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Spatial Varying Relationship between Financial Development and New Firm Formation: Evidence from a Developing Country

Summary: This study investigates the spatial varying relationship between financial development and new firm formation in Turkey. Even preliminary findings show that regional financial development spurs new firm formation; evidence from Geographically Weighted Regression stresses the heterogeneous impact of finance, which mostly favours the developed regions. Results for the 2002 to 2009 epoch show impact of finance fluctuates within a range of 0.189 for deposits and 0.082 for credits with the lowest impact observed in Eastern Turkey. This points to the necessity of considering the spatial heterogeneity of regional policies, which underlines that one size does not fit all regions.

Key words: Finance, GWR, New firms, Regional development.

JEL: R11, R12, R52.

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New firm formation and its link with regional development are receiving increasing attention. It is widely discussed that link between new firms and local development can work over different channels. For instance, traditional arguments pin point that local labour markets and new firms are *inter alia* related (Per Davidson, Leif Lindmark, and Christer Olofsson 1994; Michael Fritsch 1997; Fritsch and Pamela Mueller 2004; Andre van Stel and David J. Storey 2004; Rui Bapista, Vitor Escaria, and Paulo Madruga 2008; Mueller, Van Stel, and Storey 2008; Van Stel and Kashifa Suddle 2008; Sierdjan Koster and Van Stel 2014). Meanwhile recent discussions shift the focus towards endogenous growth models. New firms are mostly small, innovative and flexible agents. Given their abilities to transmit gross knowledge into economic knowledge, new firms are accepted as important units influencing economic growth (Zoltan J. Acs et al. 2009; Acs, Lawrence A. Plummer, and Ryan Sutter 2009; Pontus Braunerhjelm et al. 2010). As "new firms" find a place among different dimensions of regional development, emphasis starts to shift towards the factors affecting the formation of new firms. Among different factors, financial development is regarded as a stimulus affecting the decision of new firms. Paul Reynolds (1994) as well as Reynolds, Storey, and Paul Westhead (1994) argue personal wealth can act as an important source of finance during the early formation processes of firms. Likewise, the role of borrowing, saving and financial intermediation *via* money markets is recently

incorporated by Vinod Sutaria and Donald A. Hicks (2004) and Wim Naude et al. (2008). These models underline that financial development is a non-negligible factor for new firms since a pool of financial capital represents a source during the initial start-up of businesses.

Originating from the role attributed to financial development for the formation of new firms, this study critically questions the finance-new firm mechanism in Turkey from a regional perspective. Based on earlier evidence for rising duality in the form of developed West and underdeveloped East, central interest of the study is spatial variability of the impact of finance on new firms (for a brief overview on regional inequalities in Turkey, see Alpay Filiztekin 1998; Fatma Doğruel and Suut Doğruel 2003; Ferhan Gezici and Geoffrey J. D. Hewings 2004, 2007). That is, not only the regional differences of finance matters but also its varying effect on the formation of new firms. This spatial variability issue is central to Stewart A. Fotheringham, Chris Brunsdon, and Martin Charlton (2002) who emphasised that local realisation of parameter estimates can diverge from global estimations. In turn, it is reasonable to discuss the possible local variations in the magnitude and direction of influences or regional policy implementations.

The paper will continue as follows: Section 1 reviews the literature on finance and new firms in a regional setting. Section 2 revisits the regional inequality discussions with focus on the new firms in Turkey. Section 3 constructs the benchmark strategy to question the impact of finance on new firm formation. Section 4 diverts the attention towards the impact of spatial dependence and heterogeneity. Section 5 contains an overall discussion and finally the paper ends with a conclusion.

1. Literature Review

1.1 Financial Development and Regional Economic Growth

Evidence from cross country studies indicate that finance is mostly beneficial for economic growth (Robert G. King and Ross Levine 1993; Levine and Sara Zervos 1998). However, limited evidence exists on the way that regional financial development affects regional economic well-being. One possible explanation comes from data availability; obtaining financial data at regional level is difficult. The second reason comes from a conceptual complexity. It is sophisticated to construct a framework that evaluates the true impact of financial capital at regional level. The most obvious reason for this comes from differences in regional administrative structures of different countries; as administrative structure affects the link between source and use of financial funds. That is, it is difficult to assess whether accumulation of financial capital in a region represents necessarily a fund base for consumers and producers within the same region. This becomes even more complex for a centralised administrative structure as it will enable full financial capital mobility. Yet, this so-called financial capital mobility is challenged by Orley M. Amos and John R. Wingender (1993) as their evidence indicates financial capital is not necessarily mobile; rather it tends to be segmented. The mobility of financial capital and different ways to investigate the impact of financial capital on regional growth is detailed by Sheila C. Dow and Carlos J. Rodriguez-Fuentes (1997). Given all these concerns, evidence indicates that the deepening of

financial capital in certain regions is mostly associated with higher regional growth. Katherine A. Samolyk (1994) underlines that banking based financial development has explanatory power in understanding the regional growth differentials in the United States. Similarly, Jonathan Williams and Edward Gardener (2003) express that regional development of the banking system favours regional growth *via* increasing efficiency. Moreover Zhang Jun, Guanghua Wan, and Yu Jin (2007) explained the productivity differences among Chinese regions by using regional loan generation capacities. In a similar vein, Santiago Carbo Valverde, Rafael Lopez Del Paso, and Francisco Rodriguez-Fernandez (2007) underline that financial development that mostly occurs through innovation in the banking sector spurs regional growth in Spain. Likewise Andrea Vaona (2008) explained that size of the regional banking sector is able explain the economic growth of Italian regions. Meanwhile there are some contradictory findings. Valverde, David Humphrey, and Rodriguez-Fernandez (2003) find that financial deregulation does not have direct impact of on regional growth for Spain. Similarly, Valverde and Rodriguez-Fernandez (2004) detect the dominance of a reverse causality running from regional growth towards local financial deepening in Spain. Zhicheng Liang (2006) examined the link between finance and regional growth from a different perspective and underlined that financial development can explain the success of Chinese regions only to some extent. Liang (2006) detected that impact of regional financial development on regional development works only for the coastal regions, while, for less developed inland provinces, finance seems to be a negligible factor.

1.2 Financial Development and Regional New Firm Formation

Regional models that test the link between financial development and economic growth follow the theoretical view of Ronald I. McKinnon (1973) and Edward S. Shaw (1973). However, finance might affect regional well-being through different mechanisms. For instance, we can implement views of David S. Evans and Boyan Jovanovic (1989) on the liquidity constraints of entrepreneurs in a regional setting. Evans and Jovanovic (1989) discuss that capital is essential for starting-up a business; their evidence for the United States suggests ease of reaching capital is an important determinant of entrepreneurial start-up decisions. Originating from these capital constraints, David Keeble and Sheila Walker (1994), Reynolds (1994) and Reynolds, Storey, and Westhead (1994) are the first to underline the importance of household wealth and capital in the early stages of firm birth in the United States. More recently Georgios Fotopoulos (2014) underlined the impact of household wealth for the United Kingdom. On the contrary, Davidson, Lindmark, and Olofsson (1994) for Sweden, Gioacchino Garofoli (1994) for Italy and Aki Kangasharju (2000) for Finland remark that financial development in the form of household wealth does not directly explain new firm formation. Similarly, Bernard Guesnier (1994) for France and Henry Renski (2014) for the United States end up with contradictory findings remarking that impact of household wealth depends on the type of new firms considered (i.e. industrial composition of new firms).

The common property of these studies is the use of dwelling prices or house ownership to measure the impact of capital availability. However, a similar impact can

also be measured by money market indicators that will not only control the level of wealth but, more generally, will measure the level of financial development and intermediation. For instance, Sandra E. Black and Philip E. Strahan (2002) discuss that deregulation and consolidation in the banking system, which decreases number of small banks and increases the level of competition, will certainly favour the new comers. Meanwhile Garofoli (1994) underlines that even household wealth does not have explanatory power to explain the new firm formation, money market indicators measured by *per capita* deposits illustrates the relation in Italian case. Likewise, Sutaria and Hicks (2004) control the impact of regional financial development by using micro data for the Texas-metro regions and indicate that *per capita* deposits influence the formation of the new firms. While these studies give evidence from core developed countries, evidence from developing countries also supports the existing link. Naude et al. (2008) underline that financial development measured by the number of bank branches explains the regional new firm formation in South Africa. Similarly, Ejaz Ghani, William R. Kerr, and Stephen O'Connell (2014) note the importance of banking sector for new firms, depending on the production type in India. Still it is notable that evidence from developing and less developed countries is relatively limited.

Finally note that, even though these studies control for the direct impact of finance on new firm formation; Donal G. McKillop and Liam P. Barton (1995) for Northern Ireland; Juan Fernández De Guevara and Joaquín Maudos (2009) for Spain observe that financial development also influences growth of existing firms. This describes an alternative mechanism; as financial development will not only affect new firms but tend to influence the overall behavior of the firms in an industry.

2. Regional Differences and New Firms in Turkey

Turkey has an overall geographical surface of 783,562 km^2. In terms of its regional administrative structure, it is composed of 12 NUTS-I, 26 NUTS-II and 81 NUTS-III regions (NUTS - Nomenclature of Territorial Units for Statistics). Even though Turkey is mostly cited as a cultural and social path-way between East and West; it also stands as a geographical transition between Europe, the Middle East, North Africa, and Asia. This distinct geography of Turkey brings different internal and external disputes to the country. Among different dimensions, regional disparities is an ongoing problem in Turkey with economic, political, and social ramifications. While regions located on the west are relatively more developed; the eastern and south eastern regions have been suffering from numerous social and economic problems. Doğruel and Doğruel (2003) explain the roots of the regional dichotomy in Turkey by revisiting İlhan Tekeli (1992). The collapse of the ties with the East during the late Ottoman area and the early republican period is intensified with the loss of a young population during the First World War. These early developments contribute to the disadvantageous initial condition of the eastern regions. During the early industrialisation decades (1923-1950) as well as during the planned development period (1960-1980), priority was mostly on the scale and extent of production. Similarly, during the post-1980s, primacy was given to policies leading to an export boom and trade based macroeconomic performance.

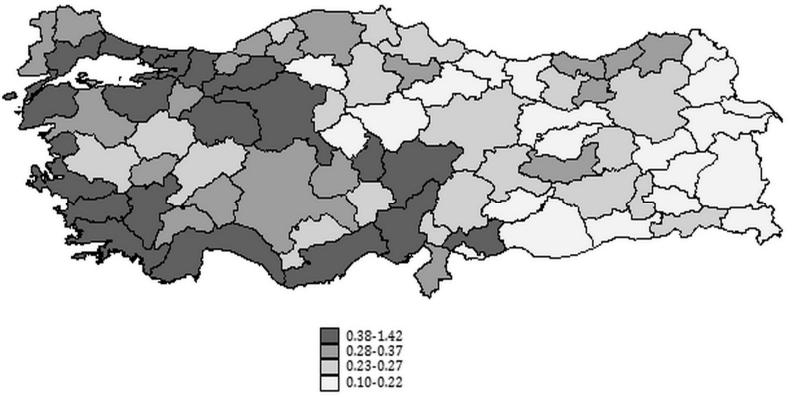
However, even though regional disparity is an issue from a policy point of view (specifically within the development plans of the 1960s), in terms of implementations

it is mostly a neglected phenomenon. This asymmetry between policy awareness and implementations for regional disparities has been heavily studied among regional scholars in Turkey. Inspired mostly from the traditional neo-classic convergence model, the number of studies focusing on the regional gaps in Turkey continue to increase. Doğruel and Doğruel (2003), Orhan Karaca (2004), Gezici and Hewings (2004, 2007) and Julide Yıldırım and Nadir Öcal (2006) validate that eastern regions are unable to converge to the west and unsuccessful in closing the gap with the western territory. Even regional income gaps is highly studied, other dimensions of regional disparities are also starting to receive rising interest among development economists. Filiztekin (2009), Fatih Çelebioğlu and Sandy Dall'erba (2010), Adem Yavuz Elveren (2010), Hasan E. Duran (2013), Filiz Yeşilyurt and J. Paul Elhorst (2014), Ayşe Özden Birkan and Serpil Kahraman Akdoğdu (2016), Burhan Can Karahasan, Doğruel, and Doğruel (2016), all find that other socio-economic characteristics of regions are also suffering from inequalities.

While regional income patterns as well as other socio-economic properties of regions have distinct explanations for understanding regional disparities, new firms can also be used to examine the extent of regional dichotomy in Turkey. Two consecutive questions deserve interpretation for Turkey: (i) *What is the dispersion pattern of new firm formation (any signs of heterogeneity)?* (ii) *What is the relationship between new firm formation and regional inequalities?*

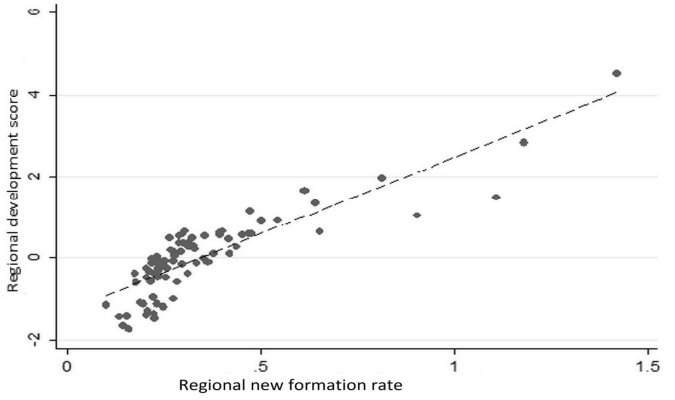
Figure 1 represents the dispersion of new firm formation per 1,000 individuals for a 2002 to 2009 average. Geographically, this pattern highlights the well-known spatial dichotomy in Turkey. Firm formation rate is higher in the west spilling over Marmara and Aegean Regions towards capital city Ankara. In contrast, low firm formation rate is mostly concentrated in the eastern and south eastern Turkey. Note that at this stage new firms cover the whole industries; a detailed discussion on the types of new firms in Turkey will be carried out in the next section.

A second concern is on the relationship between dispersion of new firms and regional disparities. The problem in evaluating the importance of new firms at the regional scale comes from data availability. Regional income, demand, and wealth data at NUTS-III level is not provided for the 2002 to 2009 period. However, it is possible to use the regional development ranking recently developed by the Ministry of Development (MOD). Regional development ranking is based on an index constructed *via* principal component analysis that takes into account various properties of regions in Turkey (see Research on Socio-Economic Development of Provinces of the Ministry of Development of Turkish Republic 2013 for details).This index has started to receive increasing attention and is discussed as a possible proxy for explaining the regional differences in Turkey. For instance, Davide Luca and Andres Rodriguez-Pose (2014) used this index in an attempt to investigate different dimensions of regional disparities in Turkey. Here one complexity is the time inconsistency as the index is available for the year 2011 and new firm formation values covers the period of 2002 to 2009. Keeping this shortfall in mind, Figure 2 compares the regional development scores of regions with their new firm formation rates. This descriptive figure shows the strong tie between regional development and new firm formation. Regions with higher new firm formation are the more developed ones based on the regional development index.



Source: Own calculations based on data from TurkStat (2015).

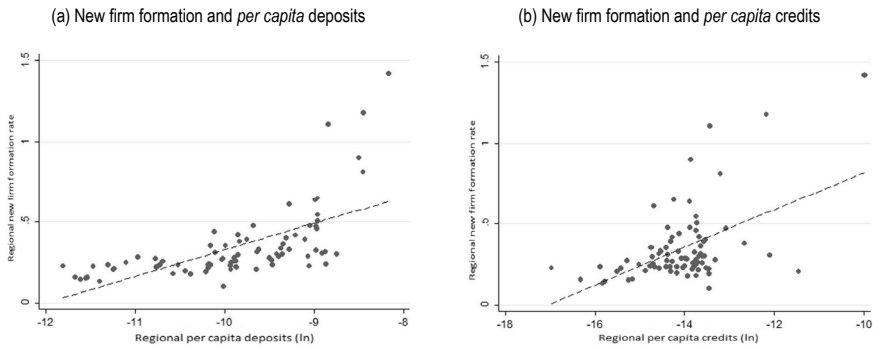
Figure 1 Spatial Dispersion of New Firm Formation (2002-2009 Average)



Source: Own calculations based on data from TurkStat (2015).

Figure 2 Regional New Firm Formation and Regional Development

After observing the importance of new firms for regional development in Turkey, we offer a discussion on the link between financial development and regional new firm formation. Here financial development is measured by *per capita* credits and deposits. Figure 3 shows the first set of descriptive information on the relationship between regional financial development and the regional new firm formation in Turkey. The positive relationship between regional financial development and new firm formation is apparent. It seems that new firms prefer to locate their start-up operations in regions that accumulates and uses more financial capital.



Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Figure 3 Regional Financial Development and New Firm Formation

3. Benchmark Strategy: Non-Spatial Perspective

Given the aim of observing the spatial variability of the impact of finance on new firms, first we start by estimating a set of benchmark models to better apprehend the strength of the connection between finance and formation of new firms. Consecutively, a more detailed analysis on the spatial ties and the variability of the overall pattern will be analysed in the next section. Equation (1) is a non-spatial panel model, where y denotes the new firm formation rate, X represents the financial development variable, Z is a set of control variables, i and t represents the cross sections and time respectively.

$$y_{i,t} = \alpha + \beta X_{i,t} + \delta Z_{i,t} + \mu_i + v_{i,t}. \quad (1)$$

New firm formation data is provided from NACE 1.1 disaggregation by Turkish Statistics Office (TurkStat 2015)[1] and covers the 2002 to 2009 period for the 81 NUTS-III regions (NACE is the French abbreviation for Nomenclature statistique des activités économiques dans la Communauté européenne). New firm data includes all lines of production, where a new firm is defined as an economic unit that starts operating in a given location during a specific year. Note that the initial set of estimates focus on total new firms. To see whether type of production affects the link between finance and new firm formation, additional robustness checks are going to be done in the next section by splitting the sample among manufacturing, services, and trade (see Karahasan 2015 for a similar implementation). An important dimension for measuring new firm formation is related to "standardisation". As discussed by Evans and Jovanavic (1989) disregarding the size of a region can be an issue as high (or low) new formation in regions of different scales will have dissimilar representations.

Two different approaches are highlighted; the labour market approach standardises new firm numbers by using regional employment and the ecological approach uses the number of existing firms for standardisation. Since data availability inhibits

[1] **Turkish Statistics Office (TurkStat).** 2015. https://biruni.tuik.gov.tr/bolgeselistatistik/anaSayfa.do?dil=en/ (accessed January 01, 2015).

the use of these approaches, regional new firm numbers are normalised by regional population provided by TurkStat. Another important concern is on the measurement of financial development at regional level. Given earlier discussions, this study focuses on the banking side of financial intermediation and development. Household wealth or housing prices can be alternative measures; however neither of the indicators is provided at NUTS-III classification. The Central Bank of the Turkish Republic provides housing prices at NUTS-II aggregation after 2013. Given the coverage of this study's sample (2002 to 2009 for 81 NUTS-III regions), this data is not applicable. Similarly, data on capital markets covering the equity based financing is not provided at regional level. Given these limitations, regional *per capita* deposit and credit volumes are used to measure the extent of regional financial development. Data is provided by the Turkish Banking Association (TBA 2015)[2] for 81 provinces covering the 2002 to 2009 period. *Per capita* deposits include all type of deposits held within Turkey, while *per capita* credits include all types of credits including consumer and commercial credits. Both are given in constant prices.

While the former measure is a way to assess the extent of savings at regional level within the banking side of the financial system, the latter highlights the economic activity level both from supply as well as the demand sides of the economy. Here instead of using different types of deposit and credit definitions, aggregated measures are used because both will include vital information for the new firm formation. For instance while commercial credits within a region signals the capital availability and usage for the supply side, consumer credits are related with the level of economic activity from the demand side. That is to say, not only supply side but also demand side matters to identify a link between financial development and new firms' start up decisions. Moreover, note that data availability prevents the construction of a balanced panel data set for most of the sub items of credits and deposits. Although this does not represent a central concern for panel data models, it turns out to be a major limitation for spatial data analysis as well as the spatial econometric models. Supportive descriptive figures that are also available upon request indicate spatial dispersion of the disaggregated deposit and credits figures are more or less similar to the aggregated deposit and credit values.

In line with the theoretical discussions on dynamics of new firm formation, a set of centripetal forces are considered. These forces are expected to influence the formation of new firms *via* different mechanisms. First, as discussed by Paul Krugman (1991), to evaluate the demand side effects population density is used. Population density controls for the intensity of demand as well as impact of urbanisation. Additionally, connected with the remarks of a pooled labour market (Alfred Marshall 1920) and the knowledge spillover discussions (Krugman 1991), regional human capital development is considered by using two different indicators. Education enrolment (in high school as well as university education relative to regional population) and education quality (in high school education *via* the ratio of lecturers to pupils) are the two preferred indicators. Note that due to missing data for lecturers at the university level,

[2] **Turkish Banking Association (TBA).** 2015. Information by Provinces and Region. https://www.tbb.org.tr/tr/bankacilik/banka-ve-sektor-bilgileri/veri-sorgulama-sistemi/illere-ve-bolgelere-gore-bilgiler/73 (accessed January 01, 2015).

quality in university education is not calculated. It should be noted that while the first enrolment indicator captures the labour market pooling and the stock of human capital base, the second quality indicator variable captures mostly the development differences in education believed to have influence on knowledge spillovers.

As inclusion of all these separate channels may create multicollinearity problem, we carry out a pre-analysis on the strength of these separate channels on new firm formation. Results indicate student enrollment in secondary and university education does not have a significant influence; thus labor market pooling may not be an ideal way of assessing the impact of human capital base in Turkey. Among some other factors, migration and the mobility of educated individuals can be one reason. However, a deeper investigation stands out of the scope of this study. For this reason, only models using education quality are reported. Models using education enrollment are available upon request.

The impact of public policy, incentives, and regional infrastructure investment as discussed by Storey (1994) is controlled by the share of regional public expenditures. Another important dimension is the production structure of regions. As industrial and traditional production oriented regions might have fundamental differences, new firm formation processes might be influenced by different factors (we would like to thank to the anonymous reviewer for expressing this point). The shortfall here is the lack of regional data to control for the composition of provincial production structure. That said, to proxy this effect, *per capita* electricity usage in industry and in trade is included to all models. Mohsen Mehrara (2007), Chien-Chiang Lee and Chun-Ping Chang (2008) discuss the bi-directional link between energy consumption and economic growth, specifically with a long-run equilibrium in developing countries. Given high connectivity between industrial production and electricity usage of industry, one should expect adaptability of electricity usage as a good proxy to consider regional production structure (see Galip Altinay and Erdal Karagol 2005 for a discussion on the strength of electricity consumption to mimic the level of overall economic activity in Turkey). Note that electricity usage data is also provided for agricultural production. However, as this data contains too many missing values, we kept this outside the model. Also, note that decomposition of regional value added could also be preferred; with that said, consistent data for the whole sample period is not available at NUTS-III disaggregation. Using electricity consumption in industrial production might yield unexpected results due to unavoidable re-structuring of industrial production from urbanised areas towards some other peripheral regions (Doğruel 2013). Moreover, given lack of data to consider service-based production, it would also be impossible to capture the effect of rising service oriented production and structural changes in the Turkish economy during the last couple of decades (see İzak Atiyas and Ozan Bakis 2015 for a discussion on the structural change in employment for Turkey). A final important dimension is the macroeconomic conditions of Turkey. Given a contraction around 6.1% in 2009 for the Turkish economy, a dummy variable is considered for 2009.

Population density, education quality, electricity consumption variables are obtained from TurkStat. Public expenditure data is obtained from Ministry of Development of Turkish Republic (2013) and is at constant prices. All variables are collected for 2002 to 2009 at NUTS-III level.

Table 1 reports results for non-spatial panel models. Fixed effect (FE), random effect (RE), and pooled-OLS results are given together. For the initial set of benchmark models, these three specifications are provided. Additionally, for every specification a Hausman test is applied; with the null hypothesis of consistent and efficient random effect estimator, consistent and inefficient fixed effect estimator; with the alternative hypothesis of inconsistent random effect and consistent fixed effect estimators (Jerry

Table 1 Non-Spatial Panel Models

	Pooled OLS	*FE*	*RE*	*Pooled OLS*	*FE*	*RE*
Per capita deposits	0.028** (0.011)	0.208** (0.016)	0.175*** (0.016)	-	-	-
Per capita credits	-	-	-	0.0109** (0.004)	0.060*** (0.005)	0.035*** (0.005)
Population density	0.0001*** (0.00003)	0.0005** (0.0002)	0.0005*** (0.00009)	0.0001*** (0.00003)	0.0002 (0.0002)	0.0004*** (0.00006)
Education quality in HS	-0.082** (0.024)	0.194*** (0.023)	0.167*** (0.023)	-0.0717 (0.022)	0.179*** (0.025)	0.109*** (0.025)
Public expenditures	3.559*** (0.259)	0.528 (0.443)	1.050*** (0.394)	3.571*** (0.260)	-0.310 (0.465)	2.033*** (0.368)
2009 growth dummy	-0.070*** (0.014)	-0.085*** (0.010)	-0.079*** (0.009)	-0.079*** (0.016)	-0.082*** (0.010)	-0.080 (0.011)
Per capita elec. (ind.)	-0.022*** (0.004)	-0.029*** (0.009)	-0.032*** (0.007)	-0.018*** (0.004)	-0.010 (0.009)	-0.009 (0.006)
Per capita elec. (trade)	0.206*** (0.011)	-0.003 (0.013)	0.028** (0.013)	0.214*** (0.010)	-0.007 (0.015)	0.092*** (0.013)
Number of observations	648	648	648	648	648	648
AIC	-903.38	-1663.08	-1268.11	-902.353	-1616.174	-1229.839
R^2	0.77	0.36	0.61	0.77	0.18	0.63
F/Wald test [*p*-value]	308.88 [0.00]	120.29 [0.00]	939.40 [0.00]	308.25 [0.00]	106.30 [0.00]	900.85 [0.00]
Hausman test [*p*-value]	-	279.99 [0.00]	-	-	140.03 [0.00]	-
Breusch-Pagan test [*p*-value]	-	-	335.95 [0.00]	-	-	334.20 [0.00]
F-test fixed effects (u_i = 0) [*p*-value]	-	15.61 [0.00]	-	-	14.06 [0.00]	-
LM lag test [*p*-value]	27.52 [0.00]			12.41 [0.00]		
LM lag test robust [*p*-value]	695.22 [0.00]			1.21e+04 [0.00]		
LM error test [*p*-value]	55.52 [0.00]			49.52 [0.00]		
LM error test robust [*p*-value]	723.23 [0.00]			1.22e+04 [0.00]		

Notes: *, **, *** represent significance at 10%, 5%, 1% respectively. Standard errors are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

A. Hausman 1978). In general, our stand will be to use the FE estimation as diagnostic checks and model comparisons ratify the validity of the FE models in all cases. While a Breusch-Pagan test (Trevor Stanley Breusch and Adrian Rodney Pagan 1980) enables the comparison of RE and OLS models, our sample is relatively more convenient for FE estimations, as FE estimation will enable one to control for the heterogonous time invariant effects, which mostly exists for Turkey.

These models will be unable to control for the possible endogeneity bias as regional financial development is eventually influenced from specific regional properties. While in technical terms it would be possible to control for this effect *via* instrumental variable (IV) approach, given lack of data at regional scale, construction of a reliable IV model is difficult. While neglecting the endogeneity or simultaneity could bring bias to results obtained so far; given that the central focus of the paper is on the spatial heterogeneity, we see no reason to claim that extent of endogeneity should not be varying across the geography of Turkey. Therefore, any influence we fail to detect due to endogeneity will not influence the construction of the models, questioning the varying impact of financial development on local firm formation.

Results given in Table 1 indicate, for all models, financial development measured by the *per capita* deposits and credits significantly and positively influence the formation of the new firms in Turkey. In general for the regional control variables, FE and RE estimations results are consistent yet there are minor differences for pooled-OLS estimations. Even though the Breusch-Pagan test recalls the validity of RE models over pooled-OLS, Hausman test statistics underline the superiority of FE estimations. Also as discussed in Badi H. Baltagi (2001), an *F*-test for the joint significance of the fixed effects is highly significant. Therefore, based on FE results other than finance; education quality (positively) and economic downturn (negatively) influences new firm formation. Population density also positively affects new firm formation when finance is measured by *per capita* deposits. Similarly when *per capita* deposits are used to describe finance, electricity consumption influences new firm formation negatively. This can be due to the so called de-industrialisation of urbanised and more developed areas. This finding is consistent with Karahasan (2015) underlining that the industrial composition of provinces has relatively weak and unexpectedly negative influence on the formation of new firms. Karahasan (2015) stresses that the observed pattern is related to the level of regional competition. Similarly, Doğruel (2013) discusses the fall of industrial production and employment in relatively more industrialised regions of Turkey. While for industrialised NUTS-II regions share of manufacturing is in a downward trend, for hinterlands, emerging, minor industrial, and poorly industrialised regions' share of manufacturing employment is rising.

4. Augmented Specifications: Spatial Perspective

Even an initial set of analyses contains valuable insight to describe regional financial development and new firm formation link. However, the spatial dimension that could influence regional policy construction is neglected. As discussed by Sergio J. Rey and Brett D. Montouri (1999), cross sections may be influenced by spatial dependence. Similarly, Simonetta Longhi, Peter Nijkamp, and Jacques Poot (2006) suggest administrative boundaries may fall short in explaining the true dispersion; regions may

influence each other and form spatial clusters well beyond the pre-defined governmental borders. Moreover Fotheringham, Brunsdon, and Charlton (2002) emphasise that spatial heterogeneity, which creates local imbalances, may be dominant in spatial analyses. Even if the impact of a specific policy is accepted in general, observed impact of policies can vary across geography. Originating from these discussions, we will first investigate spatial dependence of regional financial development and new firm formation *via* exploratory spatial data analysis (ESDA) and econometric tools. Second, for understanding the spatial variability of the relationship, we will investigate local variations *vis-à-vis* spatial non-stationarity analysis.

4.1 Testing Spatial Dependence

Luc Anselin, Atilla Varga, and Acs (1997) underline the necessity to consider the extent of spatial dependence. Correspondingly, Anselin (2010) cautions that neglecting the impact of spatial dependence is an important shortfall of econometric models. Anselin (2010) discusses different ways to incorporate spatial econometric modelling within cross and panel models. In line with the concerns on the spatial dimension of regional data sets, first Moran's I and Geary's C spatial autocorrelation tests are considered (Equations (2) and (3)). Both tests have the null hypothesis of spatial randomness. Moran's I lies within a range of 1 and -1; while values higher and lower than 0 represent positive and negative spatial autocorrelation respectively. If a test statistic is zero, data exhibits spatial randomness. By comparison, Geary's C values lower than 1 represent increasing positive spatial autocorrelation and values higher than 1 represent increasing negative spatial autocorrelation. Finally, a value of 1 represents spatial randomness for Geary's C. n is the number of cross sections and s is the summation of the all elements in the weight matrix (w). There are different ways to construct weight matrices (Anselin and Arthur Getis 1992). Two different weight matrices are used. First, a contiguity weight matrix is considered, which assigns values of 1 to adjacent regions and 0 otherwise. Second, an inverse distance weight matrix is constructed using distance as a discount factor to relate each pair of locations. Distance is measured by bird's eye distance. Road distance is not preferred as it is difficult to control for road quality differences. Besides travel time between regions is not used since there is lack of reliable data on the changes in travel times during the sample period.

$$I_i = \frac{n}{s}\frac{\sum_i\sum_j w_{ij}(x_i-\overline{x})(x_j-\overline{x})}{\sum(x_i-\overline{x})^2}, \tag{2}$$

$$C_i = \frac{(n-1)(\sum_i\sum_j w_{ij}(x_i-x_j)^2}{2(\sum_i\sum_j w_{ij}(x_i-x_j)^2)}. \tag{3}$$

Tables 2 and 3 give the results of the spatial autocorrelation tests. Spatial autocorrelation statistics computed with both weight matrices indicate significant spatial dependence for the whole sample period. Moreover, spatial dependence is observed to be higher for the contiguity weight matrix and tend to diminish for the inverse distance weight matrix specification. This indicates spatial spillovers are more localised and tend to diminish at higher orders and distance (see Vassilis Monastiriotis 2009 for a discussion on the link between distance and spatial spillovers). Another key finding is the rise in the level of spatial dependence for both weight matrices throughout the sample period. Even though there are cyclical movements in the level of spatial

Table 2 Spatial Autocorrelation (A): Moran's I Test

	New firm formation rate		*Per capita* deposits		*Per capita* credits	
	Contiguity	Inverse distance	Contiguity	Inverse distance	Contiguity	Inverse distance
2002-2009	0.242*** (0.068)	0.115*** (0.016)	0.690*** (0.072)	0.310*** (0.016)	0.396*** (0.070)	0.145*** (0.016)
2002	0.139** (0.065)	0.072*** (0.015)	0.664*** (0.072)	0.297*** (0.016)	0.328*** (0.069)	0.126*** (0.016)
2003	0.213*** (0.065)	0.109*** (0.015)	0.667** (0.072)	0.296*** (0.016)	0.379*** (0.069)	0.155*** (0.016)
2004	0.182*** (0.067)	0.096*** (0.015)	0.683*** (0.072)	0.311*** (0.016)	0.325*** (0.070)	0.130*** (0.016)
2005	0.194*** (0.068)	0.093*** (0.015)	0.672*** (0.072)	0.305*** (0.016)	0.416*** (0.070)	0.152*** (0.016)
2006	0.297*** (0.069)	0.140*** (0.016)	0.680*** (0.072)	0.305*** (0.016)	0.390*** (0.070)	0.151*** (0.016)
2007	0.284*** (0.069)	0.122*** (0.016)	0.708*** (0.072)	0.316*** (0.016)	0.441*** (0.070)	0.139*** (0.016)
2008	0.282*** (0.069)	0.129*** (0.016)	0.707*** (0.072)	0.314*** (0.016)	0.393*** (0.070)	0.117*** (0.016)
2009	0.253*** (0.069)	0.103*** (0.016)	0.703*** (0.072)	0.311*** (0.016)	0.400*** (0.070)	0.117*** (0.016)

Notes: **, *** represent significance at 5%, 1% respectively. Standard errors are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Table 3 Spatial Autocorrelation (B): Geary's C Test

	New firm formation rate		*Per capita* deposits		*Per capita* credits	
	Contiguity	Inverse distance	Contiguity	Inverse distance	Contiguity	Inverse distance
2002-2009	0.746*** (0.093)	0.850*** (0.025)	0.296*** (0.075)	0.656*** (0.018)	0.579*** (0.085)	0.816*** (0.022)
2002	0.836** (0.102)	0.899*** (0.029)	0.329*** (0.075)	0.674*** (0.018)	0.620*** (0.088)	0.840*** (0.024)
2003	0.763*** (0.102)	0.863*** (0.029)	0.327*** (0.075)	0.672*** (0.018)	0.586*** (0.086)	0.808*** (0.023)
2004	0.802*** (0.095)	0.873*** (0.026)	0.303*** (0.075)	0.657*** (0.018)	0.646*** (0.085)	0.833*** (0.022)
2005	0.794*** (0.094)	0.870*** (0.026)	0.312*** (0.075)	0.662*** (0.018)	0.555*** (0.085)	0.811*** (0.022)
2006	0.688*** (0.089)	0.822*** (0.024)	0.303*** (0.075)	0.662*** (0.018)	0.595*** (0.084)	0.817*** (0.022)
2007	0.706*** (0.089)	0.839*** (0.024)	0.271*** (0.076)	0.648*** (0.018)	0.551*** (0.082)	0.827*** (0.021)
2008	0.703*** (0.089)	0.836*** (0.024)	0.277*** (0.076)	0.651*** (0.018)	0.595*** (0.083)	0.845*** (0.021)
2009	0.749*** (0.090)	0.868*** (0.024)	0.281*** (0.075)	0.655*** (0.018)	0.583*** (0.083)	0.846*** (0.022)

Notes: **, *** represent significance at 5%, 1% respectively. Standard errors are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

dependence, the increase from 2002 to 2009 signals that spatial links for regional financial development as well as creation of new firms are important. Additionally, financial development realises higher spatial dependence compared to new firms. This suggests that diffusion ability of financial capital is geographically wider compared to formation of new firms.

To overcome the possible biases evolving from the neglected role of spatial dependence, we constructed a number of fixed effect spatial panel models (Anselin 2010). Note that random effect variants of the spatial models are not reported as earlier evidence already validate that using FE procedures are more convenient for the current sample (see Elhorst 2005, 2012 for a discussion). However Hausman test statistics are also reported for the spatial FE models to compare FE and RE estimators (see Jan Mutl and Michael Pfaffermayr 2011 for details of Hausman test for spatial models). Equation (4) is a Spatial Lag Model (SAR) that assumes spatial dependence over the new firms' regional dispersion, Equation (5) is the Spatial Error Model (SEM) that regards the regional common shocks as spatially correlated and finally Equation (6) is the Spatial Durbin Model (SDM) that allows for the spatial dependence of the regional financial development. Note that as given in Elhorst (2010) we further control for the impact of spatial lag process in the SDM model.

$$y_{i,t} = \alpha + \rho W y_{i,t} + \beta X_{i,t} + \delta Z_{i,t} + \mu_i + v_{i,t}, \tag{4}$$

$$y_{i,t} = \alpha + \beta X_{i,t} + \delta Z_{i,t} + \mu_i + \lambda W u_{i,t} + v_{i,t}, \tag{5}$$

$$y_{i,t} = \alpha + \rho W y_{i,t} + \varphi W X_{i,t} + \beta X_{\iota,t} + \delta Z_{i,t} + \mu_i + v_{i,t}. \tag{6}$$

Results are given in Table 4. All spatial models are estimated by using the contiguity weight matrix. Similar results are obtained by the inverse distance weight matrix. These results are available upon request. First, Hausman test statistics significantly validate that FE estimations are also valid for the spatial models. Moreover, following Baltagi (2001), an *F*-test on the fixed effects is implemented to compare spatial models with and without fixed effects (see Elhorst 2003 for details). These results also remark that FE specification is valid as fixed effects are still jointly significant for all spatial specifications. Finally, significance of the spatial effects are tested by using a Wald test (see Mehmet Güney Celbis and Denis de Crombrugghe 2016 for an application). Results given in Table 5 show that all spatial models perform better compared to non-spatial models. Returning to coefficient estimates in Table 4, results indicate that *per capita* deposits and credits significantly and positively influence formation of new firms, regardless of the spatial specification. Moreover, education quality (positively), the 2009 growth dummy (negatively), and industrial electricity consumption (negatively) affects new firm formation. We report a significant fall in the explanatory power of the public expenditures, which vanishes completely once finance is controlled by *per capita* credits. Regarding spatial effects; spatial lag and error procedures are all significant, indicating the spillover of new firms and omitted factors across the geography of Turkey. Similarly, for SDM specification controlling for *per capita* credits, spatial spillovers work with respect to both new firms and regional financial development. However for SDM models controlling for *per capita* deposits, spatial spillovers work only over new firm formation.

Table 4 Fixed Effect Spatial Panel Models (All Industries)

	SAR	***SEM***	***SDM***	***SAR***	***SEM***	***SDM***
Per capita deposits	0.115*** (0.014)	0.208*** (0.018)	0.125*** (0.027)	-	-	-
Per capita credits	-	-	-	0.030*** (0.004)	0.050*** (0.006)	0.016** (0.007)
Population density	-0.0001 (0.0002)	-0.0001 (0.0001)	-0.0001 (0.0001)	-0.0002 (0.0001)	-0.0003 (0.0001)	-0.0003* (0.0001)
Education quality in HS	0.081*** (0.020)	0.075*** (0.024)	0.082*** (0.020)	0.068*** (0.020)	0.059** (0.025)	0.062** (0.021)
Public expenditures	0.592* (0.350)	0.715** (0.344)	0.600* (0.350)	0.175 (0.360)	0.079 (0.360)	0.301 (0.364)
2009 growth dummy	-0.039*** (0.008)	-0.081*** (0.018)	-0.038*** (0.008)	-0.033*** (0.008)	-0.060** (0.022)	-0.039*** (0.009)
Per capita elec. (ind.)	-0.028*** (0.008)	-0.024*** (0.007)	-0.027*** (0.007)	-0.017** (0.007)	-0.014* (0.007)	-0.019** (0.007)
Per capita elec. (trade)	-0.014 (0.010)	-0.003 (0.011)	-0.013 (0.011)	-0.014 (0.012)	-0.003 (0.012)	-0.020 (0.012)
ρ	0.568*** (0.038)	-	0.570*** (0.039)	0.601*** (0.037)	-	0.584*** (0.038)
λ	-	0.588*** (0.043)	-	-	0.626*** (0.048)	-
W**per capita* deposits	-	-	-0.012 (0.030)	-	-	-
W**per capita* credits	-	-	-	-	-	0.018** (0.008)
Number of observations	648	648	648	648	648	648
AIC	-1817.88	-1789.13	-1816.06	-1793.15	-1747.52	-1796.11
R^2	0.28	0.35	0.30	0.01	0.01	0.03
F/Wald test [*p*-value]	1956.06 [0.00]	650.71 [0.00]	1846.19 [0.00]	1751.96 [0.00]	714.33 [0.00]	1738.85 [0.00]
Hausmann test [*p*-value]	60.91 [0.00]	39.00 [0.00]	57.19 [0.00]	53.29 [0.00]	39.33 [0.00]	52.41 [0.00]
F-test fixed effects (u_i = 0) [*p*-value]	16.11 [0.00]	13.83 [0.00]	16.20 [0.00]	15.09 [0.00]	11.48 [0.00]	14.94 [0.00]
Log-likelihood	917.94	903.56	918.03	905.57	882.76	908.05

Notes: *, **, *** represent significance at 10%, 5%, 1% respectively. Standard errors are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Table 5 Wald Test Results for Spatial Dependence (A)

	$H_0: \rho = 0$	$H_0: \lambda = 0$	$H_0: \varphi = \rho = 0$
Per capita deposits	216.11 [0.00]	185.95 [0.00]	217.13 [0.00]
Per capita credits	258.73 [0.00]	164.05 [0.00]	259.77 [0.00]

Notes: *p*-values are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Even though spatial specifications based on the Wald test are all significant (Table 5) and do not significantly influence our overall judgment reported in Table 4; comparing these three spatial procedures is informative (see Nicolas Debarsy and Cem Ertur 2010 for an overall discussion). First as noted by Anselin (1988, 2003), Anselin et al. (1996), the LM-test and robust LM-test based on the OLS specifications can be used to decide the relevant spatial specification. As reported in Table 1, both spatial lag and error procedures are convenient as OLS is rejected in favour of both SAR and SEM. Anselin (2003) notes, provided that both LM and robust-LM tests are significant, one may choose the specification yielding higher LM test value (see Raul Ramos, Catia Nicodemo, and Esteve Sanroma 2015 for an application). Meanwhile Elhorst (2010) suggests that such a case will allow one to compare SAR and SEM models with SDM as both specifications are simplified versions of the SDM (see James LeSage and Robert Kelley Pace 2009). A likelihood ratio test (LR-test) will be implemented to test two consecutive hypotheses. If $H_0: \varphi = 0$ and $H_0: \varphi + \rho\beta = 0$ are both rejected, then SDM is applicable. Elhorst (2010) remarks that, if one of the hypotheses cannot be rejected, then SAR or SEM will be valid. For instance, in a case where the first hypothesis cannot be rejected, the SAR procedure should be used; conversely, in the case where the second hypothesis cannot be rejected, SEM should be preferred. Note that Elhorst (2010) stipulates that, for both cases, model selection should be consistent with the robust LM-test result. Results of the LR-test are reported in Table 6. For the models using *per capita* credits, we reject both of the hypotheses; confirming that SDM is the right procedure. In contrast, once *per capita* deposit is used to control for financial development, we fail to reject the first hypothesis; confirming that SAR model is the right specification. However, this finding contradicts the robust LM-test that points out the SEM specification. Elhorst (2010) discusses that in such cases SDM specification will be the right procedure as it acts as a generalised version of lag and error models. Overall, as mentioned previously, selection of the spatial models has no influence on our overall judgment for finance and new firms connection.

Table 6 Log Likelihood Ratio Test for Spatial Specification (A)

	***Per capita* deposits**	***Per capita* credits**
SAR simplified to SDM $H_0: \varphi = 0$	0.18 [0.67]	4.96 [0.03]
SEM simplified to SDM $H_0: \varphi + \rho\beta = 0$	28.94 [0.00]	59.59 [0.00]

Notes: *p*-values are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

While results so far control for structure of production (*via* electricity consumption as a proxy) structural differences can be further investigated by splitting the sample among different lines of production. Further attempts to control for production structure of provinces can be crucial for policy issues as there are sizable regional differences in both new formation as well as financial development levels. There are also structural differences between west and east territory of Turkey. This dual pattern is endogenously related to various socio-economic conditions, all of which may be

shaping the interaction between finance and new firms. Therefore, controlling for industrial effects with right hand side variables as well as splitting the sample among main lines of production will also enable one to consider the effect of structural differences among the Turkish regions. To assess the impact of production lines separately with the same set of fixed effects, spatial models are estimated for manufacturing, services, and trade. Tables 7, 8 and 9 give the results. Diagnostics for spatial specifications are summarised in Tables 10 and 11.

Table 7 Fixed Effects Spatial Models (Manufacturing)

	SAR	***SEM***	***SDM***	***SAR***	***SEM***	***SDM***
Per capita deposits	0.016*** (0.003)	0.023*** (0.004)	0.013* (0.007)	-	-	-
Per capita credits	-	-	-	0.006*** (0.001)	0.009*** (0.001)	0.008*** (0.002)
Population density	-0.00003 (0.00004)	-0.00009 (0.00005)	-0.00003 (0.00004)	-0.00006 (0.00004)	-0.0001* (0.00005)	-0.00005 (0.00004)
Education quality in HS	0.025*** (0.005)	0.026*** (0.005)	0.025*** (0.005)	0.021*** (0.005)	0.021*** (0.005)	0.022*** (0.005)
Public expenditures	0.386*** (0.095)	0.421*** (0.093)	0.383*** (0.095)	0.294*** (0.095)	0.313*** (0.093)	0.281*** (0.096)
2009 growth dummy	-0.006*** (0.002)	-0.010*** (0.003)	-0.007*** (0.002)	-0.008*** (0.002)	-0.012*** (0.003)	-0.007*** (0.002)
Per capita elec. (ind.)	-0.004** (0.002)	-0.004** (0.002)	-0.004** (0.002)	-0.002 (0.002)	-0.002 (0.001)	-0.002 (0.002)
Per capita elec. (trade)	-0.002 (0.002)	-0.001 (0.003)	-0.003 (0.003)	-0.007** (0.003)	-0.006* (0.003)	-0.006* (0.003)
ρ	0.340*** (0.049)	-	0.339*** (0.049)	0.340*** (0.049)	-	0.346*** (0.049)
λ	-	0.361*** (0.052)	-	-	0.378*** (0.051)	-
W**per capita* deposits	-	-	0.003 (0.008)	-	-	-
W**per capita* credits	-	-	-	-	-	-0.001 (0.002)
Number of observations	648	648	648	648	648	648
AIC	-3547.377	-3545.644	-3545.605	-3557.314	-3560.146	-3556.006
R^2	0.27	0.11	0.18	0.01	0.02	0.01
F/Wald test [*p*-value]	531.52 [0.00]	194.91 [0.00]	490.94 [0.00]	561.91 [0.00]	204.19 [0.00]	506.20 [0.00]
Hausman test [*p*-value]	27.55 [0.00]	23.70 [0.00]	21.92 [0.00]	31.75 [0.00]	33.45 [0.00]	27.12 [0.00]
F-test fixed effects (u_i = 0) [*p*-value]	23.52 [0.00]	23.05 [0.00]	23.47 [0.00]	23.34 [0.00]	23.11 [0.00]	23.41 [0.00]
Log-likelihood	1782.68	1781.82	1782.80	1790.72	1791.99	1792.10

Notes: *, **, *** represent significance at 10%, 5%, 1% respectively. Standard errors are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Table 8 Fixed Effects Spatial Models (Services)

	SAR	*SEM*	*SDM*	*SAR*	*SEM*	*SDM*
Per capita deposits	0.037*** (0.006)	0.052*** (0.007)	0.025** (0.012)	-	-	-
Per capita credits	-	-	-	0.007*** (0.002)	0.012*** (0.002)	-0.003 (0.003)
Population density	0.0002*** (0.00008)	0.0001** (0.00008)	0.0002** (0.00008)	0.0001** (0.00008)	0.0001* (0.00008)	0.0001 (0 .00008)
Education quality in HS	0.018** (0.008)	0.018* (0.010)	0.016* (0.009)	0.017* (0.009)	0.018* (0.010)	0.010 (0.009)
Public expenditures	0.496*** (0.161)	0.508*** (0.160)	0.487*** (0.161)	0.392** (0.165)	0.356** (0.165)	0.496*** (0.166)
2009 growth dummy	-0.010*** (0.003)	-0.016*** (0.005)	-0.011*** (0.003)	-0.007** (0.003)	-0.011* (0.006)	-0.011*** (0.003)
Per capita elec. (ind.)	-0.008** (0.003)	-0.007** (0.003)	-0.008** (0.003)	-0.004 (0.003)	-0.003 (0.003)	-0.006* (0.003)
Per capita elec. (trade)	0.0003 (0.004)	0.003 (0.005)	-0.001 (0.005)	0.004 (0.005)	0.006 (0.005)	-0.0004 (0.005)
ρ	0.379*** (0.047)	-	0.374*** (0.047)	0.419*** (0	-	0.404*** (0.046)
λ	-	0.357*** (0.051)	-	-	0.383*** (0.051)	-
W**per capita* deposits	-	-	0.015 (0.013)	-	-	-
W**per capita* credits	-	-	-	-	-	0.014*** (0.003)
Number of observations	648	648	648	648	648	648
AIC	-2858.481	-2845.381	-2857.685	-2838.461	-2818.849	-2851.977
R^2	0.36	0.38	0.36	0.27	0.26	0.23
F/Wald test [*p*-value]	671.35 [0.00]	247.62 [0.00]	610.41 [0.00]	534.95 [0.00]	236.64 [0.00]	583.26 [0.00]
Hausman test [*p*-value]	26.30 [0.00]	35.50 [0.00]	30.91 [0.00]	34.38 [0.00]	63.02 [0.00]	33.62 [0.00]
F-test fixed effects (u_i = 0) [*p*-value]	15.39 [0.00]	14.77 [0.00]	15.37 [0.00]	14.82 [0.00]	14.06 [0.00]	14.99 [0.00]
Log-likelihood	1438.24	1431.69	1438.84	1428.23	1418.42	1435.98

Notes: *, **, *** represent significance at 10%, 5%, 1% respectively. Standard errors are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

First of all, results show, similar to all lines of production fixed effects, spatial panel specification is superior compared to RE (note that RE results are not reported, however they are available upon request). The Hausman test statistic and joint significance of the fixed effects both indicated FE should be implemented. In general, results indicate sectoral differences do not significantly influence the impact of finance on new firm formation. Only for SDM specification for services we fail to detect a relationship between *per capita* credits and formation of new firms. Note that the LR-test

Table 9 Fixed Effects Spatial Models (Trade)

	SAR	***SEM***	***SDM***	***SAR***	***SEM***	***SDM***
Per capita deposits	0.035*** (0.004)	0.053*** (0.005)	0.032*** (0.009)	-	-	-
Per capita credits	-	-	-	0.011*** (0.001)	0.016*** (0.001)	0.008*** (0.002)
Population density	-0.00003 (0.00006)	-0.00001 (0.00006)	-0.00003 (0.00006)	-0.00008 (0.00006)	-0.00005 (0.00006)	-0.0001 (0.00006)
Education quality in HS	0.038*** (0.007)	0.041*** (0.008)	0.037*** (0.007)	0.033*** (0.007)	0.036*** (0.008)	0.031*** (0.007)
Public expenditures	0.276** (0.124)	0.308** (0.123)	0.273** (0.124)	0.118 (0.125)	0.101 (0.126)	0.147 (0.127)
2009 growth dummy	-0.017*** (0.003)	-0.028*** (0.004)	-0.017*** (0.003)	-0.017*** (0.003)	-0.027*** (0.004)	-0.018*** (0.003)
Per capita elec. (ind.)	-0.002 (0.002)	-0.001 (0.002)	-0.002 (0.002)	0.0008 (0.002)	0.001 (0.002)	0.0003 (0.002)
Per capita elec. (trade)	-0.005 (0.003)	-0.002 (0.004)	-0.005 (0.004)	-0.008** (0.004)	-0.005 (0.004)	-0.009** (0.004)
ρ	0.372*** (0.045)	-	0.370*** (0.046)	0.384*** (0.044)	-	0.371*** (0.046)
λ	-	0.357*** (0.050)	-	-	0.353*** (0.050)	-
W**per capita* deposits	-	-	0.003 (0.010)	-	-	-
W**per capita* credits	-	-	-	-	-	0.004 (0.002)
Number of observations	648	648	648	648	648	648
AIC	-3197.492	-3182.193	-3195.623	-3193.758	-3173.563	-3193.798
R^2	0.27	0.37	0.25	0.01	0.09	0.01
F/Wald test [*p*-value]	1169.03 [0.00]	403.73 [0.00]	1083.60 [0.00]	1128.11 [0.00]	410.72 [0.00]	1080.36 [0.00]
Hausman test [*p*-value]	35.41 [0.00]	27.49 [0.00]	40.10 [0.00]	40.09 [0.00]	47.73 [0.00]	44.50 [0.00]
F-test fixed effects (u_i = 0) [*p*-value]	11.80 [0.00]	11.13 [0.00]	11.79 [0.00]	11.44 [0.00]	10.70 [0.00]	11.43 [0.00]
Log-likelihood	1607.74	1600.09	1607.81	1605.87	1595.78	1606.89

Notes: *, **, *** represent significance at 10%, 5%, 1% respectively. Standard errors are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

result reported in Table 10 reveal SDM is the right specification for services; suggesting *per capita* credits do not robustly influence formation of new firms in services. In terms of control variables, results reported in Tables 7, 8 and 9 are comparable with Table 4. While the impact of population density diminishes once sectoral differences are considered, education quality and the 2009 economic downturn dummy is significant in all of the specifications. Results on public expenditures and electricity consumption continue to be at odds preventing us from making an overall generalisation.

Finally regarding the diagnostics of spatial models in Table 10; spatial effects are valid in all cases. However spatial specifications do not follow a uniform structure. Table 11 shows models for manufacturing cannot be simplified to a SDM, rather they are best explained *via* SAR models. However, service models significantly converge towards to SDM if finance is measured *via per capita* credits. For service sector models using *per capita* deposits point out the validity of SAR model. Finally, trade models converge towards SAR specification. All that said, similar to our remarks for all lines of production, spatial specification does not significantly affect our overall judgment on the impact of finance on new firms formation.

Table 10 Wald Test Results for Spatial Dependence (A)

		$H_0: \rho = 0$	$H_0: \lambda = 0$	$H_0: \varphi = \rho = 0$
Manufacturing	*Per capita* deposits	46.80 [0.00]	47.02 [0.00]	47.04 [0.00]
	Per capita credits	47.98 [0.00]	54.35 [0.00]	48.96 [0.00]
Services	*Per capita* deposits	63.49 [0.00]	48.63 [0.00]	64.59 [0.00]
	Per capita credits	82.52 [0.00]	56.44 [0.00]	99.59 [0.00]
Trade	*Per capita* deposits	67.38 [0.00]	50.44 [0.00]	67.40 [0.00]
	Per capita credits	73.46 [0.00]	49.29 [0.00]	75.09 [0.00]

Notes: *p*-values are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Table 11 Log Likelihood Ratio Test for Spatial Specification (B)

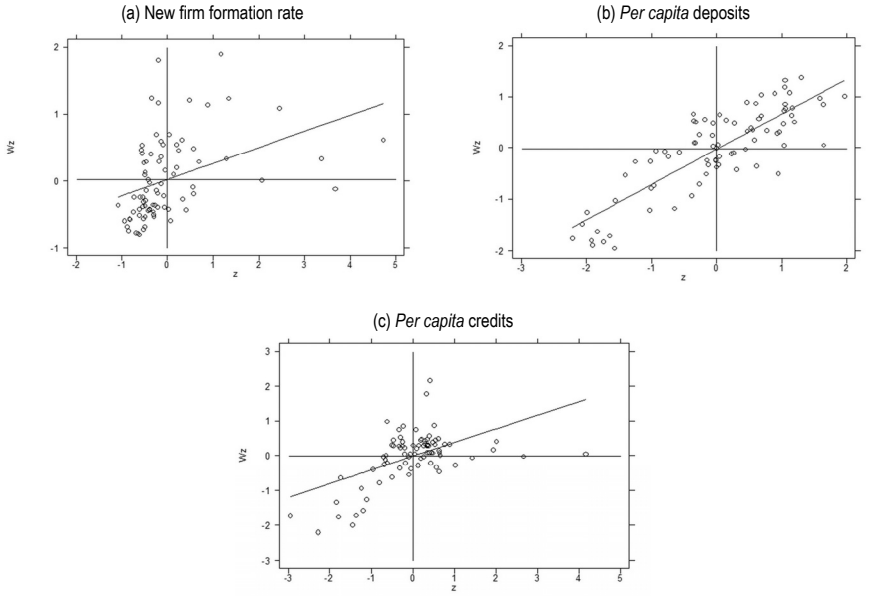
		***Per capita* deposits**	***Per capita* credits**
Manufacturing	SAR simplified to SDM $H_0: \varphi = 0$	0.23 [0.63]	2.75 [0.10]
	SEM simplified to SDM $H_0: \varphi + \rho\beta = 0$	1.96 [0.16]	0.218 [0.60]
Services	SAR simplified to SDM $H_0: \varphi = 0$	1.20 [0.27]	15.52 [0.00]
	SEM simplified to SDM $H_0: \varphi + \rho\beta = 0$	14.30 [0.00]	35.13 [0.00]
Trade	SAR simplified to SDM $H_0: \varphi = 0$	0.13 [0.71]	2.04 [0.15]
	SEM simplified to SDM $H_0: \varphi + \rho\beta = 0$	15.43 [0.00]	22.23 [0.00]

Notes: *p*-values are in parentheses.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

4.2 Testing Spatial Heterogeneity

Findings so far indicate that new firm formation in Turkey is higher in financially developed regions. However, these analyses fail to consider an additional aspect of regional development. As discussed in Fotheringham, Brunsdon, and Charlton (2002), spatial instabilities in regional analyses prevent the healthy evaluation of econometric models. Global parameter estimates that summarise the overall relation may not represent the whole geography if the relationship tends to vary across space. This argument means that analyses so far represent a general relationship but fail to identify the true association at the local level. To apprehend better the spatial instability issue, local spatial clusters and regimes should be identified. As a first attempt to consider spatial instability, spatial autocorrelation statistics are decomposed (Anselin 1996). Figures 4(a), 4(b) and 4(c) illustrate the Moran Scatterplot decomposition for 2002 to 2009 averaged data. Findings indicate the positive spatial dependence is stronger among low firm formation areas. By contrast, findings for financial development it seems to be the reverse. This asymmetry is vital, but these figures do not control for the significance of the local variations.



Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Figure 4 Moran's I Scatterplot Diagrams

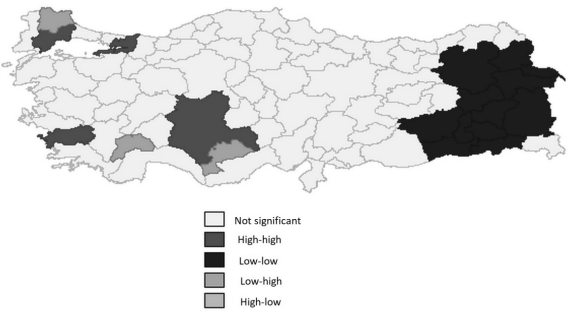
As offered by Anselin (1995), Local Indicator of Spatial Association (LISA) can be computed to see the significance and the direction of local variations (Equation (7)). Positive local association can prevail in two separate ways: if regions with high values are clustered then "hot spots" are formed, whereas in the case of low values clustering, then "cold spots" are generated. Negative local associations are going to

represent the outliers. Figures 5(a), 5(b) and 5(c) give the LISA maps for new firm formation and the regional financial development based on 2002 to 2009 averaged data (at 5% local significance level). Note that new firm formation in all industry lines is reported.

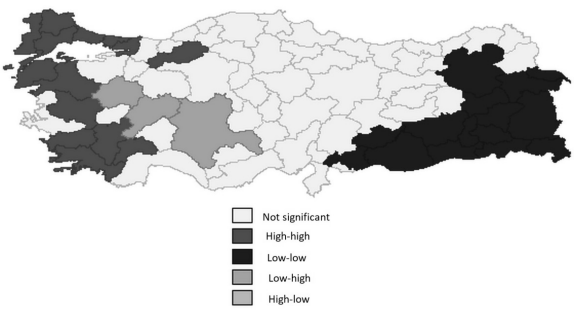
For individual sectors (manufacturing, services and trade) the same set of LISA analysis are also implemented. These results are not reported, but they are available upon request. Overall, once the number of provinces within different spatial regimes are investigated, results show contradictory findings. Considering new firm formation, the connection between eastern regions is stronger and mostly dominated by low new firm formation. However, western regions that have a relatively higher amount of new firms present lower local connectivity between each other. *Per capita* deposit spatial connectivity is significantly dual and observed to be sizable both in high and low *per capita* deposits areas. This pattern mimics the well-known east-west dichotomy in Turkey. For *per capita* credits, spatial connectivity is higher only among regions with low *per capita* credits (unlike high *per capita* credit areas).

These exploratory findings from LISA analysis enable us to make several descriptive generalisations. In eastern Turkey, the spatial regime of cold spots are similar for both new firm formation as well as financial development (measured by both *per capita* deposits and credits). However, hot spots in the western Turkey from the manufacturing belt around the Marmara District towards the Aegean Region is only present for the accumulation of savings through *per capita* deposit. We fail to detect a similar local spatial regime for *per capita* credits and new firm formation. These first sets of analyses become even more interesting once each region's LISA scores are compared to understand the extent to which local spatial spillovers influence each other. Monastiriotis (2009) discussed that local spatial correlation indicators can be compared for understanding the diffusion of policy measures. To understand local interaction, a basic correlation coefficient is computed between the LISA scores of new firm formation and the financial development indicators. Here the important issue is how to treat the local insignificant autocorrelation values. Figures 5(a), 5(b) and 5(c) show that there are high number of insignificant LISA scores. One approach is to simply disregard the insignificant LISA scores and compare the significant ones. However, inevitably this may result in loss of information. As underlined in Monastiriotis (2009), since the central idea is to make comparison cross-variables rather than comparing spatial dynamics across space, all local values can be observed by neglecting their significance. Originating from the idea of using all local LISA values, basic correlation analysis is carried out. In general for 2002 to 2009 averages link between the spatial diffusion of new firms and financial development is weak. The correlation between *per capita* deposits and new firms is 0.37; between *per capita* credit and new firms is 0.08 when all LISA scores are considered. More remarkably, if only significant LISA scores are used, correlation scores for the *per capita* deposits-new firms and *per capita*

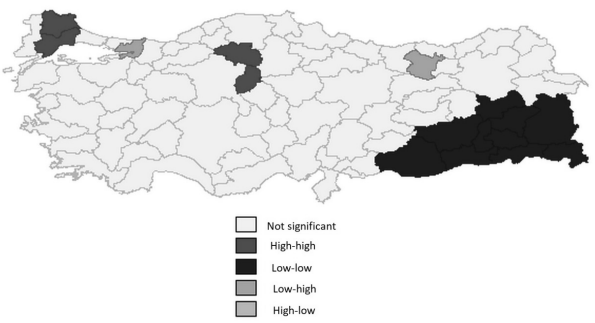
(a) New firm formation rate



(b) *Per capita* deposits



(c) *Per capita* credits



Notes: No high-low outlier region is detected in the LISA analysis.

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Figure 5 Local Indicator of Spatial Association (LISA) Maps

credits-new firms become -0.36 and -0.69 respectively. Correlation between the LISA scores of financial development variables remains more or less constant at 0.85 and 0.87 once local significance is neglected and considered correspondingly. These descriptive results from LISA do not necessarily mean local interaction between new firm formation and financial development are not important; rather this expresses the instability of the relationship between regional financial development and the new firms' start up decisions. Note that LISA cluster maps and correlation analysis are also carried out for the individual years and for individual sectors. Results are similar and available upon request.

$$I_i = (x_i - \overline{x}) \sum_j w_{ij} (x_j - \overline{x}). \quad (7)$$

All analyses highlight the spatial heterogeneity of financial development and new firm formation but they fail to construct a causal framework that would allow one to question the stability of the positive impact of finance. Nevertheless, decomposition analyses indicate that at local level there are different spatial regimes. In terms of cold spots, there are substantial similarities between new firms' formation and financial development. However a careful interpretation of local statistics show substantial fall in the ties between finance and new firms. Based on these contradictory results, construction of a causal framework becomes essential. Following Brunsdon, Fotheringham, and Charlton (1998), Fotheringham and Brunsdon (1999), Fotheringham, Brunsdon, and Charlton (2002), a Geographically Weighted Regression (GWR) is implemented. Our central aim is to obtain local parameter estimates for the impact of finance on new firms. Equation (8) is the general form of the GWR model where u and v give the location of i^{th} observation through space.

$$y_i = \alpha_i(u_i, v_i) + \beta_i(u_i, v_i) X_i + \delta_i(u_i, v_i) Z_i + \varepsilon_i. \quad (8)$$

Fotheringham, Brunsdon, and Charlton (2002) observe that GWR analysis spatially weights the observations, where the weight represents the neighbouring effects in a given bandwidth. The optimal bandwidth, which can be fixed or adaptive, is determined by a number of different criteria; Akaike Information Criteria (AIC), Bayesian Information Criterion (BIC) and Cross Validation (CV). Fotheringham, Brunsdon, and Charlton (2002) mention that a fixed kernel may create high variance based on the size of the data, yet an adaptive kernel will be able to control for the size effects. We conducted the GWR analyses by using an adaptive kernel function throughout the analyses. All estimations are done by using the GWR 4.0 software, which is developed from its initial versions by Tomoki Nakaya, Martin Charlton, Paul Lewis, Chris Brunsdon, Jing Yao, and Stewart A. Fotheringham (Tomoki Nakaya 2014a). GWR methodology has started to gain increasing attention among scholars (Yefang Huang and Yee Leung 2002; Longhi, Nijkamp, and Poot 2006; Dan-Lin Yu 2006; Hans-Friedrich Eckey, Reinhold Kosfeld, and Matthias Türck 2007; Nadir Öcal and Julide Yıldırım 2010; Vicente Royuela, Rosina Moreno, and Esther Vaya 2010; Steven Deller 2011; Huaqun Li, Shaoming Cheng, and Kingsley E. Haynes 2011). Similarly, Robert J. Breitenecker and Rainer Harms (2010) and Breitenecker and Erik J. Schwarz (2011) for Austria; Cheng and Li (2010, 2011) for the United States applied GWR to understand the spatial variability of the determinants of new firms. In general given

the unique nature of GWR, it has ability to contribute to regional policy making. Kamar Ali, Mark D. Partridge, and M. Rose Olfert (2007) remark that standard analysis that neglects the spatial imbalances are harmful for policy design. Disregarding the local variations will create a mismatch between policy and local realisations. Therefore, application of GWR for Turkey is important as the outcomes of the analyses will contain information about the way that promoting the accumulation of financial capital will stimulate creation of the new firms in certain locations.

The time dimension is an important aspect while applying the GWR framework. Since GWR observes the cross section variability, time dimension is mostly neglected. However, neglecting the time dimension may result in loss of information. Following Longhi, Nijkamp, and Poot (2006), we considered individual years separately and we implemented GWR procedures for each of the years as well as the 2002 to 2009 average figures. Application of GWR in a panel setting is a recent discussion. Simon P. Blainey and John M. Preston (2013) discussed the use of panel GWR type of models and recently Yu (2014) applied the GWR model in a panel setting. Within this study, the cross section GWR models are preferred and sample years are considered separately. The reason for doing this is to understand not only the spatial heterogeneity patterns but also the path of spatial instability through time. This will guide in our evaluation of the overall relationship by considering not only the path of spatial dependence but also the path of spatial instability, both of which are crucial for policy construction. One final note is on the sample size of GWR models. Antonio Páez, Steven Farber, and David Wheeler (2011) underlined that for relatively small samples GWR results should be interpreted with caution. Sample size is an important dimension of GWR estimation. However still GWR estimations are carried out as the central objective of the research is best understood by following an empirical strategy allowing the observation of spatially varying coefficient estimates. We continue to rely on the current structure of the cross section GWR models. Also see Huand and Leung (2002) for Japan, Öcal and Yıldırım (2010) for Turkey who implemented GWR methodology for relatively small sample sizes. We will conduct a number of diagnostic checks to validate the strength of the GWR models.

Tables 12 and 13 give the results for all lines of production considering 2002 to 2009 averages. For each variable, it is possible to trace the variability and the range of the distribution. Moreover, we conducted three set of diagnostics to compare GWR (local) models with its global variants. First, we compare information criterion (AIC) and *R*-squared between local and global models. Second, we implemented overall improvements of the GWR model over residuals *via* GWR ANOVA analysis. As a third diagnostic check; instead of Monte-Carlo based stability tests offered by Fotheringham, Brunsdon, and Charlton (2002), we performed a more recent parameter geographic variability test as offered by Nakaya et al. (2005) and Nakaya (2014b). This test is the model comparison of the fitted GWR model and a model in which the coefficient of the tested variable is kept fixed and the other variables are left as in the fitted GWR model. The same criteria with the bandwidth selection are compared between two models, where the smaller yields a better fit with respect to the other. In the case of a negative diff. AIC, the fitted GWR model is observed to be performing better, in favour of the parameter geographic variability.

Table 12 GWR Results for 2002-2009 Averages (A)

	Minimum	Maximum	Median	Lower quartile	Upper quartile	Range
Per capita deposits	-0.035	0.086	-0.0005	-0.008	0.073	0.122
Population density	-0.00003	0.0001	0.00006	-0.000003	0.00009	0.0002
Education quality in HS	-0.406	-0.004	-0.061	-0.2932	-0.046	0.401
Public expenditures	2.329	4.029	3.302	2.978	3.421	1.699
Per capita elec. (ind.)	-0.052	0.005	-0.023	-0.038	-0.0001	0.057
Per capita elec. (trade)	0.111	0.300	0.215	0.136	0.243	0.188
Number of observations	81					
Diagnostics for spatial variability						
AIC (global)	-169.29					
AIC (local)	-180.82					
R^2 (global)	0.88					
R^2 (local)	0.91					
GWR Anova table	***SS***	***DF***	***MS***	***F***		
Global residuals	0.470	74.000				
GWR improvement	0.178	13.210	0.013			
GWR residuals	0.292	60.790	0.005	2.811304		
Geographically variability test of local coefficients						
Per capita deposits	-253.497					
Population density	3.967					
Education quality in HS	-134.834					
Public expenditures	0.504					
Per capita elec. (ind.)	-0.092					
Per capita elec. (trade)	-88.933					

Notes: GWR Anova table gives the summary results to compute the *F*-statistics. Geographical variability test originates from Nakaya (2014a).

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Results of the GWR models show a sizable spatial variability exists while defining the relationship between regional financial development and formation of new firms. For *per capita* deposits, spatial variability measured by the range of the distribution is higher compared to *per capita* credits; for both variables we detect some regions in which relationship between finance and new firm formation turns out to be negative, unlike our expectations. This interesting finding contradicts findings obtained from global models. Note that a similar spatial variability pattern is also observed for other control variables. Regarding the validity of GWR models, our diagnostic tests validate that GWR is superior to global models: (a) *R*-squared is maximised in GWR, AIC is minimised in GWR; (b) GWR ANOVA test clearly shows improvement in GWR residuals (*F*-test results are significant at 5% significance level); (c)

negative values obtained from geographical variability test indicate sizable spatial instability for *per capita* deposits and credits. While results of GWR and panel models do not correspond on every point, still these results reveal that defined mechanisms between finance and new firm formation may have local instabilities (we would like to thank to the anonymous reviewer for underlining the need for careful interpretation of GWR results).

Table 13 GWR Results for 2002-2009 Averages (B)

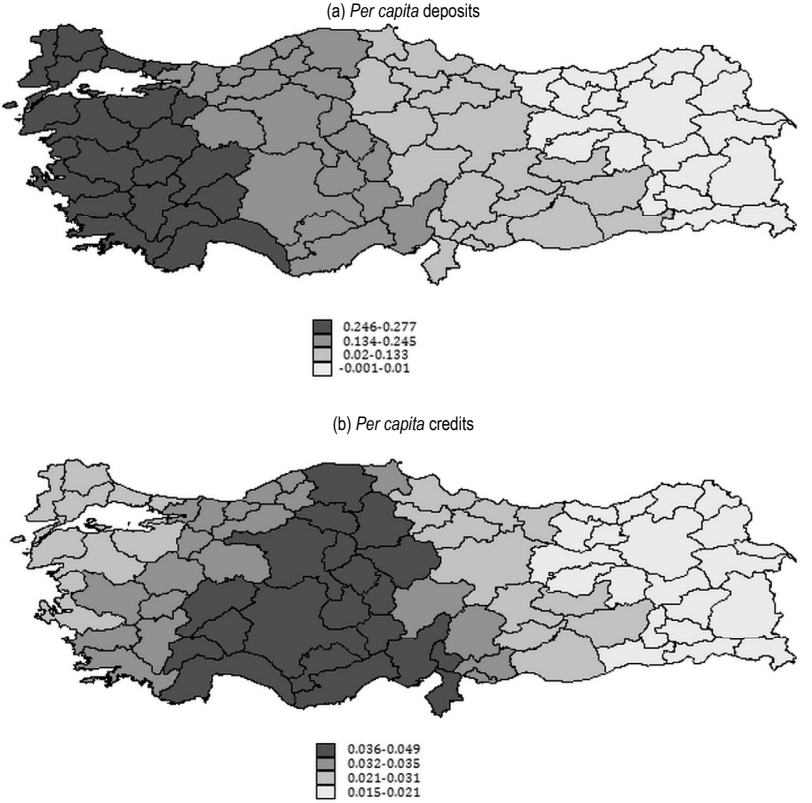
	Minimum	Maximum	Median	Lower quartile	Upper quartile	Range
Per capita credits	-0.021	0.038	-0.004	-0.011	0.011	0.060
Population density	-0.00004	0.0001	0.00005	-0.00002	0.0001	0.0002
Education quality in HS	-0.234	-0.00003	-0.055	-0.128	-0.031	0.234
Public expenditures	2.277	4.017	3.319	2.946	3.650	1.739
Per capita elec. (ind.)	-0.043	0.005	-0.019	-0.025	-0.0005	0.048
Per capita elec. (trade)	0.116	0.307	0.234	0.138	0.280	0.191
Number of observations	81					
Diagnostics for spatial variability						
AIC (global)	-169.07					
AIC (local)	-176.60					
R^2 (global)	0.88					
R^2 (local)	0.90					
GWR Anova table	***SS***	***DF***	***MS***	***F***		
Global residuals	0.471	74.000				
GWR improvement	0.165	13.269	0.012			
GWR residuals	0.306	60.731	0.005	2.459234		
Geographically variability test of local coefficients						
Per capita credits	-240.809					
Population density	3.358					
Education quality in HS	-291.207					
Public expenditures	-2.080					
Per capita elec. (ind.)	1.924					
Per capita elec. (trade)	-46.021					

Notes: GWR Anova table gives the summary results to compute the *F*-statistics. Geographical variability test originates from Nakaya (2014a).

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Figure 6 shows regional dispersion of spatial variability obtained from GWR models for 2002-2009 averages. The idea is to observe the coefficient estimates for

each region. Similar analyses are performed for the individual years and sectors. These analyses with similar results are all available upon request. In general, the western territory benefits more from the accumulation of financial capital. It is less likely that formation of the new firms in east is altered from the financial capital deepening. There is a minor difference between *per capita* deposits and credits spatial variability in western Turkey. While *per capita* deposits create an impact on the West very identical to that of the regional development and new firm concentration, dispersion of the spatial varying link between *per capita* credits and new firms have some marginal differences. Eastern and south eastern Turkey show a relatively weak spillover between credits and new firms; yet in terms of the strong positive ties, the highest impact is observed in the south and some central regions clustered around Ankara, the capital city. Western regions form the second and third set of clusters, showing strong ties between credits and new firms. Note that these regions have a high new firm formation rate as well as *per capita* deposit accumulation.



Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Figure 6 Spatial Variability of Coefficient Estimates from GWR

There may be different implications; one can be the ability of the newcomers to access capital markets rather than borrowing from money markets in the most developed areas. This side could not be identified within this study since there is lack of data on capital markets at the regional scale. Moreover it could also be the case that *per capita* credit, which includes the financing needs of both the supply and the demand side, may be reflecting the financing behaviour of the demand within this geography. In both cases, results obtained from the GWR estimations are not invoked as they all indicate the strength and weakness of the relationship in the West and East respectively. Finally, it has to be kept in mind that comparing GWR results with spatial distribution of finance and new firms make it necessary to talk about equity and efficiency. In other words, specific regional factors might be reason for the divergence between the influence of finance we detect in western and eastern Turkey (see next section for a detailed discussion).

As a final exercise, to understand the historical evolution of spatial variability, GWR models are estimated for individual years in the sample. This will enable one to observe the robustness of the spatial variability as well as to trace the path of geographical instability among the chosen financial development indicators. While reporting this, as a contribution, sectoral effects will also be considered and individual GWR models for manufacturing, services, and trade will also be estimated. The results of the historical evolution of spatial variability are reported in Tables 14, 15, 16 and 17. First, for the aggregated lines of production we detect higher spatial instability compared to individual sectors. In general, the impact of *per capita* deposits exhibit higher spatial heterogeneity once the range of the coefficient estimates is considered. This distinction is more visible for total production (see Table 14). By contrast, once historical evolution of spatial variability is observed for aggregated production, a significant rise in the range of the distribution is detected until 2007. This acceleration is more pronounced for *per capita* deposit's impact on new firm formation and can be observed easier for aggregated lines of production. Interestingly, there are local units in which financial development and new firm formation are inversely related. This evaluation is subject to the chosen financial indicator and investigated year of the sample. An overall assessment of the individual sectors prevail that spatial variability of the impact of finance diminishes once sectoral composition is considered. However, difference criteria reported in Tables 15, 16 and 17 indicate the significance of spatial heterogeneity for individual sectors. Spatial heterogeneity continues to dominate even when differences in production structures are considered. Only for the GWR models estimated for service based production do we fail to detect significant spatial variability of *per capita* credits for the years 2005 and 2007. At this stage, we discuss that what matters is not the size of the heterogeneity but it is the existence of spatial heterogeneities, especially in the form of inverse relationships. That is, not only the historical evolution of spatial instabilities matter; but also evidence indicating that impact of financial development on the start-up decisions of new firms. These factors have divergent impact that make it difficult to generalise.

Table 14 Historical Evolution of Spatial Variability (All Industries)

	Minimum	Maximum	Median	Lower quartile	Upper quartile	Range	Diff. of criterion
Panel A: *Per capita* deposits							
2002	-0.015	-0.0004	-0.002	-0.005	-0.001	0.015	-180.167
2003	-0.012	0.100	0.026	-0.004	0.091	0.113	-164.04
2004	-0.010	0.081	0.043	0.031	0.073	0.092	-168.21
2005	0.083	0.156	0.110	0.097	0.151	0.073	-188.240
2006	0.031	0.179	0.043	0.035	0.170	0.148	-161.35
2007	-0.013	0.175	0.024	0.00009	0.163	0.189	-95.98
2008	0.002	0.073	0.032	0.004	0.068	0.071	-23.309
2009	0.023	0.033	0.029	0.026	0.032	0.009	-54.043
Panel B: *Per capita* credits							
2002	-0.014	0.001	-0.002	-0.009	-0.0007	0.015	-141.09
2003	-0.014	0.005	-0.001	-0.003	0.0004	0.020	-98.67
2004	0.004	0.044	0.014	0.007	0.031	0.040	-332.68
2005	0.011	0.045	0.031	0.013	0.037	0.033	-139.88
2006	-0.004	0.077	0.034	0.005	0.047	0.082	-231.73
2007	-0.024	0.017	-0.010	-0.021	0.014	0.041	-0.764
2008	-0.013	0.010	0.0006	-0.008	0.008	0.024	-46.095
2009	-0.016	0.014	-0.005	-0.006	0.008	0.031	-96.87

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Table 15 Historical Evolution of Spatial Variability (Manufacturing)

	Minimum	Maximum	Median	Lower quartile	Upper quartile	Range	Diff. of criterion
Panel A: *Per capita* deposits							
2002	-0.004	0.003	-0.001	-0.002	0.002	0.007	-23.344
2003	-0.004	0.014	-0.0004	-0.004	0.011	0.018	-18.490
2004	-0.0006	0.039	0.007	0.001	0.035	0.040	-0.817
2005	0.012	0.039	0.022	0.014	0.035	0.027	-16.804
2006	-0.008	0.037	0.002	-0.001	0.024	0.046	-50.732
2007	-0.011	0.040	0.007	-0.006	0.035	0.052	-39.813
2008	-0.010	0.029	0.007	0.003	0.020	0.039	-209.517
2009	0.0007	0.008	0.004	0.003	0.006	0.007	-191.926
Panel B: *Per capita* credits							
2002	0.0003	0.003	0.002	0.0004	0.003	0.003	-25.228
2003	0.001	0.004	0.003	0.002	0.003	0.003	-127.973
2004	0.007	0.027	0.018	0.009	0.026	0.019	-332.406
2005	0.008	0.030	0.015	0.011	0.028	0.021	-100.810
2006	0.002	0.027	0.015	0.004	0.026	0.025	-157.738
2007	-0.003	0.019	0.002	-0.001	0.018	0.022	-6.647
2008	-0.0005	0.013	0.002	0.001	0.011	0.013	-65.577
2009	-0.001	0.019	0.001	0.0007	0.016	0.020	-43.692

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Table 16 Historical Evolution of Spatial Variability (Services)

	Minimum	Maximum	Median	Lower quartile	Upper quartile	Range	Diff. of criterion
Panel A: *Per capita* deposits							
2002	-0.006	0.002	-0.0005	-0.001	0.001	0.009	-140.59
2003	-0.009	0.028	0.003	0.001	0.023	0.037	-95.660
2004	-0.004	0.018	0.002	-0.002	0.016	0.022	-66.113
2005	0.010	0.037	0.026	0.021	0.029	0.026	-73.778
2006	0.010	0.075	0.029	0.017	0.066	0.064	-41.291
2007	0.019	0.079	0.034	0.020	0.071	0.059	-31.142
2008	0.008	0.059	0.025	0.015	0.052	0.050	-42.916
2009	0.012	0.076	0.028	0.022	0.064	0.063	-43.057
Panel B: *Per capita* credits							
2002	-0.007	0.0005	-0.002	-0.006	0.0001	0.008	-103.89
2003	-0.014	-0.001	-0.007	-0.012	-0.003	0.013	-103.080
2004	-0.015	0.015	0.007	-0.013	0.008	0.031	-224.692
2005	-0.022	0.014	0.005	-0.020	0.009	0.036	1.331
2006	s-0.021	0.030	0.006	-0.020	0.008	0.052	-35.392
2007	-0.015	0.004	-0.006	-0.013	0.002	0.019	0.441
2008	-0.027	-0.00002	-0.011	-0.023	-0.001	0.027	-21.898
2009	-0.027	0.001	-0.011	-0.024	-0.0005	0.029	-5.623

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

Table 17 Historical Evolution of Spatial Variability (Trade)

	Minimum	Maximum	Median	Lower quartile	Upper quartile	Range	Diff. of criterion
Panel A: *Per capita* deposits							
2002	-0.002	0.004	0.001	0.0008	0.002	0.006	-113.825
2003	-0.001	0.027	0.010	-0.00005	0.024	0.028	-120.604
2004	0.003	0.039	0.020	0.018	0.034	0.036	-19.100
2005	0.031	0.042	0.037	0.035	0.041	0.011	-59.764
2006	0.016	0.060	0.030	0.019	0.055	0.043	-30.370
2007	0.007	0.022	0.015	0.009	0.020	0.014	0.789
2008	0.011	0.026	0.016	0.013	0.023	0.014	0.479
2009	0.018	0.028	0.025	0.020	0.026	0.010	-50.488
Panel B: *Per capita* credits							
2002	-0.007	0.0005	-0.0006	-0.006	0.0002	0.007	-77.529
2003	-0.003	0.0003	-0.003	-0.003	-0.0004	0.004	-236.917
2004	0.001	0.019	0.010	0.003	0.019	0.018	-201.433
2005	0.001	0.016	0.011	0.002	0.015	0.015	-134.358
2006	0.007	0.013	0.009	0.008	0.013	0.005	-158.018
2007	-0.003	0.008	-0.001	-0.002	0.006	0.011	-1.202
2008	0.002	0.010	0.007	0.002	0.010	0.008	-0.888
2009	0.0004	0.006	0.002	0.001	0.005	0.006	-69.965

Source: Own calculations based on data from TBA (2015) and TurkStat (2015).

5. Discussion

As interest on formation of new firms increases, factors affecting the creation process of newcomers becomes more important. We have densely investigated different dimensions of the new firms' formations and we aim to enrich our findings from a number of different perspectives.

Cases investigating the factors affecting new firms' decisions are mostly from developed countries (Storey 1991; Fritsch 1992; Guesnier 1994; Mark Hart and Graham Gudgin 1994; Keeble and Walker 1994; Peter Johnson and Simon Parker 1996; David B. Audretsch and Fritsch 1999; Kangasharju 2000; Elisabet Berglund and Kurt Brännäs 2001; Catherina Armington and Acs 2002; Sam Youl Lee, Richard Florida, and Acs 2004; Audretsch, Erik E. Lehmann, and Susanne Warning 2005; Neils Bosma, Van Stel, and Suddle 2008; Jordi Jofre-Monseny, Raquel Marin-Lopez, and Elisabet Viladecans-Marsal 2011; Fotopoulos 2014; Renski 2014; Christian Hundt and Rolf Sternberg 2016). By contrast, evidence from developing countries is relatively rare (see Naude et al. 2008; Ghani, Kerr, and O'Connell 2014; Carla Daniela Cala, Miguel Manjon-Antolin, and Josep-Maria Arauzo-Carod 2016). For this reason, investigating Turkey as a developing country suffering from persistent regional imbalances brings to the fore new knowledge that offers more macroeconomic as well as developmental analyses to the new firm formation issue.

Few studies deal with the impact of finance on new firms (Keeble and Walker 1994; Reynolds 1994; Reynolds, Storey, and Westhead 1994; Sutaria and Hicks 2004; Naude et al. 2008; Fotopoulos 2014; Ghani, Kerr, and O'Connell 2014). In general, these studies control for the impact of financial development on new firm formation. However, none of them have an explicit aim of focusing directly on the finance and new firm connection.

More importantly, this study sought to discover specific links between finance and new firms by questioning the spatial varying relationship, something that had not been previously constructed. Overall spatial heterogeneity and the variability of different factors affecting the formation of new firms is a neglected issue in the literature. Breitenecker and Harms (2010), Cheng and Li (2010, 2011) and Breitenecker and Schwarz (2011), question the spatial varying relationships of the determinants of new firms. However none of the studies has specific focus on the impact of finance on new firms specifically. Moreover, considering the nature of Turkey as a developing country, results of the GWR models contain valuable discussions on economic and regional policies. In general we find out from GWR analyses that finance has stronger impact on new firms among the regions that are already financially more developed and dominated by more new firms. Among these geographies, finance is observed to be productive and significantly stimulates formation of more new firms. Contrary to those regions mostly located in the west and centre, there are regions with very low new firm formation and lower financial development mostly clustered among the eastern territory of the country. What makes the picture even more remarkable is the inability of financial development to stimulate more new firms within this same geography. These eastern regions, which are predominantly culturally isolated, geographically landlocked, and economically less developed require vital discussions for policy making. If these eastern regions have both low financial development and very low new firm

formation, then this could be interpreted as if more financial capital availability would stimulate formation of more new firms among these regions (considering the good practice of western regions).

However based on GWR results, one would naturally argue that financial development is unproductive to stimulate more new firms as links between finance and new firms are detected to be lower among the eastern regions of the country. This mechanism, which is mostly fed by the possible endogeneity between local financial development and regional economic conditions, makes one think more financial development will have negligible effect on the formation of new firms in some specific regions, i.e. eastern regions, unless some particular conditions are not satisfied. Inevitably the underlying explanation to identify which relation dominates the other and in which particular locations more financial development spurs new firms lies in observing the reasons that cause financial development to be less productive among some particular locations. Presumably local socio-economic environment, cultural factors, and institutional differences shape this distinction. This point stands as an important future research path and will have sizable implications for developing countries like Turkey (we would like to thank to the anonymous reviewer for underlining this issue).

Our study makes one more, final contribution is to the literature on Turkey. Secil Kaya and Yesim Üçdoğruk (2002) and Burak Günalp and Seyit Mumin Cilasun (2006) remark that profitability, competition, productivity, capital/labour intensity, returns to human capital, and borrowing cost influence the dispersion of the new firms among industries. Meanwhile Esma Gaygısız and Miyase Yesim Köksal (2003) accentuate that population density, qualification of the labour force, population growth, and unemployment rate will influence the formation of the new firms among regions. More recently, Karahasan (2015) argued that local demand, human capital development, and the cyclical nature of the economy explain the new firms' evolution regionally. Karahasan (2015) also notes that results are robust to the inclusion of spatial links as well as investigation of different industries. Even these studies contain sizable information on new firms in Turkey; once again they depart from ongoing study. In neither of the studies offer explicit discussion and control on the spatial heterogeneities. That is, findings of the study will create a new line of discussions among scholars on the instability of the overall relationship between specific regional properties and new firms' location decision for the Turkish experience with persistent instabilities.

Inevitably, findings of the study are unable to control for a number of issues. Lack of data prevents us from considering the possible impact of equity based regional financial development. Moreover, the centralised nature of the financial system in Turkey inhibits study to predict the level of financial capital mobility and the match between accumulation of financial capital and the use of financial sources. Finally, on the structure of new firms, we are only able to make a classification based on NACE 1.1. However, it would be informative if employment composition, size (large *versus* medium-small), institutional characteristics, and composition of new firms could also be examined. Once again, data availability prevents a more detailed discussion on the firms' characteristics.

Given these expected contributions and the listed shortcomings, findings of the study contain valuable insight for policy makers. First, findings validate that one policy

regarding financial development will not fit all regions. Promoting accumulation of financial capital by monetary and fiscal tools may have limited effects. New firms or individual entrepreneurs considering the formation of a new entity are more influenced by financial capital if they are in the already developed regions of Turkey. Meanwhile, for the eastern regions, the impact of financial capital accumulation has limited effect, reminding us that some other factors are concerns in less developed regions. To put this differently, one should also think of the conditions that would stimulate the effect of more financial capital development among the less developed eastern regions in Turkey. That is, two policy issues stand for eastern locations: (1) some other policy tools work well in the eastern and south eastern Turkey to promote the local business environment; (2) some other conditions or policy measures are necessary to increase the productivity of financial capital to support formation of more new firms. These stand as valuable future research paths.

6. Conclusion

Among different factors affecting the formation of new firms, financial capital and the ease of access to finance is important. Even a centralised financial system may mobilise financial capital without allowing for a one-to-one connection between source and use of funds; still evidence suggests local financial development is beneficial for new firm formation. Regarding the positive impact of finance on new firms; this study critically discusses whether this holds within a developing country once spatial variability is considered.

Our initial analyses indicate that new firms' dispersion, which mimics regional disparities in Turkey, are well explained by the extent of regional financial development. Regions with better financial development are attracting more new firms even once the spatial dependence and specific regional conditions are considered. Although this approach allows for incorporating spatial networks and spillovers, it basically fails to assess the level of local instabilities. The point here is even if the spatial panel models are able to control for the rise in the spatial dependence, they are unable to take into account the rising spatial heterogeneity from 2002 to 2009. This brings additional concerns about the representation power of the parameter estimates obtained from the first set of global models. Our second set of analyses validates this concern and indicates the existence of sizable local instabilities. Estimation results from the GWR models highlight the widening range of the impact of finance on new firms' decisions. The impact of financial development on new firm formation diverging while for the developed western regions regional financial development and new firm formation are strongly related. This impact tends to diminish in most of the eastern and south-eastern regions of Turkey. Results are robust for sectoral decomposition. Even for the global models, financial capital development explains new firms' formation; individual GWR models for manufacturing, services, and trade indicate the variability of the finance-new firm relationship. However, spatial variability is relatively higher once overall aggregated production lines are considered.

Findings of the study are crucial from a number of different perspectives. First, spatial dependence of new firm formation as well as regional financial development is persistent throughout the whole sample period. This suggests regional policy can be

effective beyond a limited geographical sphere as spillover property of regional implementations will give rise to externalities and positive economies between provinces. Second, rising spatial heterogeneity from 2002 to 2009 indicate the existence of different spatial regimes in Turkey. This makes local policy tools even more sophisticated. In other words, even when regional policies spillover geographically, the existence of different spatial regimes makes us expect different outcomes and results from similar sets of policies in Turkey. Moreover, there are some hidden mechanisms that make the global link between finance and new firms fail in some given geographies. In that sense, this paper demonstrates that controlling for spatial instabilities or heterogeneities are crucial as it enables us to discuss some indirect mechanisms through which some socio-economic dimensions of regions influence local economic activities. Given that controlling for spatial instabilities show more influence of finance on the developed locations, a single policy for all seems to fall short in explaining the low firm formation potential and realisation of the eastern and south eastern regions, which are socio-economically lagging behind the rest of Turkey. Discussing more flexible and adaptive regional policies while accounting for the level of spatial spillovers and networks, together with the existence of diverse spatial regimes and heterogeneities is an important dimension of regional policies in Turkey and other peripheral developing countries.

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