate of independent fiscal policy variables in institutions (*FP\*ins*) for both the scenarios of constant and constant plus time trend term.

Table 1a, presents the results of the LLC, IPS, and MW panel unit root tests at level indicating that all variables are  $I(0)$  in the constant and constant plus time trend of the panel unit root regression. These results clearly show that the null hypothesis of a panel unit root in the level of the series cannot be rejected at various lag lengths. We can

conclude that most of the variables are non-stationary in with and without time trend specifications at level by applying the LLC, IPS and MW tests which are also applied for heterogeneous panel to test the series for the presence of a unit root. The results of the panel unit root tests confirm that the variables are non-stationary at level.

Table 1b presents the results of the tests at first difference for LLC, IPS and MW tests in constant and constant plus time trend. We can see that for all series the null hypothesis of unit root test is rejected at 95% critical value (1% level). Hence, based on LLC, IPS, and MW test, there strong evidence that all the series are in fact integrated of order one.

The findings of a unit root on the variables in this study are consistent with the results of a number of previous studies such as Campbell and Perron (1991), McCoskey and Selden (1998), Macdonald and Nagayasu (2000), Lee and Chang (2006), and Al-Awad and Harb (2005). Given the results of LLC, IPS, and MW tests, it is possible to apply panel cointegration methodology in order to test for the existence of the stable long-run relation among the variables.

#### 4.1 Panel Cointegration Tests

The next step is to test whether the variables are cointegrated using Pedroni's (1999, 2001, and 2004) methodology as described previously for Model 1 to Model 6. This is to investigate whether long-run steady state or cointegration exists among the variables and to confirm what Oh *et al.* (1999) and Coiteux and Olivier (2000) state that the panel cointegration tests have much higher testing power than conventional cointegration test. Since the variables are found to be integrated in the same order  $I(1)$ , we continue with the panel cointegration tests proposed by Pedroni (1999, 2001, and 2004). Cointegrations are carried out for constant and constant plus time trend and the summary of the results of cointegrations analyses are presented in Table 2.

In constant level, we found that Model 1 indicates that 7 statistics reject null by hypothesis of no cointegration at the 1% level of significance except for the group-*adf* which is significant at 5% level. Model 3 used the same explanatory variables in Model 1 and institutions variable is added to the regression model. We found that Model 3 indicates that all 7 statistics reject the null hypothesis of no cointegration at the 1% level of significance except for the group-*adf* which is significant at the 5% level. In Model 2, the results are the same as in Model 1 indicating that the null hypothesis is rejected at the 1% level of significance except for the group-*adf* which is significant at the 5% level. In Model 4, institutions variable is added to the regression model, the results indicate that 7 statistics reject the null hypothesis of non cointegration at the 1% level of significance except for the group-*adf* which is significant at the 5% level. Model 5 and Model 6 which are with interaction term indicate that all 7 statistics reject the null hypothesis of non cointegration at the 1% level of significance except for the group-*t* which is significant at the 5% level.

Overall, results on the panel cointegration tests in Model 1 to Model 6 with constant level, however, show that independent variables do hold cointegration in the long run for a group of thirteen Asian countries with respect to real per capita GDP. As indicated by the panel non-parametric (*t*-statistic) and parametric (*adf*-statistic) statistics as well as group statistics that are analogous to the IPS-test statistics, the null hypothesis of non cointegration is rejected at the 1% and 5% level of significance. These results imply that taken as a group, the theory of growth through augmented Solow model for Model 1 to Model 6 does hold over the estimation period.

In the panel cointegration test for Model 1 to Model 6 with constant plus trend level, the results indicate that all 7 statistics reject the null hypothesis of non cointegration at the 1% level of significance. It is shown that independent variables do hold cointegration in the long run for a group of thirteen Asian countries with respect to real per capita GDP. However, since all the statistics conclude in favour of cointegration, and this, combined with the fact that the according to Pedroni (1999) the panel non-parametric (*t*-statistic) and parametric (*adf*-statistic) statistics are more reliable in constant plus time trend, we conclude that there is a long run cointegration among our variables in thirteen Asian countries.

#### 5. Fully Modified OLS (FMOLS)

The previous section already confirmed that all variables in six equations (six models) are cointegrated. In other words, long run equilibrium does exist among the variables. This section discusses the estimated long-run equation. Following Pedroni (2000 and 2001), cointegrating explanatory variables for the data is estimated using the Fully Modified OLS (FMOLS) technique. In Table 3a and Table 3b and Table 4a and Table 4b, results are reported for Within Group (within-dimension) FMOLS and Panel Group (between-dimension) FMOLS estimators without and with common time dummies.

In Table 3a, within group FMOLS results without time dummies, all variables in Model 1 to Model 6 reported tests reject the null hypotheses at the 1% and 5% level of significance. While In Table 3b (panel group FMOLS) shows

that all variables in Model 1 to Model 6 reported tests reject the null hypotheses at the 1% and 5% level of significance. In Table 3a, the estimate of coefficient for government expenditure on health ( $\ln he$ ) and government expenditure on education ( $\ln ee$ ) and the estimate of the coefficient are positive (1.16 and 0.42, 0.27 and 2.55) and statistically significant at the 5% level. Table 3b shows that the estimate of coefficient for government expenditure on health ( $\ln he$ ) and government expenditure on education ( $\ln ee$ ) and the estimate of the coefficient are positive (1.81 and 0.66, 0.42 and 0.08) and statistically significant at the 1% level. Results in both table shows that education and health expenditures increase economic growth, which means that there is a long run cointegration between education and health expenditures and economic growth.

For defence expenditure ( $\ln de$ ) for Model 1 and Model 3 in both tables, it also rejects the null hypotheses of non cointegration and the coefficient is negative [-7.16 and -4.25 (Table 3a) and -6.85 and -3.99 (Table 3b)] and statistically significant at 1% level. We conclude that results in both tables shows that increase in defence expenditures will decrease in economic growth, which means that there is still a long run cointegration between health expenditures and economic growth and defence expenditure have an adverse affect on economic growth.

The estimates of the coefficient for the aggregate of fiscal policy ( $\ln FP$ ) in both models and both tables are positive (0.02) and statistically significant at the 5% level for both models in Table 3a and statistically significant at the 1% level for both models in Table 3b. The results in both tables show that the aggregate of fiscal policy positively affect growth meaning that there is a long run cointegration between the aggregate of fiscal policy and economic growth.

The estimate of the coefficient for the savings in physical capital (investment) ( $\ln s_k$ ) is positive (0.12 and 0.16) for Model 1 and Model 3 and statistically significant at the 5% level in Table 3a. While Table 3b shows that the estimate of the coefficient for the savings in physical capital (investment) ( $\ln s_k$ ) is positive (0.08 and 0.13) for both models and statistically significant at the 1% level. We conclude that investment in these models is one of the strongest correlates of economic growth; which means there is a long run cointegration. In Table 3a and Table 3b, the coefficient on population growth ( $\ln(n + g + \delta)$ ) is negative [-0.31 and -0.21 (Table 3a) and -0.29 and -0.40 (Table 3b)] and statistically significant at the 5% level in Table 3a and statistically significant at the 1% level in Table 3b. We conclude that results in both table shows that increase in population growth will decrease economic growth, meaning that there is still a long run cointegration between population growth and economic growth and population growth have an adverse affect on economic growth.

Table 3a and Table 3b, used the same explanatory variables in Model 1 and institutions variable is added to Model 3. We found that there is a positive coefficient (0.19 in Table 3a and 0.03 in Table 3b) and statistically significant at the 1% level. The results in both tables show that the institutions positively affect growth which means that there is a long run cointegration between the institutions and economic growth. While the inclusion of institutions as an added regressor in the growth equation (Model 3) does not generally affect the sign or absolute magnitude of the estimates, they are not less precisely estimated than their counterparts in Model 1. This is not surprising given that institutions are positively correlated with some of the regressors

In Model 2 and Model 4 in Table 3a, all variables reported that tests reject the null hypotheses of non cointegration at the 1% and 5% level. While in Table 3b we found that all variables reported that tests reject the null hypotheses of non cointegration at the 1% level. Both tables show that there is a negative coefficient [-3.44 and -2.65 (Table 3a) and -2.57 and -2.25 (Table 3b)] and statistically significant at the 1% level for the distortionary taxation ( $\ln dt$ ). The estimate of the coefficient of the budget balance ( $\ln bb$ ) is also negative [-0.02 and -0.10 (Table 3a) and -0.06 and -0.07 (Table 3b)] and statistically significant at the 5% level in Table 3a and statistically significant at the 1% level in Table 3b. The results in both tables show that the distortionary taxation and budget balance have an adverse affect on economic growth which means that there is a long run cointegration between the distortionary taxation and budget balance and economic growth.

In Model 2 and Model 4, the estimate of the coefficient for the aggregate of government expenditure ( $\ln GE$ ) is positive [2.08 and 2.02 (Table 3a) and 0.02 (Table 3b)] and statistically significant at the 1% level. We conclude that there is presence of a long run relationship between GDP and government expenditure. The estimate of the coefficient for the savings in physical capital (investment) ( $\ln s_k$ ) is positive [0.14 (Table 3a) and 0.14 and 0.12 (Table 3b)] and statistically significant at the 5% level in Table 3a and statistically significant at the 1% level in Table 3b. These results are the same as in Model 1 and Model 3 and we conclude that investment and economic growth have a long run cointegration.

The coefficient on population growth ( $\ln(n + g + \delta)$ ) is negative (-0.21) and statistically significant at the 5% level in Table 3a. On the other hand, the coefficient on population growth ( $\ln(n + g + \delta)$ ) is negative (-0.29 and -0.45) and statistically significant at the 1% level in Table 3b in Model 2 and Model 4. As in Model 1 and Model 3 results

in both tables shows that there is still a long run cointegration between population growth and economic growth and population growth has an adverse affect on economic growth.

In Model 4, we used the same explanatory variables in Model 2 and institutions variable is added to the regression model. We found that there is a positive coefficient [0.17 (Table 3a) and 0.15 (Table 3b)] and statistically significant at the 5% level in Table 3a and statistically significant at the 1% level in Table 3b. The results from the analysis are significant in both tables and imply that the important role of institutions has a potential impact on long-run steady-state levels of growth. Thus, there is a long run cointegration between institutions and economic growth. While the inclusion of institutions as an added regressor in the growth equation (Model 4) does not generally affect the sign or absolute magnitude of the estimates, they are not less precisely estimated than their counterparts in Model 2. This is not surprising given that institutions are positively correlated with some of the regressors.

In Model 5 and Model 6 (with interaction term) in Table 3a and Table 3b, all variables reported that tests reject the null hypotheses of non cointegration at the 1% and 5% level of significance. For the aggregate of government expenditure ( $\ln GE$ ), the estimate of coefficient is positive [0.07 and 0.72 (Table 3a) and 1.06 and 0.88 (Table 3b)] and statistically significant at the 5% level in Table 3a and statistically significant at the 1% level in Table 3b. Therefore, there is presence of a long run relationship between government expenditure and GDP. The estimate of the coefficient for the aggregate of fiscal policy ( $\ln FP$ ) is positive [0.02 (Table 3a) and 0.02 and 0.04 (Table 3b)] and statistically significant at the 5% level in Table 3a and statistically significant at the 1% level in Table 3b. The aggregate of fiscal policy positively affect growth and there is a long run cointegration between the aggregate of fiscal policy and economic growth.

There is a positive coefficient [0.43 and 0.52 (Table 3a) and 0.05 and 0.10 (Table 3b)] and statistically significant at the 5% (Table 3a) and 1% (Table 3b) level for institutions ( $\ln ins$ ) in Model 5 and model 6. Thus, there is a long run cointegration between institutions and economic growth. The estimate of the coefficient for the savings in physical capital (investment) ( $\ln s_k$ ) is positive [0.13 and 0.16 (Table 3a) and 0.12 and 0.16 (Table 3b)] and statistically significant at the 5% level in Table 3a and statistically significant at the 1% level in Table 3b. We conclude that investment and economic growth have a long run cointegration. The coefficient on population growth ( $\ln(n + g + \delta)$ ) is negative [-0.20 (Table 3a) and -0.49 and -0.37 (Table 3b)] and statistically significant at the 5% level in Table 3a and statistically significant at the 1% level in Table 3b. Both tables show that there is still a long run cointegration between population growth and economic growth and population growth has an adverse effect on economic growth. The interaction term between institutions and aggregate of government expenditure ( $\ln GE * ins$ ) and institutions and aggregate of fiscal policy ( $\ln FP * ins$ ) have positive coefficient (0.32 and 0.02 (Table 3a) and 0.34 and 0.02 (Table 3b)) and statistically significant at the 5% and 1% level in Table 3a and Table 3b for Model 5 and Model 6, respectively. We conclude that aggregate of government expenditure and aggregate of fiscal policy variables which interact with institutions variable and have a potential impact on long-run steady-state levels of growth. Thus, there is a long run cointegration between aggregate of government expenditure and aggregate of fiscal policy variables interact with institutions variable and economic growth. Again we found that while the inclusion of interaction term between aggregate of government expenditure and institutions and aggregate of fiscal policy and institutions as an added regressor in the growth equations (Model 5 and Model 6) do not generally affect the sign or absolute magnitude of the estimates, they are not less precisely estimated than their counterparts in Model 5 or Model 6.

Comparing the results reported in Table 3a and Table 3b, we found that the panel groups give higher values of estimation coefficient and higher values of significance (1% level) which would be a more accurate representation of the average long-run relationship. Therefore, we conclude that all variables are cointegrated and there is long run relationship.

Table 4a and Table 4b present the results of within group and panel group FMOLS with time dummies, respectively. In Table 4a, all variables reported that tests reject the null hypotheses of non cointegration at the 1% and 5% level of significance. On the other hand, Table 4b shows that all variables reported that tests reject the null hypotheses of non cointegration at the 1% and 5% level of significance. Model 1 and Model 3 in Table 4a and Table 4b, the estimate of the coefficient for the government expenditure on health ( $\ln he$ ) is positive (1.69 and 2.92 (Table 4a) and 1.99 and 3.22 (Table 4b)) and statistically significant at the 5% (Table 4a) and 1% (Table 4b) levels, while the estimate of the coefficient for the government expenditure on education ( $\ln ee$ ) government expenditure is also positive (2.07 and 2.29 (Table 4a) and 0.85 and 0.75 (Table 4b)) and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. Therefore, there is a long run cointegration between education and health expenditures and economic growth.

For defence expenditure ( $\ln de$ ) for Model 1 and Model 3 in both tables, the null hypotheses of non cointegration is rejected and the coefficient is negative [-0.76 and -0.67 (Table 4a) and -4.22 and -3.22 (Table 4b)] and statistically

significant at 5% level in Table 4a and significant at the 1% level in Table 4b. Therefore, there is a long run cointegration and defence expenditure has an adverse affect on economic growth.

The estimate of the coefficient for the aggregate of fiscal policy ( $\ln FP$ ) in both models and both tables are positive [0.03 (Table 4a) and 0.02 (Table 4b)] and statistically significant at the 1% level for both models in Table 4a and Table 4b. The results in both tables show that the aggregate of fiscal policy positively affect growth and there is a long run cointegration between the aggregate of fiscal policy and economic growth.

The estimate of the coefficient for the savings in physical capital (investment) ( $\ln s_k$ ) is positive (0.13 and 0.99) for Model 1 and Model 3 and statistically significant at the 5% level in Table 4a. While Table 3b shows that the estimate of the coefficient for the savings in physical capital (investment) ( $\ln s_k$ ) is positive (0.19 and 0.20) for both models and statistically significant at the 1% level. These results show that the investment in Table 3a and Table 3b have a long run cointegration with economic growth. In Table 4a and Table 4b, the coefficient on population growth ( $\ln(n + g + \delta)$ ) is negative [-0.22 and -0.23 (Table 4a) and -0.24 and -0.34 (Table 4b)] and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. We conclude that there is still a long run cointegration between population growth and economic growth and population growth has an adverse affect on economic growth.

Table 4a and Table 4b, used the same explanatory variables in Model 1 and institutions variable is added to Model 3. We found that there is a positive coefficient (2.19 in Table 4a and 0.12 in Table 4b) and statistically significant at the 1% level. The results in both tables show that the institutions positively affect growth and there is a long run cointegration between the institutions and economic growth. The result is the same in Table 3a and Table 3b, when the inclusion of institutions as an added regressor in the growth equation (Model 3) does not generally affect the sign or absolute magnitude of the estimates; they are not less precisely estimated than their counterparts in Model 1.

In Model 2 and Model 4 in Table 4a, all variables reported that tests reject the null hypotheses of non cointegration at the 1% and 5% level. While in Table 4b we found that all variables reported tests that reject the null hypotheses of non cointegration at the 1% level. Both tables show that there is a negative coefficient [-0.03 (Table 4a) and -0.79 and -0.94 (Table 4b)] and statistically significant at the 5% (Table 4a) and 1% (Table 4b) levels for the distortionary taxation ( $\ln dt$ ). The estimate of the coefficient of the budget balance ( $\ln bb$ ) is also negative [-0.04 (Table 4a) and -0.06 and -0.02 (Table 4b)] and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. The results in both tables show that the distortionary taxation and budget balance have an adverse effect on economic growth which means that there is a long run cointegration between the distortionary taxation and budget balance and economic growth.

In Model 2 and Model 4 also we found that the estimate of the coefficient for the aggregate of government expenditure ( $\ln GE$ ) is positive [2.18 and 2.13 (Table 4a) and 0.04 (Table 4b)] and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. We conclude that there is a presence of a long run relationship between GDP and government expenditure. The estimate of the coefficient for the savings in physical capital (investment) ( $\ln s_k$ ) is positive (0.14 and 0.13 (Table 4a) and 0.20 and 0.21 (Table 4b)) and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. Therefore, we conclude that investment and economic growth have a long run cointegration. The coefficient on population growth ( $\ln(n + g + \delta)$ ) is negative (-0.21) and statistically significant at the 5% level in Table 4a. On the other hand, the coefficient on population growth ( $\ln(n + g + \delta)$ ) is negative (-0.26 and -0.27) and statistically significant at the 1% level in Table 4b. These results in both tables show that there is still a long run cointegration between population growth and economic growth and population growth has an adverse effect on economic growth.

In Model 4, we used the same explanatory variables in Model 2 and institutions variable is added to the regression model. We found that there is a positive coefficient [2.73 (Table 4a) and 0.18 (Table 4b)] and statistically significant at the 1% level in both tables. Therefore, we conclude that there the important role of institutions has a potential impact on long-run steady-state levels of growth. Thus, there is a long run cointegration between institutions and economic growth. Same as results from Table 3a and Table 3b, we found that when the inclusion of institutions as an added regressor in the growth equation (Model 4) does not generally affect the sign or absolute magnitude of the estimates, they are not less precisely estimated than their counterparts in Model 2.

In Model 5 and Model 6 (with interaction term) in Table 4a and Table 4b, all variables reported that tests reject the null hypotheses of non cointegration at the 1% and 5% level of significance in Table 4a and 1% level of significance in Table 4b. For the aggregate of government expenditure ( $\ln GE$ ), the estimate of coefficient is positive [0.29 and 2.08 (Table 4a) and 2.23 and 2.53 (Table 4b)] and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. Therefore, there is a presence of a long run relationship between government expenditure and GDP. The estimate of the coefficient for the aggregate of fiscal policy ( $\ln FP$ ) is positive [0.04 and

0.09 (Table 4a) and 0.02 and 0.48 (Table 4b)] and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. The aggregate of fiscal policy positively affect growth and there is a long run cointegration between the aggregate of fiscal policy and economic growth.

There is a positive coefficient [1.17 and 1.21 (Table 4a) and 0.25 and 1.64 (Table 4b)] and statistically significant at the 1% level for institutions ( $\ln ins$ ) in Model 5 and model 6. Thus, there is a long run cointegration between institutions and economic growth. The estimate of the coefficient for the savings in physical capital (investment) ( $\ln s_k$ ) is positive [0.14 and 0.16 (Table 4a) and 0.25 and 0.21 (Table 4b)] and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. We conclude that investment and economic growth have a long run cointegration. The coefficient on population growth ( $\ln(n + g + \delta)$ ) is negative [-0.21 and -0.19 (Table 4a) and -0.29 and -0.27 (Table 4b)] and statistically significant at the 5% level in Table 4a and statistically significant at the 1% level in Table 4b. Both tables show that there is still a long run cointegration between population growth and economic growth and population growth has an adverse effect on economic growth. The interaction term between institutions and aggregate of government expenditure ( $\ln GE * ins$ ) and institutions and aggregate of fiscal policy ( $\ln FP * ins$ ) have positive coefficient [0.28 and 0.22 (Table 4a) and 0.50 and 0.14 (Table 4b)] and statistically significance at the 5% and 1% level in Table 4a and Table 4b for Model 5 and Model 6, respectively. We conclude that aggregate of government expenditure and aggregate of fiscal policy variables interact with institutions variable and have a potential impact on long-run steady-state levels of growth. Thus, there is a long run cointegration between aggregate of government expenditure and aggregate of fiscal policy variables which interact with institutions variable and economic growth. The results are the same in Table 3a and Table 3b, when the inclusion of interaction term between aggregate of government expenditure and institutions and aggregate of fiscal policy and institutions as an added regressor in the growth equations (Model 5 and Model 6) do not generally affect the sign or absolute magnitude of the estimates, they are not less precisely estimated than their counterparts in Model 5 or Model 6.

Comparing the results reported in Table 4a and Table 4b, we found that the panel groups give higher values of estimation coefficient and higher values of significance (1% level) which would be a more accurate representation of the average long-run relationship. Therefore, we conclude that all variables are cointegrated and there is long run relationship.

Overall, our results in Table 3a to Table 4b the panel estimators' tests show that the within groups estimator without and with time dummies almost have the coefficient of panel relative all variables levels and are statistically significant at 1% and 5% levels. While, for the panel groups' estimator without and with time dummies have the coefficient of panel relative all variables levels and are statistically significant at 1% level. It is interesting to note that panel groups FMOLS estimators consistently produce larger estimates than do the within groups estimators. Therefore, our results are the same as Pedroni's (2001) arguments that the panel groups estimators produce consistent estimates of the average slope under the alternative hypothesis that the slopes are different from one another and vary across countries whereas the within groups estimators do not.

## Conclusion

We assessed the empirical evidence on the link between fiscal policy and growth. The analyses of fiscal policy in thirteen Asian economies show that the authorities do make active use of fiscal policy. This implies that fiscal policy is practically possible and can be effective in influencing the real per capita GDP.

Our study attempts to identify the important role of institutions as determinants of economic growth rates in a sample of thirteen Asian countries. While the inclusion of institutions as an added regressor in the growth equations does not generally affect the sign or absolute magnitude of the estimates, they are not less precisely estimated than their counterparts. This is not surprising given that institutions are positively correlated with some of the regressors. The results from the analysis are significant, and provide support for the historical evidence presented by North and Thomas (1973), and North (1990). They show that the security of property rights provides incentives for economic growth in the world. Secure role of institutions also leads to an efficient allocation of government expenditure and fiscal policy.

Our study also provides another framework of a set of linkages to capture most of the important interaction among economic growth, institutions, government expenditure and fiscal policy. Economic indicator especially interacts with non-economic indicator. The positive results of the effect of interaction term between the aggregate of government expenditure and institutions, and the aggregate of fiscal policy and institutions on economic growth in thirteen Asian economies are really interesting. These interaction terms as an added regressor in the growth equations do not generally affect the sign or absolute magnitude of the estimates; they are not less precisely estimated than their counterparts.

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## Notes

1. The countries chosen for our study are as follows: China, Hong Kong, China, Korea, Japan, Indonesia, Malaysia, Philippines, Singapore, Thailand, Bangladesh, India, Pakistan, and Sri Lanka

Table 1a. Panel Unit Root Tests: Level

	<u>CONSTANT</u>			<u>CONSTANT + TREND</u>		
	LLC	IPS	MW	LLC	IPS	MW
$\ln rgdpc$	-0.35(5)	1.72(0)	21.81(1)	2.1192)	1.15(1)	30.44(1)
$\ln he$	3.39(8)	3.40(0)	12.39(0)	0.52(0)	2.19(0)	18.80(0)
$\ln ee$	-1.32(0)	3.23(0)	15.01(0)	2.17(0)	2.57(0)	20.87(0)
$\ln de$	-0.58(0)	3.74(2)	23.82(3)	0.08(0)	1.49(0)	20.89(0)
$\ln dt$	-2.36(0)	-0.83(0)	23.92(0)	-0.76(0)	-0.57(0)	26.79(0)
$\ln bb$	-0.74(2)	-0.91(1)	33.98(1)	1.19(2)	-0.68(2)	28.15(2)
$\ln GE$	-1.52(0)	3.52(0)	17.41(0)	3.34(0)	1.58(1)	13.73(1)
$\ln FP$	-0.99(0)	3.51(0)	9.33(0)	0.42(1)	-0.59(0)	25.08(1)
$\ln ins$	0.04(0)	1.75(0)	12.95(0)	0.29(0)	1.04(0)	18.12(0)
$\ln s_k$	0.10(0)	-0.71(0)	33.11(0)	1.73(2)	-0.03(0)	25.25(0)
$\ln(n + g + \delta)$	-1.08(2)	-0.51(4)	22.38(4)	0.12(2)	-0.77(2)	28.97(2)
$\ln(GE * ins)$	-1.84(0)	3.26(0)	13.99(0)	1.97(0)	3.18(1)	19.21(1)
$\ln(FP * ins)$	-1.21(0)	3.18(0)	12.02(0)	1.60(0)	2.61(1)	12.59(1)

Notes: The number in ( ) are Probability value. The lag length is chosen on the basis of the Akaike's Information Criteria (AIC) where we specify maximum lag order (k) in autoregression and then we select appropriate lag order according to the AIC. For LLC *t*-stat all reported values are distributed  $N(0,1)$  under null of unit root or no cointegration.

Table 1b. Panel Unit Root Tests: First Difference

	<u>CONSTANT</u>			<u>CONSTANT + TREND</u>		
	LLC	IPS	MW	LLC	IPS	MW
$\ln rgdpc$	-7.51(0)*	-5.57(0)*	75.95(0)*	-8.25(0)*	-5.30(0)*	71.07(0)*
$\ln he$	-10.56(0)*	-10.14(0)*	137.29(0)*	-11.47(0)*	-9.67(0)*	121.72(0)*
$\ln ee$	-7.75(0)*	-8.69(0)*	118.59(0)*	-7.58(0)*	-7.63(0)*	99.14(0)*
$\ln de$	-11.06(0)*	-10.09(0)*	135.84(0)*	-11.51(0)*	-9.81(0)*	122.65(0)*
$\ln dt$	-12.73(0)*	-12.48(0)*	169.97(0)*	-11.58(0)*	-10.92(0)*	134.49(0)*
$\ln bb$	-17.06(0)*	-15.83(0)*	214.48(0)*	-14.57(0)*	-13.67(1)*	166.69(0)*
$\ln GE$	-5.00(0)*	-4.69(0)*	67.90(0)*	-5.49(0)*	-3.78(0)*	56.40(0)*
$\ln FP$	-14.17(0)*	-12.74(0)*	172.04(0)*	-13.29(0)*	-11.77(0)*	144.00(0)*
$\ln ins$	-7.49(0)*	-5.89(0)*	79.39(0)*	-6.68(0)*	-3.37(0)*	49.39(0)*
$\ln s_k$	-10.64(0)*	-9.03(0)*	121.18(0)*	-9.42(0)*	-6.53(0)*	85.39(0)*
$\ln(n + g + \delta)$	-19.09(0)*	-17.09(0)*	230.74(0)*	-16.87(0)*	-15.26(0)*	185.03(0)*
$\ln(GE * ins)$	-7.61(0)*	-8.88(0)*	121.80(0)*	-9.02(0)*	-8.58(0)*	110.92(0)*
$\ln(FP * ins)$	-9.16(0)*	-8.81(0)*	118.58(0)*	-9.34(0)*	-8.00(0)*	101.03(0)*

Notes: The number in ( ) are Probability value. The lag length is chosen on the basis of the Akaike's Information Criteria (AIC) where we specify maximum lag order (k) in autoregression and then we select appropriate lag order according to the AIC. For LLC *t*-stat all reported values are distributed  $N(0,1)$  under null of unit root or no cointegration.

Table 2. Panel cointegration tests for heterogeneous panel (dependent variable: real per capita GDP)

	Constant						Constant + Trend					
	M1	M2	M3	M4	M5 (with interaction)	M6 (with interaction)	M1	M2	M3	M4	M5 (with interaction)	M6 (with interaction)
Panel- $\nu$	2.06*	2.62*	2.13*	2.34*	-2.24*	-2.40*	3.61*	3.27*	3.31*	3.97*	3.50*	3.95*
Panel- $\rho$	3.27*	3.53*	4.03*	4.08*	3.15*	3.34*	4.08*	4.45*	4.88*	5.13*	3.72*	4.12*
Panel- $t$	2.37*	2.62*	2.74*	2.65*	2.50*	2.97*	3.53*	3.13*	3.53*	3.84*	-3.22*	3.65*
Panel- $adj$	2.50*	2.96*	2.91*	2.68*	2.72*	2.24*	3.96*	3.11*	3.24*	3.83*	3.13*	3.18*
Group- $\rho$	4.33*	4.11*	5.01*	5.01*	4.31*	4.01*	4.56*	4.28*	5.06*	5.06*	4.46*	4.68*
Group- $t$	1.98*	2.33*	1.96*	2.43*	1.76**	1.83**	-2.45*	2.56*	2.28*	2.33*	2.63*	2.62*
Group- $adj$	1.94**	1.68**	1.91**	1.93**	2.62*	2.11*	-2.12*	2.66*	-2.10*	-2.08*	3.12*	3.35*

Notes. All statistics are from Pedroni's procedure (1999) which is the adjusted values can be compared to the  $N(0,1)$  distribution.

Panel  $\nu$  is a nonparametric variance ratio statistic. Panel  $\rho$  and panel  $t$  are analogous to the nonparametric Phillips-Perron  $p$  and  $t$  statistics respectively. Panel- $adj$  is a parametric statistic based on the augmented Dickey-Fuller ADF statistic. Group- $\rho$  is analogous to the Phillips-Perron  $p$  statistic. Group- $t$  and group- $adj$  are analogous to the Phillips-Perron  $t$  statistic and the augmented Dickey-Fuller ADF statistic respectively.

The Pedroni (2004) statistics are one-sided tests with a critical value of 1.64 ( $k < -1.64$  implies rejection of the null), except the  $u$ -statistic that has a critical value of 1.64 ( $k > 1.64$  suggests rejection of the null). Note that the means and variances used to calculate the Pedroni statistics are reported in Pedroni (1999).

\*, \*\* indicates rejection of the null hypothesis of no-cointegration at 1% and 5%, level of significance. M1 to M6 – refer to Model 1 to Model 6

Table 3a. Within Group FMOLS Results, **Without Time Dummies** (Dependent variable: real GDP per capita)

	Model 1	Model 2	Model 3	Model 4	Model 5 Model 6 (with interaction)	
$\ln he$	1.16** (2.61)	-	0.42** (2.76)	-	-	-
$\ln ee$	0.27** (2.82)	-	2.55** (2.71)	-	-	-
$\ln de$	-7.16* (-5.61)	-	-4.25* (-3.28)	-	-	-
$\ln dt$	-	-3.44* (-4.44)	-	-2.65* (-3.10)	-	-
$\ln bb$	-	-0.02** (-2.54)	-	-0.10** (-2.12)	-	-
$\ln GE$	-	2.08* (-3.47)	-	2.02* (-3.04)	0.07** (2.20)	0.72** (2.65)
$\ln FP$	0.02** (2.40)	-	0.02** (2.47)	-	0.02** (-2.50)	0.02** (-2.49)
$\ln ins$	-	-	0.19* (-3.30)	0.17** (2.98)	0.43** (-1.94)	0.52** (-2.87)
$\ln s_k$	0.12** (-1.99)	0.14** (-2.05)	0.16** (-2.60)	0.14** (-2.39)	0.13** (-1.99)	0.16** (-2.32)
$\ln(n + g + \delta)$	-0.31** (-2.65)	-0.21** (-2.40)	-0.36** (-2.79)	-0.21** (-2.42)	-0.20** (-2.37)	-0.20** (-2.28)
$\ln(GE * ins)$	-	-	-	-	0.32** (2.81)	-
$\ln(FP * ins)$	-	-	-	-	-	0.02** (-2.04)

Note: The null hypothesis for the  $t$ -ratio is  $H_0 = \beta_i = 1.0$ ; Figures in parentheses are  $t$ -statistics

(\*) and (\*\*) significant with 95% (90%) confidence level;

“within-dimension” reports Pedroni (1996) weighted within-dimension adjusted-FM.

Table 3b. Panel Group FMOLS Results, **Without Time Dummies** (Dependent variable: real per capita GDP)

	Model 1	Model 2	Model 3	Model 4	Model 5 Model 6 (with interaction)	
$\ln he$	1.81* (-3.26)	-	0.66* (-4.08)	-	-	-
$\ln ee$	0.42* (-3.25)	-	0.08* (-3.51)	-	-	-
$\ln de$	-6.85* (-5.85)	-	-3.99* (-3.50)	-	-	-
$\ln dt$	-	-2.57* (8.24)	-	-2.25* (9.78)	-	-
$\ln bb$	-	-0.06* (-6.12)	-	-0.07* (-6.66)	-	-
$\ln GE$	-	0.02* (5.15)	-	0.02* (-6.73)	1.06* (-3.56)	0.88* (11.19)
$\ln FP$	0.02* (3.08)	-	0.02* (-6.49)	-	0.02* (-4.69)	0.04* (-6.86)
$\ln ins$	-	-	0.03* (-4.21)	0.15* (-3.95)	0.05* (-4.71)	0.10* (-10.09)
$\ln s_k$	0.08* (-3.12)	0.14* (-9.41)	0.13* (-4.51)	0.12* (-7.04)	0.12* (-4.46)	0.16* (-4.95)
$\ln(n + g + \delta)$	-0.29* (-4.78)	-0.29* (-5.12)	-0.40* (-6.17)	-0.45* (-4.03)	-0.49* (-5.01)	-0.37* (-5.65)
$\ln(GE * ins)$	-	-	-	-	0.34* (3.40)	-
$\ln(FP * ins)$	-	-	-	-	-	0.02* (-4.52)

Note: The null hypothesis for the  $t$ -ratio is  $H_0 = \beta_i = 1.0$ ; Figures in parentheses are  $t$ -statistics

(\*) and (\*\*) significant with 95% (90%) confidence level;

“between-dimension” reports Pedroni (1996, 2000) group mean panel FMOLS.

Table 4a. Within Group FMOLS Results, **With Time Dummies** (Dependent variable: real GDP per capita)

	Model 1	Model 2	Model 3	Model 4	Model 5 (with interaction)	Model 6
$\ln he$	1.69** (2.71)	-	2.92** (2.82)	-	-	-
$\ln ee$	2.07** (1.82)	-	2.29** (1.99)	-	-	-
$\ln de$	-0.76** (-2.62)	-	-0.67** (2.58)	-	-	-
$\ln dt$	-	-0.03** (-2.36)	-	-0.03** (-2.72)	-	-
$\ln bb$	-	-0.04** (-2.71)	-	-0.04** (-2.73)	-	-
$\ln GE$	-	2.18** (-3.39)	-	2.13** (-3.24)	0.29** (-1.99)	2.08** (2.15)
$\ln FP$	0.03* (3.43)	-	0.03* (3.39)	-	0.04* (4.39)	0.09* (3.36)
$\ln ins$	-	-	2.19* (-3.30)	2.73* (10.6)	1.17* (4.60)	1.21* (3.60)
$\ln s_k$	0.13** (-1.98)	0.14** (-2.05)	0.99** (-2.60)	0.13** (2.14)	0.14** (-2.24)	0.16** (-2.32)
$\ln(n + g + \delta)$	-0.22** (2.65)	-0.21** (2.40)	-0.23** (-2.34)	-0.21** (2.42)	-0.21** (2.37)	-0.19** (2.28)
$\ln(GE * ins)$	-	-	-	-	0.28** (-2.55)	-
$\ln(FP * ins)$	-	-	-	-	-	0.22** (-2.04)

Note: The null hypothesis for the  $t$ -ratio is  $H_0 = \beta_i = 1.0$ ; Figures in parentheses are  $t$ -statistics

(\*) and (\*\*) significant with 95% (90%) confidence level; “within-dimension” reports Pedroni (1996) weighted within-dimension adjusted-FM.

Table 4b. Panel Group FMOLS Results – **With Time Dummies** (Dependent variable: real per capita GDP)

	Model 1	Model 2	Model 3	Model 4	Model 5 Model 6 (with interaction)	
$\ln he$	1.99* (3.18)	-	3.22* (3.96)	-	-	-
$\ln ee$	0.85* (-3.96)	-	0.75* (-4.88)	-	-	-
$\ln de$	-4.22* (-7.31)	-	-3.22* (-8.53)	-	-	-
$\ln dt$	-	-0.79* (-4.48)	-	-0.94* (-5.67)	-	-
$\ln bb$	-	-0.06* (-4.53)	-	-0.02* (-8.71)	-	-
$\ln GE$	-	0.04* (-12.62)		0.04* (-4.67)	2.23* (-4.76)	2.53* (11.11)
$\ln FP$	0.02* (-4.12)	-	0.02* (-6.70)	-	0.02* (-3.62)	0.48* (-3.60)
$\ln ins$	-	-	0.12* (9.80)	0.18* (-3.69)	0.25* (-3.34)	1.64* (-4.30)
$\ln s_k$	0.19* (-4.38)	0.20* (-8.81)	0.20* (-3.21)	0.21* (3.05)	0.25* (-3.50)	0.21* (-3.09)
$\ln(n + g + \delta)$	-0.24* (-4.09)	-0.26* (-9.23)	-0.34* (-4.33)	-0.27* (-4.33)	-0.29* (-5.98)	-0.27* (-5.09)
$\ln(GE * ins)$	-	-	-	-	0.50* (-5.13)	-
$\ln(FP * ins)$	-	-	-	-	-	0.14* (-6.14)

Note: The null hypothesis for the  $t$ -ratio is  $H_0 = \beta_i = 1.0$ ; Figures in parentheses are  $t$ -statistics

(\*) and (\*\*) significant with 95% (90%) confidence level;

“between-dimension” reports Pedroni (1996, 2000) group mean panel FMOLS

# Limiting Factors for the Development of China's Tourism Shopping and Countermeasures

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## Abstract

Tourism shopping remains the weak link in the industrial structure of China's tourism industry and to accelerate the development of tourism shopping has become the consensus in the academic circle of tourism industry. In this paper, the author analyzes the limiting factors for the development of China's tourism shopping from three levels, that is, microscopic, mediumscopic and macroscopic, and the author also probes into the countermeasures and suggestions for the accelerating development of China's tourism shopping on this basis.

**Keywords:** Tourism shopping, Limiting factors, Countermeasures

## 1. Introduction

Proportion of tourism shopping expenditure in total tourism consumption is the dominant index, which reflects whether or not the consumption structure in certain country or area is reasonable, and it is also used to evaluate the depth and maturity of the development of tourism industry in certain country or area. Many countries and areas in the world support tourism shopping, which has become the important support in modern tourism economy. Currently, tourism shopping expenditure in western countries such as America, etc, covers 30% to 36% in total tourism consumption and the proportion in China is only about 20% ( Zeng Zhonglu ,2007) .The six essential elements in tourism industry have developed during the development process of China's tourism industry but the relatively undeveloped Purchasing remains the weak link in the industrial structure in China's tourism industry, which limits the effective exertion of the further development of China's tourism industry and its related functions. Tourism shopping is the important tourism requirement of tourists, which is the indispensable link in tourism. To promote the tourism shopping and consumption is favorable for the development of tourism industry with depth and connotation, which has become the consensus in China's tourism circle.

Recently, tourists have strong objections against problems existing in tourism shopping in both domestic tourism and outbound travel and the number of complaints against tourism shopping remains numerous. Information from Quality Supervision Institute of China National Tourism Administration (CNTA) indicates that complaints against tourism shopping increased greatly with many more problems among complaints formally accepted as cases by quality supervision institutes in different levels in 2006 (Xiong Yan ,2007) . Recently, some travel agencies, tourist guides or drivers have fully understood the shopping intentions of tourists and exerted immoral black trades, which has disturbed the normal order in China's tourism shopping market and caused enormously negative influences and it has become one of the main non-harmonious performances in the development of tourism development. Therefore, to analyze the limiting factors for the development of China's tourism shopping and to probe into promotion countermeasures for development of tourism shopping from the aspect of tourism economy in order to realize Multiple Winnings among tourism areas, tourism enterprises and tourists have become the research subject with certain realistic meanings.

## 2. Analysis of limiting factors for the development of China's tourism shopping from three levels

### 2.1 Microscopic level: Direct factors that limit the realization of tourists' shopping requirements

#### 2.1.1 Undeveloped tourism commodities

Tourism commodities remain the important precondition and basis of tourism shopping and consumption. In China, there are abundant kinds of tourism commodities. Nevertheless, we also find out that most tourists have the same feeling, that is, the severe phenomenon of monotonous and duplicate commodities such as tourism souvenir and native products, etc, instead of native products with renowned brands, exists in tourism everywhere and there are little purchasing-worthy products, which is unable to effectively satisfy tourism shopping and it just indicates the lagged condition of tourism commodity development. The contradiction between profundity of potentials in the development of tourism commodity and the lagged condition of its practical development remains the principal



contradiction in the development of China's tourism commodity development, which is the principal problem in front of us.

#### 2.1.2 Fraudulence in commodities and prices

Recently, many problems, namely, impractical quoted prices, virtual height in prices, replacement of quality goods with fakes, replacement of high-quality goods with goods in bad quality, shortage of marked prices of commodities and great difference in quoted prices among similar commodities, etc, are severe in tourism commodity market, which make tourism commodity market bear the notoriety of selling only the commodities with bad qualities, high prices and faked commodities, influence the construction of harmonious relationship between tourism enterprises and tourists and force most tourists to have risk-preventing conscientiousness.

#### 2.1.3 Misled shopping and forced shopping

Some sales personnel in shops and tourist guides irresponsibly exaggerate in the introduction to tourism commodities, mislead tourists and even force tourists to purchase commodities. According to Investigation on Tourism Service Quality on March 15th released by Ctrip in 2007, Forced Shopping has become the largest Cancer in tourism industry and over 60% consumers list it as the most nauseous thing in tourism. We will find, from the aspect of tourism destinations that the outbound tourism shopping complaints focus on Hong Kong and Macau and domestic tourism shopping complaints center on Zhuhai and Shenzhen (Xiong Yan ,2007) . Prices of guided commodities are higher than market prices with unreliable qualities. Tourists' negative mentality and resistance against guided shopping by tourist guides become more and more intense.

Furthermore, problems in some areas, such as imperfect shopping facilities, bad service attitudes of some service personnel, imperfect sale service, shortage of materials in propaganda and introduction to tourism commodities, and severe imbalanced information between suppliers and providers, etc, have also become the limiting factors.

### 2.2 Mediumscopic level: Credibility crisis in tourism industry limits the development of tourism shopping

Recently, behaviors with the deficiency of credibility in some tourism enterprises such as violation against contracts, discounted service, impractical quoted prices, bad qualities and fakes, misled advertisement and fraudulence in prices, etc, occur, which influenced the entire image of China's tourism industry. The negative influence caused by phenomenon of "Zero tourism group fee" happening in places such as Hainan, etc, that is, tourism group composition in low prices, shopping in high prices, benefits division by three parties (travel agencies, drivers and tourist guides, shopping places), aggravates the credibility crisis in tourism industry. The publication of book titled How can I resist the temptations in killing you written by Guo Jingmin makes people to have further attentions to the problem of credibility in tourism shopping, forces most people to have risk-preventing conscientiousness, which is also the important factor limiting the development of tourism shopping. The author summarizes the main reasons from the following aspects:

#### 2.2.1 China's tourism agencies remain in low level and cut-throat competition of low prices exists among them

The amount of China's tourism agencies increases rapidly, 1063 agencies in 1990, 4986 in 1997 and 18475 in 2006, among which there are only about 100 powerful agencies and most agencies are small in size, weak in power, sporadic in location and bad in quality and the contracting of departments makes scale effects of enterprises become less and less. Tourism agency industry enters the state of purchaser's market and meager profit.

Some agencies, pressed by competition and driven by profits, concentrate only on misleading tourists and ignore cost orientation. They sell their products in the way of cutting prices, which makes their profit margin less and less and the phenomenon of zero tourism group fee emerges thereby.

#### 2.2.2 Imbalanced information and limited combat among main bodies of tourism commodities trading

Imbalanced information indicates that one party owns more information in comparison with that of the other one during the trading process owing to the imbalanced information amount, which causes inverse selection and survival of the un-fittest.

Imbalanced information will make tourism commodity suppliers with advantage of information, according to their principle of maximum profits, adopt opportunistic behaviors, namely, enterprises will choose the unfaithful operations when their unfaithful net earnings are larger than their contracted net earnings. Therefore, the deficiency of credibility of tourism commodity suppliers belongs to the market trading behavior and performance with the target for their own maximum profits under the condition of imbalanced information. The larger the imbalanced information is, the more severe the problem of deficiency of credibility in tourism is.

The combat between tourism enterprises and tourists belongs to the limited combat under incomplete information. Imbalanced information puts tourists in disadvantageous position in the combat, which makes them unable to

distinguish the fake from the real, good from the bad. The limited times of traveling for tourists in tourism destinations make them unable to punish the immoral behaviors of illegal enterprises. The limited combat makes it easy for some tourism enterprises to pursue the motive for maximum profits in short periods in immoral methods and causes the deficiency of credibility in tourism enterprises.

### 2.2.3 Declining of moral standard of tourism personnel

Declining of moral standard in management personnel, sales personnel in shops and tourist guides, etc, is obvious, which causes the deficiency of credibility consciousness.

The deficiency of tourist guides' payment security and popularly low prices of tourist guides make them depend mainly upon tips and the rake-off in shopping process for their major economic resources. Some tourist guides in the cooperation with drivers work for tourism shops who take back rake-off from purchasing behaviors of clients, which is obliged behavior to some extent.

## 2.3 Macroscopic level: Ignorance and deficiency of government's management on tourism shopping

### 2.3.1 Insufficient recognition of its importance

Development of tourism shopping resources has been ignored for a long time and nobody takes shopping as one kind of precious resource. Insufficient development of tourism commodities in depth is related to insufficient leading and support by administrative management departments over development, production and sale of tourism commodities.

### 2.3.2 Deficiency of information introduction service

Purchasing of tourism commodities belongs to the consumption in different place. Therefore the integrated providing of service information by government is favorable for lowering purchasing risks with governments' credits and reducing imbalanced commodity information. We will find, after we have consulted web pages of tourism bureaus in many provinces and cities, that information on tourism shopping is extremely limited.

### 2.3.3 Imperfect market administration

Tourism quality supervision institutes in all places often compose of few or over ten people and the costs for execution mainly come from meager interests of quality security earnest money paid by tourism agencies, which determines lower execution amount and frequency in tourism market, causes short-sighted operating behaviors with malignant price declination and common practices of Gresham's Law due to insufficient punishment, makes fakes and commodities of bad qualities flood in the market and damages the general image of tourism commodities.

Insufficient joint control conducted by tourism administrative management department and other administrative management departments.

## 3. Countermeasures and suggestions for development of China's tourism shopping

### 3.1 Aspect of tourists

He Guangwei, Director of CNTA, once pointed out in the work conference aimed to regulate tourism market orders that the immaturity of tourism consumers fosters unhealthy ways and customs in tourism market. Currently most tourists are unknown of their rights and benefits who indulge the irregularities of tourist guides and tourism agencies. Besides, the deficiency of maturity in purchasing and consumption makes them depend on enthusiasm of tour guides and shop personnel in making purchasing decisions instead of being on their own wills. To strengthen self-protecting consciousness and independent consumption consciousness of tourists plays important role in monitoring and promoting the regulation and control of tourism market order.

### 3.2 Aspect of tourism enterprises

#### 3.2.1 Deepen the leading in tourists' requirements

Development of tourism commodities shall be based upon the study on market requirements and insist on tourist oriented development thought, which shall not only provide commodities with obvious characteristics, abundant categories, nice packaging, excellent quality, low price, genuine goods at fair prices, and comfortable shopping environment, but also gradually develop operations such as mail order, consignment and free delivery, etc, which will get rid of tourists' fear of trouble in the rear. Besides, tourism commodity manufacturing enterprises shall strengthen cooperation with dealers and constitute production and marketing alliance, which will better satisfy diversified and individualized shopping requirements of tourists and promote the effective supply of tourism commodities.

Strengthen consciousness of brand and establish brands of tourism commodities, which shall be related to uniqueness of tourism destinations and features of tourism resorts, by which it will enable the commodity to become

spokes commodity of area image or spokes commodity of tourism resort and improve attractiveness and competitive strength.

### 3.2.2 Improve sales methods and strategies

Enterprises such as tourism commodity developers and dealers, etc shall cooperate with administrative departments, make great efforts in promoting sales and improve acquisition capability of tourism shopping information. In the aspect of sales methods, it shall utilize both traditional and modern diversified propaganda methods to increase the transparency of information and improve credibility of information. The only way to form concurrent consumption with preparations is to enable tourists to master full shopping information.

Tourism enterprises such as tourism agencies shall carry out differentiated product strategy and brand strategy. The establishment of brand is mainly based upon the differentiation of commodities, which will increase characteristics of commodities and promote competitive strength of enterprises.

### 3.2.3 Strengthen establishment of its own credibility

Strengthen moral construction and foster credibility culture. Firstly the idea of credibility must exist in moral thoughts of leaders and the moral philosophy and individual quality of leaders in the enterprises determine the development direction of the enterprises and the credibility of tourism enterprises mainly comes from the operation ideas of enterprise leaders. Secondly, carry out education training on employees, form active enterprise culture and promote employees to have excellent professional ethics.

Tourism enterprise especially tourism agencies and shops shall consciously participate in the establishment of credible tourism, conquer the three deficiencies, that is, centering on profits and ignoring credibility; centering on operations and ignoring management; focusing on immediate profits and ignoring long-term benefits, operate with credibility, provide genuine goods at fair prices, provide excellent service, which will satisfy tourists materially and spiritually.

### 3.2.4 Rationalization of tourist guides' payment system

Currently the unreasonable tourist guides' payment system largely impacts tour guides' enthusiasm, which makes tour guides providing best service quality become shopping guide in order to make a living. Therefore, the reformation of currently existing tour guides' payment system is imperative.

Tourism agency shall establish a kind of payment system, which will not only fully reward responsible tour guides, but also punish those who violate against rules by paying all costs, by which tour guides will put all their minds on how to satisfy tourists instead of how to attract tourists to purchase more commodities and force them to go shopping. They will treat the problem of leading tourists in shopping in a correct and active attitude.

## 3.3 Aspect of government

As to the aspect of tourism shopping market, we shall, when we let market, the invisible hand give better play in resource distribution, strengthen the dominant function of government to create an excellent tourism shopping environment. Creditable and harmonious tourism shopping environment belong to typical public belong, which possesses obvious positive externality and needs the correct leading by government.

### 3.3.1 Governments at all levels shall take tourism shopping as the component of tourism industry in developing it

Tourism shopping system is relatively complicated and it is hard to make great achievements relying only on tourism management departments and it is necessary for relative administration departments in governments such as industrial and commercial management department, etc and all essential elements to cooperate together in joint efforts to propel it. Currently all places shall strengthen the basic construction of tourism commodities, make efforts in the establishment of sales networks of tourism commodities in all places, implement refined product project of tourism commodity, start establishing tourism commodity brand in every place, promote the propaganda and strengthen HR training in tourism commodities. Besides, the realization of brand development of native products in different places shall be emphasized.

### 3.3.2 It is necessary to constitute organizational and management platform for tourism shopping

Establish management and organizational institute for tourism shopping, for example, strengthen the establishment of tourism commodity associate or tourism shopping associate, try to make tourism commodity development and sales market more normalized and scientific, encourage and regulate research, development and design for innovated tourism commodities, support the sales of tourism commodities and development of service network, and improve the acquiring capability of tourism shopping information.

### 3.3.3 Strengthen the tourism credibility system establishment and system building, maintain competition orders

It is necessary to strengthen credibility consciousness, improve credibility system in tourism industry and establish

relevant local codes, rules and systems, etc, which will be favorable for establishing good social credit and image for enterprise industry, training professional ethics of related personnel and building an equal and fair market competition environment. The basic framework for tourism credibility system includes: the establishment of tourism credibility database, which will publicly open credibility records of tourism enterprises and relative tourism personnel; establishment of credibility evaluation system for tourism enterprises and relative tourism personnel; establishment of credibility awarding and punishing system for relative tourism personnel, etc. Choose through public appraisal model credibility tourism enterprises and excellent tourist guides to establish models for creditable operations of tourism enterprises and relative tourism personnel. Tourism enterprises without credibility shall be punished to avoid the awkward situation, that is, tourists hesitate to purchase.

#### 3.3.4 Implement combining-four supervision system for tourism shopping market

In order to actually maintain legal rights and profits of tourists, it is necessary to constitute the combining-four, namely, centering legal supervision, administrative supervision, social group supervision and supervision by public opinion, and mutually coordinated model tourism enterprises, establish social mechanism for protecting tourists' rights and benefits, create a fair, equal and credible market competition environment, all of which shall play an important and fundamental role in establishing harmonious society and regulating industrial structure in tourism industry.

Certainly the development of China's tourism shopping is very complicated with numerous influencing factors. But we firmly believe that China's tourism shopping and consumption market will become more and more prosperous and mature with the joint efforts made by all circles in the society, which will greatly promote more continuous, rapider and healthier development of China's tourism industry.

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# A Problem-Analysis-Based Study on the Development Strategy of Small- and Medium-Enterprise Cluster in Shandong Province

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## Abstract

In recent years, the small- and medium-enterprise cluster has gained fast and healthy development in Shandong province, what contributes a lot to the regional economic development. However, its development still confronts many problems and barriers. Based on a deepening research and analysis on the development of small- and medium-enterprise cluster in Shandong province, this paper puts forward a general strategy and development thought to drive the healthy development of small- and medium-enterprise cluster in Shandong province, according to Shandong's present situation.

**Keywords:** Small- and medium-enterprise cluster, Cluster development strategy, Dislocation development, Innovation culture

Recently, Shandong province has kept on providing with favorable policies in fields of land, taxes, and services, for driving the development of small- and medium-enterprise cluster, aiming at cultivating and developing regional enterprise cluster. Since 1993, Shandong province has taken out 50 million Yuan each year to support the development of enterprise cluster. According to data issued by the small- and medium-enterprise office, there are 121 enterprise clusters whose sales have surpassed 500 million Yuan, including 65,926 enterprises and 3.67 million employees. Therein, there are 90 enterprise clusters whose sales have surpassed 1 billion Yuan, 22 have surpassed 5 billion Yuan, and 9 have surpassed 10 billion Yuan (Qigang Yuan. & Jinbao Xia, 2006, p117). By developing enterprise clusters, Shandong province has already built up five advantage industrial systems in fields of machine production, textile and apparel, construction materials, chemical, and food processing, what have greatly drive the economic development of Shandong province. In general, the small- and medium- enterprise cluster in Shandong province develops fast. But there are still many problems and barriers in front of its development.

## 1. Problems and barriers in the development of small- and medium-enterprise cluster in Shandong province

*1.1 There are no regional function positioning and general programming for industry arrangement, and industry isomorphism is severe.*

Because there is no rational programming for regional macro arrangement in different regions of Shandong province, enterprise clusters do not possess a clear and reasonable functional position in regional economy. In fact, different regions in Shandong province merely pursue independent industry system instead of establishing and developing their dominant and key industries based on self advantage resources. As a result, the disorder regional functions and the overlapped industries in regions cause the industry isomorphism issue and the blind competition. Take Qingdao, Yantai, Weihai, Jinan, Weifang for examples. Analyze their degrees of isomorphism by similarity coefficient. The similarity coefficient formula is as follow.

$$S_{ij} = \sum_{k=1}^n X_{ik} X_{jk} / \sum_{k=1}^n X_{ik}^2 X_{jk}^2, (0 \leq S_{ij} \leq 1)$$

Here,  $S_{ij}$  means the similarity degree of manufacturing between city i and city j. 0 means completely different. 1 means totally same.  $X_{ik}$  and  $X_{jk}$  mean the proportions of manufacturing in city i and city j. The calculation result is in table 1.

According to the table above, the degree of isomorphism in manufacturing is higher among Jinan, Weifang, Qingdao, Yantai, and Weihai. In fact, concerning with the ten industries, namely automobile, shipping, petrification, chemical and rubber, new material, electric information, household electric appliance, textile and apparel, food, and medicine emphasized by Shandong Economy & Trade Committee, they overlapped mutually in Qingdao, Yantai, Weihai, and Weifang. Take textile and apparel for example. Qingdao and Weifang are almost at a same level. And even Weifang surpasses Qingdao in productivity. In automobile, Qingdao and Yantai are silimar. In shipping, Yantai and Weihai are almost the same. These cities do not make best use of their special advantages. The isomorphism of industrial structure not only influences the stability of clusters, reducing the driving effect of clusters on regional economy, but also hurt the coordinate development of economy because of the jamming effect, exterior diseconomy, and economic cycle brought about by clusters.

*1.2 The lower degree of enterprise aggregation, the lack of specialization and coordination, and the lower cluster equipment ratio.*

Comparing with the Yangtze Delta and the Pearl River Delta, the aggregation degree of small- and medium-enterprise cluster in Shandong province is lower in general, being lack of high cluster connecting effect. Some industrial zones occupy large areas but generate lower output. The degree of aggregation is lower. For instance, according to the international development zone's economic intensity evaluation standard, an international development zone should achieve a production of 10 billion Yuan per kilometer. Shanghai development zone realizes 6.8 billion Yuan per kilometer, Zhejiang development zone 2.5-3.5 billion, and Shenzhen high-tech zone 6.45 billion. However, the GDP per kilometer realized in Qingdao development zone is merely 30 percent of that in Suzhou, and the foreign trade in the former is merely 17 percent of that in the later, and the real utility of foreign capitals in the former is only 58 percent of that in the later (Yinghui Sui, 2006). Also, a great number of small- and medium-enterprise clusters aggregate in space, without forming mutually-associated and mutually dependent industry system with specialization and coordination. In one cluster, enterprises do not associate closely in business and technology, being lack of clear industry features. The isomorphism of industry is severe. Besides, there is not a perfect mechanism for the cooperation of enterprises, colleges, scientific and technological research institutions in one cluster. Enterprises do not possess strong ability of scientific and technological research, which makes them fail in continuous development.

The lower equipment of local enterprise clusters is more severe. For example, Qingdao's household appliance industry, the best advantage in Shandong province, has to purchase raw materials, electric parts and components from Eastern China and Southern China (for instance, merely 18 percent of parts and components of air condition are purchased in Qindao). Thereof, only 5 percent of core parts and main electric items are purchased locally. In 2003, Weihai determined to develop three industries, namely shipping equipment, mechanic tools, and electric information, among the five industry clusters. Although they associate closely, the match rate in Weihai is very low. Thereof, the match rate of shipping equipment is merely 3.5 percent, and mechanic tools less than 10 percent, and electric information only 20 percent. Comparing with the Yangtze Delta and the Pearl River Delta, the match rate in Shandong is merely 5 percent or 10 percent of that in the former areas. It influences not only the construction of clusters and industrial function regions, but also the quality of foreign capitals and the transfer of high industries, which makes it hard to exert clusters' advantages in specialization.

*1.3 The enterprise cluster is at its initial stage and its development is lower in general.*

Most small- and medium-enterprise clusters in Shandong province are at their initial stages. Most are labor-intensity clusters, with lower technologies. Enterprises in one cluster stress on competition instead of complement. The stability is low. And these kinds of clusters face relatively greater crowding risks. In the aspect of technology innovation, the transformation of scientific and technological fruits and the technological innovation are poor, being lack of core technology and relevant implementation. And the manufacturing base is at the stage of equipment and construction. The added value is low. It is far from a mature manufacturing base that supports design, research, and development. In Shandong, the augment value of manufacturing is merely 30 percent of that in developed countries, and the labor productivity is only 5 percent or so. Although Shandong has lots of large- and medium- manufacturing enterprises, most are at the producing and processing stages, which are far from ODM (original design manufacturer) and OBM (original brand manufacturer). Because the development of manufacturing does not have an innovation system that fits for global economic competition and drives industrial transformation, manufacturing industry confronts with many problems, such as technological upgrade, increasing costs, and profits allocation, what serve as a series of challenges for small- and medium-enterprise clusters' formation and development.

*1.4 The development of foreign-funded enterprise cluster lags behind, and its localization is poor.*

From the quality of foreign direct investment in Shandong province most are small-scale, low- technology, and labor-intensive. Generally speaking, an investment project with latest technologies and long-term competence demands for relatively large scale of investment. The average of transnational companies' foreign direct investment is about 6 million dollars. In contrast, the number is only 1.4 million dollars. Besides, few enterprise clusters are based on foreign direct investment in Shandong province. Even there is, high-tech projects are few. Up till now, the Samsung Electronics Company has already set up 12 factories, and its investment in Suzhou has reached one hundred million dollars. And among Japan's world top 500 companies, 31 have invested in Suzhou. 11 projects have gained an investment more than one hundred million dollars. This number almost occupies one third of world top 500 companies' total investment in Shandong. Besides, Shandong Peninsula has few foreign-funded high- tech projects. Processing industry has occupies a proportion of 70 percent. Both the added value and the profits from exports are lower. Although some industries are regarded as high-tech industries in statistics, most are just processing factories instead of producing real high-tech products or parts. Moreover, in Shandong province there is a

“copy cluster chain” phenomena for the foreign-funded enterprise clusters. It is hard for foreign-funded enterprises to amalgamate with local economic and social development. Their localization is poor. For example, most equipped companies for Shandong Samsung Electronics Company already serve the later in Korea. The technologies of local companies can not meet relevant technological requirements. Rongcheng Huatai Automobile has to import key parts from Korea. And 56.2 percent of parts are purchased in China. It just buys parts from Triangle Group in the same city. The match rate is only 2.5 percent in city.

*1.5 The government emphasizes the development of large companies and groups but neglect that of small- and medium- enterprises.*

Shandong economy is featured by “large company, large brand, and large industry”. The state-owned large companies have gained well development. But private small- and medium-enterprises do not. Next, let’s analyze the fixed assets of different economic subjects in Shandong province in recent ten years from 1996 to 2005 (table 2).

From the figure 1, the proportion of state-owned assets is decreasing annually in Shandong province. Accordingly, the proportion of foreign-funded assets is increasing annually. But the proportion of other economic subjects (chiefly the private economy) does not change a lot, wondering around ten percent. It is well known that the subjects of cluster are chiefly small- and medium- enterprises that belong to private economy. As a great economic province, Shandong does not have well-developed private economy. The effects of small- and medium-enterprises does not gained sufficient emphasis, which makes Shandong province fail to match its position in national economy. The government’s supportive policies are not equal, laying more stresses on large companies and groups, neglecting small- and medium-enterprise clusters, emphasizing super large companies and projects, omitting small- and medium-enterprises and projects. As a result, it affects the healthy development of small- and medium-enterprise clusters in Shandong province to a great degree and the general improvement of regional economic quality. It is urgent to encourage private enterprises to realize further development, which will contribute to an industrial cluster and chain development.

## **2. The general strategy of driving the development of small- and medium-enterprise cluster in Shandong province**

### *2.1 Constitute a general industry programming, and realize clusters’ dislocation competition and coordination*

Whether Shandong’s small- and medium-enterprise cluster can achieve healthy and long-term development or not is determined by whether the government can constitute a rational programming for industry’s general development, realizing the dislocation competition and coordination between regions and clusters, changing the industrial isomorphism and blind competition. Therefore, the initial step is to take the whole province as one great system, comprehensively innovating and perfecting the coordinate system, constitutions, and organizations, forming a general programming for regional development, insisting the principle of economic integration, and achieving the regional integration of economic development. Therefore, it is necessary to deal with the relationship of resources allocation, uses, and exchanges among regions in Shandong province. Use the policy guidance in cluster development and common market to ensure the transfer of industries and the clusters’ effective cooperation. In this process, lay stresses on the important effects of integrated rules, services, and networks. Generally program and integrate civil technology standards, research and development resources, industrial arrangement, industrial emphasis, and inviting investments. Make the enterprise clusters in Shandong province possess perfect functions, prominent emphasis, well coordination, and special advantages. Improve the core competence of cluster economy further.

Secondly, cities and counties should exert their comparative advantages and competitive advantages completely according to their regional resources structure, assets structure, and industrial bases, expediting the formation of special cluster advantages over other regions. With “special products, special talents, and special strategies”, and the rational choice of social regional center, cities and counties can build up their competition marks and regional brands that meet international standards, speeding up the transformation of people, logistics, capitals, technologies, and information. By developing enterprise clusters and relevant industries, cities and counties can increase the values of cluster assets.

Thirdly, the development of Shandong’s small- and medium-enterprise clusters has to follow the principle of comparative interests, strengthening the regional clusters’ advantage complement and differentiating cooperation. Realize mutual complement by exchanging regional factors. Exert regional advantages to the largest degree. Make best use of regional resource advantages, industrial advantages, and capital advantages. Therefore, the interest-related subjects in clusters development should focus on the whole regional development, and consider others’ interests in development. Based on the regional industry economic cooperation spirit, namely “mutual benefit, complement each other”, all interest- related subjects should lay more stresses on sorts of technological

association, specialization, and coordination. With the support of local governments, they can realize an effective connection of regional advantages and transaction services between regions.

### *2.2 Develop small- and medium-enterprises greatly, and increase the clusters' match rate in local area.*

Whether an enterprise cluster can success or not is determined by the head enterprise in the cluster and the coordination of equipped small- and medium-enterprises. Therefore, we should stresses on the cultivation of head enterprises in clusters. Following the principle of government guidance and market operation, support the best and help the power. By augment investment and large projects, cultivate large companies and brands with core competence. Make them exert their heading effects. Meanwhile, clusters are an industrial ecological system. It demands for mutual complement of small- and large- enterprises. Its development is realized in the process of competition and cooperation. Without equipped services from amounts of small- and medium-enterprises, clusters can not exert their advantages. Why lots of Japanese automobile brands achieve success and fast development depends on the support of thousands of equipped small- and medium-enterprises. Therefore, as we cultivate the head enterprise in a cluster, we should emphasize the development of small- and medium-enterprises, encouraging them, especially the energetic private enterprises, to join in the large enterprise' industrial system, forming rational industrial arrangement, driving specialization, achieving a nice circulation of mutual support and cooperation between "the head and the followers", improving regional industries and technologies' competitive advantages, and further expanding the development space of clusters.

To build up a series of equipped resources rapidly is the common way adopted by Tianjin, Suzhou, Kunshan, and Dongguan in order to cultivate large enterprise clusters. In Kunshan, the government sets up a special institution in charge of industrial construction, executing an exterior equipped engineering, and taking out special capitals from finance as encouragement funds and capitals to support the development of equipped enterprises. Presently, it has already cultivated 528 private equipped enterprises, accounting for 90.4 percent of total equipped enterprises. It is possible for Kunshan government to invite all computer parts producers to invest in Kunshan in order to produce a complete computer in Kunshan city. The equipped enterprises greatly decrease the costs of exterior investors, which serve as Kunshan enterprise clusters' largest competitive advantages over other regions. We can take references from these facts. At the same time, it can enhance the localization of foreign-funded clusters.

### *2.3 Emphasize on the introduction of foreign capitals, and lay more stresses on developing extroversive enterprise clusters.*

The development of extroversive economy and the introduction of foreign capitals serve as the main driving powers for clusters' fast development. According to the development experiences of southern advanced regions in recent years, the cultivation of one dominant industry has to be guaranteed by two or three projects with more than 50 million dollars per project each year, or one great project with more than 100 million dollars. By this way, it takes three or five years to form a series of extroversive and characterized enterprise clusters. Therefore, we should grasp the strategic chance of world economic structure adjustment, stressing on inviting investments from Japan, Korea, Europe, and America, trying to realize the transformation from project investment toward industrial investment, and the transfer from product-oriented co-funding and cooperation toward cooperative reengineering, purchase and merge, and multi-level transnational strategic cooperation, which can help to gain more technological overflow and knowledge property right. Follow products' added value standard to realize industrial chain investment. Emphasize on the introduction of transnational projects. Make best use of the foreign-funded projects' industrial associative effect, and lay stresses on trace researches on industries and its upward products and downward products. Force equipped enterprises to catch up with the large project. Ensure that the introduction of one large project can form one big industry. In special, build up all kind of favorable conditions and help to set up joint-funded research and development centers. Create a technology-sharing mechanism for foreign-funded enterprises and local enterprises. Drive the upgrade of technologies in local enterprises.

Shandong peninsula city group locates in the seaside of eastern China, neighboring with Japan and Korea over the sea. The distance from Yantai and Weihai to Korea is less than 100 kilometers. Facing with the great chance of economic structure adjustment and industrial transformation in Japan and Korea, Shandong peninsula should make best use of its excellent location, exerting its regional advantages completely. Construct a Japan-Korea "industrial coordination zone" and develop into a production and supply base for Japan and Korea's automobiles, shipping, components of household appliances, parts of large equipments. At the same time, it is necessary to adjust the operation of clusters and enterprises to meet the international rules, guiding clusters and enterprises to produce, process, and sale according to the international standards, speeding up the step of joining in the global manufacturing net and transnational supply chain.

In the process of inviting investment, we should deal with the relationship of clusters' construction and projects'



short-term interests and long-term interests properly. Evaluate and balance the performances of foreign-funded projects rightly. Emphasize both effects (economic and social effects) and quality (technology, product, and industry structure). Avoid any exaggeration and bubbles in clusters' construction. Meanwhile, the market behavior of foreign capitals in Shandong province should be regulated, managed, directed, and controlled according to international rules and local situations. Clear the irrational benefit policies in local areas completely. Constitute general benefit policies for regional industry. Realize the national treatment for foreign-funded enterprises gradually.

#### 2.4 Create a better innovative environment and drive the industrial upgrade of clusters.

The final power that helps to achieve the long-term economic growth in one area is not from natural resources and material capitals, but from scientific and technological progresses and ability of innovation. Therefore, we have to associate the cultivation and development of small- and medium- enterprise clusters with the construction of provincial innovation system, creating an innovation- favorable environment, which can help to improve the ability of research and development, realizing the upgrade of clusters. From the successful enterprise clusters in foreign countries, the government exerts an important effect on the construction of enterprise clusters' innovation environment. And the effect of government serves as a vital condition in determining the success of enterprise clusters.

Firstly, inspire and encourage innovation by supportive policies. The government should make best use of financial policies and taxation policies to encourage clusters and enterprises to keep on making innovation. These policies include financial discount, local tax return, income tax relief and special funds. Meanwhile, the government should support certain locally-characterized innovation projects or some powerful innovative enterprises. Besides, the government should take the lead to achieve the mutual cooperation between financial institutions, medium agencies, colleges, science and research institutions, and enterprises. Constitute relevant policies to encourage enterprise clusters to join in the global industrial value chain system, which can help to improve their abilities of self-innovation, by learning, assimilating, and absorbing the advanced technologies from transnational companies.

Secondly, construct an overall service system to provide with multi-level services for clusters' innovation. For example, the government can provide with fundamental facilities and public facilities, such as better transportation, communication net, supply of water and electrics, for the development of enterprise clusters. Develop the medium agencies for technological innovation. By building up online technology market and online database for scientific and technological talents, these agencies can provide with information collection and issuance, technology evaluation consultation, technology training service, technology management, and legal services. The government can also organize certain research and development activities and construct a regional innovation platform based on enterprise clusters. Absorb amounts of talents into the platform and improve the innovation ability of clusters and regions. Turn clusters into manufacturing bases supported by design, research, and development.

Besides, emphasize the creation of a better innovative culture and realize the ecological and sustainable development. The government should create a cultural environment that benefits innovation, combining with local features of culture. People in Shandong are hardworking, intelligent, brave, kind, and firm. All these merits contribute to the relatively better development of Shandong's small- and medium-enterprises clusters. However, Shandong people are conservative in general. They are lack of energies in gaining greater success. The spirit of innovation is weak. Therefore, the provincial government in Shandong should encourage the spirit of innovation and the cultural value of confronting risks among people, helping them to accept new things and pursue self values. Besides, the government should cooperate with the media to improve innovative entrepreneurs' political and social positions, creating a better environment for innovation.

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Table 1. The similarity coefficient of manufacturing in Shandong peninsula.

	Jinan	Weifang	Qingdao	Yantai	Weihai
Jinan	1.00	0.44	0.69	0.65	0.41
Weifang	0.44	1.00	0.48	0.82	0.76
Qingdao	0.69	0.48	1.00	0.72	0.63
Yantai	0.63	0.82	0.72	1.00	0.78
Weihai	0.41	0.76	0.63	0.78	1.00

Resource: Cities' Statistical Yearbooks in 2004

Table 2. The structure of fixed assets in Shandong province from 1996 to 2005 (%).

Year	State-owned	Collectivity-owned	Foreign-funded	Other
1996	44.4	31.1	11.5	13.0
1997	43.1	31.8	11.6	13.5
1998	45.6	29.7	11.4	13.3
1999	46.9	28.6	10.5	14.0
2000	45.4	26.7	14.0	13.9
2001	41.2	24.5	20.6	13.7
2002	35.3	23.1	27.7	13.9
2003	30.0	22.2	33.9	13.9
2004	25.1	23.2	37.9	13.8
2005	18.0	24.8	40.1	17.1

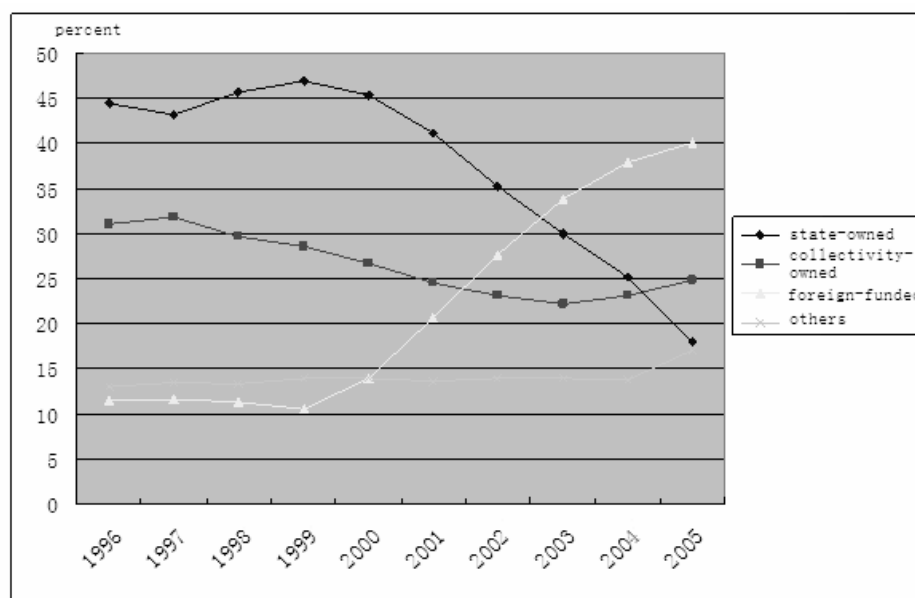


Figure 1.

Resource: Shandong Statistics Yearbook.

# Leverage Effect and Market Efficiency of Kuala Lumpur Composite Index

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## Abstract

Stock market is a main source for raising new private capital in many developing countries including Malaysia. Therefore, its efficiency and leverage effect is utmost important and interest. This paper aims to estimate the leverage effect of Malaysian stock market using EGARCH as well as investigating its efficiency using Augmented Dickey-Fuller (ADF). Data used consists of weekly closing prices for Malaysia stock market indices, namely the Kuala Lumpur Composite Index (KLCI), from 9 January 2004 to 8 Jun 2007. Results show that the EGARCH model did not confirm the existence of the leverage effect. The KLCI possess a unit root with no trend but with drift or known as random walk drift. It suggests that KLCI is weak form hypothesis.

**Keywords:** Market efficiency, Leverage effect, Kuala Lumpur Composite Index (KLCI), Malaysia

## 1. Introduction

Stock market has been critical to many developing economies, playing important roles as source for new private capital and information dissemination. Hence, various empirical models, particularly time series models have been employed to study stock market leverage effect and efficiency. Time series models could explain the dynamics of financial time series and thus the applications of the ARCH model introduced by Engle (1982) or its extension Generalized Autoregressive Conditional Heteroscedasticity (GARCH) by Bollerslev (1986) in finance have become commonplace. Generally, this type of non-linear time series model is able to capture a special type of non-linearity in the data generating process, known as multiplicative non-linearity, or non-linear-in-variance, in which non-linearity affects the process through its variance (Hsieh 1989). For most financial data, one of the stylized features is that they do experience volatility clustering and thus GARCH models have been popular used for examined financial data because they are able to capture this clustering feature. Despite their popularity, the ARCH parameterization of the conditional variance does not have any solid grounding in economic theory, but represents 'a convenient and parsimonious representation of the data' (Hall et al. 1989).

Many studies have tries to estimates the leverage effect in the stock market. Many empirical studies use different kind of model to estimate the leverage effect. In which this paper will focus on the Exponential GARCH model to estimate whether there is leverage effect on the stock market. In earlier period many authors uses GARCH model to capture the leverage effect. But if GARCH shows the negativity in volatility, it's meaningless. So, non-negativity constraints have to be imposed on these parameters. Nelson (1991) stated that the non-negativity constraints in the GARCH model are too restrictive. He introduced the Exponential GARCH (EGARCH) model to overcome this

problem. EGARCH models the logarithm of the conditional variance where, the coefficient  $\gamma$  measures the asymmetric effect, which if negative, indicates that negative shocks have a greater impact upon conditional volatility than positive shocks of equal magnitude. EGARCH has certain advantages over GARCH. Firstly, by using the exponential formulation, the restrictions of positive constraints on the estimated coefficients in GARCH are no longer necessary. Secondly, GARCH fails to capture the negative asymmetry apparent in many financial time series. The EGARCH model solves this problem by allowing for the standardized residual as a moving average regressor in the variance equation, while preserving the estimation of the magnitude effect. Due to the argument about, this paper will apply EGARCH model to capture the Malaysia stock markets data.

Further studies will hold to examine the weak form market hypothesis. A vast number of the empirical studies on efficient market hypothesis in the stock markets have been examined, which asserts that stock market price should reflect the intrinsic value of underlying assets. According to Fama (1970), a market is efficient if prices fully reflect all available information on a particular stock market. This means that there are no opportunities for investors to make abnormal returns by exploiting information contained in the history of fundamental data (includes price movement as well as indicators of changing economic fundamentals). When asset and commodity markets are efficient, economic agents who make decisions on the basis of observed prices will insure an efficient allocation of resources. Furthermore, the issue of efficiency is particularly important for emerging markets because efficiency signals an increase in liquidity, a removal of institutional restrictions and an increase in the quality of information revealed in these markets.

Fama (1970) categorized three forms of market efficiency which is weak form, semi-strong form and strong form. These three forms differ in terms term of the types of information which are used in developing investment strategies. This paper is concerned with the weak form test of the efficient market hypothesis only because if the evidence fails to pass the weak form test, there is no reason to examine strong forms before declaring the market inefficient on such evidence (Wong and Kwong, 1984). Efficient market hypothesis (EMH) states that weak-form efficiency exists if security prices fully reflect all the information contained in the history of past prices and movement. As McNish and Puglisi (1982) pointed out, a sufficient condition for weak-form efficiency is that stock price fluctuates randomly. Thus, a market is efficiency in weak-form if stock prices follow a random walk process. If capital markets are weak-form efficient, then investors cannot earn excess profits from trading rules based on past prices or returns. Therefore, stock returns are not predictable, and so-called technical analysis (analyzing patterns in past price movements) is useless. Following the seminal paper of Fama (1970) on market efficiency, a large number of empirical studies have been conducted which find evidence in support of efficient market hypotheses. But Fama's seminal paper set the theoretical basis for the concept of efficiency in capital markets, and the methodology for testing certain aspects of the hypothesis of efficient markets. Therefore, tests for Fama's efficient market hypothesis (EMH) in the context of stock market usually meant testing the null hypothesis that autocorrelation coefficient of different lags are statistically insignificant.

The main purpose of this paper will focus on the EGARCH to estimate the leverage effect of Malaysia stock market. Further studies will investigate the weak from efficiency for Malaysia stock market using Augmented Dickey-Fuller (ADF). The remainder of this paper is organized as follows. The second part will provide an extensive review of literature on the efficient market hypothesis with emphasis on time series studies. Part three will introduce the methodology with an emphasis on recent econometric developments in time series analysis. Part four will concentrate on the empirical results obtained from the research and the final part will provide conclusions of the research.

## 2. Literature review

In the literature, the family of GARCH models has grown at a wonderful rate. Engle (1995), Hentschel (1995) and Pagan (1996), among others, provided an excellent account of the variations and extensions of GARCH models over the years. In the GARCH models, the variance is time varying and this provides an alternative and useful measurement of volatility. Volatility refers to a statistical measure of the dispersion of a return distribution, and it is specified as the square root of the conditional variance estimated on the basis of the information available in  $t$ , and projected  $\tau$  periods ahead (Schwert, 1990). In the literature, consensus has been reached that volatility in asset returns has some basic characteristics such as volatility clustering, leptokurtosis or fat tails, leverage effect and mean reversion.

Normally, the plot of financial time series data such as stocks, exchange rate is often observed that large and small changes tend to occur in clusters. That is, large returns are followed by more large returns, and small returns are followed by more small returns. This behavior was first evidenced by Mandelbrot (1963) and Fama (1965), and further reported by Baillie et al., (1996), Chou (1988) and Schwert (1989). The implication of volatility clustering is that volatility shocks today will influence the expected volatility many periods ahead. In this paper, the stock market

data will be plotted to check the volatility clustering. Figure 1 shows that stock market (KLCI) produces volatility clustering which larger return follows by larger return and smaller return follow by smaller return for the period from year 2004 to 2007.

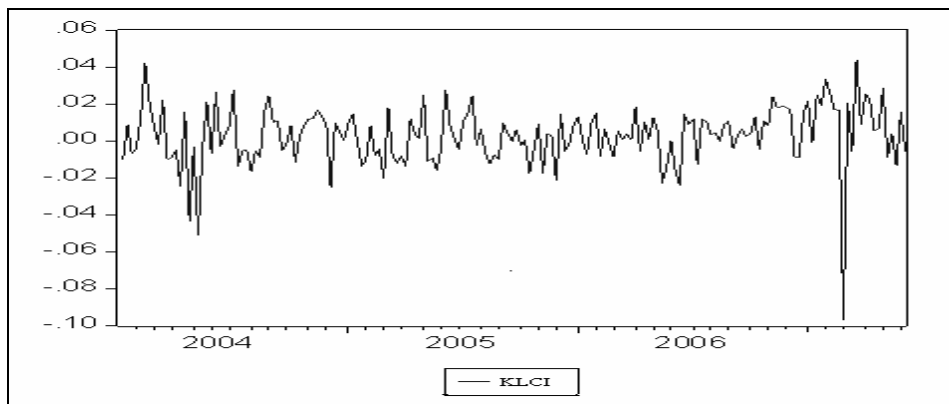


Figure 1. Volatility Clustering of the KLCI

Financial time series often show fat tails in their distributions. This phenomenon is usually referred to as leptokurtosis. Simply stated, this means that we observe more extreme values (outliers) than we expect to. Statistically, fat tails suggest that the kurtosis of the return series exceeds the kurtosis of a standard Gaussian distribution (Mandelbrot, 1963). Besides that, it is often observed in many stock returns that volatility is higher after negative shocks (bad news) rather than after positive shocks (good news) of the same magnitude. So volatility seems to be affected asymmetrically by positive and negative returns. This fact is called the leverage effect and was first noted in Black (1976). The leverage effect suggests that changes in stock prices tend to be negatively correlated with changes in volatility. Christie (1982) and Nelson (1991) both documented this negative relationship of volatility with equity returns. Engle and Ng (1993) described a News Impact Curve with asymmetric response to good and bad news. Therefore, this paper will concern the leverage effect of Malaysia stock markets data.

Most financial practitioners believe volatility is mean reverting. For example, Engle and Patton (2001) interpreted mean reversion of volatility as meaning that there exist a normal level of volatility, to which volatility will eventually return. Extremely long run forecasts of volatility should all converge to this normal level of volatility, and current information has no effect on the long run volatility forecast. The properties addressed above have important implications for the understanding of various volatility models, as the development of volatility forecasting models is largely motivated to capture and reflect these stylized facts in volatility.

The GARCH models have been known for more than two decades, most of their applications are on the widely traded financial markets of developed industrialized countries. However, there is a growing trend of their applications in the Asian stock markets, for instance forecasting volatility of stock returns (Choo et al. 1999), modeling the volatility of stock index futures market (Tan 2001) and determining volatility spillover effects among major Asia-Pacific stock markets (Hooy and Tan 2002). While these Asian studies involved different applications of GARCH models, none of them conducted a thorough investigation to determine the adequacy of the GARCH models.

This issue is of great importance to the field of finance in view of the wide application of GARCH models in understanding the relationship between risk and expected returns, particularly in the areas of asset pricing, portfolio selection and risk management. Motivated by the above consideration, this study contributes to the current literature by addressing the fundamental issue of GARCH adequacy in characterizing the behavior of Malaysia KLCI stock returns series. GARCH models are capable of capturing the first two properties of the return series, but their distribution is symmetric. Therefore, fails to model the leverage effect (good and bad news). To solve this problem, many nonlinear extensions of the GARCH model have been proposed in the last twenty years. Among the most widely spread are EGARCH of Nelson (1991), Threshold ARCH (TARCH) and Threshold GARCH (TGARCH), which were introduced independently by Zakoian (1994) and Glosten, Jagannathan and Runkle (1993). This paper will apply the EGRACH model that introduced by Nelson (1991) to test out the leverage effect.

Financial economists have studied the relationship between risk and expected returns and the conditional volatility of stock markets. For example, Baillie and DeGennaro (1990) studied the dynamics of expected stock returns and volatility in the U.S. stock markets. Poon and Taylor (1992) investigated the same relationship in the U.K. stock market. Both studies found volatility clustering, predictability, and persistence is presented in these markets. For

practical forecasting purposes, however, the predictability of various conditional volatility models is of most concern, whereas the results on this issue are inconsistent in the literature. Pagan and Schwert (1990) compared GARCH, EGARCH, the Markov switching regime and three nonparametric models for forecasting monthly U.S. stock return volatilities. The EGARCH, followed by the GARCH models, were found to perform moderately, while the remaining models produce very poor predictions.

Besides testing the volatility and the clustering effect of stock markets, there have been many studies on the random walk hypothesis (RWH) for stock markets efficiency for different countries. The rejection of the RWH implies that stock returns are predictable on the basis of its own lagged values, which can say that the markets are not weak-form efficiency. However, the empirical evidence of random walk on the weak form efficiency indicates mixed results. Conrad and Juttner (1973) applied parametric and non-parametric tests to daily stock price changes in the German Stock Market. They found that the random walk hypothesis is inappropriate to explain the price changes. Furthermore, Frennberg and Hansson (1993) examined the random walk hypothesis using Swedish data from 1919 to 1990. They found that Swedish stock prices have not followed a random walk in that period. Cooper (1982) studied world stock markets using monthly, weekly and daily data for 36 countries. He examined the validity of the random walk hypothesis by employing correlation analysis, run tests and spectral analysis. With respect to the USA and the UK, the evidence supports the random walk hypothesis. For all other markets, the random walk hypothesis can be rejected. Whereby, Panas (1990) could not reject the hypothesis of random walk and thus demonstrated that the Athens stock Market is efficient. This paper will studies the RWH for Malaysia stock market efficiency as well.

### 3. Methodology

#### 3.1 EGARCH

The EGARCH model is an alternative choice to accommodate the asymmetric relationship between stock returns and volatility changes. EGARCH (1, 1, and 1) is chosen as the appropriate model for the return series.

$$\ln h_t^2 = w + \beta \ln \sigma_t^2 + \delta \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad (1)$$

where  $h_t$  is the risk of the market. If  $\gamma$  hypothesis do not reject, then the model does not have leverage effect. If the  $\gamma$  is negative then it shows that the good news is better than bad news and vice versa. For the  $\delta$  is to capture the negative value which to avoid the negativity constraint.

#### 3.2 Weak form hypothesis

The weak EMH model can be return as

$$R_t = \alpha + \mu_t \quad (2)$$

Expressing  $R_t$  as the differences between two successive logarithmic price indexes

$$\ln P_t = \alpha + \ln P_{t-1} + \xi_t \quad (3)$$

Applying the augmented Dickey-Fuller test (ADF) test that addresses the problem of autocorrelation in  $\xi_t$ ,

equation 3 may be tested by

$$\Delta P_t = \beta_1 + \beta_2 T + \lambda P_{t-1} + \tau_t \sum \Delta P_{t-1} + \mu_t \quad (4)$$

with  $T$  being time trend. In performing the ADF test the lag length  $m$  is selected such that the new error term  $\mu_t$  is

free of auto correlation. This paper uses Akaike Information Criterion to check the significant lag length to test.

### 4. Results

#### 4.1 Data

In this study, the data consist of weekly closing prices for Malaysia stock market indices Kuala Lumpur Composite Index (KLCI), these indices collected from Bursa Saham Malaysia. The prices covering the sample period from 9 January 2004 to 8 Jun 2007 are transformed into a series of continuously compounded percentage returns, using the relationship:  $r_t = \log(P_t / P_{t-1})$  where  $P_t$  is the closing price of the stock on week  $t$ , and  $P_{t-1}$  the price on the previous trading week.

#### 4.2 Test for stationary

To provide a better description of the time dependant pattern that is important in modelling the series under study, it is necessary to test the stationarity of the return series, which is an approximation of the volatility process. This paper tests for stationarity can be performed by the Augmented Dickey-Fuller (ADF) unit root test. As reported in Table 1, show the result with no constant and no lagged term, the ADF t-statistic for the return series is  $-7.374291$ , which is less than the critical value of  $-2.567926$  at the 1% significance level. Therefore, we can reject the unit root hypothesis of the return process with a confidence level of more than 99%. Furthermore, in Table 1, the paper concludes that the KLCI return series are stationary.

Table 1. Augmented Dickey-Fuller Tests for Unit Root on the Returns of Malaysian KLCI for the period from 9th January 2004 to 8th Jun 2007

variable	t-statistic
KLCI	$-7.374291^*$

Notes: The null hypothesis is that the series is non-stationary, or contains a unit root for the ADF.

The rejection of null hypothesis for ADF tests based on the Mackinnin critical values

\* indicates the rejection of the null hypothesis of non-stationary at 5% significance level.

#### 4.3 Test for ARCH effect

The results of the ARCH LM test for the return series on the KLCI index in Table 2. It is interesting to see that lag 1 and lag 2 AR terms are not significant in the ARCH LM test, whilst lag 3 and lag 4 terms are significant in the test. This indicates that volatility displays a long memory, or long-term dependence. The ARCH LM test, in Table 2, F-statistic is significant, with a p-value of 0.088673 with a confidence level of 10%. This paper concludes that ARCH effects exist and the variance of the return series is non-constant. This result can be further confirmed by examining the correlogram of the squared standardized residuals from the mean equation the Q-statistics from lag 3 are highly significant, indicating the existence of an ARCH effect. It shows that the data have ARCH effect. The paper will proceed to test the EGARCH to determine the leverage effect.

Table 2. ARCH LM Test

F-statistic	2.056827	Probability	0.088673*
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Note: (\*\*\*), (\*\*), (\*) denotes significance at the 1%, 5% and 10% level respectively

#### 4.4 Testing for EGARCH

$$h_t = -8.909048 + 0.514998 \sigma_t + 0.346928 \delta_t - 0.016686 \gamma$$

$$(1.9422941) \quad (0.228860) \quad (0.168054) \quad (0.236854)$$

The EGARCH model did not confirm the existence of the leverage effect, because the measure of the leverage effect  $\gamma$ , which equals to  $-0.016686$  is larger than the critical value, which indicates that any news in the market would not reflect in the stock market. The ARCH LM test in Table 3 indicates the F-stat cannot be rejected at any significant level; there is no ARCH effect left in the model. The paper uses LM autocorrelation test to find out the autocorrelation problem and find out that the result support the null hypothesis. Also, normality test been conducted to test whether the model is normal; the test supports also the null hypothesis. The paper shows that there is no misspecification error in the model.

Table 3. EGRACH LM Test

F-statistic	0.944166	Probability	0.439946
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Note: (\*\*\*), (\*\*), (\*) denotes significance at the 1%, 5% and 10% level respectively

#### 4.5 Testing for weak form hypothesis

Table 4 illustrates that, the KLCI possess a unit root with no trend but with drift or known as random walk drift. It suggests that KLCI is weak form hypothesis. The paper shows that the F-stat is more than the critical value which this show that the null hypothesis cannot be rejected. The KLCI cannot be predicted or no technical analysis can be used to determine the price movement.

Table 4. Augmented Dickey-Fuller Tests for Unit Root on the Natural Logarithms of Malaysian KLCI for the Period from 9<sup>th</sup> January 2004 to 8<sup>th</sup> Jun 2007

variable	without trend	trend
KLCI	0.684266	-0.92001

Notes: The null hypothesis is that the series is non-stationary, or contains a unit root for the ADF.

The rejection of null hypothesis for ADF tests based on the Mackinnin critical values

\* indicates the rejection of the null hypothesis of non-stationary at 5% significance level.

#### 5. Conclusion

In this paper, the EGARCH has been tested for KLCI. The result show that the market would not captured the bad or good news. The results may support the behavioural finance theory which indicates that people will think irrationally or the market is random walk. For example, a person purchase a stock with their prediction that the stock price expected to increase in the future, any bad news about the stock would effect his decision because the person believe his stock or may not want to admit that he made the wrong decision. So, this kind of person would hold the stock until it rises.

For the weak form EMH result show that KLCI move randomly which no one can predict the stock price movement. This result may be supportive with the EGARCH in the sense that the stock price has already fully reflected all available information into the market. Which any news cannot shift the stock price movements. Moreover, it can be said that any technical and fundamental analysis cannot be performed to predict the stock price.

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# Research on Bertrand Dual-Oligopoly Dynamic Game Model

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## Abstract

In this article, we study the equilibrium solution and the dynamic change process of the Bertrand price competition model under the condition of dual-manufactures, give the model of dynamic change, prove that whatever manufactures choose about price, the equilibrium solution only exists, and prove that the manufacture's price change process must be the monotonic process, and develop relative conclusions of the Bertrand model.

**Keywords:** Bertrand model, Dynamic game, Equilibrium

For  $i(i=1,2,\Lambda I)$ , if  $u_i(\sigma_i^*, \sigma_{-i}^*) \geq u_i(s_{ij}, \sigma_{-i}^*) \forall s_{ij} \in S_i$  comes into existence, the mixed strategy section  $\sigma^*$  in the problem of complete information static game is called as the Nash equilibrium of the game. The introduction of Nash equilibrium offers a base to confirm the equilibrium of the oligopoly market, and on the Nash equilibrium, various manufactures will consider their competitors and suppose their competitors will do the same thing. In 1883, French economist Joseph Bertrand utilized the concept of Nash equilibrium in the Bertrand model established by him to study the price competition, afterward that model was broad used to explain and analyze phenomena and problems about price competition, and analysis and researches about dynamic price competition game were numerous. The reference 1 gives the different oligopoly optimal orientation pure strategies and their respective optimal profits under conditions of different cost advantages. The reference 2 introduces the oligopoly dynamic game problem under the situation of information asymmetry. And many references from reference 3 to reference 6 analyze different problems from different views, but the analysis has not displayed the equilibrium solution and the dynamic change process of the oligopoly competition. In the reference 7, professor Tang Xiaowo utilizes the Cournot model to study the dynamic competition problem under dual oligopoly manufactures, but this model is on the base of output competition, more dynamic competition problems about price exist in fact.

## 1. The introduction of Bertrand dual-oligopoly manufacture model

We consider the Bertrand dual-oligopoly model and suppose that two oligopoly manufactures produce same products with different brands, different qualities and different packages, manufacture A and manufacture B respectively select price  $p_A$  and  $p_B$ , and the demand function to the manufacture i is  $q_i = f(P_i, P_j)$ , and  $q_i(P_i, P_j) = a - P_i + bP_j$ , where,  $b(|b| < 1)$  reflects the reflection degree of the manufacture i's product to the manufacture j's product (here, suppose that the price demands to the competitive manufactures' products have same influencing coefficient). We make the marginal cost as the constant  $c$  ( $c < a$ ) and don't consider the fixed production cost. Two manufactures select their prices at the same time, so the manufacture i's profit function is  $u_i(p_i, p_j) = q_i(p_i, p_j)[p_i - c]$  ( $i=1,2)(i \neq j)$ , and from the profit function we can obtain

that  $P_1^m = P_2^m = P^m = \frac{a+c}{2-b}$  is the Nash equilibrium of the game, and here two manufactures get the profit

$$\left[ \frac{a + (b-1)c}{2-b} \right]^2 \quad (\text{Jean Tirole, 1997}).$$

When the manufacturer A in the market first enters into the market, he sets down the product price  $p_A(1)$ , and the manufacturer B makes his optimal price  $p_B(1) = \frac{a+c+bP_A(1)}{2}$  according to the demand function

$q_{i(P_i, P_j)} = a - P_i + bP_j$  and the condition of profit maximization. In the same way, if the manufacturer A adjusts his price to  $p_A(2) = P_A(1) \pm \Delta P_A(1)$ , the manufacturer B will correspondingly adjust his price to  $p_B(2) = \frac{a+c+b(P_A(1) \pm \Delta P_A(1))}{2} = p_B(1) \pm \frac{\Delta P_A(1)}{2}b$ . The other way round, if the manufacturer B adjusts his price to  $p_B(2) = p_B(1) \pm \Delta P_B(1)$ , the manufacturer A will also correspondingly adjust his price to

$$P_A(2) = \frac{a+c+b(P_B(1) \pm \Delta P_B(1))}{2} = P_A(1) \pm \frac{\Delta P_B(1)}{2}b.$$

Therefore, for one time game, according to the hypothesis of the model, we can obtain that manufacturer j's optimal

adjustment extent is  $\frac{b}{2}\Delta P_i$ . But in fact, the game process of two oligopoly enterprises is dynamic and multistage, and we need to review the first manufacturer's equilibrium solution and dynamic change process under the condition of initial random selection.

## 2. The dynamic process and equilibrium of Bertrand price competition

Suppose that the price that the first manufacturer (manufacturer A) enters into the market is  $p_A(1)$ , and the price that the second manufacturer (manufacturer B) enters into the market is  $p_B(1) = \frac{a+c}{2} + \frac{b}{2}p_A(1)$ . After that, according to the price of manufacturer B, the manufacturer A adjusts his optimal price to  $p_A(2) = \frac{a+c}{2} + \frac{b}{2}p_B(1)$ , correspondingly, the price of manufacturer B is adjusted to  $p_B(2) = \frac{a+c}{2} + \frac{b}{2}p_A(2)$ . After  $n$  times adjustment, the manufacturer A and the manufacturer B's prices are respectively adjusted to  $p_A(n) = \frac{a+c}{2} + \frac{b}{2}p_B(n-1)$  and  $p_B(n) = \frac{a+c}{2} + \frac{b}{2}p_A(n)$ .

And we use the vector form to analyze the price competition,

$$\begin{bmatrix} p_A(n) \\ p_B(n) \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ \frac{b}{2} & 0 \end{bmatrix} \begin{bmatrix} p_A(n) \\ p_B(n) \end{bmatrix} + \begin{bmatrix} 0 & \frac{b}{2} \\ 0 & 0 \end{bmatrix} \begin{bmatrix} p_A(n-1) \\ p_B(n-1) \end{bmatrix} + \begin{bmatrix} \frac{a+c}{2} \\ \frac{a+c}{2} \end{bmatrix}$$

$$\text{i.e. } \begin{bmatrix} 1 & 0 \\ -\frac{b}{2} & 1 \end{bmatrix} \begin{bmatrix} p_A(n) \\ p_B(n) \end{bmatrix} = \begin{bmatrix} 0 & \frac{b}{2} \\ 0 & 0 \end{bmatrix} \begin{bmatrix} p_A(n-1) \\ p_B(n-1) \end{bmatrix} + \begin{bmatrix} \frac{a+c}{2} \\ \frac{a+c}{2} \end{bmatrix}$$

$$\begin{bmatrix} p_A(n) \\ p_B(n) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -\frac{b}{2} & 1 \end{bmatrix}^{-1} \begin{bmatrix} 0 & \frac{b}{2} \\ 0 & 0 \end{bmatrix} \begin{bmatrix} p_A(n-1) \\ p_B(n-1) \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ -\frac{b}{2} & 1 \end{bmatrix}^{-1} \begin{bmatrix} \frac{a+c}{2} \\ \frac{a+c}{2} \end{bmatrix}$$

$$= \begin{bmatrix} 0 & \frac{b}{2} \\ 0 & \frac{b^2}{4} \end{bmatrix} \begin{bmatrix} p_A(n-1) \\ p_B(n-1) \end{bmatrix} + \begin{bmatrix} \frac{a+c}{2} \\ \frac{b+2}{2} \cdot \frac{a+c}{2} \end{bmatrix}$$

Suppose that  $p(n) = \begin{bmatrix} p_A(n) \\ p_B(n) \end{bmatrix}$ ,  $D = \begin{bmatrix} 0 & \frac{b}{2} \\ 0 & \frac{b^2}{4} \end{bmatrix}$  and  $E = \begin{bmatrix} \frac{a+c}{2} \\ \frac{b+2}{2} \cdot \frac{a+c}{2} \end{bmatrix}$ , so,

$$p(n) = Dp(n-1) + E$$

$$p(n) = D^{n-1}p(1) + D^{n-2}E + D^{n-3}E + \Lambda + D^2E + DE + E$$

$$= D^{n-1}p(1) + \sum_{i=0}^{n-2} D^i E$$

It is easy to prove that  $D^i = \begin{bmatrix} 0 & \left(\frac{b}{2}\right)^{2i-1} \\ 0 & \left(\frac{b}{2}\right)^{2i} \end{bmatrix}$ , and  $D^{n-1} = \begin{bmatrix} 0 & \left(\frac{b}{2}\right)^{2n-3} \\ 0 & \left(\frac{b}{2}\right)^{2n-2} \end{bmatrix}$

$$\begin{aligned}
\sum_{i=0}^{n-2} D^i &= I + \sum_{i=1}^{n-2} D^i = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \sum_{i=1}^{n-2} \begin{bmatrix} 0 & \left(\frac{b}{2}\right)^{2i-1} \\ 0 & \left(\frac{b}{2}\right)^{2i} \end{bmatrix} \\
&= \begin{bmatrix} 1 & \frac{b}{2} \cdot \frac{1 - \left(\frac{b}{2}\right)^{2n-4}}{1 - \left(\frac{b}{2}\right)^2} \\ 0 & 1 + \left(\frac{b}{2}\right)^2 \cdot \frac{1 - \left(\frac{b}{2}\right)^{2n-4}}{1 - \left(\frac{b}{2}\right)^2} \end{bmatrix} \\
p(n) &= D^{n-1} p(1) + \sum_{i=0}^{n-2} D^i E \\
&= \begin{bmatrix} 0 & \left(\frac{b}{2}\right)^{2n-3} \\ 0 & \left(\frac{b}{2}\right)^{2n-2} \end{bmatrix} \begin{bmatrix} p_A(1) \\ p_B(1) \end{bmatrix} + \begin{bmatrix} 1 & \frac{b}{2} \cdot \frac{1 - \left(\frac{b}{2}\right)^{2n-4}}{1 - \left(\frac{b}{2}\right)^2} \\ 0 & 1 + \left(\frac{b}{2}\right)^2 \cdot \frac{1 - \left(\frac{b}{2}\right)^{2n-4}}{1 - \left(\frac{b}{2}\right)^2} \end{bmatrix} \begin{bmatrix} \frac{a+c}{2} \\ \frac{b+2}{2} \cdot \frac{a+c}{2} \end{bmatrix} \\
&= \begin{bmatrix} \left(\frac{b}{2}\right)^{2n-3} p_B(1) + (1 - 2^{3-2n} b^{2n-3}) \cdot \frac{a+c}{2-b} \\ \left(\frac{b}{2}\right)^{2n-2} p_B(1) + (1 - 2^{2-2n} b^{2n-2}) \cdot \frac{a+c}{2-b} \end{bmatrix}.
\end{aligned}$$

We take  $p_B(1) = \frac{a+c}{2} + \frac{b}{2} p_A(1)$  into the above equation, and can obtain the dynamic adjustment model of dual-manufacturer price competition,

$$\begin{aligned}
p_A(n) &= \left(\frac{b}{2}\right)^{2n-3} \left[ \frac{a+c}{2} + \frac{b}{2} p_A(1) \right] + (1 - 2^{3-2n} b^{2n-3}) \cdot \frac{a+c}{2-b} \\
&= 2^{2-2n} b^{2n-2} p_A(1) + (1 - 2^{2-2n} b^{2n-2}) \cdot \frac{a+c}{2-b} \\
p_A(n) &= \left(\frac{b}{2}\right)^{2n-3} \left[ \frac{a+c}{2} + \frac{b}{2} p_A(1) \right] + (1 - 2^{3-2n} b^{2n-3}) \cdot \frac{a+c}{2-b} \\
&= 2^{2-2n} b^{2n-2} p_A(1) + (1 - 2^{2-2n} b^{2n-2}) \cdot \frac{a+c}{2-b}
\end{aligned}$$

If dual-oligopoly game times is infinite, i.e.  $n \rightarrow \infty$ , and the limitations of  $p_A(n)$  and  $p_B(n)$  confirmed in the above two equations exist, so the equilibrium solution exists, and the limitation is the equilibrium price.

$$\begin{aligned}
\lim_{n \rightarrow \infty} p_A(n) &= \lim_{n \rightarrow \infty} \left[ 2^{2-2n} b^{2n-2} p_A(1) + (1 - 2^{2-2n} b^{2n-2}) \cdot \frac{a+c}{2-b} \right] \\
&= \frac{a+c}{2-b}
\end{aligned}$$

$$\lim_{n \rightarrow \infty} p_B(n) = \lim_{n \rightarrow \infty} \left[ 2^{1-2n} b^{2n-1} p_A(1) + (1 - 2^{1-2n} b^{2n-1}) \cdot \frac{a+c}{2-b} \right]$$

$$= \frac{a+c}{2-b}$$

It indicates that whatever the price that the first manufacturer enters into the market is, the equilibrium solution of the price model exists only, and the final adjusted price is the equilibrium price.

And we continue to analyze the dynamic change of dual-manufacturer price.

$$p_A(n+1) = 2^{-2n} b^{2n} p_A(1) + (1 - 2^{-2n} b^{2n}) \cdot \frac{a+c}{2-b}$$

$$p_B(n+1) = 2^{-1-2n} b^{2n+1} p_A(1) + (1 - 2^{-1-2n} b^{2n+1}) \cdot \frac{a+c}{2-b}$$

Accordingly,

$$p_A(n+1) - p_A(n) = 2^{-2n} b^{2n-2} (b^2 - 4) p_A(1) + 2^{-2n} b^{2n-3} (b+2)(a+c)$$

$$= 2^{-2n} b^{2n-2} (b^2 - 4) \left[ p_A(1) - \frac{a+c}{2-b} \right]$$

$$p_B(n+1) - p_B(n) = 2^{-1-2n} b^{2n-1} (b^2 - 4) \left[ p_A(1) - \frac{a+c}{2-b} \right]$$

When  $p_A(1) < \frac{a+c}{2-b}$ , we can get from above two equations:

$$p_A(n+1) - p_A(n) > 0$$

$$p_B(n+1) - p_B(n) > 0.$$

Therefore, when the price that the first manufacturer enters into the market is smaller than the equilibrium price, two manufacturers' prices strictly monotonically increase by degrees.

In the same way, when  $p_A(1) > \frac{a+c}{2-b}$ , we can get

$$p_A(n+1) - p_A(n) < 0$$

$$p_B(n+1) - p_B(n) < 0.$$

i.e. when the price that the first manufacturer enters into the market is larger than the equilibrium price, two manufacturers' prices strictly monotonically decrease by degrees.

When  $p_A(1) = \frac{a+c}{2-b}$ , we can get

$$p_A(n+1) = p_A(n) = \frac{a+c}{2-b}$$

$$p_B(n+1) = p_B(n) = \frac{a+c}{2-b}.$$

It indicates that the price that the first manufacturer enters into the market is the equilibrium price, two manufacturers' prices are changeless and kept at the level of the equilibrium price, in another words, and two manufacturers' prices have no dynamic changes, which achieve the equilibrium status at the very start.

### 3. Conclusions

Through the analysis of the equilibrium solution and price sequence dynamic changes of the Bertrand price competition model, we can get following conclusions.

(1) Under the condition of dual-manufacturer, however the first manufacturer initially selects the price, the equilibrium solution of the Bertrand model only exists.

(2) When the first manufacturer's initial price is  $\frac{a+c}{2-b}$ , two manufactures achieve the equilibrium at the very start.

When the initial price deviates from the equilibrium price, the equilibrium process of dual-manufacture price is an infinite process, and the price adjustment sequence is the strictly monotonic sequence and the dual-manufacturer price adjustment changes at the same direction.

Otherwise, in this article, we give the dual-manufacturer price dynamic change model under the fixed demand function, and many problems such as manufacturer's profit change and price dynamic change under the condition of multi-manufacture need to be further studied.

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# Quality Management in Supply Chain Based on ISO9000

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## Abstract

This paper discussed the application of the eight modern quality management principles of ISO9000 in supply chain quality management, namely customer focus, leadership, involvement of people, process management, system management, continual improvement, factual approach to decision making, and mutually beneficial supplier relationships.

**Keywords:** Supply Chain, Quality Management, ISO9000

## 1. Introduction

In nowadays, the series standards of ISO9000 are implementing in many industries, such as manufacturing, service, even administrative organizations. In the introduction of *Quality Management System* of ISO9000:2000, eight principles of quality management are proposed, namely customer focus, leadership, involvement of people, process management, system management, continual improvement, factual approach to decision making, and mutually beneficial supplier relationship [1]. The eight principles generalize the success experience of the advanced enterprises in the developed countries.

In supply chain circumstance, the emphasis of research and practice of quality management has transferred from enterprise focus to supply chain focus. Not only the high quality of product and service but also the high level of quality control of the whole supply chain system ensures the competition advance. Therefore, the establishment of quality management system of supply chain based on the management ideas of ISO9000 will promote the involvement of all the members and facilitate the implement of quality control of the whole supply chain system.

## 2. Supply chain quality management based on ISO9000

### 2.1 Customer focus

Customer focus is the core principle and idea of quality management because quality effort comes of customer's needs and ends with customer's acceptance. In supply chain circumstance, customer includes not only the end user but also many in-between users, such as suppliers, manufacturers, sellers, etc. Therefore, the core enterprise must pay attention to the needs and expectation of end users, and all the members of supply chain must pay attention to the needs and expectation of their backward users. The needs and expectation of end users should be deployed layer upon layer in the whole supply chain system. The end users will satisfy if all the member of supply chain can satisfy the needs of their backward users. Moreover, the operation efficiency of supply chain system can be improved through the satisfaction level of the end users. Here, some traditional tools of total quality management (TQM) are also effective. For example, we can use Quality Function Deployment (QFD) to understand the distinct and potential needs of users, use Fishbone Chart to investigate the factors affecting the satisfaction level of users and then use Pareto Chart to find out the key factors.

### 2.2 Leadership

The effective of quality management depend on the effective of leadership because quality effort can get actual effect only with the recognition and support of the leadership. In supply chain circumstance, the core enterprise play as the leadership since it establishes the development strategy and operation targets of supply chain affect the actual efficiency and effectiveness of the quality effort of all the other members. Therefore, the core enterprise must act as leadership to consider adequately the needs and expectation of the other members, establish a clear, realizable and coincident holistic target, and then lead and inspire the other members to strive jointly for the target. At the same time, the core enterprise should foster more leaders of TQM in each layer of supply chain and make them take their responsibility zealously.

### 2.3 Involvement of people

The exertion of enthusiasm and creativity of all the employees is the precondition of the actual effect of quality

management. In supply chain circumstance, an up-and-coming excelsior work atmosphere should be established to inspire the enthusiasm and creativity of the employees of all the members. Each employee should understand his/her role and responsibility in the supply chain system, solve the problems forwardly as mastership, and learn the principles, skills and technologies of TQM and ISO9000. Here, we can foster the ethos of self-motion and self-knowledge in supply chain through 5S, i.e. seiri, seiton, seiso, seiketsu, and shitshke. Furthermore, we can make all the employees participate into supply chain quality management and strive for the satisfaction of users jointly through the establishment of cross function or cross enterprise QC teams.

#### *2.4 Process management*

The focus of modern quality view is the process quality management but not the product itself of traditional quality view. It is the requirement of the quality management system of ISO9004:2000 and the essential difference of modern and traditional quality view. In each step of supply chain, there are many correlative processes, such as procurement, logistics, production, inventory, selling, service, etc. These processes have their own independent objectives and programs. There are usually conflicts among the objectives and programs. Therefore, the processes and their mutual effects should be identified and managed to ensure the harmonious operation of supply chain. Then, all the processes, especially the key processes, can realize high quality, i.e. small variation, small waste, and more increment, through the total quality control in all the steps of supply chain.

#### *2.5 System management*

The application of system approach in quality management is to view the quality management system as a big system, identify and manage the sub-systems respectively. Then, the coordinated effect and mutual promotion among the sub-systems will make the whole effect more than the sum of the improvement of each sub-system [2]. In supply chain circumstance, enterprise should confirm the mutual dependence relationship among the processes in supply chain system, break the boundary among supply chain members, construct and integrate the processes. Then, many well operation sub-systems can be constructed to collocate the resources rationally among the sub-systems. Finally, the whole supply chain system, including supply, transport, production, distribution, inventory, etc., can realize the target and policy of quality through the optimal operation mode.

#### *2.6 Continual improvement*

Continual improvement is one of the focuses of modern quality research and practice. Enterprise must improve the quality of product and service continually and reduce the cost to make customer satisfactory. In supply chain circumstance, the pressure of continual improvement is more and more pressing because the market competition is more and more hard. Not only the core enterprise but also the other members, such as suppliers, sellers, and logistics providers, must improve their product and service respectively so as to construct the continual improvement of products and services all over the supply chain process. Then, the continual, stable and harmonious ability of quality assurance can be established. Furthermore, the core enterprise and other members must find the ways and practices improving performance in or out of supply chain through benchmarking to make the continual improvement speed fast than the one of rivals.

#### *2.7 Factual approach to decision making*

The sufficient and adequate data and information is the foundation of making effective decision. Up to now, many enterprises have began to collect and deal with all kinds of data and information by utilizing many advanced information technology, e.g., EDI, MRP II, ERP, POS, Intranet, Extranet, Internet, so as to provide foundation for making effective decision. In supply chain circumstance, enterprise should collect data and information of not only itself but also the other members of supply chain to record and analyze the current operation situation of each member. Therefore, the potential problems in any step of supply chain can be found duly according to the results of data analysis. Then, the corresponding correct and timely decision can be made to avoid or rectify the problem.

#### *2.8 Mutually beneficial supplier relationships*

The organization and its supplier are mutually dependent. Maintaining the mutually beneficial relationships between them can improve the ability of creating value both of them. In supply chain circumstance, the product quality is performed and ensured by all the members of supply chain because the production, selling and service must be performed by all the members [3]. Therefore, the task of supply chain quality management is not only to establish the product inspection system and comprehensive evaluation system of suppliers, but also to strengthen the mutual beneficial partner relationships with suppliers. The core enterprise must realize the following activities:

- (1) Identify and select the main suppliers, reduce the scale of supply system, and realize small supply base management;
- (2) Investigate the requirements of customers and develop new product jointly with suppliers;



- (3) Share information, technology, and resource with suppliers;
- (4) Admit the improvement and achievement of suppliers;
- (5) Take joint improving activities with suppliers;
- (6) Ensure the conformity of quality system between core enterprise and the other members, including basic conformity (e.g. program files, technology specification, process interface) and advanced conformity (e.g. quality target, quality policy, and quality culture).

In fact, there is a new trend in the international practices of supply chain management. Namely, more and more large-scale enterprises have pay attention to the management and development of suppliers, e.g. providing capital, technology, human resource, equipment and training for suppliers, sending quality teams to help suppliers improve their processes, and sharing the yields of continual improvement with suppliers.

### 3. Concluding remarks

The series standards of ISO9000 are made for the standardization of quality management and quality assurance. Therefore, in supply chain circumstance, the implementation of ISO9000 is the basic assurance for an enterprise to provide acceptable product or service and improve the quality level in a certain supply chain. The application of ISO9000 in supply chain quality management will promote the improvement of operation efficiency and competition ability of the whole supply chain system.

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# Study on Formation of Methods for Safety Accounting

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## Abstract

By theoretical analysis, this paper firstly discusses the effects of safety accounting's basic methods systematically, studying the effects of macro economic factors on safety, the effects of production accidents on social economy, the law of safety activities' effects, and the mode of safety investment resources' finance management and finance report. Based on accounting, management, and statistics that are founded on methods of safety accounting, this paper constitutes and describes a brand-new system for safety accounting's basic methods in detail, insisting that methods of safety accounting are composed of checking and information disclosing method, management method, value-measuring method, and effect-assessing method.

**Keywords:** Accounting, Safety, Method, Formation

## 1. Introduction

Considering the concept of sustainable development, the development means not only growth of economy, but also concerning resources, environment, social progresses, and human comprehensive development. Safety production is an important part of sustainable development, being a sign of social civilization and progress. Safety production demands for all branches' participation and researches. The participation of accounting in safety management is a must objectively. Accounting possesses special advantages over other specialties for the safety of resource management. It is necessary to set up an independent theoretical system for safety accounting, which helps the newly-built safety accounting research not only the micro safety resource planning but also the macro safety resource allocation. This paper will present some personal opinions on the base and the specific methods of safety accounting that generates from the participation of accounting in safety production management.

## 2. Effects of safety accounting's basic methods

Safety accounting is a kind of management activity used by organizations where production accidents may happen. By safety accounting, organizations use multiple measurement units, mainly currency, to reflect and control the safety investment resources, the process and result of evaluating and repaying accident losses. The purpose is to provide with exact, timely, and effective information about safety resource investment, use, production accidents, losses, and repayments for users of safety accounting information who can make relevant decision, in order to the improve the whole social production's economic benefits and social benefits comprehensively. Therefore, the system of safety accounting's basic methods chiefly includes following aspects.

### *2.1 To research the effects of macro economic factors on safety*

Discuss the effects of macro economic factors, such as social economic system, economic structure, economic development, on safety, and the relationship between these factors and human safety activities. Establish the position and the effects of safety goals in social production and social economic development. Discuss the proportion relationship between the growth ratio of safety investment and the development rate of social economy theoretically.

### *2.2 To research the effects of production accidents on social economy*

Discuss the law of accidents' losses and its influences on social economy at different times (time), in different

regions (industries, branches, and other spaces), at different scientific and technological levels, under different productivities. Explore theories and methods for analyzing, evaluating accidents and losses, especially the scientific, exact measurement theories and methods according to losses' indirect, implicit, and chain characteristics, which can serve as bases for mastering the effects of production accidents on social economy.

### *2.3 To research the law of safety activities' effects*

There are both connections and differences between safety benefits and production benefits. Safety benefits include not only economic benefits, but also non-value factors (healthy, stability, happiness, etc.) and other social benefits. Under this condition, it is hard to assess safety benefits. Therefore, to research safety benefits' complexity and its lasting effects, and to disclose the comprehensive benefits of safety provide with scientific causes for assessing and controlling safety economic activities.

### *2.4 To research the mode of safety investment resources' finance management and finance report*

Discuss the feasibilities' demonstration methods for safety investment's economic resource projects, and the investment policies. Explore the mode of safety investment resources' finance reports that is based on modern accounting theories, and relevant safety resource management methods, such as audition system, and statistic of accidents' losses and repayments. Realize the reasonable use of national safety investment resources and the optimal effects of investments, including people, capitals, and materials.

## **3. Formation base of methods for safety accounting**

### *3.1 The accounting base*

Because safety accounting is a component and a new branch of accounting system, the methods system of accounting is the natural base of methods system for safety accounting. The basic effects chiefly include following aspects. The first is the wide implement of mature accounting methods, such as setting up accounts, and multiple accounts. The second is the adoption of accounting methods, such as calculation methods of costs, calculation methods of depreciation, allocation of expenses, and accounting methods of taxes. The third is the reform of some accounting methods, such as accounting reports that should be reformed based on finance reports' basic types and structures considering the contents reflected by safety accounting, adding new necessary items according to users of safety accounting information, which can help to exert the effects of safety accounting better. Besides, some special accounting also has certain influences on the formation of methods for safety accounting, such as human resource accounting, and social responsibility accounting. These influences mainly focus on relevant accounting methods' introduction and references, and the contents' reformation and innovation.

### *3.2 The management base*

The so-called management is to design and retain a nice environment in which people can accomplish supposed goals with high efficiency (Harold Koontz & Heinz Weihrich, 1993). Management is inevitable for all social production process. Management, being the lead in all fields, occupies a dominant position. It is the soul of an organization. And it can guarantee the accomplishment of organizational goal.

Management, as a kind of social activity, centers in people. People are not only the subjects of management (managers) but also the objects (followers). Everyone is at certain management level. On one hand, he or she governs his or her followers or materials. On the other hand, he or she is governed by his or her governor. By this way, a people-oriented management chain is in form. In management, the root is to motivate people's enthusiasm and dig out their creativity. That is the principle of people in management. The people-oriented safety management is to activate workers' enthusiasm in the whole production process. All people join in and guarantee the safety and production. On one hand, it emphasizes that the fundamental target of safety production is to protect workers' healthy and safety. On the other hand, it has to depend on people's enthusiasm and creativity to achieve safety production. The safety management is a process of organizing and employing sorts of material sources, such as human resources, materials, and capitals, in order to achieve safety production. It adopts the management mechanism, namely plan, organize, direct, coordinate, and control, to control the natural, mechanic, or material unsafe factors and human unsafe activities, avoiding casualties and hurts, ensuring workers' safety and healthy, and guaranteeing the production.

### *3.3 The statistics base*

From the development and history of accounting and statistics, statistical methods and accounting methods overlapped in nature. And this is a must in a sense. A. C. Littleton, a famous American accounting expert, thought that accounting connects with statistics in the mathematical aspect. Therefore, in essence, accounting methods and statistical methods come down in one continuous line. Although accounting has the characteristics of economics and its methods have the features of statistics, their processes include classification, collection, and re-classification.

Therefore, many accounting theories and the practical implements relate with the development of statistics and the introduction of statistical theories. Their relationship between accounting and statistics is mainly reflected by the wide application of statistical methods, as the quantity calculation and analysis methods, in accounting field. Firstly, in the finance accounting aspect, the static factor asset, debt, and ownership in accounting assess are the time indexes in statistics. And the dynamic factor income, expense, and profit are the period indexes in statistics. The principle of weighted mean method and moving weighted mean method for stock pricing is the statistical mean. And the repayment ability, operation ability, and profitability in finance report analysis are the application of principle of statistical relative number in accounting. Secondly, in the management accounting, the application of statistical methods is obvious in its method system for prediction, decision, and control, such as the correlation analysis and regression analysis used by mixed cost decomposition, the trend model used by sales and costs prediction, the probability decision in short-term business decision, the calculation of risk values' standard deviation coefficient in long-term business decision, the regional evaluation in uncertainty decision, the probability budget in general budget, and the factor analysis in standard cost differentiation analysis. All these methods take references from statistical methods and technologies to different degrees. Besides, in finance management, the finance and investment's risk prediction and the capital structure's evaluation also take references from statistical methods and technologies. Therefore, some domestic accounting scholars think that because of the emphases on application of statistical theories and technologies in specific accounting issues, the researches and analyses of accounting issues under uncertainty conditions possess supportive tools (Guangyun Wang & Yingqi He, 1997). The connection between accounting methods and statistical methods can affect the specific methods of safety accounting, because the safety accounting aims at providing with necessary information for different users in order to improve the economic benefits and the social benefits, what is similar to the general finance accounting and management accounting. Obviously, methods for safety accounting have close connection with statistical methods in many ways. Therefore, statistics should be one of bases for safety accounting methods.

#### **4. Formation of methods for safety accounting**

Safety accounting methods are necessary fundamental ways in order to reflect and control the objects of safety accounting, and accomplish tasks of safety accounting. Regarding safety accounting as an object of management activity, or regarding it as a specific operation in information system, its contents focus on the processes and results of investing and using the safety resources that relate with safety production. Considering the specific aims of safety accounting, it emphasizes on providing with exact, timely, and effective comprehensive information concerning safety resources' investments and uses, and production accidents' losses and repayments for safety accounting information' users in order to meet the need for decision-making. By accounting management activities, the economic benefits and social benefits of investing and using safety resources can be improved. The complexity of safety accounting and the uniqueness of its aims determine that the basic methods for safety accounting should form a relatively complete system. This system can include four parts as follow.

##### *4.1 Methods for safety accounting assessing and information disclosing*

The method for safety accounting assessing is fundamental for safety accounting. It assesses the stocks and variables of different safety resources. Theoretically, it includes value assessing and material assessing. But in practice, it chiefly adopts value assessing. Because in essence, safety accounting is a new assessing branch of finance accounting, its methods will inevitably adopt methods of finance accounting, such as the design of accounting items, the set-up of accounting check, the assessment of costs and expenses, and the composition of accounting reports. Similar to common accounting assessing, safety accounting information is mainly disclosed in form of accounting reports internally and externally. And the carriers are various, including words, tables, numbers, graphics, or combination of different forms. The report form is determined by the target users as a matter of fact.

##### *4.2 Methods for safety accounting management*

Methods for safety accounting management are important components of safety accounting methods. It concerns issues of adopting certain ways to control the safety resources' economic circulation process and result. In form, it includes many specific activities, such as predicting, decision-making, planning, assessing, checking, testing, and analyzing the economic activities related with safety resources.

##### *4.3 Methods for safety accounting measurement*

Value measurement method is the base for safety accounting assessing and management methods. Because the objects of safety accounting assessing are more complicate, especially the accidents' losses and relevant repayments, as the subjects of assessing, have greater uncertainty, and change frequently, the exactness is restricted by social economic environment, customs, faith, education, and values. Therefore, the measurement is merely relative exact. In order to achieve a comprehensive reflection and control from an accounting viewpoint, the value measurement

becomes one of fundamental factors that restrict the effectiveness of safety accounting information. Because of the greater uncertainty concerning losses and repayments after accidents, the constitution of safety accounting's value measurement system and the researches on measurement methods should be the core of safety accounting research.

#### *4.4 Methods for checking safety accounting's benefits*

Methods for checking safety accounting's benefits aim at examining the safety resources' investment, the safety accidents' losses and repayments, and the result of prediction. Considering the safety resources' investment and the safety accidents' losses and repayments, these methods should include two parts, namely the methods for checking the economic benefits, and the methods for checking the social benefits. The main way is to design an effective checking indexes' system, define the checking indexes' basic constitutional factors, determine the data's effective sources, and the time periods for each check.

### **5. Conclusion**

The market economy system determines that all social activities should follow the law of values and the principle of benefits. Similarly, all human safety activities should be in accord with this law and principle. Besides, because the resources (capitals, human resources, and materials) invested in safety production by country, society, and enterprises are limited, the use of resources should be effective, considering both economic thoughts and demonstrations, and specific accounting assessing. In order to make best use of country's limited safety resources and manage them well, it is necessary to explore the researches on safety accounting, developing a series of theories to direct practices. By perfecting the constitution of safety accounting' methods system, we can provide with exact, timely, and effective comprehensive information about safety accidents defending resources' allocation and checking for users to satisfy the need for safety decision on one hand. On the other hand, by applying advanced accounting methods and executing accounting management activities, we can drive the effective utility of safety resources, avoiding economic losses from safety accidents, improving economic benefits and social benefits directly, and contributing to the sustainable development of human society.

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# A Comparative Analysis of Bankers' Perceptions on Islamic Banking

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## Abstract

This research was conducted to gauge the perceptions of employees, in both Islamic banks and conventional banks, of Islamic products and services, the training and experience gained in Islamic banking, and the potential of Islamic banking in Malaysia. Questionnaires dealing with Islamic banking were distributed to bankers in the northern part of Malaysia. The results revealed that bankers in Islamic banks have more positive perceptions on the above issues. Interestingly, few of the bankers possessed a relevant academic background or relevant experience in Islamic banking before embarking on this career. The bankers also claimed that they had very limited knowledge in this area prior to working with the banks; thus, the issue of the availability of well-trained and skilled employees must be addressed critically by the government, industry players and educationists for the sustainable growth of Islamic banking in Malaysia, and to meet the target set for the year 2010.

**Keywords:** Perceptions, Products and Services, Training, Islamic Bankers

## 1. Introduction

In 1970, Islamic banking was almost unknown and considered to be wishful thinking. By the early years of the twenty-first century, however, Islamic banking has become a reality that cannot be ignored, for it is growing at a steady pace. The size of the industry, which amounted to a few hundred thousand dollars in 1975, had reached billions of dollars by 2004. (Note 1) The value of *Shariah*-compliant accounts worldwide is estimated between US\$200 billion and US\$500 billion and is growing at an average annual rate of 10-15 percent. (Note 2) It is predicted that Islamic banks will control around 40-50 per cent of Muslims' savings by 2009/10, for the population of Muslims in the world in 2006 has been calculated to be more than 1.2 billion (Zaher and Hassan, 2001). (Note 3)

The establishment of Islamic banks is associated with the Islamic revolution and the escalating awareness of Muslim society in embracing Islam as its way of life, in the fields of finance and banking as well as in other aspects. However, it should be borne in mind that although the emergence of Islamic banking was in response to the market needs of Muslims, these banks are not religious institutions, as they provide banking services for non-Muslim customers as well. Further proof of the viability of Islamic banking is the fact that many conventional banks, including some major multinational Western banks, have also started using Islamic banking techniques. Malaysia is among the countries that have chosen to operate Islamic banking alongside the conventional system. This is achieved by the opening of "Islamic windows". (Note 4) in conventional institutions, or the establishment of separate banks or branches and subsidiaries specializing in Islamic financial products. Serious research over the past two-and-a-half decades has shown that Islamic banking is not only feasible and viable, but is an efficient and productive form of financial intermediation.

It has been stated that the idea of creating actual Islamic financial institutions was visualized as early as the 1940s (Khan, 1987). However, it is stated that the first attempt to establish such institutions was in Pakistan in the late 1950s, with the establishment of a local bank in a rural area, although this did not have a lasting impact (Wilson, 1983). The second attempt to establish an Islamic bank took place in Egypt, in Mit Ghamr. (Note 5) in the Nile delta from 1963 to 1967, this model being adopted by its founder, Ahmed Al-Najjar, from the concepts of the German savings bank (Scharf, 1983). The experiment of the Mit Ghamr Savings Bank came to an end for political reasons in late 1967, when its operations were undertaken by the National Bank of Egypt and the Central Bank.

Such an undertaking had a significant impact on the Mit Ghamr Savings Bank; operational policies consequently changed, with the operations of the bank being run on an interest basis, so that interest-free banking was deserted. However, the Mit Ghamr experiment had opened the way for the establishment of the Nasser Social Bank in 1971, which was a kind of revival (El-Ashker, 1990). (Note 6)

Islamic banking in Malaysia started back in 1983 with the establishment of the first Islamic bank; Bank Islam Malaysia Berhad (BIMB). This was followed by the introduction of the Interest-free Banking Scheme in the conventional banks in March 1993, which then saw the emergence of the dual-banking system in Malaysia. This scheme allows conventional banks to offer Islamic banking products and services under the same roof, utilizing the same infrastructures and employees. In 1998, the interest free banking scheme was changed to the Islamic Banking System to reflect the importance and specific roles of the Islamic banking system in Malaysia. Bank Muamalat was added to the list as the second Islamic bank in Malaysia in 1999. To date, there are 12 full-fledged Islamic Banks, including 2 foreign banks, Al-Rajhi Banking & Investment Corporation (Malaysia) Berhad and Kuwait Finance House (Malaysia) Berhad.

To strengthen the industry, Bank Negara Malaysia has formulated a 10 year strategic plan in its Financial Sector Master Plan to achieve the goal that 20% of banking assets are held in Islamic banking by the year 2010. At the end of 2006, Islamic banking only held 12.2% of banking assets, which promises a greater potential to be exploited.

### 1.1 Problem statement

Islamic banking faces a number of forces of change that can potentially affect the overall Islamic banking system:

1.1.1 Intense competition arising from financial globalization and liberalization due to the emergence of other conventional players in the Islamic banking market globally and locally, especially in the structuring of investment deals and financing based on *Shariah* principles.

1.1.2 Increase in technological advancement in structuring the micro aspects of businesses, and development of the financial market, which contributes towards stiff competition; in addition, an increase in the skills and expertise of the employees.

1.1.3 A new generation of customers, who are knowledgeable and well-educated, demanding superior and innovative products and services.

One of the main objectives of the Financial Sector Master Plan is to develop an efficient, resilient and dynamic Islamic financial system that can contribute towards the overall safety and soundness of the Malaysian financial system. The effectiveness of Malaysia as an Islamic financial hub can only be achieved through good governance, efficiency in operation, and a well-formulated *Shariah* framework coupled with effective regulation and supervision.

According to Hassan and Ahmed (2002), based on the market share of 8.2% of banking assets in 2001, Islamic banking needs to concentrate more on the financing sector, and emphasize the diversity of concepts used in Islamic banking products and services. This is based on the fact that financing aspects in Islamic banking are more focused on particular sectors: almost 38% of the assets are in the real-estate sector and only 11% have been directed to the manufacturing sector. Moreover, most of the concepts used in formulating Islamic banking products and services are dependent on the concept of *al-Bai Bithaman Ajil*; this applies to nearly 52% of the Islamic banking products and services, while *al-Ijarah Thumma al-Bai*, or leasing concepts, applies to almost 22%. Other concepts, such as *Ijarah*, *Musyarakah* and *Istisna*, have had less applicability. Thus, Hassan and Ahmed suggests that this circumstance provides two contrasting implications. It shows that products and services under Islamic banking are not sufficient to meet the demand by many sectors; on the other hand, it opens up enormous potential to exploit the intact market.

Therefore, it is apparent that the achievement in Islamic banking is largely dependent on the level of expertise in the field and efficiency in its management. The bright potential of Islamic banking, as well as the importance of the bankers' expertise in this area, provides the key motivation for of this study.

This is an exploratory study to examine the perceptions of Islamic bankers respecting Islamic banking products and services. The study is important because Islamic bankers deliver the products and services directly to customers at the branch level. In addition, using in-depth understanding, it is easier for them to market the products and services by giving detailed explanations of the areas concerned. Moreover, customers nowadays are better educated and more knowledgeable of the wider financial world, and thus demand more innovative products and services.

### 1.2 Objectives of the study

1.2.1 To examine the perceptions of bankers in Islamic banks and conventional banks towards Islamic banking products and services.

1.2.2 To evaluate the perceptions of bankers in Islamic banks and conventional banks towards the training and experience gained in Islamic banking.

1.2.3 To investigate the perceptions of bankers in Islamic banks and conventional banks towards the future potential of Islamic banking in Malaysia.

## 2. Literature review

Intense competition arising from globalization and liberalization in the banking industry, whether in conventional banking or Islamic banking, demands that institutions place greater emphasis on their customers. According to Zeithaml and Bitner (2000), organizations nowadays have to effectively compete and maintain their competitive edge by accentuating service quality and, consequentially, increased customer satisfaction. It also has been stated by Peters (1999) that:

*“Quality can be a “magic bullet” which provides lower cost, higher customer service, better products and services, and higher margins. Without managing quality, asserting and adding value become an impossible proposition.”*

Zeithaml (2000) stress that the inside customer and outside customer have a similar view regarding the service dimension and the way a customer accesses the services. The outside customer is an individual or business entity that purchases or uses the service from suppliers, while the inside customer refers to the organization's staff. Hence, service quality is an important factor in creating a competitive advantage; a bank must acknowledge its customers' perception and then provide the desired service to meet the customers' needs.

This statement is further supported by Donnelly et al. (1985), who urge that:

*“... employees who make the discretionary effort – who are friendly and responsive, who ask the extra question or suggest the extra services, who take time to listen - provide the competitive edge!”*

Nevertheless, employees can better deliver excellent services to customers when the organization provides them with the necessary resources, including logistic, administrative, equipment, and management support (Schneider and Bowen, 1985). Zeithaml (2000) also confirm this by stating that *“satisfied employees make for satisfied customers (and a satisfied customer can, in turn, reinforce employees' sense of satisfaction in their jobs).”*

Research conducted by Bowen and Scheider (1988) discovered that employees working on the front-line play prominent roles in representing an organization to the outside world, and influence the awareness and behavior, as well as the assessment made by customers. The importance of the front-line employees in delivering a quality service is further confirmed by Congram and Friedman (1991). They listed ten principal criteria to determine success in an organization. Of importance is whether the employees are empowered to assist or deliver the service to the customers in any way they deem fit, in addition to employees who are able to meet the customer's expectation. Zeithaml (2000) further reaffirms this point: *“...the employee's relative strength of identification with an organization's goals, objectives and values could impact on service delivery. Identification with the organization's goals, objectives and values is referred to as organizational commitment.”*

Furthermore, according to Buchanan (1974), Cook and Wall (1980), and Katz (1996), loyalty towards the organization is one of the components which creates, or is associated with, commitment to the organization. As highlighted by Dessler (1988) and Davis (1989), organizational factors can actually create employee loyalty towards the organization, and this is attributed to several elements, namely employees' roles in decision making, fair and adequate compensation, open communication, an ideal and comfortable workplace, and training and work development.

In respect to the above, Katz (1996) urges that compensation in the form of financial reward and training helps create employee loyalty towards organizations. Ismail and Makhbul (2000), on the other hand, have discovered that training and work development have a significant and positive relationship vis-à-vis employee loyalty in comparison with other factors. According to Zeithaml (2000), the power given to the employees should not only be limited to the power to react; employees must also be equipped with suitable and adequate knowledge to execute accurate decisions.

From the Islamic banking viewpoint, Haron (1996) emphasizes the contradictory objectives in conventional banks versus Islamic banks. The objectives of Islamic banks are based on two fundamental objectives: the religion factor and the profitability factor. If the religion factor alone is accentuated, the banks will be driven into insolvency and bankruptcy, thus damaging the situation of the depositors and Muslim society as a whole. Conversely, if the profitability factor is given more priority, it will certainly divert from the true Islamic line that is based on the concepts of justice.



Haron (1996) also further reaffirms that, in line with the objective of establishment, all business activities associated with financial transactions and Islamic banking must be conducted in accordance to Islamic principles and Islamic legal practices. As such, Islamic banks are prohibited from engaging in any business that is based on *riba*. Hamid and Nordin (2001) conducted research to determine the importance of education in Islamic banking, and a viable strategy by which Islamic banks could face the new millennium. They discovered that customers possess very limited knowledge of Islamic banking, in that 60% of the respondents could not differentiate between Islamic banking products and conventional banking products.

Interestingly, a study completed by Hassan and Ahmed (2002) on the customers and employees of the Islamic bank in Dhaka, Bangladesh, found that the respondents were not interested in conducting banking transactions in Islamic banks because they believed that only the name of the bank had been changed to reflect that it was an Islamic-based bank; they believed that interest, which is prohibited in Islam, was still practiced. Overall, the researchers determined that the customers' and employees' understanding of the concepts and practices of Islamic banking is still vague. The authors recommend that to prevent any misunderstanding, adequate training must be given to the employees, future researchers and also the customers. This issue came up again in research completed by Makiyan (2002), who revealed that the infrastructure problem experienced by banks' employees in Iran was due to inadequate knowledge and training. Additionally, Haron and Ahmad (2002) have highlighted that nearly 65% of corporate banking customers clarified that they had very limited knowledge of Islamic banking. The authors further stressed that the banks do not put much effort into marketing their products or educating their customers.

Thus, based on the aforementioned issues and the importance of Islamic banking in Malaysia, the current research has been conducted to assess the perceptions of the Islamic service provider.

### 3. Research method

The research population consists of all officers in two Islamic banks as well as officers in conventional banks offering Islamic banking products and services (Islamic window). The banks include Bank Islam (M) Berhad, Bank Muamalat, and all conventional banks offering Islamic banking products and services. A simple random sampling method was employed in which 200 questionnaires were distributed to officers at Bank Islam (M) Berhad, Bank Muamalat and all conventional banks offering Islamic banking products and services in the northern area of Malaysia: Kedah, Pulau Pinang and Perlis. Of the 200 questionnaires, 97 were returned, which yielded a response rate of 48.5%. The data was analyzed using Statistical Packages for Social Science (SPSS) 12.0. The statistical techniques employed in this study were T-test and cross tabulation, while the confidence level was 0.05.

### 4. Findings

The respondents' demographic profile is presented in Table 1.

A total of 97 bankers were involved in this study. 67% of them were male while the rest were female officers. The majority of the respondents were Malay (89.7%), while 9.3% were Chinese and the remaining 1.0% was Indian. In addition, of the 97 bankers surveyed, 19.6% were below 30 years old, nearly 50% were in the range of 30-39 years of age, and the rest were between 40 and 49 years old (28.9%) and above 50 years old (2.1%).

Bankers in the operations department accounted for 49.5%, while bankers in lending departments comprised 41.2%. Also, the majority of the bankers held at least a diploma level education, while the bankers who held undergraduate and postgraduate degrees accounted for 21.6% and 3.1% respectively. In addition, most of the respondents in this study were from the conventional bank, and encompassed 60.8% of the total number of the respondents, while 39.2% of the respondents worked with the Islamic banks.

An analysis of the perceptions of bankers of Islamic products and services is depicted in Table 2. The first item concerns with the knowledge of the bankers regarding the understanding of *riba*, which is clearly prohibited in Islam. 79.4% of respondents strongly agree that the Islamic banking system was introduced because Muslims are prohibited from dealing in any transactions based on *riba*, which is practiced in the conventional banking system. The mean score for this item is 4.62, which shows that the average respondent gave a positive response to this statement. The second item tests the principles of profit maximization in Islamic banking. The majority of respondents (61.9%) indicated that they agree with this statement, while only 28.8% do not agree. Only 9.3% responded that they were unsure of the principles in Islamic banking. The mean score for this item is 3.59, which indicates that most of the respondents agree with this statement; this shows that most of those who responded to this statement do not realize the objective of the establishment of Islamic banks, which are based on two main factors, namely religion and profitability.

For the third, fourth and fifth items, the respondents gave their opinions of the Islamic products and services offered by their respective banks. Based on the Likert scale of 1-5, the third item exhibited the highest mean of 3.08,

followed by the fourth item with a mean of 2.70, and a mean of 2.49 and 2.31 for the fifth and sixth items, respectively. It can be concluded that most of the respondents have positive perceptions of Islamic products and services.

An analysis of the perceptions of the bankers concerning training and experience is detailed in Table 3. For the first item, it was found that only 3.1% of the respondents strongly agree with the statement that they possessed an extensive academic background in a related field prior to working with the banks. 14.4% agree with this statement, another 21.6% are undecided, 47.4% disagree while 13.4% of the respondents strongly disagree with the statement. Interestingly, the mean score for this item was just 2.46, which shows that the respondents on the whole evidently do not have an extensive academic background in Islamic banking. The second item examined whether the respondents possessed vast experience in the field of Islamic banking prior to working at their present banks. Only 19.6% of the respondents agree that they have extensive experience in the related field, while almost 61.9% declared that they do not have any relevant experience in the field. Consequently, the mean score obtained for this item is merely 2.44, which indicates that the majority of the respondents did not have extensive working experience before assuming their current post.

Interestingly, however, most of the respondents (76.3%) claim that they have broad knowledge of the products and services they handle, as seen from the subsequent score of a mean of 3.82. Meanwhile, 82.5% of the respondents also declare that they have the ability to solve customers' problems. 9.3% remained undecided, and the rest did not agree with the statement.

The third, sixth and seventh items measured the bankers' perceptions towards the training provided by their management in the area of Islamic banking. With a mean of 3.70, the response to the third item showed that 20.6% of respondents strongly agree, 50.5% agree, 9.3% undecided, 17.5% somewhat disagree, while 2.1% strongly disagree with the statement that there is efficient training and exposure to products and services. Meanwhile, for the sixth item, which considered the adequacy of training programs, 18.6% of respondents strongly agree, 52.6% somewhat agree, 10.3% are undecided, 17.5% somewhat disagree and only 1.0% strongly disagree with the statement, yielding a mean score of 3.7. This demonstrates that most of the respondents perceive that they have received an adequate and sufficient amount of training in the field of Islamic banking. Besides this, with a mean score of 4.02, they also clearly professed that their bank management encourages them to attend short-courses, seminars and conferences in the field of Islamic banking.

Table 4 presents an analysis of the bankers' perceptions concerning the potential for Islamic banking in Malaysia. The potential usage of Islamic banking products and services by non-Muslim customers, 18.6% of respondents said the products and services are less likely to be used by non-Muslims while 66.0% positively believe that the products and services have a huge potential with non-Muslim customers.

The second item tests the potential usage of Islamic banking products and services by Muslim customers. As expected, almost all respondents (93.8%) agree that the products and services have substantial potential. The last item in this section measures the utilization of Islamic banking products and services within the corporate sector in Malaysia. The survey indicates that only 16.4% believe that the products and services have no potential, while 72.2% of the respondents claimed that the Islamic products and services have outstanding potential with corporate customers.

Table 5 presents an analysis of the perceptions of bankers concerning the Islamic banking products and services and types of banks to see if there are any differences between the banks. From the T-test, it was discovered that the p-value is 0.000, which is smaller than the confidence level of 0.05. This finding noticeably indicates that significant differences exist in the perceptions of bankers in Islamic banks and bankers in the conventional banks.

The abovementioned findings are supported by the cross-tabulation analysis between the bankers' perceptions of the Islamic products and services with the banks they work with, as depicted in Table 6. It was discovered that only 2.6% of bankers in Islamic banks strongly disagree and disagree, while 28.8% of their counterparts said they disagree. It is shown here that bankers in Islamic banks asserted more positive perceptions towards this issue.

The above table shows the outcome of a t-test in determining whether there exist any differences in perceptions among the bankers on the training and experience gained with the banks to which they are attached. The p-value obtained from this test (0.938), which is higher than the confidence level of 0.05, revealed that there is no significant difference in the perceptions of bankers from the Islamic banks and bankers from the conventional banks.

The p-value from the analysis in Table 8 yielded 0.009. This value is lower than the confidence level of 0.05, which clearly indicates that there are significant differences in the perceptions of bankers towards the potential of Islamic banking in Malaysia with the types of banks.

According to the cross tabulation analysis depicted in Table 9, merely 1.0% of the bankers in Islamic banks claimed that Islamic banking has modest potential in Malaysia, while 3.1% of their counterparts in conventional banks made this assertion. 35.1% of the respondents from the Islamic banks and 41.2% of bankers from the conventional banks believe that Islamic banking has a bright future in Malaysia. However, if this outcome is explored using a percentage to judge between the differences in perception of bankers who work with Islamic banks and those working for conventional banks, it can deduce a percentage of 89.5 to 67.8 respectively. Thus, bankers in Islamic banks undoubtedly have more positive perceptions in comparison with their counterparts.

## 5. Discussions

### 5.1 Perceptions of Islamic banking products and services

Bankers in Islamic banks are more positive in relation to Islamic banking products and services than their counterparts. Based on this outcome, it is clear that the bankers in Islamic banks are more exposed to the Islamic banking products and services, since they are involved in day-to day operations and transactions. In contrast, bankers in the Islamic window face difficulties in understanding Islamic banking concepts and principles, as they work with conventional banks.

Moreover, the knowledge of employees of the fundamental aspects of Islamic banking – with particular reference to the objectives of the establishment of Islamic banks – is very limited. Most of the respondents are not aware of the objectives, which place religion as the main feature, unlike the conventional banks which place greater emphasis on the profitability factor.

### 5.2 Perceptions on the training and experience gained in Islamic banking

There exists little difference in bankers' perceptions of the training and experience in Islamic banking with the types of banks to which they are attached. From the analysis, it is clear that a significant number of the respondents did not possess extensive working experience or a related academic background prior to working with their respective banks. Nevertheless, most of them agree that they have sufficient knowledge of the products and services with which they are dealing.

### 5.3 Perceptions of the potential of Islamic banking

From the analysis, it has been revealed that the perceptions of bankers towards Islamic banking are dependent on the banks with which they work. The two-way analysis suggests that employees in Islamic banks are more positive than their counterparts in conventional banks. This might be due to their wider involvement in the arena of Islamic banking.

## 6. Conclusion

This research was conducted to gauge the perceptions of employees in both Islamic banks and conventional banks of Islamic products and services, the training and experience gained in Islamic banking, and the future potential of Islamic banking in Malaysia.

The findings yielded that most of the respondents have positive perceptions of the Islamic products and services. However, employees in Islamic banks are more optimistic than their counterparts. Based on the undesirable outcome in terms of the level of knowledge of employees in the Islamic banking field, it is recommended that the banks' management take greater initiative in providing their employees with sufficient knowledge of and exposure to rules of the *Shariah* and the principles governing Islamic banking in particular. This is to ensure that the employees are well equipped with knowledge to handle their customers and to perform their duties. Hence, moving forward, bank management must be considerably proactive in organizing seminars and workshops to expose their employees to innovations in Islamic banking products and services, and to equip them well so that they can face the challenges and meet the objectives of the Malaysian government in positioning Malaysia as an Islamic financial hub in the region.

This research should be expanded further to gauge the perceptions of employees in Islamic banks as well as in conventional banks throughout Malaysia. It is suggested that foreign banks involved in offering Islamic banking products and services be included in the sample. It is hoped that the research will further assess the perceptions of employees in depth.

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## Notes

Note 1. Iqbal and Molyneux (2005) state that while the estimates about the exact magnitude of the Islamic banking market vary, it can be safely assumed that it presently exceeds \$150 billion and is poised for further market growth.

Note 2. Statement by the Deputy Prime Minister of Malaysia, Datuk Seri Najib Razak, when officiating at the opening of the Islamic Financial Forum in Kuala Lumpur in 2005.

Note 3. It also has been stated by Iqbal and Molyneux (2005) that the period between 1975 and 1990 was the most important period in the history of the development of the Islamic financial industry. By 2004, there were about 70 Islamic banks working in different socio-economic environments. Iran and Sudan are two countries that have fully transformed their financial systems to that of an Islamic system. In addition to this encouraging scenario, there are more than 40 conventional banks participating through Islamic banking windows.

Note 4. Islamic windows are special facilities offered by conventional banks to provide services to Muslims who wish to engage in Islamic banking.

Note 5. Much of the literature on Islamic banks identifies Mit Ghamr as the first Islamic bank in Egypt and in the world.

Note 6. Kahf (2005) rebuts the claim that either the Mit Ghamr Local Savings Bank or the Nasser Social Bank was the pioneer of the Islamic banking system. As he says, “While these writings prepared the Muslim public to see the merits of Islamic banks and later to celebrate their founders as religious heroes, the actual establishment of the Islamic bank unexpectedly came in two areas of the Muslim world far away from each other. Islamic Banks were concurrently established in the countryside of Lower Egypt and in metropolitan Kuala Lumpur in Malaysia”.

Table 1. Demographic profile of respondents

Variable		Frequency	Percent
<b>Gender</b>	Male	65	67.0
	Female	32	33.0
<b>Race</b>	Malay	87	89.7
	Chinese	9	9.3
	Indian	1	1.0
<b>Age</b>	Below 30 years	97	19.6
	30-39 years	80	49.5
	40-49 years	44	28.9
	>50 years	15	2.1
<b>Number of officers per department</b>	Operations Officers	48	49.5
	Lending Officers	40	41.2
	N/A	9	9.3
<b>Highest education attained</b>	Diploma and below	70	72.2
	Bachelor's Degree	21	21.6
	Master's Degree	3	3.1
	N/A	3	3.1
<b>Respondents per Bank</b>	Bank Islam	25	25.8
	Bank Muamalat	13	13.4
	Conventional banks with Islamic Window	59	60.8

Table 2. Analysis of perceptions of the bankers pertaining to the Islamic product and services

Item	Mean	STD	SD	UD	SA	STA
Item 1 The Islamic banking system was introduced because Muslims are prohibited to take <i>riba</i>	4.62	2 2.1%	5 5.2%	1 1.0%	12 12.4%	77 79.4%
Item 2 The Islamic banking system must adhere to the profit maximization principle	3.59	4 4.1%	24 24.7%	9 9.3%	31 32.0%	29 29.9%
Item 3 Products and services in Islamic banks are similar to the products and services of conventional banks with the exception that the banks use different names to differentiate the products and services	3.08	13 13.4%	29 29.9%	8 8.2%	31 32.0%	16 16.5%
Item 4 Products and services in Islamic banks are more expensive than in conventional banking	2.70	13 13.4%	41 42.3%	15 15.5%	18 18.6%	10 10.3%
Item 5 Non-Muslim customers are not interested in utilizing the Islamic products and services	2.49	9 9.35%	53 54.6%	14 14.4%	20 20.6%	1 1.0%
Item 6 Customers choose Islamic banking products and services because they are more interested in the Arabic concepts applied to these products and services	2.31	23 23.7%	42 43.3%	15 15.5%	13 13.4%	4 4.1%
Item 7 Your bank management shows commitment in marketing and promoting Islamic banking products and services	4.16	2 2.1%	6 6.2%	6 6.2%	43 44.3%	40 41.2%
Item 8 The Malaysian government shows commitment to further developing Islamic banking in Malaysia	3.80	3 3.1%	7 7.2%	20 20.6%	43 44.3%	24 24.7%
Item 9 Islamic banks and conventional banks market their Islamic banking products and services in an effective manner	3.78	4 4.1%	23 23.7%	0 0%	60 61.9%	10 10.3%
Item 10 You are convinced that Islamic banking asset will achieve a set target of 20% by the year 2010	3.80	4 4.1%	28 28.9%	0 0%	48 49.5%	17 17.5%

Legend: STD = strongly disagree      SD = somewhat disagree      UD = undecided  
 SA = somewhat agree      STA = strongly agree

Table 3. Analysis of perceptions of the bankers pertaining to the training and experience gained in Islamic banking

Item	Mean	STD	SD	UD	SA	STA
Item 1 Extensive academic background prior to working with the bank	2.46	13 13.4%	46 47.4%	21 21.6%	14 14.4%	3 3.1%
Item 2 Extensive work experience prior to working with the present bank	2.44	15 15.5%	45 46.4%	18 18.6%	17 17.5%	2 2.1%
Item 3 Clear and efficient training and exposure on the products and services before they are launched	3.70	2 2.1%	17 17.5%	9 9.35%	49 50.5%	20 20.6%
Item 4 Extensive knowledge on the products and services under my supervision	3.82	1 1.0%	11 11.3%	11 11.3%	55 56.7%	19 19.6%
Item 5 Capable to solve customers' problems	3.94	8 8.2%	9 9.35%	0 0%	61 62.9%	19 19.6%
Item 6 Adequate training and exposure before assuming the current post	3.70	1 1.0%	17 17.5%	10 10.3%	51 52.6%	18 18.6%
Item 7 Bankers are encouraged to attend short-courses, seminars and conferences in related field	4.02	11 11.3%	4 4.1%	0 0%	54 55.7%	28 28.9%

**Legend:****STD = strongly disagree****SD = somewhat disagree****UD = undecided****SA = somewhat agree****STA = strongly agree**

Table 4. Analysis of perceptions of the bankers pertaining to the potential for Islamic banking in Malaysia

Item	No Potential	Less Potential	No Idea	Potential	Huge Potential
Item 1 Potential usage of Islamic banking products and services by non-Muslims	0 0.0%	18 18.6%	4 4.1%	64 66.0%	11 11.3%
Item 2 Potential usage of Islamic banking products and services by Muslims	2 2.1%	2 2.1%	2 2.1%	37 38.1%	54 55.7%
Item 3 Potential usage of Islamic banking products and services by the corporate sector	8 8.2%	8 8.2%	11 11.3%	52 53.6%	18 18.6%

Table 5. T-Test value on the bankers' perceptions pertaining to Islamic banking products and services, and types of banks

Types of Banks	N	Mean	SD	T	Sig (2-tailed)
Bank I&M	38	15.03	2.97	4.166	0.000
Other Banks	59	12.37	3.12		

Table 6. Cross tabulation of bankers' perceptions of Islamic banking products and services and types of banks

Perception	Bank I&M	Other Banks	Total
Strongly Disagree	1 2.6%	1 1.7%	2 2.1%
Disagree	1 2.6%	17 28.8%	18 18.6%
Undecided	10 26.3%	24 40.7%	34 35.1%
Agree	21 55.3%	17 28.8%	38 39.2%
Strongly Agree	5 13.2%	0 0.0%	5 5.2%
Total	38 39.2%	59 60.8%	97 100.0%

Table 7. T-Test value on bankers' perceptions of training and experience gained and types of banks

Types of banks	N	Mean	SD	T	Sig (2-tailed)
Bank I&M	38	11.45	2.54	0.078	0.938
Other Banks	59	11.41	2.49		

Table 8. T-Test value on bankers' perceptions on Islamic banking potential and types of banks

Types of Banks	N	Mean	SD	T	Sig (2-tailed)
Bank I&M	38	12.47	1.91	2.676	0.009
Other Banks	59	11.36	2.07		



Table 9. Cross tabulation of the bankers' perceptions on the potential of Islamic banking and types of banks

<b>Perception</b>	<b>Bank I&amp;M</b>	<b>Other Banks</b>	<b>Total</b>
No Potential	0 0.0%	0 0.0%	0 0.0%
Less Potential	1 1.0%	3 3.1%	4 4.1%
No Idea	3 3.1%	16 16.5%	19 19.6%
Potential	22 22.7%	32 33.0%	54 55.7%
Huge Potential	12 12.4%	8 8.2%	20 20.6%
<b>Total</b>	38 39.2%	59 60.8%	97 100.0%

# Discussion on Reader Service Concept in Cataloging under Network Environment

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## Abstract

This paper discusses the relationship among the construction of book storing, literature cataloging and reader service in libraries, and points out that only if the reader service awareness were set up can we do well the cataloging under network environment and improve the use rate of literature information in libraries.

**Keywords:** Network environment, Literature cataloging, Reader service, Makings of library staff.

With the rapid development of information technology, the working environment of libraries has been greatly improved. Under network environment formed by the interlacing of local network of libraries, campus network, China educational research and science network and internet, the jobs of libraries have undergoing great changes. The demand of readers on literature information has new changes. Readers lay higher and higher requirement as to the service of libraries, therefore, traditional service cannot meet the demands of readers any more and the requirements on reader service become higher and higher. Then, how can we perform well reader service in cataloging under network environment? Usually, when reader service of libraries is mentioned, many craft brothers engaged in cataloging will take for grant that it is the word of circulation and literature reference consultants. Actually, it is a wrong understanding. Cataloging is subject to basic business department of library and has no direct contact with readers; however, it does not mean that cataloging has nothing to do with reader service. The ultimate aim of literature cataloging and the construction of book storing is to "help readers find proper books and help books find their readers". In cataloging, how to "help readers find proper books and help books find their readers"?

## 1. Problems of cataloging personnel

### *1.1 Erroneous opinions of the society*

In China, library staff generally cannot obtain the recognizing of the public. Many people think that libratory work is rather simple and comfortable and anybody can qualify. Consequently, people will assume that cataloging personnel in libraries are not important either, whose specialty requirement is weak and who have nothing to do all day long. Under this kind of social opinions, cataloging personnel of libraries will generally lose their confidence in their work, further be suspicious about their posts, and be influenced by opinions of the outside world, which will be detrimental to the improvement of their business capacities. Even, many will give up their posts and turn to other occupations.

### *1.2 Weak psychological makings*

Cataloging personnel of libraries are engaged in behind-scene work, whose existence will generally be neglected and whose work achievement is hard to be seen. Cataloging is a repetitive, dull and fussy job. Long term engagement in this job will lead workers generate weary psychology and years of silent work will easily lead people to trap in listless mood, which will severely influence the speed and quality of work. Some cataloging personnel cannot adjust their work mood and are weak in psychological makings.

### *1.3 Knowledge not extensive*

At present, cataloging personnel in libraries in common are old in knowledge, narrow in knowledge scale and single in skill structure. Those who are specialized in library major know little about relevant specialty knowledge and those who have specialty knowledge background lack systematic library knowledge. Cataloging personnel lack knowledge on computer science, foreign languages and ancient Chinese and are low in education level. There are only a few high class talents who are expert in cataloging.

## 2. Basic makings for cataloging personnel

Under present network condition, with the increasing development of cataloging, the work of cataloging personnel of libraries is not restricted to their traditional roles any more, such as classification, cataloging, assigning book number and standard management. The work of cataloging refers more to the search and selection of network information sources and order arrangement, which lays higher requirements on the makings of cataloging personnel.

### 2.1 Ideology making

Cataloging personnel of libraries are engaged in behind-scene work. They will deliver the scattered literature information to readers after getting those information in order. Each worker shall apply the opinions of Marxism to understand the world, set up correct world view, life view and value view, love library career, treat readers with ardent and responsible spirit, be positive and enterprising, be willing to devote selflessly to library career, have strong career and responsibility sense, and endeavor to perform well service for readers. Besides, a significant content in the ideology and politics makings under network environment is to resist information garbage. Network is an open system with large amount of information, both good and bad; Therefore, cataloging personnel will meet some pseudo-scientific and unhealthy information garbage when randomly searching the internet, which requires that cataloging personnel have rather high politics and ideology makings and strong identification capacity.

### 2.2 Specialty making

Network environment lays new requirement on the specialty making of cataloging personnel. Besides to master traditional library science, classification, cataloging and informatics, cataloging personnel should also possess the following makings:

2.2.1 Cataloging personnel should have acute information awareness and rather strong information capacity. Information awareness refers to acute sense of cataloging personnel towards information and consciousness extent of cataloging personnel in catching, analyzing, judging and absorbing information. Information capacity includes information gaining capacity, information processing capacity and information transferring capacity. As for the changing information network, cataloging personnel shall understand the contents and characteristics of information websites, be able to manipulate network terminals, and improve information decision-making and judgment capacity.

2.2.2 Cataloging personnel must have strict criterion awareness. The criterion and standardization of cataloging data is the base for data exchange and the realization of resource share. If the cataloging data is not standard, the search fullness rate, search correctness rate and resource use rate in literature search will be harmed and information communication and resource share will be blocked. Therefore, it is necessary to regulate and control the cataloging data and to require that in cataloging, unified recording rules and criterions be adopted. The criterions include, literature recording criterion, namely China Literature Cataloging Rules and Foreign Language Literature Recording Regulations, literature machine reading format criterion, namely, China Machine Reading Catalogues Formats and DC element data format of recording network information and digital information, Chinese literature subject word marking and citation criterion, namely, Chinese Subject Word Table, western literature subject word marking and citation criterion, namely, Subject Words Table of Library of Congress of America, and literature classification criterion, namely, Methods of Chinese Library Classification. Cataloging personnel engaged in foreign language cataloging shall also master Dewey Classification. Cataloging personnel must set up criterion awareness, strictly perform the afore mentioned rules and criterions, and carry out standard treatment and control as of search points, such as the titles, authors, subjects and classification. Consequently, the consistency of literature marks will be achieved through the criterions on titles, authors, subjects, classifications and formats.

2.2.3 Cataloging personnel must have strong innovation awareness. Cataloging now is totally different from the former hand labor cataloging. But what does not comply with reality is that the thoughts of librarians does not keep pace with the rapid change of information eras. Many cataloging workers cannot discard the limitation of hand labor cataloging; therefore, their old fashioned thoughts on cataloging influence the development of today's cataloging, which is a problem deserving the emphasis of the field of libraries. Cataloging personnel must change their concepts and establish new concepts in order to adapt to the rapidly changing and developing network environment. Under knowledge economy condition, the demand on information of users increasingly grows and changes. But the users' capacity in using modern methods to search for useful information cannot be improved in a short time. The search fullness rate and correctness rate of information demanded are both rather low, which requires the libraries to provide information service of a higher class to the users. The libraries shall carefully select and process information of various carriers in great amount so as to meet various information demands of users of different types. In a rather long time, printed literature and electronic literature will co-exist. Therefore, the functions of purchasing and editing department lie more on the collecting and order arrangement of digital information stored in disks, CDs, and

networks. With regard to disks and CDs, the work is not restricted to the initial processing of the information carrier, but also the work involves the work to arrange the order of the contents of the digital information according to the classification requirements of libraries and to set up indexes and relevant date bases, aiming at providing more and more convenient information service to users.

### **3. Methods for improving cataloging work**

The value of cataloging is realized through the use rate of the catalogue by readers. Cataloging workers shall set up the concept of "cataloging for use", endeavor to improve work and raise the applicable effect of catalogues.

#### *3.1 To deepen the depth of cataloging*

The contents of literature science are all-embracing and complex. When inputting the data of names of books, cataloging workers should try their best to completely reflect the conditions of literatures. After computers are used to manage cataloging, the cataloging quality is improved. Compared with traditional cataloging, the modern cataloging makes great improvement in reader service. Therefore, in the cataloging process with computers, cataloging workers shall make deep, profound, outer to inner, multi-aspect and multi-level analysis on the contents of the literatures so as to fully exhibit the valuable information of literatures. The correctness and fullness of the quoted mark of the cataloging workers determines the search correctness and fullness of readers.

Nowadays, the more evident trend in information field is that the work key point is transferred from storing to gaining and from the description of literature to the transfer of literatures. The center of the work is transferred from book title gaining to information gaining. Information service is to provide information and is not just to provide information about information any more. All the library work aims at providing the service of "gaining", which is not just the responsibility of a certain functional department. Therefore, cataloging work shall overcome being simply restricted to the process of book title information and shall quote and mark some important literature information and internet information so that readers can directly gain the needed information.

#### *3.2 To extend the cataloging range*

With the increasingly enriching and deepening of the contents of literature information, the cataloging work now is not restricted to the catalogue making for paper literature. The development of machine reading catalogue and metadata raises the extent and depth of cataloging work. The range of literature cataloging extends from books and periodicals to non book material, such as multi-media, network resources and CD data base. Through the relevant link by 856 filed provided by machine read catalogues, readers can through the OPAC of library log on relevant websites and databases to search relevant information.

The tenet of cataloging work is to provide first class service for readers. Then how to offer readers with more good information? Machine read catalogues can be used to realize it. InterCat and NetFirst is two network resource data base of demonstration meanings. The two apply the selection, description, quotation and mark in traditional literature information in network information, which is the extension of machine-linked unified catalogue to network information field. The CORC system developed by OOLC provides a cataloging function where DC metadata is used to describe internet resource. Libraries can convert the cataloging date of internet resources from the DC format to USMARC format and then store it into the local system to provide readers with relevant catalogues for the internet resources. By this way, the catalogue resource of libraries have the multi-search function.

#### *3.3 To improve the quality of cataloging data*

The cataloging work of libraries is an inner business work with strong technological demand, including to effectively classify books, periodicals, and electric resources and quote and mark theme and to catalog using MARC format. The quality of cataloging exerts direct influence on reader service. Proofreading is also an important method to ensure the quality of cataloging data. In the process of cataloging, sometimes it is hard for cataloging workers themselves to find mistakes, such as the wrongly written character in titles, book number, bar code and library storing wording, which will directly influence the circulation and data quality of books. Proofreading can find out these mistakes. Therefore, besides self-proofreading of cataloging workers, full time proofreaders with the spirit of contribution, carefulness and responsibility and familiar with machine read catalogue format shall be appointed or cataloging workers can proofread each other's catalogue. Proofreaders shall carefully check each data, in pursuit of accuracy and quality.

#### *3.4 To set up a cataloging team of high quality*

Only cataloging team of high quality can edit catalogues of high quality. At present, the publications are abundant, whose contents and forms are various and complex, raising a higher requirement on cataloging personnel. Besides solid specialty knowledge, cataloging personnel shall also have extensive knowledge, high vocabulary level, certain computer knowledge, the awareness for serving readers and career sense, which is the premise and basis for doing a

good job and is also a primary way to improve the makings of cataloging personnel. Cataloging personnel shall study hard, continually innovate, supplement knowledge, emphasize practices, combine theories closely with practices and accumulate experience in practices. At the same time, libraries shall try their best to provide cataloging personnel with the opportunities to gain further education so as to improve the overall level of the cataloging team.

#### **4. Cataloging personnel shall keep studying**

The profession knowledge in book information is the most basic requirement of librarians. Only a person lays solid foundation on the theories of book information, be familiar with basic work procedures of this specialty, and master basic work methods and basic skills, can the person realize the transfer from with printed literature material as processing materials to with modernized and electronic information resources as the processing materials, from single hand search to computer search, and realize the rapid development of information management and service of libraries under network information environment.

The work of high school libraries under internet environment must be done by professional and technical talents or special librarians. 10% of workers in American libraries have double master degrees. Some even have there degrees. Near 1/3 managers have doctor degrees. The reason for the need of high standard managers is that in information era, the dependence of readers on literature and librarians has undergone fundamental change. They have urgent demand towards special librarians. The internet service requires librarians, especially cataloging personnel, to have the following makings: high responsibility sense and career sense, specialty knowledge, knowing well more than on other specialty knowledge, and being capable of developing specialty knowledge information and collecting the newest science and research achievement in their disciplines through internet. In addition, if the librarians can master network management skill, the data processing software development skill, network information development and application skill, and the operation skill of outer equipments and sound and image information processing equipments of computers, they will be able to do a better job in serving readers.

##### *5.1 Management concept innovation*

The innovation of management concept is the premise to manage all innovation activities. The managers of books must set up innovation awareness, according to the development rule of libraries and the demands of professions in economy and knowledge era on libraries, set down correct development strategy and management mode, use modernized innovation methods to scientifically manage libraries, and create good environment for the training of the innovation making and the improvement of innovation capacity of librarians.

##### *5.2 Technology innovation*

The resources of libraries under network environment extends from limited resources to unlimited. The resources stored by libraries now include the books stored by the libraries and network resources. A most important criterions to evaluate a library is not the number of books stored by the library, but is the capacity to obtain network resources. Therefore, the work of librarians is certainly to carry put technology innovation and to apply computer network technology, multimedia technology and information technology to the library work in order to diversify and modernize the service methods of libraries. Since cataloging personnel are members of librarians, they should also do alike.

##### *5.3 Service innovation*

Service is the ultimate aim of the work of libraries and is the basic tenet of the libraries. With the development of science and technology and the rapid growth of information transferring amount, the work of libraries is forced to rapidly change from traditional service ways to information service mode. Libraries are in urgent need to optimize resource structure, enrich network information and establish electronic, digital and mutual active information communication platform so that users can obtain the needed literature without going to the libraries and a innovative, multi-modal, personalized and active service centering the users is formed.

In a word, book cataloging personnel under network information environment shall keep pace with the era, systematically and comprehensively study knowledge and innovate, arm their minds with knowledge and comprehensively improve general capacities and makings, and become librarians of a new generation with innovative awareness specializing in one field and good at many aspects. Cataloging personnel shall create new phase for the development of libraries in th 21<sup>st</sup> century with newest spiritual status and further do well the job of “help readers find proper books and help books find their readers”.

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# An Investigation and Study of the Terminal Energy Consumption in Beijing

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## Abstract

With the 2008 Beijing Olympics' approaching, Beijing has increasingly become the focus of the world, simultaneously the energy problem is regarded as an urgent work, so the investigations and studies on the status of the terminal energy consumption in Beijing have some practical significance. This paper analyzed the structure of coal, oil, natural gas, electricity and other major energy consumption for nearly a decade in Beijing using the information of relevant researches and the published statistical data, and also analyzed the changing trends and characteristics of energy consumption in-depth, to provide some reference for the development of energy in Beijing.

**Keywords:** Beijing, Energy consumption, Investigation and study, Clean energy

## 1. Preface

On the way of rejuvenation in China, the energy industry, composed of oil, natural gas, coal, electricity, waterpower and new energy, is acting as a driving force. Along with the strategic position's increasing enhancement, energy resources determine the realization of Oriental power dream to some extent. Energy resource is an important material basis for the survival and development of human society, and also an important material basis for our comprehensively constructing the well-off society and speeding up the socialist modernization. Adhering to the basic national policy of saving resources, and accelerating the construction of a resource-saving and environment-friendly society, is a long-term strategic task and the current urgent task of our country.

Beijing, as the capital of China and the international metropolis, is our country's second-largest city of energy consumption, however, its energy structure is not reasonable, its electrification level is not high, the environment pollution is serious. At the same time, Beijing is about to hold the 2008 Olympic Games. With the proposal of slogan of the Green Olympic Games, Beijing is taking a series of measures to optimize its energy structure, to make sure realization of the "New Beijing, New Olympics" strategy, so as to make Beijing meet the worldwide friends with the best posture.

In order to have an in-depth understanding of Beijing energy structure, it is necessary to conduct the investigation and study of Beijing area's present situation of terminal energy consumption. The investigation and study of terminal energy consumption in Beijing is contributed to analyze the Beijing's trends and characteristic of the terminal energy consumption structure changes, and provide a theoretical basis of the development trends of Beijing area's terminal energy consumption.

This paper mainly uses the literature method to carry on the investigation and study, the data of investigation and study originates from "China Energy Statistical Yearbook" and "Beijing Statistical Yearbook." "China Energy Statistical Yearbook" is edited together by the industrial traffic Statistics Division of the State Statistical Bureau and the Energy Bureau of the State Development and Reform Commission, is an authoritative book full of reflection of China's energy construction, production, consumption, the balance of supply and demand. It has a large amount of information, strong authority, and integrity. "Beijing Statistical annual" is a year-on-year large-scale statistical data published book, it has really recorded Beijing's Municipal socio-economic and technology changes through a lot of data to help international public to understand and recognize Beijing, it's an important information tool. The above two annuals combine two characteristics of Beijing area and energy, and provide important data for smoothly progressing of investigations and studies.

## 2. The past 10 years' terminal energy consumption situation in Beijing

Make analysis on trends in the total energy consumption of Beijing, so as to draw the trends of total terminal energy consumption of Beijing, in Figure 1. From the total terminal energy consumption tendency chart of Beijing (Figure 1), we can see that during the period of 1997-2006, Beijing's region total terminal energy consumption has been growing rapidly. In 1997, the total final energy consumption of Beijing is 35.658 million tons of standard coal. The last three years of the "Ninth Five-Year" period, in Beijing, the growth rate of the terminal energy consumption was 4.02 percent. During the "10th Five-Year" period, the growth rate is 5.81 percent, which has 1.79 percentage points

over the "Ninth Five-Year" period. By 2006, the total terminal energy consumption of Beijing has reached 56.8221 million tons of standard coal.

Then make the analysis on the Beijing area's terminal energy consumption structure during 1997-2006, shown in Table 1, the table shows the consumption's quantities of the coal, the oil, the natural gas, the electricity and other energy every year and demonstrates the total energy consumption quantity per year, their units are unified into 10,000 tons of standard coal conversion.

Table 1 shows that during 1997-2006, Beijing's terminal energy consumption structure has been continuously optimized. The proportion of Coal, coke and other solid fuels pollution is declining in the total consumption, the proportion of coal fell from 41.46 percent in 1997 to 24.46% in 2006. With the rapid development of the country's economy, the continued improvement of people's living standard, the upgrading of the consumption structure, as well as more and more environmental control efforts, the energy consumption of electricity, oil, natural gas, and other high-quality resources have been rapidly growing, the proportion has been rising. In 2006, the consumption of the electricity, oil, and natural gas respectively are 18.81395 million tons of standard coal, 16.2763 million tons of standard coal, and 3.7789 million tons of standard coal, accounting respectively for the proportion of terminal energy consumption are 33.11%, 28.64%, 6.65%, Compared to 1997, they respectively rose 7.64 percentage points, 7.47 percentage points and 6.10 percentage points. Make the trend analysis on each primary energy variety in the past 10 years changes, it can be concluded that their changes of consumption are different, energy consumption development is directed to the quality-oriented, as is shown in Figure 2.

The consumption of energy is gradually to the quality-oriented development, clean energy's proportion is rising, represented at the following aspects:

(1) the terminal consumption of the coal grows in very few years, which shows a downward trend overall. In 2006, the terminal consumption of coal in Beijing is 13.9021 million tons of standard coal, accounting for 24.46% in the terminal energy consumption, less than 884,000 tons of standard coal in 1997, the ratio dropped by 17%. For nearly 10 years, only in 1998, 2001, 2003, Beijing's coal terminal consumption increased slightly than last years. In 2001, Beijing's terminal consumption of coal is 15.2655 million tons of standard coal, which increases by 6.16%, accounting for 37.05% in the total terminal energy consumption. In 2003, the Beijing's total terminal consumption of coal is 14.5903 million tons of standard coal, an increase of 9.09%, accounting for 32.17% of the total terminal energy consumption.

(2) the upward trend of the terminal electricity consumption is quite obvious year by year. In 1997, Beijing's terminal electricity consumption is 9.083733 million tons of standard coal. During the last 3 years of "Ninth Five-Year" period, the average growth rate arrived at 8.04 percentages. In 2005, the terminal electricity consumption is 17.19399 million tons of standard coal, 12 percent more than the ratio in 2004, accounted for 32.3 percent of the total consumption of energy, respectively increased by 0.55, 1.50 and 1.95 percentage points compared with 2004, 2003 and 2002. During the "10th Five-Year Plan" period, the average increase is 8.46%, exceeding the "Ninth Five-Year" period about 0.44 percentage points. In 2006, the terminal consumption of electricity in Beijing is 18.81395 million tons of standard coal, increased 9.72 percent than 2005, accounting for 33.1 percent of the total consumption of energy, increased 0.80 percentage points than 2005.

(3) the oil terminal consumption shows upward trend overall and an increasing momentum after declining slightly in 2003. In 1997, in Beijing, the terminal consumption of oil is 7.5515 million tons of standard coal, accounting for 21.18% of the total energy consumption. The last 3 years of the "Ninth Five-Year" period and the previous two years of the "10th Five-Year Plan" period, it has continued to rise, with an average annual growth rate of 7.43 percent. By 2002, the terminal consumption of oil has reached 10.8081 million tons of standard coal, and has 43.13 percent growth over 1997, accounting for 25.12 percent of the total consumption of terminal energy. In 2003, the terminal consumption of oil turned to negative growth, the total quantity only reached to 10.5187 million tons of standard coal, declining 2.68 percent over 2002, after that, the terminal consumption of oil grows rapidly. In 2006, Beijing's terminal consumption of oil is up to 16.2763 million tons of standard coal, growing 13 per cent over 2005, accounting for 28.64% of the total terminal energy consumption, respectively compared with 2005, it increased 1.59 percentage points and with 2004, increased 2.19 percentage points.

(4) the terminal consumption of natural gas has increased significantly. In 1997, Beijing's terminal consumption of natural gas was 197,900 tons of standard coal, accounting for the total energy consumption by 0.56%. In the last three years of the "Ninth Five-Year", it grew rapidly with an average annual growth rate of 52.75%. By 2000, the consumption of natural gas has reached 705,500 tons of standard coal, increased 256 percentage points over 1997. During the "10th Five-Year Plan" period, the average annual growth rate of natural gas remains 39.96 percent. In 2006 Beijing's terminal consumption of natural gas was 3.779 million tons of standard coal, growing 11.1 percent



over 2005, accounting for 6.65% of the total terminal consumption respectively compared with 2005, 2004 and 2003, it increased 0.26, 0.82 and 1.53 percents.

### **3. Analyze the characteristics of Beijing area's terminal energy consumption**

From the energy terminal status and the change trend of Beijing, we may analyze the characteristics of terminal energy consumption, and get the following conclusions:

(1) Beijing's energy consumption growth rate has intensifying trend, but the level of consumption of output is declining.

In 1997, the total energy consumption of Beijing was 31.619250 million tons of standard coal, and in 2006 it reached to 56.8221 million tons of standard coal. From the growth rate of the total terminal energy consumption, since 1997, the total terminal energy consumption has an annual growth rate of 5.31%, the average annual growth is about 2.3516 million tons of standard coal. Although the total terminal energy consumption has been growing fast, the production value per unit consumption in Beijing was decreasing year by year (as shown in Figure 3). In 2006 Beijing area's GDP production value per unit consumption was 0.72 tons of standard coal consumption / million, drop off 6.6 percent compared to 2005, was lowest in the nation.

(2) The energy was mainly used for industrial production.

In 2006, in Beijing's terminal energy consumption, the terminal energy consumption in industrial accounted for 42.31 percent of the city's total energy consumption, and showed a higher proportion compared to the 20-40% of the developed countries, the proportion of industrial energy consumption in United States was 21.6 percent. To reduce the total energy consumption level of Beijing, the focus is on the control of energy consumption of industrial, particularly about oil processing, coking and nuclear fuel processing, chemical raw materials and chemical products, non-metallic mineral products industry, ferrous metals smelting and pressing industry, transportation equipment manufacturing, electricity, gas and water production and supply industry, in 2006 these six industries' total energy consumption accounted for 91.56 percent of the total consumption of industrial. To control the scale of development, structural adjustment and phase products of high energy consumption out, reduce product consumption and improve energy-saving rate, is the key to curb the excessive growth of energy consumption needs of Beijing.

(3) Coal is primary, which shows the declining trend, and the electricity surpasses year by year.

For a long time, influenced by the national resources and energy policy, before the year 2005, coal has been the dominant in Beijing's terminal energy structure. Although dropped from 41.47 percent in 1997 to 32.17 percent in 2003, it still has 1.37 percent points higher than the electricity consumption which ranks the second. In 2006, the consumption of coal accounted for 24.47 percent in the total terminal energy consumption. As early as 1998, the total coal consumption of all OECD countries was only 4.3%. In 2006, the United States' proportion of coal consumption is only 2.03 percent, far below Beijing's ratio. The coal oriented energy structure, is one of the main root of serious atmospheric pollution, it does not conform to Beijing's urban function and nature, but also affects our country's international image. Until 2004, Beijing has increases the intensity of the industrial structure adjustment, make the electricity consumption proportion slightly over the coal consumption, industrial industries, the tertiary industry and the lives of the residents of these three industries are fastest-growing.

### **4. Conclusion**

The result showed that Beijing area's terminal energy consumption is developing toward the encouraging direction. On one hand, the output level of energy consumption is unceasingly declining, it is completely coinciding with our national policy that is to build a resource-conserving society, promoting the development of the national economy well and fast is not at the expense of large amount of resources; on the other hand, the proportion of electricity and other clean energy act as an upward trend, and coal and other primary energy showed a downward trend, so the energy structure has been continuously optimized to make a positive role in improving Beijing's air quality and the environmental standards.

"The 11th Five Year Plan Summary Beijing National economy And Social development in Beijing" has cleared out main development targets of Beijing in the next 5 year: to continue to maintain the capital's economic development steady and rapid, and on the basis of optimizing structure, improving the efficiency and reducing the resource consumption, the average annual GDP grows 9 percent, and annual GDP of per person will be doubled that of 2000 by 2010. With the implementation of a series of related policies and under the opportunity of the Green Olympic, Beijing will realize harmonious development of the economy, society and environment.

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Table 1. Beijing area's structure table of terminal energy consumption

Unit: Ten thousands tons of standard coal

year	coal	oil	natural gas	electricity	other	total
1997	1478.61	755.15	19.79	908.37	403.88	3565.80
1998	1521.33	742.71	31.21	953.14	409.74	3658.13
1999	1457.88	816.35	51.73	1029.10	378.41	3733.47
2000	1437.96	865.74	70.55	1145.61	493.94	4013.81
2001	1526.55	901.21	144.99	1187.63	359.72	4120.10
2002	1337.52	1080.81	200.48	1305.84	377.24	4301.90
2003	1459.06	1051.87	232.30	1397.11	394.95	4535.28
2004	1372.59	1279.12	281.96	1535.13	366.19	4834.99
2005	1371.03	1440.35	340.00	1719.40	452.29	5323.07
2006	1390.21	1627.63	377.89	1881.39	405.08	5682.21

Note: The data originates from "Beijing Statistical annual" and "Chinese Energy Statistical annual"

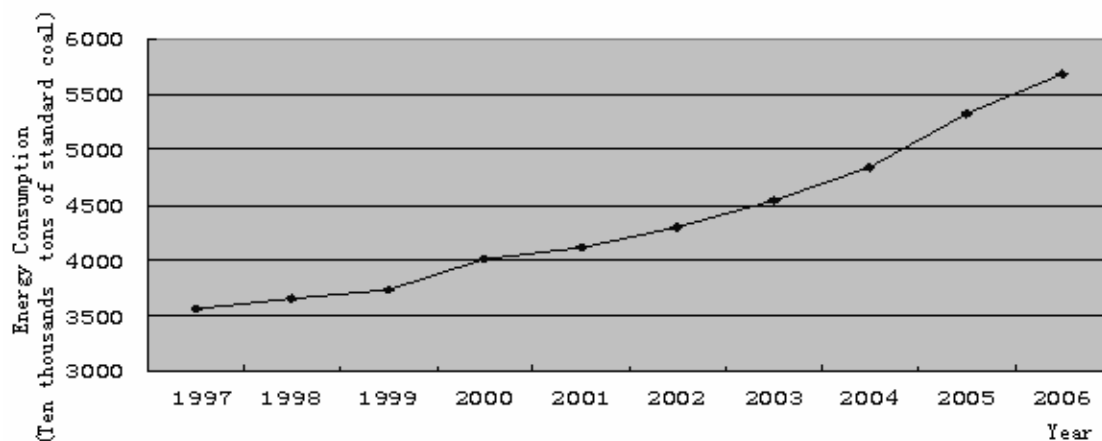


Figure 1. The total terminal energy consumption tendency chart of Beijing

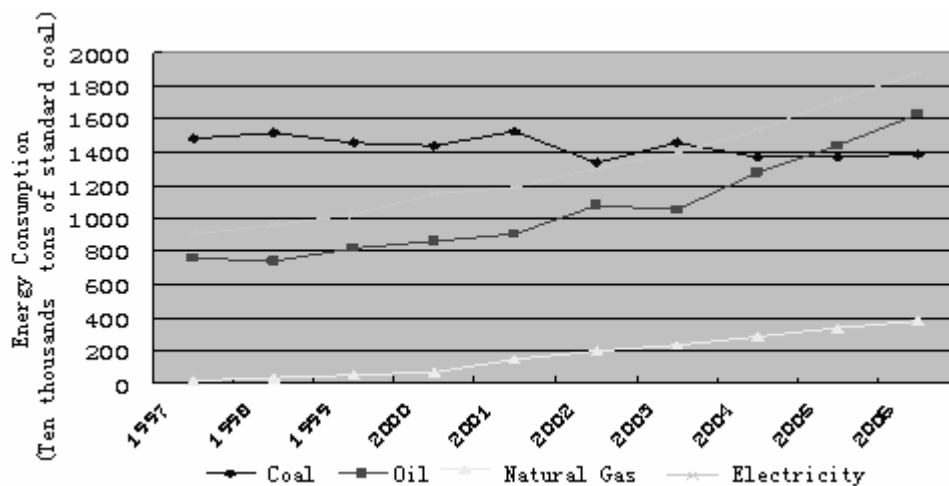


Figure 2. Beijing area's terminal energy structure chart

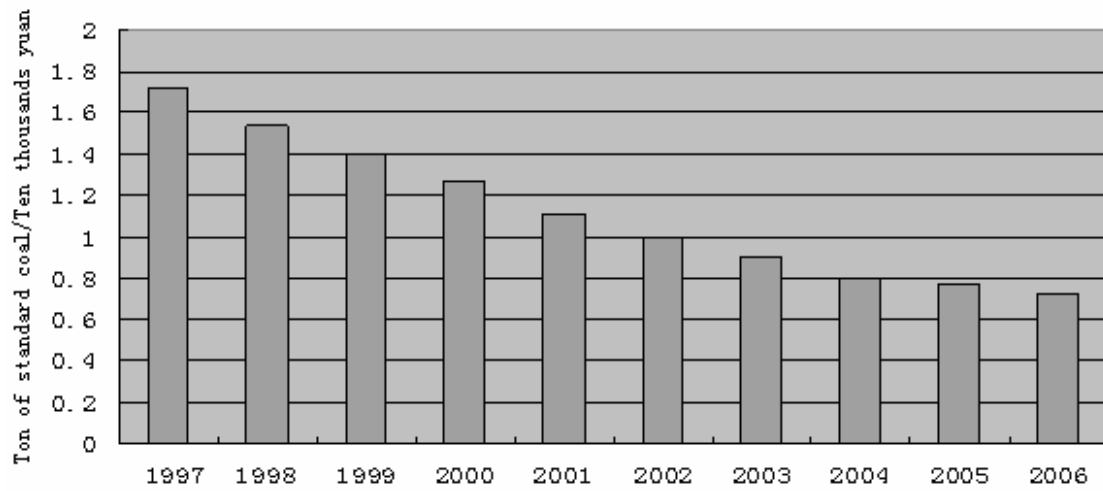


Figure 3. Beijing Area's tendency chart about production value  
per unit consumption of the terminal energy

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