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Drawing the Economical Balanced Line for Railway and Sea Way Transportation between Iran and China

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Abstract

In international trade, from a cargo departure point to destination point, there may be two basic ways to use transportation means, by sea or railway as there are geographically several availabilities of airways ,railway lines and sea voyage lines and meantime transportation costs are dynamically changed, it is possible to draw some area by use of Geographic-Economic Line, which gives business people an easy reference for their choosing transportation means for logistic solution to some kinds of cargos. This paper first introduces general situation of China-Europe and Middle East block train development. Second the paper focused on China-Iran block train case, collected various railway and sea way transportation route and rate information to support deep analysis. Third, the paper developed some formulas to find the balanced cost by using all available data. Finally, the paper traced from cost information to get geographic places which are further turn out to be as economic balanced lines marked in map which could serve as reference lines for their easy decision.

Keywords: China-Europe block train, China-Iran block train, rate of container transportation, balanced economic line, China-Iran business

1. Introduction

1.1 Research Purpose

This research would like to explore the sustainability of China-Middle East Railway transportation, to make a deep cost or price or charge analysis of intermodal transportations which combine sea and railway as well as truck means. Particularly this research tries to develop a dividing measure which can give the concerned business peoples and scholars an easy way to make logistic decision to use sea transportation or to use railway if particular destination is decided.

1.2 Focusing on China-Iran Logistic Solution

Because of unbalanced going and returning issue of China-Europe cargo Train business, this research would explore the possibility to develop a business to use railway to transport Iranian products to China, the representative goods is bitumen, the inner logic of this research is that if bitumen (related low value) could work via railway transportation, then other goods have definitely the chance to use this model. Especially if the market destination of Iranian exportable products is west part of China, then applying this railways mean will make it a balance route.

2. Literature Review

Since this topic is an innovative subject and maybe new in railway transportation calculation between two countries then I can found a few papers and article relatively. But since the main concern in this paper is running the railway system utilizing subsidy of government which may affect in applying or not applying the railway, then in this part I will bring some literature accordingly.

2.1 Three Railway Routes from China to Europe and Middle East

Now from China to Europe and Middle East there are three railway routes, northern, middle and western routes respectively. Traditionally the northern route is from Manzhouli City, the busiest land port in North of China, then though Russian Siberian railway to Moscow and connecting to European cities.

Second railway route is from Inner Mongolian's Erenhot City via Mongolia's Ulan Bator then to Russian's

Siberian Railway.

The third one is the hottest route that has been discussed very much recently, which is from China's Longhai Railway and Lanxin Railway exiting from Huoerguosi Port to Almaty, Kazakhstan, and to the southwest via Tashkent, Uzbekistan and Turkmenistan, and to the west via the Caspian Sea connected three states in Transcaucasia and the Black Sea arrived in southern Europe. Or this route can go to pass from Turkmenistan to southwest Iran, Turkey, connecting the Middle East and North Africa.

2.2 The Operation of China-Europe and Middle East Railway Transportation

Since 2011, China's Chongqing city has sent a cargo train to Duisburg, until June 2016 there being totally 1700 trains sent by 16 Chinese cities (Note 1).

Meanwhile the return cargos from Europe to China has been also increased, even such cargoes are relatively in few quantities comparatively to the cargo going to Europe. For the economic aspects, to find more return cargo to fill the empty containers is a big challenge to the operation party.

2.3 Subsidizing the Railways Transportations and Its Affects in Business Cooperation

Ahmad (1992) in his paper "Import Competition, Government Subsidies, and Trade with Developing Countries" Government subsidies to import-threatened industries, particularly in the TCF sectors, in the industrial countries have departed significantly from their earlier counterparts as means of orderly retreat from non-competitive sectors. They have, instead, become instruments of "revitalization" of these industries through sustained investment in capital equipment and contrived increases in labor productivity. Unlike trade barriers that are temporary in nature, investment subsidies have fostered permanent obstacles to the growth of bilateral trade between the developed and the developing countries. Though mitigating the need for even more stringent trade barriers, they have tended to shift the burden of adjustment disproportionately on to the developing countries. Moreover, heavy government involvement in the TCF sectors has set dangerous precedents for other import-vulnerable sectors (Note 1)

Stephen Tokarick in his paper of "Export promotion: the role of transportation subsidies", he has provided a simple methodology for estimating the effect of "disguised" distortions on trade flows. The paper focuses on a prevalent form of input distortions – subsidies applied to the purchase of transportation services. He Presents a methodology which is useful for analyzing the effects of indirect trade control measures that influence the price of a basic input, such as transportation services, rather than direct measures such as export subsidies. As an example of its usefulness, the methodology described in his paper was then implemented to quantify the effects of transportation subsidies, applied by the Canadian government, on production and trade in alfalfa products. The model focuses attention on the effects these subsidies have on US production and exports and the severity of the displacement caused by these subsidies. Using the central case elasticity for alfalfa cubes, removal of the Canadian transportation subsidies results in a reduction in the value of Canadian production of US$6.1 million and a reduction in the value of exports of US$2.4 million. In the USA, the Canadian subsidies reduce the value of production of cubes by US$1.2 million and displace exports worth US$1.3 million. Using the central case elasticity for alfalfa pellets, subsidy removal results in a reduction in the value of Canadian production of US$10 million and a reduction of US$2.8 millions of exports. In the USA, Canadian transportation subsidies displace US$1.6 million of exports of pellets and reduce the value of production by US$2.9 million. These results are consistent with fact that US exports of alfalfa cubes are almost four-and-a-half times as great as Canadian exports, while the USA is "small" in the world market for alfalfa pellets, since Canadian exports are more than 85 times as great as US exports. Thus, from the perspective of the USA, removal of the Canadian transportation subsidies has a greater impact on US exports of alfalfa pellets than on exports of alfalfa cubes. The magnitudes of these results represent an upper bound, so the results could be smaller, especially if alfalfa products from different exporters are perceived to be imperfect substitutes. This exercise also points out the value of using simple partial equilibrium trade models to evaluate the effects of trade distorting policies that are not readily transparent, such as those applied to transportation services. (Note 2)

Zesheng Sun in his paper of" Revisiting the economic effect of export subsidy: an expansion of the traditional analysis" he found out that Compared with the traditional analysis, exporting countries that implement export subsidies suffer less welfare loss and induce intra-industry trade of homogeneous products. Due to export subsidy policy incentives, transportation costs heavily influence trade patterns, trade volumes and welfare. Trade patterns evolve from unidirectional export to intra-industry trade as transportation costs are reduced, with the main source of welfare loss coming from transportation costs. The distribution of export subsidies is biased when domestic transportation costs are high. Under low domestic transportation costs, inefficient intra-industry trade would emerge as a result of export subsidy incentive. (Note 3)

MillaLaisi also has investigated in published paper of "Stimulating competition in the liberalized railway freight market" his insights into the railway freight markets' situation after the deregulation process in three countries, namely in Sweden, Poland and Finland. The main purpose of the study was to research the main barriers to entry and market entry strategies utilized by the new entrants. (Note 4)

2.4 The Problems and Challenges of China-Europe (Middle East) Freight Train Development

2.4.1 Railway's Higher Costs vs. Sea Transportation

The first Yu-Xin-Ou freight train, one standard container cost 8,000-9,000 USD, which is double as sea transportation per standard containers 4,000 USD cost. The costs charged in different regions such as Europe Union Region, the Commonwealth of Independent States and China, are different. it's difficult to get the detailed data, but According to a research done by author Zhao Qingsong, Xinjiang Financial University, its claimed that in EU the ratio of rail transportation to sea transportation is 4X ,in CIS countries and china is 2 (Note 5)

Please note that cost ratio of EU; the format of figure used is 4.X, which needs further dig out. Even for this not precise expression, it is still useful for business management research. Same paper also mentioned that the freight transportation in EU is also differently charged, the Germany and Czech Republic charged even more than other EU member countries. Such issues are remained as cost barrier, which will be long existed in China-Europe Freight Business fields.

2.4.2 Railway Track Width Issue

From China to Europe via railway system, the railway track width issue should be solved technologically. The width of three regions, China, Commonwealth Independent States, and European Union each use different track width historically, detailed dimensions are EU 1435 mm, Commonwealth Independent States1520 mm and China is 1435 mm.

So the containers on the trains between China to European Union need to have two times of shifting tracks, which means that those containers need to be transferred into other trains twice. Usually those trains across China and Kazakhstan board need to have such transferred operation in the station Dostky, Kazakhstan, and then second transferred operation will be done in the station Brest, Poland. One Journalist from China's Dahe Daily reported on 2013 that one operation of custom check and container transferring needs about 5-6 hours (Note 6), which could be further reduced.

2.4.3 Document Issues

Documents related with China-Europe Railway Freight Transportation were regarded as an issue, which inferences the development of such transcontinental logistic business. At beginning, the documents are not legally regarded as cargo loss's compensation evidences as that sea transportation bill of landing can be, so it caused customers' worry about to use such kind of transportation means. Later China Railway Freight Service Company solved such issues, which let customers could track the cargo transportation in all processes.

2.4.4 Unbalanced Freight Direction

Still based on the data from the literature searching, unbalanced freight direction problem appears clearly, the following table showed this situation.

From the table 1, the accumulation data to June 2016, China-Europe Freight Train numbers are 1,700, most of them are full loaded, but when those train come back to China, the trains are usually less loaded in cargo. For example, from China Youth Daily report, the Freight trains from Yiwu, China's largest commodity whole sale city in Zhejinag province, since November 18, 2014 Yiwu sent his first freight train to Madrid, Spain, June of 2016, totally sending off 58 times of Yiwu to Europe City freight trains, loaded 3,800 standard containers, whereas the return standard containers are only 296 (Note 6).

So the direction from China to Europe V.S. the direction from Europe to China is unbalanced greatly, the return cargo from Europe to China is only 7.8 percentage of China to Europe. Such unbalanced transportation situation has caused the costs of China-Europe Freight Trains up, which reduced confidence of parties involved in this new development of intercontinental cargo businesses.

3. Research Methodology

By collecting various railways and sea way container transportation route and rate information between China-Europe and China-Iran, try to screen them to get valuable data for being used.

To develop formulas to add all costs related with container transportation in both railway and sea way, to make a sum of cost first, and to get a balanced solution in cost information, then to trace geographic places with

geographic solution, finally to mark economic lines in map.

First, For Reference port; to select Shanghai as starting port, via sea way to Bander Abbas port Iran, then using railway to Teheran. The railway route starts from Shanghai to Urumqi, Alashankou, Almaty, Turkmenistan to Sarakhs, then to Teheran.

Second, for another Reference port; to select Shenzhen as starting port, also via sea way to Bandar Abbas port Iran, then using railway to Teheran. The railway route starts from Shenzhen to Hunan then to Chengdu to Lanzhou, finally also via Urumqi and Alashankou to Iran.

There are several types of railway cargo transportation models, boxcar, flatcar, oil tank and container car, and so on. This research will mainly focus on container transportation model.

3.1 The Investigation of Sea Route Transportation from China to Iran

3.1.1 Sea Transportation Route and Rate

From China to Iran, there are three main ports such as Bandar Abbas, Bushehr and Bandar Khomeini, in which Bandar Abbas there has been frequent ship lines to Shanghai. The information searched from Baidu.com, the largest searching engine in China, we get the shipping price in June 2016 for 40-foot container and days needed in table 1.

Table1. Shanghai to Bandar Abbas days and rates for 40-foot container

Company	Days	Rate USD
A	23	1,000
B	25	1,200
C	19	1,350
D	20	1,000
E	25	1,200
Average	22.4	1,150

From above table, we can get clear information that from Shanghai to Abbas ship needs about 23 days, and rate is about USD 1,150, But when we tried to call them, the information from them all those prices seem to be the attraction sign to catch customer's eyes, whereas real transportation price is much high than the above table showed.

Furthermore, also from baidu.com, as figure.1 indicates Shanghai to Abbas port 20-foot container rates in April to July 2016, which is provided by www.jctrans.com, one of the largest global container business platform companies on June 26, 2016.

Figure1. Shanghai to Abbas Port Iran Rate Trend in 2016

*The container size is 20 foot one

From above figure.1, we could see from May 2016 sea transportation rate are continuously going down, and on May 4th, the rate was USD 694.55, and on July 25th the rate will be USD 832.39, which are in the top in the figure, whereas in the bottom data could be seen as on June 13, USD 576.12 and on June 30, USD 586. So average rate is roughly SD 672.

3.1.2 Main sea Transportation Charge Information from The Investigation in 2014

Information searching by our research team did by this paper author and team members in 2014 winter, we collected port treatment days and rates from Iran-China chamber of commerce and industries, the data are put into following table 2.

Table2.Container shipping costs from Shanghai China to Isfahan Iran Unit: USD

	Shipping from China(Shanghai) to Iran Port	Terminal charge (Chinese port Shanghai)	Cost from Isfahan to Abbas port by train/truck	Terminal charge (Abbas port)	Total costs
Cost	2，500-3，5000	A = approximately 200	B= approximately 500	C= approximately 100	(2，500 – 3，500) +A+B+C
Days	28	5	1	3	37

So from above information, we could know that such sea transportation rates are quite big, in 2014 winter, the container (40 foot) rate was about USD 2500-3,500, whereas this year in 2016 the rate is going down, if proportional calculating 40-foot container rate is double than 20-foot container, then we can get the result of our research in following table. it is necessary to mentioned that sea transportation from Iran to China always is very low and even one fifth or less than of shipping cost from China to Iran, then most of cargo coming from Iran to China by container which are not sensitive to time consuming, preferably apply sea transportation compare to other ways, if cargo going to west part of China, then in such circumstances we may need to consider rail transportation as well.

3.1.3 the results of investigation

In order to develop a precisely calculation for getting the balanced points of railway and sea transportation, we need to have basic rate of all means in all available sources, therefore above specific data information is really valuable so as to get the results of investigation in following table 5.

Table3.Research results of 40-foot container rate from Shanghai to Abbas Iran Unit: USD

	2014	2016
Average 1	(3,000+4,000)/2 =3,500	(1150+672*2)/2 =1247
Average 2	(3,500+1,247)/2 = 2,374	

In above table, Average 1 showed year 2014 and 2016 rate from Shanghai to Abbas port Iran for 40-foot container, and Average 2 showed all the research period's average rate of same route. So as further calculation, we need to use above data to get the balanced shipping and railway price point.

3.2 Railway Route Rate Investigation

3.2.1 China-Europe Block Trains Since 2011

On March 19, 2011, first Freight Train from Chongqing, China's western metropolis, to Duisburg Germany was sent off, which is regarded as "Yu-Xin-Ou" Regular Freight Train, meaning from Chongqing through Xinjiang Uygur Autonomous Region to Europe. After that, from China to Europe, such freight trains have been boomingly developed; there are more than 10 cities, such as Wuhan, Suzhou, Yiwu, and Zhengzhou, named as "Han-Xin-Ou", Yi-Xin-Ou and Zheng-Xin-Ou respectively, and so on. Until June of 2016, the numbers of such freight trains have increased up to 1,700 (Note 7).

all collected data about China-Europe (including to Middle Asia, like Iran) has been put in the following table 6, to see the increased trend.

Table4. China-Europe block trains development

Year	2011	2012	2013	2014	2015	2016 June
Regular Train Numbers	17	42	80	308	815	438
Accumulation	17	59	139	447	1262	1700
Annual Increase		147%	90%	285%	165%	

In above table, the data of 2011 and 2012 is come from Mr.LiZhongyu's paper, which is published in Port Economy (Note 8). Main data above is from the report of "Sino-Europe Regular Cargo Train Accumulated to 1500", written by Mr.PengQian and Mr. Ma Jian, published in the People's Railway of China, April 13, 2016.

The report said that until April 6, 2016, the numbers of China-Europe block trains have accumulated to 1500, the sending cities of which in China are increased to 10. The services offered to customers are following, transportation document development, Custom clearance, inspection and quarantine, information follow up, consultation, loading and uploading, and port to port logistics. Daily transportation in China territory is distance of 1,300 km (Note 9).

3.2.2 China-Iran Railway Cargo Transportation

In January 2016, China Railway sent first cargo train from Yiwu to Teheran, which passes about 9,500 KM in 14 days. The report said that this block train is passing Alashankou pass in Yining Region, China's Northwestern Xinjiang Uygur Autonomous Region.

Figure 2.The first block Train from Yiwu to Teheran

3.2.3 Railway Rate Decision Makers

From China to Iran the railway passes several countries, such as China, Kazakhstan, Uzbekistan, Turkmenistan, and Iran. As Kazakhstan, Uzbekistan and Turkmenistan are the members of Commonwealth Independent States, under government agreement of cost calculation treaty, which uses same fare rate for railway transportation, so there are totally three fare decision makers, China, Commonwealth Independent States, and Iran.

3.2.4 China's Railway Rate Decision Maker

Before March 10 2013, China had Ministry of Railway (MOR), which had decided passenger tickets prices and cargo transportation fares. Comparatively speaking, cargo fares are more complicated than passenger tickets, which usually followed some formula to calculate total charges for cargo transportation. Such fare formulas have been changed in new system, but for the research, those formulas are still having value to understand China Railway's fare management.

Owing to the reform by the state council of China, MOR has been divided into two parts China Railway Bureau that undertakes the administration tasks that MOR previously did, whereas railways operation is undertaken by China Railway, which is a state owned company with the registered capital of RMB 1,036 billion. China Railway has three transportation sub-companies, among them, China Railway Container Transport Co., Ltd. (CRCT), is a 100% subsidiary of China Railway, which is the main operator and management responsibility holder for China-Europe and China-Middle east container's transportation business. Of cause, CRCT is the China container price decision maker. Now such rate is roughly about one USD per container per KM more or less, the containers are referred as FEU (Forty Foot Equivalent Unit).

3.2.5 Commonwealth Independent States' Rate Decision Maker

From the literature review, the commonwealth Independent States' container fares are different, for example, the railway line through Alashankou Pass to Kazakhstan per container per KM rate is about USD 0.66-0.74, whereas the railway line through Manzhouli pass to Russia per container per KM is about USD 0.39 (Note 10). So we know that even in Commonwealth Independent States, railway rates are decided by different decision makers, which have space to further reduce. These important prices information is extremely valuable, so we put them into following table7.

Table 5. 40-Foot Container Rate in Commonwealth Independent Statesunit: USD

Passing Kazakhstan Rate	Passing Russia Rate	Average Rate in CIS
0.66-0.74	0.39	((0.66+0.74)/2 +0,39)/2=0.545

In above table, we get the average rate in CIS region, which is about half USD per KM per 40-foot container.

Of cause, concerning the Commonwealth Independent States, Russia is acting tremendous inference, so in the railway field, we need pay more attention to Russia Railway, one of top three railway systems. Fortunately, from The XI International Rail Business Forum Strategic Partnership 1520 in Sochi ended on 3 June 2016, the Russia Railways President Oleg Belozerov, has delivered very long sight summary speech that "We need to move from competition to cooperation and coordinate our joint efforts." Within the framework of the business program, questions were raised on the target market model for freight transportation, tariff formation, attracting investment, improving the operation of rolling stock technology and developing international transport corridors. Special sessions allowed experts to discuss the development of information technologies in rail business management systems, fundamental and applied science for the rail sector and human resources policy (Note 11).

3.2.6 Iran Railway Container Transportation Rate Maker

Iran has developed railway system of 14,000KM, which is almost same as UK's total mileage of railway system; meanwhile the territory of Iran is 10 times of UK. Islamic Republic of Iran Railway Systems (RAI) is the administration body for whole system.

3.2.7 Railway Route Rate from Shanghai to Teheran

Both from literature review and international map, mainly from Iran to China to use railway transportation, detailed route cities could be seen in table 8.

Table 6. Railway route from Teheran to China border passes Horgos or Alashankouunit: KM

Country	Iran			Turkmenistan			Uzbekistan
Passing cities	Teheran	Mashhad	Sarakhs	Tejen	Mary	Turkmenabat	Tashkent
Distance	0	900	200	130	150	250	750
Accumulation		900	1,100	1,230	1,380	1,630	2,380
Order	1	2	3	4	5	6	7
Country		Kazakhstan			Kazakhstan	China	
		Shymkent	Taraz	Bishkek	Almaty	Horgos Pass	Alashankou
Distance		165	180	320	240	400	580
Accumulation		2,545	2,725	3,045	3,285	3,685	4,265*
Order		8	9	10	11	12	13

*From Teheran to Alashankou is not via Horgos Pass. The data in above table are collected by this paper author. Database from:http://www.china.com.cn/chinese/zhuanti/xjbjmy/656411.htm and http://wenda.haosou.com/q/1370556726068759

3.2.7 Railway Distance from Shanghai to Middle and Western Parts of China

Table 7. Railway distance from Shanghai to Middle and Western Part Cities in China unit: KM

Routes	Shanghai → Zhengzhou	Zhengzhou → Xi'an	Xi'an → Lanzhou	Lanzhou → Yumen	Yumen → Turpan	Turpan → Urumqi
Distances （km）	998	485	600	820	810	170
Total distances	998	1,483	2,083	2,903	3,713	3,883

China Railways has provided excellent cargo transportation service to companies, and developed cargo transportation rate in its www.12306.cn, which is quite transparent. For research purpose we provide an information example from Eastern Cost city to Western Region City in following table 8.

Table 8. China cargo railway rate information example (S-U) unit: Rmb

Type	Station-Station	Port-Station	Station-Port	Port-Port
Whole Wagon	37,788	39,168	39,858	41,238
20 foot container	13,622	14,162	14,282	14,822
40 foot container	18,745	19,555	19,735	20,545

*whole wagon refers to 60 Metric Ton cargo.

From above table together with our investigation, we could roughly know that 40-foot container is not as the proportional rate as 20-foot container's cubic volume (13,622/18,745 =73%), which means that larger container is cheaper in cargo transportation as usual. Also China Railways indicated that the service charge to pick up the container (40 foot) is about RMB 800-900 each time. Per KM per container (40 foot) rate is about RMB 4.83, which is equivalent to USD 0.73 (1 USD =6.615 RMB on June 26, 2016).

3.2.8 Railway routs and costs from Teheran to other Iranian cities

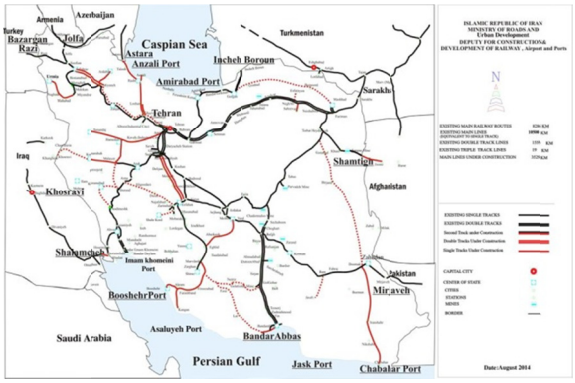

Figure3. Iranian railway system

From above figure, we could clearly know the railway situation in Iran, thick line indicates double tracks and thinner line indicates single track. From this paper author's investigation, the detailed distance from Iran capital Tehran to main ports such as Bandar Abbas, Booshehr Port, and Imam Khomeini Port as well as railway border station Sarahks are listed in table 9.

Table 9. The distances from Teheran to main port and railway border cities in Iran unit: KM (Note 12)

	Bandar Abbas	Bushehr Port	Imam Khomeini Port	Sarahks
Teheran	1,350	1,100	850	1,150

3.3 China Local Government's Subsidies to the China-Europe Cargo Trains

Government subsidies to China-Europe or China-Middle East railway transportation could be seen in China, which reflected China's governmental concerns to develop new transportation channels between China and Europe as well as Middle East Regions. From a research paper named as China-Europe cargo transportation; Present Situation, Problem and Suggestions by Wang Yangkun，he provided valuable some China-Europe block trains rate information as well as subsidies in detail put in following table 10.

Table 10. Container Rate and Government Subsidies of China-Europe Cargo Trains Unit: USD

Name Of Train	Origin To Finish	Transport Kilometers	Transport Expenses(Dollars)	Transport Time (Days)	Government Subsidies
Yu XinOu	Chong Qing Toduisburg, Germany	11,000	8,900	15~17	3,500~4,000
Han XinOu	Wu Han To Chech, Poland	10,700	12,000	15~17	4,000~5,000
RongOu Fast Train	Cheng Du To Lodz, Poland	9,965	10,290	12~14	3,000~3,500
ZhengOu	Zheng Zhou To Hamburg, Germany	10,245	10,500	16~18	3,000~7,000
Su Man Ou	Su Zhou To Warsaw, Poland	11,200	7,500	12~15	1,000(Has Been Canceled)
Yi XinOu	Yi Wu To Madrid, Spain	13,052	10,000	21	_
Ying Man Ou	Ying Kou To Poland, Belarus And Slovakia	14,000	_	12~13	_
Yu XinOu	Chong Qing To Duisburg, Germany	11,000	8,900	15~17	3,500~4,000

From above table12, we could see China government's subsidy is varying from 0 to 5000 USD per FEU in 2014. Why did such different situation happen? The reasonable explanation for this is that all these decisions of the subsidies are decided by Chinese local provincial governments. The author of this paper would like to point out that China Railways realized that because so many provincial governments involved in this new transportation means development, which all use local name in such railway route, which caused unnecessary provincial region competition to collect cargo sources, and also caused chaotic situation to negotiation internationally. Soin order to formulate unified image, China Railway in June 2016 announced that all those China-Europe Block Trains are renamed as "China Railway Express", previous name as Yu-Xin-Ou, Han-Xin-Ou, Yi-Xin-Ou, and Zheng-Xin-Ou are stopped to use again.

From also above table, Henan Provincial Government offered extremely high subside to per 40 foot container maxim USD 7000, where eastern provinces such as Jiangsu and Zhejiang province have not provided such subsidies, this kind of transportation means is more sustainable.

Based on our investigation about China-Europe Block Trains cases, we know that now government subsidies are normal cases, so for this research, we use subsidies' data in table 12 and get average per block train's government subsidies are about USD 3542, thinking about the trend to gradually reduce such subsidies, we intend to use USD 3500 as a calculation figure for this research.

4. The Exploration of the Balanced Economic Points Or Line

4.1 Started from Balanced Formula Development

4.1.1 Sea Transportation from Shanghai to Teheran

First we need to think about sea transportation from China to Iran, as we know that Shanghai is the largest sea transportation port in China, so we choose Shanghai Port as a sending port. As Bandar Abbas is the busiest sea transportation port in Iran, we choose Bandar Abbas as the destination of Iran. Furthermore, as Teheran is the economic center of Iran, our economic sea-railway balance point (belt) calculation want to use Teheran as the final destination of the cargo.

$$\sum RSC = CRS + SC + IR + \ all\ other\ charges \qquad formula\ (4.1)$$

In above formula,

RSC means Costs of Railway with Sea transportation from China to Iran,

*CRS*means China Railway costs, which mainly use sea way, so with S appearing in the end,

SC means Sea transportation from China to Iran,

IR means Iran Railway Cost.

All other charges, indicate all custom document fees as well as other service charges, which are complicated to explain, for simplify the issue, we suppose all these charges equal to a percentage ρ,so the all other charges are (CRS+SC+IR)*ρ,therefore,(7-1) explains as (7-2)

$$\sum RSC = (CRS + SC + IR) * (1 + \rho) \qquad formula\ (4.2)$$

4.1.2 Railway route costs formula development

From Shanghai to Teheran all though railway is second option that developed very recently this year (January 2016), until now there are few research paper to dig it in all cost aspects. Also in order to simplify the research issue, we use adding method formula to put all costs together then to seek the balanced point solution.

$$\sum RCR = CRR + ICSC + IRR + \ all\ other\ rate \qquad formula(4.3)$$

RCR means the costs inclusive in Railway, so in the end with R,

CRR means the costs in China Railway system,

ICSC means the costs in ICS Railway systems,

IRR means the cost in Iran Railway system, with a R to make difference to formula (4-1) and (4-2)

All other rate means similar contents with all other charges in (4-1), which including all document fees and service charge, but here we refer it to all other rate. For similar formula development, we use ω to get the formula (4-4) to mean the different operation situation.

$$\sum RSR = (CRR + ICSC + IRR) * (1 + \omega) \qquad formula(4.4)$$

In above formula (7.4), ω means the all other rate percentage in railway systems operation, which needs further investigation to get it.

4.2 The Smart Logic to Get Balanced Point

In order to get the balanced point, we think that first to add two means cost together, then dividing 2 could get the data that indicates the where two means are equal in costs. So the formula of (4-5) is developed as following.

$$(\sum RSC + \sum RSR) = 2f(x) \text{formula(4.5)}$$

In above formula, f(x) means where the" x" place has the feature that mainly sea transportation means costs equal to only railway transportation means in China's logistic transportation to Iran.

From (7-5), we get more detail formula (4.6)

$$f(x) = \frac{1}{2}[\![\ \ (CRS + SC + IR) * (1 + \rho) + (CRR + ICSC + IRR) * (1 + \omega)\ \ ]\!] \text{Formula (4.6)}$$

4.3 Further Computational Formula in Detail

4.3.1 Computational Formula of the Cost by Mainly Sea Combined with Railway

We need to further seeking above formula's solution, so a table to detailed computational formulas is listed in following table 13.

Table 13. Costs formulas explanation from China Port to Teheran (mainly Sea way)

Sea and railway transportation	W_x(city in the inland of China)	CP (China Port)	IP (Iran Port)	Teheran
Distance(km)	D_{CPW}		D_{TIP}	
Price of per container and per	E_{Ch}		E_{Ir}	

kilometer(USD)	
Expenses of transportation by sea	SC
Cost	∑RSC=CRS+SC+IR+ all other charges=(CRS+SC+IR)*(1+ ρ) =(D_{TIP} *E_{Ir}+ SC+ D_{CPW}*E_{Ch}))*(1+ ρ)

In above table, detailed item names are explained in following:

Wx means the place where both railway and sea way transportation costs are same.

D_{CPW} : distance between CP (China Port) and Wx,

D_{TIP}: distance between Teheran and IP (Iran Port),

D_{IPCP}; distance between IP and CP, actually this distance has only enrich meanings, while mileage rate giving, so this data could be used,

E_{Ir}: Rate of per container and per kilometer in Iran Railway,

ECh: Rate of per container and per kilometer in China Railway,

SC: Sea transportation Cost (per 40 foot container).

4.3.2 Computational Formula of the Cost by Railway

As we know there are now a railway from China to Iran has been developed, the railway cost calculation information is put in the following table 14.

Table 14. Costs formulas explanation from China Inland City to Teheran (exclusive by railway)

Railway transportation	W_x(city in the inland China)	M(City in the border of Iran)	N (City in the border of Iran)	Teheran
Distance(km)	D_{WM}	D_{MN}	D_{NT}	
Expenses of per container and perkilometer(USD)	E_{Ir}	E_{MN}	E_{Ch}	
Costs	∑RCR=CRR+ICSC+IRR+ all other rate =(CRR+ICSC+IRR)*(1+ω)) =(D_{WM} * E_{Ir} +D_{MN} * E_{MN} + D_{NZ} * E_{Ch}))*(1+ω)			
Government subsides	G			
Costs including subsides	∑RCR=(D_{WM} * E_{Ir} +D_{MN} * E_{MN} + D_{NZ} * E_{Ch}))*(1+ ω)-G			

D_{WM}: distance between Wx and M

D_{MN}: distance between M and N

D_{NT}: distance between N and Teheran

E_{MN}: Rate of per container and per KM in the balanced point from China to Iran.

G: Government subsidies.

4.4 To Get the Solution of Above Formula

In order to get the above formula solution, first we need to assume that ρ and ω are all equal to 0, which make our research relatively simple. Second, we still need to have all detailed information about the mileages of each route and all rates from different countries, such as China, Commonwealth Independent States and Iran. As our investigation results provided in above already, here we put all related data in following table 15.

Table 15. Basic data of Railway and Sea way of transportation between China and Iran

Types of means	Railway transportation	Railway and sea transportation
Route	Shanghai-Urumqi-Alashankou-Kazakhstan-Turkmenistan-Sarakhs-Teheran	Shanghai-Bandar Abbas-Teheran
Distance	Shanghai-Urumqi(3883) , Urumqi-Alashankou(460), Kazakhstan and Turkmenistan (total 4497), Iran Region (1276) , totally 10,116KM	1,276 + Sea Voyage
Costs	F=0.56x1,276+0.70x4,497+4,243x0.73=6,960	F=0.56x1,276+2,500 =3,215

4.5 The Discussion about to Consider Government Subsidy Issue

So to put all data in table 15 into formula (7.6), we get the $f(x) = 1/2\ (6{,}960+3{,}215) = 5{,}087$ (USD)

Such data of 5,087 means in somewhere, we define it as X place, the railway and sea way transportation costs are same, that is the balanced cost point.

4.6 From Costs Solution to Geographic Place Information

With above result of balanced cost information, we can easily get the geographic place information that there are two kinds of solution. First without government subsidies, the balanced place is 2,641 KM western direction of Shanghai, along the China railway system, this place is in the eastern part of Lanzhou Station (distance from Shanghai is 2,185KM), so this place is in ZhangyeGanshu Province (distance from Shanghai to Zhangye city is about 2,635KM). Second when considering government subsidies, this balanced place will move forward eastern direction. Here we happen to find a subsidies efficiency reducing effect, that is to say, usually people think about the distance moving forward could be simply with the formula = subsidy / 0.73/KM (this data is from our above calculation, which is China's railway rate for 40-foot container.) to get result. But this is not correct, since if moving eastern direction 100 KM, as going sea transportation's whole cost will be reduced, so each 100 KM eastern forward will cost subsidy expectation increase to 200KM, which is meant such subsidy could have inference to cause business people to make decision moving from sea way to railway.

So in this particular case calculation, we get the conclusion that if government provides subsidy USD 2,793 per 40-foot container, this new balanced place will be moving forward eastern direction 1,913 KM, that is from Shanghai about 728KM. So this place is in Shangqiu city Henan Province (which is like 743 KM away from Shanghai).

4.7 Discussion with Government Subsidy Ratio

In order to consider government subsidy issue, we need to think about ratio of government subsidy over total mileage of the transportation route. Thanks the data already existing in table 12, we can easily get the ratio from following calculation.

$$(3{,}250+4{,}500+3{,}750+5{,}000)\div(8{,}900+1{,}2000+10{,}290+10{,}500)=39.58\%$$

4.8 To Get the Balanced Points with the Government Subsidies

We use the bottom formula in table 14, to use table 15 data, and can get the new balanced place with government subsidies. In order to get at least two points in map, we use also same method to calculate the situation with Shenzhen to Bander Abbas route. The sea transportation cost is assumed as same as the cost from Shanghai. The government subsidies are all assumed as same ratio of 39.58 to whole railway costs. So finally we get the two balanced geographic places as Rongshui Town (with government subsidy of USD 3,163 per 40 foot container) , whereas the balance place without government subsidy is at Lanzhou city , capital of Gansu province.

4.8 Summary of All Related Data and Balanced Geographic Places

We put all related data in table 16, to get a clear picture of this research.

Table16. Summary of data

Reference Port	Shanghai Port	Shenzhen Port
Distance	11,106 KM	
Balanced place without Subsidy	Zhangye City, Gansu Prov.	Lanzhou City, Gansu Prov.
Distance from balanced place to reference port	2,185 KM	2,083 KM
Balance place with Subsidy	Shangqiu City, Henan Prov.	Rongshui County, Guangxi
Subsidy quantity	USD 2,793	USD 3,163
Subsidy Ratio	39.58%	39.58%
Distance from Balanced place to reference port	743 KM	1,119 KM

4.9 Drawing the Balance Lines in Map

Figure4. Economic Balanced lines of Railway and Sea Way Transportation with China-Iran

We marked two blue lines to indicate the routes both from Shanghai and Shenzhen Ports. The short Rad line from Zhangye to Lanzhou is a balance line is related without government subsidy, which also means that eastern part of the line to use sea way transportation is better in cost, whereas in the western part of the line to use railway transportation is better in cost. The longer Rad line passing from Shangqiu to Rongshui in right side of map is the balance line with government subsidy; the economic meanings are as same as the short red line in left side of map. From the map we could see a blue dash line that connects Chengdu to Lanzhou, which will be operated in 2018 when the distance from Chengdu to Lanzhou will be reduced down 443 KM. So in that time, we can draw a new line for same purpose.

5. Discussion

First, with the development of China to Middle East block train, the trade between China and Middle Eastwill increased a new cargo transportation means, which will benefit both regions, has developed. As the first destination is Teheran Iran, both China and Iran business people will get more chance to do export and import business. Because China and Iran all have big railway system, the containers can easily transport to remote areas, both local SMEs can make use of such opportunities to develop whole sale and retail business in each areas.

Second, China has developed very advanced e-commerce, but in Iran such e-commerce is still in early development stage, China-Middle east block train, especially from Yiwu to Teheran block train could promote a lot of chance to stimulate Iranian e-commerce development.

Third, from above analysis, we know that at the beginning stage, China's local provincial governments provided huge subsidies to promote such new means, which have acted important role to such innovative transportation means, because the price ration of railway over sea way is so big, if without such government subsidies, there would be no such new way happened. We also noticed that such subsidies have been reduced down since it started in 2011.As China central government wants to promote one belt one road project, we could expect that such subsidies will be continuously remained for a few years. As China is now mainly carrying out market economy system, such government subsidies will be gradually reduced down. We have seen that such block train from Guangdong province that has not enjoyed government subsidies, which is still welcomed by local business

people. Especially for some cargo with time requirement, so this block train will be used.

Fourth, we can also expect that present railway rate could be further reduced, as China Railways run the new management measure to unify all those block train name as new name of China-Europe Express, which has increased better negotiation position internationally that will finally reduce international transportation cost down. Also we have seen that concerning China's railway cargo transportation rate, it is higher than Russia (Concerning 40-foot container per KM rate, Russia is only USD 0.39, whereas China is about USD 73). So with the further technology and management development, such China rate could be also reduced down. One of very possible solution is that China may try to get more return cargo from Europe and Middle Asia. Also to collect empty containers going back from sea transportation could be another means to reduce block train rate down. Of cause, this is some further research to dig.

Fifth, we could easily point out the movement directions of railway-sea transportation economic balanced line, if railway rate is going to down, the line is going to eastern movement forward, if railway rate is going up, the line movement is going to western forward. If government subsidies are going up then the line is going to eastern direction, whereas government subsidies are going down, the line is going to western direction.

6. Conclusion

First,this research result proves that there are really balanced economic geographic points existing in the way from China to Middle East, in this research such destination is Iran. We have used two railways exploration, to find such mysterious places, with the reference Port of Shanghai, such place without government subsidies is Zhangye city Gansu Province, reference with Port of Shenzhen, such place without government subsidies is Lanzhou City Gansu Province. If considering government subsidies, reference with Port of Shanghai with USD 2793 per 40 foot container government subsidy, such place is Shangqiu city Henan Province, with reference port of Shenzhen with government subsidy of USD 3163, such place is Rongshui County, Guangxi Zhuang Autonomous Region, and southwest China.

Second, from above research result, we have drawn the economic geographic lines. first, the line without government subsidies is from Zhangye City to Lanzhou, this line has passed big mountain area, the direction of this line has few reference meanings. As we know that there will be soon a new line from Chengdu to Lanzhou, so such line has more economic meaning for business people's decision making. Further explanation is that in the eastern part of the line, to choose sea transportation is better, but when company considering time requirement, so they can choose railway solution. When government subsidies are provided, such lines are transferred to Shangqiu city Henan province to Rougshui County Guangxi Zhuang Autonomous Region, similar meanings are as same as above line. Such balanced lines could be regarded as reference and measurement for business people and SME's managers to make decision.it is necessary to mentioned that sea transportation from Iran to China always is very low and even one fifth or less than of shipping cost from China to Iran, then most of cargo coming from Iran to China by container which are not sensitive to time consuming, preferably apply sea transportation compare to other ways, if the cargo going to west part of China, then in such circumstances we may need to consider rail transportation as well.

Third, we have also got some meaningful research result from our research processes, which are listed as follows. Concerning the rate along the railway road from China to Europe or Middle East, the lowest one is in Russia territory, which usually via Manzhouli station in Helongjiang province, the rate is only USD 0.39 per container per KM. Now Kazakhstan and China have similar rate as USD 0.70-0.73, which is almost double as the rate of Russia. Average speaking, China local government's subsidies are about 40% of total railway cost, which have the intention to gradually reduced down. So such line needs to be adjusted dynamically.

Notes

Note 1.CCTV news, June 20,2016

Note 2.Jaleel Ahmad, (1992),"Import Competition, Government Subsidies, and Trade with Developing Countries", Journal of Economic Studies, Vol. 19 Iss 2 pp.

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Note 4.Zesheng Sun Shuyun Wang, (2013),"Revisiting the economic effect of export subsidy: an expansion of the traditional analysis", Journal of Chinese Economic and Foreign Trade Studies, Vol. 6 Iss 1 pp. 35 – 45.

Note 5.MillaLaisi,MiikaMäkitalo Olli-PekkaHilmola, (2012),"Stimulating competition in the liberalized railway

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Note 8.Tao Liping, China Railway starts to use unified brand of China Railway Express to Sino-Europe-Freight Trains, China Youth Daily, June 11 2016.

Note 9.Li Zhongyu, Constructing Sino-Europe Regular Cargo Train Brand to Form One Belt One Road Railway Transportation New Structure, Port Economy, December 2015 (in Chinese).

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Note 11.Huang Sencai, To develop national strategy to deal with China-Europe Block Train Multimodal Transportation Competitiveness, Science & Technology Vision, 2016(1). (in Chinese)

Note 12.Oleg Belozerov , the summary speech in the XI International Rail Business Forum Strategic Partnership 1520 in Sochi ended on 3 June 2016, www.eng.rzd.ru

Note 13.http://www.aftabir.com/portal/trains/