


Article

The Relationship Between Firm Formation and Unemployment: Evidence from Türkiye

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Abstract: This paper aims to explore the relationship between firm formation and unemployment using regional and city-level Turkish data. We focus on the post-2008 financial crisis period and analyze the effects of unemployment and other control variables on firm formation at NUTS-II and NUTS-III regions of Türkiye. We estimate a fixed-effects panel data model and control for GDP per capita, urbanization, population density, patents, high school education, and higher education. Our results suggest that there is a significant positive effect of unemployment on new firm formation. The analysis concerning the converse relation, the impact of firm formation on unemployment, reveals no significant results at the NUTS-II level; however, a significant negative relationship is found at the city level with 4- and 5-year lags.

Keywords: unemployment; firm formation; Schumpeter effect; refugee effect; regional analysis

1. Introduction

Businesses are a large part of the economy, especially small- and medium-sized establishments that account for the high number of employees and GDP. According to the World Bank, SMEs comprise about 90% of all businesses around the globe and over 50% of the employment (World Bank, 2019). This figure is even greater for developing economies; for example, in the case of Türkiye, 99.8% of all registered businesses are SMEs (TOBB, 2020). Labor market dynamics and firm formation move together, given their close relation whether it be unemployment leading to firm formation or firm formation leading to employment and economic growth.

The relationship between unemployment and self-employment is well-documented in the literature, with mixed results. Likewise, the inverse relationship, that is, the effects of firm formation on the unemployment rates within a region, has also been the subject of several studies. While numerous studies provide evidence for a positive effect of firm formation on unemployment, other studies find these effects to be very limited and even non-significant.

Unemployment can lead to an increase in firm formation, named in the literature as *unemployment push, refugee, or desperation* effect (Thurik et al., 2008). This is derived from the theory of income choice, which simply states that unemployed individuals move towards self-employment as the opportunity costs for firm formation decrease (Blau, 1987; Evans & Leighton, 1990; Blanchflower & Meyer, 1994). In addition, salaried positions may decrease as a result of unemployment, hence individuals are pushed into self-employment in order to survive.



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On the other hand, unemployment can also lead to a lower degree of firm formation. The unemployed may not have high enough human capital to sustain a firm, and/or they may not have the endowments necessary to establish their own business. Personal wealth is another determinant of self-employment, where unemployment may indicate a decreasing level of wealth and therefore lower self-employment (Johansson, 2000; Hurst & Lusardi, 2004; van Stel & Suddle, 2008). Likewise, in the case of people who do not have collateral, it would be extremely difficult for them to obtain loans from a financial institution. The possession of collateral can play an important role in securing a loan in pursuing self-employment for unemployed individuals mitigating the negative impacts of unemployment on new firm formation.

The opposite relationship also exists, whereby entrepreneurship can affect unemployment levels. Firm formation has a positive effect on the economic growth and performance of a region, which is referred to as the '*Schumpeter effect*' in the literature (Van Stel et al., 2007). New firms hire employees, which in turn leads to a decrease in unemployment (Picot et al., 1998; Audretsch & Thurik, 2001). However, this may not be immediate since new firms will hire employees when their performance and market demand increase; therefore, an expansion of their operations will lead to new hires. This effect may be observed in the years following the establishment of new firms; hence, it would be more pronounced in the medium term.

The objective of this paper is to shed light on the bilateral relationship between unemployment and firm formation using regional and city-level data for Türkiye. Türkiye is an interesting developing country case offering the potential to unpack the important link between new firm formation and unemployment from a developing country perspective. Labor market dynamics and new firm formation have been at the center of just a handful of studies for the country, where many of them have used time series data at a national scale. Given the differences in the cities and regions of Türkiye, a more disaggregated level study has the potential to unveil a relationship based on better foundations.

Mixed evidence exists for both the Schumpeter effect and refugee effect in the firm formation and unemployment literature. This study contributes to the literature in several ways. First, it provides an in-depth analysis of the relationship between firm formation and unemployment on two different regional levels. Second, the results provide insight into the lagged effects of firm formation and unemployment, showing how the relationship may develop on a medium- and long-term basis. The study distinguishes itself from the previous literature on Türkiye by utilizing a panel dataset that covers 81 Turkish cities and 26 s-level regions over 10 years (2009 to 2019). Finally, it adds to the literature by analyzing an emerging economy case. Most of the literature studying this topic focuses on developed economies, while more attention has been turning to developing economies in recent years. Türkiye presents a unique case in that it is a developing economy that has grown quickly since the 2000s and continues its economic growth with a young population. This study extends the literature on firm formation and unemployment in the context of a developing country. The analyses shed light on both the Schumpeter and refugee effect, at the regional (NUTS-II) level and city (NUTS-III) level. The study also adds to the literature by using control variables that act as determinants for both firm formation and unemployment.

To that end, we estimate a fixed-effects panel data model, and our results show that at the regional level, there is significant evidence for an unemployment push hypothesis complementing previous studies that provide evidence for a similar effect. Our city-level analysis reinforces our region-level findings on the unemployment push hypothesis. Moreover, we find a significant Schumpeterian effect at the city level, with 48- and 60-month lags, implying that new firm formation has the potential to reduce unemployment in the medium to long run.

The structure of our paper is as follows. In Section 2, we summarize the literature on new firm formation and unemployment/employment creation. Section 3 summarizes our methodology and data; Section 4 presents our results. In Section 5, we discuss our results and conclude the paper in Section 6.

2. The Literature on New Firm Formation and Unemployment/ Employment Creation

Numerous studies investigate the impact of unemployment on entrepreneurial activity. [Wosiek \(2023\)](#) analyzes this for various sectors in Poland. The results of this study show that an increase in unemployment leads to new firm formation. A similar result, that is, unemployment rate leading to higher self-employment, is obtained for Croatia ([Payne & Mervar, 2017](#)), France ([Aubry et al., 2015](#)), Romania ([Grigorescu et al., 2020](#)), and the US ([Cole, 2018](#)). Likewise, [da Fonseca \(2022\)](#) shows that although unemployed individuals are twice as likely to start a business, they have a lower probability of making hires and a higher probability of exiting. Besides empirical findings on the positive impacts of unemployment on firm formation, some studies provide evidence for the reverse effect. Considering the positive impact of wealth and possession of collateral, some studies show that the lack of these among the unemployed leads to a negative relationship between unemployment and firm formation ([Johansson, 2000](#); [Hurst & Lusardi, 2004](#); [van Stel & Suddle, 2008](#)). Home ownership was found to have a positive effect on self-employment as it serves as a proxy for wealth ([Ritsilä & Tervo, 2002](#)). In addition, unemployment may reduce self-employment due to other factors such as stagnant economic growth ([Audretsch, 1995, 2002](#)). A slowing down of the economy would deter new entrants in the market because of a reduction in the demand for products and services. Moreover, the probability of revenue streams decreasing in the near future, further discouraging new entrants who will be faced with lower revenues and higher chances of failure.

The literature also examines the opposite relationship, where new firm formation can affect unemployment levels. Many studies show the existence of this positive effect of firm formation on employment levels (negative effect on unemployment), namely the “Schumpeter effect”. [Van Stel et al. \(2007\)](#) use Japanese data and find that the *Schumpeter* effect, where entrepreneurship lowers unemployment, takes an 8-year lag to come into effect. [Fritsch and Mueller \(2004\)](#) find the same in the case of Germany, wherein they observe that new business formation has a positive effect on employment after the first five years (during which the relationship is negative). They show that a Schumpeter effect exists with a lag of 6 to 9 years, and the biggest impact occurs with a 7- and 8-year lag. [Thurik et al. \(2008\)](#) refer to this as the ‘*Entrepreneurial*’ effect and test it for 23 OECD countries. They also provide evidence for a lagged negative relationship between self-employment and unemployment, where a 1% increase in self-employment leads to a 1.12% decrease in unemployment 8 years later.

Job creation is another important aspect of firm formation and has been a subject of study in the literature. There is mixed evidence on whether firm formation leads to job creation. [Van Stel and Storey \(2004\)](#) find that in Great Britain, firm formation is associated with employment growth; however, at the same time, they find that is not the case in Scotland. Policy and implementation are an important aspect of how firm formation may affect the labor market. Similarly, [Ashcroft and Love \(1996\)](#) also found there to be a positive relationship between new firm formation and net employment. Regional employment increases as a result of self-employment rates, which has been found to be the case for Sweden ([Foelster, 2000](#)) and Germany ([Grotz & Brixy, 2002](#)). Using Portuguese data, [Baptista et al. \(2008\)](#) find that there is a lagged positive effect of firm formation on employment and the indirect effects (greater competition, efficiency, innovation) are greater than direct effects.

In addition to the improvements in the labor market, entrepreneurial activity leads to improved economic growth (Acs & Armington, 2004; Van Stel et al., 2005). Furthermore, new firms may introduce new products or processes in the market that appeal to the changing demands of the customers. New and improved processes may also lead to more efficient production. As a result, other firms in the market are also forced to adapt to the changing environment, improving the competition in their respective industry. The effects of entrepreneurial activity may vary with the development level of an economy. Van Stel et al. (2005) find this type of activity to be more effective for highly developed economies. Likewise, Thurik et al. (2008) find the 'Entrepreneurial' effect to be higher in more developed nations. Inducing high-growth entrepreneurship would lead to higher benefits to the respective industry and economic growth. In this regard, the level of innovation through the number of patents issued may provide some insights into the effectiveness of innovation. It is predicted that higher innovation (patents) would lead to more entrepreneurial activity (formation of new firms).

Recent studies in the field have studied the aforementioned effects that link new firm establishment and unemployment at a regional level. Economic performance may be a significant determinant in the direction of this relationship as found by O'Leary (2022) for different European regions. Their results highlight that higher-performing regions show a more positive relationship, whereas the inverse is shown in lower-performing regions. Carree and Dejardin (2020) find an unemployment push effect in their study of different regions within Belgium; this is especially the case in industries with low entry barriers. Individuals may be more willing to move towards firm formation due to the perceived low startup capital that accompanies industries with low entry barriers. The results of Wosiek (2023) also provide support for a positive relationship whereby unemployment results in enterprise births within the service sector in the case of different European countries. The unemployment push hypothesis is also confirmed in the case of Korea, where higher unemployment is observed to lead to an increase in startups, particularly for small businesses (Sung & Kim, 2020). A common pattern found across these studies is the higher number of startups in the service sector, particularly those businesses that have low entry barriers. Another study by Pisá-Bó et al. (2021) investigates the impact of spatial and temporal variations in Spain along some economic indicators including unemployment on entrepreneurship. They divide the sample into three subperiods containing crisis and non-crisis years and find that unemployment is an important driver of entrepreneurial activity during crisis years. Goschin et al. (2021) conducted a similar study in Romania. The results from their dynamic spatial panel model reveal that economic crises are important drivers of new firm formation. They also found that in the long run, higher unemployment results in more new firm establishments through the "push effect". Edobor and Marshall (2021) analyzed a similar case using MSA-level data for the US. Their ultimate goal is to measure the impact of disasters on new firm formation. Their results suggest no significant impact of these negative events on new firm formation, but they report a significant negative impact of unemployment on the establishment of new firms.

These studies have focused on developed economies, whereas studies on developing economies still lag and present an opportunity to enrich this literature. For the case of Türkiye, the strand of the literature on regional dynamics of firm formation can be traced back to early studies by Kaya and Ucdogruk (2002) where they analyze the dynamics of entry and exit in the Turkish manufacturing industry. Gaygisiz and Koksall (2003) study firm formation using both a cross-section and panel data approach for the manufacturing industry where they find that population density is an important indicator of firm formation, and Günalp and Cilasun (2006) unfold an important role for the real interest rate in firm formation in the manufacturing sector.

Only a few studies have shed a spotlight on the relationship between new firm formation and unemployment in Türkiye. [Karahasan \(2015\)](#) finds that an east–west duality exists where the western regions are seen to be more developed compared to their eastern counterparts. This correlates with the unequal distribution of new firm shares across Türkiye, following the same pattern as the economic performance and environment in those regions. In addition, it may be correlated with the business cycles, where a higher amount of firm formation is observed during expansions and relatively lower levels of firm formation during contractions. Unveiling these relationships can assist policymakers in devising city-level and regional economic and development policies that may improve the conditions of the labor market and further lead to economic development.

[Kum and Karacaoğlu \(2012\)](#) offer another study on Türkiye which finds that an increase in unemployment leads to a decrease in self-employment in the country. They note that a lack of entrepreneurial knowledge and support from the government may be hindering the chances of entrepreneurship in the country. In addition, people may be risk averse and opt to keep their savings in banks where they can benefit from the interest returns instead of taking higher risks through investment. [Özerkek and Doğruel \(2015\)](#) point to an inverse relationship, where changes in the self-employment rate have a negative effect on unemployment in subsequent periods. Similarly, [Apaydin \(2018\)](#) also found the same relationship using the ARDL model in Türkiye, where a one percent increase in self-employment leads to a two percent decrease in unemployment. [Demirdag and Eraydin \(2021\)](#) recently studied government policies as a determinant of entrepreneurship in the country. Their findings show that government policies lead to higher entrepreneurship rates in regions where there is existing high startup activity but not in those regions with low entrepreneurship rates. This highlights the importance of regional development in determining the effects of government policies when it comes to firm formation.

Regional disparities are noted in [Karahasan \(2015\)](#), which documents the differences between the eastern and western parts of Türkiye. The study indicates that firm formation in the service industry is increasing in various regions of north, central, and southeastern Türkiye with a drastic fall in firm formation in manufacturing and trade; however, that does not disrupt the east–west duality, and the eastern region continues to lag behind. These regional disparities in new firm establishment are explained by regional differences in various factors, such as local demand, provincial business cycles, human capital development, and financial availabilities. Knowledge of these relationships can assist policymakers in devising city-level and regional economic and development policies that may improve the conditions of the labor market and further lead to economic development.

3. Methodology and Data

3.1. Data

This study used several sources of data. The data used are from the 2009–2019 period. The Turkish Statistical Institute (TUIK) provides a wide variety of data on city-level as well as economic region (NUTS-III and NUTS-II, respectively) levels. For firm establishment data, our source is the Union of Chambers and Commodity Exchanges of Türkiye (TOBB). TOBB provides detailed NUTS-III (city-level) and NUTS-II (regional) data on the establishment and closure of firms across Türkiye. The data used in this study are collected on an annual basis, providing 260 observations for the 10-year period on the NUTS-II regional level. A list of all the variables can be found in [Table 1](#) and their descriptive statistics in [Table 2](#).

Table 1. List of variables.

Variable	Notation	Definition	Sources	Period
Dependent Variable				
Net Firm Formation	FirmRate	New Net Firms Formed per 1000 Labor Force	TOBB	2010–2019
Firm Entrants	EntRate	New Firms Established per 1000 Labor Force	TOBB	2010–2019
Firm Exits	ExitRate	Firms Exited per 1000 Labor Force	TOBB	2010–2019
Independent Variables				
Unemployment Labor Force	Unemploy LF	Unemployment Rate (% of Labor Force)	TUIK	2009–2019
GDP Per Capita	GDPCapita	GDP per Capita (TL, constant 2009)	TUIK	2009–2019
Patents	Patent	Approved Patents by numbers per 1000 Labor Force	TPMK	2009–2019
Population	PopDen	Population Density (# of inhabitants per sq. km)	TUIK	2009–2019
Urbanization	Urban	Population living in Urban areas within city limits	TUIK	2009–2019
Net Migration Rate	NetMig	Net Migration between regions (# of inhabitants entered minus # of inhabitants exited)	TUIK	2009–2019
High School Education	HSEdu	Number of people with High School or Equivalent Education (as a percentage of total population of area)	TUIK	2009–2019
Higher Education	HigherEdu	Number of people with university degree or higher (as a percentage of total population of area)	TUIK	2009–2019

Table 2. Descriptive Statistics of variables at NUTS-II Level.

Variable	Observations	Mean	Std. Dev.	Min	Max
Net Firm Rate	260	1.19524	0.733402	0.146809	4.285651
Firm Entry Rate	260	1.518204	0.885455	0.318066	5.279316
Firm Exit Rate	260	0.322964	0.229062	0.03794	1.528773
Net Firm Rate (Eco Approach)	260	10.6024	5.664764	1.185593	31.70771
Firm Entry Rate (Eco Approach)	260	13.40471	6.440355	3.592346	39.40718
Firm Exit Rate (Eco Approach)	260	2.802314	1.536786	0.4855211	10.11756
Unemployment Rate	260	10.09846	4.532516	3.4	30.9
Labor Force	260	13.68484	0.61707	12.54611	15.72327
GDP per Capita	260	10.00832	0.514404	8.749098	11.37047
Population Density	260	4.534069	0.9140959	3.258096	8.002025
Urbanization Rate	260	81.30304	15.75268	46.62	100
Net Migration Rate	260	−1.230411	9.488787	−29.41066	58.49405
Patent Rate	260	0.027546	0.035483	0	0.21935
High School Education	260	0.211913	0.034973	0.132266	0.286355
Higher Education	260	0.127327	0.042524	0.040111	0.278856

Note: Net firm, firm entry, and firm exit rate data are collected from TOBB, and calculated by authors. Patent rates are collected from TPMK, and calculated by authors. Net migration rate is calculated by authors.

Unemployment rate

The unemployment rate used in this paper is calculated with the total number of unemployed and the labor force in each region ($U_{it} = Total\ Unemployed_{it} / Labor\ Force_{it}$). TUIK provides unemployment rate data which are used in this paper.

Firm Establishment Rates

The firm entry/exit rate can be calculated through two methods, the firm approach and the ecological approach (Armington & Acs, 2002). The firm approach, also termed the labor market approach (Audretsch & Fritsch, 1994), states that the firm establishment rate

be calculated as the number of firms entering/exiting relative to the labor force, whereas the ecological approach is calculated by the number of firms entering/exiting relative to the number of total established firms. The ecological approach can show relatively greater differences in the entry/exit rate since it is based on the number of business establishments in the region (Armington & Acs, 2002).

This study makes use of both approaches, allowing the authors and readers to make a comparison between the results produced by each. Though results are presented for both approaches, the labor market approach is considered more appropriate; hence, the entry and exit rate table (see Table 3) and graphics (see Figures 1 and 2) use the labor market approach. The entry and exit rate table for the ecological approach can be found in Appendix A (Table A1).

Table 3. NUTS-II regional unemployment and firm statistics—annual average from 2010 to 2019.

Region	Code	Labor Participation	Unemployment	Entry Rate	Exit Rate
Adana	TR62	50.44%	11.55%	4.16	1.19
Agri	TRA2	52.73%	6.91%	1.11	0.24
Ankara	TR51	50.81%	11.09%	1.04	0.28
Antalya	TR61	56.81%	12.25%	2.16	0.56
Aydin	TR32	55.24%	7.90%	1.42	0.38
Balikesir	TR22	48.10%	6.20%	0.90	0.21
Bursa	TR41	50.09%	8.53%	1.96	0.38
Erzurum	TRA1	49.83%	6.89%	1.59	0.29
Gaziantep	TRC1	44.89%	12.13%	3.51	0.73
Hatay	TR63	47.01%	13.81%	1.60	0.35
Istanbul	TR10	53.56%	12.70%	2.37	0.43
Izmir	TR31	59.78%	14.67%	1.84	0.37
Kastamonu	TR82	54.67%	6.12%	1.36	0.22
Kayseri	TR72	48.76%	10.95%	1.20	0.33
Kirikkale	TR71	49.37%	9.80%	1.44	0.34
Kocaeli	TR42	54.08%	11.05%	0.68	0.20
Konya	TR52	50.08%	6.40%	0.69	0.21
Malatya	TRB1	49.85%	7.78%	0.90	0.21
Manisa	TR33	52.71%	5.77%	0.79	0.19
Mardin	TRC3	37.90%	22.72%	0.80	0.25
Samsun	TR83	51.69%	6.57%	0.54	0.09
Sanliurfa	TRC2	40.66%	15.45%	1.08	0.22
Tekirdag	TR21	57.03%	8.27%	0.92	0.17
Trabzon	TR90	54.84%	6.17%	2.05	0.25
Van	TRB2	46.84%	14.26%	1.64	0.17
Zonguldak	TR81	53.03%	7.79%	1.72	0.15

Calculated by the authors; the entry and exit rates shown have been calculated using the labor market approach.

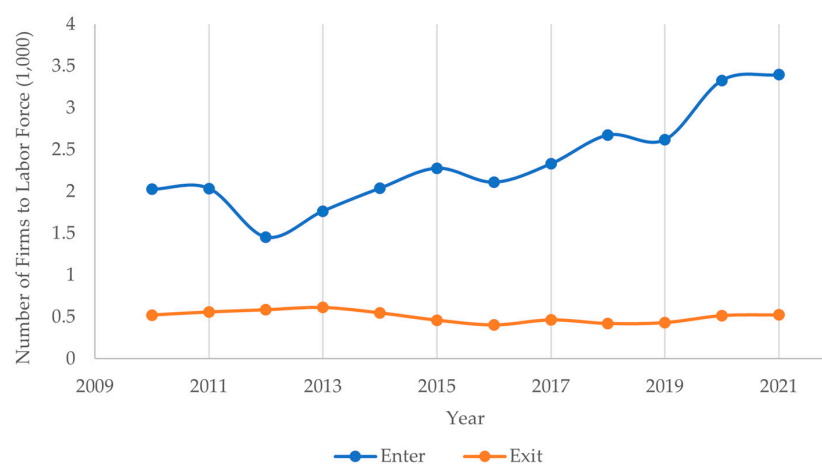


Figure 1. Annual firm entry and exit rate in Türkiye from 2010 to 2021 (per 1000 LF).

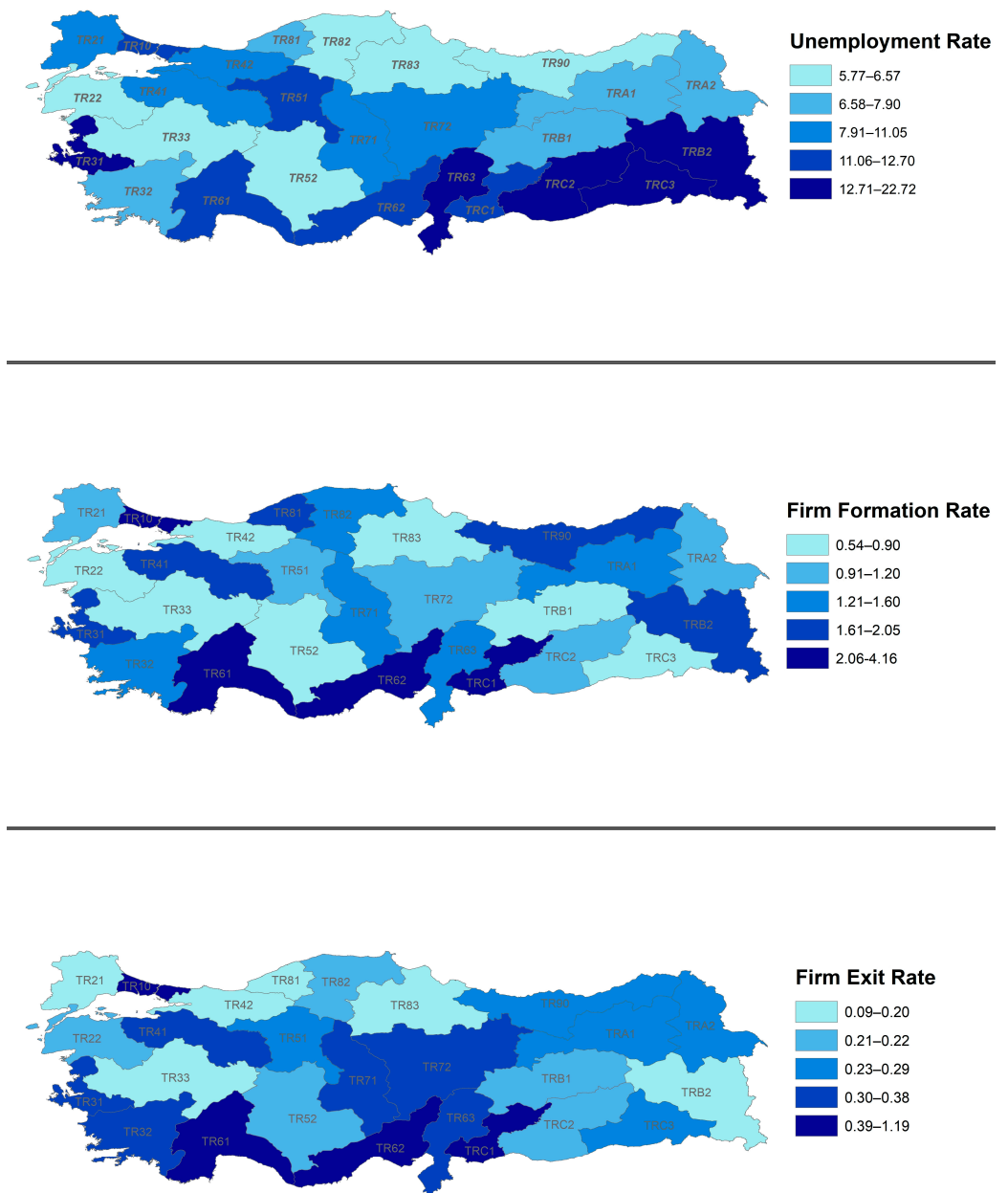


Figure 2. The average annual unemployment, firm formation, and firm exit rates from 2010 to 2019.

Labor Market Approach

$$\text{Net Firm Formation} = \frac{\text{Number of Firms Established}_{i,t} - \text{Number of Firms Closed}_{i,t}}{\text{Labor Force}_{i,t} (1000)}$$

$$\text{Firm Entry Rate} = \frac{\text{Number of Firms Established}_{i,t}}{\text{Labor Force}_{i,t} (1000)}$$

$$\text{Firm Exit Rate} = \frac{\text{Number of Firms Closed}_{i,t}}{\text{Labor Force}_{i,t} (1000)}$$

Ecological Approach

$$\text{Net Firm Formation} = \frac{\text{Number of Firms Established}_{i,t} - \text{Number of Firms Closed}_{i,t}}{\text{Number of Existing Businesses}_{i,t-1}}$$

$$\text{Firm Entry Rate} = \frac{\text{Number of Firms Established}_{i,t}}{\text{Number of Existing Businesses}_{i,t-1}}$$

$$\text{Firm Exit Rate} = \frac{\text{Number of Firms Closed}_{i,t}}{\text{Number of Existing Businesses}_{i,t-1}}$$

A variation in entry and exit rates across the region is observed with some outliers that have much higher or lower entry/exit rates than the average. Observing the annual entry rates, with an exception for a dip in 2012, they have been increasing since 2010 across Türkiye, while the exit rates have remained consistent for the most part over this period (see Figure 1). In addition, we observe that the entry rates have increased over the years among regions, but the disparity has also increased between the regions. While the difference between the highest and lowest in 2010 firm formation rate was 3.212, it rose to 4.619 in 2019, which implies that between-region variation is rising. This observation is also confirmed by the rising standard deviation and variance, thus suggesting that there is more variation in firm formation rate across Türkiye than in the past (see Table 4). Another observation is that the firm exit rates have decreased over the years signaling better sustainability of firms in the market. Provided that there is a rise in the number of new firms, it would also naturally give a rise in employment opportunities and economic growth.

Table 4. Firm entry and exit rate descriptive statistics over the studied period.

	Min	Max	Mean	SD	Variance
Firm Formation Rate (2010)	0.708	3.920	1.552	0.764	0.584
Firm Formation Rate (2014)	0.380	4.008	1.423	0.847	0.717
Firm Formation Rate (2019)	0.660	5.279	1.753	1.087	1.181
Firm Exit Rate (2010)	0.107	1.320	0.333	0.261	0.068
Firm Exit Rate (2014)	0.099	1.206	0.363	0.228	0.052
Firm Exit Rate (2019)	0.070	0.994	0.270	0.186	0.035

On the other hand, unemployment disparities across regions should also be noted as the average annual unemployment for the studied period varies considerably, with 5.77% being the lowest in Manisa (West side of Türkiye) and 22.72% being the highest in Mardin (Southeast of Türkiye). Overall, this trend can be observed across western regions and east and southeastern regions. In Türkiye, these disparities are more pronounced due to development differences among the east and west, and this development gap is reflected in the unemployment rates (Filiztekin, 2009). The regional disparities can be explained by the differences in various factors such as the labor market participation rates, the share of the young population, the share of agriculture in the overall economic activities of the region, and education attainment (Orhan & Gülel, 2016). Income disparities also impact the individuals, where higher per capita income in urban settings attracts skilled and unskilled workers, therefore leading to increased internal migration among the regions. Regions that lag economically have low productivity and value-added economic activities, lower employment rates, and high population growth when compared to other regions (Karaalp-Orhan, 2020). Among others, these factors are responsible for the disparity that is observed in the unemployment rates of Türkiye as shown in Figure 2 (annual average unemployment rate between 2010 and 2019). While we hypothesize that higher unemployment should lead to higher firm formation rates, this may also vary due to other factors such as education that have a positive effect on new firm formation. It is also observed in the previous literature that eastern and southeastern regions lag in education levels (Lynn et al., 2015), which may explain why their new firm formation rates are also lower.

In addition, the increase in the number of immigrants, notably the Syrian refugees, may be causing increased unemployment in regions near the Syrian border. Previous studies have found there to be negative effects of the Syrian population on unskilled/low-skilled natives in Türkiye who compete with Syrian refugees (Del Carpio & Wagner, 2015; Ceritoglu et al., 2017). It is also documented that native businesses are growing in refugee–host areas. However, this growth is in the informal economy and is leading to a displacement of native workers (Altındağ et al., 2020). Overall, the unemployment rates in the southeast may have further increased since 2013–2014 due to the influx of refugees in this region. That is not to say that the region had a much lower unemployment prior to the Syrian refugee influx, but rather it helps to explain why there may be a further rise in unemployment in this specific region.

3.2. Empirical Model (Regional NUTS-II Analysis)

In Equation (1), we assume that all firms are established by individuals who reside within the region. The model is set up to check for the effects of unemployment ($U_{i,t-1}$) on net firm formation ($F_{i,t}$). In addition to unemployment, we also include other control variables ($Z_{i,t-1}$) which may affect firm formation. We utilize the previous year's data on unemployment as well as other explanatory variables because of the possible lagged impact of these variables on the number of new firms established. There are two possible reasons for this lagged relation: the first is that unemployed individuals will most probably try to find a new job within a short period of being unemployed; second, it may take them several months to make the decision for firm formation, and again, may take them some time to bring that decision to fruition. Therefore, $T - 1$ is used for the explanatory variables; hence, their data observation period begins from 2009. In Equations (2) and (3), we replace the dependent variable from net firm formation to firms entered/established ($E_{i,t}$) and firms exited/closed ($X_{i,t}$), respectively.

$$F_{i,t} = U_{i,t-1} + Z_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

$$E_{i,t} = U_{i,t-1} + Z_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

$$X_{i,t} = U_{i,t-1} + Z_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

In Equation (4), we include the labor force as another explanatory variable because there is a possibility that all individuals in the labor market (whether employed or unemployed) may start up a business (Santarselli et al., 2009).

$$F_{i,t} = L_{i,t-1} + U_{i,t-1} + Z_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

3.3. Empirical Model (City-Level NUTS-III Analysis)

The base form of the model is used to test the refugee effects on the city level. The same has been utilized for NUTS-II analysis (Equation (1)); however, control variables are not used in this model. This model is set up to understand the effects of unemployment ($U_{i,t}$) on net firm formation ($F_{i,t}$).

$$F_{i,t} = U_{i,t} + \varepsilon_{i,t} \quad (5)$$

Likewise, the opposite relationship is tested to observe for the Schumpeter effect. An important distinction between the NUTS-II and NUTS-III analyses is that 6-month lags are used in the latter to observe the lagged effects of unemployment and firm formation. The

availability of monthly data allows the authors to observe these lags which are otherwise not tested in the NUTS-II analysis.

$$U_{i,t} = F_{i,t} + \varepsilon_{i,t} \quad (6)$$

The analysis is further enriched by utilizing data on vacancies and labor market matching. In using the vacancies and matching data, we can test whether a relationship exists between new firms and vacancies ($V_{i,t}$) in the market as well as job matches ($M_{i,t}$).

$$V_{i,t} = F_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$M_{i,t} = F_{i,t} + \varepsilon_{i,t} \quad (8)$$

These analyses will further inform us on the effectiveness of firm formation and how it affects the labor market mechanisms. In the data gathered, vacancies are defined as the requests for workers made on behalf of the businesses to the Turkish Employment Agency (İŞKUR). Job matches are defined as the placement of job seekers through İŞKUR.

4. Results

We utilized a balanced panel dataset in conducting our analyses, whereby unit root tests have been performed on the dependent variables and show that the data are stationary (see Table 5). The complete list of variables with unit root test results can be found in Appendix B. In the literature, there is a debate about whether the unit root should be tested in the case of panel data. The reliability of the tests in the case of a small value of T may be in question as there exists a risk of declaring a short panel nonstationary while the longer panel may be stationary (Karlsson & Lothgren, 2000). The results from these unit root analyses show that the panel is stationary at level; hence, we can continue using it in our further analyses (results from the panel unit root tests for all variables can be found in Appendix B, Table A2). The Hausman test was performed in order to find the better model fit between fixed and random effects, the results of which led to the usage of the fixed-effects model for this study (see Appendix C, Table A3 for results).

Table 5. Results of panel unit root tests for the dependent variables.

	Panel Unit Root Test			
	LLC	<i>p</i> -Value	Breitung	<i>p</i> -Value
Net Firm Formation	−3.7316	0.0001	−3.3822	0.0000
Firm Entry	−4.1083	0.0000	−3.5185	0.0002
Firm Exit	−2.0145	0.0220	−4.0499	0.0000
Net Firm Formation (Ecological Approach)	−3.4776	0.0003	−3.6976	0.0001
Firm Entry (Ecological Approach)	−4.5162	0.0000	−3.9296	0.0000
Firm Exit (Ecological Approach)	−3.6476	0.0001	−4.6995	0.0000

As a first check, we plot the new firm establishment rate against the lagged unemployment rate. Figure 3 shows the relationship between the net new firms and the unemployment rate for the observed period and regions. A positive relationship between the two variables exists: as unemployment increases, the number of firms established also increases. The overall pattern, represented by the linear prediction line, is an increasing pattern over the space of increasing unemployment.

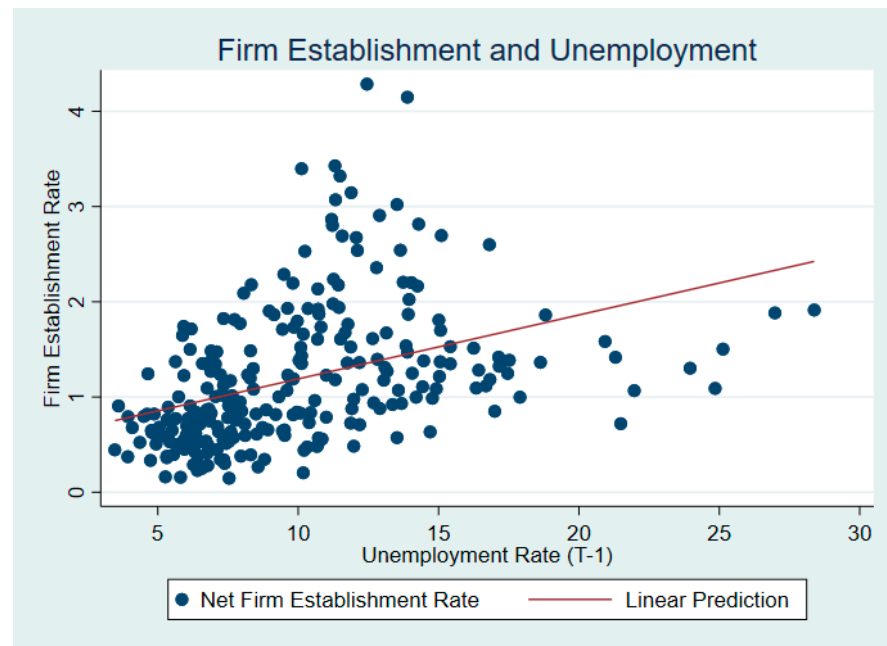


Figure 3. Scatter plot graph between the net firm establishment rate and unemployment rate ($t - 1$).

Tables 6 and 7 show the results of the models presented in the previous section. The results for both the labor market approach and ecological approach are summarized. The model is calculated with robust standard errors to account for any heteroskedasticity that may be present. The unemployment rate has a significant positive effect on net firm formation. Both the labor market approach and ecological approach give the same results, though the ecological approach results are more significant and higher in numbers. These results are similar to what has been found in previous studies in the case of France (Aubry et al., 2015), Iran (Cheratian et al., 2020), Poland (Wosiek et al., 2022), and Belgium (Carree & Dejardin, 2020), among other research in the literature. The ecological approach results in relatively higher birth and exit rates since they are calculated by the number of establishments (firms) rather than the number of employees (labor market approach). When compared to the labor market approach, the ecological approach may show higher results, as our results confirm, due to the entry and exit rates being relatively higher. This is an expected result as the ecological approach relies on all companies as a measure of new firm formation, whereas the labor approach relies on the labor force. GDP per capita has a negative significant effect on net firm formation in our analysis. This result is somehow surprising. One explanation is that with higher wages, people face a higher opportunity cost in switching to their own business. An individual earning more money would be unwilling to take on the risk of failure from a new business and hence settle for their job. Therefore, an increase in the GDP per capita may lead to a decline in new firm formation.¹ Population density also has a positive significant effect on new firm formation, found in the ecological approach. This is also expected as a higher population within a region needs to be catered for by a higher number of shops, services, and other businesses.

Table 6. Results of NUTS-II region using the fixed-effects model and labor market approach.

	(1)	(1)	(2)	(3)	(4)
	Net Firms	Net Firms Robust SEs	Entry Robust SEs	Exit Robust SEs	Net Firms Robust SEs
Unemployment Rate	0.243 *** (0.0889)	0.243 * (0.124)	0.185 * (0.104)	−0.0576 ** (0.0238)	0.273 ** (0.116)
Labor Force					−1.255 *** (0.384)
GDP per capita	−1.065 *** (0.295)	−1.065 *** (0.356)	−0.770 ** (0.347)	0.295 *** (0.069)	−0.872 ** (0.333)
Population Density	1.02 (0.927)	1.02 (1.433)	0.986 (1.371)	−0.0334 (0.195)	2.859 ** (1.226)
Urbanization	−0.00127 (0.00272)	−0.00127 (0.00408)	0.000293 (0.00397)	0.00156 ** (0.000574)	−0.00197 (0.00299)
Net Migration	−0.00451 (0.00301)	−0.00451 (0.00316)	−0.00439 (0.00284)	0.00012 (0.000445)	−0.00707 ** (0.00314)
Patent Rate	5.125 *** (1.619)	5.125 ** (2.197)	4.217 ** (1.906)	−0.908 ** (0.388)	5.043 ** (2.148)
High School Education	9.612 *** (3.159)	9.612 *** (3.126)	8.264 *** (2.898)	−1.348 ** (0.602)	8.169 ** (2.978)
Higher Education	14.76 *** (3.572)	14.76 *** (4.988)	9.820 * (4.817)	−4.936 *** (0.977)	14.24 *** (4.555)
Constant	2.595 (4.49)	2.595 (7.922)	1.101 (7.725)	−1.494 (0.984)	9.91 (7.927)
Observations	260	260	260	260	260
R-squared	0.461	0.461	0.378	0.538	0.499

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.**Table 7.** Results of NUTS-II region using the fixed-effects model and ecological approach.

	Net Firms	Net Firms Robust SEs	Entry Robust SEs	Exit Robust SEs	Net Firms Robust SEs
Unemployment Rate	2.656 *** (0.709)	2.656 *** (0.899)	2.330 *** (0.745)	−0.326 * (0.184)	2.776 *** (0.911)
Labor Force					−4.936 * (2.863)
GDP per capita	−8.873 *** (2.350)	−8.873 *** (2.784)	−7.019 ** (2.683)	1.854 *** (0.496)	−8.117 *** (2.831)
Population Density	14.60 ** (7.389)	14.6 (9.894)	15.97 * (9.010)	1.373 (1.529)	21.84 ** (10.26)
Urbanization	−0.0147 (0.022)	−0.0147 (0.022)	−0.0077 (0.019)	0.00697 (0.004)	−0.0174 (0.02)
Net Migration	−0.0435 * (0.024)	−0.0435 * (0.021)	−0.0479 ** (0.019)	−0.00445 (0.004)	−0.0535 ** (0.022)
Patent Rate	44.45 *** (12.90)	44.45 ** (16.58)	39.98 ** (14.89)	−4.476 (2.874)	44.13 ** (16.62)
High School Education	61.85 ** (25.18)	61.85 ** (24.23)	43.93 * (22.02)	−17.93 *** (4.945)	56.18 ** (25.79)
Higher Education	137.9 *** (28.47)	137.9 *** (38.87)	109.6 *** (36.59)	−28.28 *** (6.432)	135.8 *** (38.28)
Constant	−4.506 (35.79)	−4.506 (52.54)	−18.53 (49.45)	−14.02 * (7.351)	24.27 (56.36)
Observations	260	260	260	260	260
R-squared	0.568	0.568	0.547	0.388	0.575

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Urbanization and net migration do not have any significant effects despite the theoretical prediction that urbanization would have a positive effect while net migration would have a negative effect on net firm formation. The significant positive effects of patent rate show that technology plays a positive role in firm formation. Hence, governments should focus on assisting firms with technological transformation. In addition, research and development spending should be increased to improve innovation across the regions.² Education also has a positive significant effect on new firm formation. Higher education displays a significant impact. This is a finding in line with the literature which implies that higher educated individuals have more developed entrepreneurial skills. A 2019 GEM report on entrepreneurship in Türkiye shows that 11.81% of entrepreneurs between the ages of 18 and 64 have educational levels below high school, 14.21% have high school education, and 17.44% have higher education (Karadeniz, 2019, p. 30). This also adds to the explanation that more educated individuals are more likely to become entrepreneurs.

In addition to net firm formation, we also checked for the effects of new entries and exits of firms from the market. In the case of new firm entry, the effects are similar to net firm formation though smaller in magnitude, whereas there is a significant negative effect of unemployment on the firm exit rate. This could be due to market conditions in which as the unemployment rate rises, firms may downsize to cut costs and stay afloat. Overall, the results support the strand of literature that documents the positive effects of unemployment on the net establishment of new businesses.

4.1. City-Level Results

This study investigates the same the relationship between entrepreneurship and unemployment, using monthly and city-level data. The Turkish Employment Agency provides city-level monthly data on various labor market indicators such as the number of people that registered as unemployed, the number of new vacancies opened, and the number of people that are matched with jobs in the labor market. The monthly unemployment covers the period 2009–2017³ with a total of 8748 observations. The vacancies and matching data are from 2009 to 2018, a 10-year period with 9720 observations for 81 cities in Türkiye. The natural log was taken for the dataset. These labor market dynamics can further help us to understand how firm formation may affect unemployment and vice versa. Additionally, the effects of firm formation on matching and vacancies are also observed. The descriptive statistics of the variables used in the city-level analysis are presented in Table 8.

Table 8. Descriptive statistics of city-level data from 2009 to 2018 (unemployment data are until 2017).

Variable	Observations	Mean	Std. Dev.	Min	Max
Net Firms	9720	2.445941	1.493576	0	8.002694
Firm Entry	9720	2.772208	1.409498	0	8.255049
Firm Exit	9720	1.294806	1.292183	0	7.218177
Unemployment	8748	7.120807	1.094751	3.713572	11.31197
Vacancies	9720	5.99413	1.694825	0	11.4339
Matching	9720	5.326965	1.689312	0	10.97102

This study utilized a balanced panel dataset in conducting the analyses. As a first check, unit root tests are conducted. The results of these tests are provided in Table 9 and reveal that the data do not have a unit root and are stationary at levels. Hence, the analysis uses a fixed-effects model to investigate the relation between firm formation and various labor market indicators.

Table 9. Unit root test results using Levin–Lin–Chu (LLC), Breitung, and Harris-Tzavalis methods.

	LLC	<i>p</i> -Value	Breitung	<i>p</i> -Value	Harris-Tzavalis	<i>p</i> -Value
Firm Entry	−24.9215 ***	0.000	−38.2234 ***	0.000	0.3277 ***	0.000
Net Firm Formation	−27.4591 ***	0.000	−33.9428 ***	0.000	0.3609 ***	0.000
Unemployment	−14.095 ***	0.000	−21.6713 ***	0.000	0.6575 ***	0.000
Matching	−22.5148 ***	0.000	−15.0071 ***	0.000	0.5884 ***	0.000
Vacancies	−18.7109 ***	0.000	−8.9225 ***	0.000	0.7218 ***	0.000

Standard errors in parentheses, *** $p < 0.01$.

The first step is to examine the relationship between firm formation and unemployment. As mentioned before, the literature provides evidence in both directions for this relation, which are namely the Schumpeter effect and the Refugee effect. In the city-level analysis, some additional lagged variables are used. The use of further lags is plausible in monthly data because the frequency of the effects can be delayed. Moreover, since this dataset has a large number of observations, lags can be applied and still provide meaningful results.

4.1.1. Refugee Effect

City-level results support the regional level; that is, there is a positive effect of unemployment on net firm formation. As unemployment increases, firm formation also increases, giving rise to new businesses and new employment opportunities. Using a 6-month lag for the first year and a 12-month lag afterward up to 5 years, the refugee effect is found to be strongest after 2 and 3 years.

4.1.2. Schumpeter Effect

The Schumpeter effect was not significant at the regional level. The city-level analysis results point out a positive and significant Schumpeter effect (see Table 10). The decline in coefficients implies that the long-run effects exceed those of the short run. A point to note is that in the 4th and 5th years, this study finds a negative and significant relationship, showing that as time passes, new firm formation does lead to a decrease in unemployment. Hence, it is concluded that, in the long run, new firms can help to reduce unemployment and have a positive effect on the labor market.

Table 10. Fixed-effects regression results for city-level analysis.

	Net Firm (5)	Unemployment (6)
At Level (no lags)	0.0793 ***	0.0549 ***
	−0.0129	−0.00892
6-month lag	0.248 ***	0.0202 **
	−0.013	−0.00908
12-month lag	0.266 ***	0.0000796
	−0.0129	−0.00924
24-month lag	0.364 ***	0.0358 ***
	−0.0151	−0.00917
36-month lag	0.343 ***	0.000117
	−0.0172	−0.00912
48-month lag	0.140 ***	−0.0683 ***
	−0.0172	−0.00924
60-month lag	0.187 ***	−0.124 ***
	−0.0174	−0.0106
Observations	8748	8748

Standard errors in parentheses, ** $p < 0.05$, *** $p < 0.01$.

4.1.3. Employment Analysis

Storey (1985) finds that manufacturing firms are generally 8 to 9 years old when they reach peak employment. Therefore, the lag structure may be an important factor when studying this relationship given that some effects will be realized in the medium to long run. Our overall results are in line with Apaydin (2018) who also investigated Turkish firms, though in their study they only found evidence for the Schumpeter effect and not the refugee effect. To further the analysis, vacancy data are utilized to explore the impact of new firm formation. Findings in this study suggest that there is a significant positive relationship between firm formation and vacancies at level and with a 6-month lag (see Table 11). However, with further lags, the relationship is not significant. Though it was expected to be positive in the long run, the evidence does not support that hypothesis.

Table 11. Fixed-effects regression results for employment analysis.

	Vacancies (7)	Matching (8)
At Level (no lags)	0.166 *** −0.0171	0.112 *** −0.0179
6-month lag	0.0629 *** −0.0162	0.0456 *** −0.0172
12-month lag	0.0233 −0.0149	0.0375 ** −0.0163
24-month lag	−0.0117 −0.0129	−0.0274 * −0.0152
36-month lag	−0.0228 −0.0121	0.023 −0.0154
48-month lag	0.0153 −0.0117	0.0713 *** −0.016
60-month lag	0.00244 −0.0124	−0.0197 −0.0174
Observations	9720	9720

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

New firms can be an important source of job openings, creating opportunities for the local labor market. Employment growth as a result of new firms is established in the literature in the case of different countries, Spain (Arauzo Carod et al., 2008), the US (Acs & Mueller, 2008), and Portugal (Baptista et al., 2008), among many others. In the literature, there are different effects of firm formation on employment. One is an immediate effect on job creation; the second is the displacement of existing jobs; and the third refers to the long-term effects that may result from increased competition (Baptista & Preto, 2011). These effects may differ in magnitude and timing given the different regions and economic makeup of the countries. This study investigates whether a relationship exists between firm formation and the number of monthly employment matches in the labor market. The results imply a positive relationship between firm formation and matching in the first year, though the strength of the relationship decreases with further lags.

5. Discussion

The existing literature on firm formation and unemployment provides evidence for mixed results. Although studies focusing on developed economies are more abundant, there is also rising interest in studying the same question for developing economies over the past 15 to 20 years. To obtain a better understanding of this relationship, this study utilizes both a NUTS-II- and NUTS-III-level analysis using data on Türkiye that incorporate various variables that may affect firm formation or unemployment.

On the NUTS-II level, we find evidence for an unemployment push hypothesis complementing different studies that have found the same in the past (Aubry et al., 2015; Carree & Dejardin, 2020; Wosiek, 2023). We also find that education plays an important role in firm formation, adding to the strand of the literature which states that higher levels of education lead to higher entrepreneurship (Jiménez et al., 2015). Similarly, the unemployment push or refugee effect is also found through the city-level analysis. Using lagged data, this study determined that the effects increase with time, reaching the highest point in year 3. This confirms our hypothesis that higher unemployment would lead to higher firm formation.

The Schumpeter effect, entrepreneurship leading to lower unemployment, is found to be significant at the city level with 48- and 60-month lags. New firm formation may reduce unemployment in the medium to long run. Differently from previous studies, vacancies and employee matching were used as dependent variables to observe whether they are impacted by firm formation. Firm formation has a positive effect on vacancies in the short run (6- and 12-month lags), which is also in line with the past literature on employment growth resulting from new firm establishment (Baptista et al., 2008). In the long run, we do find evidence for our hypothesis of the presence of the Schumpeter effect; however, we do not find this in the short or medium run.

This study has several implications. First, new firms and entrepreneurial activity should be prioritized within government policies. The focus should be on small- and medium-sized enterprises which create employment opportunities. Entrepreneurial training and education may also motivate individuals to move towards new firms. Second, there can be a greater focus on regions that have lower education levels since education plays an important role in firm formation. Currently, there are education disparities among different regions within Türkiye; therefore, the focus should be turned towards creating an equal playing field through improvements across regions. This may be attained through regional policies that focus on and prioritize regions that currently lag behind.

6. Conclusions

This study examines the relationship between firm formation and unemployment at the NUTS-II level in Türkiye. We investigate how new firm formation affects unemployment and vice versa using a 10-year dataset for the country covering the period 2010–2019. In addition, the paper tests the relationship on the NUTS-III level, albeit with slightly different data than have been used traditionally in the literature. Instead of using total unemployment, we utilize monthly newly registered unemployed individuals, and we do the same for vacancies and labor market matching statistics. The results show that unemployment does lead to an increase in firm formation in Türkiye on the regional level, which is complemented by the results from the city-level analysis.

This study adds to the literature on the refugee and Schumpeter effects within the field of firm formation and unemployment. It also provides insights into the lagged effects of this relationship. Lastly, it contributes to the literature in this field on emerging economies. Ideally, microdata would be preferred to better understand the relationship between the studied variables. However, due to data limitations, the current study utilizes NUTS-II and NUTS-III data. In future studies, sectoral analysis should also be considered because firm formation in different sectors can affect the labor markets differently. Sectoral growth may also be an important aspect for future studies. The impact of the concentration of different firms (firm density) and firm diversity on labor markets is an interesting avenue for future research. Furthermore, given the rapid rise in the number of immigrants in Türkiye, the effects of foreign firm formation is an important question to analyze.

From a policy perspective, there are various implications. First, policies should focus on supporting new firms since they provide employment opportunities. In addition, the government should formulate policies that decrease the disparities among regions within Türkiye. There is actively a lower degree of firm formation in southeastern Türkiye which is possibly rooted in lower educational levels, fewer employment opportunities, and slower economic growth. Therefore, policies should try to improve the economic situation of cities where there is slower economic growth and lower education levels since these are significant factors in firm formation.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. NUTS-II firm entry and exit rate average for 2010–2019 according to the ecological approach per 1000 firms.

Region	Code	Entry Rate	Exit Rate
Adana	TR62	16.64	3.21
Agri	TRA2	7.30	1.21
Ankara	TR51	28.68	5.73
Antalya	TR61	17.38	3.16
Aydin	TR32	10.49	2.81
Balikesir	TR22	7.72	2.10
Bursa	TR41	17.14	3.30
Erzurum	TRA1	8.32	2.65
Gaziantep	TRC1	17.13	1.96
Hatay	TR63	12.21	2.01
Istanbul	TR10	30.12	8.29
Izmir	TR31	18.08	4.60
Kastamonu	TR82	7.06	2.23
Kayseri	TR72	13.55	3.24
Kirikkale	TR71	10.71	3.04
Kocaeli	TR42	15.36	2.85
Konya	TR52	13.02	2.84
Malatya	TRB1	11.00	2.36
Manisa	TR33	8.04	1.91
Mardin	TRC3	18.86	1.68
Samsun	TR83	8.53	1.95
Sanliurfa	TRC2	16.33	1.67
Tekirdag	TR21	10.27	2.17
Trabzon	TR90	7.60	1.88
Van	TRB2	11.60	2.33
Zonguldak	TR81	6.74	2.03

In the calculation of the entry and exit rate, we need total established firms $t - 1$, and therefore, the average is 9 years, and $t - 1$ is equal to 2010 and onwards. The rate is calculated per 1000 established firms.

As expected, the rate is much higher when compared to the labor market approach because the denominator for the ecological approach (number of established firms per 1000) is much smaller than that for the labor market approach (labor force per 1000).

Appendix B

Table A2. Results for unit root test for all variables used at the NUTS-II level.

	LLC	p-Value
Net Firm Formation	−3.5095	0.0002
Firm Entry	−4.1083	0.0000
Firm Exit	−2.0145	0.0220
Net Firm Formation (Ecological Approach)	−3.4776	0.0003
Firm Entry (Ecological Approach)	−4.5162	0.0000
Firm Exit (Ecological Approach)	−3.6476	0.0001
Unemployment Rate	−16.2775	0.0000
Labor Force	−4.0952	0.0000
GDP per capita	3.496	0.9998
Population Density	−5.8898	0.0000
Urbanization	−4.3556	0.0000
Net Migration	−3.641	0.0001
Patent Rate	−4.824	0.0000
High School Education	11.7304	1.0000
Higher Education	−10.9512	0.0000

Given that there was a small *T* value in this study (10 time periods) and the unit root tests show nonstationary GDP per capita, the authors examined studies that had been specifically conducted on the unit root testing of GDP or GDP per capita. There are mixed results in the literature, with some studies finding the GDP data for various countries to be stationary (Hegwood & Papell, 2007; Chang et al., 2008; Murthy & Anoruo, 2009; Chang, 2011; Chang et al., 2014), whereas other studies find there be a unit root across various countries studied (Chang et al., 2006; Guloglu & İvrendi, 2010; Çınar, 2015). In the case of Türkiye, Ozturk and Kalyoncu (2007) find the GDP per capita data to be stationary using the ADF unit root test. Although Zeren and İşlek (2019) find that a unit root does exist in the GDP per capita data for D8 countries including Türkiye, they use a BCIPS panel unit root test. There is yet a debate about whether unit root should be tested on data where the *T* is small, since the unit root test can give inaccurate results. In addition, in this study, the *N* (26) is much greater than *T* (10), and therefore, it may not be appropriate to test for unit root, though the results are shown in the body and appendix of the paper.

Appendix C

Table A3. Hausman test results to decide whether to use random effects or fixed effects.

	Coefficients			
	(b)	(B)	(b − B)	sqrt(diag(V_b-V_B))
	fe	re	Difference	Std. Err.
Unemployment Rate	0.2427587	0.4031754	−0.1604166	0.041485
GDP Per Capita	−1.064694	−0.4587345	−0.605959	0.2288104
Population Density	1.019697	0.2222758	0.797421	0.9243385
Urbanization	−0.0012686	0.0016915	−0.0029602	0.001102
Net Migration	−0.0045125	−0.0029208	−0.0015918	0.0005281
Patent Rate	5.125259	5.572583	−0.4473243	0.9470923
High School Education	9.612212	0.0554659	9.556747	2.445507
Higher Education	14.75648	11.3589	3.39758	2.680975

\bar{b} = consistent under H_0 ; \bar{B} = inconsistent under H_a , efficient under H_0 . Test of H_0 : difference in coefficients is not systematic. $\chi^2(8) = (\bar{b} - \bar{B})'[(V_{\bar{b}} - V_{\bar{B}})^{-1}](\bar{b} - \bar{B}) = 27.64$. Prob > $\chi^2 = 0.0005$ ($V_{\bar{b}} - V_{\bar{B}}$ is not positive definite).

The Hausman test shows that the fixed-effects model is appropriate for the dataset used in this article.

Notes

- ¹ A counter argument is that a higher GDP per capita implies a higher purchasing power for individuals, which may motivate people to start up businesses. To examine that channel, we should check the consumer expenditure data and see if they raise the net firm formation.
- ² The research and development spending for each region was also considered as a variable; however, due to a lack of data, it was omitted. While we have utilized data since 2009, the R&D data at the NUTS-II level is only available from the year 2018 onwards.
- ³ The data on registered unemployed each month are not shared by the Turkish Employment Agency starting in 2018.

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