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Abstract

The purpose of this paper is to explore the determinants of innovative capabilities in an emerging country context. We focus more particularly on the impact of recent changes in SME policies in Turkey. Using a unique firm-level survey conducted on 45.000 SMEs, innovative capabilities of firms are assessed at three different levels; their innovation efforts, innovation decision and innovative intensity. We analyze and compare the impact of two different incentive schemes; one a purely financial support, and the second, consultancy and technological assistance coupled with financial facilities. Whereas all firms seem to benefit from financial support, only less innovative firms take full advantage of the advisory services. Overall, the determinants of innovative capabilities depend considerably on the type of firms, suggesting the need for differentiated policy measures.

Keywords: Small and Medium-Sized Enterprises (SMEs), technological capability building, innovation, SME policies

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1 Introduction

Small and medium-sized enterprises (SMEs) have emerged as important agents of industrial growth since 1980s, even though they account for a small part of overall research and development (R&D) investments (Acs and Audretsch, 1990; Cohen and Levin, 1989). It's now generally acknowledged that SMEs increase overall efficiency: they are considered to be the key to the development of technology and to the knowledge driven economy, bringing innovation to the market. Micro-enterprises and SMEs[3] are the emerging private sector in most countries, and thus constitute the base for private sector-led growth (Hallberg, 2000). Furthermore, given that the World Trade Organization (WTO) regulations forbid all industrial support policies with the exception of those for the promotion of SMEs, local development and R&D activities, the support for the SME sector is one of the main policy tools available to the developing countries to support its industries (Taymaz, 2001). In this context, accumulation of technological capability is crucial for the ability of small and medium manufacturing enterprises to make a significant contribution to local industrial development (Caniëls and Romijn, 2001).

Technological capability is defined as the knowledge, skills and experience necessary in firms to produce, assimilate, improve and develop technologies (Lall, 1992). This is not a straightforward process and can't be promoted simply by investing in and/or buying new technology, but by active technological learning and capacity building. Firms should invest in their own capabilities and develop skills and experiences in order to absorb, adopt or create new technologies. Capabilities here refer to routines that allow firms to combine efficiently their tangible and intangible assets, and to transform them into a marketing function (Dosi et al., 2000).

Several taxonomies of technological capabilities have been proposed in the literature (Kim, 1997; Lall, 1992). They can be categorized by their complexity or by their function. According to their complexity, capabilities can be viewed as routine or adaptive, compared to innovative and risky. It is possible to break down the capability notion by its function, into investment, production, linkages and/or innovation. However, these categorizations are rather indicative and do not aim to show a necessary sequence of learning.

Investment capabilities are the skills to identify needs, prepare and obtain the necessary technology, then design, construct, equip, and staff the facility, before a new facility is commissioned or existing plant is expanded (Salomon et al., 1994). Production capabilities range from basic skills like operation and maintenance to more advanced ones like adaptation or improvement. Linkage capabilities include establishing links among other enterprises, suppliers, sub-contractors and services firms, as well as with institutions such as universities,

[3] Although different countries are working with different classifications, we refer here to the definitions used by the SME Department at the World Bank: microenterprise up to 10 employees, total assets of up to $10,000 and total annual sales of up to $100,000; small enterprise up to 50 employees, total assets and total sales of up to $3 million; medium enterprise – up to 300 employees, total assets and total sales of up to $15 million (Ayyagari et al., 2003).

consultants, or development agencies: and therefore foster the diffusion of technology within the firm, and throughout the economy.

In this paper, we are interested in innovation capabilities of Turkish firms, that is the skills and knowledge required to make independent adaptations and improvements to existing technologies, and ultimately to create entirely new technologies (Romijn and Albaladejo, 2002). It is a difficult task to measure or evaluate adequately the innovation capability. Generally, knowledge creation is reduced to be the outcome of the R&D expenditures and the number of engineers, scientists, or high-skilled human capital. However, firms learn in a variety of ways, thus the innovation capability is composed by a number of sources, both internal and external to the firm. Whilst the internal processes that lead to technological capability building are training, learning by using and learning by searching (Dosi, 1988; Rosenberg, 1982), the external resources correspond to learning by interacting (Lundvall, 1988). Further to these internal and external factors, governments also should be concerned with capability building, especially in newly industrializing countries (Kim and Nelson, 2000). Government policies should stimulate the development of industrial technology capacity by re-enforcing institutional environment, strengthening financial institutions or reducing the risks and transactions costs (Hallberg, 2000).

Although a policy measure should aim to create an innovative and strong private sector regardless to the firm size, some areas are still very much size-related. One of these areas, and probably the most important one, is the access to external sources of finance. Small firms consistently report higher financing obstacles than medium and large enterprises (Beck et al., 2006). World Bank reports that the cost of finance is rated as a major growth constraint by over 35% of SMEs, and access to finance, by over 30% (Ayyagari et al., 2003). The impact of these obstacles is stronger in small firms than in large firms: financing obstacles have almost twice the negative effect on small firms' growth compared to the large ones (Beck et al., 2006). We expect these problems to be even more important in emerging countries, often characterized by under-developed financial markets where the information and enforcement problems are more likely to occur.

In this context, innovative small firms are more likely to be credit constrained, given the highly risky nature of R&D projects. The cost for searching, acquiring and/or creating new technologies is higher for small firms. Hence, carefully designed policy tools are often needed in order to increase SME's access to finance and to correct for their under-investment in technology.

The purpose of this paper is to evaluate the effectiveness of such policies, by analyzing their impact on Turkish SMEs. In line with the European harmonization programs, Turkey has recently established a business support infrastructure for SMEs, through a certain number of institutions, technology development centers and agencies, and by implementing credit and banking facilities. However, the extent of penetration of these programs into small firms has not been properly evaluated, mainly because of the lack of data (OECD-UNIDO, 2004).

We aim to fulfill this gap by conducting an empirical analysis on the determinants of innovation activities, by distinguishing between internal and external factors influencing technological capabilities, and highlighting the impact of policy measures. Given the complexity of measuring the innovative capabilities, we conduct an empirical analysis in three levels, by looking into innovative efforts, innovation decision, and innovation intensity of SMEs.

The focus here is on a particular policy area which is support and financial facilities. We seek to evaluate two different subvention schemes designed to develop SMEs' capabilities. The first one is the incentive certificates implemented by Undersecretariat of Treasury, whose aim is to support the Small and Medium Sized industry by offering exemptions from taxes, duties and fees, facilitating and increasing their credit usage and investments. The second one is Small and Medium-Sized Industry Development Organization (KOSGEB)'s support schemes, which consist of a wide range of financial, technical and/or managerial assistance and consultancy services. Our main objective is to evaluate to what extent these two policy tools affect small and medium sized firms' innovative capabilities.

The next section reviews briefly the national system of innovation in Turkey and existing policies on SME support. Section 3 presents the database and variables. Results will be discussed in Section 4. Section 5 concludes.

2 SMEs, capabilities and SME policies in Turkey

2.1 SMEs and their innovative capabilities

Turkish economy has longtime been characterized by high inflation, high real interest rates and public sector imbalances, leading to repetitive crises. The export-led growth strategy adapted in early 1980s came off with an export boom, but to the expense of real wages and a non-increasing gross fixed capital formation[4]. The burden of state economic enterprises and the heavy bureaucracy blocked a rapid liberal transformation. Furthermore, Turkey failed to implement adequate productive and technological policies to accompany its export promotion (Ozcelik and Taymaz, 2004).

Medium and small sized have a central place in Turkish economy. It has been highlighted that the growth of the last decade were relying on the SMEs, whose dynamism comes from a high level of profitability and a highly flexible labor market (CEPII, 2004). According to the latest Census of Industry and Business Establishments (2002), the Turkish firms' average size is around 4 employees and enterprises employing 1-49 persons constitute 99.41% of the total enterprises in Turkey (TSI, 2002). SMEs account for 61.1% of the employment and 27.3% of the value added, but only for 38% of capital investment, 10% of exports and 5% of bank

[4] For a comparative analysis of export-led growth strategies in Turkey and East Asian countries, see Rodrik (1995).

credit (KOSGEB-OECD, 2005). The small size of Turkish SMEs and their relatively small contribution to national output and exports is also revealed by international comparisons with similar countries. In transition economies, small firms' share of total turnover is around 14-31% and of exports, 20-44%, for an employment share of 15-20% (Serger and Hansson, 2004). In the East Asian countries, small enterprises tend to be more export-oriented, present in S&T-intensive sectors in highly competitive countries like Taiwan and South Korea, and in more labor-intensive industries in late-developers such as Malaysia, Thailand, Indonesia and Philippines; whereas in China, knowledge intensive small firms have higher productivity and capital intensity, but a lower export ratio (Lundin et al., 2007).

However, the picture is rather different when we look at the main science and technology indicators. Turkey is rather low-ranked, with a share of the R&D expenses in GDP of 0.59% (0.85%) in 2005 (2009), compared to 1.82% (2.01%) in EU-27. On the technology output side, the number of EPO (USPTO) patents per million people is 2.31 (3.82) in Turkey, whilst 113.8 (119.5) in EU-27[5]. But as pointed by the European Trend Chart Report, innovation performance may not be adequately measured by these data in a newly industrializing country such as Turkey. Although its performance is substantially lower than the EU level, Turkey is among the countries showing the fastest improvement in the Global Innovation Index (INSEAD, 2011). R&D expenditures almost tripled between 2002 and 2007; and between 2003 and 2005, the growth in total R&D expenditures reached 50%, well above the EU-27 (9%) (EU, 2010). We can therefore conclude that the country demonstrates a strong willingness to catch-up. Turkey also displays a relative strength in the areas of science and engineering enrolment at tertiary level and scientific and technical journal articles, as well as royalty and license fee payments and patent applications, compared to the Europe and Central Asia Region (World Bank, 2004).

2.2 A brief overview of Turkish SME policies

SME policies have been put in the agenda in Turkey only after mid-90s, and until recently, small and medium sized industry has particularly suffered from an unfavorable business environment, characterized by high inflation, exchange rate instabilities, recessions, fluctuation in GDP and introduction of adjustment policies. OECD points to six main weaknesses of the Turkish Support System for SMEs identified by the private sector representatives in Turkey as following: insufficient support mechanisms, non-availability of information on support mechanisms, insufficient knowledge of how to apply for the benefits, inability to obtain bank loans and equity financing, and excessive taxation (OECD-UNIDO, 2004). It has been reported that the recent programs providing credits/guaranteed funds to small businesses have experienced a lack of demand (Napier et al., 2004). This seems to indicate that besides the lack of capital, the lack of people with adequate entrepreneurial

[5] The data on Science and Technology Indicators comes from Eurostat.

skills to make use of the capital that is available is also critical.

There are several public organizations responsible for defining and implementing SME policies in Turkey, which lead to some coordination problems and effectiveness of ensuing schemes[6]. In 2003, a "SME Strategy and Action Plan" has been approved by the High Planning Council, indicating that policy changes should be implemented in the areas of finance, technology and competitiveness, which are the weakest points of Turkish SMEs[7]. In order to improve the overall the business environment, increase competitiveness and create sustainable growth, Turkey has also adopted an "Industrial Policy for Turkey" strategy in 2003, where promoting SMEs and entrepreneurship stands out as one of the main objectives. The SME Strategy and Action Plan and Industrial Policy strategy provide the basis for policies to enhance SMEs’ capacities. In line with the European harmonization programs, Turkey has also adopted the "European Chart for Small Enterprises", and hence committed itself to develop programs and projects in ten areas specified by the Charter. These ten key areas are education and training for entrepreneurship, cheaper and faster start-ups, better legislation and regulation, availability of skills, improving the online access, getting more out of the Single Market, taxation and financial matters, strengthening the technological capacity, making use of successful e-business models and developing top-class small business support and developing stronger, more effective representation of small enterprises’ interest at Union and national level.

However, the extent of penetration of these programs into small firms has not been properly evaluated, mainly because of the lack of data. In this paper, we are interested in the impact of two policy tools; one resulting from the new legislations; the support scheme offered by KOSGEB, and the more traditional second one, State-supported incentive certificates implemented by the Undersecretariat of Treasury.

The first scheme, on the other hand, is a wide range of measures offered by KOSGEB which consists not only on low-interest loans, but also technical and managerial advices, training programs and laboratory services. Between 2003-2007, 44 544 small and medium sized enterprises have benefited from KOSGEB’s support schemes. Furthermore, SMEs using this scheme are rather well represented in the database as it is collected by KOSGEB.

The second scheme consists in investment and working capital credits that are provided for investors with incentive certificates. These incentive certificates are given within the

[6] The Ministry of Industry and Trade is the primary authority for SME policies through KOSGEB. The Undersecretariat of State Planning Organization is responsible for planning long-term development plans that also covers SME policies. The Undersecretariat of Treasury is responsible for state aids to SMEs, whilst the Undersecretariat of Foreign Trade develops programs to foster the export activities. Finally, Halkbank could be seen as the main financial institution to support small and medium sized industry (Isik, 2005). There are also a number of institutions to promote he SMEs such as Scientific and Technical Research Council of Turkey, Turkish Patent Institute, Ministry of National Education, Turkish Union of Chambers and Commodity Exchange, to name a few.

[7] SME Strategy and Action Plan, which formulates a road map for SMEs has been prepared by the “SME Study Group” composed of Ministry of Industry and Trade, Undersecretariat of State Planning Organisation (SPO), Undersecretariat of Treasury, Undersecretariat of Foreign Trade (DTM), State Institute of Statistics (SIS), Small and Medium Industry Development Organisation (KOSGEB), Turkish Union of Chambers of Commerce, Industry, Maritime Trade and Commodity Exchanges (TOBB), Confederation of Tradesmen and Artisans of Turkey (TESK) and has been approved by the High Planning Council by its decision dated 10 November 2003.

framework of the Resolution on State Aid for SME Investments, which is implemented by the Undersecretariat of Treasury's General Directorate of Incentive and Implementation. Furthermore, within the scope of incentive certificates, SMEs are also entitled to make use of exemptions from customs duty and Mass Housing Fund; investment allowance; VAT exclusion; and taxes, duties and fees exemption (KOSGEB - OECD, 2005).

3 Database, Variables and Empirical Methodology

3.1 Database

We use a unique firm-level survey data collected by Small and Medium-Sized Industry Development Organization (KOSGEB) in 2005[8]. The original database covers 50 347 SMEs mainly in manufacturing sector[9], where 71.83% are small firms employing less than 25 people and only 0.05%, more than 150 people. 71% of the firms are founded after 1980, so our sample has also old and established firms as well as new entrants.

The survey gives information about the educational level of the employees, machinery and equipment, technological infrastructure, number of quality certificates and labels, and the exporting activity. Besides, we also have some information about the access to financial markets, such as the type of loans, the incentives and credits -if any- that the firms have benefited from. Moreover, the survey also has information on whether a firm has a patent or a utility model[10]. We also know whether firms are performing any research and development activities, they have a research laboratory or rely on any technological outsourcing.

Earlier studies analyzing the determinants of innovation in Turkish manufacturing firms with data from Turkish Statistical Institute (TSI)[11] highlight a non-linear relationship between the innovation capacity and market structure, as well as with the firm size, suggesting therefore an unexpected higher innovation propensity for SMEs compared to larger firms (Pamukçu and Cincera, 2001). However, SMEs do not seem to enjoy less internal flexibility

[8] The lack of longitudinal data does not seem to be a major problem, since the entry and exit of small firms are mostly conducted by the sake of tax corruptions in Turkey. Anecdotical evidence suggest that a considerable part of the small Turkish firms prefer to exit the market, and to re-enter with a new name and tax number in order to benefit from the tax incentives. For a comprehensive analysis on entry and exit rates in Turkish manufacturing industry see Pamukcu and Taymaz (2010). The authors point that both entrants and exitors are smaller than average surviving firm.

[9] There are only 3% of the firms performing in Computer and Related Activities (NACE 72).

[10] Utility models are a form of patent-like protection for minor or incremental innovations, which tend to protect the func¬tional aspect of a product. The main difference between utility models and patents lie on the cost of application and the length of protection. Utility models are very common in the mechanical, optical and electronic fields and played an important role in the industrial development of countries like Germany and Japan, as well as South Korea and India (Suthersanen, 2006).

[11] Note that the percentage of innovating firms are considerably low in KOSGEB database that we use in this paper compared to TSI Data, and the industrial distribution of innovative activities by firm size do not correspond to the one revealed by TSI. This is due to the different methodologies, definitions and particularly to the differences in sample sizes. TSI follows the methodology of Community Innovation Surveys, and hence innovator firms are those who introduced either (i) a product improvement; (ii) a new product for the market; (iii) a process improvement; (iv) use of new processes for production during the period 2000-2002. TSI survey has been sent to 8375 firms, with a response rate of 15%, whilst KOSGEB survey covers 50.347 SMEs.

advantages (in terms of technology and labor) compared to larger firms (Sak and Taymaz, 2004). Therefore this situation may be explained by the lack of innovativeness of large firms performing in traditional manufacturing sectors.

Another result shown by these empirical analyses relates to technological spillovers. Being a technology licensee, an exporter or having a foreign partner do not affect the probability to innovate (Pamukçu, 2003), and moreover, there is evidence about negative spillovers from multinational corporations in Turkish manufacturing industry, especially for the very small and very large firms (Taymaz and Lenger, 2004).

3.2 Variables

3.2.1 Indicators of innovation capabilities

Measuring innovative capabilities is a difficult task, especially in an emerging country context. Our data does not provide a direct measure of innovative activities[12]. Furthermore, given the inherent complexity of innovation process, and its less knowledge-intensive nature in emerging country SMEs, we chose to approximate the innovative capabilities at three different levels; namely the innovation efforts, the innovation decision and the innovation intensity. By doing so, we aim to reflect the whole spectrum of innovative activities in Turkish SMEs. At one end of the spectrum there are the less technology intensive SMEs; these are the firms that try to innovate, but we do not take into account whether they succeed or not. At the other end of the spectrum there are highly and persistently innovative firms, holding at least one patent.

Therefore, our first approximation of innovative capability is based on the question that asks whether the firm has attempted to develop new products. We use the answers to this question as an indicator of SMEs' innovation efforts: a dummy variable that equals to 1 if the firm has attempted (but not necessarily succeeded) to develop a new product, and 0 otherwise.

However, this definition might be too broad, and we risk to over-estimate the Turkish SMEs' innovative capabilities if we only look at innovation efforts. Hence we decide to use also the information on patents available in the dataset, i.e. whether the firm has been granted a patent, and the number of patents that a firm holds. A patent should fulfill the requirements of originality, non-obviousness and economically profitable use; and this definition corresponds to that of new ideas (Peri, 2005). Therefore, our second dependent variable, decision to innovate, will equal to 1 if the firm has a patent and 0 otherwise[13]. Although a noisy measure of innovation, patents have been widely used in the literature as an innovation

[12] We do not have a specific question on innovation activities (introduction of new or significantly improved product/process) as defined by the Oslo Manual and used commonly in innovation surveys.

[13] From henceforth, the terms "innovation decision" and "patenting" are used interchangeably. This is a choice for the sake of clarity; we are fully aware that all innovations do not result in patents..

output[14]. "

However, by only looking at the innovation decision, i.e. patenting, we risk to underestimate the capabilities of the knowledge-intensive, persistently innovative SMEs. Therefore, in the third specification, we limit our sample to innovative firms (i.e. firms that hold a patent and/or a utility model), and assess the determinants of technology creation by exploring their behavior. Our final dependent variable is thus the number of patents.

Table 1: Sectoral distribution of dependent variables

NACE	Tech. intensity	Share of : Sector in the sample	Firms attempting to innovate in the sector	Firms with patents in the sector	Firms with 2 or + patents in the sector Whole sample	Firms with 2 or + patents Innovative sample
15	LT	12.54	67	10.19	3.32	30.67
16	LT	0.30	73	5.62	2.25	40.00
17	LT	14.97	74	8.34	2.73	30.95
18	LT	2.99	79	8.60	3.28	37.18
19	LT	2.74	79	9.38	4.44	43.90
20	LT	1.89	63	3.76	0.90	20.00
21	LT	2.03	64	5.51	1.34	21.62
22	LT	1.25	64	1.08	0.27	14.29
23	MT	0.25	72	12.00	1.33	11.11
24	HT	3.61	85	10.04	3.47	30.58
25	MT	6.97	70	7.08	2.04	20.90
26	MT	5.54	69	5.31	1.22	20.83
27	MT	5.64	67	5.94	1.26	15.91
28	MT	8.18	72	5.37	1.07	13.33
29	HT	10.23	78	7.54	1.65	14.58
30	HT	0.19	91	5.26	1.75	33.33
31	HT	3.60	82	8.46	2.73	23.58
32	HT	0.33	88	6.19	1.03	11.11
33	HT	0.91	86	10.74	2.59	20.00
34	HT	2.48	73	5.32	1.36	18.52
35	HT	0.59	78	6.36	1.73	23.08
36	LT	12.48	73	7.78	1.90	20.77
37	LT	0.30	78	11.11	3.33	25.00

Table 1 shows the sectoral distribution of the sample, as well as the dependent variables. As expected, the major part of Turkish SMEs performs in low-tech sectors such as textiles and furniture manufacturing. Only 18 percent of our sample belongs to high-technology intensive manufacturing sectors. We see that on average, 73 percent of the SMEs in our sample have been trying to innovate, however only 8 percent has applied for a patent. The share of firms with more than 1 patent in the whole sample is only 2 percent. We also note that, with the exceptions of chemicals and optical instruments, the patenting activity is not concentrated in high-tech sectors; furthermore, firms that have more than one patent are highly present in low tech sectors.

[14] See Jaffe and Trajtenberg (2002), among others for a discussion on the use of patents statistics.

3.2.2 Independent variables

As briefly mentioned earlier, we consider two sets of independent variables to explain Turkish SMEs' propensity to innovate; factors internal and external to the firm. Description and sources of the variables are presented in Table 5, and the descriptive statistics in Table 6 in the Appendix.

In the first set of explanatory variables, we consider firm size, firm age, workforce qualifications measured by the ratio between the number of people with a higher degree over the total number of employees and whether the firm is investing in R&D[15]. The firm size in measured by the logarithm of the number of employees. Squared term of age is also introduced in order to account for potential non-linearity.

Other potential sources of technological learning inside the firm are the use of ICT, measured by the number of computers, the use of technology-intensive production process[16] and the number of quality labels belonging to the firm. The latter, measured by different quality labels and certificates, ranging from Turkish Standards Institutes Certificates to ISO labels, reflects SMEs' level of total quality management (TQM). TQM is a multidimensional, organizational dynamic capability, and hence is expected to be positively associated with innovation. Finally, the number of utility models, a potential innovation tool for developing economies, held by the firm is also taken into account.

As for the factors external to the firm, we consider traditional variables such as market structure, or firm's participation in international markets, as well as potential learning sources by taking into account subcontracting relationships, technology outsourcing or agglomeration economies.

The market structure, highlighted as the principal determinant of innovative activities in industrial economics (Arrow, 1962) is approximated by the share of four largest firms in a given sector. The relationship between market structure and innovation has so far yielded to ambiguous conclusions. Schumpeterian hypothesis states that firms with greater market power would be more able to finance their R&D as well as to appropriate the returns from their innovation (Schumpeter, 1942). However, empirical studies show that this impact of concentration on innovation depends on number of factors such as industrial characteristics, barriers to entry, types of R&D and/or strength of IP protection (Cohen et al., 1987, Gilbert, 2006).

We also take into account being a subcontractor with a dummy variable. Previous literature, largely illustrated by the Asian experience, argues that subcontracting relationships would increase knowledge diffusion in the SMEs, increasing hence their productivity (Okada,

[15] The database do not report the R&D expenses, so we use a dummy variable which equals to 1 if the firm is investing in R&D and 0 otherwise.

[16] We consider that a firm is technology intensive if it uses either programmable logic controller (plc), numerical controller (cnc) or robots in its production process.

2004; Kim, 1997). However, not all types of subcontracting relationships have the expected positive effects; larger partners can also transfer the burden of risks and costs on the subcontracted SMEs (Taymaz and Kilicarslan, 2005). Technology outsourcing is also a dummy variable that equals to 1 if the firm uses an external laboratory.

Agglomeration externalities are proven to have a positive effect on firms' productivity, and to play an important role on the regional development (Glaeser et al., 1992; Feldman and Audretsch, 1999). However, the literature is rather ambiguous on the underlying rationale of these externalities; that is whether the more specialized or on the contrary more diversified structures foster the innovativeness. In order to take into account the impact and the type of agglomeration economies, we introduce both Marshallian and Jacobian externalities into our regression at regional (NUTS 2) level.

Marshallian externalities are measured by the location quotient which shows the locational advantage of a region in a given industry[17]. Introduced by Florence (1939), the employment location quotient, ratio between the regional employment share for the industry and the industry's share of total employment, has been widely used to measure industrial agglomeration (See Beaudry and Schiffauerova, 2009).

Jacobian externalities correspond to the benefits gained from the industrial diversity in the region. This variable is constructed in two steps. First, a *Gini* index at the regional level is computed. As a Gini index close to 1 implies a highly concentrated region, we consider that 1 - *Gini* would correspond to the degree of diversification in regional production.

Finally, we control for SMEs' institutional environment. The capability building is wrapped in economic, political and social complexities; similar patterns may be observed between innovative activities and social, economic and political development. Especially in an emerging country context, the institutions -or the lack of them- have a direct effect on firms' capabilities. According to the social and economic development index calculated by the State Planning Organization, inequalities among Turkish cities and regions are very high (Dincer et al., 2003). We expect therefore the institutional variables to have a considerable effect on SMEs' innovation capabilities.

In order to reduce the number of existing indicators and to determine an adequate measure of the institutional environment, we conducted a factor analysis on different social and economic indicators at the NUTS3 (district) level. For this purpose, we first conducted a principal component analysis in order to discover the factor structure. Then, we fit the hypothesized factor structure to the observed data by using iterated principal factor analysis and applying the Kaiser criterion to confirm the unidimensionality of the factors. Three factors have been retained.

[17] We use location quotient ratios calculated by TUSIAD/SPO (2005).

Table 2: Rotated Factor Matrix

Variables (NUTS 3 Level)	Factor 1	Factor 2	Factor 3
Urbanization rate	0.435	0.135	0.180
Proportion of employers	0.489	0.306	0.322
Proportion of higher education graduates	**0.916**	0.041	-0.089
Schooling rates in technical schools	0.184	**0.541**	-0.058
Number of medical doctors*	**0.996**	-0.031	0.024
Number of hospital beds*	0.538	-0.034	0.198
Number of plots in OIZ	-0.102	0.281	**0.594**
Total capacity of power equipment	0.232	0.432	-0.044
Electricity consumption**	0.094	-0.126	**0.740**
Industrial value added**	0.089	**0.541**	0.284
Amount of indus., comm. and tourism credits*	-0.038	**0.599**	-0.003
Total public expenditures*	0.300	0.087	-0.343
Amount of investments with incentive cert.**	-0.067	**0.527**	-0.046
Consolidated budget revenues**	0.005	**0.738**	-0.066
Proportion of asphalt road	0.002	0.237	**0.581**

Iterated principal factors analysis, Oblique rotation.N=81, χ^2=632.82, p=0.000
Notes:*per 10.000 person, **per capita

These factors are of considerable interest as they provide some indication of the different dimensions of social and economic development (See Table 2). Factor 1 seems to reflect the quality of the human capital endowment at the district level. Indicators loading on Factor 2 indicate the extent of public investments available at the district level. Finally, Factor 3 points towards the capacity and the quality of infrastructure. These three factors will be used to reflect the characteristics of the institutional environment at the district level.

Finally, the policy tools that we analyze relate to financial facilities and support to the SMEs. Previous literature has shown that the smaller the enterprise, the more it is likely to have financial constraints. Information asymmetries in financial markets lead to adverse selection and moral hazard problems (Stiglitz and Weiss, 1981). The risk of credit rationing is increased when banks ask for collateral, as a substitute for information. Therefore, even in mature financial markets, the access to the capital could be difficult for the SMEs, who often lack resources to provide the collateral. Furthermore, in Turkey, both small and large enterprises view high innovation costs and lack of appropriate finance as the main barrier for innovation activities (Napier et al., 2004), as it is the case in many of the developing or emerging countries/economies (Beck et al., 2006). Furthermore, the cost of short-term financing has been found the highest in Turkey compared to the other European countries (EU, 2003). Following years of unstable and unfavorable macroeconomic environment characterized by high inflation, and a succession of deep recession and sharp up-turns, the crisis in 1994 and 2000-2001, credit availability to Turkish SMEs has been dramatically limited. Various programs have been created in order to support SMEs for many years, but in our study we will focus on only two of these policy tools. The first one is the incentive certificates, a purely financial tool, whose aim is to support the SMEs by offering exemptions from taxes, duties and fees, facilitating and increasing their credit usage and investments. The second one is Small and Medium-Sized Industry Development Organization (KOSGEB)'s support schemes, which consist of a wide range of financial, technical and/or managerial assistance and consultancy services[18]. For each policy tool, we introduce a dummy variable which takes the value of 1 if the firm uses the particular facility and 0 otherwise.

3.3 Estimation Method

In the first two specifications (i.e. determinants of innovative efforts and innovation decision), the dependent variable is a dichotomous qualitative variable, taking on the value of 1 when a firm attempted to develop a new product or has a patent and the value of 0 otherwise. Our estimation method is hence a binomial probit model, which allows us to explore how each explanatory variable affects the occurrence of innovative capabilities measured by different indicators.

In the third specification, we only take into account innovating firms, and the dependent variable is the number of patents held by a firm[19]. The non-negative and discrete nature of patent data advocates the use of count models. Poisson regression provides the standard framework to estimate count data[20]. However, the Poisson Model assumes equidispersion, i.e. equality between expected value and the variance, which makes it very restrictive. The non respect of equidispersion yields the same implications as heteroscedasticity in a model of Ordinary Least Squares (Cameron and Trivedi, 1998). Furthermore, the Poisson Model assumes homogeneity, given that the conditional expectation has a determinist form depending on the explanatory variables. Given the nature of our data, the non-consideration of specific effects may lead to overdispersion. Therefore, a negative binomial model which allows for the unobserved heterogeneity is used in our study.

4 Results

Prior to the econometric estimation, first the outliers have been removed. As we are working with a cross-section data, it is important to examine if there are possible outliers that might affect our results. Therefore we decided to remove some extreme values related to firm size and to the number of patents and utility models in order to reduce the skewness of these variables; this has been done by taking out values larger than the 99th percentile[21]. Together

[18] The list of the KOSGEB supports available to SMEs are presented in the Appendix (6.1).

[19] Although analyzing a sub-sample with only innovative firms is a deliberate choice in order to evaluate the determinants of capabilities in more technology intensive, persistently innovative SMEs which are different from the rest of the sample, we are aware that a selection problem might arise. We therefore estimated a Type 2 Tobit model where the number of patents have been considered as truncated variable. Tobit model imposes restriction on the effect of each regressor on the probability of patenting and patent intensity. The validity of this restriction can be tested against an alternative unrestricted form consisting on a separate probit for the probability of patenting and a truncated regression on patent intensity. The likelihood-ratio test rejects the null hypothesis that the restricted model (Tobit) is true, the two equation approach is therefore more appropriate than Tobit (LR = 870.29).

[20] For a survey on the specification and estimation of count models, see Greene (1994) and Winkelmann and Zimmermann (1995).

[21] Note that we do not know whether the outliers are the "real" observations or coding errors, therefore we preferred to remove than rather than to try to correct them.

with the observations with missing variables, 27% of the original sample has thus been eliminated, and our final sample has 29.570 firms[22]. 19 2-digit sectoral dummies as well as 11 NUTS-1 level regional dummies (not reported) have been added to each regression. Descriptive statistics are shown in Table 6.

Three models, following different factors that contribute to innovative capabilities, have been estimated for each specification. The first model assesses the impact of internal factors on innovative capabilities (Table 3 – Internal Factors). The second model distinguishes between the internal and external factors (Table 3 – External Factors). In the third model we introduce the two policy tools (Table 4).

Regarding to the internal determinants of Turkish SMEs' innovative capabilities, firm size is found to exert a positive effect on the innovative capabilities of patenting firms. Since Schumpeter (1942), larger firms have been acknowledged to have a critical advantage in innovation, given the costly and risky nature of R&D investments. With the firm size, the ability to achieve scale economies, diversify, and obtain funds and/or to offer higher wages also increases (Amsden, 2001; Cohen and Klepper, 1992)[23]. However, this positive impact of the firm size disappears when we take into account external factors. The impact of firm age, on the other hand, seems to depend on the type of innovative capability that we're analyzing. Age decreases the likelihood of innovative efforts, but increases the likelihood of patenting.

Innovative efforts are found to increase with a higher educated workforce. However, this positive effect disappears when we evaluate the innovation decision and the innovation intensity. A high ratio of employees with a degree indeed increases firms' innovative capabilities, but when it comes to patenting, a more specific type of education, such as degrees in Science and Engineering and technical skills may be more appropriate. However, our data does not allow us to have more precise measure of education level.

Overall, according to the first model, innovation efforts, innovation decision and the intensity of innovation have rather different determinants. As expected, the innovative efforts of Turkish SMEs seem to depend heavily on R&D investment, the use of technology intensive production processes, and the use of information and communication technologies. The decision for innovation, on the other hand, is found to be less dependent on ICT, but more on utility models. Finally, when we look at the innovation intensity, none of these internal factors seems to matter except the R&D. The results suggest that the more SMEs

[22] The KOSGEB database had 50.432 observations. However, 2239 of those firms had no information on the sector of performance, and 4, on the firm location. We also removed a further 1505 firms performing in Computer and Related Activities (NACE 72). The database thus obtained had 46.688 observations and is referred as the original database, which has been cleaned for outliers and missing values.

[23] Please note that the largest firm in our final database has 150 employees.

increase their innovative capabilities, the less they rely on internal factors. Furthermore, we find a negative impact of the number of utility models on innovation intensity, indicating a substitution effect between utility models and patents.

Table 3: Determinants of Innovation Efforts

	Internal Factors			External Factors		
	Innovation effort	**Innovation Intensity**	**Innovation decision**	**Innovation decision**	**Innovation Effort**	**Innovation Intensity**
Firm age	-0.0096***	0.024***	0.0069	-0.012***	0.024***	0.0076
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
Age squared	0.00014*	-0.00044***	-0.00011	0.00020**	-0.00041***	-0.00012
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Size	0.00098	0.0016**	0.0013*	-0.00043	0.0011	0.00093
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.16***	0.035	-0.012	0.17***	0.040	-0.0055
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
Nr of quality labels	0.019	0.22***	0.066***	0.0040	0.20***	0.060***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Use of ICT	0.014***	-0.0011	-0.00054	0.0093***	-0.0028	-0.00095
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Nr of utility models	0.41***	0.57***	-0.55***	0.37***	0.56***	-0.55***
	(0.06)	(0.04)	(0.05)	(0.06)	(0.04)	(0.05)
R&D	0.81***	0.18***	0.059**	0.80***	0.18***	0.059**
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)
Use of technology	0.11***	0.10***	-0.026	0.099***	0.12***	-0.022
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)
High-Tech Dummy	0.41*	-0.62**	0.071	0.50*	-0.68**	0.099
	(0.21)	(0.26)	(0.28)	(0.27)	(0.31)	(0.28)
Low-Tech Dummy	-0.077	-0.12	0.18	0.23	-0.18	0.27
	(0.16)	(0.19)	(0.14)	(0.48)	(0.57)	(0.69)
Factor 1: Human K				0.034***	0.017	0.026
				(0.01)	(0.01)	(0.02)
Factor 2: Public inv.				0.043***	0.045*	-0.061**
				(0.01)	(0.02)	(0.03)
Factor 3: Indus. infra				0.017	0.038*	0.058**
				(0.01)	(0.02)	(0.03)
Exporting				0.31***	0.15***	0.095***
				(0.02)	(0.03)	(0.03)
Outsourcing				0.11***	0.027	-0.0061
				(0.02)	(0.02)	(0.03)
Herfindhal index				0.0098	0.0016	0.0043
				(0.01)	(0.01)	(0.02)
Being subcontractor				-0.15***	-0.25***	-0.11***
				(0.02)	(0.03)	(0.04)
Marshallian ext.				0.029**	0.065***	0.059**
				(0.01)	(0.02)	(0.03)
Jacobian ext.				-0.29	0.016	0.38
				(0.18)	(0.28)	(0.27)
Constant	0.32*	-1.41***	0.19	-0.42	-1.56	-0.50
	(0.16)	(0.20)	(0.14)	(0.93)	(1.09)	(1.37)
Sectoral Dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Regional Dummies	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
N	29570	29570	2709	29570	29570	2709
Log-likelihood	-15455.44	-7345.56	-3299.28	-15249.76	-7270.96	-3289.91

Notes:*Significant at 10%; ** significant at 5%; *** significant at 1%.
Marginal Effects are reported for the first two specifications (innovation efforts and innovation decision).

We find that innovation intensity is highly associated with owning quality labels and certificates. These quality standards demonstrate the firms' ability to learn, adopt, and adapt specialized and codified knowledge. Even though certified management systems and/or quality labels require considerable economical expenses, especially for the small firms, the expected benefits also seem to be substantial. The result shows that alongside the usual positive effects such as increased profits and market shares, improved performance, ability to meet client expectations and facilities to participate in international markets: quality labels and certificates also improve the innovation abilities of small firms[24].

Potential learning sources external to the firm and available institutional supports are introduced into the regression in the second specification in Table 3 (External Factors). Exporting seems to be highly associated with innovative capabilities. This is consistent with the view that international trade carries knowledge flows, via technological spillovers (Coe and Helpman, 1995). Furthermore, competition in international markets is likely to yield to higher growth rates in exporting firms, mainly through technological change, in order to gain new market shares, or even not to lose the existing ones (Clerides et al., 1998; Bernard and Jensen, 1999; Hahn, 2004). However, the cross-section nature of our data does not allow us to assess the direction of causality between exporting and innovation. It is also possible that more innovative firms are more likely to export than the less innovative ones. While evaluating the impact of trade reforms on Turkish manufacturing sector' innovativeness during 1989-1993 period, Pamukcu (2003) has found that although innovative firms were more likely to participate in international trade, there was no significant impact of exports on the innovation decision.

Outsourcing increases innovation effort, suggesting a complementary relationship between internal and external innovative activities in the early stages of innovative capability building (Cassiman and Veugelers, 2002; Veugelers, 1997). This complementary effect disappears when we look at patenting and the number of patents.

Being a sub-contractor has a negative impact on innovative capabilities. Subcontracting has been reported to be an important channel of technology diffusion in other emerging countries, where the disembodied knowledge transmitted by vertical linkages foster the technological learning (Kim, 1997; Amsden, 2001), this does not seem to be the case for the Turkish SMEs. This finding is in line with previous work such as Pamukcu (2003) where impact of foreign subsidiaries has been found on technology diffusion. Especially in sectors where subcontracting translates in unequal power relations between SMEs and larger firms, being a subcontractor is found unlikely to increase small firms' innovative capabilities (Taymaz and Kilicaslan, 2005). This seems to be true even in the case of persistently innovative SMEs.

Besides exports, results show interesting results on the other potential spillover variables. We find evidence Marshallian externalities on innovative capabilities. On the whole, agglomeration effects arising from specialized production structures increase the innovative abilities of Turkish SMEs. Furthermore, more innovative the firm, larger is the externality effect.

[24] However, given the cross-section nature of our data, we can't rule out the possibility of a reverse causation, i.e. innovative firms are more likely to own quality labels and certificates.

Market structure, as approximated by the concentration ratio, although significant in earlier studies, here is only found significant for innovative efforts. Sectors' technological intensity has been approximated by two dummy variables, identifying high-tech and low-tech sectors (mid-tech intensive sectors being used as the reference category). Performing in high-tech sectors has a positive impact on innovation efforts, but an unexpected negative impact on patenting. It seems that SMEs in high-tech sectors try harder than those in middle-low tech sectors, but these innovative efforts do not always lead to patenting activities.

Table 4: Impact of SME policies

	Innovation Efforts		Innovation Decision		Innovation Intensity	
	Kosgeb Support	**Incentive Certificate**	**Kosgeb Support**	**Incentive Certificate**	**Kosgeb Support**	**Incentive Certificate**
Firm age	-0.013***	-0.012***	0.023***	0.023***	0.0072	0.0072
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Age squared	0.00022***	0.00020**	-0.00040***	-0.00040***	-0.00012	-0.00012
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Size	-0.00056	-0.00048	0.0010	0.0010	0.00087	0.00089
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Educational level	0.17***	0.17***	0.039	0.040	-0.0043	-0.0045
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
Nr of quality labels	-0.0050	0.0012	0.20***	0.20***	0.058***	0.056***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Use of ICT	0.0083***	0.0091***	-0.0031	-0.0030	-0.0011	-0.0011
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Nr of utility models	0.37***	0.38***	0.56***	0.56***	-0.55***	-0.55***
	(0.06)	(0.06)	(0.04)	(0.04)	(0.05)	(0.05)
R&D	0.80***	0.80***	0.18***	0.18***	0.056**	0.054**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Use of technology	0.096***	0.096***	0.12***	0.11***	-0.021	-0.025
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
High-Tech dummy	0.51*	0.51*	-0.69**	-0.68**	0.069	0.074
	(0.26)	(0.27)	(0.30)	(0.30)	(0.28)	(0.26)
Low-Tech dummy	0.23	0.22	-0.18	-0.19	0.23	0.19
	(0.48)	(0.48)	(0.56)	(0.56)	(0.68)	(0.66)
Factor 1: Human K	0.035***	0.035***	0.017	0.016	0.026*	0.026*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Factor 2: Public inv.	0.045***	0.044***	0.046**	0.048**	-0.060**	-0.058**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
Factor 3:Indus. infra	0.014	0.019	0.040*	0.036	0.057**	0.059**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
Exporting	0.30***	0.31***	0.14***	0.14***	0.090***	0.086***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Outsourcing	0.10***	0.11***	0.025	0.027	-0.0073	-0.0045
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Herfindhal index	0.0097	0.0097	0.0015	0.0012	0.0035	0.0023
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Being subcontractor	-0.15***	-0.15***	-0.25***	-0.25***	-0.11***	-0.12***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)
Marshallian ext.	0.030**	0.028*	0.065***	0.064***	0.060**	0.056**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
Jacobian ext.	-0.32*	-0.30	0.00029	-0.0019	0.37	0.38
	(0.18)	(0.18)	(0.28)	(0.28)	(0.27)	(0.27)
Kosgeb support	0.13***		0.063**		0.053	
	(0.02)		(0.03)		(0.03)	
Incentive certificate		0.089***		0.13***		0.13***
		(0.03)		(0.04)		(0.04)
Constant	-0.39	-0.41	-1.53	-1.52	-0.42	-0.34
	(0.93)	(0.93)	(1.09)	(1.09)	(1.37)	(1.31)
Sectoral dummies	yes	yes	yes	yes	yes	yes
Regional dummies	yes	yes	yes	yes	yes	yes
N	29570	29570	29570	29570	2709	2709
Log-Likelihood	-15235.27	-15245.62	-7268.66	-7265.37	-3289.18	-3286.83

Notes:*Significant at 10%; ** significant at 5%; *** significant at 1%. Marginal Effects are reported for innovation efforts and innovation decision specifications.

Regarding the institutional framework, the human capital index affects only the innovation decision of small and medium-sized firms whereas the industrial infrastructure seem to foster both innovative efforts and innovation decision. However, we found a negative impact of the public investment at the district level on SMEs' innovative intensity.

Table 4 present specifications where we introduced the two policy tools. The first one is KOSGEB support, which also includes consultancy and technological support as well as financial facilities; and the second one is the incentive certificates, which consist mainly of financial facilities. The results show that the incentive certificates, a purely financial support, increases the innovative capabilities of Turkish SMEs. However, the support and facility program proposed by KOSGEB do not increase the number of patents. We may conclude that KOSGEB support, who provides not only low-interest loans, but also advisory services and technical and managerial assistances, are mainly beneficial at the first stages of the innovation process.

5 Conclusion

This paper has analyzed the determinants of innovative capabilities in Turkish Small and Medium-Sized Enterprises, with a particular emphasis on the impact of SME policies on financial and/ or technical support. Three different specifications have been used in order to evaluate fully the innovative capabilities: the innovative efforts, the decision to innovate and the intensity of innovation in Turkish SMEs.

The innovative efforts are highly associated with R&D investments, exporting, and utility models, Educational level of the employees, outsourcing, use technology intensive production processes and ICT also arise as important determinants of innovative efforts. The innovation decision, i.e. patenting, is also associated with R&D investments and the use of technology intensive production processes; and is correlated with owning quality labels and utility models.

Whereas, once the firm becomes innovator, its propensity to innovate does not depend anymore on the use of technology or ICT. This result may be explained by the higher percentage of technology users among the innovative sample. It appears that these factors do not determine for the extent of innovative activities. The innovative performance is associated with R&D and mainly the number of quality labels and certificates.

We found evidence of Marshallian externalities, i.e. agglomeration effects arising from specialized production structures increase the innovative capabilities of Turkish SMEs. Furthermore, the industrial diversity appears to have a negative effect at the early stages of innovative capacity building. The institutional environment, particularly the human capital and public investment at the regional level seems particularly important for innovative efforts and patenting. However, the negative relationship between the public investment and the capabilities of persistently innovator SMEs point to a location disadvantage; innovative firms have a lower patenting intensity in poorer districts.

The impact of SME support programs varies according to the level of innovative capabilities. The most effective public support to increase the innovative efforts is the financial and advisory services provided by KOSGEB. For relatively more innovative firms, the financial support seems to have a higher positive impact. For persistently innovative firms, only financial support matters. Our results suggest that at the early stages of innovative capacity building SMEs need more than just financial support. Although access to finance remains a real problem in Turkish SMEs, access to scientific and non-scientific knowledge also appears as an important barrier to innovation.

Overall, the determinants of innovative capabilities depend considerably on the type of SMEs, suggesting the need for differentiated policy measures according to the firms' existing technological capabilities. Given the high impact of the use of technology-intensive processes and industrial infrastructure on innovation capabilities, there is a clear need for a broader spread of technologies throughout Turkey, where there is important regional disparities. Agglomeration economies also appear to be a driving force behind the knowledge creation, and emphasize the importance of networking and interactive learning. Finally, our study show that Turkish SMEs haven't reached yet the status of knowledge-based, innovative, internationally competitive small firms, that are acknowledged to be the engine of growth in more developed countries.

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6 Appendix

6.1. List of Kosgeb Supports:

1. Consultancy and Training Supports
a. SME Development Consultancy
b. SME Development Training

2. Technology Development and Innovation Supports
a. Technology Research and Development Support
b. Industrial Property Rights Grant

3. ICT Supports
a. Computer Software Support
b. E-Trade Support

4. Quality Improvement Supports
a. General Test-analysis and Calibration Support
b. Test-Analysis Support for CE Marking
c. System Certification Support

5.Market Research and Export Promotion Supports
a.Support for Participating in Domestic Industrial Fairs
b. Support for Participating in Domestic Fairs with International Features
c. Support for Participating in Foreign Fairs Within the National Level Organizations
d. Support for Participating in Foreign Fairs Out of National Level Organizations
e. Trademark Promotion Support
f. Brand Development Support

6 Supports for the Development of International Cooperation
A Participation in Business Trips for Export Purposes
b.Twinning Support

7.Regional Development Supports
a.Local Economic Research Support
b.Support for the Purchase of Machinery-Equipment for Common Use
c.Infrastructure and Building Construction Project Preparation Support
d. Support for the Recruitment of Qualified Personnel

8.Entrepreneurship Development Supports
a.Establishment of Business Incubators
b.Start-up capital

Source: Muftuoglu (2009)

Table 5: Description of Variables and Sources

Innovation Efforts	Firms trying to innovate (yes/no)	KOSGEB
Patent Counts	Number of granted patents	KOSGEB
Patent	Patenting Activity (yes/no)	KOSGEB
Firm age	Number of years passed since the firm's creation	KOSGEB
Firm size	Number of employees	KOSGEB
Educational level	Average enrollment year	KOSGEB
Quality	Ownership of quality certificates and/or labels	KOSGEB
ICT	Number of computers in the firm	KOSGEB
Utility Model	Number of granted utility models	KOSGEB
R&D	Investment in Research and Development (yes/no)	KOSGEB
Technology	Use of plc, cnc and/or robots	KOSGEB
Export	Exporting Activity (yes/no)	KOSGEB
Outsourcing	Use of external laboratories and/or acquisition of external technology (yes/no)	KOSGEB
Concentration	Market share of the four largest firms in the industry (%) ISIC Rev.2 4-digit level	TSI
Being a subcontractor	Subcontracting (yes/no)	KOSGEB
Marshallian Ext.	Location quotient at NUTS 2 level $LQ = \frac{e_i/e}{E_i/E}$ where: e_i = Local employment in industry i e = Total local employment E_i = Reference area employment in industry i E = Total reference area employment	TUSIAD-SPO
Jacobian Ext.	Degree of diversification in regional production 1 - *Gini* at the NUTS 2 level $Gini_j = \frac{1}{2n^2 \bar{s}_j} \sum \lvert s_{ij} - s_{kj} \rvert$ where $s_{i(k)j}$ = share of industry i(k)'s employment in region j n= number of industries	TSI
Kosgeb Subvention	Use of KOSGEB subventions (yes/no)	KOSGEB
Incentive certificates	Use of incentive certificates (yes/no)	KOSGEB

Table 6: Descriptive Statistics for Sample Regression

	Mean	Std. Dev.	Min	Max
Innovation efforts	0.73	0.45	0.00	1.00
Patenting	0.08	0.26	0.00	1.00
Patent counts	0.11	0.44	0.00	4.00
Firm age	12.95	8.59	2.00	48.00
Firm Size	14.86	18.91	1.90	100.25
Education level	0.58	0.45	0.00	14.66
Number of quality labels	0.28	0.60	0.00	6.00
ICT	4.04	5.62	0.00	150.00
Utility model	0.04	0.25	0.00	3.00
R&D	0.40	0.49	0.00	1.00
Technology	0.33	0.47	0.00	1.00
Factor 1: Human Capital	1.64	1.65	-1.54	5.18
Factor 2: Public Investment	1.19	1.24	-1.23	3.61
Factor 3: Industrial Infrastructure	1.13	1.07	-2.26	2.75
Export	0.42	0.49	0	1.00
Outsourcing	0.37	0.48	0	1.00
Concentration Ratio	40.07	8.83	27.69	87.59
Being a subcontractor	0.37	0.48	0	1.00
Marshallian externalities	1.20	0.59	0	9.73
Jacobian externalities	0.34	0.14	0	0.50
Kosgeb subvention	0.18	0.38	0	1.00
Incentive certificate	0.09	0.29	0	1.00

Table 7: Correlation Table:

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	**Innovation efforts**	1.00																								
2	**Patenting**	0.08	1.00																							
3	**Patent counts**	0.07	0.87	1.00																						
4	**Firm age**	-0.0	0.05	0.05	1.00																					
5	**Firm age squared**	-0.0	0.03	0.03	0.95	1.00																				
6	**Firm Size**	0.07	0.06	0.06	0.10	0.07	1.00																			
7	**Education level**	0.07	0.00	0.00	-0.1	-0.1	-0.2	1.00																		
8	**Number of quality labels**	0.06	0.11	0.10	0.12	0.10	0.21	0.03	1.00																	
9	**ICT**	0.11	0.06	0.06	0.11	0.08	0.52	0.03	0.28	1.00																
10	**Utility model**	0.06	0.15	0.15	0.03	0.02	0.03	0.01	0.08	0.05	1.00															
11	**R&D**	0.28	0.07	0.07	0.02	0.02	0.10	0.07	0.14	0.16	0.07	1.00														
12	**Technology**	0.07	0.04	0.03	0.03	0.02	0.15	0.01	0.09	0.15	0.04	0.12	1.00													
13	**High Tech Sectors**	0.08	0.01	0.00	0.06	0.05	-0.1	0.15	0.17	0.07	0.06	0.13	0.03	1.00												
14	**Low-Tech Sectors**	-0.0	0.03	0.03	-0.1	-0.1	0.07	-0.1	-0.2	-0.0	-0.1	-0.1	-0.1	-0.1	1.00											
15	**Factor 1: Human Capital**	0.09	0.06	0.06	0.01	0.00	0.02	0.13	0.05	0.16	0.04	0.1	-0.0	0.15	-0.1	1.00										
16	**Factor 2: Public Inv.**	0.00	0.01	0.01	0.02	0.01	0.02	-0.0	-0.1	0.10	0.01	-0.0	0.03	0.02	0.04	0.30	1.00									
17	**Factor 3: Industrial Infra.**	0.09	0.05	0.06	0.01	0.00	0.06	-0.0	-0.0	0.13	0.02	0.06	0.04	0.01	0.03	0.29	0.19	1.00								
18	**Export**	0.17	0.08	0.08	0.06	0.04	0.30	-0.0	0.13	0.30	0.07	0.12	0.12	0.07	-0.0	0.18	0.11	0.18	1.00							
19	**Outsourcing**	0.07	0.03	0.03	0.02	0.01	0.09	0.03	0.10	0.09	0.03	0.08	0.08	0.06	-0.1	0.07	-0.0	0.05	0.14	1.00						
20	**Concentration Ratio**	0.01	0.00	0.00	0.02	0.03	-0.1	0.10	0.09	-0.0	0.03	0.02	-0.0	0.28	-0.2	0.00	-0.0	-0.1	-0.1	-0.1	1.00					
21	**Being a subcontractor**	-0.0	-0.1	-0.1	0.07	0.06	0.00	0.07	0.02	0.07	0.02	0.08	0.14	0.23	-0.4	0.07	0.07	0.04	0.04	0.11	0.00	1.00				
22	**Marshallian externalities**	0.01	0.02	0.03	0.00	-0.0	0.03	-0.0	0.01	0.01	0.01	0.01	0.02	0.05	0.07	-0.0	-0.1	-0.1	0.04	0.03	-0.0	0.00	1.00			
23	**Jacobian externalities**	0.06	0.04	0.05	0.00	0.00	0.05	0.03	-0.0	0.17	0.02	0.01	0.03	0.04	0.00	0.52	0.69	0.54	0.19	0.05	-0.0	0.09	-0.1	1.00		
24	**Kosgeb subvention**	0.09	0.04	0.05	0.08	0.06	0.15	0.03	0.20	0.19	0.05	0.10	0.08	0.10	-0.1	0.05	-0.0	-0.0	0.18	0.09	0.02	0.04	0.01	-0.0	1.00	
25	**Incentive certificate**	0.04	0.04	0.04	0.05	0.03	0.12	0.00	0.12	0.10	0.01	0.07	0.09	0.00	-0.0	-0.0	-0.1	-0.1	0.09	0.04	-0.0	0.02	0.03	-0.1	0.22	1.00