Spatial Drivers of Firm Birth in Iran

Iman Cheratian[1,♠], Saleh Goltabar[1], Carla Daniela Calá[2]

[1]*SMEs research group, Academic Center for Education, Culture, and Research (ACECR) on Tarbiat Modares University, Iran.*

[2]*Facultad de Ciencias Económicas y Sociales, Universidad Nacional de Mar del Plata, Funes 3250,7600, Mar del Plata, Argentina.*

"*Preliminary: please do not distribute without permission*"

Abstract

Entrepreneurial decisions on locational choice are determined by a wide range of regional factors. Given the importance of regional characteristics, this paper investigates the determinants of firm entry in the 30 Iranian regions, considering four different sizes: micro (1-10 employees), small (11-49 employees), medium (50-99 employees) and large (100 and more employees) over 2000-2013. The main innovation of the paper is to analyze regional differences in the decision to start a new firm on a size basis, for a developing country. Using a new and unique database, we estimate panel non-spatial random effect and panel spatial autoregressive models. We find that regional variations explain firm dynamics, but the impacts are not homogeneous across firms of different size. We also find that all types of firms are influenced by the negative effect of economic sanctions during the sample period. Furthermore, direct government intervention seems to be a key driver of firms' birth in the Iranian economy.

Keywords: firm entry, labor market approach, ecological approach, spatial autoregressive models, Iranian economy.

JEL Classification: M13, O18, L26.

♠*Corresponding author, Email address:* cheratian@acecr.ac.ir

Tel: +98 2182884114. *Fax:* +98 2188220298.

1. Introduction

In recent decades there has been a quick expansion on the study of regional determinants of firm creation in economic geography and growth literature. Since entrepreneurship capital is considered as a key factor to prompt economic growth, national and regional policymakers in different countries wonder how to boost firm birth, especially at the regional level ((Fritsch & Mueller, 2004, 2008); Van Stel and Suddle (2008);Von Graevenitz, Harhoff, and Weber (2010); Dejardin (2011); Fritsch (2013)).

Firm entry promotion is particularly relevant in developing countries, since startups not only enhance economic growth, but also promote structural transformation by absorbing labour from traditional sectors, provide innovative inputs, promote specialization, raise productivity (Gries & Naudé, 2010) and lead to gap-filling and input-completing activities (Acs & Amorós, 2008). Moreover, start-ups also allow to commercialize innovations (D. B. Audretsch, Keilbach, & Lehmann, 2006) and discover a country´s competitive advantages (Hausmann & Rodrik, 2003).

Despite its relevance, firm formation in developing countries has been barely studied, in comparison to the attention that it has received in developed and industrialized economies. This paper aims to contribute to the empirical literature on the role of regional factors on firm dynamics in developing countries, by identifying the determinants of firms' birth across Iranian provinces over the period 2000-2013. This is, to our knowledge, the first attempt to investigate regional-level determinants of firm entry for the Iranian provinces.

This paper also adds some other major contributions to the existing literature. Most of previous studies in developing countries don´t take into account spatial differences and mostly rely on non-spatial methods, given the large size of the administrative units. However, the spatial stationary assumption might be over-simplifying and a misspecification, in light of the important spatial variations in these countries (Scott & Storper, 2003). Our study aims to overcome this limitation and to exam whether a spatially varying relationship exists among firm entry and the relevant regional factors. Furthermore, we divide firms into four types, according to their size (micro, small, medium and large) and we investigate the role of regional factors on firms' birth in each group.

Iran has many features that are worthwhile noting. In terms of population, it is the second-largest country in the Middle East and it is a major regional and middle power. As many other developing countries, Iran has the challenge to diversify its oil-reliant economy and has to cope with short-term commodity and capital booms that have a limited effect on sustained growth. Another common feature with the rest of developing countries is the acute regional differences in terms of wages, labor skills, growth rates and natural resources, as well as the high concentration of firms and population around the main cities. In fact, the uprooting of these regional

imbalances has been included as one of the objectives of the Constitution of the Islamic Republic after the 1979 Revolution (Farzanegan & Alaedini, 2016).

Entrepreneurship policies in Iran have been gradually included in the successive Economic and Social Development Programmes, both at the national and regional level. However, despite this desirable focus on entrepreneurship in plans and policymaking, start-ups heavily depended on macroeconomic variations due to the economic and financial sanctions imposed by the European Union and the United States from 2006 to 2013, as the result of the political conflicts about the Iranian nuclear program. Thus, the relevance of entrepreneurship policies, along with the vulnerability of business environment to macroeconomic shocks, make Iran an interesting case to quantify the magnitude and significance of regional factors on firm entry.

Our results show that regional variations explain firm dynamics, but the magnitude and significant of the impacts is not homogeneous across firms of different size. Econometric models also reveal that all types of firms are influenced by the negative impact of economic sanctions during the sample period. Furthermore, direct government intervention seems to be a key driver of firms' birth in the Iranian economy.

The structure of the paper is as follows. As a starting point, Section 2 reviews the main regional determinants of firm entry in theory and evidence. In Section 3, we describe the data as well as the period of interest. The method and the results of the dynamic spatial panel regressions are conducted in the fourth section. Finally, Section 5 summarizes the main conclusions.

2. Regional Determinants of Firm Birth: Theory and Evidence

2.1 Review of Related Theories and Empirical Evidence for Developed Countries

Since the early 1980s, a vast body of studies discusses that in a variety of countries, a high portion of firm birth variation may be explained by the socio economic characteristics of the regions within each country. Current theories classify these regional factors into five major categories: 1) local demand factors, 2) supply-side factors, 3) agglomeration effects, 4) policy environment, and 5) cultural factors.

Local demand factors mainly include regional differences in the population size or its growth (which reflects the home market potential for entrepreneurial activities) as well as the regional per capita income. According to Keeble and Walker (1994),P. D. Reynolds, Miller, and Maki (1995), Kangasharju (2000), and Lee, Florida, and Acs (2004) changes in population growth have a key positive role on firm entry rates. Regional per capita income also leads to new startups, since it is a proxy for higher market demand as well as better access to capital (P. Reynolds, Storey, and Westhead (1994); D. Audretsch and Keilbach (2004); Li, Goetz, Partridge, and Fleming (2016)). However, higher level of regional income may also prevent firm entry due to the

higher labor costs and upper opportunity costs of self-employment for business owners (Ashcroft, Love, & Malloy, 1991). As the demand effect is usually more important than the cost effect, it is generally expected that increased levels of regional income induce more firms to enter (Nyström, 2007).

Supply-side factors usually refer to personal incentives to start new business. These factors may be classified into five main headings: unemployment rates, human capital, knowledge capital, access to finance and industrial structure. Firstly, unemployment rates can play two contrasting roles on firm entry. One the one hand, there may be a positive effect if unemployed workers, with scarce chances of getting a paid job, start their own business (Storey (1991); Evans and Leighton (1990); Johnson and Parker (1996)). On the other hand, there may be a negative effect since high unemployment weakens regional demand (P. Reynolds et al. (1994); D. B. Audretsch and Fritsch (1994); Carree (2002); Sutaria and Hicks (2004)). Secondly, regarding human capital, Evans and Leighton (1990) argue that a higher level of education of the workforce may stimulate firm entry since these people are expected to be more successful at discovering new entrepreneurial activities. However, Delmar (2005) and Binet and Facchini (2015) argue that for most educated people the decision to become an entrepreneur is a second choice option, because they usually prefer to be full time employees. Knowledge capital, measured by R&D expenditures also drives entrepreneurial activity, especially in technological base industries ((D. B. Audretsch et al., 2006); Binet and Facchini (2015)). Access to finance is another supply factor which explains regional variation in startups (P. Reynolds et al. (1994); Sutaria and Hicks (2004)). Thus, an easier access to financial resources encourages entrepreneurs to entry in the market.[1] Finally, firm entry tends to be higher in regions with more small-scale firms, ceteris paribus. This is because employees in small and medium enterprises usually find market opportunities more easily, and they use to be more familiar with how to operate this type of business. Besides, these firms usually pay lower wages, reducing the opportunity cost of self-employment (Johnson and Parker (1996); Ashcroft et al. (1991); Spilling (1996); Nyström (2007)).

Agglomeration effects, that is, the external economies driven by the geographical concentration of firms and individuals, enhance firm birth by increasing local market opportunities in terms of customers and required inputs (P. Reynolds et al. (1994); Fritsch, Brixy, and Falck (2006)). When a firm locates close to other ones, it can benefit from some advantages such as access to a broader labor market, knowledge spillovers, specialized suppliers and sharing of research organizations. Therefore, densely populated regions are more attractive for entrepreneurs (D. B. Audretsch and Fritsch (1994); Keeble and Walker (1994); P. Reynolds et al. (1994); Armington and Acs (2002); Nyström (2007)). Nonetheless, there may be disagglomeration effects if the excessive concentration of firms leads to congestion effects, higher labor wages and raised input prices. In addition, a competition effect may also expel firms out of dense regions, since these firms may compete for the same resources or markets (Nyström (2005); (Bosma, Van Stel, & Suddle, 2008)).

[1] For more debate, see Naudé, Gries, Wood, and Meintjies (2008).

Policy environment which includes access to infrastructures (roads and airports), subsidies or tax policies refers to the direct and indirect role of government through linking policy to the other determinants of entrepreneurial activities. As mentioned by Verheul, Wennekers, Audretsch, and Thurik (2002), the government can influence on entrepreneurship by five channels: first, it can impact on the demand side of the entrepreneurship and increase the entrepreneurial opportunities. In fact, some policies such as technological developments, competition, and income policies help to create demand for entrepreneurship and reduce barriers to entry for small businesses. Type 2 refers to government interventions which affect the supply of potential entrepreneurs at the aggregate level. Immigration or regional development policies are some of the actions that can influence regional socioeconomic characteristics. Access to resources, knowledge, and skill for potential entrepreneurs is the third type of intervention. Governments can focus on policies to overcome the financial and knowledge gap through increasing the accessibility of financial and informational resources and help to small-business owners to obtain basic requirements to start or expand a business. In type 4, governments can play a decisive role in forming entrepreneurial targets and values in the educational systems (as a whole) and the media and finally, government intervention can be linked to the decision-making process of potential entrepreneurs (type 5). Some policies such as tax reduction, social security improvement, and deregulation encourage people to give up their present state of (un)employment to become an entrepreneur.

Finally, cultural factors may also have a role on firm entry. The idea that in some "social climates" entrepreneurship flourishes more than in others is related, for example, to the social position and esteem enjoyed by businessmen in a particular society. Thus, some authors tried to include some proxy of the cultural attitudes towards entrepreneurship in their empirical contributions. For example, Garofoli (1994) argues that startups are higher in areas with higher social mobility, and Tamasy and Heron (2008) show that more entries are expected in communities with higher inflows of migrants. Regions with more openness and creativity also attract more human capital, which leads to entrepreneurship dynamism (Lee et al., 2004). Also, a high share of employees in the public sector may proxy for a lack of entrepreneurial spirit and consequently leads to a low firm formation rate (Spilling, 1996).

2.2 Review of Empirical Evidence on Firm Entry by Size

It has been recognized that determinants of entry are not independent of startup size. This is because not all types of firms perceive entry barriers in the same way, or they are not equally able to take advantage from the endowments of territories they locate in (José Mata, 1991). Rather, their perception of entry barriers is mediated by firm´s characteristics (such as the size) and the exploitation of resources and opportunities depends on their internal capacities (which are usually more limited as the size decreases).

Empirical literature on firm entry by size is referred exclusively to developed countries, for example Nurmi (2006) for Finland; Fotopoulos and Spence (1998) and

Fotopoulos and Louri (2000) for Greece; Görg, Strobl, and Ruane (2000) and Görg and Strobl (2002) for Ireland; Colombo, Delmastro, and Grilli (2004) for Italy; Jose Mata (1996) and José Mata and Machado (1996) for Portugal; and Arauzo-Carod and Segarra-Blasco (2005) for Spain. They find that:

- The evidence about the relative importance of demand factors is ambiguous. While the former studies find that industry growth is more important for larger start-ups (entrants may choose to enter at a larger scale in growing markets), D. B. Audretsch (1995) shows that smaller and younger firms are more positively affected by high economic growth, and Mills and Schumann (1985) find that small firms account for greater share of economic activity during economic expansions and a reduced share during contractions.
- As for the supply-side factors, higher share of SMEs may promote especially small start-ups, while unemployment may have a positive effect only on small-scale entry, since firms founded by unemployed people are smaller on average(Segura, Garrigosa, & Vergés, 2005).
- Agglomeration economies as well as the local availability of skilled workforce may be more important for small firms, as large entrants are able to provide by themselves the necessary suppliers or workforce or even bring them from other locations. This is consistent with the incubator theory which holds that small firms are more dependent on the environment. Disagglomeration effects, such as higher labor or land costs, may be also especially important for small firms.[1]

2.3 Review of Empirical Evidence for Developing Countries

In contrast to the vast empirical evidence for developed countries, studies that analyze regional factors associated to firm entry in developing countries are very scarce (we are only aware of contributions about Argentina (Calá, Manjón-Antolín, and Arauzo-Carod (2016); Calá (2018)), India, Indonesia (Deichmann, Lall, Redding, and Venables (2008); Ghani, Kerr, and O'connell (2014)), South Africa (Naudé et al., 2008), Turkey (Karahasan, 2015) and Vietnam (Santarelli & Tran, 2012). They usually take as a starting point the set of variables typically included in studies for developed countries (see section 2.1) and occasionally add some variables that proxy the specificities of developing economies.

Interestingly, when the same study is performed in a developed country (USA) and replicated in a developing country (India), the same variables that explain over 80% of spatial variation in entry rates in USA, can only explain 30% of the same dependent variable in India (Ghani et al., 2014). This suggests that determinants of entry for developed economies can explain just a small part of regional firm dynamics in a developing country.

[1] Figueiredo, Guimaraes, and Woodward (2009) find evidence that plants located in areas with great industrial concentration are smaller than plants in the same industry outside such areas.

Demand variables are usually significant and show the expected sign. Profits and economic growth rate encourage entry, while wages (which can proxy demand as well as input prices) have either a positive or insignificant effect. As for the supply-side factors, the unemployment rate is not statistically significant in any case (Naudé et al. (2008); Santarelli and Tran (2012); Calá et al. (2016); Calá (2018)), probably because the unemployed start new firms in the informal sector, which is not reflected in official firm entry registers. On the contrary, the availability of skilled workers is relevant (Naudé et al. (2008); Santarelli and Tran (2012); Karahasan (2015)) and, in the case of India, it seems to be stronger than in comparable studies for developed countries(Ghani et al., 2014). The access to credit is positively related to firm entry in India, South Africa and Turkey, while the remaining studies do not include this dimension, possibly due to the lack of information at the regional level. The role of SMEs as seedbeds for future start-ups has been scarcely analyzed and it is only (positively) significant in Argentina.

Agglomeration economies are very important, not only because of the labor market externalities and the proximity to customers, but also because of the availability of small suppliers. However, disagglomeration economies are also significant, and in highly populated countries like India and Indonesia, new firms avoid the high costs of urban areas, and prefer locating by large population centers (Deichmann et al. (2008); Ghani et al. (2014)). Congestion effects are also significant in South Africa and Argentina (Naudé et al. (2008); Calá et al. (2016); Calá (2018)).

Lastly, economic crisis exerts a negative effect on entries (Karahasan, 2015), and after it, the usage of the idle capacity of the existing firms may act as a substitute for firm entry (Calá et al. (2016); Calá (2018)). That is, incumbent firms increasing their number of employees satisfy great deal of the increasing demand, instead of new ventures. Regarding the variables typical for developing countries, the size of the informal sector and the level of poverty have considerable explanatory power in entry regressions for Argentina.

As macroeconomic instability is higher in developing countries (Stiglitz, 1999), it is particularly worthly to explore the impact of macroeconomic conditions on firms of different size -i.e. are small firms more vulnerable or are they more flexible and have consequently in a better position to afford demand fluctuations? (Mills and Schumann (1985); Carlsson (1989)). In Turkey, for example, adverse macroeconomic conditions discourage small-scale entries, while large plants find it easier to enter(Günalp & Cilasun, 2006).

3. Data

3.1 Entry rates

To analyze the regional determinants of firm entry in Iran, we collected an annual database consisting of 30 provinces over the period of 2000-2013. Thus, the total number of observations in the dataset for the whole sample period is 420. Entry data come from the Ministry of Industry, Mining, and Trade (MIMT) unique database. The MIMT database provides geographical and sectoral information about the

number of entries, exits and incumbents based on the International Standard Industrial Classification (ISIC Rev.3) system on all mining of coal and lignite (10), mining of metal ores (13), other mining and quarrying (14), manufacturing (15-37), electricity, gas, steam and hot water supply (40), supporting and auxiliary transport activities (63), computer and related activities (72), research and development (73), and other business activities (74) firms. The data collected by MIMT is at individual-level and covers all public and private single-establishment formal firms with one or more employees registered with social security. Therefore, it does not cover the information about the informal or multi-establishment firms. Furthermore, the MIMT database provides this information by firms according to their size: micro (1-10 employees), small (11-49 employees), medium (50-99 employees), and large (100 and more employees). Therefore, our dependent variable is the entry rate in each province between 2000 and 2013 for each firm size group.

Entry rates are computed according to two different methods: Labour Market Approach (LMA) and Ecological Approach (EA). It should be noted that measuring the absolute number of new entrances and then comparing them across different regions would be more misleading than revealing. It is because the economic regions are not homogeneous with respect to size (D. B. Audretsch and Fritsch (1994); Armington and Acs (2002)). The LMA approach standardizes the number of new entrance relative to the number of workers in the industry (per 1000 workers). This approach is based on the theory of entrepreneurial choice –people's decisions to start a new business or not- suggested by Evans and Jovanovic (1989). Instead, the EA approach standardizes the number of new entrances relative to the number of existing firms (per 100 firms). This approach considers start-up activity relative to the size of the existing population of business (Armington & Acs, 2002).

Figures 1(A-D) show the mean geographical distribution of firm entry rates across the Iranian provinces which range from a minimum of 0.0016 to a maximum of 0.1578. To provide a clearer picture of spatial patterns of new entries, we depicted the map for each firm size group. As can be seen, the spread of firm entry rates varies largely among regions and it is not simply related to the size of each region. New entries are mostly concentrated in regions with higher level of industrialization and this finding is nearly constant for all firm size groups. In particular, the highest density of new entries is around the industrialized regions such as East Azerbaijan, Tehran, Ghazvin, Mazandaran, Razavi Khorasan, Isfahan, Fars, and Yazd. While, entry rates in less industrialized regions (e.g. North Khorasan, Golestan, Kermanshah, Hamedan, Bushehr, South Khorasan, Kohkiloyeh, and Hormozgan) have much lower values.

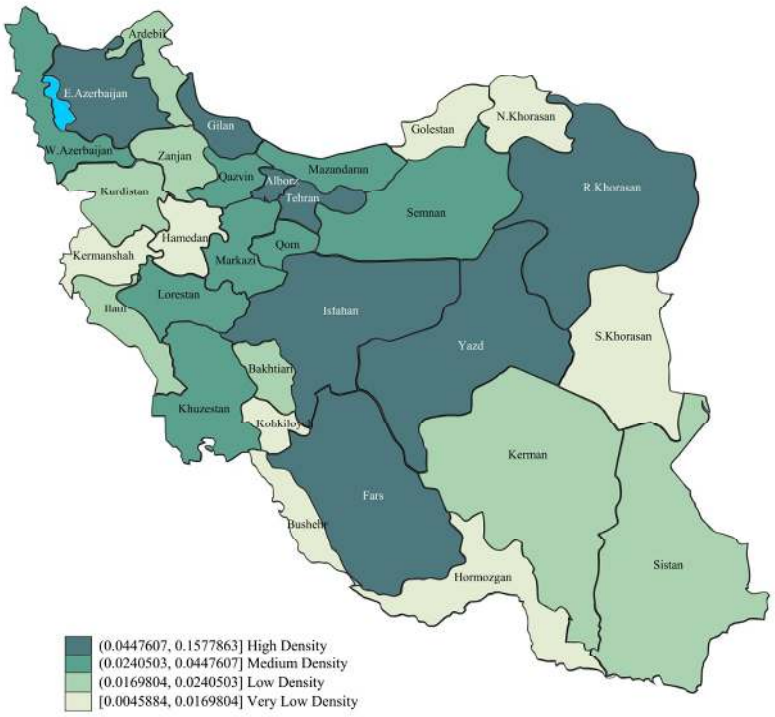


Figure 1(A). Geographical distribution of micro firm birth (Average 2000-2013)

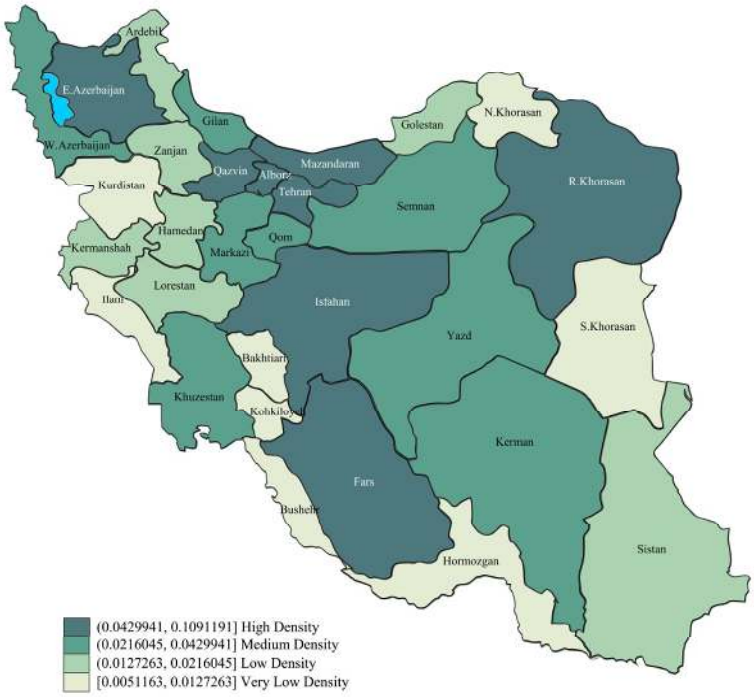


Figure 1(B). Geographical distribution of small firm birth (Average 2000-2013)

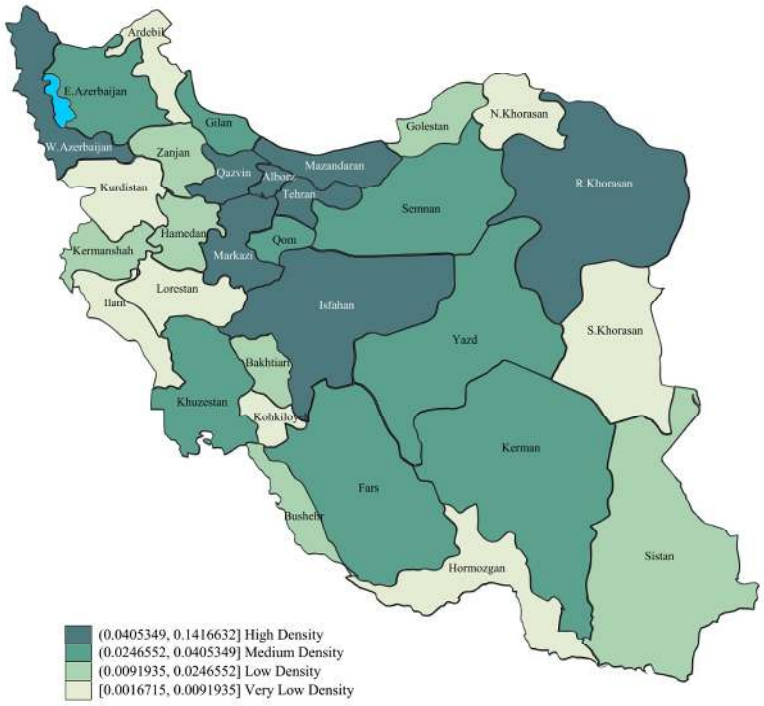


Figure 1(C). Geographical distribution of medium firm birth (Average 2000-2013)

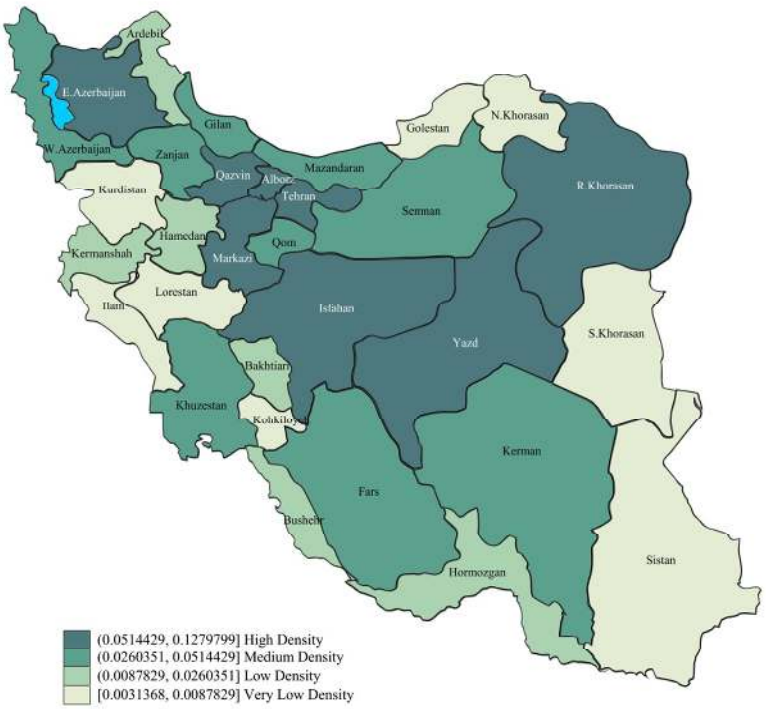
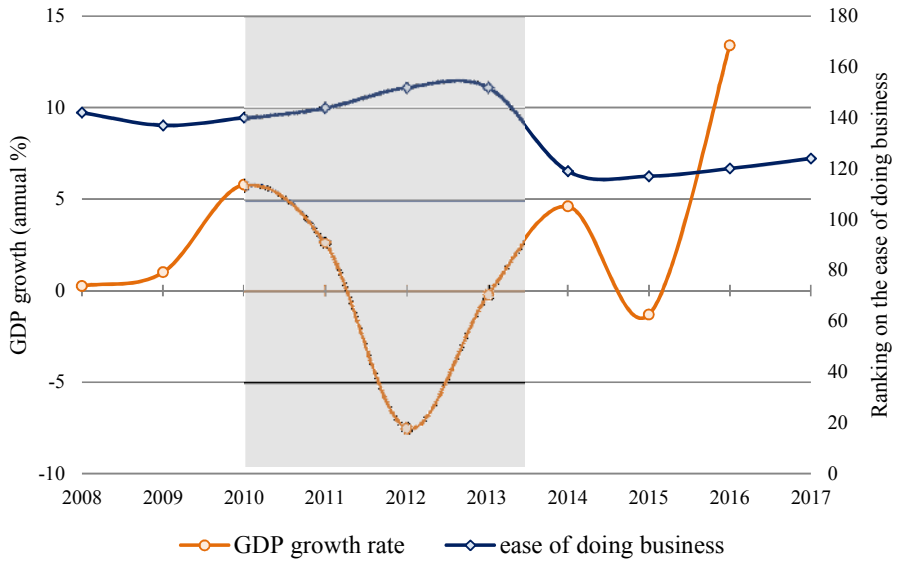


Figure 1(D). Geographical distribution of large firm birth (Average 2000-2013)

The attention given by Economic and Social Development Programmes (DP hereafter) to entrepreneurship development has been increasing. In particular, in the 3rd DP (2000-2004) the concept of "Academic Entrepreneurship" was considered in macro policies and educational plans, and in the 4th DP (2006-2010), for the first time, "Improvement of Business Environment" has been regarded in national and regional development strategies, and a proper budget was allocated in order to promote entrepreneurial activities and support SMEs.[1] Finally, the 5th DP (2011-2015) emphasized on the improvement of business environment and obligated government to support the private sector, clusters, SMEs, and local and home businesses in a broader scale. The Labor Law and Social Security regulations were modified in order to increase the harmonization between employers and employees and other promoting policies were implemented as well, such as competitive markets creation or unemployment insurance reinforcement (Moghadam, 2017).

Anyway, despite the desirable focus on entrepreneurship context in Iranian development plans and policymaking, the last decade trend of doing business shows that easing to business start-up heavily depended on macroeconomic variations due to the external conflicts. By starting the Ahmadinejad's administration and due to political conflicts about the Iranian nuclear program, the European Union and the U.S. imposed a set of economic and financial sanctions on Iran during 2006 to 2013 with the supposed goal of changing its government's political behavior. Harder sanctions to the import, purchase and transport of Iranian crude oil by the EU in 2012 were combined with international financial, banking and insurance sanctions. As a result, Iran's GDP growth decreased to -7.44 percent in 2012 and the ease of doing business index reached its worst ranking (152 out of 190) (Figure 2).

[1] During the Ahmadinejad's first administration (especially between the years 2006 and 2007), a high percentage of bank credits were allocated to the launch and development of SMEs in agriculture, industry, mining, service, and training sectors. The main target of the policy was to encourage job seekers to start their own business (with focus of start-ups between 5-50 employees). Based on this policy, during the Iranian 4th DP, the banking system allocated between 20 to 50 percent of its financial resources to SMEs, while large firms benefited from the banking credits that exceed SMEs requirements.



Source: *World Bank dataset.*

Figure 2. Trend of Iranian annual GDP growth rate and ease of doing business (2008-2017)

3.2 Explanatory variables

Data of regional independent variables such as regional GDP per capita, population change, unemployment rate, schooling, human capital and agglomeration economies were collected from the Statistical Center of Iran (SCI). Information of average stock transactions in each region's stock market was obtained from the Central Bank of Iran (CBI). The definitions, sources and expected signs of the variables that are used in the empirical models are presented in Table 1.

Table 1. Data description, sources and expected sign

Variable	Definition	Source	Expected sign
Dependent			
Firm birth (LMA) ^{M,S,m,L}	Number of new firms (normalized by per 1000 workers).	a	
Firm birth (EA) ^{M,S,m,L}	Number of new firms (normalized by per 100 existing firms).	a	
Independent			
Firm birth rate $_{-1}$	New birth rate in each region with one lag	a	+
Income	Real regional GDP Per Capita.	b	+
Population change	Change in population in each region between the period *t* and *t-1*.	b	+
Unemployment	Annual unemployment rate in each region.	b	+/-
Agglomeration effect	Ratio of industry establishment to population in each region.	c	+/-
Financial depth	Average value of stock transactions in regions' stock market.	d	+
Human capital	Ratio of technical institution graduates to the number of institutions.	c	+/-

Table 1. Data description, sources and expected sign

Variable	Definition	Source	Expected sign
Schooling	Share of population with secondary school.	c	+/-
Economic sanction dummy	For the years 2006, 2007, …, 2013=1; for other years=0.		-
Ahmadinejad policy dummy	For the years 2006, 2007=1; for other years=0.		+

Note **1**: M: micro, S: small, m: medium, L: large. *Note* **2**: [a] authors' calculation base on MIMT database, [b] Statistical Center of Iran, [c] authors' calculation base on SCI database, [d] authors' calculation base on CBI database. *Note* **3**: All variables are used in the models in their natural logarithm form.

Summary statistics for all of the regional variables in their logarithm form are provided in Table 2. Entry rates, both through the LMA approach and the EA approach, decrease as the firm size increase. The dispersion of these entry rates suggests that there are important variation across the different firm size groups considered.

Table 2. Summary statistics for regional variables for regressions

Variable	Mean	Medium	Max.	Min.	Std. dev.
Micro firm birth (LMA)	5.51	5.38	7.68	3.12	0.52
Micro firm birth (EA)	5.08	4.95	7.17	2.50	0.50
Small firm birth (LMA)	2.16	2.13	4.09	-0.38	0.63
Small firm birth (EA)	2.95	2.93	4.97	0.35	0.66
Medium firm birth (LMA)	-1.18	-1.19	1.97	-3.67	0.97
Medium firm birth (EA)	2.60	2.53	6.59	-0.08	0.97
Large firm birth (LMA)	-1.51	-1.52	0.67	-4.76	0.95
Large firm birth (EA)	1.66	1.73	4.61	-1.19	0.97
Income	10.69	10.69	12.20	9.35	0.43
Population change	0.16	0.22	2.42	-2.58	0.54
Unemployment	2.44	2.45	3.56	1.41	0.30
Agglomeration effect	-8.67	-8.69	-6.38	-12.21	0.82
Financial depth	4.47	7.56	9.80	0.00	4.03
Human capital	6.56	6.59	8.52	4.17	0.59
Schooling	-4.57	-4.52	-3.44	-6.80	0.31

Note: All variables are in their natural logarithm form.

4. Method and Results

In order to provide initial evidence on the effect of various regional variables on the newly founded firms, we used of two different estimators. In the first step, do not consider spatial dependencies and used the non-spatial panel random effect. This step was constructed basing on the assumption that the error terms are not spatially correlated. The results are reported in columns 1 and 4 in Tables 3 to 6. In the second step, we estimate a panel spatial autoregressive model (SAR) by adding spatial dependence in the form of spatial lag to panel data structure with random effects. The results of the panel SAR model are reported in columns 2, 3, 5 and 6 in Tables 3 to 6.

A spatial autoregressive model in the form of a spatial lag to a panel data structure with random effects can be written in the following form:

$$y_{it} = \tau \sum_{i \neq j}^{N} W_{ij} y_{ij} + x'_{it}\beta + u_{it}, \qquad (1$$

In the equation (1), $u_{it} = \mu_i + \vartheta_{it}$ and $\vartheta_{it} = \rho\vartheta_{i,t-1} + e_{it}$ refer to the structure of disturbances. In this equation, y_{it} is the dependent variable on the *i*th region in period *t*, x_{it} is the $k \times 1$ vector of independent variables, and u_{it} is the unobserved error term. The parameter τ denotes the lag of the dependent variable ($|\tau| < 1$) and provides a measure of the effect of the neighboring regions on the *i*th region. In equation (1), random effect component in the region *i* is measured by $\mu_i \sim i.i.d.N(0, \sigma_\mu^2)$. Furthermore, $e_{it} \sim i.i.d.N(0, \sigma_e^2)$ is the i.i.d. random effect component and ϑ_{it} measures the serially correlated component in the *i*th region. Finally, $|\rho| < 1$ indicates the serial autocorrelation for each region. We can rewrite the equation (1) as a $nT \times 1$ vector form as follows:

$$y_{nT} = \tau(I_T \otimes W)y_{nT} + X_{nT}\beta + u_{nT}, \qquad (2$$

Where $y_{nT} = (y'_{n1}, y'_{n2}, \dots, y'_{nt})'$ is an $nT \times 1$ vector of dependent variable observation for the regions *i* (i= 1,…,N) and period *t* (t= 1,…,T). $X_{nT} = (X'_{n1}, X'_{n2}, \dots, X_*(\rho)')'$ is a $nT \times k$ matrix of *k* independent variables for the regions *i* and period *t*. In the equation (2), u_{nT} is the overall disturbance $nT \times 1$ vector and equals to $\left(\iota_T \iota'_T \otimes diag(\mu_1, \mu_2, \dots, \mu_N)\right)\iota_{NT} + (I_T \otimes I_N)\vartheta$. ι_T is a T-dimensional vector of ones, *I* is an identity matrix, *W* is the spatial matrix, $\otimes$ indicates the Kronecker matrix product and $W_\otimes = I_T \otimes W$. As Anselin and Bera (1998) argue, the covariance of *u* is equal to $B_\otimes(\tau)^{-1}\Omega(\sigma_e^2, \sigma_\mu^2, \rho)B_\otimes(\tau)^{-1\prime}$where $B(\tau) = I_N - \tau W$, $B_\otimes(\tau) = I_T \otimes B(\tau)$ and $\Omega(\sigma_e^2, \sigma_\mu^2, \rho)$ is the standard variance-covariance matrix of a panel data model with random effects and serial correlation. The fact that *Wy* is correlated with the error term *u* suggests that instrumental variables (IV) can be used to solve this endogeneity issue. In particular, spatially lag explanatory variables (WX, W^2X, …) can be used as IV (Montes-Rojas, 2010).

Now we turn to the results obtained from the empirical model regressions. As noted before, columns 1 and 4 in Tables 3 to 6 report results from the specification that contains variables without spatial dependencies and the parameters are assumed to be constant across regions, while columns 2, 3, 5 and 6 include variables with spatial dependencies. In order to check the robustness of our results to alternative specifications of the model, we proceed in the following way. First, we consider the firm entry variable by using two different approaches: Labor market approach (columns 1 to 3) and Ecological approach (columns 4 to 6). The labor market approach rests upon the theory of entrepreneurial choice that each new firm is created by someone, as opposed to the ecological approach which implicitly assumes that new business emerge from existing ventures (Cheng & Li, 2011). Second, we consider two different time-invariant spatial weight matrixes in the model; a binary contiguity matrix (W) that is reported in columns 2 and 5 and inverse distance weight matrix (M) that is reported in columns 3 and 6. The W matrix assumes that spillovers

only take place between bordering provinces, while the M matrix assumes that all provinces contribute to the geographical spillovers proportionally to the distance, so that the weights penalize the most distance provinces more heavily.

Table 3 presents the results of estimation where micro firm entry rate is used as the dependent variable. From the random effect estimation with non-spatial effect, we conclude that the significant factors are the economic size, agglomeration effect, financial depth, human capital, economic sanctions and the Ahmadinejad's policy (just in labor market approach and at the 10% level of significant). The model with including the spatial dependencies (SAR) between regions reported in columns 2, 3, 5 and 6 which present similar qualitative results for independent variables. The economic size has positive and significant impacts on micro new firm birth and a reasonable explanation for that is that increase in regional income level leads to increase in local market demand, and this phenomenon encourages new firms to enter the market. The next explanatory variable is agglomeration effect that measures by the ratio of the establishment to the population in each region at the period of *t*. According to the results, this variable has negative and significant impacts on dependent variable at the 1% significant level and refers to this fact that if the average industry size in the region is large, entry rates are low. The next variable is the average value of stock transactions in each region stock market and used as a proxy for financial depth indicator in our estimations. As can be seen in Table 3, the financial structure in Iranian regions suggests that more concentration in stock transactions is associated with a decrease in the start-up rate of micro firms and thus that financial structure in the form of stock transactions has a negative effect on micro start-ups in Iran. Unlike of previous variables, the coefficients for human capital, as measured by the ratio of technical institution graduates to the number of institutions, in all models (except Model 3) are positive and statistically significant. The positive impact of human capital on micro start-ups is consistent with other findings in the literature –such as Mengistae (2006), Naudé et al. (2008) and Evans and Leighton (1990) - suggesting that regions with a higher level of human capital will have higher micro start-up rates.

Table (3). Estimation results of empirical models (dep. Variable: **Micro firm birth**)

Variable/Methods	*Labor market approach*			*Ecological approach*		
	Panel RE	Panel SAR		Panel RE	Panel SAR	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Ln (income)$_{i,t}$	**0.355 *****	**0.307 *****	**0.183 *****	**0.336 *****	**0.29 *****	**0.18 *****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (population change)$_{i,t}$	-0.0218	-0.029	-0.003	-0.053	-0.057	-0.033
	(0.889)	0.854	(0.982)	(0.726)	(0.702)	(0.824)
Ln (unemployment)$_{i,t}$	0.0126	0.0100	-0.035	-0.026	-0.029	-0.068
	(0.875)	(0.899)	(0.650)	(0.731)	(0.709)	(0.369)
Ln (agglomeration effect)$_{i,t}$	**-0.215 *****	**-0.19 *****	**-0.14 *****	**-0.197 *****	**-0.178 *****	**-0.137 *****
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.003)
Ln (financial depth)$_{i,t}$	**-0.019 *****	**-0.016 *****	-0.008	**-0.019 *****	**-0.017 *****	-0.009
	(0.006)	(0.024)	(0.259)	(0.003)	(0.014)	(0.149)
Ln (human capital)$_{i,t}$	**0.089 *****	**0.079 *****	0.0497	**0.089 *****	**0.081 *****	**0.056 ***
	(0.012)	(0.026)	(0.157)	(0.008)	(0.018)	(0.099)
Ln (schooling)$_{i,t}$	0.0825	0.0726	0.0632	0.0843	0.0717	0.063

Table (3). Estimation results of empirical models (dep. Variable: **Micro firm birth**)

Variable/Methods	*Labor market approach*			*Ecological approach*		
	Panel RE	Panel SAR		Panel RE	Panel SAR	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	(0.311)	(0.370)	(0.419)	(0.281)	(0.357)	(0.406)
Dummy (economic sanction)	**-0.571 *****	**-0.504 *****	**-0.31 *****	**-0.527 *****	**-0.461 *****	**-0.293 *****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy (Ahmadinejad policy)	**0.0991 ***	0.0873	0.0496	0.0773	0.067	0.038
	(0.064)	(0.103)	(0.346)	(0.132)	(0.190)	(0.454)
Spatial lag for the dep. Variable (λ)		**0.122 ***	**0.463 *****		**0.128 ***	**0.443 *****
		(0.069)	(0.000)		(0.056)	(0.000)
Contiguity matrix (W)		YES			YES	
Inverse distance matrix (M)			YES			YES
Wald chi² test	**9140.92**	**9305.1**	**10140.9**	**8254.8**	**8567.8**	**9262.8**
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wald test of spatial terms		**3.30 ***	**26.34 *****		**3.64 ***	**21.87 *****
P-value		(0.069)	(0.000)		(0.056)	(0.000)
R^2 *adjusted*	0.233	0.246	0.270	0.221	0.235	0.259
Log likelihood	-190.78	-189.16	-179.84	-174.33	-172.55	-165.15

Note **1**: Number of observations: 420. *Note* **2**: Number of groups: 30. *Note* **3**: P-values are reported in parentheses. *Note* **4**: * significance at the 10%; ** significance at the 5%; *** significance at the 1%. *Note* **5**: The calculations were carried on using the software STATA15.

The variable of economic sanction notes to the new set of EU and U.S. sanctions imposed on Iranian economy during 2006 to 2013. The results are shown in Table 3 and reveal that there is a strong negative and significant effect of economic sanctions on micro start-ups during the sample period. The range of coefficients is between -29.3 percent to -57.1 percent depends on different models and scenarios.

Regarding the importance of governments' direct intervention in new firm formation which argued in Section 2, we also analyzed the effect of government policy in new firms' start-up during the sample period. As the results show, the effect of Ahmadinejad's policy on micro start-ups is insignificant and just non-spatial random effect model (Column 1) shows a positive and weak effect of policy at 10% level of significance. According to the results in Table 3, we note that the coefficients for spatial lag for the dependent variable (λ) are statistically significant for all spatial autoregressive specifications. In fact, the positive and significant coefficient of the spatial lag of firm birth supports the idea that higher levels of birth rate in neighboring regions impact positively on birth rate in a given region.

The results for random effects estimation- without and with spatial dependencies between regions- are shown in Table 4 by using of small firm birth as the dependent variable. In Table 4, the income coefficient is statistically significant for all specifications, indicating the positive effect of demand-side on new small start-ups in Iranian regions. Instead, the other demand-side factor (population change) put a strong negative and significant effect on small firms' birth surprisingly. Although the results of several studies have shown that population change is associated with birth

rates positively[1], however, the effect is not apparently agreed upon. As Verheul et al. (2002) argue, a higher level of population can lead to the pursuit of economies of scale, which enables businesses to serve more efficient services to their customers and leaves fewer opportunities for small firms. In addition, population growth (if measured by the degree of urbanization) leads to excessive competition, wages level, and input prices, thus discouraging entry.[2] In the supply-side factors, the sign of unemployment rate is negative and strong in all of the specifications at the 1% level of significance. It means that higher level of unemployment in a region lowers small entry rates and refers to the fact that, a higher level of unemployment may reduce aggregate disposable income, effectively reducing local demand for goods and services, thereby putting downward pressure on the rate of new firms' birth(P. Reynolds et al., 1994). Furthermore, a higher level of unemployment indicates that the current labor market conditions face to higher risk levels. In this situation, the rate of new firms birth is likely to be lower because it would be more harder to survive, as compared to the situation when labor market conditions were judged to be more favorable (Sutaria & Hicks, 2004).

For the case of financial depth and human capital, the obtained results show the weak and negative effect of these variables on small firms' birth at the 1% and 10% levels of significance. Similar to the case of micro firms, the estimations show that the economic sanctions put negative, strong and significant effects on small start-ups that the range of coefficients varied between -15.9 to -43.2 percentage. But the result of the Ahmadinejad's policy is interesting. As can be seen in Table 4, the coefficients of Ahmadinejad's policy in all specifications are positive, significant and strong relatively. In fact, it shows that despite micro firms, the direct government intervention put a positive impact on the birth rate of small firms which were the key target of mentioned policy during the years 2006 to 2007. Finally, in all spatial dependence specifications, the coefficients for spatial dependence (λ) are positive and statistically significant. The positive spatial lag of firm birth means that one region located in a relatively rich neighborhood will tend to have a higher rate of firm birth if the other things being equal. The other diagnostic tests are shown in Table 4.

Table (4). Estimation results of empirical models (dep. Variable: **Small firm birth**)

Variable/Methods	*Labor market approach*			*Ecological approach*		
	Panel RE	Panel SAR		Panel RE	Panel SAR	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Ln (income)$_{i,t}$	**0.326 *****	**0.249 *****	**0.143 *****	**0.381 *****	**0.294 *****	**0.184 *****
	(0.000))	(0.000)	(0.012)	(0.000)	(0.000)	(0.003)
Ln (population change)$_{i,t}$	**-0.596 *****	**-0.598 *****	**-0.557 *****	**-0.628 *****	**-0.625 *****	**-0.575 *****
	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.006)
Ln (unemployment)$_{i,t}$	**-0.241 *****	**-0.276 *****	**-0.309 *****	**-0.273 *****	**-0.309 *****	**-0.352 *****
	(0.021)	(0.007)	(0.002)	(0.015)	(0.005)	(0.001)
Ln (agglomeration effect)$_{i,t}$	-0.095	-0.075	-0.054	-0.104	-0.0822	-0.053
	(0.135)	(0.223)	(0.368)	(0.122)	(0.214)	(0.414)
Ln (financial depth)$_{i,t}$	**-0.016 ***	-0.015	-0.011	**-0.017 ***	**-0.016 ***	-0.012

[1] For example see P. Reynolds et al. (1994); Armington and Acs (2002); Wennekers, Van Wennekers, Thurik, and Reynolds (2005); Bosma et al. (2008).

[2] For more discussion see Nyström (2007); Van Stel and Suddle (2008).

Table (4). Estimation results of empirical models (dep. Variable: **Small firm birth**)

Variable/Methods	*Labor market approach*			*Ecological approach*		
	Panel RE	Panel SAR		Panel RE	Panel SAR	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	(0.081)	(0.1000)	(0.210)	(0.081)	(0.096)	(0.201)
Ln (human capital)$_{i,t}$	**-0.091 *****	-0.066	-0.039	-0.074	-0.056	-0.034
	(0.049)	(0.145)	(0.374)	(0.134)	(0.253)	(0.467)
Ln (schooling)$_{i,t}$	0.158	0.076	-0.0039	0.135	0.0638	-0.015
	(0.133)	(0.460)	(0.968)	(0.231)	(0.566)	(0.889)
Dummy (economic sanction)	**-0.418 *****	**-0.289 *****	**-0.159 *****	**-0.432 *****	**-0.318 *****	**-0.182 *****
	(0.000)	(0.000)	(0.027)	(0.000)	(0.000)	(0.019)
Dummy (Ahmadinejad policy)	**0.411 *****	**0.295 *****	**0.157 *****	**0.393 *****	**0.295 *****	**0.161 *****
	(0.000)	(0.000)	(0.032)	(0.000)	(0.000)	(0.040)
Spatial lag for the dep. Variable (λ)		**0.269 *****	**0.596 *****		**0.239 *****	**0.571 *****
		(0.000)	(0.000)		(0.000)	(0.000)
Contiguity matrix (W)		YES			YES	
Inverse distance matrix (M)			YES			YES
Wald chi^2 test	**881.3**	**986.6**	**1053.6**	**1413.2**	**1518.9**	**1608.0**
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wald test of spatial terms		**19.70**	**59.42**		**14.54**	**48.63**
P-value		(0.000)	(0.000)		(0.000)	(0.000)
R^2 *adjusted*	0.088	0.113	0.119	0.069	0.089	0.093
Log likelihood	-302.87	-293.72	-281.75	-331.13	-324.29	-313.34

Note **1**: Number of observations: 420. *Note* **2**: Number of groups: 30. *Note* **3**: P-values are reported in parentheses. *Note* **4**: * significance at the 10%; ** significance at the 5%; *** significance at the 1%. *Note* **5**: The calculations were carried on using the software STATA15.

Table 5 presents the results when the medium firm birth included in the model as the dependent variable. Based on the obtained results, income has a positive and significant impact on the entry of new firms' birth for the case of ecological approach and the range of coefficients is between 17.3 to 31.1 percentages. While the same effect in the case of labor market approach is insignificant. The results for the next explanatory variable (agglomeration effect) indicate that the variable put negative and significant effects (in Columns 4 and 5) on new firms start-ups in terms of higher rent, wage costs and potential competition from incumbent firms located in the area. Two other empirical results are statistically significant and negative for financial depth and human capital. In regions with a higher level of skilled people, we observe a lower rate of new firms' start-up (Columns 1 and 2). It is in line with Binet and Facchini (2015) suggesting that more skilled people usually prefer to choose a paid work as they face less risk of unemployment and low-income levels.

To measure the level of basic education in the economy, we include the measure of secondary educational attainment in each region. This variable is defined as the number of adults with secondary school degree in each year divided by the number of population in the region. The positive and statistically significant coefficients of schooling in Table 5 indicate that more population with basic educational degree encourages entrepreneurs to found their business which can rather be attributed to hire labor force with a lower level of educational degree and pay lower wages and benefit fringes to them. Results of the economic sanction dummy indicate that economic turmoil has heavily hit the medium firms' birth.. Indeed, for the case of

medium start-ups, the negative impact of the economic sanction is observed between -36.1 to -70.5 percentage depends on different methods and scenarios. Similar to previous regressions, the results show positive and strong effects of Ahmadinejad's policy on medium firms' start-up with coefficients that are always significant at the 99% level of confidence and showing a magnitude ranging from 33.1 to 59.2 percentage. Finally, the coefficients for spatial dependence (λ) present positive signs and are statistically significant.

Table (5). Estimation results of empirical models (dep. Variable: **Medium firm birth**)

Variable/Methods	*Labor market approach*			*Ecological approach*		
	Panel RE	Panel SAR		Panel RE	Panel SAR	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Ln (income)$_{i,t}$	0.029	0.0152	-0.0113	**0.311 *****	**0.262 *****	**0.173 *****
	(0.700)	(0.840)	(0.880)	(0.000)	(0.001)	(0.033)
Ln (population change)$_{i,t}$	-0.159	-0.170	-0.159	-0.427	-0.427	-0.406
	(0.537)	(0.507)	(0.533)	(0.124)	(0.121)	(0.135)
Ln (unemployment)$_{i,t}$	0.0713	0.0615	0.053	0.096	0.073	0.044
	(0.596)	(0.645)	(0.688)	(0.501)	(0.607)	(0.756)
Ln (agglomeration effect)$_{i,t}$	-0.077	-0.077	-0.081	**-0.177 ****	**-0.161 ***	-0.134
	(0.411)	(0.404)	(0.377)	(0.050)	(0.074)	(0.135)
Ln (financial depth)$_{i,t}$	-0.010	-0.0094	-0.0092	**-0.029 *****	**-0.027 *****	**-0.025 *****
	(0.385)	(0.415)	(0.424)	(0.020)	(0.027)	(0.044)
Ln (human capital)$_{i,t}$	**-0.135 *****	**-0.115 ****	-0.0829	-0.088	-0.076	-0.052
	(0.022)	(0.050)	(0.165)	(0.161)	(0.225)	(0.401)
Ln (schooling)$_{i,t}$	**0.252 ***	0.216	0.154	**0.322 *****	**0.277 ***	0.202
	(0.064)	(0.116)	(0.258)	(0.024)	(0.054)	(0.161)
Dummy (economic sanction)	**-0.611 *****	**-0.512 *****	**-0.361 *****	**-0.705 *****	**-0.583 *****	**-0.391 *****
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.001)
Dummy (Ahmadinejad policy)	**0.592 *****	**0.506 *****	**0.368 *****	**0.567 *****	**0.483 *****	**0.331 *****
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.003)
Spatial lag for the dep. Variable (λ)		**0.141 *****	**0.377 *****		**0.143 *****	**0.403 *****
		(0.037)	(0.001)		(0.032)	(0.000)
Contiguity matrix (W)		YES			YES	
Inverse distance matrix (M)			YES			YES
Wald chi^2 test	**245.08**	**250.28**	**261.98**	**737.04**	**742.76**	**753.97**
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wald test of spatial terms		**4.36**	**11.78**		**4.62**	**15.40**
P-value		(0.037)	(0.000)		(0.032)	(0.000)
R^2 *adjusted*	0.186	0.191	0.201	0.238	0.241	0.240
Log likelihood	-408.89	-406.78	-403.81	-432.50	-430.25	-425.9

Note **1**: Number of observations: 420. *Note* **2**: Number of groups: 30. *Note* **3**: P-values are reported in parentheses. *Note* **4**: * significance at the 10%; ** significance at the 5%; *** significance at the 1%. *Note* **5**: The calculations were carried on using the software STATA15.

Finally, Table 6 presents the estimation results when using large firm birth as the dependent variable. According to the results, income, agglomeration effect, financial depth, human capital, schooling, economic sanction and Ahmadinejad's policy are the variables that are significant. First of all, it should be noted that for the case of labor market approach (columns 2 and 3), the coefficients for spatial dependence (λ) are not statistically significant and indicate that, the use of spatial econometrics might not be necessary because the spatial dependence not appears in the specifications. Turning our attention to the main result, it shows that the size of the economy has a weak and positive effect on new firms' birth (Column 4) and the coefficients are

insignificant in the most cases. Thus, the general outcomes suggest that in the Iranian economy, the regional GDP per capita has larger positive effects on firms with the smaller size. While our regional variables for the agglomeration effect, financial depth, and human capital have negative and significant effects on large start-ups, the share of the population with secondary education degree has positive and relative strong effects on the dependent variable. This result is similar to the model estimation in Table 5 and reveals that the share of the population with a low level of education seems to be a driver for entrepreneurs to launch their own business. On the other hand, similar to previous regressions, economic sanction deters entry, which suggests that macroeconomic instability hampers new firm formation and the rate of entry reflects negative expectations about the harsh economic conditions. From the obtained results, we conclude that large entries are positively affected by the government direct intervention.

Table (6). Estimation results of empirical models (dep. Variable: **Large firm birth**)

Variable/Methods	*Labor market approach*			*Ecological approach*		
	Panel RE	Panel SAR		Panel RE	Panel SAR	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Ln (income)$_{i,t}$	0.043	0.034	0.032	**0.132 ***	0.107	0.075
	(0.556)	(0.636)	(0.660)	(0.057)	(0.127)	(0.287)
Ln (population change)$_{i,t}$	-0.224	-0.218	-0.215	-0.209	-0.198	-0.184
	(0.382)	(0.392)	(0.399)	(0.435)	(0.457)	(0.483)
Ln (unemployment)$_{i,t}$	0.064	0.067	0.057	0.188	0.169	0.113
	(0.633)	(0.612)	(0.666)	(0.171)	(0.214)	(0.405)
Ln (agglomeration effect)$_{i,t}$	-0.126	-0.134	-0.131	**-0.281 *** **	**-0.271 *** **	**-0.237 *** **
	(0.145)	(0.122)	(0.130)	(0.001)	(0.001)	(0.004)
Ln (financial depth)$_{i,t}$	-0.008	-0.008	-0.0077	**-0.044 *** **	**-0.038 *** **	**-0.029 *** **
	(0.463)	(0.497)	(0.507)	(0.000)	(0.002)	(0.016)
Ln (human capital)$_{i,t}$	**-0.265 *** **	**-0.254 *** **	**-0.24 *** **	**-0.113 ***	**-0.114 ***	**-0.116 ** **
	(0.000)	(0.000)	(0.000)	(0.061)	(0.057)	(0.050)
Ln (schooling)$_{i,t}$	**0.283 *** **	**0.269 *** **	**0.250 ***	**0.306 *** **	**0.282 *** **	0.218
	(0.035)	(0.044)	(0.067)	(0.026)	(0.039)	(0.112)
Dummy (economic sanction)	**-0.431 *** **	**-0.372 *** **	**-0.35 *** **	**-0.716 *** **	**-0.589 *** **	**-0.408 *** **
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.001)
Dummy (Ahmadinejad policy)	**0.601 *** **	**0.545 *** **	**0.513 *** **	**0.520 *** **	**0.449 *** **	**0.341 *** **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Spatial lag for the dep. Variable (λ)		0.094	0.154		**0.137 *** **	**0.362 *** **
		(0.164)	(0.233)		(0.036)	(0.000)
Contiguity matrix (W)		YES			YES	
Inverse distance matrix (M)			YES			YES
Wald chi^2 test	**268.23**	**272.44**	**271.25**	**570.81**	**590.12**	**592.73**
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wald test of spatial terms		1.94	1.42		**4.38**	**12.63**
P-value		(0.164)	(0.233)		(0.036)	(0.0004)
R^2 *adjusted*	0.141	0.145	0.148	0.335	0.337	0.341
Log likelihood	-405.17	-404.21	-404.49	-414.95	-412.81	-409.34

Note **1**: Number of observations: 420. *Note* **2**: Number of groups: 30. *Note* **3**: P-values are reported in parentheses. *Note* **4**: * significance at the 10%; ** significance at the 5%; *** significance at the 1%. *Note* **5**: The calculations were carried on using the software STATA15.

6. Summary and Conclusions

Entrepreneurial decisions on location choice are affected by a wide range of regional variations. Thus, due to the importance of regional characteristics, this paper

analyses the regional determinants of new firms' birth in the 30 Iranian regions, considering four different sizes: Micro, Small, medium and large over the period 2000-2013. We estimate non-spatial panel random effect and panel spatial autoregressive models to explain the role of regional variations in new firms' birth in Iranian regions. This is a novelty in the context of an empirical study that largely previous studies focus on evidence from developed and industrialized economies. First of all, the results show that firms' birth rate in a given region is affected positively by the birth rate in the previous year and its' growth in neighboring regions. This finding reveals persistence in entrepreneurship rates and suggests that policies to favor entrepreneurial activities should be implemented in the long run. We also find that agglomeration effect in terms of the ratio of industry establishment to population put a negative and significant effect on new firms' birth in the most cases and scenarios. The similar results were found for some other regional variables such as financial depth (in all cases), human capital (in the cases of small, medium and large firms' birth), and population change and the unemployment rate (in the case of small firms' birth). On the reverse, our results suggest that economic size has a positive and significant effect on new firms' birth, although this effect is less important when the firms with bigger size included in the models. Our findings highlight the positive role played by human capital in micro firms' birth and schooling in medium and large firms' birth respectively. Another important finding in the paper is that all types of the firms are influenced by the negative effect of economic sanctions, and the rate of new firms' entry actually reflects negative expectations about the harsh economic conditions. Furthermore, government direct intervention seems to be a key driver of new firms' birth in the Iranian economy.[1]

In terms of policy implications, our results suggest that for the case of Iran –as a developing country- policymakers should take into account regional conditions when designing birth-promoting policies. Furthermore, the spatial interactions of new firms' birth should be taken into account and it would be more desirable for birth-promoting policies to be coordinated with a broader regional focus in order to benefit from spatial externalities. This paper has provided the first empirical analysis of the regional determinants of new firm birth in Iran, considering spatial dependence in a panel data setup. Although this paper provides impressive results, the regional issues on exit across firm size are not analyzed in this research, and this subject is an important avenue for future studies about Iranian economy.

Appendix 1. Summary of obtained results (in terms of significant signs)

	Dependent variables			
	Micro firm birth	**Small firm birth**	**Medium firm birth**	**Large firm birth**
Economic size	+	+	+	+
Population change		-		
Unemployment		-		
Agglomeration effect	-		-	-
Financial depth	-	-	-	-
Human capital	+	-	-	-
Schooling			+	+

[1] Appendix 1 provides summary of obtained results in terms of significant signs.

Appendix 1. Summary of obtained results (in terms of significant signs)

	Dependent variables			
	Micro firm birth	**Small firm birth**	**Medium firm birth**	**Large firm birth**
Economic sanction	-	-	-	-
Ahmadinejad policy	+	+	+	+
Spatial lag for the dep. variable	+	+	+	+

References

Acs, Z. J., & Amorós, J. E. (2008). Entrepreneurship and competitiveness dynamics in Latin America. *Small Business Economics, 31*(3), 305-322.

Anselin, L., & Bera, A. K. (1998). Spatial dependence in linear regression models with an introduction to spatial econometrics. *Statistics Textbooks and Monographs, 155*, 237-290.

Arauzo-Carod, J.-M., & Segarra-Blasco, A. (2005). The determinants of entry are not independent of start-up size: some evidence from Spanish manufacturing. *Review of Industrial Organization, 27*(2), 147-165.

Armington, C., & Acs, Z. J. (2002). The determinants of regional variation in new firm formation. *Regional studies, 36*(1), 33-45.

Ashcroft, B., Love, J. H., & Malloy, E. (1991). New firm formation in the British counties with special reference to Scotland. *Regional Studies, 25*(5), 395-409.

Audretsch, D., & Keilbach, M. (2004). Entrepreneurship capital and economic performance. *Regional studies, 38*(8), 949-959.

Audretsch, D. B. (1995). Innovation, growth and survival. *International journal of industrial organization, 13*(4), 441-457.

Audretsch, D. B., & Fritsch, M. (1994). The geography of firm births in Germany. *Regional studies, 28*(4), 359-365.

Audretsch, D. B., Keilbach, M. C., & Lehmann, E. E. (2006). *Entrepreneurship and economic growth*: Oxford University Press.

Binet, M.-E., & Facchini, F. (2015). The factors determining firm start-ups in French regions and the heterogeneity of regional labor markets. *The Annals of Regional Science, 54*(1), 251-268.

Bosma, N., Van Stel, A., & Suddle, K. (2008). The geography of new firm formation: Evidence from independent start-ups and new subsidiaries in the Netherlands. *International Entrepreneurship and Management Journal, 4*(2), 129-146.

Calá, C. D. (2018). Sectorial and regional determinants of firm dynamics in developing countries: evidence for low, medium and high tech manufacturing in Argentina. *CEPAL Review*(124).

Calá, C. D., Manjón-Antolín, M., & Arauzo-Carod, J. M. (2016). Regional determinants of firm entry in a developing country. *Papers in Regional Science, 95*(2), 259-279.

Carlsson, B. (1989). Flexibility and the theory of the firm. *International journal of industrial organization, 7*(2), 179-203.

Carree, M. A. (2002). Does unemployment affect the number of establishments? A regional analysis for US states. *Regional Studies, 36*(4), 389-398.

Cheng, S., & Li, H. (2011). Spatially varying relationships of new firm formation in the United States. *Regional Studies: The Journal of the Regional Studies Association, 45*(6), 773-789.

Colombo, M. G., Delmastro, M., & Grilli, L. (2004). Entrepreneurs' human capital and the start-up size of new technology-based firms. *International journal of industrial organization, 22*(8-9), 1183-1211.
Deichmann, U., Lall, S. V., Redding, S. J., & Venables, A. J. (2008). Industrial location in developing countries. *The World Bank Research Observer, 23*(2), 219-246.
Dejardin, M. (2011). Linking net entry to regional economic growth. *Small Business Economics, 36*(4), 443-460.
Delmar, F. (2005). *Self-employment among the Swedish Science and Technology Labor Force: The evolution of the firms between 1990 and 2000*: Swedish Institute for Growth Policy Studies [Institutet för tillväxtpolitiska studier](ITPS).
Evans, D. S., & Jovanovic, B. (1989). An estimated model of entrepreneurial choice under liquidity constraints. *Journal of political economy, 97*(4), 808-827.
Evans, D. S., & Leighton, L. S. (1990). Small business formation by unemployed and employed workers. *Small Business Economics, 2*(4), 319-330.
Farzanegan, M. R., & Alaedini, P. (2016). *Economic Welfare and Inequality in Iran*: Springer.
Figueiredo, O., Guimaraes, P., & Woodward, D. (2009). Localization economies and establishment size: was Marshall right after all? *Journal of Economic Geography, 9*(6), 853-868.
Fotopoulos, G., & Louri, H. (2000). Location and survival of new entry. *Small Business Economics, 14*(4), 311-321.
Fotopoulos, G., & Spence, N. (1998). Accounting for net entry into Greek manufacturing by establishments of varying size. *Small Business Economics, 11*(2), 125-144.
Fritsch, M. (2013). New business formation and regional development: A survey and assessment of the evidence. *Foundations and Trends® in Entrepreneurship, 9*(3), 249-364.
Fritsch, M., Brixy, U., & Falck, O. (2006). The effect of industry, region, and time on new business survival–a multi-dimensional analysis. *Review of Industrial Organization, 28*(3), 285-306.
Fritsch, M., & Mueller, P. (2004). Effects of new business formation on regional development over time. *Regional Studies, 38*(8), 961-975.
Fritsch, M., & Mueller, P. (2008). The effect of new business formation on regional development over time: the case of Germany. *Small Business Economics, 30*(1), 15-29.
Garofoli, G. (1994). New firm formation and regional development: the Italian case. *Regional studies, 28*(4), 381-393.
Ghani, E., Kerr, W. R., & O'connell, S. (2014). Spatial determinants of entrepreneurship in India. *Regional Studies, 48*(6), 1071-1089.
Görg, H., & Strobl, E. (2002). Multinational companies and entrant start-up size: Evidence from quantile regressions. *Review of Industrial Organization, 20*(1), 15-31.
Görg, H., Strobl, E., & Ruane, F. (2000). Determinants of firm start-up size: an application of quantile regression for Ireland. *Small Business Economics, 14*(3), 211-222.
Gries, T., & Naudé, W. (2010). Entrepreneurship and structural economic transformation. *Small Business Economics, 34*(1), 13-29.
Günalp, B., & Cilasun, S. M. (2006). Determinants of entry in Turkish manufacturing industries. *Small Business Economics, 27*(2-3), 275-287.
Hausmann, R., & Rodrik, D. (2003). Economic development as self-discovery. *Journal of development Economics, 72*(2), 603-633.
Johnson, P., & Parker, S. (1996). Spatial variations in the determinants and effects of firm births and deaths. *Regional Studies, 30*(7), 679-688.

Kangasharju, A. (2000). Regional variations in firm formation: Panel and cross-section data evidence from Finland. *Papers in Regional Science, 79*(4), 355-373.
Karahasan, B. C. (2015). Dynamics of regional new firm formation in Turkey. *Review of urban & regional development studies, 27*(1), 18-39.
Keeble, D., & Walker, S. (1994). New firms, small firms and dead firms: spatial patterns and determinants in the United Kingdom. *Regional studies, 28*(4), 411-427.
Lee, S. Y., Florida, R., & Acs, Z. (2004). Creativity and entrepreneurship: A regional analysis of new firm formation. *Regional studies, 38*(8), 879-891.
Li, M., Goetz, S. J., Partridge, M., & Fleming, D. A. (2016). Location determinants of high-growth firms. *Entrepreneurship & Regional Development, 28*(1-2), 97-125.
Mata, J. (1991). Sunk costs and entry by small and large plants. *Entry and market contestability: An international comparison*, 49-62.
Mata, J. (1996). Markets, entrepreneurs and the size of new firms. *Economics Letters, 52*(1), 89-94.
Mata, J., & Machado, J. A. (1996). Firm start-up size: A conditional quantile approach. *European Economic Review, 40*(6), 1305-1323.
Mengistae, T. (2006). Competition and entrepreneurs' human capital in small business longevity and growth. *The Journal of Development Studies, 42*(5), 812-836.
Mills, D. E., & Schumann, L. (1985). Industry structure with fluctuating demand. *The American Economic Review, 75*(4), 758-767.
Moghadam, S. J. (2017). Entrepreneurship Policy in Iran. In *Iranian Entrepreneurship* (pp. 15-39): Springer.
Montes-Rojas, G. V. (2010). Testing for random effects and serial correlation in spatial autoregressive models. *Journal of Statistical Planning and Inference, 140*(4), 1013-1020.
Naudé, W., Gries, T., Wood, E., & Meintjies, A. (2008). Regional determinants of entrepreneurial start-ups in a developing country. *Entrepreneurship and Regional Development, 20*(2), 111-124.
Nurmi, S. (2006). Sectoral differences in plant start-up size in the Finnish economy. *Small Business Economics, 26*(1), 39-60.
Nyström, K. (2005). Determinants of regional entry and exit in industrial sectors. In: CESIS, KTH Royal Institute of Technology.
Nyström, K. (2007). An industry disaggregated analysis of the determinants of regional entry and exit. *The Annals of Regional Science, 41*(4), 877-896.
Reynolds, P., Storey, D. J., & Westhead, P. (1994). Cross-national comparisons of the variation in new firm formation rates. *Regional studies, 28*(4), 443-456.
Reynolds, P. D., Miller, B., & Maki, W. R. (1995). Explaining regional variation in business births and deaths: US 1976–88. *Small Business Economics, 7*(5), 389-407.
Santarelli, E., & Tran, H. T. (2012). Growth of incumbent firms and entrepreneurship in Vietnam. *Growth and Change, 43*(4), 638-666.
Scott, A., & Storper, M. (2003). Regions, globalization, development. *Regional studies, 37*(6-7), 579-593.
Segura, J., Garrigosa, E. G., & Vergés, J. M. V. (2005). Determinants of start-up size and subsequent growth: A multivariate analysis. *unpublished paper, Universidad Autónoma de Barcelona*.
Spilling, O. R. (1996). Regional variation of new firm formation: the Norwegian case. *Entrepreneurship & Regional Development, 8*(3), 217-244.
Stiglitz, J. E. (1999). *Towards a new paradigm for development: strategies, policies and processes*: UN.
Storey, D. J. (1991). The birth of new firms—does unemployment matter? A review of the evidence. *Small Business Economics, 3*(3), 167-178.

Sutaria, V., & Hicks, D. A. (2004). New firm formation: Dynamics and determinants. *The Annals of Regional Science, 38*(2), 241-262.
Tamasy, C., & Heron, R. L. (2008). The geography of firm formation in New Zealand. *Tijdschrift voor economische en sociale geografie, 99*(1), 37-52.
Van Stel, A., & Suddle, K. (2008). The impact of new firm formation on regional development in the Netherlands. *Small Business Economics, 30*(1), 31-47.
Verheul, I., Wennekers, S., Audretsch, D., & Thurik, R. (2002). An eclectic theory of entrepreneurship: policies, institutions and culture. In *Entrepreneurship: Determinants and policy in a European-US comparison* (pp. 11-81): Springer.
Von Graevenitz, G., Harhoff, D., & Weber, R. (2010). The effects of entrepreneurship education. *Journal of Economic Behavior & Organization, 76*(1), 90-112.
Wennekers, S., Van Wennekers, A., Thurik, R., & Reynolds, P. (2005). Nascent entrepreneurship and the level of economic development. *Small Business Economics, 24*(3), 293-309.