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Macroeconomic Determinants, Innovation and the Birth of New Firms: Negative Binomial Regression Approach

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Abstract

This paper employs the random-effects negative binomial regression model (RENBM) to test the relationship between macroeconomic factors and the birth of new firms. The test is across countries and uses count data. We consider a sample of 135 panel-data observations, taken from 27 countries in the European Union (EU) during the period 2004 to 2008. We found that the birth of new firms is positively related to the growth of gross domestic product (GDP), inflation and openness, and is negatively related to unemployment. This result is in accordance with macroeconomic theory. The results also show that expenditure on research and development (R&D) has a significant positive effect on the number of new firms. This result further supports the hypothesis of new economic growth theory. Moreover, the empirical evidence shows a positive correlation between the number of new businesses and ethnic heterogeneity.

Keywords: birth of new firms, macroeconomic factors, innovation, ethnic heterogeneity, negative binomial regression model

1. Introduction

The attention given to birth of new firms phenomenon is not new. Several theoretical and empirical studies have been dedicated to this phenomenon in recent decades. Many social economists have written articles about the birth of new firms being a core part of economic development. And mainstream theory a business is likened to a 'black box', which, like a machine, converts input into output through the function of production. This black box is exogenous in mainly mainstream models. New firms, compared with existing ones, contribute more to rising revenues and productivity rates; the more firms that exist, the greater impact they have on deregulation, competition and exploitation of new technology and knowledge Braunerhjelm (2007). Empirical research has shown that promoting new businesses can create long-run benefits for society Braunerhjelm (2007). And previous empirical studies emphasized the importance of government policy and macroeconomic determinants but neglected the effect of ethnic heterogeneity and innovation determinants on the entry of new businesses into the market. New firms play a key role in generating jobs, new ideas and encouraging entrepreneurial activity, and they make a major contribution to the well-being of nations.

What determines the number of business start-ups is important for the evolution of firms and regional development. The role of business start-ups first attracted the attention of European governments in the 1990s because of the belief in the benefits they bring to the economy and employment. In EU countries, the beneficial effects of the birth of new firms also received positive appraisal in the economic stagnation of the 1980s, and even in the recent financial crisis 2009. Although a policy of encouraging new firms had been in effect in EU countries since the 1980s, it was the change in the law in the 1980s which helped the weak overcome disadvantage. The revised law characterized the formation of new firms positively as a source of economic vitality and employment and stated that it was governmentss' responsibility to offer the necessary support to promote the start-up of new businesses.

Classical growth theory reminds us that our physical resources are limited and that, without advances in

technology, we must eventually hit diminishing returns. Neoclassical growth theory reaches the same conclusion but not because of a population explosion. Instead, it emphasizes diminishing returns to capital and reminds us that we cannot keep growth going just by accumulating physical capital. We must also advance technology and accumulate human capital. We must become more creative in our use of scarce resources.

New growth theory emphasizes the capacity of human resources to innovate at a pace that offsets diminishing returns. It fits the facts of today's world more closely than either of the other two theories does but that does not make it correct. Thus the question remains: is new growth theory overemphasizing the capacity of human resources to innovate at a pace that offsets diminishing returns? If innovation and advances in technology do not eventually hit diminishing returns, then the coefficient of estimations for the expenditure on R&D can be statistically significant and have a strong positive effect on the dependent variable. Our empirical study is a first attempt at answering this question. Moreover, it helps explain whether the socio-economic factor of ethnic heterogeneity has an effect on the number of business start-ups and jobs created across countries (Froyen, 2013).

The aim of this study is first to show the significance of macroeconomic and socio-economic factors in terms of the birth of new firms in Europe, and second to shed some light on the determinants of the entrance of these new businesses into the market for the period 2004 to 2008. The relationship between the growth of GDP, the CPI, unemployment, openness, expenditure on R&D (or innovation), ethnic heterogeneity and the birth of new firms is examined using 135 samples of business start-ups, operating in 27 EU countries. The period 2004 to 2008 saw major changes in the policy decisions taken by industry and governments in EU countries. Our evaluation tries to highlight the effects of various nations' development policy on the growth and formation of firms. The results, from our sample, show that the relationship between newly established firms and expenditure on R&D (or innovation) is highly sensitive to methods of estimation, functional form and definition of the birth of new firms. In this paper, we conduct the negative binomial regression model by using an approach that is half-way between a heterogeneous pan-country and single regional approach. Furthermore, we also include ethnic heterogeneity as an independent variable, which has not been used in any of the above-mentioned studies (in spite of its general popularity). The paper contributes to the literature on macro-econometrics and socio-economics by using the negative binomial regression model. In this study we will use the negative binomial estimator (NBE), because overdispersion renders the Poisson model inappropriate. We investigate the relationship between the birth of new firms and the determinants, using the panel data for macroeconomic variables such as the growth in GDP, unemployment, CPI, openness, expenditure on R&D, real GDP, unemployment and ethnic heterogeneity. The data was collected from the World Bank's database for the period of study 2004 to 2008 using 135 samples. The calculations were performed using the statistical program package STATA version 11.0. The main purpose of this study is to give more empirical evidence to the measurement of the determinants of the birth of new firms, with special reference to EU countries. Specifically, our aim is to find the relationship between the birth of new firms and factors such as the growth of GDP, unemployment, CPI, openness, expenditure on R&D and ethnic heterogeneity. The reasons for our study are, first, that EU countries provide an interesting context for study because of their position as economies in transition, which developed to be on a par with the more industrial countries within the time period studied. Secondly, these countries have adopted new development policies; they have given support to small- and medium-sized companies, and they are more dependent on industry and are moving towards increased international competition. Hence, an innovative feature of this study is the investigation of the evolution of how the determinants of the birth of new firms work for EU countries in transition to technological improvement. The rest of this paper is organized as follows: section 2, empirical literature; section 3, research design, selection of variables and data definition; section 4, methodology; section 5, results and the important findings; and section 6, concluding remarks.

2. Empirical Literature

According to Schumpeter (1912) it is the entrepreneur who, through innovation, creates business activity. An early definition of this 'innovation' was to introduce a new combination. Latterly Schumpeter (1942) gives a more mature definition of this innovation, identifying it as the 'new commodity, the new technology, the new source of supply, and the new type of organization' (see also, Aghion & Howitt, 1992; Romer, 1990; Romer 2012). Schumpeter's approach is based not only on innovation but also on the availability of credit to the entrepreneur. Haltiwanger (2009) uses U.S. census data to demonstrate that it is the entry of new firms into the market, not small firms as is commonly believed, which is the main force behind job creation. Entrepreneurship is essential for economic dynamism and a large number of new firms can stimulate competition and economic growth (Klapper, Laeven, & Rajan, 2006). The contribution of innovation and business start-ups is shown by Mansfield (1962), who found that new businesses adopting new technology grow faster in terms of turnover than existing firms using existing/new technology. And van Reenen (1997) finds that in UK manufacturing between

1976 and 1982, businesses which sold new innovative products had a positive impact on employment. Highfield & Smiley's (1987) empirical analysis of the determinants of start-ups in the U.S. in the period 1948 to 1984 found that lower growth of GNP, lower inflation rates and greater growth in unemployment were followed by increases in the rate of new incorporations. In addition, (Reynolds, 1993; Reynolds & Storey, 1993), found six determinants of new business formation, namely: (potential) demand; urbanization (agglomeration); unemployment; personal household wealth; specialization (industry-level differentiation); and government spending on infrastructure, education, and health. The evidence of the relation between unemployment and the birth of new firms is contradictory, however. (Bosma, de Wit & Carree, 2005) find a significant relationship between unemployment and the number of new businesses. Moreover, (Ritsilä & Tervo, 2002) show a non-linear relationship between these variables. While the more recent analysis by (Klapper & Love, 2010) shows that more dynamic formal business creation, measured not in terms of the number of new firms but of the density of new firms, occurs in countries which give entrepreneurs a stable legal and regulatory regime, fast and inexpensive business registration, more flexible employment regulations and low corporate taxes.

In addition to indications in previously mentioned research, a variety of research has been developed to explain the relationship between economic performance and population heterogeneity (Alesina & La Ferrara, 2005; Alesina, Baqir & Hoxby, 2000). Accordingly, heterogeneity also has effects on social capital, which can be explained as 'norms of trust or co-operation that improve economic productivity'. (Routledge & Amsberg, 2003) argue that growth is a function of social capital. They assert that the idea in existing literature is that societies characterized by higher levels of social capital have rapid economic development and better institutions. Therefore, this study also considers ethnic heterogeneity as an independent variable in the model.

The econometric results show that the main relationship between the birth of new firms and the majority of the independent variables is in accordance with new growth theory and macroeconomic theory. The estimation of the model is achieved by the use of both Poisson and NBEs. The results show that alpha (a) is significantly different from zero, and this explains why we maintain that the Poisson distribution is not valid, while the negative binomial regression result is valid and adopted in this study. Using the valid method we also show the conformity between the expected signs for coefficients and those obtained as theoretical criteria. Indeed, an increase in expenditure on R&D (innovation) and the existence of ethnic heterogeneity should engender an increase in the number of new firms. Therefore, the signs of these variables should be positive. Whereas, an increase in unemployment should result in a decrease in the number of new firms, so we would expect that the sign of this variable would be negative. Therefore, we can also conclude that this finding links with macroeconomic theory.

3. Research Design, Selection of Variables and Data Definition

In this section we discuss the research design and the variables which may be important for determining the dependent variable for business start-ups in European countries.

3.1 Research Design

Many researchers have investigated business demography in a regional context; only a few, such as (Klapper & Love, 2010), have researched it using a pan-country approach. We think that a pan-country approach may have some bias because of the heterogeneity of different countries. The EU gives us an exceptional opportunity to limit the effect of heterogeneity, using pan-country analysis. The EU has common laws on many matters, such as labor mobility, visas, copyright, market regulation, nuclear power development (EURATOM) and, for some states, monetary policy, incentives to employment (ESF) and agricultural policy (CAP).

One can argue that not all states of the EU have been part of the union for many years. In fact the fourth enlargement for EU was in 2004, the year in which many states of the ex-soviet bloc joined the EU (except Romania and Bulgaria which joined in 2007). As the Copenhagen accession criteria of 1993 state, candidates for joining the EU have to accept and convert to EU laws. So we have to assume that from the point of application, governments of candidate countries start to change their laws to meet the accession requirements. In our study we consider: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Our study covers the five years from 2004 to 2008. We chose this period because it is prior to the sub-prime crisis and effects of this crisis on the world and European economies, which we take to start from the public's awareness of the bankruptcy of Lehman Brothers on the 15th September of 2008.

The majority of research on business demography has been analysis of the determinants of the birth of new firms.

However, we decided to use an estimator for count variables. In order to estimate the factors that influence the birth of new firms, we analyze the characteristics of the business start-up variable. The number of new firms is a count variable, this kind of variable cannot be negative, because we cannot have negative birth of new firms. There can be bankruptcy but not without a business, so a negative value of this variable is nonsense. Also we have another constraint: a business is always an integer number, so a 'half-business' is another nonsense. So we need an estimator that can be robust to these two constraints. An ordinary least squares (OLS) / generalized least squares (GLS) estimator can be used with log-transformation of count variable, for non-integer data, but it is also not possible to use this approach where the count variable assumes the value of zero, because we cannot have log(0). Hence, we thought that models based on the classical OLS/GLS estimator were not appropriate. The simplest approach to count model is Poisson count regression model.

The Poisson model is very restrictive in that it imposes that the variance and the mean are equal. Usable data for Poisson regression are very rare. There are two ways to use count data without Poisson regression, either the quasi-maximum likelihood (QML) Poisson regression or the negative binomial regression (Verbeek, 2008). The QML Poisson regression still presents a problem, in our case because the sample is large (135 observations), so the easiest alternative is to use the negative binomial regression as described in Hausman, (1984) (HHG). To estimate the effects of the macroeconomic variables, and the one social variable, on the birth of new firms we have decided to use the random-effects NBE. HHG estimation procedure, the most commonly used procedure in statistical software for fixed-effects NBE (FENBE), does not qualify as a true fixed-effects method, because it does not control for unchanging covariates. In fact, as explained by (Allison & Waterman, 2002), the problem with the HHG-FENBE is that it allows for individual-specific variation in the dispersion parameter rather than in the conditional mean. So the time-invariant covariates can appear statistically significant when they are not. This approach is pursued because the heterogeneity index does not have variation over time. In fact heterogeneity has variation only with great demographic shocks, such as wars, invasions or long-term immigration.

3.2 Selection of Variables

Generally, the macroeconomic factors that can incentivize entrepreneurs to start new firms are used only in sociological and regional economics articles. In our study we have decided to use only macroeconomic variables and one social variable, ethnic heterogeneity. We attach a strong importance to the dependent variable. The dependant variable is an integer data; it comes from World Bank Group Entrepreneurship Snapshots. In particular we can measure the dependent variable as private companies with limited liability. Partnerships and sole proprietorship are not considered in our analysis because these types of entities differ substantially in respect of their definition and regulation worldwide. This study is limited to the formal private sector. We omit firms which work informally, because business registries do not give information about this kind of firm. The first variable is the growth of GDP, which represents the growth of the economy of each country. GDP growth is measured as an annual percentage growth rate of GDP at market prices, based on a constant country currency. Aggregates are based on a constant of 2000 U.S. dollars. The second variable is the openness ratio. This variable is the result of the sum of import and export rates to GDP, and it is the proxy to measure the openness of the country to international trade, which can create a wider market, more development potential but can also mean danger from external competition. The third variable is the CPI, which is a proxy for price dynamics. The fourth variable is expenditure on R&D measured as share of GDP, which is the variable used as a proxy for innovation and is put into this study because technological change is the key variable in Schumpeterian theory of development and in new-classical theory of development, see Froyen (2013). It is defined as expenditure on R&D and capital expenditure (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture and society, and the use of knowledge for new applications. R&D covers basic research, applied research and experimental development (Agion & Howitt, 1988). The fifth variable is unemployment, which is measured as share of active population and is included in the regression mainly because literature on business demography, such as Bosma (2005), shows that unemployed people display entrepreneurial behaviour by starting new businesses. Many variables that can be considered reasonable, for example inflow foreign direct investment, are omitted because of problems with collinearity. The social variable that we use is ethnic heterogeneity. In social science, a society or a group is said to be heterogeneous if it includes individuals of differing ethnicities, cultural backgrounds, sexes or ages. In this article we focus on heterogeneity as the presence of different ethnic groups in an economic system. 'Ethnic groups' is a fuzzy concept, without an explicit definition. The application of ethnic-group concept can be different over time. It can be explained better through the concept of minority. The minority is a small subset of people having characteristics which most people can identify to be different from theirs. So we first have to quantify the presence of minorities and then to find out whether they have an effect on the number of new firms.

To do that, we have used the Gini (1912) index of heterogeneity, as calculated by Alesina (2003); Alesina & Ferrara, (2005).

For completeness we use the calculation formula for Gini's heterogeneity index, which is described as follows:

$$ETH = \sum_{i=1}^{N} \pi_i (1 - \pi_i) = 1 - \sum_{i=1}^{N} \pi_i^2$$

where π_i is the proportion of subjects belonging to the group i, and N is the number of groups.

3.3 Count-Data Estimation Procedure Discussion

The count-data approach in business demographics isn't new. Papke (1991) uses the HHG procedure to estimate the relationship between local taxes and the formation of new firms in the U.S. with FENBE. Dohse and Schertler (2003) conducted a survey about the determinant factors of the regional distribution of new firms in Germany, using the HHG-FENBE procedure. They found evidence that the number of firms is positively related to the number of patents in each region and with number of employees in each region, and is positively related to the regional supply of venture capital. Brixy & Grotz (2006), using HHG-FENBE, analyze both the formation of new firms and the survival of firms for 74 western German regions for ten years, they also study the spatial effects. Bönte & Falck & Heblich (2007) use a count-data approach with German regional panel micro-data, using a Poisson fixed-effects QML regression. Otsuka (2008) conducted an inquiry of determinants of new firms in Japan, unfortunately in his article he does not declare what kind of procedure he uses, or whether he uses a fixed-, random-effects or population-averaged model. HHG-FENBE estimation procedure, which is the most commonly used procedure in statistical software for FENBE, is not a true fixed-effects method, because it does not control for unchanging covariates which do not change over time. In fact, as explained by Allison & Waterman (2002), the problem with the HHG-FENBE is that it allows for individual-specific variation in the dispersion factor rather than in the conditional mean. Consequently, the time-invariant covariates can seem statistically significant, when in reality they are not. Therefore, they recommend using RENBE instead or a different procedure to calculate FENBE.

4. Methodology

4.1 Hypothesis

In order to find the determinants of the birth of new firms, we have used some variables taken from literature such as the growth of GDP, openness, inflation and unemployment. In the literature, these variables have positive effects on the formation of new firms. Ethnic heterogeneity can have a strong effect on economic systems. As Alesina (2000) states, there is a strong trade-off between economies of scale and heterogeneity. Glaeser & Saks (2004) argue that, if there are many ethnic groups in a society, politicians and bureaucrats tend to display ethnocentric behaviour, and members of an ethnic group continue to support a politician/bureaucrat of their own ethnic group even if he or she known to be corrupt. This heavily influenced governance may create bias to incentive fractionation of new firms and influence social capital. Social capital is defined as 'norms of trust or cooperation that improve[s] economic productivity' by (Routledge & von Amsberg, 2003). They also argue that the idea in the existing literature is that societies characterized by higher levels of social capital have more rapid economic development and better institutional performance, through better collaboration. In the EU, differently from countries such as the US, there is no systematic exclusion of minorities from higher education. In the US, as argued by Glaeser (2005), ethnic heterogeneity causes skill inequality, because some ethnic groups are excluded from access to higher education, and, as a result, the highly qualified professions. Thus, our hypothesis is: heterogeneity creates deficits of collaboration, so people do not start businesses, or people start a greater number of small businesses, which are able to exploit the natural heterogeneous externality, creating a positive relationship between new firms and fractionation.

4.2 Model Specification

In this section we present the model specification, together with the estimation method that we used in our study. The main task is to distinguish the effect of different independent variables on the birth of new firms. The basic empirical model, consisting of the six variables as described above, is as follows:

$$\mathrm{NEW}_{it} = B_0 + B_1\mathrm{GDPG}_{it} + B_2\mathrm{OPENNESS}_{it} + B_3\mathrm{CPI}_{it} + B_4\mathrm{R\&D}_{it} + B_5\mathrm{UNEP}_{it} + B_6\mathrm{ETH}_{i} + \varepsilon_{it}$$

where:

NEW = the number of new firms formed.

GGDP = the aggregate commodity demand growth, measured by the growth of GDP.

OPENNESS = economic openness, measured by the sum of imports and exports, in relation to GDP.

CPI = the consumer price index.

R&D = innovation, measured by expenditure on research and development.

UEMP = the unemployment rate.

ETH = ethnic heterogeneity index, measured using the Gini heterogeneity index.

ε_{it} = error terms.

B_0 is the intercept and B_1 to B_6 are parameters associated with the respective independent variables.

t is the total number of observations over time. The model is estimated for 27 EU countries.

4.3 Estimation Methodology

In our model we focus not only on the major macroeconomic factors, but the model also introduces a social factor to get a satisfactory explanation for its effect on the birth of new firms. The estimation of the model is achieved by the use of both Poisson and NBEs. Results from the Poisson, and the negative binomial regression models are presented in Table 3. With respect to deciding between the Poisson and negative binomial models, the negative binomial is appropriate when the outcome variable is overdispersed (i.e., the mean and variance differ significantly from each other), which is a basic assumption of the Poisson model. When conducting a negative binomial regression model, the statistical software, STATA, automatically computes a likelihood-ratio (LR) test which examines the null hypothesis that the dispersion parameter is equal to zero. In the present analysis, this test was statistically significant, X^2 = 3.07e+6, p> 0.000, indicating that the dependent count variable is overdispersed. Thus, the observed data are better explained by the negative binomial rather than the Poisson model.

5. Results

In this section we present and discuss the results in following order: first, determination of which model provides the best fit with the observed data; and second identification and interpretation of significant predictors. All regression results and analyses were conducted with the statistical software, STATA version 11. Description statistics, such as mean, standard deviation and correlation among variables, are presented in Tables 1 and 2.

Table 1. Mean, standard deviation of used variables

Variable	Mean	Std. dev.	Min	Max
NEW	46559.92	77331.15	1756	449700
GGDP	3.881831	2.895675	-4.24355	12.23323
OPENNESS	113.6389	52.58758	49.6776	319.554
CPI	3.576155	2.523369	0.187123	15.4032
R&D	1.430284	0.898948	0.367548	3.721164
UEMP	7.240741	2.847342	2.8	19
ETH	22.76758	16.696	4.143221	58.6668

Table 2. Correlation coefficients among independent variables

GGDP	OPENNESS	CPI	R&D	UEMP	ETH	
1	0.1906	0.1416	-0.3769	0.1501	0.3803	GGDP
	1	0.0911	-0.1107	-0.2023	0.4257	OPENNESS
		1	-0.4641	0.0128	0.4602	CPI
			1	-0.2547	-0.2701	R&D
				1	0.1098	UEMP
					1	ETH

5% critical value (two-tailed) = 0.1697 for n = 135.

5.1 Estimation Results

In this section we present our most important results, using the FENBE to find out what kind of factors have an effect on the birth of new firms in EU countries. First, we wrote a theoretical specification, which consisted of

the six variables described above. In addition to the major macroeconomic factors, the model also included a social factor to get a satisfactory explanation for its effect on the dependent variable. To improve the robustness of the results, the sample starts from 2004. It finishes in 2008 to exclude the shocking effects of the sub-prime crisis on the economic system.

From the results of model (1) presented in the Table 3, and by looking at the LR-test which is a test of the overdispersion parameter (alpha), it is clear that these results are affected by overdispersion. When the overdispersion parameter is zero the negative binomial distribution is equal to a Poisson distribution. In this case, alpha is significantly different from zero, and thus it explains why we maintain that the results from the Poisson regression are not valid and concentrate on the results from the negative binomial regression in this study. Additionally, we can easily explain the results of the regression as semi-elasticities hence measuring the relative variation of the conditional expected value for a variation of the i-th unit of the covariate, leaving other regressors constant. Growth of GDP has the effect of increasing the number of firms going into business by 1.28% per year. Openness has a small influence on the birth of new firms, because the openness of a new market is not always a positive factor. In fact, openness can increase competition and, in the period that we observed the birth of new firms, there was a strong increase in competition by Asian firms. Therefore, a marginal increment of openness can increase the number of new firms going in business by 0.41% per year. The CPI has a positive effect, increasing the number of new firms by 1.73% per year. R&D is still the main factor positively affecting the birth of new firms as theorized by Schumpeter (1942). In fact a marginal increment of expenditure on R&D can increase the number of new firms by 32.62%. Contrary to the findings in some literature–Guesnier (1994)– our results indicate that unemployment is a negative factor to new firm formation, causing a reduction in the number of new firms of 5.4%. Additionally, macroeconomic theory suggests that a higher unemployment rate may lead to lower aggregate demand, thereby putting downward pressure on the number of firms going into business. Ethnic heterogeneity has a positive effect on the birth of new firms, in fact the variable has the positive effect of increasing the number of new firms by 1.95%.

Table 3. Summary of poisson and negative binomial regressions analysis, predicting the birth of new firms

	Poisson model (1)	Negative Binomial model (2)
GGDP	0.0122499	0.0127227
	(0.000309)***	(0.0069719)*
OPENNESS	0.007769	0.0041543
	(0.0000951)***	(0.0014164)***
CPI	-0.0004853	0.0171892
	-0.0004352	(0.0101477)*
R&D	0.0471552	0.2823614
	(0.0057127)***	(0.0862021)***
UEMP	-0.0454289	-0.0534166
	(-0.0004496)***	(0.0111548)***
ETH	-0.0182178	0.0193342
	(0.0175299)***	(0.0114741)*
_cons	10.73731	3.161053
	(-0.4741928)***	(0.3125194)***
/lnalpha	0.5690917	
	(-0.2273224)	
alpha	1.766662	
	(-0.4016018)	

Model (1); LR test alpha=0, *Chi bar* (01):3.07e+6, Prob > = *chi bar 2* = 0.000, Wald test; 30940.10 ***.

Model (2); LR test vs. Pooled, *Chi bar* 2 (01) = 405.11, Prob > = *chi bar* 2 = 0.000, Wald test; 100.38***.

Standard error in Parentheses; *,**,*** indicate significance at 10%,5% and 1% level respectively with *p*- Values calculated on Z-test.

6. Concluding Remarks

In this paper we conduct a panel-data estimation of 27 EU countries over a period of five years to examine the macroeconomic factors that influence the birth of new firms. To do this we have used a random-effects negative binomial regression model (RENBM), because the statistical results indicate that the Poisson model should be rejected. The macroeconomic variables, such as growth of GDP, inflation and openness, are macroeconomic

determinants of the birth of new firms. These kinds of determinant are not shown to have a great effect on the birth of new firms, while the expenditure on R&D (innovation) variable has a greater effect on the number of new firms in the EU, which reflects what is argued by new-growth theory (Note 1). It is important to mention the negative results of the unemployment variable as related to macroeconomic theory suggests that a higher unemployment rate may lead to lower aggregate demand, thereby putting downward pressure on the number of firms going into business. We have also tried to test whether heterogeneity is correlated with the birth of new firms. The evidence of this study has important implications for determining socio-macroeconomic policy.

6.1 Implications

Former studies have employed descriptive statistics methods in their analysis or based the analysis on the classical OLS/GLS estimator. These methods although useful may not be suitable for analysis of more complex nature. In this study, we apply the Poisson and RENBM regression technique and a random-effects negative binomial regression to overcome difficulties caused by count data and to draw more reliable inferences. As a result, we have also been able to make more subtle inferences about the effects of the key factors like growth in GDP, Unemployment, Consumer price index, as well as the expenditure on R&D (innovation) variable and the heterogeneity.

The results also show that expenditure on research and development (R&D) has a significant positive effect on the number of new firms. This result further supports the hypothesis of new economic growth theory. Moreover, the empirical evidence shows a positive correlation between the number of new businesses and ethnic heterogeneity. Our concluding recommendation to those who are responsible for birth of new firms is that recruiting can be stated in the following straight pucks: Do increase the expenditure on R&D and encourage the innovations.

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Note

Note1. Innovation leads to the development of new and better techniques of production, and new and better products. To take advantage of new techniques and to produce new products, new businesses start-up and existing ones go out of business, some jobs are destroyed and others created. The new jobs created are better than the old ones, and they pay higher wages in real terms. And with higher wages and more productive techniques, leisure increases. New and better jobs and products lead to higher consumption of goods and services, and, combined with increased leisure, bring a higher standard of living, see also Romer (1989).