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Abstract

This paper aims to investigate the stationary properties of entrepreneurship capital in the Iranian business sector. The investigation is conducted based on firm size (micro, small and medium, and large), sector (ISIC classification), and location (31 provinces) over the period 1981-2021. To achieve the purpose of the paper, we apply the Lagrange Multiplier (LM) unit root test with structural breaks. The results of our study confirm the stationarity of entrepreneurship for the majority of our categorizations. Therefore, entrepreneurs' willingness to start a business is temporarily affected by sharp shocks, suggesting that the entrepreneurship trends in these categories will eventually revert to their long-run equilibrium. However, the time series of entrepreneurship in provinces such as Zanjan and Lorestan, as well as in the electrical machines and devices (code 31) sector, remain permanent. These findings can assist policymakers in each sector and location in designing effective policies to promote entrepreneurial activities. The economic literature reveals that empirical studies on the persistence of entrepreneurship have received relatively less attention in the context of emerging and resource-based economies, compared to the increasing focus on them in developed countries. Therefore, to address this gap, this paper aims to extend the current empirical literature by presenting new evidence for the case of Iran, which has an emerging and resource-based economy.

Keywords: Entrepreneurship, Iran, Structural breaks, Unit root
JEL Classifications: C01, C22, L26, M13, O18, R10

ملخص

تهدف هذه الورقة إلى التحقيق في الممتلكات الثابتة لرأس مال ريادة الأعمال في قطاع الأعمال الإيراني. يتم إجراء التحقيق بناءً على حجم الشركة (الصغير والمتوسط والكبير) والقطاع (تصنيف ISIC) والموقع (31 مقاطعة) خلال الفترة 1981-2021. لتحقيق الغرض من الورقة، نطبق اختبار جذر وحدة مضاعف لاغرانج (LM) مع فواصل هيكلية. تؤكد نتائج دراستنا ثبات ريادة الأعمال في غالبية تصنيفاتنا. لذلك، فإن استعداد منظمي المشاريع لبدء عمل تجاري يتأثر مؤقتًا بالصدمات الحادة، مما يشير إلى أن اتجاهات تنظيم المشاريع في هذه الفئات ستعود في النهاية إلى توازنها على المدى الطويل. ومع ذلك، فإن السلسلة الزمنية لتنظيم المشاريع في مقاطعات مثل زانجان ولورستان، وكذلك في قطاع الآلات والأجهزة الكهربائية (الرمز 31)، لا تزال دائمة. ويمكن لهذه النتائج أن تساعد مقرري السياسات في كل قطاع وموقع على تصميم سياسات فعالة لتعزيز أنشطة تنظيم المشاريع. وتكشف المؤلفات الاقتصادية أن الدراسات التجريبية بشأن استمرار تنظيم المشاريع حظيت باهتمام أقل نسبياً في سياق الاقتصادات الناشئة والاقتصادات القائمة على الموارد، مقارنة بالتركيز المتزايد عليها في البلدان المتقدمة. ولذلك، وبغية معالجة هذه الفجوة، تهدف هذه الورقة إلى توسيع نطاق المؤلفات التجريبية الحالية من خلال تقديم أدلة جديدة لقضية إيران، التي لديها اقتصاد ناشئ وقائم على الموارد.

1. Introduction

Entrepreneurship-promoting policies have gradually been incorporated into a wide range of Iranian economic and social development programs, at both the national and regional levels (Moghadam, 2017). However, despite the notable emphasis on entrepreneurship in policies and plans, the business environment in Iran has heavily relied on macroeconomic fluctuations, particularly economic and financial sanctions that have been implemented for a prolonged period in the country (Cheratian et al., 2021; Laudati and Pesaran, 2023). Since 2012, as a result of the multilateral sanctions imposed on Iran's financial system, the GDP growth rate decreased to -7.44%, and the Ease of Doing Business ranking was downgraded to 152 (out of 190) in the same year. Thus, it can be concluded that international sanctions, as a primary external shock, not only harm the Iranian economy but also cause significant collateral damage to its business environment and economic welfare (Cheratian et al., 2023). Considering the relevance of entrepreneurship capital and the vulnerability of the business environment to external shocks, Iran presents an intriguing case for quantifying the persistence of these shocks on the trend of business start-ups across various sizes, sectors, and geographical locations.

Public policies aimed at promoting entrepreneurial activities are a central point of attention in many developed countries. Consequently, politicians in advanced economies have devised a wide range of policies to support entrepreneurship, which have yielded different outcomes (Audretsch et al., 2002). In these nations, any positive shocks to national income are transmitted to the creation of new firms through various channels. In this context, Audretsch and Keilbach (2004) and Li et al. (2016) argue that an increase in per capita income leads to the creation of new start-ups. This increase serves as a proxy for higher market demand and improved access to capital. Therefore, it is generally expected that higher levels of a country's income will induce more firms to enter the market (Nyström, 2007; Cheratian et al., 2021).

However, the story is different for resource-based economies. In resource-based economies, the country's income is closely tied to global commodity price fluctuations since the export of natural resources accounts for the majority of GDP growth. In this situation, public policies aimed at promoting entrepreneurial prosperity tend to be temporary rather than persistent. In his seminal work, Baumol (1996) argues that entrepreneurs have the potential to engage in two types of activities. The first type is *productive entrepreneurship*, which involves creating and selling products and services with added value in the market. However, the second type refers to individuals who are often known as *unproductive entrepreneurs*. These individuals focus on establishing connections with sources of rent and competing to capture a larger share of the rent within the economy. In this context, a review of the current literature widely acknowledges that the presence of natural resource wealth can potentially hinder entrepreneurial activities. This is due to the tendency it creates for individuals to engage in rent-seeking behavior (Torvik, 2002; Mehlum et al., 2006; Kolstad and Wiig, 2009) rather than productive entrepreneurship. In this regard, the negative association between resource rent dependency and entrepreneurship has been considered significant (Farzanegan, 2014; Majbouri, 2016).

Given the importance of entrepreneurial persistence and its crucial role in driving economic development, a growing body of empirical studies has explored the aspects of stationarity and convergence in entrepreneurship over the past decade (see Appendix 1). However, a review of the

current literature reveals that this subject has received relatively less attention in the context of emerging and resource-based economies, compared to the increasing focus on it in developed countries. Among the developed countries, a significant number of studies have concentrated on the EU group countries (Taylor, 2011; Faria et al., 2021; Cuadros et al., 2021), as well as OECD countries (Parker et al., 2012; Saridakis et al., 2019), with predominantly inconclusive and mixed results. Furthermore, a few studies have investigated entrepreneurship convergence with a focus on industrialized countries such as Sweden (Andersson and Koster, 2011), the UK (Fotopoulos, 2014; Fotopoulos and Storey, 2017; Saridakis et al., 2020), and Germany (Fritsch and Wyrwich, 2017). However, the overall results mostly support a high degree of entrepreneurship persistence across developed countries. To fill the research gap and contribute to the existing literature, this paper aims to investigate the persistence of new firm establishment in Iran. Being an emerging and resource-based economy, Iran has experienced significant shocks over the past decades, including an eight-year war with Iraq, international sanctions, hyperinflation, economic recession, and widespread social protests. These shocks have had profound impacts on various aspects of Iran's economy, including its business environment. In terms of the related theory, if the establishment of new firms remains stationary, it implies that policy implications will only have temporary effects on entrepreneurs' willingness to enter the market. Conversely, if the series of new firm entries exhibits a unit root, policy implications will persistently influence entrepreneurship.

Our study makes a significant contribution in two key areas. Firstly, it addresses the research gap on the persistence of entrepreneurship in a resource-based economy that has experienced significant shocks over the past decades. Secondly, it uncovers the perspective of subgroups, which explains differences in entrepreneurship stickiness based on size, sector, and location. By doing so, we can determine which subgroups are the best candidates for the implementation of business policies to achieve sustainable development goals. The results, which take into account a time trend and multiple structural breaks, reveal that shocks to new firm formation in various size, sector, and location subgroups have a transitory influence. However, there are permanent effects from such shocks in a few provinces, namely Zanjan and Lorestan, as well as in the electrical machines and devices (code 31) sector. The paper's structure is organized as follows: Sections 2 and 3 describe the data and methodology applied in this study. We present the empirical results in Sections 4, respectively. Finally, Section 5 provides our conclusion and policy implications.

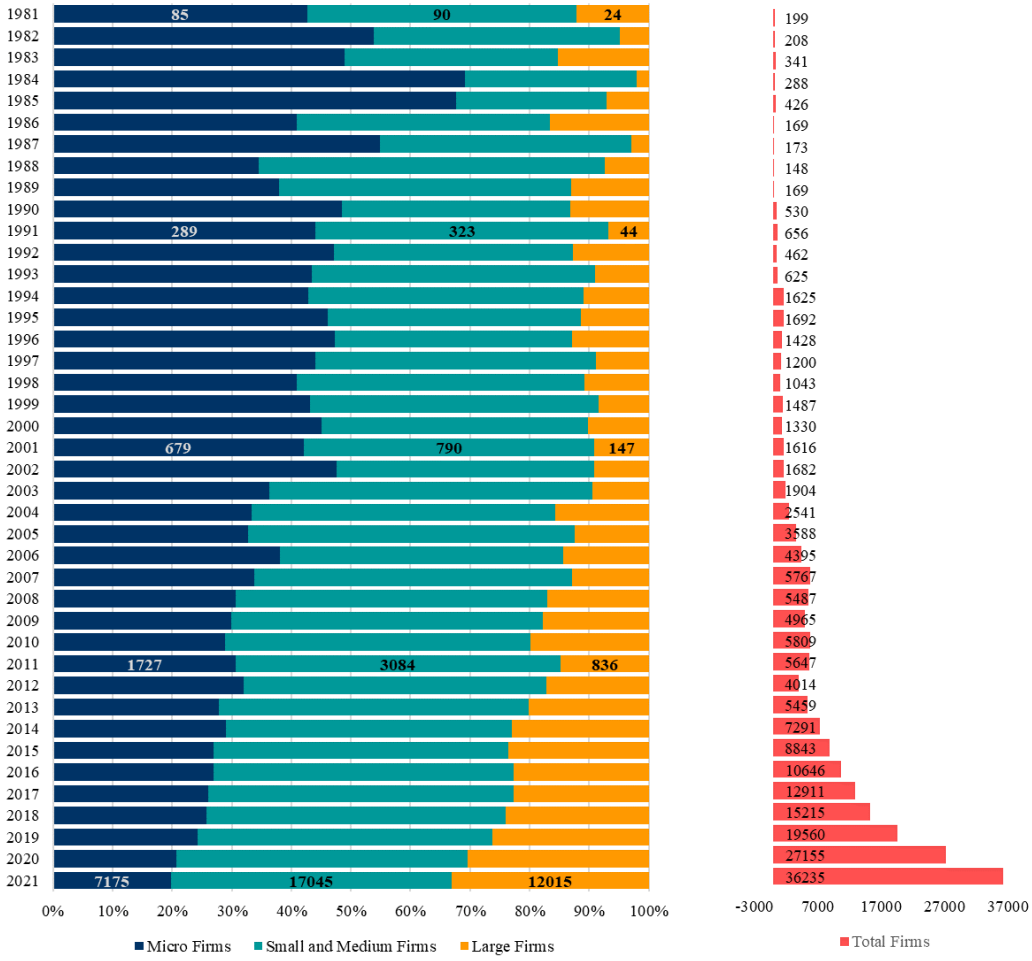
2. Data

To analyze hysteresis in firm entry in Iran, we utilize an annual database spanning the period 1981-2021. Entry data originate from the unique database of the Ministry of Industry, Mining and Trade (MIMT). The MIMT database furnishes geographical and sectoral information regarding the quantity of entries, exits, and incumbents as per the International Standard Industrial Classification (ISIC Rev.3) system across 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 MIMT data is collected at the individual level and encompasses all public and private single-establishment formal firms with one or more employees registered with social security. Therefore, informal firms and multi-establishment firms are excluded. Entry rates are computed per the *Labor Market Approach*, tallying the number of new entrants relative to the labor force. It is important to

acknowledge that comparing the absolute number of new entrances across different sizes, sectors, and regions would be more misleading than informative (Cheratian et al., 2020). The reason for this is that economic activities are not homogeneous in terms of their size, type of activity, and location (Audretsch and Fritsch, 1994; Armington and Acs, 2002). This approach is grounded in the theory of entrepreneurial choice, which pertains to individuals' decisions to start a new business or not, as suggested by Evans and Jovanovic (1989).

In addition to aggregate data on business establishment, the data is also assessed across three principal categories: establishment size, industrial activity code, and province. Size is bifurcated into three groups: Micro (1-9 employees), Small and Medium (10-49 employees), and Large (50+ employees). Figure (1) delineates the overall trajectory of business entry in Iran, as well as fluctuations in business entry by size across the study period. For example, in 1984 and 1985, micro businesses constituted nearly 70% of total market entries. However, by 2021 the percentage of micro business entries had declined to around 20% of total entries. Moreover, there has been significant growth in the proportion of large business entries, increasing from approximately 5% in 1982 to over 30% in 2021.

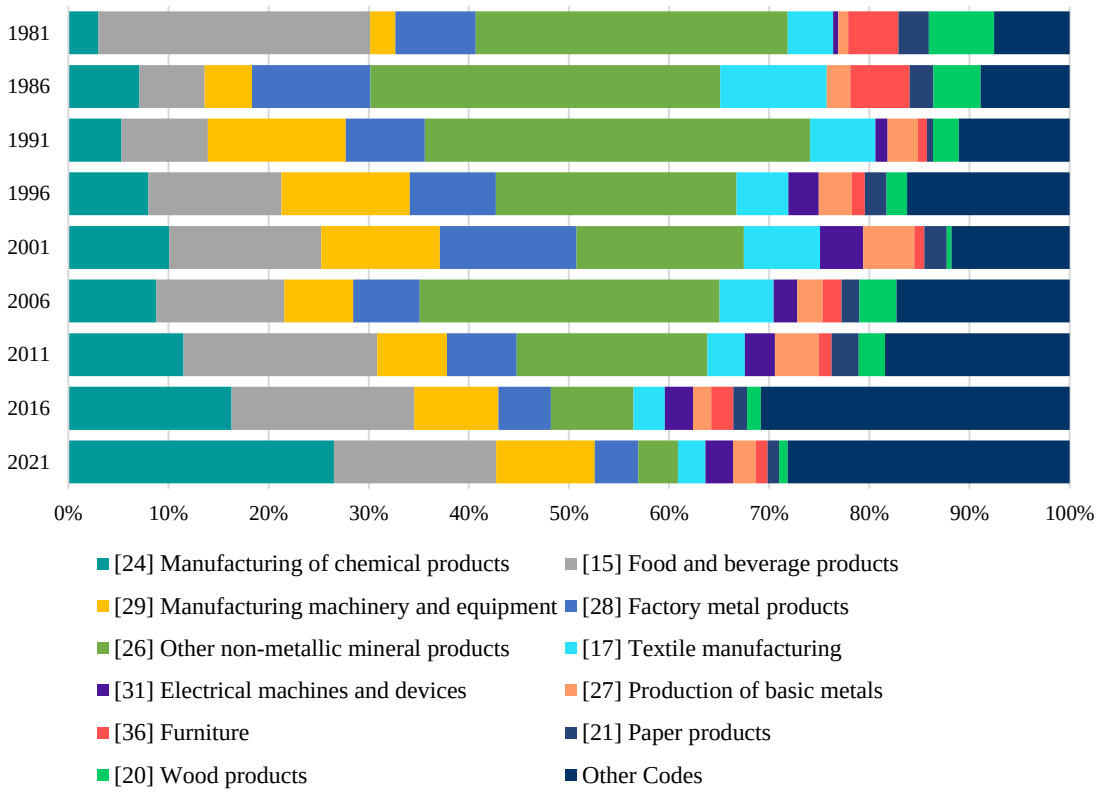
Figure 1: Total firm entry trend and share of each size (1981-2021)



Source: Authors based on MIMT database.

Moreover, the evaluation concentrated on 11 two-digit ISIC codes predominately representing the establishments, while the remaining establishments were classified under other discrete industrial activity codes. Figure (2) elucidates shifts in the composition of business entry by activity code over the study period. Initially in 1981, the majority of business entries pertained to the production of food and beverages alongside non-metallic mineral products, jointly accounting for over 50% of total entries. However, by 2021, the share of non-metallic mineral products had significantly decreased (less than 5%), while chemical product manufacturing claimed the largest proportion of business entries (over 25%). Despite declining as a percentage of the whole, food and beverage production remains the second most dominant industrial activity in terms of business entry in Iran.

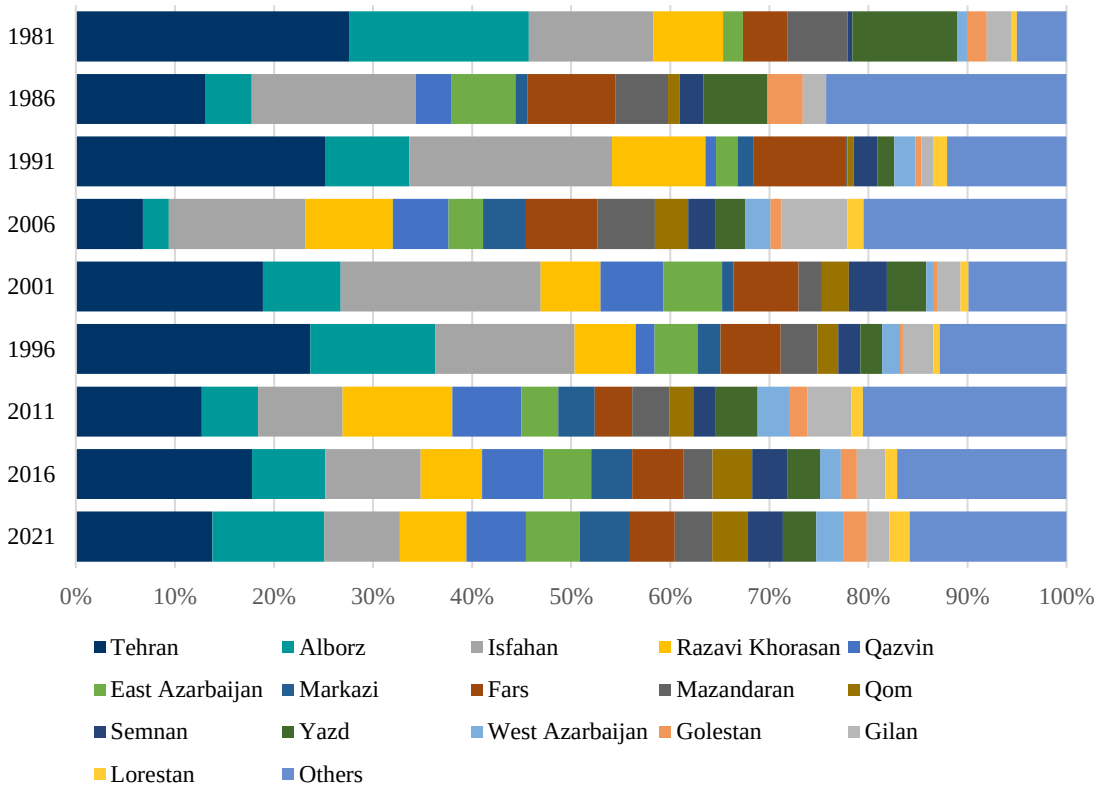
Figure 2: Share of selected two digit-ISIC codes in firm entry (1981-2021)



Source: Authors based on MIMT database.

Regarding provincial breakdown, data from 23 provinces out of 31 total provinces in Iran were analyzed. Notably, some provinces were established during the study period after being separated, thus their data was excluded from the overall assessment. Figure (3) also highlights the primacy of Tehran, Alborz, and Isfahan provinces within Iran's industrial sector. Throughout the study, these provinces persistently accounted for the greatest share of business entry. However, it is evident that in recent years, business entry has become more dispersed across different provinces, reducing the concentration in specific provinces.

Figure 3: Share of selected province in firm entry (1981-2021)



Source: Authors based on MIMT database.

3. Methodology

If a time series contains a unit root, it is non-stationary, non-mean reverting, and essentially unpredictable using only past values of the series itself. Initially, we utilize the Ng and Perron (2001) test to examine the presence of a unit root in a time series without accounting for potential structural breaks. However, it is now well established that structural breaks like economic depressions, sanctions, the Covid-19 pandemic, tax changes, or energy price shocks can spuriously generate the appearance of a unit root. Thus, we implement the Lagrange Multiplier (LM) unit root *t*-test of Lee and Strazicich (2003, 2013), which facilitates endogenous one and two (unknown) breaks. The methodologies are elucidated for each test in the ensuing subsections.

Lee and Strazicich (2013) formulated two versions of the Schmidt and Phillips (1992) LM unit root test with one structural break. Using Perron's (1989) nomenclature, Model 1 is the ‘‘crash” model, permitting a one-time change in the intercept under the alternative hypothesis.

Model 1 can be depicted as $Z_t = [1. t. D_t]'$, where $D_t = 1$ for $t \geq T_B + 1$ and zero otherwise, T_B denotes the date of the structural break, and $\delta' = (\delta_1. \delta_2. \delta_3)$. Model 2, the “Trend break” model, allows for a shift in the intercept and altered trend slope under the alternative hypothesis, described by $Z_t = [1. t. D_t. DT_t]'$, where $DT_t = t - T_B$ for $t \geq T_B + 1$ and zero otherwise.

Lee and Strazicich (2003) formulated a version of the LM unit root test accommodating two structural breaks. The endogenous two-break LM unit root test proceeds as follows. Model 3, extending Model 1, permits two shifts in the intercept, depicted by $Z_t = [1. t. D_{1t}. D_{2t}]'$, where $D_{jt} = 1$ for $\geq T_{Bj} + 1$, *j*=1,2 and zero otherwise. T_{Bj} denotes the date of the breaks. In Model 3, contingent on the β value, the null and alternative hypotheses are:

$$H_0: y_t = \mu_0 + d_1 B_{1t} + d_2 B_{2t} + y_{t-1} + v_{1t} \quad (1)$$
$$H_A: y_t = \mu_1 + \gamma t + d_1 D_{1t} + d_2 D_{2t} + v_{2t} \quad (2)$$

Where v_{1t} and v_{2t} are stationary error terms, $B_{jt} = 1$ for $= T_{Bj} + 1$, *j*=1,2 and zero otherwise.

Model 4, extending Model 2, incorporates two changes in the intercept and slope, depicted as $Z_t = [1. t. D_{1t}. D_{2t}. DT_{1t}. DT_{2t}]'$, where $DT_{jt} = t - T_{Bj}$ for $t \geq T_{Bj} + 1$, *j*=1,2 and zero otherwise. For Model 4, the hypotheses are:

$$H_0: y_t = \mu_0 + d_1 B_{1t} + d_2 B_{2t} + d_3 D_{1t} + d_4 D_{2t} + y_{t-1} + v_{1t} \quad (3)$$
$$H_A: y_t = \mu_1 + \gamma t + d_1 D_{1t} + d_2 D_{2t} + d_3 DT_{1t} + d_4 DT_{2t} + v_{2t} \quad (4)$$

Where v_{1t} and v_{2t} are stationary error terms, $B_{jt} = 1$ for $= T_{Bj} + 1$, *j*=1,2 and zero otherwise.
Per the LM principle, unit root test statistics are obtained from:

$$\Delta y_t = \delta' \Delta Z_t + \emptyset \bar{S}_{t-1} + u_t \quad (5)$$

Where $\bar{S}_t = y_t - \hat{\psi}_x - Z_t \hat{\delta}_t$, *t* = 2,….,*T*; $\hat{\delta}$ are coefficients from regressing Δy_ton ΔZ_t; $\hat{\psi}_x$ is given by $y_t - Z_t \delta$; and y_1 and Z_1 represent the first observations of y_t and Z_t.

Using this equation, the null hypothesis of a unit root ($\phi = 0$) is tested via the LM t-statistic. The location of the break (T_B) is determined by searching all possible break points to find the minimum unit root test statistic:

$$inf\tilde{\tau}(\bar{\lambda}_i) = inf\tilde{\tau}(\lambda) \text{ where } \lambda = T_B/T. \quad (6)$$

Critical values for the one-break case are tabulated in Lee and Strazicich (2013), while critical values for the two-break case are from Lee and Strazicich (2003).

4. Empirical Results

The persistence of entrepreneurship is analyzed across three scenarios pertaining to firm size, industrial classification, and region. This approach aims to ascertain the duration entrepreneurship can persist based on firm size, industry-specific conditions, and geographic location. First, the Ng and Perron (2001) unit root test without breaks is utilized. As shown in Table (1), total new firm formation, micro firms, and large firms are stationary including intercept and trend, while small and medium firms are not.

When examining industrial sectors, it can be observed that new firm formation is stationary in at least one of two approaches with intercept and with intercept and trend for almost all industrial groups, except for basic metals, chemical, electrical machines, and devices, which are not stationary in either approach. By considering geographical location, the results in Table (1) show

that new firm formation is stationary in at least one of two approaches with intercept and with intercept and trend for most provinces, except for West Azarbaijan, East Azarbaijan, Hamedan, Lorestan, Semnan, and Zanjan, which are not stationary in either approach.

Table 1: Ng and Perron (2001) unit root test by firm size, sector and province

	Intercept (ng1)				Intercept and trend (ng2)			
	MZa	MZt	MSB	MPT	MZa	MZt	MSB	MPT
Total	0.73	0.59	0.80	45.23	**-1221.75*****	**-24.71*****	**0.02*****	**0.07*****
By Size								
Micro (1-9)	**-10.62****	**-2.25****	**0.21****	**2.50****	**-25.13*****	**-3.54*****	**0.14****	**3.64*****
Small and Medium (10-49)	-1.63	-0.71	0.43	11.88	-10.41	-2.28	0.21	8.75
Large (50 and more)	**-16.30*****	**-2.78*****	**0.17*****	**1.77*****	**-15.35***	**-2.75***	**0.17***	**6.03***
By Sector								
Wood (code 20)	**-11.21****	**-2.35****	**0.20****	**2.24****	-13.42	-2.56	0.19	6.93
Basic metals (code 27)	-0.99	-0.50	0.50	15.85	-9.91	-2.22	0.22	9.19
Paper (code 21)	**-17.31*****	**-2.90*****	**0.16*****	**1.55*****	**-15.84***	**-2.81***	**0.177***	**5.77***
Machinery and equipment (code 29)	-4.23	-1.31	0.31	5.97	**-16.94***	**-2.90***	**0.17****	**5.40****
Textile (code 17)	-2.71	-1.15	0.42	8.95	**-15.65***	**-2.79***	**0.17****	**5.82***
Chemical (code 24)	-0.61	-0.34	0.56	19.69	-5.45	-1.63	0.29	16.63
Non-metallic mineral (code 26)	**-9.01****	**-1.99****	**0.22****	**3.19***	**-14.75***	**-2.71***	0.18	**6.18***
Electrical machines and devices (code 31)	-0.77	-0.45	0.58	19.82	-3.13	-1.21	0.38	28.19
Furniture (code 36)	**-12.57****	**-2.49****	**0.19****	**2.00****	**-30.04*****	**-3.87*****	**0.12*****	**3.03*****
Food and beverage (code 15)	-2.81	-1.00	0.35	8.16	**-18.82****	**-3.05****	**0.16****	**4.90****
Factory metal (code 28)	**-5.88***	**-1.64***	**0.27***	**4.38***	**-15.5***	**-2.78***	**0.17***	**5.89***
Other manufactures	**-11.92****	**-2.41****	**020****	**2.13****	-12.99	-2.52	0.19	7.13
By Province								
Alborz	-5.37	-1.57	0.29	4.72	**-19.72****	**-3.14****	**0.15****	**4.61****
W.Azarbaijan	0.81	1.02	1.25	102.08	-4.26	-1.45	0.34	21.37
E.Azarbaijan	0.36	0.27	0.74	36.71	-2.63	-1.14	0.43	34.47
Esfahan	**-6.62***	**-1.72***	**0.26***	**4.02***	-2.97	-1.21	0.40	30.62
Fars	**-15.96*****	**-2.79*****	**0.17****	**1.65*****	-12.95	-2.54	0.19	7.03
Gilan	**-11.03****	**-2.27****	**0.20****	**2.52****	**-18.17****	**-3.01****	**0.16***	**5.02****
Golestan	0.25	0.29	1.13	74.47	**-15.89***	**-2.81***	**0.17***	**5.76***
Hamedan	-1.50	-0.70	0.46	12.95	-11.63	-2.40	0.20	7.86
Hormozgan	**-13.56****	**-2.51****	**0.18****	**2.14****	**-15.04***	**-2.71***	**0.18***	**6.23***
Kerman	**-16.06*****	**-2.78*****	**0.17****	**1.70*****	**-16.98***	**-2.90***	**0.17***	**5.42****
Kermanshah	-0.30	-0.23	0.76	33.05	**-15.88***	**-2.81***	**0.17***	**5.74***
Khuzestan	-1.23	-0.63	0.51	15.28	**-19.19****	**-3.07****	**0.16***	**4.86****
R.Khorasan	**-7.31***	**-1.87***	**0.25***	**3.49***	-12.01	-2.44	0.20	7.59
Lorestan	0.87	0.97	1.11	81.98	-12.26	-2.46	0.20	7.48
Markazi	-0.28	-0.21	0.74	31.77	**-17.61****	**-2.96****	**0.16***	**5.18****
Mazandaran	**-6.26***	**-1.66***	**0.26***	**4.24***	**-19.73****	**-3.14****	**0.15****	**4.62****
Qazvin	**-18.70*****	**-3.03*****	**0.16*****	**1.39*****	**-18.81****	**-3.06****	**0.16***	**4.85****
Qom	-5.16	-1.48	0.28	5.05	**-25.34*****	**-3.55*****	**0.14****	**3.64*****
Semnan	0.50	1.05	2.09	251.63	-0.10	-0.10	1.01	197.85
Sistan	**-14.01*****	**-2.60*****	**0.18****	**1.90****	**-17.60****	**-2.96****	**0.16***	**5.18****
Tehran	**-16.85*****	**-2.84*****	**0.16*****	**1.64*****	**-19.83****	**-3.14****	**0.15****	**4.59****
Yazd	**-15.84*****	**-2.80*****	**0.17****	**1.56*****	**-17.28***	**-2.93****	**0.16***	**5.29****
Zanjan	-0.52	-0.30	0.58	21.20	-4.75	-1.52	0.32	19.04

Note: * Significance at 10% level. ** Significance at 5% level. *** Significance at 1% level.

A limitation of the Ng and Perron (2001) unit root test is that it does not account for potential structural breaks, thereby biased towards incorrectly accepting the null hypothesis. Moreover, new firm formation likely experienced exogenous shocks during the period. Thus, we implement the LM unit root tests allowing one and two structural breaks under the null per Lee & Strazicich (2003, 2013).

Table (2) presents the results of the LM unit root test with one structural break (Lee & Strazicich, 2013). The incorporation of one structural break in a Crash model (with intercept) leads to the rejection of the null hypothesis of unit root for almost all series, except for wood, chemical,

electrical machines, furniture, food and beverage, and the provinces of Hamedan, Lorestan, Semnan, Yazd, and Zanjan. However, the results slightly change after analyzing the trend break model (with intercept and trend) by incorporating one structural break. The null hypothesis of unit root is rejected for all new firm formation series, and they are stationary.

Table 2. LM unit root test with one break by firm size, sector and province

	Crash 1 (with intercept)				Break 1 (with intercept and trend)				
	T_{B1}	k	S_{t-1}	B_t	T_{B1}	k	S_{t-1}	B_t	D_t
Total	2000	8	**-3.97****	5.85	2003	6	**-5.37*****	-5.42	4.57
By Size									
Micro (1-9)	2014	1	**-4.92*****	0.04	2010	1	**-4.57****	0.13	0.81
Small and Medium (10-49)	2011	7	**-4.81*****	-0.16	2013	7	**-6.78*****	6.37	-7.12
Large (50 and more)	1999	0	**-4.72*****	0.56	2012	2	**-4.87****	-2.11	2.50
By Sector									
Wood (code 20)	2011	7	-2.49	-2.28	2002	8	**-6.82*****	2.71	-6.47
Basic metals (code 27)	2005	1	**-5.79*****	-1.98	2004	7	**-10.07*****	4.67	-10.20
Paper (code 21)	2005	7	**-4.71*****	-1.55	2006	10	**-6.81*****	5.22	-6.17
Machinery and equipment (code 29)	2006	4	**-5.73*****	0.29	2008	5	**-5.69*****	0.53	-4.49
Textile (code 17)	1999	0	**-4.61*****	-1.22	2002	8	**-11.02*****	-7.56	7.75
Chemical (code 24)	2004	2	-1.26	0.49	2003	10	**-4.49****	0.17	0.88
Non-metallic mineral (code 26)	2002	7	**-5.65*****	-1.89	2002	7	**-7.09*****	-2.63	-1.14
Electrical machines and devices (code 31)	2002	7	-0.90	-3.85	2005	7	**-4.04***	-2.25	3.58
Furniture (code 36)	2011	4	-4.69	-1.56	2015	10	**-5.81*****	-0.83	-3.94
Food and beverage (code 15)	1999	2	-1.32	-2.60	2006	8	**-5.09*****	-1.21	3.22
Factory metal (code 28)	2004	3	**-5.95*****	-1.95	2006	8	**-6.59*****	4.76	-6.20
Other manufactures	2007	3	**-5.25*****	-1.96	2003	7	**-5.28*****	-8.13	4.26
By Province									
Alborz	1995	6	**-8.59*****	-4.0	1995	6	**-10.07*****	-6.1	0.0
W.Azarbaijan	1998	8	**-4.92*****	1.8	1997	7	**-5.89*****	-4.1	4.4
E.Azarbaijan	1992	8	**-4.72*****	-4.5	1997	7	**-4.08***	-2.8	2.6
Esfahan	2005	6	**-6.25*****	-1.4	2005	6	**-6.50*****	-1.1	-1.6
Fars	1997	6	**-3.23***	-1.6	2017	10	**-9.71*****	-5.3	4.1
Gilan	2017	6	**-4.69*****	1.0	1997	8	**-5.79*****	-3.3	6.3
Golestan	1992	8	**-8.21*****	-2.7	2001	8	**-15.59*****	-4.4	-2.6
Hamedan	1997	7	-2.13	3.6	1996	9	**-6.17*****	-4.6	6.0
Hormozgan	2011	6	**-4.69*****	-0.7	2005	6	**-4.82****	-1.3	-1.5
Kerman	1994	8	**-4.06****	-4.1	1995	8	**-3.92***	5.3	-3.1
Kermanshah	1991	4	**-7.06*****	-3.0	2008	7	**-4.73****	-2.8	3.8
Khuzestan	2008	3	**-4.43*****	-3.0	2009	3	**-5.88*****	-0.0	2.6
R.Khorasan	1995	1	**-4.25*****	-0.4	1994	1	**-4.90*****	2.2	-3.2
Lorestan	1998	4	-1.68	0.9	2005	9	**-4.23***	-3.5	3.9
Markazi	1996	6	**-6.24*****	-1.3	1993	5	**-9.87*****	4.8	-8.0
Mazandaran	1995	2	**-4.94*****	-1.1	2001	10	**-7.75*****	-4.5	9.9
Qazvin	2003	8	**-4.68*****	-0.7	1996	8	**-6.68*****	-4.1	1.4
Qom	2008	2	**-5.47*****	0.8	1995	2	**-6.46*****	1.3	-2.3
Semnan	1998	2	-1.07	2.1	1995	10	**-5.44*****	-2.5	3.8
Sistan	2001	5	**-4.64*****	-1.5	1997	7	**-7.12*****	1.8	-4.0
Tehran	2017	7	**-5.66*****	0.3	2011	7	**-6.10*****	0.9	-4.2
Yazd	2005	5	-1.43	-1.9	2003	8	**-5.87*****	2.4	-5.6
Zanjan	2007	8	-1.00	1.6	1997	9	**-4.07***	-4.0	2.6

Note1: * Significance at 10% level. ** Significance at 5% level. *** Significance at 1% level.
Note2: The 1%, 5%, and 10% critical values for the minimum LM test with one breaks are -4.71, -4.14 and -3.85, respectively. TB_1 is the date of the structural break; k is the lag length that is the optimal number of lagged first differenced terms included in the unit root test to correct for serial correlation. S_{t-1} is the LM test statistic; B_t is the coefficient on the break in the intercept.

Table (3) presents the results of the LM unit root test with two structural breaks (Lee & Strazicich, 2003). When two structural breaks are incorporated in a Crash model (with intercept), the null hypothesis of unit root is rejected for almost all series, except for chemical, electrical machines, food and beverage, and the provinces of Fars, Hamedan, Lorestan, Semnan, and Zanjan. However, the results slightly change after analyzing the trend break model (with intercept and trend) by incorporating two structural breaks. The null hypothesis of unit root is rejected for all series, except for total new firm formation, machinery and equipment, electrical machines, and the provinces of Kermanshah, Lorestan, and Zanjan. Therefore, our findings suggest that shocks to the

entrepreneurship rate in most size, sector, and location subgroups have a transitory influence, and the rate of new firm creation will return to its trend path after a short time. However, it can be concluded from all of the examined approaches that there are some permanent effects of external shocks on the entrepreneurship trend in provinces such as Zanjan and Lorestan, as well as in the electrical machines and devices sector (code 31). Appendix (2) displays the provincial results on a map of Iran.

Table 3: LM unit root test with two breaks by firm size, sector and province

	Crash 2 (with intercept)						Break 2 (with intercept and trend)							
	T_{B1}	T_{B2}	k	S_{t-1}	B_{t1}	B_{t2}	T_{B1}	T_{B2}	k	S_{t-1}	B_{t1}	B_{t2}	D_{t1}	D_{t2}
Total	2001	2007	6	**-3.43***	1.83	-1.37	2002	2012	2	-5.51	0.41	-2.38	-1.95	4.51
By Size														
Micro (1-9)	1999	2011	8	**-5.74*****	-3.88	4.96	1999	2011	8	**-6.44****	-4.64	5.41	2.52	-4.04
Small and Medium (10-49)	1999	2002	5	**-4.73*****	4.20	-1.42	1999	2009	6	**-6.15***	6.57	1.24	-5.44	4.26
Large (50 and more)	1999	2001	0	**-4.86*****	0.11	0.75	2002	2013	2	**-5.87***	-1.33	2.53	3.35	0.76
By Sector														
Wood (code 20)	2003	2011	1	**-4.63*****	-3.24	-1.72	2000	2006	2	**-6.83*****	7.19	-0.70	-6.26	4.48
Basic metals (code 27)	2005	2011	1	**-5.57*****	-1.80	0.63	2005	2009	7	**-9.36*****	-4.27	2.07	0.82	-5.82
Paper (code 21)	1999	2005	7	**-4.64*****	1.92	-0.83	2005	2016	7	**-5.89***	-0.09	-2.84	-4.71	-1.03
Machinery and equipment (code 29)	2002	2006	4	**-5.35*****	2.10	-0.08	2008	2013	5	-5.90	1.34	1.29	-4.75	1.49
Textile (code 17)	1999	2001	0	**-5.29*****	-0.78	3.19	2002	2007	8	**-9.40*****	-5.85	3.34	4.32	-0.45
Chemical (code 24)	2006	2017	2	-1.89	0.90	0.97	2001	2011	5	**-11.23*****	7.87	-1.65	-3.70	8.19
Non-metallic mineral (code 26)	2005	2015	6	**-5.02*****	-2.47	0.35	2006	2016	7	**-8.68*****	7.56	-3.38	-8.12	5.77
Electrical machines and devices (code 31)	2011	2016	4	-1.63	1.21	0.15	2001	2009	4	-5.06	0.06	-3.75	4.34	4.49
Furniture (code 36)	2001	2003	1	**-4.55*****	-1.27	-1.23	1999	2010	6	**-6.44****	-4.06	1.74	0.33	-6.40
Food and beverage (code 15)	2001	2010	5	-2.52	-1.60	2.39	1999	2012	8	**-6.73****	-6.93	-6.13	4.86	5.06
Factory metal (code 28)	2004	2013	3	**-5.92*****	-2.21	-0.22	2006	2016	7	**-8.68*****	7.56	-3.38	-8.12	5.77
Other manufactures	2000	2002	0	**-4.00****	1.42	1.42	2006	2014	3	**-7.28*****	4.01	-0.48	-6.60	3.50
By Province														
Alborz	1995	2008	6	**-9.61*****	-4.8	-2.3	1995	2014	6	**-8.40*****	-4.89	0.31	-0.7	0.3
W.Azarbaijan	1991	1993	0	**-8.76*****	-0.1	0.1	1991	2000	1	**-8.85*****	0.25	-0.26	-3.1	-0.5
E.Azarbaijan	1992	2002	8	**-4.60*****	-4.0	-0.0	1991	2002	8	**-7.47*****	6.90	-2.85	-3.0	7.1
Esfahan	1994	1999	6	**-6.35*****	-2.3	-2.7	2004	2012	6	**-6.36****	2.74	-2.14	-3.3	2.2
Fars	1997	2007	6	-2.97	-1.6	-0.4	2011	2017	10	**-7.92*****	1.61	-4.68	1.7	4.7
Gilan	1993	2004	1	**-4.93*****	-1.7	-1.2	1998	2008	8	**-9.63*****	-7.29	-1.73	9.4	-1.9
Golestan	1992	2006	8	**-8.44*****	-3.0	-0.7	1997	2007	8	**-16.85*****	7.94	2.98	-13.0	4.8
Hamedan	1993	1998	7	-3.29	-4.1	-2.4	2001	2011	7	**-9.10*****	-3.22	0.59	7.5	3.8
Hormozgan	1993	1995	5	**-4.62*****	0.4	3.6	1995	2008	10	**-6.16***	5.92	-5.07	-5.0	5.8
Kerman	1992	2001	5	**-4.67*****	3.8	-0.8	1994	2012	5	**-8.78*****	-7.04	1.44	6.6	-6.0
Kermanshah	1991	2014	4	**-7.56*****	-2.7	-0.6	1997	2013	8	-5.23	-1.09	3.71	2.71	-5.1
Khuzestan	2008	2013	3	**-5.27*****	0.0	1.8	1991	2001	8	**-7.37*****	6.14	-5.48	-6.0	7.2
R.Khorasan	1995	2001	1	**-4.22*****	-1.5	-0.8	1993	2002	6	-5.37	-3.93	0.72	1.7	-3.6
Lorestan	1998	2007	4	-2.39	1.5	2.6	1993	1997	2	-5.69	-0.18	-3.56	3.7	2.8
Markazi	1991	1994	6	**-7.90*****	-5.6	-4.3	1993	1996	5	**-10.11*****	1.79	0.57	-5.1	-3.1
Mazandaran	1993	1999	8	**-4.72*****	-0.8	4.0	1998	2009	9	**-16.04*****	2.21	-1.91	-15.1	5.6
Qazvin	1993	2002	5	**-5.19*****	-2.7	-0.9	1996	2007	8	**-6.06***	-4.35	-2.41	2.2	2.2
Qom	2008	2014	2	**-5.24*****	0.8	0.1	1994	2002	2	**-7.76*****	-3.55	-0.85	2.6	-3.5
Semnan	1991	1999	5	-1.38	-1.8	-2.4	1995	2004	10	**-6.20***	-1.92	2.84	3.8	3.9
Sistan	1994	1997	5	**-4.54*****	-0.2	0.8	1997	2007	8	**-8.37*****	4.04	-2.66	-6.8	4.2
Tehran	1998	2008	4	**-5.37*****	-0.8	-2.4	1993	2003	4	**-6.51****	1.48	-4.25	-3.2	5.1
Yazd	2001	2011	2	**-4.83*****	-1.8	-0.8	1995	2004	4	**-7.17****	-0.99	-1.44	0.6	-7.0
Zanjan	2005	2007	8	-1.74	2.0	1.1	1993	1999	10	-5.40	6.22	-5.11	0.0	5.8

Note1: * Significance at 10% level. ** Significance at 5% level. *** Significance at 1% level.

Note2: The 1%, 5%, and 10% critical values for the minimum LM test with two breaks are -6.97, -6.28 and -5.99, respectively. TB_1 and TB_2 are the date of the structural breaks; k is the lag length that is the optimal number of lagged first differenced terms included in the unit root test to correct for serial correlation. S_{t-1} is the LM test statistic; B_t is the coefficient on the break in the intercept.

5. Summary and conclusions

In the early 1980s, as the wave of nationalization of large industries and skepticism towards capitalism began, entrepreneurship and business ownership faced significant constraints in Iran. This era is reflected in the approved Constitution of 1979, which imposed restrictions on private sector entry into major industries, mining, banking, transportation, and energy, relegating its role to that of a complementary sector to the government. In such an environment, the private sector and entrepreneurs were marginalized, leading to a sharp decline in industrial investment and economic growth in the country. In addition to that, macroeconomic fluctuations, political conflicts, strict business regulations, and a lack of a comprehensive approach to the business environment, as well as coordination between economic policies and business development plans at the national and regional levels, are at the heart of entrepreneurs' decision-making instability to starting their new startups during the last four decades. These issues can explain a significant part of the temporary nature of entrepreneurship development policies in Iran.

In light of this, we investigate the stationarity properties of entrepreneurship in Iran over the period 1981-2021. Utilizing time series data collected from the Ministry of Industry, Mine, and Trade, we employ the Lagrange Multiplier (LM) unit root test with structural breaks to analyze the persistence of new firm establishment across different sizes, sectors, and geographical locations. Our findings reveal that shocks to the entrepreneurship rate in most size, sector, and location subgroups have a transitory influence, and the rate of new firm creation will return to its trend path after a short time. In this situation, any policy implications will only have short-run effects on entrepreneurs' decisions to enter the market. On the other hand, there are some permanent effects of external shocks on the entrepreneurship trend in provinces such as Zanjan and Lorestan, as well as in the electrical machines and devices sector (code 31).

As a term for policy implications regarding entrepreneurship persistence in Iran, government economic policies should be directed towards encouraging production, trade, and healthy economic activities. The policies can be guided in a way that promotes stability in the overall economy, develop public infrastructure, ensures security and order, improves political relations, and foster international economic cooperation. Additionally, the governments should focus on market development, financial infrastructure, increasing transparency and competition, and enhancing the quality of laws and regulations. Such policies can gradually help increase the production capacity of businesses and boost investment motivation, providing a conducive environment for healthy and productive entrepreneurial activities. In this context, it is suggested that the government focuses on its primary role of ensuring investment security and economic stability instead of engaging in rent-seeking behaviors and strengthening destructive economic activities. Furthermore, the government can make efforts to steer the country's economy towards more efficient competition and transparency. In light of the severe financial sanctions imposed on Iran over the past decade, there is a need to facilitate the normalization of banking communications with the international financial system and rescue the country's banking system from this instability. The government policies should provide the groundwork for infrastructure development, amend laws and regulations that contradict production, and refrain from interfering in pricing. To enhance economic competitiveness, the related policies can gradually reduce tariffs and trade barriers, empowering entrepreneurs and economic actors to innovate and compete.

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Appendix 1: Review of related literature

Author(s)	Year	Sample (period)	Methodology	Findings
Taylor	2011	12 EU countries (1994-2001)	Dynamic random effects models	The results show a high degree of persistence in self-employment across countries.
Andersson and Koster	2011	Sweden (1994-2004)	Pooled OLS and GMM	Existence of a regional dimension in persistence, indicating that regions characterized by high levels of start-up rates will display a greater degree of persistence.
Parker et al.	2012	23 OECD countries (1972-2006)	Panel unit root tests	Entrepreneurship rates in OECD countries exhibit persistence rather than hysteresis.
Fotopoulos	2014	UK (1994-2007)	Pooled ordinary least squares (OLS)	The results suggest that interregional differences in the formation of new firms and their determining factors persist over time.
Fritsch and Wyrwich	2017	Germany (1925-2005)	Pooled OLS regressions	The findings demonstrate a significant and enduring persistence of self-employment and start-up rates within various regions of Germany, over long periods of time.
Fotopoulos and Storey	2017	England and Wales (1921-2011)	Spatial Durbin Error Model	The results indicate a robust path-dependence in entrepreneurship wherein previous levels of self-employment rates have strong bearing on future rates.
Saridakis et al.	2019	21OECD European countries (1990-2011)	Pedroni panel cointegration test	The authors find some weak evidence of convergence among all European countries.
Saridakis et al.	2020	UK (2004-2016)	Phillips and Sul (2007) convergence method	The authors show that there is no global and regional convergence in both overall and gender-specific self-employment rates.
Faria et al.	2021	17 EU countries (1995-2018)	Unit root tests	The findings point at mixed evidence of convergence.
Cuadros et al.	2021	17 European countries (1999-2018)	Panel unit root tests	The self-employment rates among foreign-born individuals exhibit a convergence pattern across all European Union countries. In contrast, the convergence of self-employment rates among native individuals is relatively weak.

Appendix 2: Results of the regional analysis on the map