Geography of innovation and new firms in Turkey: Evidence from local and firm level data

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Extended Abstract

Among different factors shaping local economic growth, innovation and technological advances stand as core dimensions for policy makers. Actions and tools to promote more innovation, adjusting local labor force in terms of skills and education are key elements of the long lasting territorial cohesion debate within the advanced countries. Naturally, nation-wide and local policies are in effect to boost innovation and realize a more equal regional distribution. That said, we have relatively less talk for the developing world, where regional disparities play a crucial role in terms of growth and development. Besides, our knowledge for the locality of innovation and assessment of the factors shaping formation of innovative regions is extremely limited. Motivated from this gap, this paper aims to examine the geographical and firm level distribution of innovation in Turkey by exploring the spatial distribution of patent registrations. Within this setup our main interest is the possible influence of new start-ups as a key tool to promote innovation. The empirical strategy of the paper rests in a two-stage framework.

The first stage aims at examining the geography of innovation at aggregate level. Using a panel data from 1997 to 2020 at the NUTS III level we hypothesize that regions with more new firm formation are going to be more innovative. Regional innovation patterns are controlled by using patent applications (Per 100,000 population). New firm formation is measured in two ways: (i) the new firm start-ups (per 100,000 population) and (ii) the net firm formation (new firm start-ups- firm closures, per 100,000 population). Note that, because of data issue we form three sub-periods by collapsing the data: (i) 1997-2003, (ii) 2004-2013, (iii) 2014-2020. After controlling for a host of other factors that can also influence innovation results suggest that new firm formation significantly affects the innovation performance of regions. These results are robust to the inclusion of various spatial batteries (e.g. spatial spillovers) (Table 1 and 2) as well as the possible endogeneity of firm formation (Table 3). Note that, we use the market potential index by using the historical population figures in order to construct the instruments.

In the second stage, we focus on firm level data for the year 2015 that is representative at the NUTS II level. We hypothesize that controlling for a host of firm level determinants, firms that locate in regions with more new firm formation will be more innovative. Our second set of analyses from firm level data show that, after controlling for firm level heterogeneities the likelihood of being innovative is higher for those firms that locate in regions with more start-ups which we measure by the formation of new firms (Table 4). Here we use two firm level measures of innovation. Innovation is a binary variable taking a value of 1 if the firm engages in any kind of innovative activity (patent, trade-mark, copyright), zero otherwise. Process innovation on the other hand refer to other forms of daily business innovation (logistics, method, production etc.), again coded as a binary variable. Next, we augment the probit models by incorporating a spatial variable (spatial lag of new firm formation). Results reported in Table 5 suggest that proximity of the regions is also important for the firm innovation decisions. Those firms that locate in regions with a spatial proximity that host more new firms have higher probability of being more innovative.

We also estimate other models by grouping the regions into certain development classes. Results show that for each class new firms have an influence albeit this depends on the local factors as well as the level of development of the regions. Overall, our results confirm that territorial cohesion in innovation

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and firm level promotion of new ideas can be achieved by following territorial policies that ease the formation of new firms and that allow for an egalitarian competition at the local level.

Keywords: Innovation, new firms, spatial disparities, Turkey

JEL Codes: O30, R10, R11

Table 1. Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
New firms	0.162***	0.059*	0.076**	0.081**	0.048*	0.044*	0.039	0.046*	0.044*	0.029	0.079***	0.087***	0.068***
	(0.036)	(0.031)	(0.035)	(0.033)	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.030)	(0.032)	(0.022)
Rho					0.828***		0.774***	0.800***		0.760***	0.582***		-1.236*
					(0.047)		(0.054)	(0.055)		(0.066)	(0.157)		(0.662)
Lambda						0.890***			0.801***			0.608***	
						(0.039)			(0.054)			(0.217)	
New firms*W							0.034			0.193*			-0.832***
							(0.039)			(0.116)			(0.238)
Obs.	243	243	162	162	243	243	243	243	243	243	162	162	162
R2	0.249	0.409	0.520	0.538	0.442	0.275	0.445	0.437	0.275	0.382	0.435	0.489	0.466
Region count	81	81	81	81	81	81	81	81	81	81	81	81	81
Wald (rho=0)					305.25		208.57	209.1		134.51	13.71		3.48
					[0.00]		[0.00]	[0.00]		[0.00]	[0.00]		[0.00]
Wald (lambda=0)						529.33			216.75			7.84	
						[0.00]			[0.00]			[0.00]	
Wald (w*New firm=0)							0.76			2.74			12.18
							[0.38]			[0.09]			[0.00]
Regional controls	No	No	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes
Region FE.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE.	No	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Clustered (NUTS II) standard errors are in ( ), P-values [], *** p<0.01, ** p<0.05, * p<0.1

Table 2. Baseline Results II

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Net firms	0.158***	0.076**	0.080**	0.086**	0.055***	0.057***	0.053**	0.061***	0.056**	0.044**	0.083***	0.090***	0.067***
	(0.031)	(0.027)	(0.036)	(0.033)	(0.021)	(0.022)	(0.022)	(0.023)	(0.022)	(0.022)	(0.030)	(0.032)	(0.023)
Rho					0.796***		0.783***	0.791***		0.657***	0.579***		-1.076
					(0.046)		(0.046)	(0.061)		(0.104)	(0.158)		(0.655)
Lambda						0.882***			0.790***			0.592***	
						(0.038)			(0.060)			(0.227)	
Net firms*W							0.007			0.355**			-0.752***
							(0.025)			(0.163)			(0.247)
Obs.	243	243	162	162	243	243	243	243	243	243	162	162	162
R2	0.291	0.424	0.526	0.544	0.413	0.290	0.413	0.414	0.290	0.348	0.421	0.492	0.462
Region count	81	81	81	81	81	81	81	81	81	81	81	81	81
Wald (rho=0)					301.01		294.31	166.25		39.56	13.5		2.7
					[0.00]		[0.00]	[0.00]		[0.00]	[0.00]		[0.10]
Wald (lambda=0)						550.51			171.88			6.84	
						[0.00]			[0.00]			[0.00]	
Wald (w*Net firm=0)							0.09			4.71			9.28
							[0.76]			[0.02]			[0.00]
Regional controls	No	No	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes
Region FE.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE.	No	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Clustered (NUTS II) standard errors are in ( ), P-values [], *** p<0.01, ** p<0.05, * p<0.1

Table 3. 2SLS-IV Models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
New firms	0.344***	0.512***			0.358***	0.327***	0.356***	0.325***				
	(0.061)	(0.138)			(0.099)	(0.092)	(0.100)	(0.097)				
Net firms			0.297***	0.582***					0.346***	0.316***	0.344***	0.314***
			(0.046)	(0.167)					(0.093)	(0.087)	(0.094)	(0.091)
Observations	243	243	243	243	162	162	162	162	162	162	162	162
R-squared (centered)	-0.066	-0.738	0.064	-1.133	0.006	0.154	0.006	0.147	0.057	0.197	0.058	0.190
Number of id	81	81	81	81	81	81	81	81	81	81	81	81
First stage F statistic	107.47 [0.00]	24.16 [0.00]	153.86 [0.00]	21.45 [0.00]	20.76 [0.00]	19.39 [0.00]	20.65 [0.00]	20.69 [0.00]	22.33 [0.00]	19.97 [0.00]	22.52 [0.00]	21.03 [0.00]
Underidentification test	224.45 [0.00]	50.88 [0.00]	321.36 [0.00]	45.17 [0.00]	44.86 [0.00]	42.17 [0.00]	44.33 [0.00]	44.69 [0.00]	48.24 [0.00]	43.42 [0.00]	48.34 [0.00]	45.43 [0.00]
Weak identifcation test	107.465	24.158	153.861	21.448	20.765	19.394	20.653	20.687	22.326	19.969	22.518	21.029
Hansen J statistics	3.920 [0.05]	5.078 [0.03]	2.892 [0.09]	2.799 [0.09]	1.261 [0.26]	0.327 [0.56]	0.589 [0.44]	0.058 [0.81]	1.234 [0.27]	0.309 [0.58]	0.567 [0.45]	0.049 [0.83]
Regional controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exclude HK control	n/a	n/a	n/a	n/a	No	No	Yes	Yes	No	No	Yes	Yes
Cross Section FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Clustered (NUTS II) standard errors are in ( ), P-values [], *** p<0.01, ** p<0.05, * p<0.1

Table 4. Baseline Probit Models

	Panel A: y= Innovation						Panel B: y= Innovation (process)					
	1	2	3	4	5	6	7	8	9	10	11	12
New firms	0.154***		0.048***		0.312***		0.025***		0.044***		0.160***	
	(0.000)		(0.011)		(0.052)		(0.000)		(0.007)		(0.033)	
Net firms		0.177***		0.055***		0.357***		0.029***		0.050***		0.183***
		(0.000)		(0.013)		(0.059)		(0.000)		(0.007)		(0.038)
Obs.	5,581	5,581	4,465	4,465	2,159	2,159	5,581	5,581	4,465	4,465	2,159	2,159
Firm demography	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Firm integration (local)	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Firm capacity	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes

Notes: Clustered standard errors (NUTS II) are in parenthesis, *** p<0.01, ** p<0.05, * p<0.1

Table 5. Spatial Probit Models

	Panel A: y= Innovation						Panel B: y= Innovation (process)					
	1	2	3	4	5	6	7	8	9	10	11	12
New firms*W	1.352***		0.421***		2.731***		0.221***		0.386***		1.397***	
	(0.000)		(0.097)		(0.454)		(0.000)		(0.057)		(0.293)	
Net firms*W		1.344***		0.419***		2.715***		0.220***		0.384***		1.389***
		(0.000)		(0.096)		(0.452)		(0.000)		(0.057)		(0.291)
Obs.	5,581	5,581	4,465	4,465	2,159	2,159	5,581	5,581	4,465	4,465	2,159	2,159
Firm demography	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Firm integration (local)	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Firm capacity	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes

Notes: Clustered standard errors (NUTS II) are in parenthesis, *** p<0.01, ** p<0.05, * p<0.1