FACTORS AFFECTING SME PRODUCTION IN TURKEY : A PANEL DATA ANALYSIS

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I hereby declare that all information in this thesis has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work; otherwise I accept all legal responsibility.

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ABSTRACT

FACTORS AFFECTING SME PRODUCTION IN TURKEY : A PANEL DATA ANALYSIS

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In developed and developing economies Small and Medium Sized Enterprises (SMEs) play significant roles as in Turkey. In this perspective 99.8% of the total number of enterpreunerships, 73.5% of total employment and 57.8% of GDP belongs to SMEs. Nevertheless in Turkey most of studies about SMEs do not use micro data because of lack of data. The aim of our study is explaining the variable production of SMEs with independent variables number of employees, export value and spending in R&D in TL with micro data taken from TUIK. 86 firms are tested with balanced panel data. Since most of firms have no export or R&D department number of firms decrease. After appliying fixed and random effect models Hausman Test is performed. The results show that only number of employees is significant.

Keywords : SME, Turkey, Panel Data, TURKSTAT

ÖZET

TÜRKİYE'DEKİ KOBİ'LERİN ÜRETİMİNİ ETKİLEYEN FAKTÖRLER : PANEL VERİ ANALİZİ

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Küçük ve Orta Büyüklükteki İşletmeler (KOBİ'ler) gelişmiş ve gelişmekte olan ekonomilerde önemli rol oynamaktalar. Bu durum Türkiye için de geçerlidir çünkü toplam işletmelerin %99,8'ini, toplam istihdamın %73,5'ini ve GSYİH'nın %57,8'ini KOBİ'ler oluşturmaktalar. Buna rağmen Türkiye'de KOBİ'lerle ilgili yapılan çalışmaların sayısı düşüktür ve pek çoğu betimsel ya da kısıtlı bölgelere uygulanmış olan anket çalışmalarıdır. Bunun ana sebebi verilerin yetersiz olmasıdır. Ne var ki, Türkiye İstatistik Kurumu'nda (TÜİK) yaptığımız veri gözlemi bize mikro veri kullanarak panel veri analizi yapabilmek için yeterli verinin birikmiş olduğunu göstermiştir. Dolayısıyla bu tezin ekonomi literatürüne en önemli katkısı bildiğimiz kadarıyla ilk kez mikro veri kullanarak panel veri analizi yapılmış olmasıdır. Tezde KOBİ'lerin üretimini etkileyen faktörleri 86 firma ile çalışarak belirlemeye çalıştık. Aslında TÜİK veri tabanında daha fazla firma verisi bulunmaktadır fakat bu firmaların bir kısmının ihracat yapmaması ve bazılarının ise Ar-Ge faaliyetinde bulunmaması dengeli bir veri ile çalışmayı istememizden dolayı analize dahil edilmemiştir. Tezde sabit etkiler modeli ve rastgele etki modeli uygulandıktan sonra Hausman testi yapılmıştır ve sadece firmalarda çalışan sayısının üretimi etkilediği sonucuna varılmıştır.

Anahtar Kelimeler : KOBİ , Türkiye, Panel Veri Analizi , TÜİK

To my family and beloved ones …

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LIST OF ABBREVIATIONS

SME	Small and Medium Sized Enterprises
GDP	Gross Domestic Product
MSME	Micro Small and Medium Enterprises
TURKSTAT	Turkish Statistical Institute
R&D	Research and Development
ANP	Analytical Network Process
OLS	Ordinary Least Squares
GLS	Generalised Least Squares
USA	United States of America
EU	European Union
KOSGEB	Small and Medium Industry Development Organization
IFRS	International Financial Reporting Standards
IASB	International Accounting Standards Board
TOSYÖV	Turkish Foundation for Small and Medium Businesses
KGF	Credit Guarantee Fund
TOBB	The Union of Chambers and Commodity Exchanges of Turkey
TESK	Turkish Tradesmen anf Craftsmen
METU	Middle East Technical University
TUBITAK	The Scientific and Technological Research Council of Turkey
GOSB	Gebze Organized Industrial Zone
ITU	Istanbul Technical University

ID	Identification Number
LLC	Levin, Lin, Chu Test
ADF	Augmented Dickey – Fuller
IPS	Im, Peseran, Shin Unit Root Test
LNemp	ln of the Number of Employees
LNR&D	ln of the R&D Investment
LNexp	ln of the Export Value
LNpro	ln of the Production Value

1. INTRODUCTION

Small and Medium Sized Enterprises (SMEs) have a significant role in the economies of both developed and developing countries in the World. This role was firstly realized during the 1930 crises any the number of SMEs in the World started to increase after the oil crises of 1970s. (Turkoglu, 2002). Since SMEs do not need much capital and use generally labor intensive techniques, they are not effected from such kind of big crises very much. (Ilhan, 2006). Realization of this fact increased the interest to SMEs.

Ayyagari, Demirguc-Kunt and Maksimovic (2011) and state that over 90% of total enterprises globally are SMEs and SMEs with 250 employees or fewer generate 86% of the jobs. Moreover, Eurostat (2011) also reports some rates for the European countries. The share of SMEs in Europe is 99% which is above the World rate. However, contribution to employment is 67% which is lower than the World rate. 58% of GDP is created by SMEs in Europe. IMF (2010) states that contribution to GDP is lower than the European rate with a rate of 33% for emerging economies. Moreover, their contribution to employment is 45%. These percentages for emerging economies may seem to be low but it should be noted that there is a lot of SMEs in the informal sector in emerging economies.

World Trade Report (2016) gives some rates including micro firms as well. According to the report 83% of the firms are MSMEs. 85% of the micro firms and 72% of SMEs operate in the service sector, particularly in wholesale and retail trade. Two thirds of employment in developing and developed countries are generated by MSMEs. Contribution to GDP is somewhat lower for developing countries which is around 35%. This rate is around 50% for developed countries. However, SMEs are 70% less productive compared to large firms.

However, at this point, it is important to note that there is no globally accepted general definition of SMEs. Each country states its own definition, mostly depending on the number of employees or annual turnovers, individually. Therefore, while making international comparisions, researchers should be very careful about these definition. In addition, the rate

of informal sector especially for the developing countries is also very important while analysing the data.

SMEs are very important for Turkish economy as well. The data for the year 2014 show that they constitute 99.8% of the total number of firms. Moreover, for the same year, 57.8% of GDP, 73.5% of total employment, 55.1% of exports, 54.1% of all wages and salaries, 62.0% of endorsement, 55.0% of gross investment in tangible goods belongs to SMEs. (TURKSTAT, 2016).

Despite the above stated important contributions of SMEs to Turkish economy, academic studies related to Turkish SMEs are not many1 and compared to the World literature it can be realized that the studies are more recent, starting after 2000s. Almost all of the papers are either literature review or just give general information about the positions of the SMEs in Turkey. Of course, the papers which report the outcomes of the conducted surveys should not be forgotten. However, due to mostly financial constraints, such kind of surveys could only be conducted to restricted regions and the outcomes could not give the overall situation for the whole country.

One very important point to note is that there are no studies using micro data. The reason of this can be explained by the lack of data up to recent years. However, our data search in Turkish Statistical Institute (TURKSTAT) showed us that micro data started to accumulate. Therefore, panel data analysis can be possible from now on. This encouraged us to study SMEs in micro level in this thesis and as far as to our knowledge, this is the first study where the analysis are made in micro level.

Specifically, in the thesis we try to explain production of SMEs with number of employees, exports and Research and Development (R&D) spending. We obtain the data for the period 2006 – 2013 from four different data bases of TURKSTAT, which are foreign trade statistics, annual industry and service statistics, annual industrial production statistics and research and development statistics. We restricted the number of firms as 86 to make our data balanced. Some small firms do not have exports and R&D spending values. Since these are especially

[1] *Başçı and Durucan (2017) is a literature review paper related to the Turkish SMEs.*

the ones which have less than 19 employees, we excluded these firms from our analysis. Therefore, as a total we studied with 688 data.

As the methodology, we applied panel data estimation. Due to the reason that micro data about production was not available for SMEs before, it was also not possible to use panel data estimation. Therefore, this theses is the first study where panel data analysis is applied to SMEs. We used STATA Version 13.1 for our applications.

After this introduction of the thesis, we continue with literature review in the second Chapter. We divide this Chapter into three parts where in the first part we concentrate on the papers which tries to find out the determinants of growth of SMEs in Turkey. In the second part, we summarised the studies which use panel data analysis for Turkey. In the third part, we give examples of studies from different countries where economic growth of SMEs are studied either by using micro data or panel data analysis. Although, the main purpose of the thesis is to work in a micro level, in Chapter three, we summarize the current situation of SMEs in Turkey with macro variables. We summarize the data and the methodology in the fourth Chapter. Empirical results are reported in Chapter five. Finally, we complite the thesis in Chapter six with the concluding remarks.

2. LITERATURE REVIEW

We divide this literature review section into three parts. In the first part, we provide information about the articles where the concern is to explain the determinants of the growth and development of the SMEs in Turkey. Since as the methodology of the thesis, we use micro data and panel data analysis, in the second part, we give information where this methodology is used for SMEs in Turkey but for different areas such as factors effecting business performance or the interaction process between macroeconomic forces and financial performance variables of SMEs. Related to the topics of these two parts and much more, a very detailed literature review is provided in Başçı and Durucan (2017). Finally, in the third part, we give information about the papers where micro data and panel data analysis is used to analyse SME growth in different countries.

2.1. Determinants of the Growth of the SMEs in Turkey

We divide this subsection of the literature review into two parts where in the first part we summarize the papers which are emprical or theoretical and in the second part we present the survey papers. However, before moving to those subsections it is important to mention the World Bank 2011 SME report of Turkey where steps to be taken in order to improve the factors effecting SME growth were analysed.

2.1.1. Emprical and Theoretical Papers

There is a controversial issue which is whether SME credits affect economic growth or economic growth affects SME credits. Regarding this causality question, we recognise two studies written for Turkey. These are Tutar and Unluleblebici (2014) and Ceylan and Durkaya (2010). According to the study of Tutar and Unluleblebici (2014) where Granger causality test is made for the period 2006-2011, SME credits affect economic growth. On the other hand, Ceylan and Durkaya (2010) with the same test showed that for the period 1998-2008 economic growth affects SME credits. Two opposite results.

Kameyama and Kobayashi (2012) in terms of system dynamic approach presented the methodology how to create micro and macro models. Nurrachmi, Abd Samad and Foughali

(2012) applied system dynamic approach to SMEs in Turkey. They concluded that micro models are more appropriate for the Turkish SME case and the obstacles preventing the development of SMEs in Turkey are access to finance and lack of marketing and innovative activities.

Karpak and Topcu (2010) made a study to prioritize the measures of success for Turkish SMEs in the manifacturing sector by using Analytical Network Process (ANP). Saaty (2005) explains ANP methodology in his book in detail but briefly, we can say that ANP measures the strenght of two factors' direct effects with respect to a third one, which can be named as the controlling factor. ANP applies both quantitative and qualitative criteria. Karpak and Topcu (2010) by using ANP concluded that sales were the most important measure of success for Turkish SMEs in the manifacturing sector.

Finally, it is worth to mention Karadag (2015) where international data and international literature was used to reach a conclusion that low level of technology, financial constraints and lack of manaregial capability are the main obstacles for SME growth in Turkey.

2.1.2. Survey Papers

Istanbul is a huge city where 55% of total trade and 45% of the wholesale trade of Turkey takes place. Moreover, 21% of Gross National Product is generated by the city. (Istanbul Metropolitan Municipality, 2009) Of course in this dynamic city there are lots of SMEs as well. However, only two survey papers investigates the situation for these SMEs in terms of economic growth.

One of them is Wright, Bisson and Duffy (2012). There were 314 participants to the survey. The concern of the paper was about the measurement of competitive intelligence. Using responses to questions, the paper identified the areas where improvements could be made to reach an ideal situation which could provide competitive advantage for the SMEs surveyed in the study. This is important because if a company have competitive intelligence, it can grow faster.

The second survey conducted to SMEs in Istanbul was reported in Gozlu, Yenen and Baykas (2005). 28 SMEs were analysed with face-to-face interviews. Of course, the number can be thought of very little compared to the total number of SMEs in Istanbul. Production, quality

and technology problems of SMEs were investegated in the survey. The paper concluded that technological development is the essential determinat of the economic growth of the SMEs.

In addition to İstanbul, there are of course survey papers which are conducted to different regions. One first example of such a regional survey is Gurak (2001) for the city of Nazilli with 100 thousand inhabitants. This survey concluded that financial bottlenecks, lack of qualified human resourches and bureaucratic procedures are the main problems.

One more recent example of a survey study is Korkut, Erdem and Duru (2010) where the region was chosen as Düzce and the number of SMEs were 43. Face-to-face interview from the owners or the managers were taken. The sector under investigation was forest product industry. The main obstacle to economic growth was found to be insufficient finance.

Tatli (2015) is a thesis, where in it involved a survey conducted to the 364 SMEs located in cities of Erzurum, Erzincan and Bayburt. According to the outputs of the survey, 56.3% of these SMEs believe that they have to grow and 69% of the have a strategy of growth. However, still 76.4% of them do not use the government supports for growth.

Ozar, Ozertan and Irfanoglu (2008) is also a survey study but it has two special charecteristics which makes it different than the above stated survey papers. Firstly, it does not study medium enterprises but just the micro ones and the small ones. In the paper, it names these enterprises as a neglected group and calls them Micro and Small Enterprises (MSEs). Secondly, the design of questions are in such a way that the impacts of 2001 crises on the economic growth of MSEs can also be analysed. The survey was conducted to a sample of 4,776 urban enterprises where the number of employees were between 1 and 49. Results show that factors contributing to the growths of MSEs lost their influence immidiatly after the crisis.

In addition to the above national studies Seker and Correa (2010) can be mentioned as a study which bases the investigation on an international survey data of World Bank where 28 countries are included. Turkey is among them. The paper as a result of the panel data analysis concludes that compared to other countries of Eastern Europe and Central Asia, SMEs grow slower in Turkey due to lack of finance. Panel data analysis shows that access to finance is the most important determinant of growth.

Energy can be considered as one of the most important factor which influence the growth of enterprises, Therfore, since Hobikoglu and Hacioglu Deniz (2012) questiones the awareness of SMEs about alternative energy sources, it is an important paper. As an energy dependent country this awareness is very curicial for Turkey. A research was done for the IMES and TUZLA Industrial Parks. Survey responses concluded that there were not a strong awareness.

2.2. Panel Data Analysis as the Methodology for SMEs in Turkey

It is also useful to review the articles which use either micro data and/or panel data analysis for Turkish SMEs. In general, it can be noticed that most of them are related to finance. The reason for this can be, as noted in Section 2.1, the most important obstacle to economic growth which is the problems related to the accessibility to finance.

Guler (2010) studied the capital structure of SMEs which are registered to İstanbul Stock Exchange during the years 1996-2007. The number of SMEs is 24. Panel cointegration analysis was used in the paper. As a result of the analysis liquidity, issues related to tax and size of enterprise were found to be the most important factors effecting capital structure.

The second paper Sahin (2001) which studied SMEs that are register to İstanbul Stock Exchange for the period 2006-2010. The number of SMEs in the study was 18. Again, panel data analysis was used. However, in terms of concept, factors effecting business performance was investigated. The results showed that liquidity, productivity, size of enterprise and costs had effects on business performance.

The third paper which studied again İstanbul Stock Exchange is Muslumaov, Aras and Ozyildirim (2005). 32 companies were included in the study for the period 1993-2003. The paper analysed the interaction process between macroeconomic forces and financial performance variables of SMEs. For this aim unbalanced panel data analysis had been used. Empirical results showed that the profitability of SMEs was declining and business risk was increasing as a result of real exchange rate appreciation. The paper claimed that high interest rates pushed SMEs to stay liquid instead of making investment.

Duran and Zehir (2011) was a fourth paper which also analysed SMEs registered to İstanbul Stock Exchange. 45 SMEs were investigated for the period 2006-2010. Panel data analysis were used in order to determine the contribution of foreign portfolio investment to firms technical efficiency and total factor productivity. The paper obtained detail sectoral results but in general mentioned that foreign investments were important for all key aspects of SMEs' financial performance.

Aysan et al (2016) looked at the financial accessibility issue from the bank side. It tried to find out the determinants of banks willingness to finance SMEs with pooled OLS and fixed-effects estimators for 40 commercial banks from 2006 to 2014. The data used were quarterly small business panel. As a result it found Islamic banks which are known in Turkey as Participation banks were financing SMEs more than conventional banks.

2.3. Examples from Different Countries Using Either Micro Data or Panel Data Analysis for Economic Growth of SMEs

This subsection gives some examples of articles where SME growth is studied either by using micro data or panel data analysis for different countries.

Havnes and Senneseth (2001) analysed the assumption in SME literature that networks are good for SMEs. The reasoning for this assumption is that despite the disadvantages of limited sizes of SMEs, they can access and utilise external resources through network and enhance their performance and growth. A panel data of 1700 SMEs were studied for the period 1991 – 95 in 8 European countries. However, the analysis found no evidence of short-term benefits in terms of growth in employment or growth in total sales that resulted from the networking activities. On the other hand, when long-term objectives of the firms are considered networking was associated with high growth.

Heshmati (2001) was a study for Sweeden. It questioned the sensitivity of SME growth analysis to different methodologies of estimation. In fact, the study was not for SMEs but for micro and small firms where the number of employees are between 1 and 100. The data was an unbalanced panel for the period 1993–1998. Unbalanced data was used in order to allow exit and entry of firms. The results showed that the relationships between the growth,

size and age of firms is very sensitive to the method of estimation, functional form and the definitions of growth and size.

Carpenter and Petersen (2002) examined the long-standing theory which states that the growth of small firms is often constrained by the quantity of internal finance. For this aim, it used a panel of more than 1600 small firms in United States for the period 1980-1992. The paper concluded that firms were constrained by internal finance.

Elston (2002) worked with 820 observations in order to find out the relationship between cash flow and the growth of firms which were listed in the Neuer Markt of Germany. The data was unbalanced for the period 1997 – 2000.

Wagenvoort (2003) investigated the structural financing problems of SMEs by using micro data for 211,374 European manufacturing and construction firms for the period 1996 - 2000. The results showed that European SMEs suffer from a structural financing problems and this hinders their growth. Moreover, analysis of the paper also showed that the sensitivity of company growth to these problems rises as company size falls.

Jones (2005) examined the relationship between training activities and different growth development pathways in Australian manufacturing SMEs with longitudinal panel data drawn from the business longitudinal survey conducted by the Australian Bureau of Statistics over the four financial years 1994-1995 to 1997-1998. The sample size was 871. The results showed that training activities are more in the more rapidly growing SME's.

Honjo and Harada (2006) studied public policy and financial structure effects on SME growth for Japan. It used a panel data of 6961 SMEs for the period 1995-1999. It concluded that the specific public policy named Creative Business Promotion Law had an increasing effect on assets of the SMEs. Moreover, it found evidence that Creative Business Promotion Law and cash flow had an impact on the growth of younger SMEs.

Oliveira and Fortunato (2006) examined whether liquidity constraints faced by business firms affect firm growth using unbalanced panel data set of Portuguese manufacturing firms during the period 1990 to 2001. The paper applied GMM-system to estimate a dynamic panel data model of firm growth. Micro firms were also part of the analysis. The conclusion of

the analysis was higher growth-cash flow sensitivities for smaller and younger firms and lower growth-cash flow sensitivities for larger and more mature firms.

Abor and Biekpe (2009), in fact, examined the determinants of capital structure decisions of SMEs in Ghana. However, since within the paper there existed a subsection where the relationship between economic growth of SMEs and dept ratio is investigated, we included this paper in the literature survey as well. The study included 160 SMEs for the period 1998 – 2003 and concluded that long term dept ratio had a positive relationship with economic growth.

Olutunla and Obayumi (2008) studied the relationship between profitability, bank loans, age of business and the size of small and medium enterprises in Nigeria. A fixed effect regression model on a balanced data of 115 SMEs was used as the methodology in the paper. Profitability was the dependent variable of the model. The paper concluded that there is interdependence.

Mateev and Anastanov (2010) was a study for six transition economies. 560 fast growing SMEs were investigated for the period 2001-2005 in the study. Empirical results showed that other than the traditional characteristics of size and age, firm growth was also dependend on firm-specific factors such as indebtedness, internal financing, future growth opportunities, process and product innovation, and organisational changes.

Cravo, Gourlay and Becker (2012) was a study for Brazil. The paper examined the relationship between the SMEs and economic growth of the country. Annual panel of Brazilian states for the period 1985-2004 were used. It investigated the importance of the size of the SMEs and the level of human capital. The emprical results showed that human capital was more important for the economic growth of the country.

3. THE CURRENT SITUATION OF SME's IN TURKEY

The flexible structures, high production capacities and capability of creating new job opportunities of SMEs, which are all factors which lead to economic growth and social development, are realised by developed and developing countries and also international institutions. In addition to this real arena of the issue, academic world also realise this vital importance and contribute to the development of the issue by doing research. In this thesis, we try to provide a contribution to the issue by using micro data and panel data analysis for Turkey. It is also important to see the current general situation of SMEs for the country. Therefore, in this Section, we try to provide some information by using macro data. In the first Subsection, we compare the situation of Turkish SMEs with some developed and developing countries. In the second Subsection we state the differences in the definitions of SMEs with some other countries and Turkey. Then, in the third Subsection, we give general information related to SMEs in Turkey. In Subsection four, there exists a brief history of SMEs in Turkey and finally, in Section five, we present the supports to SMEs provided by several different institutions.

3.1. Comparison of Turkey with some Developed and Developing Countries

We start by comparing the situation of SMEs in Turkey with some developed and developing countries. While the developed countries under consideration are USA, EU 27 and Canada, the developing countries under consideration are Brazil, Russia, South Africa and South Korea. We chose these developing countries because these countries together with Turkey are usually considered as a special group. In fact China and India are also in this group. However, in these two countries there are lots of unregistered SMEs so the observed variables do not reflect the real situation. For this reason, we didnot include these two countries to our comparison.

The share of SMEs in the total number of enterprises and total employment are compared in Table 1. The first column reports the share of SMEs in total enterprises. The percentages

range between 95.0% and 99.9% which are all very high showing the importance of SMEs for all of the countries under investigation. The highest share is for South Korea and the lowest one is for Russia but it should be noted that the share for Russia includes only the extracting and manufacturing industries. If we exclude Russia, South Africa with a share of 96.9%, is the lowest.

In the second column of Table 1, we report the share of SMEs in total employment. This time the range is wider with a minimum of 25.2% for Russia and a maximun of 90.3% for Canada. Turkey with a percentage of 73.5% lies in the middle. However, one should be careful while comparing these rates because the reason of the differences depends also on the different definions of SME for each country.

Table 1 : Share of SMEs in Total Enterprises and Employment

Country	Share of SMEs in Total Enterprises (%)	Share of SMEs in Total Employment (%)
Canada	97.9	90.3
EU	99.8	67
USA	99.7	48.4
Brazil	99.7	68.3
Japan	99.7	70.0
Russia	95.0*	25.2
South Africa	96.9	61.0
South Korea	99.9	87.8
Turkey	99.8	73.5

Source: https://smefinanceforum.org/data-sites/msme-country-indicators

Turkstat,2016 ; DTI,2007 ; Haner,2013 ; Statistics Canada,2016 ; Europian Commission,2015 ; Labour and Employment in Russia. 2015. Statistical book. Rosstat, Moscow, 2015 ; Eurostat,2015

**Valid for extracting[2] and manufacturing industries*

[2] *Extracting industry includes coal, oil, and gas extraction as well as the chemicals and metals industries.*

Although SMEs in Turkey have a great contribution to economic growth in terms of employment, value-added and output they have also some problems. Some of them are lack of qualified human researches, bureaucratic procedures and financial supports. These restain the growth of SMEs. (Gurak, 2004)

3.2. Definition of SMEs in Turkey and in Some Other Countries

Before 2005, there was not a common definition of SME in Turkey. We summarize these different definitions of the institutions in Table 2.

Table 2 : SME Definitions Used in Turkey Before 2005

Institution	**Sectoral Definition**	**Criterion for Definition**	**Micro-sized Enterprise**	**Small-sized Enterprise**	**Meidum-sized Enterprise**
KOSGEB	Manufacturing industry	Number of workers		**1-50 Workers**	**51-150 Workers**
HALKBANK	Manufacturing industry	Number of workers, Fixed investment amount (EUR)	--- **550 000**	--- **550 000**	**1-250 Workers** **550 000**
UNDERSECRETARIAT OF TREASURY	Manufacturing industry , tourism, agro-industry, mining, education, health, software development	Number of workers, Amount of investment subject to SME incentive certificate (EUR)	**1-9 Workers** **550 000**	**10-49 Workers** **550 000**	**50-250 Workers** **550 000**
UNDERSECRETARIAT OF TRADE	Manufacturing industry	Number of workers, Fixed investment amount (EUR)	--- ---	--- ---	**1-200 Workers** **1 830 000**
EXIMBANK	Manufacturing industry	Number of workers	---	---	**1-200 Workers**

Source : SMALL AND MEDIUM-SIZED ENTERPRISES IN TURKEY: ISSUES AND POLICIES © OECD 2004
Note : Assuming EUR 1 = TRL 1 700 000

This situation was leading to confusions. Therefore, in order to solve this confusion cabinet decree issued in Official Gazette dated 18.11.2005 and numbered 25997 the following SME definition:

"Micro entrerprises are the ones which employ less than 10 workers with less than 1 million TL annual turnover or annual balance sheet, small sized enterprises are the ones which employ between 10-50 workers with less than 5 million TL annual turnover or annual balance sheet and medium sized enterprises are the ones which employ between 50 – 250 workers with less than 25 million TL annual turnover or annual balance sheet." (KOSGEB, 2005)

This was also a part of the adaptation process to European Union. As can be seen in Table 3, these definitions are identical with the definitions of EU[3].

Table 3: The Comparison of the SME Definition of EU and Turkey

	Criteria for Definition	Micro Enterprises	Small Enterprises	Medium-sized enterprise
EU	Number of Staff	<=10	<=50	<=250
	Annual Turnover (Million Euro)	<= 2	<= 10	<= 50
	Annual Balance Sheet Total (Million Euro)	<= 2	<= 10	<= 50
Turkey	Number of employees	0-9	10-49	50-249
	Annual Turnover (Million TL)	<= 1	<= 5	<= 25
	Annual Balance Sheet Total (Million TL)	<= 1	<= 5	<= 25

Source : (Small and Medium Enterprises Development Organization, 2005)

At this point, it is important to note that in Turkey, the term "SMEs" includes not only small and medium-sized enterprises but also microenterprises. From Table 4, it can be realized that the first row includes also microenterprises and the highest rate of the Table, 96%, exists in this row.

[3] *Annual turnover and balance sheet differences are due to currency differences.*

Table 4 : Distribution of SMEs According to Size in 2014

Size Class	Number of Establishments.	Share (per cent)
1-19	2587406	96,6%
20-49	58926	2,2%
50-249	26126	1,0%
Total SMEs	2672458	99,8%
250+	4858	0,2%
Total	2677316	100%

Source : Turkstat, 2016

In World different countries have different SME definitions. For example in USA, in which SMEs constitute 97% of all enterprises, there is no specific official definition of SME. In some definitions small enterprises are defined as the ones which employ workers up to 100 and medium enterprises are defined as the ones which employ between 100 and 1000. However some other definitions increase the borders to 500 and 1500, respectively (United States International Trade Commission, 2010).

In Canada, there is a general definition of SME but this definition differs from almost all of the countries. Enterprises which have employees between 1-99 are called small where medium enterprises have 100-499 employees. The highest rate of 90.3% of Table 1 for Canada is the result of these high values of employees in the definition. (Innovation, Science and Economic Development Canada Small Business Branch, 2016) Like pre 2005 situation in Turkey, in Brazil there is no one general definition but institutions and banks state different SME definitions. (Haner,2011)

Since 2003, with the SME Promotion Law of China, the definition of SMEs in China is more clear. Cunningham (2011) in page 40 summarizes the definition as follows: “Based on the new regulations, small and medium-sized industrial enterprises in China are defined as employing up to 2,000 people with annual income not exceeding 300 million Yuan, the total assets not exceeding 400 million RMB. Although the definition of SME in China is quite

complex and contains relatively large companies compared to standards in other countries, in the scale of Chinese industry these companies are still relatively small."

For India, attempts of comprehensive definition are realised in 2006. For the two sectors, manufacturing and service, where micro enterprises are also included, definitions are given in different ways. Manufacturing enterprises are categorized according to their level of invesment in plant and machinery whereas service enterprises are categorized according to their level of investment in equipments. For both of the sectors, the number of employees is not important. (Ministery of Micro, Small and Medium Enterprises, Annual Report, 2016)

In Japan, SME categorization differs depending on the sector. The four sectors are manufacturing, wholesale, service industry and retail. Number of employees and stated capital are conditions for SME categorization. (Small and Enterprise Agency, Ministry of Economy, Trade and Industry ; September 2013) In Russia SME definition is formed according to number of employment and annual sales revenue and the definitions are close to the EU definitions. (Rosstat. - Moscow , 2015) (Russian SME Resource Center, 2015)

For South Korea, there is no definite definition of SME. It differs from sector to sector. Ministry of Small Business Development in South Africa was established in 2014. However, still the definition of SME is not very clear for the country. There are eleven different definitions for eleven different sectors. (The Banking Association South Africa)

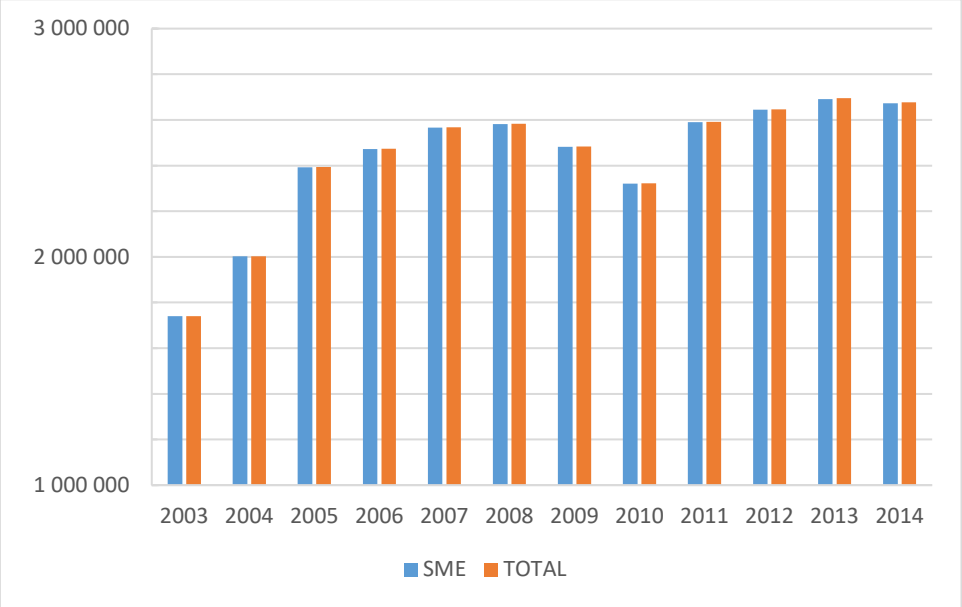
3.3. General Information About SMEs in Turkey

In 2014, there were 2,672,458 SMEs in industy and service sector and this was 99.8% of the total number of enterprises. Moreover, 73.5% of total employment was created by SMEs. In addition, 57.8% of GDP and 56.4% of exports were created by SMEs. (TURKSTAT, 2016)

Figure 1 shows both the total number of enterprises and number of SMEs in Turkey for the period 2003 – 2014. In these 12 years, the shares of SMEs in total are always around 99%. One of the important points to note about Figure 1 is that starting with the year 2004 there is a continuous increase in the number of enterprises untill 2008. The number of enterprises

increased from 2,002,834 in 2004 to 2,583,099 in 2008. We can give high growth rates of the period as the most important reason of this trend. Turkey grew 9.4%, 8.4% and 6.9% in years 2004, 2005 and 2006, respectively. However, a decrease in the numbers can be recognised for the years 2009 and 2010 which is not surprising. These are the years of global financial crisis. The effect of this crisis to Turkey was a growth rate of 0.7% in 2008 and -4.8% in 2009. However, Turkey recovered very quickly. After 2009 the growth rates are 9.2%, 8.8%, 2.2%, 4.2% and 2.9% until 2014. The affects of this recovery was also seen in the number of enterprises where 2008 levels were once again reached in 2011 and even slightly higher levels were realised in years 2012, 2013 and 2014.

Figure 1 : Total Number of Enterprises and Number of SMEs in Turkey



Source: Turksat (2005;2016)

Table 5 reports the distribution of SMEs among the sectors for the year 2014. The top three sectors of wholesale and retail trade, transportation and storage and manufacturing have a SME share of 66.96%.

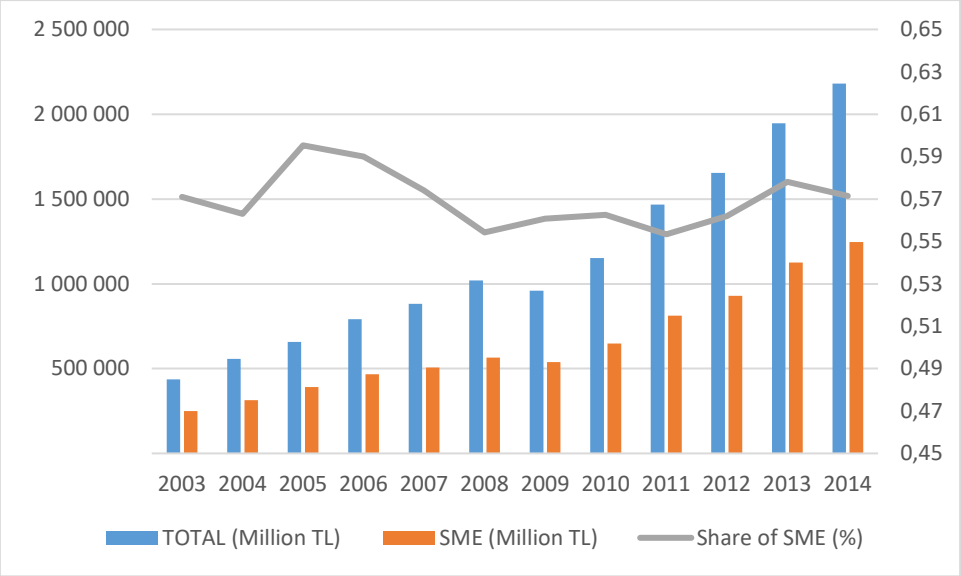
Table 5: Distribution of SMEs Among Sectors in 2014

Sector	Number of Enterprises	Number of SMEs	Proportion of SMEs (%)
Wholesale and Retail Trade	1 047 752	1 047 257	39,19
Transportation and Storage	411 174	410 958	15,38
Manufacturing	332 834	331 050	12,39
Accommodation and Food Service	233 450	233 111	8,72
Construction	171 268	170 826	6,39
Professional, Scientific and Technical Activities	161 647	161 547	6,04
Other Service Activities	150 593	150 589	5,63
Information and Communication	32 756	32 685	1,22
Administrative and Support Service Activities	33 390	32 554	1,22
Human Health and Social Work Activities	30 781	30 594	1,14
Real Estate Activities	25 175	25 168	0,94
Arts, Entertainment and Recreation	21 505	21 493	0,80
Education	16 430	16 273	0,61
Mining and Quarrying	3 715	3 642	0,14
Water Supply; Sewerage, Waste Management and Remediation Activities	3 333	3 252	0,12
Electricity, Gas, Steam and Air Conditioning Supply	1 513	1 459	0,05

Source : Turkstat, 2016

In Figure 2, we can see the contribution of SMEs to GDP for the years 2003 – 2014. The share of SMEs in total GDP fluctuates around 57%. The highest share is realised in 2005 with a rate of 59.5% and the lowest share is realised in 2011 with a rate of 55.3%.

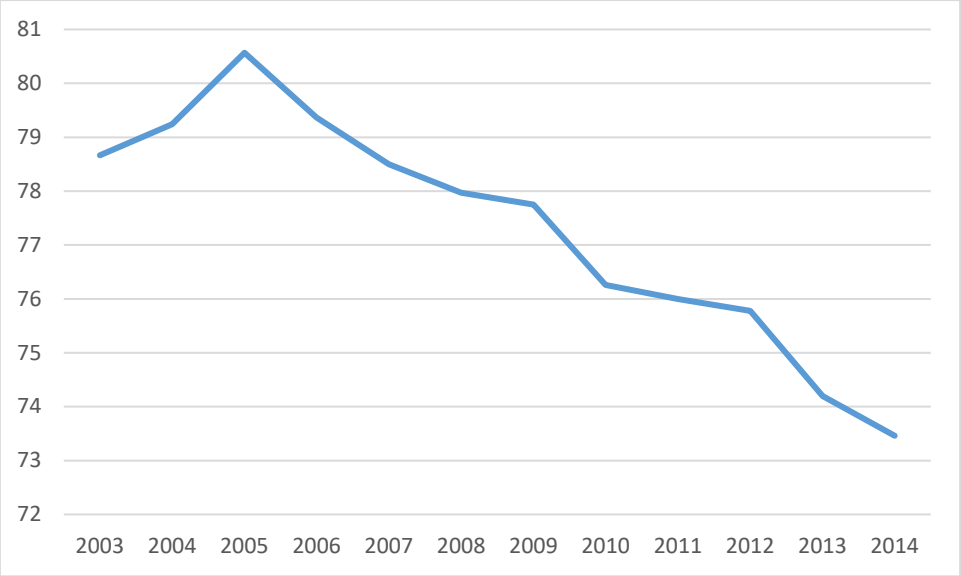
Figure 2 : Contribution of SMEs to GDP



Source : Turkstat (2003;2016)

Figure 3 presents the share of SME employment in total employment for the years 2003 – 2014. From the Figure, we can notice that the share of SMEs in total employment decreases since 2005. It is 80.6% with a maximum rate in 2005 but it declines to a rate of 73.5% in 2014. The main reason of this decline is that SMEs could not compete with big businesses in the globalizing World. They have some disadvantages such as low technology, limited financing oppurtunities, and few qualified employees. (Konya Chamber of Commerce, 2016)

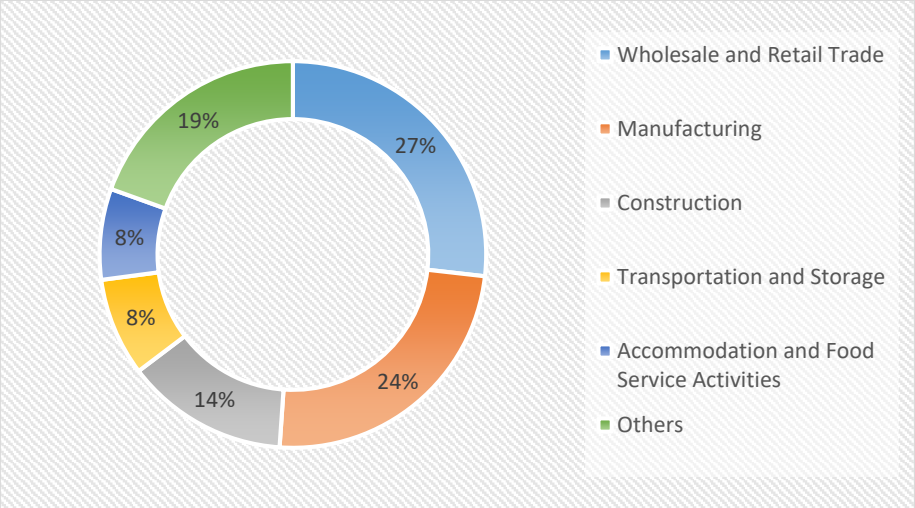
Figure 3: The Share of SME Employment in Total Employment (%)



Source: Turksat (2005;2016)

In Figure 4, we can see the sectoral distribution of the employment for the year 2014. The three sectors, wholesale and retail trade, manufacturing and construction all together creates employment of 65%.

Figure 4 : Sectoral Distribution of Employment in 2014

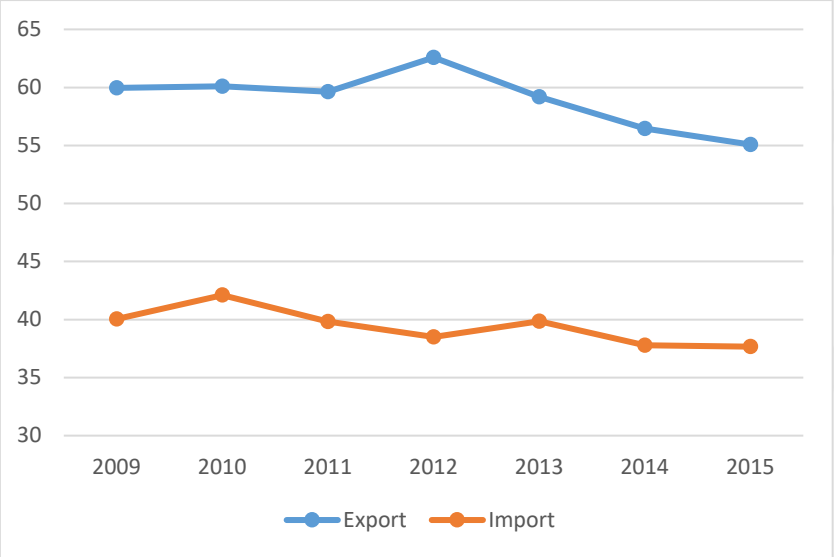


Source : (Turkstat,2016)

SMEs are important in terms of foreign trade as well. In Figure 5, we can see the share of exports and imports of SMEs in total exports and imports for the period 2009 - 2015. The shares of exports are more stable during the years 2009, 2010 and 2011 which are around

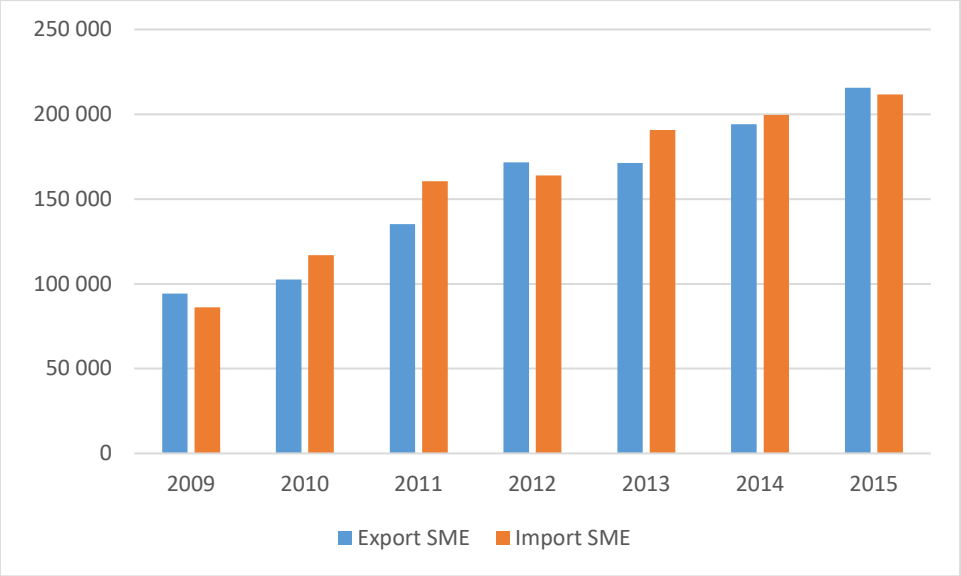
60%. In 2012 it increases to 62.6% which is the maximum share for the whole period. However, after 2012 there is a continous decline, reaching a minimum rate of 55.1% in 2015. However, as we can see in Figure 5, we do not realise a decline in total amount of SME exports. This means that bigger enterprises increased their exports more than the SMEs. Figure 5 shows that the share of SME imports are approximately 40% and it has also a declining trend. It declines to 37.7% in 2015 from its maximum rate of 42.1% in 2010. Like the case of exports, Figure 6 shows that level of imports are not declining so this again indicates that bigger enterprises increased their imports more than the SMEs.

Figure 5: Share of SMEs in Total Exports and Imports (%)



Source : (Turkstat, 2012-2016)

Figure 6 : Total Export & Import Values of SMEs (Million TL)



Source : (Turkstat, 2012-2016)

Table 6 summarizes the trade partners of SMEs for the year 2015. Europe is the most important partner with an export share of 49% and an import share of 50.4 percent. Asian countries are the second important group with an export share of 34.5% and import share of 39.5%. Other regions have very smaller shares commpared to Europe and Asia.

Table 6: Trade Partners in 2015

	Export (Thousand TL)	%	Import (Thousand TL)	%
Europe	105,554,034	49.0	106,624,167	50.4
Asian	74,416,104	34.5	83,563,997	39.5
Africa	19,904,150	9.2	4,902,093	2.3
America	11,341,993	5.3	14,003,552	6.6
Other Countries	4,372,362	2.0	2,661,123	1.3
Total	215,588,642	100	211,754,932	100.0

Source : Turkstat, 2016

Table 7 reports the distribution of exports and imports among the sectors for the year 2015. It can be realised from the Table that manufactured products with 48% and 47.2% share in total exports and imports have an absolute power in foreign trade.

Table 7: Distribution of Exports and Imports Among Sectors (2015)

Value: Thousand TL

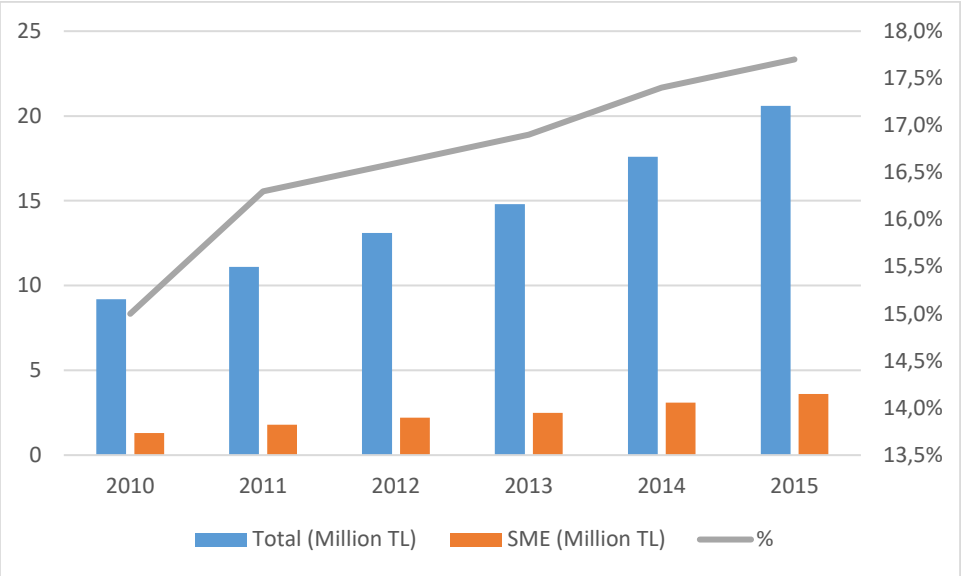
	Export (Thousand TL)	%	Import (Thousand TL)	%
Manufactured products	198,970,319	48.0	189,228,821	47.2
Chemicals and chemical products	10,816,013	2.6	35,029,754	8.7
Wearing apparel	34,387,213	8.3	1,969,196	0.0
Textiles	21,783,297	5.3	8,121,905	2.0
Basic metals	19,866,474	4.8	22,264,124	5.6
Machinery and equipment n.e.c.	14,391,215	3.5	27,760,905	6.9
Computer, electronic and optical products,potentiometers	1,502,983	0.4	16,578,944	4.1
Food products	17,239,673	4.2	7,495,700	1.9
Products of agriculture, forestry and fishing	10,066,280	2.4	10,874,778	2.7
Mining and quarrying	5,335,274	1.3	8,912,498	2.2
Beverages	412,151	0.1	672,829	0.2
Tobacco products	151,141	0.0	16,526	0.0
Leather and related products	2,474,499	0.6	1,901,246	0.5
Wood and of products of wood and cork, except furniture	1,289,585	0.3	2,416,292	0.6
Paper and paper products	2,696,168	0.7	4,613,972	1.2
Printing and recording services	14,805	0.0	12,551	0.0
Coke and refined petroleum products	1,208,578	0.3	5,168,651	1.3
Basic pharmaceutical products and pharmaceutical preparations	923,740	0.2	5,408,617	1.3
Rubber and plastic products	9,440,124	2.3	7,222,797	1.8
Other non-metallic mineral products	7,918,860	1.9	2,995,845	0.7
Babricated metal products, except machinery and equipment	11,862,943	2.9	6,626,966	1.7
Electrical equipment,potentiometers (manufacture)	10,092,259	2.4	10,092,338	2.5
Motor vehicles, trailers and semi-trailers	11,889,287	2.9	12,402,105	3.1
Other transport equipment	2,959,331	0.7	2,181,225	0.5
Furniture	4,509,032	1.1	744,088	0.2
Other manufactured goods	11,140,950	2.7	7,532,246	1.9
Electricity, gas, steam and air conditioning	196,760	0.0	816,274	0.2
Water supply; sewerage, waste management	779,640	0.2	1,288,183	0.3
Others	240,369	0.1	634,378	0.2
Toplam / Total	**414,558,961**	**100.0**	**400,983,753**	**100.0**

Source : Turkstat, 2016

In a globalizing World, to increase the share of SMEs in foreign trade, there should be effective communication among enterprises in different countries. The reporting of their financial positions, activities, and future goals should be identical for effective communication among themselves (Murphy, 1999). International comparability in financial reporting can be possible with the adoption of globally accepted standards. For this purpose, firstly, International Financial Reporting Standards (IFRS) and then International Financial Reporting Standard for SMEs (IFRS for SMEs) had been established by International Accounting Standards Board (IASB) in July 2009 (Kılıç, Uçar and Ataman, 2014 and Atik, 2010). It is announced in the website of IASB that more than one hundred countries now require or permit the use of IFRS. The position of the SMEs in Turkey in terms of the adoption of the IFRS for SMEs had been studied in several articles. A brief review of the literature can be found in Başçı and Durucan (2016, Manuscript).

Figure 7 presents the R&D expenditure for the years 2010 – 2015. We can realise a continous increase both for SMEs and as a total as well. Although the share of SMEs has an increasing trend, it is low with a rate of 17.7% in 2015.

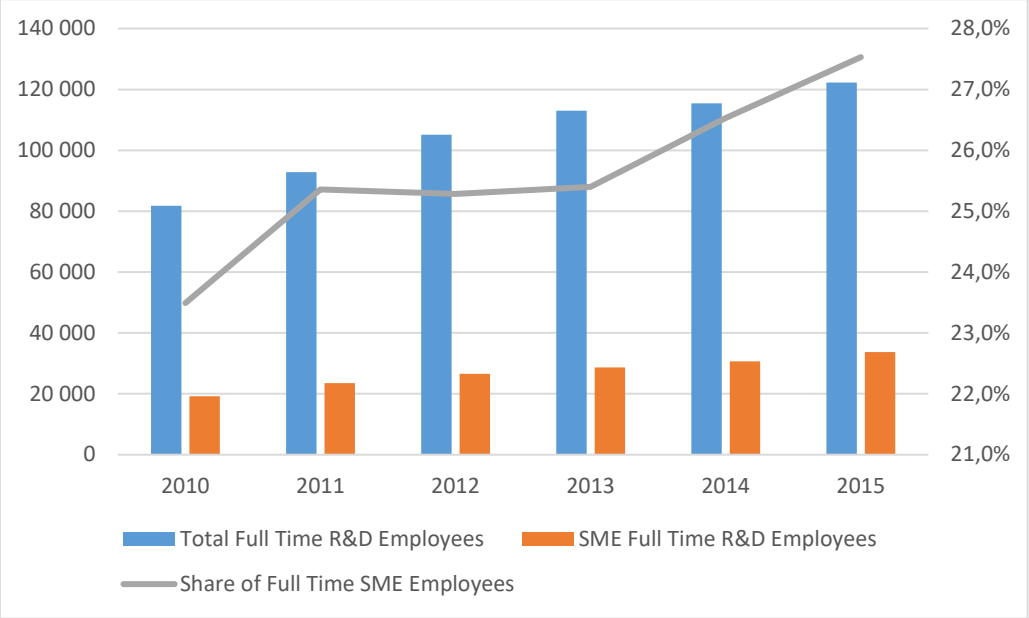
Figure 7: R&D Expenditure



Source : Turkstat (2011;2016)

Lastly Figure 8 shows the information related to the full time R&D employees for the years 2010 – 2015. An increase in the number of employees both in total and in SMEs can be realised. However, an important fact to note is that SME share is very low. This indicates that most of the R&D is made by large firms.

Figure 8 : Full Time R&D Employees



Source : Turkstat (2011;2016)

3.4. A Brief History of SMEs

In the fourth five year plan (1979 – 1983), we see the term “small industry” but we do not see the terms like “small enterprise” or “small and medium enterprise (SME)”. In the sixth five year plan (1990-1994), even though the term “small enterprise” can be realised, all of the objectives and incentives were stated to facilitate the small industry. Small enterprises of the trade and service sector were not considered.

With the establishment of KOSGEB “Small and Medium Sized Industry Development Administration” in 1990, TOSYÖV “Turkish Foundation for Small and Medium Businesses” in 1990 and KGF “Credit Guarantee Fund” in 1992 the interest for SMEs increased. It is important to note that attention to these programmes, in terms of design and implementation, increased after Turkey joined the Customs Union with the European Union

on 1 January 1996. The term “small and medium enterprises” was used first in the seventh five year plan (1996-2000). In the eighth five-year plan (2001-2005) the concepts of innoviation, R&D , value added and entrepreneurship are dealt with extensively in relation with SMEs. Objectives such as “increasing the competitive capacity of SMEs”, “inceasing the value added created by SMEs” and “maintaining sustainable growth” were exposed in this plan. In the ninth eight-year development plan (2007-2013) the concept of “entrepreneurship” was in the first place in the SME catagory. (Nurrachmi R.N. etc. ,2012)

3.5. Institutions Supporting SMEs

The below institutions are the main ones which give support to SMEs in Turkey among several others.

a. Small and Medium Industry Development Organization (KOSGEB)
b. Turkish Halk Bank (Halkbank)
c. The Union of Chambers and Commodity Exchanges of Turkey (TOBB)
d. Turkish Foundation for Small and Medium Businesses (TOSYÖV)
e. Technology Development Areas

a. Small and Medium Industry Development Organization (KOSGEB) (http://www.kosgeb.gov.tr)

The Small and Medium Enterprises Development Organization (KOSGEB) is the main institution in Turkey which provides support programs. KOSGEB is a non-profit, semi-autonomous public organization responsible for the growth and development of SMEs in Turkey which is establisehed in 1990. It is dependent to Ministry of Science, Industry and Technology. Its Board of Directors consists of representatives from the government and various business organizations. The primary objective of KOSGEB is to improve SMEs share and efficiency in the Turkish economy and to enhance their competitiveness. In order to accomplish this objective, KOSGEB has been given the responsibility of developing SMEs' technological skills, improving their training and information levels, providing appropriate financial mechanisms and enhancing their managerial infrastructure.

Supports to SMEs from KOSGEB are as follows:

1. SME Project Suppport Program
2. Thematic Project Support Program
3. Collavoration and Coalition Support Program
4. R&D, Inavation and Industrial Application Support Program
5. General Support Program
6. Entrepreneurship Support Program
7. Emerging Companies Market SME Support Program
8. Credit Interest Supports

b. Turkish Halk Bank (Halkbank) (https://www.halkbank.com.tr/en)

Halkbank identifies itself as the bank of SMEs and tradesman. Halkbank has many widespread supports to artisans, tradesman and small businesses which are the basis of the national economy and the representatives of the middle class. In this aspect Halkbank is Turkey's first and premier bank in this area. It provides many loan oppurtunities to SMEs. Moreover, Halkbank has a special web site which provides all the information necessary for SMEs and answers to all kinds of questions can be obtained from the experts through this web site as well. In addition to these services, Halkbank orginizes training programmes for SMEs where topics such as marketing, business administration, and accounting have the priority. Since some of the SMEs export their products, Halkbank gives them free foreign language education aswell.

c. The Union of Chambers and Commodity Exchanges of Turkey (TOBB) (http://www.kobi.org.tr)

TOBB supports SMEs in terms of both funding and providing information. For example, Credit Guarantee Fund (KGF) is established with a corporation of 50% TOBB, 48,5% KOSGEB and 1,5% Confederation of Turkish Tradesmen anf Craftsmen (TESK). In terms of information the web site http://www.kobi.org.tr which was established by TOBB in 2005 aims to guide SMEs in general subjects and give information which they are in need of under 14 categories. Examples of such needs can be how an entrepreneur can constitute a business,

what the procedures are, what kind of support programs are available.

d. Turkish Foundation for Small and Medium Businesses (TOSYÖV) (http://www.tosyov.org.tr)

The foundation established in Ankara in 1989, with the main purpose to determine the problems of SMEs and to find solutions to these problems. For this purpose, the foundation supports researches, makes publications, organizes seminars and conferences, visits legislature and professional organizations. Furthermore, it has consulting services for economic and social problems that can be faced by SMEs. Woman and young enterpreneurs have special importance for the foundation so it provides special support for this special group. One other purpose of the foundation is to increase production and competition capacity of SMEs. Around the country, there are 21 different supporting centers.

e. **Technology Development Areas**

Initially, there were technology development centers which were coordinated by KOSGEB and the universities. The purpose was to bring universities and SMEs together at a common platform in order to increase R&D activities. Istanbul Technical University technology development center was the first center which was established in 1991. Then, many of them followed it. Legal framework about this issue is constituted in 2001 with law 4691. After this law the name technology development centers changed to technology development areas. Therefore, the before established centers also seemed to be established by the beginnig of 2001. That's why Table 8, which is a list of technology development areas, starts from the year 2001. At the moment, there are 53 technology development areas. Moreover, there is a work going on for the establishment of 12 more technology development areas.

Table 8: List of Technology Development Areas

Number	Name	University	Province	Establishment Year
1	METU Technocity	METU	Ankara	2001
2	TUBITAK Marmara Research Center Technocity	TUBİTAK-TTGV	Kocaeli	2001

3	Bilkent Cyberpark	Bilkent University	Ankara	2002
4	Technopark Izmir	Izmir Institute of Technology	Izmir	2002
5	GOSB Technopark	Sabanci University	Kocaeli	2002
6	Hacettepe University Technology Development Area	Hacettepe University	Ankara	2003
7	ITU Ari Technocity Technology Development Area	Istanbul Technical University	Istanbul	2003
8	Eskisehir Technology Development Area	Anadolu University	Eskisehir	2003
9	Selcuk University Technology Development Area	Selcuk University	Konya	2003
10	Kocaeli University Technology Development Area	Kocaeli University	Kocaeli	2003
11	Yildiz Technical University Technology Development Area	Yildiz Technical University	Istanbul	2003
12	Istanbul University Technology Development Area	Istanbul University	Istanbul	2003
13	West Mediterranean Technocity Technology Development Area	West Mediterranean University	Antalya	2004
14	Erciyes University Technology Development Area	Erciyes University	Kayseri	2004

15	Trabzon Technology Development Area	Karadeniz Technical University	Trabzon	2004
16	Cukurova Technology Development Area	Cukurova University	Adana	2004
17	Mersin Technology Development Area	Mersin University	Mersin	2005
18	Region of Lakes Technology Development Area	Suleyman Demirel University	Isparta	2005
19	Ulutek Technology Development Area	Uludag University	Bursa	2005
20	Erzurum Ata Technokent Technology Development Area	Ataturk University	Erzurum	2005
21	Gaziantep University Technology Development Area	Gaziantep University	Gaziantep	2006
22	Ankara University Technology Development Area	Ankara University	Ankara	2006
23	Gazi Technopark Technology Development Area	Gazi University	Ankara	2007
24	Firat Technology Development Area	Firat University	Elazig	2007
25	Pamukkale University Technology Development Area	Pamukkale University	Denizli	2007

26	Cumhuriyet Technology Development Area	Cumhuriyet University	Sivas	2007
27	Dicle University Technology Development Area	Dicle University	Diyarbakir	2007
28	Trakya University Edirne Technology Development Area	Trakya University	Edirne	2008
29	Sakarya University Technology Development Area	Sakarya University	Sakarya	2008
30	Tokat Technology Development Area	Gaziosmanpasa University	Tokat	2008
31	Bogazici University Technology Development Area	Bogaziçi University	Istanbul	2009
32	Bolu Technology Development Area	İzzet Baysal University	Bolu	2009
33	Malatya Technology Development Area	Inonu University	Malatya	2009
34	Kütahya Dumlupınar Design Technology Development Area	Dumlupinar University	Kutahya	2009
35	Samsun Technology Development Area	Ondokuz Mayıs University	Samsun	2009
36	Duzce Technopark Technology Development Area	Duzce University	Duzce	2010
37	Harran University Technology Development Area	Harran University	Sanliurfa	2010

38	Kahramanmaras Technology Development Area	Sutcu Imam University	Kahramanmaras	2011
39	Namık Kemal University Technology Development Area	Namık Kemal University	Tekirdag	2011
40	Canakkale Technology Development Area	Canakkale Onsekiz Mart University	Canakkale	2011
41	Celal Bayar University Technology Development Area	Celal Bayar University	Manisa	2012
42	Corum Technology Development Area	Hitit University	Corum	2012
43	Yuzuncu Yil University Technology Development Area	Yuzuncu Yil University	Van	2012
44	Izmir Science and Technology Park Technology Development Area	Izmır Economy University	Izmir	2012
45	Dokuz Eylul Technology Development Area	Dokuz Eylul University	Izmir	2013
46	Nigde University Technology Development Area	Nigde University	Nigde	2013
47	Kirikkale University Technology Development Area	Kirikkale University	Kirikkale	2013
48	Bozok Technology Development Area	Bozok University	Yozgat	2013

49	Ege Technopark Technology Development Area	Ege University	Izmir	2014
50	Marmara University Technology Development Area	Marmara University	Istanbul	2014
51	Afyon-Usak Zafer Technology Development Area	Afyon Kocatepe University - Usak University	Afyon - Usak	2015
52	Konya Technology Development Area	Selcuk- Necmettin Erbakan-Aksaray Karamanoglu Mehmet Bey -KTO Karatay Universities	Konya	2015

Source: http://www.tgbd.org.tr/WebContent/WebContent/4707

4. DATA AND METHODOLOGY

As stated in Introduction, when studies related to SMEs in Turkey are reviewed, we realise that almost all of the papers are literature review papers, papers giving general information or survey papers. The reason of this situation is the lack of data. However, our data investigation in Turkish Studistical Institute (TURKSTAT) showed that we could be able to obtain satisfactory micro data for a panel data analysis of SME production by using TURKSTAT sources which started to accumulate. In this chapter, in Section 4.1, we give information about our data set and in Section 4.2, we describe the methodology we use.

4.1. Data

As known, two types of data which had been used for a long time and still being used are cross section data and time series data. Cross section data is a type of data for many individuals (these individuals can be people, firms, countries, sectors, regions, households etc.) obtained at some point in time. On the other hand in time series data we observe the values for one individual over a period of time. Panel data, since 2000's, in fact combines these two kinds of data. One dimension of panel data is individual which is usually indexed by i and the other dimension is time which is indexed by t. A panel data is called balanced if each individual has the same number of time series observations. However if the number of observations differ among individuals it is called unbalanced.

We collected our panel data necessary for our analysis by using TURKSTAT sources. We used four different data bases of TURKSTAT, which are foreign trade statistics, annual industry and service statistics, annual industrial production statistics and research and development statistics.

Data for foreign trade statistics includes many variables and are presented in SAS Enterprises Guide 5.1 program in TURKSTAT. Among these variables, since our analysis needs only export data, we firstly transfered export data to STATA. Among the variables included in

annual industry and service statistics database, we only took the number of employees for firms and implemented same process as we did for export data. Annual industrial production statistics are contained in an excel file in TURKSTAT. We transfered the production value in Turkish Lira data to STATA as well. Research and development statistics are also contained in an excel file but in different folders for each year in TURKSTAT. Therefore, we firstly merged these data in one folder and then transfered them to STATA. Database of TURKSTAT presents the micro data by giving an ID number to each firm. We merged all necessary data in STATA by using these ID numbers. Time period of our study is from 2006 to 2013 and number of firms is 86. Therefore, as a total we studied with 688 data. We excluded some of the firms in order to make our data balanced. Moreover, since very small firms do not have exports and R&D spending they are not included to analysis aswell. Therefore, the smallest firm in our study have 19 employees. Among the 86 firms there are 17 firms which have an employee number between 19 and 49 and there are 69 firms which have an employee number between 50 and 249.

TURKSTAT data depends on the surveys conducted by the institution. In York (1998) sample selection bias is defined as “any characteristic of a sample that is believed to make it different from the study population in some important way”. Winship and Mare (1992) states that sample selection bias ocurs when observations in the research are selected such that they are not independent of the outcome variables in the study. This leads to biased inferences. For this reason, in fact it is a possibility that in the TURKSTAT data there might be sample selection bias problem. In Cuddeback et.al. (2004), there is a very good discussion of detecting and correcting sample selection bias. However, since the surveys of TURKSTAT are conducted to a very wide range of sample after a careful investigation, in this thesis we will not test the possibility of sample selection bias.

4.2. Methodology

In Section 4.1, we described the steps we followed to obtain micro data for a panel data analysis of SME production. Now in this section, we will firstly explain briefly what panel data analysis is and then we will describe the methodology that must be used to make this analysis. We will provide information about estimation methods of fixed effects and random

effects, selection approach of Hausman test, stationarity tests of Levin-Lin-Chu and Im,Peseran,Shin.

4.2.1. Panel Data Analysis

A panel data regression can be expressed as follows:

$$y_{it} = \alpha + X'_{it}\beta + u_{it} \qquad i = 1, \dots, N; \quad t = 1, \dots, T \qquad (4.1)$$

where i denotes individuals and t denotes time. This double subscription is the main difference of panel data regression either from time series or cross section regression. α is a scalar, β is Kx1 and X_{it} is the it^{th} observation on K explanatory variables. The disturbance term can be represented as:

$$u_{it} = \mu_i + v_{it} \qquad (4.2)$$

where μ_i denotes the unobservable individual specific effect and v_{it} denotes the remainder disturbance. Note that μ_i is time invariant.

4.2.2. Estimation Methods

We will cover two alternative estimation methods in this subsection which are fixed effects and random effects estimation methods. The main difference between these two estimation methods comes from the assumptions that they make related to correlation between the unobservable variables and the explanatory variables. Fixed effects assume that there is correlation and random effects assumes that there is no correlation.

4.2.2.1 Fixed Effects

To obtain a fixed effects transformation, let's firstly substitute (4.2) into (4.1) for a simple regression to obtain

$$y_{it} = \alpha + \beta x_{it} + \mu_i + v_{it} \qquad i = 1, \dots, N; \quad t = 1, \dots, T \qquad (4.3)$$

Now, if we average this equation for each *i* over time, we get

$$\bar{y}_i = \alpha + \beta \bar{x}_i + \mu_i + \bar{v}_i \qquad i = 1, \dots, N \qquad (4.4)$$

Note that since μ_i is fixed over time, it appears in both (4.3) and (4.4). If we subtract (4.4) from (4.3), for each *t*, we obtain

$$y_{it} - \bar{y}_i = \beta(x_{it} - \bar{x}_i) + v_{it} - \bar{v}_i \qquad i = 1, \dots, N; \quad t = 1, \dots, T \qquad (4.5)$$

The data obtained by this transformation is named as time-demeaned data and the transformation itself is called within transformation. Note that in equation (4.5), μ_i does not appear anymore. Therefore, we can estimate by using pooled OLS and this estimator is called the fixed effects estimator or the within estimator.

The between estimator can be obtained by using (4.4) by running a cross-sectional regression. We can regress time averages of *y* on time averages of *x*. The problem about between estimator is that it is biased when μ_i is correlated with $\bar{x}_i$. Moreover, it ignores most of the information on how the variables change over time.

Multiple regression requires only a few changes. We use the time-demeanining on each explanatory variable in (4.1). We sometimes include time period dummies. Then, we do a pooled OLS regression.

If we assume strict exogeneity for the explanatory variables, the fixed effects estimator is unbiased. The idiosyncratic error v_{it}, should be uncorrelated with each explanatory variable across all time periods. As stated before, there can be correlation between unobservable variable and explanatory variables in any time period. One should be careful about degrees of freedom for fixed effects estimator. It is $df = NT - N - K = N(T-1) - K$ rather than NT - K. This is because of the fact that we lose one df due to time-demeaning.

4.2.2.2 Random Effects

We can start explaining random effect estimation with the same unobserved effects model of (4.3) but this time for a multiple regression with K variables:

$$y_{it} = \alpha + \beta_1 x_{it1} + \cdots + \beta_k x_{itk} + \mu_i + v_{it} \;\; i = 1, \dots, N; t = 1, \dots, T; k = 1, \cdots, K$$

We mentioned before that the main difference between the two estimation methods comes from the assumptions that they make related to correlation between the unobservable variables and the explanatory variables. Fixed effects assume that there is correlation and random effects assumes that there is no correlation. As can be noticed from the previous subsection, due to the assumption of correlation while using fixed effects, the goal is to eliminate μ_i. However, when we assume μ_i to be uncorrelated with each explanatory variable in all time periods, that is,

$$Cov(x_{itk}, \mu_i) = 0 \;\; i = 1, \dots, N; t = 1, \dots, T; k = 1, \cdots, K$$

there is no need to make a transformation to eliminate μ_i. In fact, such an elimination even results with inefficient estimators.

While estimating $\beta_k, k = 1, \dots, K$, an important key feature of the model should not be forgotten. The composite error term of (4.2) will be serially correlated in time since it includes μ_i in itself. In fact

$$Corr(u_{it}, u_{is}) = \sigma_\mu^2 / \left(\sigma_\mu^2 + \sigma_v^2\right), t \neq s$$

where $\sigma_\mu^2 = Var(\mu_i)$ and $\sigma_v^2 = Var(v_{it})$. This serial correlation problem can be solved by using generalised least squares (GLS) estimation methodology and if N is large and T is relatively small, the procedure have very good properties. Moreover, GLS transformation is very simple. We can define

$$\lambda = 1 - \left[\sigma_v^2 / \left(\sigma_v^2 + T\sigma_\mu^2\right)\right]^{1/2}$$

which is between zero and one. Then, the transformed equation turns out to be

$$y_{it} - \lambda \bar{y_i} = \alpha(1 - \lambda) + \beta_1(x_{it1} - \lambda \bar{x}_{i1}) + \cdots + \beta_k(x_{itk} - \lambda \bar{x}_{ik}) + (v_{it} - \lambda \bar{v}_i) \quad (4.6)$$

where overbar denotes the time average. (4.6) involves quasi-demeaned data on each variable. As stated before, the fixed effects estimator subtracts the time averages from the corresponding variable. However, the random effects transformation subtracts a fraction of

that time average, where the fraction depends on σ_v^2, σ_μ^2, and *T*. The GLS estimator is simply the pooled OLS estimator of equation (4.6).

The transformation in (4.6) allows for explanatory variables that are constant over time. This is one advantage of random effects among others over fixed effects. This advantage comes from the fact that random effects assumes that the unobserved effect is uncorrelated with all explanatory variables even the explanatory variables are fixed over time.

The parameter λ is usually unknown but it is possible to estimate it. There are ways to do this which are based on pooled OLS or fixed effects. Generally, $\hat{\lambda}$ take the form

$$\hat{\lambda} = 1 - \left\{1/\left[1 + T\left(\hat{\sigma}_\mu^2/\hat{\sigma}_v^2\right)\right]\right\}^{1/2}$$

where $\hat{\sigma}_\mu^2$ and $\hat{\sigma}_\mu^2$ are consistent estimators. Under the random effects assumptions, $\hat{\lambda}$ is consistent but not unbiased. However, it is asymptotically normally distributed as *N* gets large with fixed *T*.

Equation (4.6) allows us to relate the random effects estimator to fixed effects estimator. Fixed effects estimator is obtained when $\lambda = 1$. Usually, $\hat{\sigma}_\mu^2$ is larger relative to $\hat{\sigma}_v^2$, in which case $\hat{\lambda}$ is closer to unity. Moreover, as *T* gets larger, $\hat{\lambda}$ tends to one which makes the random effects and fixed effects estimates very similar.

4.2.2.3 Hausman Test

Fixed effects is used more widely since it allows arbitrary correlation between μ_i and x_{itk} while random effects does not. By this way ceteris paribus effects can be observed. However, if the explanatory variable is constant over time, we can not use fixed effects to estimate its effect on the dependent variable. We have to use random effects. Of course, if we want to assume that the unobserved effect is uncorrelated with all explanatory variables we have to use random effects.

In applied works, what is usually realised is that researchers apply both fixed effects and random effects and then they test whether the coefficients of the time varying explanatory variables are statistically significant different. The test that is used is Hausman (1978). If the Hausman test does not reject, one should use the random effects. On the other hand, rejection of Hausman test means that the key random effects assumption, which is the the unobserved effect is uncorrelated with all explanatory variables, is violated so we have to use fixed effects.

4.2.3. Stationarity Tests

Testing for unit roots in panel studies is more recent compared to testing unit roots in time series studies. The influential papers are Levin, Lin and Chu (2002), Im et al. (2003), Harris and Tzavalis (1999), Maddala and Wu (1999), Choi (2001) and Hadri (2000).

In this theses two types of panel unit root tests are applied in order to verify that all the variables have the same integrated orders. These are Levin, Lin , Chu test (2002) and Im, Peseran and Shin test (2003). Both of them are constructed according to the assumption that the individual time series in the panel are cross- sectionally independent.

4.2.3.1 Levin, Lin, Chu (LLC) Test

LLC test observe the stochastic process $\{y_{it}\}$ for a panel of individuals i = 1, 2, ..., N and each individual contains t = 1, 2, ..., T time series observations. The aim is to determine whether $\{y_{it}\}$ is integrated for each individual in the panel. The individual regression may include an intercept and time trend as in the case of single time series. It is assumed that all individuals in the panel have identical first – order partial autocorrelation, but all other parameters in the error process are permitted to vary freely across individuals.

Under this setting the null and alternative hypothesis are as follows:

H_0: Each time series contains a unit root.

H_1: Each time series is stationary.

The maintained hypothesis is that;

$$\Delta y_{it} = \rho y_{i,t-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \qquad m = 1,2,3 \qquad (4.7)$$

where d_{mt} refers to the vector of deterministic variables and α_{mi} is the corrresponding vector of coefficients for model m = 1,2,3. The lag order p_i is assumed to be unknown and therefore LLC test have three steps to follow.

Step 1: Perform seperate augmented Dickey – Fuller (ADF) regression for each cross section of (4.7). The lag order p_i can vary across individuals. To determine p_i firstly choose a maximum lag order of p_{max} and then use the t-statistics of $\hat{\theta}_{iL}$ to dtermine whether a smaller lag order can be chosen or not. Then for this p_i run the regressions

Δy_{it} on $\Delta y_{i,t-L}$ (L = 1, 2, …, p_i) and d_{mt} to get the orthogonolized residuals $\hat{e}_{it}$

and

$y_{i,t-1}$ on $\Delta y_{i,t-L}$ (L = 1, 2, …, p_i) and d_{mt} to obtain orthogonolized residuals $\hat{v}_{i,t-1}$

Standardize these by

$$\tilde{e}_{it} = \hat{e}_{it} / \hat{\sigma}_{\varepsilon i} \quad \text{and} \quad \tilde{v}_{it} = \hat{v}_{i,t-1} / \hat{\sigma}_{\varepsilon i}$$

$\hat{\sigma}_{\varepsilon i}$ is the standart error form each ADF regression, for $i = 1, \ldots, N$.

Step 2: Estimate the ratio of long – run to short – run standard deviations where under the null haypothesis of unit root, the long – run variance of (4.7) can be estimated by

$$\hat{\sigma}_{yi}^2 = \frac{1}{T} \sum_{t=2}^{T} \Delta y_{it}^2 + 2 \sum_{L=1}^{\bar{K}} w_{\bar{K}L} \left[\frac{1}{T-1} \sum_{t=2+L}^{T} \Delta y_{it} \Delta y_{i,t-L} \right]$$

where $\bar{K}$ is a truncation lag that can be data-dependent and $w_{\bar{K}L} = 1 - (L/(\bar{K}+1))$. For each cross section i, the ratio of the long-run standard deviation to the short-run standard deviation is eatimated by

$$\hat{s}_i = \hat{\sigma}_{yi}/\hat{\sigma}_{\varepsilon i}$$

The average standard deviation is estimated by

$$\hat{S}_N = \frac{1}{N}\sum\nolimits_i^N \hat{s}_i$$

Step 3: The panel test statistic can be obtained after the following steps. Firstly, run the pooled regression of

$$\tilde{e}_{it} = \rho\tilde{v}_{i,t-1} + \tilde{\varepsilon}_{it}$$

Based on $N\tilde{T}$ observations where $\tilde{T} = T - \bar{p} - 1$. $\tilde{T}$ is the average number of observations per individual in panel with $\bar{p} = \sum_{i=1}^{N} p_i/N$. $\bar{p}$ is the average lag order of individual ADF regressions. The conventional *t*-statistic for H_0: $\rho = 0$ is $t_\rho = \frac{\hat{\rho}}{\hat{\sigma}(\hat{\rho})}$, where

$$\hat{\rho} = \sum_{i=1}^{N}\sum_{t=2+p_i}^{T}\tilde{v}_{i,t-1}\,\tilde{e}_{it} \Big/ \sum_{i=1}^{N}\sum_{t=2+p_i}^{T}\tilde{v}_{i,t-1}^2$$

$$\hat{\sigma}(\hat{\rho}) = \hat{\sigma}_{\tilde{\varepsilon}} \Big/ \left[\sum_{i=1}^{N}\sum_{t=2+p_i}^{T_i}\tilde{v}_{i,t-1}^2\right]^{1/2}$$

and

$$\hat{\sigma}_{\tilde{\varepsilon}}^2 = \frac{1}{N\tilde{T}}\sum_{i=1}^{N}\sum_{t=2+p_i}^{T}\left(\tilde{e}_{it} - \hat{\rho}\tilde{v}_{i,t-1}\right)^2$$

is the estimated variance of $\tilde{\varepsilon}_{it}$. Secondly, compute the adjusted *t*-statistic

$$t_\rho^* = \frac{t_\rho - N\tilde{T}\hat{S}_N\hat{\sigma}_{\tilde{\varepsilon}}^{-2}\hat{\sigma}(\hat{\rho})\mu_{m\tilde{T}}^*}{\sigma_{m\tilde{T}}^*}$$

where $\mu_{m\tilde{T}}^*$ and $\sigma_{m\tilde{T}}^*$ are the mean and standard deviation adjustments. These are provided by tables of LLC. t_ρ^* is asymptotically distributed as *N(0,1).*

4.2.3.2 Im, Peseran, Shin (IPS) Unit Root Test

In LLC, ρ has to be homogenous across i. This is a restrictive assumption. To avoid this IPS propose an alternative testing procedure based on averaging individual unit root test statistics where the null hypothesis is H_0: $\rho_i = 0$ for all i and the alternative hypothesis allows for some of the individual series to have unit roots. Notationally:

$$H_1: \begin{cases} \rho_i < 0 \; for \; i = 1, 2, \dots, N_1 \\ \rho_i = 0 \; for \; i = N+1, \dots, N \end{cases} \qquad (4.8)$$

The IPS *t*-bar statistics is defined as the average of the individual ADF statistics as

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} t_{\rho_i}$$

where t_{ρ_i} is the individual *t*-statistics for testing H_0: $\rho_i = 0$ for all i in (4.8). If the lag order p_i is nonzero for some cross-sections, $\bar{t}$ has an asymptotic $N(0,1)$ distribution. Otherwise, simulated critical values should be found.

Monte Carlo experiments show that if large lag orders are selected for the ADF regressions, then the small sample perfermance of the *t*-bar test is better than LLC test.

5. EMPRICAL RESULTS

5.1. Model

We try to explain production of the SMEs by using number of employees, export values and research and development (R&D) investments. Number of employees is an indicator for the size of the firms. Export values is an indicator about the openness of the firms. In the literature, it is generally excepted that large firms invest to R&D more than small firms. Therefore, we also included R&D investment in the model to see whether it is an important factor effecting SME production or not.

The model is

$$LNpro_{it} = \alpha + \beta_1 LNemp_{it} + \beta_2 LNexp_{it} + \beta_3 LNR\&D_{it} + u_{it} \;\; i = 1, 2, \dots, 86 \;\; and \; t = 1, 2, \dots, 8$$

where LNpro is the production which is calculated by $ln(Product\ Value/Producer\ Price\ Index)$, LNemp is the ln of the number of employees, LNexp is the ln of the export value and LNR&D is the ln of the R&D Investment. α and $\beta_j \; j = 1, 2, 3$ are the parameters. u_{it} includes the unobservable individual specific effect and remainder disturbance. i is number of firms and t is the number of years from 2006 to 2013.

5.2. Descriptive Statistics

In the following 5 Tables we present some descriptive statistics. Tables 9 - 10 presents the average values of the variables for different groups of number of employees and for each year. There is a 47% increase in the production value for firms where number of employees are between 19 and 249 from 2006 to 2013. This increase is 22% and 31% for for firms where number of employees are between 19 and 49 and for firms where number of

employees are between 49 and 249, respectively. When we investigate the increase in export value of firms where number of employees are between19 and 249, the increase is 114%. From Tables 10 and 11 we can calculate the change for firms with number of employees between 19 and 49 and for firms where number of employees are between 49 and 249. The percentages are 104% and 123%, respectively. Lastly, we determine percentage changes for investment spending to R&D and there is a 179% increase for firms with number of employees between 19 and 249. Firms with number of employees between 19 and 49 has an 242% increase. This rate is 140% for firms where number of employees are between 49 and 249.

There is a recognisable decrease in 2009 in each of the Tables. These decreases are due to the global crisis. The percentages in product value for firms are 8%, 29% and 9% for the three groups respectively. These percentages show that firms where number of employees are between 19 and 49, in other words, small firms were affected more from the crisis. Exports of firms are also affected from global crises. In fact again small firms are the most affected group with a decrease of 16%. As we can see from Table 11 there is a 8% decrease for firms where number of employees are between 49 and 249 and from Table 9 10% decrease for firms where number of employees are between 19 and 249. Coming to the investment spending to R&D, Tables 9 – 11 show that the decreases are 5%, 13% and 3% for firms where number of employees are between 19 and 249, between 19 and 49 and between 49 and 249, respectively. Once again we recognise that the effect is the highest for small firms.

Table 9:Average Values of the Variables for Firms with Number of Employees 19 - 249

	Product Value	**Number of Employees**	**Export Value**	**Investment Spending to R&D**
2006	189,179.79	118.61	5,794,228.99	445,785.31
2007	202,505.44	127.13	6,574,428.24	516,016.52
2008	201,630.22	130.91	7,829,608.73	670,723.98

2009	186,276.80	117.95	7,048,808.50	635,878.98
2010	220,556.78	132.88	7,278,148.66	715,826.01
2011	260,263.70	147.46	9,691,833.27	890,803.93
2012	254,391.21	157.23	11,223,494.97	911,067.52
2013	277,598.23	159.20	12,415,159.52	1,244,596.47

Source: Calculated by using TURKSAT database

Table 10:Average Values of the Variables for Firms with Number of Employees 19-49

	Product Value	**Number of Employees**	**Export Value**	**Investment Spending in R&D**
2006	51,057.76	36.09	1,722,535.81	105,466.95
2007	51,216.53	35.85	1,405,236.25	136,466.31
2008	50,326.31	37.90	1,954,946.15	201,136.51
2009	35,790.76	36.00	1,630,042.32	175,226.79
2010	52,460.79	39.88	1,685,163.00	198,271.38
2011	59,948.07	40.86	2,112,081.33	263,373.33
2012	57,111.68	40.21	2,760,556.93	285,092.29
2013	62,300.43	37.12	3,517,823.13	360,751.63

Source: Calculated by using TURKSAT database

Table 11:Average Values of the Variables for Firms with Number of Employees 49-249

	Product Value	**Number of Employees**	**Export Value**	**Investment Spending in R&D**
2006	229,926.91	145.27	6,786,622.17	555,734.32
2007	248,350.57	154.80	8,140,850.06	642,546.88
2008	247,479.89	159.10	9,200,718.61	834,841.40
2009	224,414.63	141.19	8,500,398.91	809,675.87
2010	256,693.01	154.14	8,556,545.39	838,695.64

2011	304,485.31	169.98	11,293,189.31	934,627.30
2012	291,778.90	179.98	12,771,844.03	1,032,784.93
2013	301,833.91	171.73	15,132,835.05	1,335,247.22

Source: Calculated by using TURKSAT database

Tables 12 and 13 presents the mean, standard deviation and minimum and maximum values of the whole panel data. In Table 12 there are the values for the original data set. As can be seen since there is a huge difference between the minimum and the maximum values and therefore the standard deviations are very high. To smooth the data, in Table 13 logarithmic values are presented.

Table 12: Descriptive Statistics (Original Datas) – 688 Observations

	Mean	**Standard Deviation**	**Min**	**Max**
Product Value	224,050.27	260,971.68	9,068.88	1,756,505.51
Number of Employees	136.43	80.34	19.00	249.00
Export Value	8,606,963.86	14,277,262.20	11,500.00	150,653,711.00
Investment Spending in R&D	750,962.34	1,341,633.18	10,575.00	9,852,851.00

Table 13: Descriptive Statistics (LN Values) – 688 Observations

	Mean	**Standard Deviation**	**Min**	**Max**
LNProduct Value	11.71	1.30	1.18	14.38
LNNumber of Employees	4.71	0.69	3.00	5.52
LNExport Value	14.95	1.70	5.98	18.83

LNSpending in R&D	12.65	1.32	8.90	16.10

5.3. Stationarity Tests Results

In this section, we check whether the variables are stationary or not by using Levin, Lin, Chu (LLC) (2002) test and Im, Peseran and Shin (IPS) (2003) test. For this, we used STATA version 13.1. As indicated in Chapter 4 both of the tests assume cross- sectional independence. For each variable, number of firms is 86 and number of years is 8 from 2006 to 2013.

Firstly, as stated in Chapter 4, the null and alternative hypothesis for LLC test are as follows:

H_0: Each time series contains a unit root.

H_1: Each time series is stationary.

The results are presented in Table 14. LLC rejects the null hypothesis for each variable so all of the variables are stationary.

Table 14: Levin-Lin-Chu Unit Root Test

Variable	Adjusted *t*-Statistics	p-Value
LNpro	-5.1592	0.000
LNemp	-25.9864	0.000
LNexp	-7.8229	0.000
LNR&D	-17.088	0.000

Secondly, as stated in Chapter 4. the null and alternative hypothesis for IPS test are as follows:

$$H_0: \rho_i = 0$$

$$H_1: \begin{cases} \rho_i < 0 \; for \; i = 1.2. \ldots . N_1 \\ \rho_i = 0 \; for \; i = N + 1. \ldots . N \end{cases}$$

The results are presented in Table 15. IPS can not reject the null hypothesis. Therefore, some of the variables are non-stationary.

Table 15: Im, Peseran and Shin Unit Root Test

Variable	*t*-bar Statistics	p-value
LNpro	-1.6999	0.3256
LNemp	-1.5928	0.8137
LNexp	-1.4094	0.9588
LNR&D	-1.9207	0.1075

Table 16 presents the results for the first differences and they are stationary.

Table 16: Im, Peseran and Shin Unit Root Test

Variable	*t*-bar Statistics	p-value
LNpro	-3.0464	0.0000
LNemp	-2.8370	0.0000
LNexp	-2.8963	0.0000
LNR&D	-3.5686	0.0000

Since the conclusions of LLC and IPS unit root tests are different about stationarity, we will continue to our panel data analysis using both the level data and the first difference data.

5.4. Panel Data Analysis Results

In this section, fixed effect and random effect estimation methodologies are applied. We firstly start working with level data. For this analysis the period is from 2007 to 2013, 8 years

period with 688 observations.

When we apply the fixed effect estimation, we observe that $Prop > F = 0.846$. Therefore, we can not reject the null hypothesis that all coefficients are equal to zero. Moreover, we observe that the correlation between the errors and the regressors is 0.147. These initial results do not suggest the use of fixed effects estimation. Still, the estimation results are presented in Table 17. As can be seen all of the coefficients are not significant and negative sign of the R&D is interesting.

Table 17: Fixed Effects Estimation Results (Level Data)

	Coefficient	**Standard Error**	**T**	**P> |t|**
LNemp	0.910512	0.0637402	14.28	0.138
LNexp	0.183702	0.0402383	4.565	0.698
LNR&D	-0.015159	0.0302973	-0.0503	0.354
Constant	4.92336	0.254532	9.34	0.0561

Now, we assume that the correlation between the errors and the regressors is zero and apply the random effects estimation to level data. We observe that $Prop > \chi^2 = 0.2987$. Therefore, we can not reject the null hypothesis that all coefficients are equal to zero. Still, the estimation results are presented in Table 18. Model suggests the significance of the variable number of employees strongly. Negative sign of the R&D is interesting.

Table 18: Random Effects Estimation Results (Level Data)

	Coefficient	**Standart Error**	**Z**	**P> |z|**
LNemp	0.439047	0.0245541	28.24	0.001
LNexp	0.180405	0.0375954	4.799	0.163
LNR&D	-0.0563634	0.0265895	-0.212	0.832
Constant	4.89621	0.224001	15.45	0.04698

Although the results obtained above are not attractive for the model we specified, we can still run the Hausman test to determine which estimation method is better. For the Hausman test, the null hypothesis is that the preferred method of estimation is random effects and the alternative is that it is the fixed effects. We observe that $Prop > \chi^2 = 0.6731$. Therefore, we can not reject the null hypothesis so Hausman test suggests the use of random effects estimation.

We now present the results for the case where we take the first differences of the variables. Since we loose one period while taking the differences, the time period considered now is from 2007 to 2013. A 7 years period. There are 602 observations.

When we apply the fixed effect estimation, we observe that $Prop > F = 0.4248$. Therefore, we can not reject the null hypothesis that all coefficients are equal to zero. Moreover, we observe that the correlation between the errors and the regressors is 0.0034. These initial results do not suggest the use of fixed effects estimation. Still, the estimation results are presented in Table 19. As can be seen all of the coefficients are not significant and negative sign of the R&D is interesting.

Table 19: Fixed Effects Estimation Results (Difference Data)

	Coefficient	**Standard Error**	**t**	**P> |t|**
LNemp	0.2063167	0.1499069	1.38	0.169
LNexp	0.0281807	0.0402025	0.70	0.484
LNR&D	-0.0245154	0.0429751	-0.57	0.569
Constant	0.0705113	0.0326048	2.16	0.031

Now, we assume that the correlation between the errors and the regressors is zero and apply the random effects estimation. We observe that $Prop > \chi^2 = 0.31974$. Therefore, we can not reject the null hypothesis that all coefficients are equal to zero. Still, the estimation results are presented in Table 20. Only the number of employees is significant at 5% significance level and negative sign of the R&D is interesting.

Table 20: Random Effects Estimation Results (Difference Data)

	Coefficient	**Standart Error**	**z**	**P> |z|**
LNemp	0.2253461	0.1363646	1.65	0.048
LNexp	0.0262671	0.0364330	0.72	0.471
LNR&D	-0.0157602	0.0399297	-0.39	0.693
Constant	0.0682991	0.0307356	0.026	0.0080583

Although the results obtained above are not attractive for the model we specified, we can still run the Hausman test to determine which estimation method is better. For the Hausman test, the null hypothesis is that the preferred method of estimation is random effects and the alternative is that it is the fixed effects.

We observe that $Prop > \chi^2 = 0.9406$. Therefore, we can not reject the null hypothesis so Hausman test suggests the use of random effects estimation.

6. CONCLUSION

In this thesis we tried to explain production of SMEs with number of employees, exports and Research and Development (R&D) spending by using micro data. In fact, using the micro data is the main contribution of this thesis to economic literature since due to lack of data up to now it was not possible to make such an analysis. However, our search in the database of TURKSTAT showed us that, now, data accumulated to give the opportunity to make micro data analysis. This fact encouraged us to start working on this thesis.

The model that we chose is rather simple and we admit that more sophisticated models could be studied. However, since our main aim was to put a starting point for future studies of micro data for SMEs, we did not involved into model selection issues. Moreover, there were still the problem of micro data for other variables to include the model.

We had to restrict our data in order to make our data balanced. Very small firms do not have exports and R&D spending values so they are not included to analysis. Therefore, the smallest firm in our study have 19 employees.

Firstly, we checked the stationarity of the variables by using Levin, Lin, Chu (LLC) and Im, Peseran, Shin (IPS) unit root tests. Although, LLC rejected the null hypothesis of unit root for each variable, IPS did not. These different conclusions leaded us to use both the level data and difference data of the variables in our analysis of panel data later on in the thesis.

However, at this point, it should be noted that the use of both LLC and IPS depends on the assumption of cross sectional independence. One can argue that taking into consideration of the structure of SMEs, there can be a high possibility of cross sectional dependency and it may be more appropriate to use unit root tests where cross sectional dependency is assumed but this analysis is left for future studies.

We firstly applied fixed effects methodology both to level data and the difference data. Correlation between the errors and the regressors that we found for both of the cases suggested us not to use the fixed effects estimation methodology. Still, we made the estimations and found out that the coefficients of the variables are not significant for both of the cases.

With an assumption of zero correlation between the errors and the regressors, we applied random effects methodology to both level data and the difference data, as well. This time, we observed that the number of employees were significant for both of the cases. While an increase in the percentage of employees were increasing the production value by 43.9% when we used level data, an increase in the percentage of employees were increasing the production value by 22.5% when we used the difference data. These positive results may be due to the fact that most of the SMEs are using the labor intensive techniques in their production processes.

One interesting point we found out is that although not significant the sign of R&D spending is negative for all of the cases. This can be explained by the fact that usually SMEs leave R&D to large firms and imitate the findings of the large firms. The insignificance of export variable is not very much surprising because usually SMEs do not practice international trade. We also applied Hausman test and found out that this test suggests the use of random effects estimation.

As a conclusion, we can say that for this very simple model random effects estimation methodology can be used. Moreover, as the micro data accumulation goes on, more variables can be included to the model and more healty, explanatory and informative models can be created.

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