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FIRM GROWTH, PROFITABILITY AND R&D INVESTMENTS IN TURKEY: AN EMPIRICAL STUDY

Hüseyin Alperen ÖZER

MASTER'S THESIS

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ÖZET

Firma büyümesi ile ilgili araştırmalar muazzam bir hızda artmaktadır. Ampirik olarak firma büyümesi ile ilgili belirleyiciler arasındaki ilişkiyi incelemek, özgün veri setleri, gelişmiş ekonometrik metodoloji ve çok disiplinli yaklaşım gerektirir. Bu kapsamda, Türk sanayi dinamiklerini geniş bir veri seti ile araştırmaya karar verdik. Firma büyümesi ile belirleyicileri arasındaki ilişkiyi tartışırken AR-GE yatırımlarının firma büyümesine etkilerini de göz önüne aldık. Bu hedef doğrultusunda, öncelikle kârlılık üzerindeki büyüme etkilerini kontrol ettik. İlaveten, kârlılığın firma büyümesi üzerindeki etkilerini belirledik. Bazı bilim adamları, büyüme ve kârlılık arasındaki beklenen ilişkinin pozitif veya negatif olduğunu ileri sürmektedir.Fakat, çalışmamız kârlılık ve firma büyümesi arasında negatif bir ilişki olduğunu göstermektedir. Bu konuda çalışmamız, Türk iş ortamının kurumsal sınırlarına ve pazar yapısına atıfta bulunmaktadır. Ayrıca, bu çalışmada firma yöneticilerinin kar üretmek yerine büyüme yolunu seçtiğini iddia ediyoruz. İkinci önemli sonuç firma büyümesi ile kârlılık arasındaki U şeklinde dağılımdır. Son bölümde ise, AR-GE yatırımlarının GMM modeli kullanarak nakit akışı, satış ve yaş varyasyonlarına nasıl tepki verdiğini değerlendirdik. Bu noktadan yola çıkarak, gecikmeli AR-GE yatırımlarının, Türk imalat firmaları için mevcut AR-GE yatırımının ana belirleyicisi olduğunu bulmaktayız. Ayrıca, sonuçlarımızın anlamlılığını geliştirmek için modellerimizde sağlamlık kontrolleri uyguladık.

Anahtar Kelimler: Firma büyümesi, Panel veri modelleri, AR-GE yatırımları

SUMMARY

The research in the firm growth literature has been growing in a tremendous velocity. Empirical examination of the relationship between firm growth and related determinants requires unique datasets, improved econometric methodology and a multidisciplinary approach. To this extent, we decided to investigate the Turkish industry dynamics with a large longitudinal dataset. When discussing between the relationship between firm growth and its determinants, we consider the effects of R&D investments on the firm growth. In this line, firstly, we check the effect of growth on profitability. Further, we also determine the profitability effects on the firm growth. A number of scholars suggest that the expected relationship between firm growth and profitability is positive or non-existent. However, our study suggests that there is a negative relationship between profitability and firm growth. In this matter, our study refers to the institutional boundaries and market structure of the Turkish business environment. We also claim that firm managers in Turkey choose to promote growth over profits. The second notable result is that the U-shaped distribution between firm growth and profitability. In the last part, we consider how the R&D investments respond to cash flow, sales and age variations by means of GMM model. From this point of view, we find that the lagged R&D investment is the main determinant of the current R&D investment for Turkish manufacturing firms. We also apply a number of robustness checks to our models to show the significance of our results.

Keywords: Firm growth, Panel data models, R&D investments.

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LIST OF SYMBOLS AND ABBREVIATIONS

Symbols and Abbreviations	Description
SME	Small and Medium-Sized Enterprises
GMM	General Method of Moments
OLS	Ordinary Least Squares
R&D	Research and Development
VAR	Vector Autoregression
MADF	Multivariate Augmented Dickey-Fuller Test
SURADF	Seemingly Unrelated Regression Augmented Dickey-Fuller Test

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1.INTRODUCTION

What causes the growth of the firms? Many studies related to firm growth try to answer this question by conducting analyses in different contexts. Earlier firm growth studies generally determine the interconnection between growth and size distributions. In any case, most of the studies test the validity of Gibrat's (1931) Law by implementing different methodologies. It is a constructive approach to assess the firm growth in an empirical perspective. The advantage of this viewpoint could grant us efficient estimates. This study attempts to preveil an original evidence to the issue of growth-profit nexus by taking into account of R&D investments for Turkish firms. Most studies try to determine the growth equations with different firm performance variables (Coad, 2009). A number of chapters in this study refer to the empirical investigations on firm's growth rate. Before we take further steps on these issues, the measurement techniques of growth are discussed.

1.1. Measuring Firm Growth

The most common way to measure growth is to take log-differences of the total sales.

$$G_{it} = \left(\frac{S_{it} - S_{it-1}}{S_{it-1}} \right) = \frac{S_{it}}{S_{it-1}} - \frac{S_{it-1}}{S_{it-1}} = \frac{S_{it}}{S_{it-1}} - 1 \tag{1.1}$$

where S_{it} denotes the total sales of firm at time *t.* After taking the logarithms, we get:

$$\log(G_{it}) = \log((S_{it} / S_{it-1}) - 1) = \log(S_{it} / S_{it-1}) = \log(S_{it}) - \log(S_{it-1}) \quad (1.2)$$

Some studies such as Shephard and Wiklund (2009) diversify the growth measures. They addressed two growth measures. First, the relative growth rate which is measured by percentage rates (sales growth). The second is the absolute growth rate (employment growth). For this issue, Birch (1987) presents an index which contains weighted average and absolute growth rates:

$$BI_{it} = (E_{it} - E_{it-1}).\left(\frac{E_{it}}{E_{it-1}}\right) \quad (1.3)$$

where BI_{it} denotes the Birch Index and E is the total employment of the firm. Some researchers claim that the sales growth is a poor measure compared to the employment growth. They also argue that employment growth could be a great criterion to form policy implications with respect to employment.

1.2. Structure of the Study

The main object of the study is to uncover the relations between firm growth and firm performance variables. At the first step, we collect heterogeneous firm data from auditing reports and financial statements. Our dataset contains 232 Turkish manufacturing firms listed in BIST within the period of 2003Q1 – 2017Q1. Second, we implement two panel data methodologies to examine growth-profit relations of Turkish firms, namely fixed effects and GMM method. We also check the non-linear patterns of profits to take pattern-specific relations into account. Third, we consider the R&D investments when conducting the empirical analysis. So, we try to measure benefits of the R&D investments for generating growth and profits.

This study consists of five chapters. Chapter 2 provides a detailed survey on the empirical and theoretical literature of the firm growth. Chapter 3 defines the methodology on which we use to conduct our empirical analysis. Chapter 4 has two sub-chapters, first it presents our

longitudinal dataset’s features and then the empirical discussions are reported. Lastly, conclusions are presented in Chapter 5.

2. A BRIEF LITERATURE ON THE FIRM GROWTH

2.1. Introduction

In this section, we begin by explaining the early firm growth theories and review the empirical studies on the firm growth briefly. Research related to firm growth theory has a long history and most of the studies on this topic have different aspects such as managerial theory, evolutionary approach etc. It may be useful to review theories of firm growth in order to reveal thoughts on the causes of growth. Another goal of this review is to categorize the empirical literature related to the firm growth and explain the causality between firm growth and its possible determinants.

Firm growth has been a challenging term for many scholars since its emergence in theoretical studies. In this chapter, we will introduce the theories of the firm growth along with the empirical studies. There are six theories that refer firm growth strategies with different perspectives. Firm growth theories are categorized in this chapter with careful insight. Nevertheless, we limit ourselves in order to conceptualize the theoretic sources. After, we discuss some empirical works on the firm growth.

2.2. Theoretical Concepts of Firm Growth

First, we begin investigating the basic neoclassical approach. Secondly, resource-based view (Penrose, 1959) and its implications of the firm growth will be summarized in this context. The stochastic approach of the firm growth (Gibrat, 1931) is also considered in this review. Such theories have indicated that productivity may increase the growth of the firm. As Jovanovic's (1982) learning model demonstrates that a given firm may learn its productivity level over time. The growth of the firm is strictly bounded by this productivity of the firm. Another fundamental approach of the firm growth is the managerial theory of the firm introduced by Marris (1963, 1964). Lastly, the evolutionary approach which credited by Alchian (1950) will be acknowledged in the following part.

2.2.1 Neoclassical Approach of Optimal Firm Size

The neoclassical approach of optimal firm size is substantially defined by a body of literature. In the context of traditional neoclassical approach, the behavior of a representative firm is determined at the cost-minimizing level of production. The marginal product in this firm is equal to the worker's marginal wage. Because of economies of scale, the costs are descended and the optimal size of firm is obtained where minimum point of the long run average cost curve is reached. If a given firm captures its optimal size, it grows no more. (Viner, 1932)

In particular, optimal size concept has been received a great deal of attention. Another viewpoint in this context is Lucas (1978) who presumes that the distribution of managerial talents is lognormal. Large firms are large because of their managers' success. On the other hand, small firms have to remain small because of their managers' inability. The transaction cost theory (Coase, 1937) also has been discussed in the contexts of growth by acquisition (Kay, 2000) and cross-country differences (You, 1995).

To sum up, the drawback of the neoclassical approach is the lack of empirical evidence stemming from real life. Also, it has not realistic assumptions that link firm growth and its determinants.

2.2.2 Penrose's Theory of the Firm Growth

Penrose's (1959) leading book has immense contributions to the firm growth literature. In her research, "economies of growth" is the main idea. Besides the neoclassical notion of the firm growth, Penrose's Firm Growth theory defined as a dynamic procedure. Fundamentally, firms generate their growth by a learning-by-doing process. In this sense, a firm's resources, boundaries and competitive advantages lead firm growth.

Incrementally, as the managers gain experience, they become more productive. Therefore, growth opportunities of the firms are created by excessive managerial capacities. As a result, administrative tasks would be routinized and easily handled by the managers.

Some other key concept of this theory is the “Penrose Effect”. The growth of the firm is bounded by the availability of managerial attention. If the growth rate increases, growing firms have to bear higher operating costs compared to slow-growing counterparts. This proposition is referred as “Penrose Effect”.

For the firm’s competitive advantage, “resources” play the critical role in Penrose’s context. Firm’s resources can be described as unique tangibles for seizing the competitive advantage in the market. For instance, brand names, tacit knowledge of technology, skilled personnel etc. (Wernerfelt, 1984).

In Penrose’s context, firms grow for “economies of growth”. A firm’s past growth rate is such a cause of the firm’s current size. Accordingly, there is a limit to firm growth, but there is no limit for the firm size. Nonetheless, the resource-based view is dominant in the firm growth literature since its emergence.

2.2.3. Stochastic Approach

The stochastic approach of firm growth begins with Gibrat’s (1931) “Law of Proportionate Effect”. This “Law” argues that the growth rate of a firm is independent of its size and historical growth performance. The simplest form of Gibrat’s Law claims that the expected growth rate of a firm is irrelevant of its size at the market entry of the firm.

Having received much attention, Gibrat’s Law is a baseline for the empirical studies. In this context, this “law” has a basic theoretical content (due to random process of the growth). Testing the Gibrat’s Law empirically relies on the equation of;

$$\log(x_t) = a + \beta \log(x_{t-1}) + e \tag{2.1}$$

where x_t represents firm size. Empirical research on the Gibrat’s Law focuses mostly on the β coefficient. If the firm growth is independent of firm size, β coefficient must be equal to 1. If the β coefficient is smaller than 1, small firms will have relatively faster growth rates compared to large firms. In contrast, if β coefficient is larger than 1, large firms have faster

growth rates compared to smaller ones. This fact implies that there may be a monopolistic trend in the market. (Coad, 2009; Calvo, 2006; Almus & Nerlinger, 2000)

Formally, lognormal size distributions need to be studied with the basic mathematical framework. Let's assume the "x_t" size of a firm at time "t" and ε_t is the random variable representing a shock on the growth between the periods of t-1 and t. Then we have;

$$x_t - x_{t-1} = \varepsilon_t x_{t-1} \tag{2.2}$$

This equivalence can be changed by taking logarithms;

$$x_t = (1+\varepsilon_t)x_{t-1} = x_0(1+\varepsilon_1)(1+\varepsilon_2)....(1+\varepsilon_t) \tag{2.3}$$

$$\log(x_t) \approx \log(x_0) + \varepsilon_1 + \varepsilon_2 .... + \varepsilon_t = \log(x_0) + \sum_{s=1}^{t} \varepsilon_s \tag{2.4}$$

If "t" goes to infinity, $\log(x_0)$ becomes trivial and converges to zero. After that we obtain;

$$\log(x_t) \approx \sum_{s=1}^{t} \varepsilon_s \tag{2.5}$$

Equation (2.5) shows that the size of a firm at the time "t" is bounded by a random variable and only it can be explained by "firm's idiosyncratic history of multiplicative shocks" (Coad, 2009). After the assumptions, it is clear that all firms in an industry have a stochastic process in terms of growth rates and size distributions.

2.2.4. Learning Model

Learning model mostly discusses the relationship between productivity and growth. Jovanovic (1982) has presented this as "passive learning model". The learning model is simply established on productivity levels of firms. Every firm has a unique productivity level, although

a firm does not perceive its productivity level at the first time. The firm may learn its productivity level after market entry. This model also emphasizes the firm age in order to obtain the underlying mechanism lying behind the efficiency levels and growth rates of the firms. In Jovanovic's model, firm growth is edged by productivity levels. If the firm keeps operating and learns continuously about its productivity level, higher output levels occur. Therefore, learning model implies that firms with higher productivity levels would grow, but inefficient firms would shrink and leave the market.

Ericson & Pakes (1995) and Pakes & Ericson (1998) also expand Jovanovic's model by adding an extra term as "active learning process". "Active learning process" refers to some factors such as innovation ability, entrepreneurial characteristics, industry complex that are the important determinants of the growth rate of a firm.

2.2.5. Managerial Approach

A different approach was introduced by Marris (1963, 1964) and called as managerial approach. In this approach, firm growth has a strong relationship with the diversification of market activities. In other words, firms are assumed to grow only by diversifying. In Marris' approach, there is a quadratic relationship between profits and firm growth. Also, Marris (1963, 1964) claims that additional growth may have a negative effect on profits because of the U-shaped relationship between them.

2.2.6. Evolutionary Approach

The evolutionary approach generally follows the Schumpeterian vision of "creative destruction". It has its own unique concepts that refer to dynamic behaviors of the economic agents. In this framework, a turbulent market competition, as well as swift technological processes mainly characterize the industrial economy. To understand the process of evolutionary mechanism of the firm growth in a theoretical way, Alchian (1950) provides some insight on

the selection process that acknowledges the survival of the fittest firms. On the other hand, unfit firms lose their market share, shrink, and then exit the market.

The theoretical discourse of evolutionary approach assumes that the profitability is a crucial term for the growth of the firms, but in this context, some empirical studies have conflicting results on the relationship between profits and growth. As Coad (2007) argues that the "growth of the fitter" principle is valid by tracking 8405 French manufacturing firms. However, he fails to reveal any absolute relationship between profitability and growth. Instead, Coad (2007) finds that the past growth rates have a positive influence on the subsequent growth rate.

To sum up, evolutionary models mainly deal with the firm survival process in turbulent market competition noting that the profitability is the main source of high growth leading to firm survival.

2.3. Factors that Affect Firm Growth

2.3.1 Size, Age and Firm Growth

Early empirical works investigate whether Gibrat's Law is valid or not, but the overall findings of the studies generally confirm that Gibrat's Law has not enough evidence for its validation (Wagner, 1992). Since its emergence, many scholars have contended Gibrat's Law and the empirical studies have been concentrated on the rejection of its validity (Evans, 1987; Yasuda, 2005). Accordingly, Kumar (1985) attempts to test Gibrat's Law, from 1960 to 1976 for the UK manufacturing firms. He finds that there is a weak negative relationship between size and growth.

Hall's study (1986) points out that Gibrat's Law is usually rejected because of small

sample selection problem. Investments in physical capital and R&D expenditures have positive effects on firm growth. Calvo (2006) tests the Gibrat's Law by Spanish manufacturing data over the 1990 – 2000 period. Using least squares approach and a survival equation based on probit methodology, results lead him to reject the Gibrat's Law and he concludes that the small Spanish firms grow faster compared to larger ones. Additionally, he finds that the firm age is a strong determinant for firm growth. In these studies, it is also suggested that the innovation activity must be a main factor for firm's survival and growth.

Almus (2000) investigates whether the Gibrat's Law is valid for West German manufacturing firms within the period between 1990 and 1994 by means of OLS approach. However, joint test results show that the Gibrat's Law is rejected for the sample. In other words, Almus (2000) finds that distribution of firm sizes does not follow random walk. Therefore, he concludes the initial firm size is a crucial determinant of firm growth.

Firm age and size play a significant role as a determinant of firm growth. Some empirical studies provide the analytic perception between size, age and firm growth. For instance, Varyam & Kraybill (1992) establish a link between firm growth and age using Georgian dataset. Their results indicate that small firms experience higher growth rates than bigger firms. Additionally, Varyam & Kraybill (1992) also make clear that the firm growth is negatively linked to firm size and age. Dunne & Hughes (1994) find similar results compared to Varyam & Kraybill (1992). They study a great sample of UK firms in the period between 1975 and 1985 and the analysis shows that smaller companies grow faster than larger counterparts do.

Generally, the relationship between firm age and growth is inversely assessed but industry level and cross-country type studies offer different approaches to firm growth such as Das (1995). Das (1995) investigates the Indian computer hardware industry and finds that the firm age positively impacts firm growth. Furthermore, Das (1995) shows that the current and lagged size of the firm has an adverse effect on firm growth. Shanmugam & Bhaduri (2002) analyze the relationship between firm size, age, and growth of Indian manufacturing firms. They suggest that firm age positively affects growth. Their results have similarities with the results of Das

(1995).

For the newborn firms, Mata (1994) investigates firm growth determinants during the establishment of Portuguese manufacturing firms. Therefore, the relationship between firm size and growth is found to be negative for the firms with the same age.

Even though there is increasing knowledge of firm growth determinants, there is no extensive interest on the growth dynamics of small and medium enterprises (SMEs). An exception is McPherson (1996) investigating the micro and small enterprise's growth by means of a cross-country data analysis. For South Africa, Swaziland, Lesotho, Zimbabwe and Botswana, McPherson (1996) finds that the effect of firm age on firm growth is negative. Exceptionally, McPherson (1996) states that there is no obvious relationship between growth and size of Zimbabwean firms showing evidence weakly supporting Gibrat's Law.

In order to sort out the determinants of firm growth, some surveys extend the arguments and add different independent variables in the econometric models, such as labor productivity to measure the effects on firm growth. In this manner, Liu et al. (1999) employ the labor productivity in a panel structure by assessing the relationship between firm growth, size, and age. The overall results of Liu et al. (1999) show that small firms grow more quickly than big ones. Another finding of the study indicates that the labor productivity is one of the main origins of the firm growth for the Taiwanese electronics firms.

2.3.2. R&D Activities and Firm Growth

The relationship between sales growth and R&D activities has been a puzzling research for many years. When discussing the relationship between firm growth and R&D activities, it is suitable to classify the measures of firm growth into employment growth and sales growth. Some empirical studies employ these two variables as the dependent variable (Coad, 2009). There are a number of studies dealing with R&D activities and sales growth. Actually, it is not suitable to

think the R&D activities always have positive effects on sales growth.

Since the Schumpeter's (1934) context of innovation, the scholars have studied the relationship between firm growth and R&D activities with empirical studies. The R&D activity is one of the main inputs that drive the innovation. According to Schumpeter (1934), firm growth is also a process, which is designed by creative destruction. Some works find the positive impact of R&D activities on sales growth and profits. Geroski & Machin (1993) designate the characteristics of the firm with different innovative activities. Linking the innovation activities in firm growth and profits, Geroski & Machin (1993) find that profitability differences between the innovative firms and non-innovators. The results point out that the R&D activity benefits the firm survival especially during recessions. Another finding of this study is that the firm growth is boosted by R&D activities leading innovating firms to be more profitable than non-innovators.

In a different study, Geroski & Toker (1996) find a positive link between the effect of R&D expenditures and the sales growth. Roper (1997) reports the small business growth with a survey data containing 2721 small businesses. The analysis shows that the pace of sales growth of innovating small firms is much higher than non-innovators.

Freel (2000) takes the inspiring work of Geroski & Toker (1996) as the basis and he investigates the 228 UK small manufacturing businesses. He notes that small business, which are innovators, are likely more growing ones. Del Monte & Papagni (2002) use two steps of econometric analysis to decipher the relations of R&D and growth of Italian manufacturing firms. First, they highlight that the firm size has no effect on firm growth by utilizing a panel unit root test affirming the Gibrat's Law. Secondly, using panel random effects regression, they point out that the sales growth rates are relatively higher for firms with higher R&D intensity.

On the other hand, Garcia-Manjon & Romero-Merino (2012) find an association between the R&D spending and firm growth using OLS, quantile regression and General Method of Moments system estimators with a sample of 754 European firms for the period from 2003 to

2007. They also acknowledge that R&D spending is a critical term for firm survival and growth. Segerra & Teruel (2014) prove that the fastest growing firms have a dual relationship between R&D investments. Particularly, the high growth in manufacturing firms is associated with R&D spending. Also, firm growth is negatively affected by firm size.

Deschryvere (2014) implements a VAR process using Finnish SMEs' large data sample. He finds that only the persistent innovator has benefits on sales growth. Coad & Rao (2010) also apply a VAR model to determine the associations between the past growth of employment, sales growth, and R&D growth rate. The VAR analysis demonstrates that the growth of sales has a subsequent influence of the R&D growth. In addition, to get the behavioral patterns of firms on the R&D, they suggest if employment and sales growth are increased recently, firms tend to increase their R&D expenditures. While employment and sales growth are decreased recently, firms keep their R&D expenditures steady.

Demirel & Mazzucato (2012) contribute to the literature by investigating the small and large pharmaceutical US firms between 1950 and 2008. They find that the positive impact of R&D on firm growth is highly circumstantial. Their results also expand the firm growth literature by including patent statistics for pharmaceutical firms for the first time. Surprisingly, R&D investments in large pharmaceutical firms have negative effects on the firm growth. But, R&D investments in small pharmaceutical firms, that are able to patent persistently, have positive effects on firm growth.

As mentioned earlier, R&D activities may affect firm growth negatively. According to Brouwer et al. (1993), the growth of the R&D intensity has a negative impact on job creation of Dutch firms over the period between 1983 and 1988. Freel & Robson (2004) convey a survey covering 1347 respondents employing four measures of growth. These measures are "growth in employment, growth in turnover, growth in productivity, and profit margin change". Measures are separately employed in the econometric model for the manufacturing and services firms. The most definitive finding of the study is that there is a negative correlation between product innovation and growth in terms of sales and productivity. In contrast, product innovation for

manufacturing firms has a positive relationship with employment growth in the short term. Also, sales and productivity have been positively related to the accumulative process of innovations for the service firms.

2.3.3. Profitability and Firm Growth

There is a vast literature on the profitability and firm growth. The Persistence of Profit (Mueller, 1977) is a theory that mostly refers to the life cycle of the firms. In the market turbulences, firm's profit reaches to an average value in the long run if there are no market barriers to entry and exit. The classical Ricardian stance shows that if a firm reaches to high profitability levels, consequently, the firm grows and begins to exploit lucrative opportunities. This way of thinking leads to an important conclusion. The profit rates converge to zero in the long run (i.e. steady state). Finally, when the profit rates reach zero, the firm growth begins to have a negative effect on profitability. Along with Ricardian stance, the neoclassical view has similar implications about the direction of the firm growth and profitability rates. First, the firms tend to exploit their most profitable opportunities in the market. Then, incrementally, firms exploit less profitable opportunities. When the marginal profit on the last growth opportunity is equal to zero, the firm maximizes its profit level. In this context, adding another opportunity for growth generates a negative effect on profits. A different theoretical implication of firm growth on profitability is discussed as the Kaldor – Verdoorn law (Kaldor, 1934; Verdoorn, 1949). This law claims that if the firm increases its growth, then, the source of firm growth is related to the increasing productivity gains. Actually, firm's profit increases through the productivity gains according to the Kaldor – Verdoorn law.

Alchian (1950) advocates that the profitable firms should grow and the non-profitable firms should depart the industry. This is the evolutionary approach that serves a deterministic point for the firm's survival. The profit rates reflect the fitness of the firms into the turbulences in the markets. The empirical research on the evolutionary principle has received much attention for the last decade. For example, Italian manufacturing firms are investigated

by Dosi (2007) and French manufacturing firms are assessed by Coad (2007) according to the evolutionary principle. These studies shed light on the influences of profits on the firm growth rates. For example, Coad (2007) claims that there is no obvious relationship between lagged profit rates and current growth rates. But, the past growth rates seems to trigger higher profitability.

2.4. The Growth of Medium and Small Enterprises

Previous studies define the small and medium enterprises (SMEs) according to some measures such as staff headcount, turnover and balance sheet total. A firm with a maximum of 50 workers is considered a small enterprise (Nichter & Goldmark, 2009 p.1453). The classification of the medium sized enterprises requires the staff headcount to be less than 250 (EU Recommendation, 2003). Empirical studies provide some insights on the determinants of the small and medium enterprise growth. From this point of view, the determinants of the small firm growth is generally based on the individual characteristics of entrepreneurs besides firm characteristics (Jarillo, 1989; Nichter & Goldmark, 2009).

Some studies deeply investigate the small firm growth and classify the growth constraints in order to make some implications of the growth path of a SME. As far as we know, there is no wholesome economic theory to capture the idea behind the SME growth. However, theories related to small business growth are roughly similar to those explained previously in the earlier parts (For extra information, see O'Farrel & Hitchens, 1988). Additionally, studies concerning SME growth is fewer than studies that concern large firms. The reason of the scarcity is unavailability of appropriate and reliable data for SMEs (especially for micro-small firms) due to the informal structure of such firms.

Although the SMEs contribute to the economic growth in the transition economies (e.g., Albania, Slovenia), SMEs witness a variety of constraints such as financial burdens and institutional barriers. For instance, the tax system is a big problem for newly emerging

entrepreneurial activities called start-ups in the transitional economies (Hashi, 2001). Primarily, when the obstacles of SME growth are questioned in a formal way, the focus should be SME access to external finance in turbulent market conditions.

Beck & Demirguc-Kunt (2006) explain the importance of accessing external finance for the growth of the SMEs. Financial institutions help to alleviate SME growth constraints and create an efficient business environment. This is the most delicate way to put the firms on a high growth path, as well as relaxing the growth constraints. Using small and medium firm-level data of 54 countries, the seminal study of Beck et al. (2005) have concerned the effects of financial, legal and corruption problems in terms of firm growth rates. Legal and financial underdevelopment and the corruption constrains the growth rate of firms as expected.

Prior studies have also emphasized the relationship between internal finance constraints, firm growth and survival. Financial constraints definitely affect firm's investment behavior and growth path. In the same way, the internal constraints of firm and their impact on the firm performance has been attrackting much interest by many scholars (Schiantarelli, 1996; Hubbard, 1997). Firm growth may be constrained by many financial obstacles. Internal finance is one of these obstacles in the literature. The argument is mostly defined as "internal finance theory of growth" (Carpenter & Petersen, 2002). The studies are generally based on the framework of Fazzari et al. (1988). Fazzari et al. (1988) explain the relations between investment financing constraints and cash flows and their empirical research shows that investments are highly sensitive to the cash flows (as a component of the internal finance).

In the same vein, following Fazzari et al.'s (1988) seminal work, Carpenter and Petersen (2002) have analyzed whether the growth rate (which is proxied by total asset growth) of small firms depends on the internal finance availability or not. The specification of the econometric methodology is based on two fundamental variables; Tobin's Q and cash flow-total asset ratio. In this study Tobin's Q is employed for representing the firm's investment demand. The study's main results have confirmed that Tobin's Q and cash flow-total asset ratio have a positive impact on total asset growth. Carpenter and Petersen (2002) also make some implications on traditional

firm growth literature by focusing stylized facts that is found in prior firm growth studies. Most delicate phrase of the study is that higher growth-cash flow sensitivities mostly reflect the hazardous financing problems for the firms. In addition, authors claim that the examination of "internal finance theory of growth" can only be adapted to the small firms.

Wagenvoort (2003) tests relatively the same model of Carpenter and Petersen (2002) empirically. Using 211,374 medium and small firms in manufacturing and construction sectors, firm growth model employs the growth rate of total assets of the firm as the dependent variable in the econometric model. Positive relations between firm growth and Tobin's Q are consistent with Carpenter and Petersen's (2002) results. Thus, the ratio of the cash flow to total assets has a positive relation with the firm growth.

Oliveira & Fortunato (2006) use the dataset that contains large amounts of Portuguese firms to construct a relevant relationship between liquidity constraints and firm growth. Their study employ cash flow over the total assets to unveil the relationship in a GMM equation. The model has revealed that liquidity constraints have severe impact on firm growth for small firms and become an obstacle. As previous studies also show the age and firm size have a negative effect on firm growth.

In a different form of a study, Himmelberg & Petersen (1994) argue that there exists a connection between R&D investments and internal finance. Using a panel dataset containing 197 small firms in high tech industry, the study shows that external financing fairly affects the R&D investments when within firm based OLS regression equations are evaluated. Himmelberg & Petersen (1994) also test between-firm specifications and they get similar results compared to within firm based results.

Apart from the firm growth literature, a different approach is used by Goedhuys et al. (2016). Goedhuys et al. (2016) explore the effects of institutional obstacles on innovatively growing firms. Using firm-level data from Egypt and Tunisia, they show how the corruption affects the employment growth as well as the firm's innovation behavior. According to

institutional growth literature, the two main strands of corruption hypotheses are reviewed in the study. The first hypothesis assumes that corruption directly and negatively affects business environment. When firms in early development phases are exposed to corruption, it may raise transaction cost via bribery as a general assumption. This fact hinders the competition between small and large firms. Also, Goedhuys et al. (2016) acknowledge that corruption may wear away the entrepreneurial trust. Secondly, it can be argued that the positive side of the corruption could remove the bureaucratic barriers of the innovative firms. Roodman (2015) using a conditional mixed process shows that corruption and firm growth have bi-direct negative relationship. In accordance with Coad & Rao (2008), this study also finds that the innovation is the major determinant of the firm growth. In accordance with the institutional literature, Bai et al. (2016) also test the causal relationship between firm growth and corruption. The findings are relatively similar to the study of Goedhuys et al. (2016).

Chittenden et al. (1996) analyze the significant relationship between financial structure, asset structure, size, age and access to the capital markets with a sample of UK small firms. Their study shows that firm growth does not have a significant effect on the financial structure of small firms. But, other factors which are listed above do affect the financial structure of small firms.

Similarly, Bartlett & Bukvic (2001) emphasize the key institutional environment (which is the bureaucracy) along with the financial constraints. The study shows that the role of the SMEs is essential in the transition economies as Slovenia. Employment growth is used as the dependent variable for testing the barriers for the growth in Slovenia. Research shows that SMEs face some financial barriers when the growth is incurred. Moreover, Bartlett & Bukvic (2001) points out that high-cost capital has a significant negative effect on the growth of employment.

Becchetti & Trovato (2002) report Italian small and medium firm growth determinants by applying a multivariate econometric methodology. Empirical study shows that small firms have higher growth potential. Also, scarcity of external finance and lack of access to foreign markets may limit the growth potential of the small Italian firms.

Döckel & Ligthelm (2015), emphasize the availability of the credit by applying an OLS method for small businesses in South Africa. The dataset related to small firms are divided into eight sectors and three employment groups. OLS results show that credit accessibility enhances firm growth for small businesses,.

Nichter & Goldmark (2009) explore the growth for small firms by reaching some important conclusions. Asking a simple question referring to the growth path of small firms, Nichter & Goldmark (2009) discuss four types of factors affecting growth and their study shed light on the differences between developed and developing countries' small enterprises.

Coad & Tamwada (2011) focuse on the small firms in India and find results consistent with the literature. Age and firm size have a negative impact on growth of small firms. In addition, they show that the firms experience slow growth rates during take-off periods. Coad & Tamwada (2011) divide the dataset into two sets to highlight some issues that affect firm growth such as size, age, gender, exporting etc. They also determine that female owned and young firms have a tendency to grow through exporting.

Obeng et al. (2014) discuss the relationship between entrepreneurship characteristics and small firm growth in Ghana. The dataset is based on the survey responses of 441 entrepreneurs. Entrepreneurs in this dataset are grouped into four categories with respect to their abilities. Moreover, sectors in which firms are active are grouped into three classes. Obeng et al. (2014) find that there is no statistical association between investments in R&D and growth in employment indicating that the opportunity cost is related to the firm growth. In Ghana, medium-sized firms are likely to grow increasingly rapid compared to small and micro-sized firms. Also, Obeng et al. (2014) determine that family ownership does matter for the employment growth in manufacturing firms, but it has not a relationship in agriculture and services firms.

For micro and small firms in Sweden, Heshmati (2001) use an unbalanced data sample

covering 1993 – 1998 period. In their analysis, the number of employees, sales and assets are taken as explanatory variables for the firm growth. In his analysis, Heshmati (2001) rejects Gibrat's Law by means of generalized least squares method. In other words, firm growth does not have a random distribution. Secondly, Heshmati (2001) determines that there is a negative correlation between age and firm growth. Also, the indebtedness of the small firms negatively affects the growth rate of sales, although it has no significant effect on employment growth. On the other hand, profitability has a positive impact on the sales growth.

Some studies focuse on the networking activities to eliminate the growth constraints of the SMEs. Havnes & Senneseth (2001) explain how the networking activities and exogenous factors affect the performance measures of the small firms. Using a dataset covering eight European countries, Havnes & Senneseth (2001) test three different hypotheses. The results show that there is no clear between networking and growth in employment. Also, causality between growth in sales and networking activities is not statistically significant.

According to Mambula (2002), small enterprises should unite and support each other in hard times such as in recessions. Successful networking between firms can overcome financial constraints. In growth process, firms that integrated into a business network (e.g. chaebol, keiretsu) can fairly overcome the obstacles leading small firms to thrive.

Schoonjans et al. (2013) provide evidence on formal business networking via Dutch data from 1992 to 2008. Joining the formal networking contacts have positive impact on the growth of medium and small enterprises.

Gronum et al. (2012) focus on the relationship among networks, innovation capacity, and firm performance for SMEs. Their study is based on a panel dataset from 1435 SMEs. The regression results confirm that networks do matter for SME innovation and the innovation broadness improves firm performance significantly in terms of profits, productivity, sales and product growth range. Consistent with the firm growth literature, firm age affects firm performance negatively, but firm size has a positive impact on the firm performance according

to hierarchical regression analysis.

Soininen et al. (2012) focus entrepreneurial orientation concept (Corvin et al. 2006) for Finnish SMEs. Soininen et al. (2012) hypothesize whether there is a relationship between firm performance (growth, profitability) and entrepreneurial orientation. The empirical data is conveyed from a survey in 2009 and the survey contains 194 Finnish SMEs. Using profitability as a dependent variable in the linear regression model, Soininen et al. (2012) finds that age and entrepreneurial orientation have a negative effects on the profitability. In this vein, growth is related to entrepreneurial orientation positively, but it is related to age negatively.

There is a growing concern for family business studies in recent years (Debicki et al., 2009; De Massis et al., 2012). Most of the studies in this field of firm growth focus on manager-controlled firms, but the description of the family firms is usually unclear for economists in the developing countries. Whenever there is a scarcity of studies in the family firm literature, we come across with the definition of small and medium sized enterprises instead of the family businesses. Exceptionally, there are some well-known firms such as Ford motors, Wal-mart stores which are controlled by families. Casson (1999) modifies the definition of the family firms for the firm growth. He also interprets characteristics of the family firms. According to his definition, firms, that are controlled and owned by the family members, generally follow traditional firm characteristics. In Casson's (1999, p.14) framework, family firms grow by re-invested profits rather than the mergers and acquisitions.

Maury (2006) explains how family-controlled firms outperform non-family controlled firms in terms of profitability. The study consists of 1672 non-financial firms in Western Europe. Actively controlled family firms can increase their performance and profitability growth as well as productivity. In this study, profitability levels do not increase with passive control, whereas profitability starts increasing whenever high command and control mechanisms are used. On the other hand, the value of the firm increases when the family control is low.

Colombo et al. (2014) argue whether sales and employment figures differ with the family

ownership in the high-tech industries. The results show that when the family ownership holds, changes in employment and changes in sales are less in amount compared to firms without family ownership.

Lee (2006) makes a comparison in performance between family firms and firms owned by shareholders using S&P 500 sample over the period 1992 - 2002. Lee (2006) uses a multivariate panel regression and concludes that family firms have more substantial revenue and employment growth compared to the non-family firms. Over the period between 1992 and 2002, family firms show higher profit margins than counterparts do. Lee (2006) also states that the firm performance declines as it becomes more mature, but capital investment has a positive correlation with firm performance.

To sum up, previous studies related to the determinants of the medium and small firm growth have heterogeneous results showing an unstable dynamics in the growth path of the firms. Thus, we cannot argue that growth of small and medium sized firms follow standard procedure. Actually, different measurement techniques and various econometric estimation techniques help us to uncover new aspects of the firm growth.

2.5. Empirical Studies Related Firm Growth

Firm growth theories have been the central of interest for many years. Moreover, the number of empirical studies related to the firm growth keeps increasing through the years. Increasing accessibility to firm specific micro data broadens our understanding of the firm growth validating growth theories. Understanding the firm growth pattern is beneficial for the policy makers helping to understand the secrets of employment creation and resource allocation.

Firm growth has been a key theme in industrial organization literature beginning from the formulation of Gibrat's Law in 1931. When Gibrat states the distribution for firm size, nearly all studies object it arguing his law is ambiguous. Some studies also occupy in organization

literature validating the firm growth determinants in a conventional manner. Empirical studies use various econometric methods and employ different variable sets to interpret the growth pattern of the firms.

Empirical studies generally test Gibrat's Law. Some prior studies also employ different dependent variable sets in the Gibrat-type equations. Hymer & Pashigian (1962) test Gibrat's Law for the largest manufacturing firms in the US. They reveal that the asset structure has no effect on the firm growth. Actually, this result indicates that Gibrat's Law is valid for this sample.

Using net assets and tangible assets as a proxy for the growth variable, Singh & Whittington (1975) find that there is a positive relationship between size and growth for approximately 2000 individual firms in the UK in the period between 1948 and 1960. Gibrat's Law is rejected for this sample in the study.

Weiss (1998) investigates the evolution of the farm size distributions in Austrian farm sector. Different from previous studies, cultivated land and livestock figures are used as the dependent variables in this study in the OLS regression approach. Using Gibrat's Law as the starting point, the growth rates of the farms are found to be not randomly distributed. Interestingly, this study draws attention to a point showing that the small farms have bigger growth rates than medium-sized farms.

Yang & Huang (2005) investigate the Taiwanese medium and small firms in electronics sector. In this study, Yang & Huang (2005) show that R&D investments boost growth rate especially for small firms. Also GMM results lend evidence presenting that small firms have faster growth rate than large-sized firms. Additionally, Yang & Huang (2005) determine that the growth distribution of large-sized firms supports Gibrat's Law.

Chu et al. (2008) use SURADF test (Breuer et al., 2001) to investigate whether the Gibrat's Law is valid for the firms in electronics sector. Using total asset data for 48 electronics

firms in Taiwan from 1995 to 2004, the empirical results from panel-based unit root tests indicate that the total assets of all firms have stationarity lending evidence for the existence of Gibrat's law. But, the results of the panel SURADF test support Gibrat's Law for only 27 firms.

Rufin (2007) presents the implications of the Gibrat's Law for the Spanish firms in truism sector. Rufin (2007), using sales growth as a firm's growth proxy, shows that marketing actions and programs have long term effect on the firm growth, but they do not affect sales growth in the short term.

Aslan (2008) utilizes the MADF test (Taylor & Sarno, 1998) to determine the validity of Gibrat's Law for Turkish Firms. The MADF test is used for firms in 11 industries in this study and lends evidence against Gibrat's Law for 7 industries. However it is found that the firm size in food, electrical machinery, electronics and transportation industries is independent from the firm growth.

Age is also an important factor which comes into prominence to determine the firm growth. Navaratti et al. (2014) use quantile regression model to uncover the evidence for the sample of French, Italian and Spanish firms in the period between 2002 and 2008. Results suggest that if the firm is on the path of upsizing, the age of the firm has a negative impact on firm growth. Some characteristics of young firms are also stressed in this work. For instance; fast growing firms are more productive compared to slow growing firms and also access external financial funds relatively easy. Also young firms have key positions in the employment growth. Navaratti et al. (2014) make some policy implications. First, they point out that guaranteeing effective markets to access external financial funds might be the most vital reform for the young firms. Secondly, firm productivity is related to the elimination of barriers to entrepreneurship and anti-competitive market regulations.

Coad et al. (2014) state that firm age is a critical factor for the firm growth. Using Swedish firm data during 1997 – 2010, they estimate growth persistence of the firms by applying cross tabulations, transition matrices, contour plots and standard regression equations. The empirical

results indicate that young firms have positive growth rates. However, Coad et al. (2014) reject the hypothesis that older firms have a higher growth rate due to the learning effects (Jovanovic, 1982).

Delmar et al. (2013) also investigate Swedish firms by monitoring changes in the profitability. The regression results show that size and age coefficients have a negative signs. This implies high relevance of the literature on firm growth with their analysis. The model they construct supports that whenever firm profitability boosts firm growth, firm growth also raises profitability. But, the firm growth has a negative impact on survival in the market.

Serrasqueiro et al. (2010) identify the relationship between the factors leading to firm growth and the growth of Portuguese SMEs. They utilize possible factors as age, size, R&D intensity, internal financial funds (e.g. cash flow), and external financial funds (e.g. debt). Their study has remarkable interpretations. The most important of all, they find that Gibrat's Law is not valid for Portuguese SMEs. Debt and R&D intensity are also the factors supporting SME growth. But, age is found to be a negative determinant of SME growth. Lastly, Serrasqueiro et al. (2010) show that the cash flows have importance on capital accumulation whenever SMEs are on the growth path.

Oberhofer & Pfaffermayr (2013) develop an econometric model for firm growth in order to determine factors causing to positive growth spillovers for the multinational enterprises. Their empirical estimations are based on the AMADEUS database containing manufacturing firms over the period 1994 – 2008. Particularly, positive growth spillover effects are valid for only vertically organized multinational enterprises, but they are not effective on horizontally organized enterprises. Furthermore, conflicting with the literature, they argue that firm size differences are dependent on the age.

Coad (2010) traces the progression of the basic firm growth indicators such as growth of employment, gross revenue, gross operating surplus, and labor productivity growth by using a panel VAR model of longitudinal data of French firms. The panel VAR model reveals that the

employment growth has a two way causal relationship with sales growth i.e. both employment growth causes sales growth an sales growth causes employment growth. In addition, Coad (2010) finds that profit growth causes sales and employment growth. But, there is no reverse causality running from sales and employment growth to profit growth.

There are also many studies analyzing the performance of the firm growth in terms of the innovation process. Empirical studies focusing on the relationship between the firm growth and innovation process usually are based on the Schumpeter's (1934) technological process context. From this perspective, there is a vast heterogeneity among the results of innovation related studies. In other words, the impact of innovation on the firm growth is mixed. Some studies approach to the innovastion concept by employing different measures of innovation activity such as patent statistics (Demirel & Mazzucato, 2012), innovation counts (Corsino & Gabriele, 2010), patent applications (Ernst, 2001) and innovativeness index (Coad & Rao, 2008). Empirical studies based on innovation, mostly, refer to Mansfield (1962) as a starting point. Mansfield (1962) uses ten enterprises and ten aggregated industries from USA over the period 1916 – 1954. He finds that the likelihood of the innovating firms to grow faster is bigger compared to other non-innovating firms. However, Geroski et al. (1993) study UK large firms from 1976 to 1982 lending evidence on the insignificance of innovation counts on corporate growth.

Ernst (2001) employs patent applications data as an innovation activity measure for German machine tool manufacturers between 1984 and 1992. He tests the relations between patent applications and corporate firm performance. The results of the fixed effect model indicate that patent applications have positive impact on firm performance variable (sales of firm). Ernst (2001) also concludes that the influence of patent applications on the sales are realized with two to three years lags.

Cefis & Marsili (2005) investigate whether the innovation activities increase the survival chance of the firms. The authors used two microeconomic database which include 61.177 firms for the period 1996-2003. Cefis & Marsili (2005) take survival time as the dependent variable

to evaluate the continuation of firms when innovation, innovation type, firm size, firm age, firm growth and industrial classification are used as independent variables. Using a multivariate analysis, they show that variables such as age and size help firm survival. Moreover, firm growth plays a major role on survival of the firms in the market. But, they find that innovativeness of firm has infinitesimal effect on firm survival. On the other hand, they suggest that innovation activities strengthen market characteristics for competition.

Cassia et al. (2009) investigate the UK public companies for the period from 1995 to 2006. They stress the knowledge spillovers (Arrow, 1962; Nelson, 1959). Focusing the relationship between firms and universities (which is considered a critical source of knowledge), their findings indicate that outputs of firm level knowledge and inputs of university level knowledge shape the firm growth path as an important factor. Cassia et al. (2009) apply Arellano & Bond (1991) and Blundell & Bond (1998) panel estimation techniques using external research, size and age variables as independent variables. They control sectors by classifying firm level data into seven distinct sectors. Also, they add regional GDP growth as a control variable in their model to interpret the possible relationship between state of the economic and firm growth. Their findings show that knowledge spillovers stemming from the university have positive impacts on firm growth. Cassia et al. (2009) also stress the role of the education in social sciences by highlighting its positive impact on the firm growth.

Garcia-Manjon & Romero-Merino (2012) use OLS estimation, GMM system estimation, and quantile regression to find the relationship between R&D expenditures and sales growth for 754 European firms. Consistently investing in R&D increases the firm survival rate even at the time of a recession. Garcia-Manjon & Romero-Merino (2012) also claim that industries based on high technology gain more benefit from the R&D investments tcompared to the industries based on low technology.

Empirical studies such as Goadhuys & Veugelers (2012) examine the relations between innovation performance and firm growth performance by using bivariate probit model for the Brazilian firms. They claim that product innovation is a boosting factor for sales growth

whenever process innovation is made. Likewise, their study asserts that international openness of a firm is the vital factor for firm performance. In an addition, Goadhuys & Veugelers (2012) point out that the international openness stimulates the innovation processes in the firm.

Nunes et al. (2012) observe R&D intensity and growth in high tech and low tech SMEs. The study is based on two distinct samples of firm data in manufacturing industry. The two samples contain 330 low tech SMEs and 133 high tech SMEs for the period between 1999 and 2006. In order to overcome sample selection bias caused by other factors left outside the econometric model but determines the market conditions, the two step model proposed by Heckman (1977) is used in this study. To observe correctly the growth determinants of the low high tech industries and high tech industries, GMM system estimation (Blundell & Bond, 1998) is used as the estimation technique. The study is concluded with an interpretation of the relationship between R&D intensity and growth. Examining the high tech SMEs and low tech SMEs, a negative linear relationship is found between R&D intensity and firm growth in the case of low tech SMEs. However, estimations reveal that there is a reverse quadratic relationship (U-shaped) between R&D intensity and firm growth in the case of high tech SMEs.

Colombelli et al. (2013) predict Gibrat type equations in order to provide new empirical evidence for the French firms. Using Community Innovation Survey, the main determinants of the firm growth are questioned in accordance with the firm growth literature in their study (Ernst, 2001; Coad & Rao, 2008; Corsino & Gabriele, 2010). The first objective of their survey research is to diversify the different innovation types, and the assessment of the effects of the innovation types (product, process, and marketing) on the firm growth. In this framework, mainly GMM technique and quantile regressions are used to analyze firm growth. The basic Gibrat type equations argues that small firms have faster growth rates compared to larger ones. This determination is also supported by several studies (Varyam & Kraybill, 1992; Dunne & Hughes, 1994). Usually, product innovation is found to have a strong positive relationship with firm growth, compared to the other innovation types. Actually, innovative firms are shown to create more growth than non-innovators.

There is a growing body of the literature linking firm growth to firm profitability. In this vein, some studies investigate direct relationship between profitability and firm growth by utilizing econometric methods under special assumptions. Empirically, firm growth is generally measured via employment level and sales growth. Also, many types of estimation techniques are used such as OLS estimation, probit models, logit models and dynamic panel system GMM estimators (Jang & Park, 2011; Coad, 2008; Dunne & Hughes, 1994).

Empirical evidence suggests that profitability has a crucial factor for firm growth. For example, Geroski et al. (1997) study 271 large firms in the UK over the period 1976 – 1982 by using OLS and generalized method of moments method. They establish a statistically significant positive relationship between growth rates of firms and long run profitability expectation (based on stock market evaluation of the firm).

Audretsch (1995) tests whether firm growth, profitability, R&D intensity and size influence the rate of firm innovation. Including data belonging to 631 firms in a pooled regression model, Audretsch (1995) shows that there is a negative relationship between firm growth and innovation rates. In addition, he points out that profitability increases the rate of firm innovation. He also concludes that there is no significant relationship between firm growth and innovation.

Glancey (1998) investigates the small and medium manufacturing firms in Scotland. Using OLS, 2 stage least squares method and White's (1980) technique, his study defines the key determinants of firm growth for Scottish SMEs. He finds that larger firms have higher growth rates compared to smaller firms. This result contradicts with the results of some studies on the firm growth such as Reichstein & Dahl (2004). Both OLS and 2 stage least squares results prove that small firms are more profitable than large firms, but small firms do not grow quickly compared to the large firms. Robson & Bennet (2000) try to determine the effects of profits on firm growth and report a significant relationship between firm growth and profitability by using a large sample of British SMEs. The OLS results show that there is a positive relationship

between firm growth and profitability. When they repeat the same analysis by choosing employment growth as the indicator of firm growth, they show the validity of the similar results.

Guariglia (2008) analyzes 24,184 UK firms over the period 1993 – 2003. He divides the dataset of the study into two distinct groups as high profitable and low profitable firms. The result of panel data analysis shows that the relationship between profitability and firm growth is positive and significant for the case of high profitable firms, but firm growth has a negative effect on the profitability of the low profitable firms.

Kouser et al. (2012) detect the impact of profitability on Pakistani firm growth. Using 70 companies' size, growth and return of assets (profitability) data for ten years (2001 – 2010), Kouser et al. (2012) find by means of fixed-effects regression that profitability has a positive effect on the firm growth. But, they also conclude that the size of the firm has a negative influence on the firm profitability.

For the period of 1978 – 2007, 5812 restaurant places in US are examined by Jang & Park (2011). They analyze the relationship between firm growth and profitability by utilizing the panel VAR model and emphasize that prior profit rates have a positive impact on the subsequent growth rates. Moreover, they conclude that the profit rates generates growth rates, but firm growth limits the profitability.

Fitzsimmons et al. (2005) analyze approximately 9,700 Australian businesses for the period between 1994/95 and 1997/98. They use firm size, firm age and industry dummies as the control variables. Using also performance variables such as sales growth, employment growth, net profit margin and return on assets, the results of their analysis show that there is no consistent relationship between profitability and firm growth. They also points out that the performances Australian businesses are relatively better when they are younger.

Liedholm (2002) analyzes small firm dynamics and structural components of the firms within a cross-country type study. Using employment growth as the firm's growth proxy, he

points out that the firm age has a negative impact on the firm growth. This finding is also consistent with the resuts of the study McPherson (1992). Moreover, he concludes that initial size, sector type, location and human capital are the only relevant factors for the growth of small firms.

Studies dealing with the firm growth in Turkey are rather sparse. Some researhers use cross-sectional databases in order to evaluate firm growth determinants for Turkish firms. Taymaz (1997) is the first study which constructs a regression model for Turkish manufacturing firms. Using a longitudinal sample of 1,010 firms for the period between 1986 and 1992, he employs performance-related variables such as size (employment), productivity, profit margin, R&D intensity, and industry growth rates. He finds that R&D intensity and productivity are the main sources of the firm growth.

Özar et al. (2008) studies the impacts of several factors on the growth of small and micro firms in Turkey. They analyze firm growth in pre economic crisis and crisis period. Having a cross-sectional sample of 4,000 micro and small firms, they find that the effect of size and age have a negative relationship with the firm growth. They also argue that positive impacts of fast growth can vanish at the time of the economic crisises.

Recent studies such as Taymaz & Yılmaz (2014) stress the importance of survival and firm growth dynamics. They mainly focuse on the effects of explanatory variables such as size (employment), age, and the ownership of the firms. In their study, Heckman's two step model and GMM-system estimation techniques are used in order to estimate the growth equation of the firms in the Turkish manufacturing sector. They state that size and age have a negative effect on the firm growth.

Giving rise to employment opportunies is one of the main aspects of the firm growth literature. Some studies concern the relationship between firm growth and employment generation in the firm growth path. Detailed studies usually connect these two variables proposing some policy implications. Econometric models also mostly contain the number of

working people as the incator of firm growth (Coad, 2009).

As it is explained before in this study, firm growth is perceived as an organic procedure. Studies, mostly found a positive relationship between firm growth and firm performance. Whereas, the relationship between employment creation and firm performance have not yet been solidly discussed in the literature. The debate has been going on that whether firm growth affects employment creation or vice-versa. The roots of this argument begin with Birch's (1979) work. According to Birch, job creation is a dynamic issue and it is mostly conducted with small firm' performance. Also the author carried on the same arguments in his following works. (Birch, 1981; 1987)

Wagner (1995) founds a connection between firm size and job creation in German manufacturing businesses. Having unique longitudinal data set, the author finds that job creation tends to decline with firm size. Also small firms have great importance in creating jobs. This finding is also backed up by Van Praag & Versloot (2007).

Former studies have suggested that internal and external finance constraints have a great impact on the growth pattern of the firms. (Beck & Demirguc-Kunt, 2006; Carpenter & Petersen, 2002; Oliveira & Fortunato, 2006) The related studies have worked various types of country data to test the validity of the theoretical implications.

For instance, Guarigilia et al. (2011) have provided a significant link between asset growth and liquidity constraints by implementing Carpenter & Petersen's (2002) arguments. In the study, provided data contain 79.841 Chinese firms over the period 2000 – 2007. To evaluate the asset growth system, cash flow variable is employed in the GMM system equations in order to capture the relations between liquidity constraints. Also the estimation technique have been implemented to the particular ownership structures (state-owned firms, foreign, private) of the sample. The main results are also consistent with Carpenter & Petersen's (2002) and Oliveira & Fortunato (2006).

Using panel data estimations and distribution analysis, Fagiolo & Luzzi (2006) have shown that smaller firms can grow more than large firms after eliminating the obstacles of the liquidity. When the liquidity constraints are more severe for the firms, size distributions disrupt the firm's growth rates. Additionally, the authors showed that financial liquidity constraints help explaining the relationship between traditional firm growth variables and firm growth.

Some empirical studies have also tested the interrelationship between traditional growth indicators (size and age) and internal finance conditions. For instance; Yazdanfar & Turner (2013) have observed almost 10.383 Swedish firms over the 2007 – 2008 period. The significant relationship between firm growth and explanatory variables (liquidity access, size, age and industrial affiliation) has been found in the study, confirming that firm size and liquidity access positively affects the firm growth.

To sum up, the empirical studies of the firm growth have been responded many questions by utilizing various econometric methods and different data samples but few unanswered questions remain. The traditional firm growth literature has mostly dealt with Gibrat's Law of Proportionate Effects, although, recent studies employed different measures of the firm performance and firm growth. In the earlier literature, Gibrat-Type equations mostly predicted with related variables (i.e. age and size). The most of the studies strictly rejected the Gibrat's Law. (Sing & Whittington, 1975; Hall, 1986; Weiss, 1998; Almus & Nerlinger, 2000; Calvo, 2008)

In the earlier parts, R&D activities were defined as the vital determinant of the firm growth. In this sense, focusing only on the positive side of the R&D may lead us to the lacking concept due to the conflicting results of the certain studies (Demirel & Mazzucato, 2012). Nevertheless, in the firm growth literature R&D activities have such a delicate importance. Such studies have clarified the role of the R&D expenditures and its effect on the firm growth. (Del Monte & Papagni 2002; Coad & Rao, 2008; Geroski & Machin; 1992)

Assuredly, there are many studies trying to explain empirically the relationship between

profitability of the firms and firm growth. Some studies have evidence for a positive association between growth and profitability. In an influential study, Geroski et al. (1997) found a positive relationship between firm growth and long run profitability. This finding is also backed up by relevant studies (Kouser et al., 2012; Jang & Park, 2011; Robson & Bennet, 2000) but various studies have reached irregular conclusions (Fitzsimmons, 2005).

In the firm growth literature some authors report a causal relationship running from internal finance conditions to the SME growth. (Wagenvoort, 2003; Oliveira & Fortunato, 2006; Carpenter & Petersen, 2002) Also, the institutional perspective does matter for the growth of the firms. Such studies have explained that the financial institutions relieve the growth constraints of the firms (Beck & Demirguc-Kunt, 2006; Beck et al., 2005). These findings have some implications for the growth of the firms. It seems that firm growth (employment growth, sales growth) is such a multidimensional issue and its determinants rapidly change in the literature. New studies generally deal with the cross-country type data (Döckel & Ligthelm, 2015) and panel data (Acs et al., 2012) and for the econometric methodology differs as well in the firm growth literature. In the next part, first, we will focus on the econometric methodology of the growth phenomena. After, we concisely review the main findings of the central studies.

2.6. Summary

In this section, we will shortly summarize the main empirical studies of the firm growth.

Table 2.1. Gibrat's Law

Author(s)	**Date of Publication**	**Origin of the Firms in Focus**	**Data Set Range**	**Methodology**	**Results**
Hall	1986	US	1976 - 1983	Box – Jenkins Time Series	Investments in physical capital and R&D expenditures

					positively affect firm growth.
Almus & Nerlinger	2000	West Germany	1990–1994	OLS	Gibrat's Law is rejected.
Das	1995	India	1983-1988	OLS	Age positively affects firm growth
Yang & Huang	2005	Taiwan	1987-1999	Random effects, GMM	Large-sized firm size distribution supports Gibrat's Law
Calvo	2008	Spain	1990-2000	OLS, PROBIT	Small firms grow faster than counterparts.

According to the Table 2.1 all of the studies have employed different econometric methodology to decipher the puzzling patterns of the firm growth. Many of them reject the Gibrat's Law by utilizing various countries' data sets, but some of them accept the weak version of the Law (Yang & Huang, 2005). Interestingly, the traditional variables (size and age) may not be enough to explain firm growth characteristics. To expand the firm growth arguments, causality between R&D activities and firm growth provides a better viewpoint in the literature.

Table 2.2. R&D and Firm Growth

Author(s)	**Date of Publication**	**Origin of the Firms in Focus**	**Data Set Range**	**Methodology**	**Results**
Geroski & Machin	1992	U.K	1972-1983	-	Innovating firms leave behind the non-innovators.

Del Monte & Papagni	2002	Italy	1989-1997	Panel root tests, random effects	Growth rates are boosted with the R&D.
Coad & Rao	2010	US	1973, 1984, 1994, 2004	Panel VAR model	The sales growth influences R&D.
Demirel & Mazzucato	2012	US	1950-2008	GMM	R&D investments have a negative effect on the large-sized firms

Table 2.2 summarizes the relationship between R&D and firm growth. R&D expenditure is such an input for the different types of innovation. Firms are usually obliged to allocate its resources in the R&D activities in order to survive in the competitive market conditions. The role of the R&D seems to be rewarding in the past studies (Coad & Rao, 2010; Geroski & Machin, 1992) but it may have negative effects on the growth of the firm (Demirel & Mazzucato, 2012).

Table 2.3. Financial Constraints and SME growth					
Author(s)	**Date of Publication**	**Origin of the Firms in Focus**	**Data Set Range**	**Methodology**	**Results**
Carpenter & Petersen	2002	US	1980-1992	OLS (with instrumental variables)	Cash flow sensitivities reflect financing problems
Oliveira & Fortunato	2006	Portugal	1990-2001	GMM	Internal finance constraints hinder the growth of the SMEs
Wagenvoort	2003	Europe	1996-2000	OLS	Cash flow has a positive relationship with firm growth
Yazdanfar & Turner	2013	Sweden	2007-2008	SUR model	A positive relation was found between internal finance and growth.

In summary, these studies show that the SME growth is generally bounded by internal and external finance conditions, but nearly all studies related to the internal finance have found the positive relationship between cash flow and growth by using diverse estimation techniques. The growth constraints of the medium and small firms vary in the firm growth literature as we have seen in the earlier parts. In order to measure the effects of financial constraints, some

studies have offered the institutional viewpoint. The authors suggested that creating stable and efficient financial institutions may help the SMEs to tackle growth constraints (Beck et al., 2008).

3. METHODOLOGY

3.1. Introduction

In this part, we present the main panel data models. The basic linear panel models are threefold; pooled fixed-effects and random-effects. As known, panel data contain both time series and cross-sectional units; this may cause some problems such as endogeneity. If we have missing values of data in time, then such a dataset is called unbalanced panel dataset. As contrary, if our data contains no missing values of data, the data can be described as the balanced panel data. Our objective in this part is to review four models' assumptions and compare the base differences between these models.

3.2 Panel Models

3.2.1 The Pooled Model

The simplest model of the panel model is the pooled regression. (Greene, 2012) In this approach, intercept and slope coefficient do not change with the time and individuality. In order to regress the two variables, OLS and generalized least squares (GLS) methods are the most used in this approach. With these explanations, a simple pooled model with two explanatory variables can be shown as;

$$y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + e_{it} \tag{3.1}$$

Assume that we have T observation on the N individual, where "i" represents the individuality (i=1, 2, 3, 4…..N) and "t" represents the time (t=1, 2, 3, 4…..T). The second thing in this equation, indices of the coefficients do not have "i" or "t", this implies that they do not change over time or individuality. We also assume that, e_{it} has zero mean and constant variable, implies that error term does not correlate with "i" and "t". We also expect that the estimators of

the regression (ß) have similar characteristics with the multiple regression models. To ensure the significance of the parameters, F and t values must to be valued accurately.

In order to acquire efficient estimators, some assumptions on the error term and estimator need to be discussed. These assumptions are fivefold (Hill et al., 2008);

1-) Error term has zero mean.

$$E\left(e_{it}\right)=0 \tag{3.2}$$

2-) The error term's variance does not change over time and individuals. (homoscedasticity)

$$\text{var}(e_{it})=E(e^{2}{}_{it})=\sigma_{e}{}^{2} \tag{3.3}$$

3-) All error terms are uncorrelated.

$$\text{cov}(e_{it}e_{js})=E(e_{it}e_{js})=0 \tag{3.4}$$

Where $i \neq j$ or $t \neq s$.

4-) x's do not have a correlation with error terms.

$$\text{cov}(e_{it},x_{2it})=0 \quad , \ \text{cov}(e_{it},x_{3it})=0 \tag{3.5}$$

5-) Where "K" is the number of the explanatory variables, this assumption is implying that there is no serial correlation between X's.

$$rank\left(\sum_{i=1}^{N}\sum_{t=1}^{T}X'_{it}X_{it}\right)=K \tag{3.6}$$

In this model, we use pooled OLS estimation technique in order to obtain the predicted values of intercept and slope coefficient. The pooled OLS estimator is;

$$\hat{\beta}_{\mu} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} X'_{it} X_{it} \right)^{-1} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} X'_{it} X_{it} \right) \quad (3.7)$$

Additionally, even if all these assumptions are provided by the estimation, strict exogeneity assumption needs to be ensured to reach the BLUE[1] of the coefficients. (Tatoglu, 2013 pp. 42) To sum up, pooled model is strictly restrictive to observe the individuality of the panel data. The panel nature of the data also contains unobserved unit effects on the estimation.

3.2.2. Fixed Effects Model

In the fixed effects model, the model allows individual effects on the intercept and slope coefficient. Also the fixed effects model is built on the assumption that includes omitted effects in the regression model (Greene, 2012). Another important term for the fixed effects is the individual heterogeneity. In the regression model, individual heterogeneity can be demonstrated by the intercept. These intercepts imply the fixed effects (Hill et al., 2008).

We can show the general fixed effects model as:

$$Y_{it} = \beta_{1i} + \beta_{2i} X_{2it} + \beta_{3i} X_{3it} + e_{it} \quad (3.8)$$

In the fixed effects model, coefficient indices have "i" subscript to present the individual characteristics of the panel data, but estimation of the short and wide panels usually fixates the slope coefficients of the equation. (Hill et al., 2008, pp.543)

In this case, our model becomes;

$$Y_{it} = \beta_{1i} + \beta_{2} X_{2it} + \beta_{3} X_{3it} + e_{it} \quad (3.9)$$

In this model, the intercept demonstrates the individual heterogeneity. Usually intercepts are added to the model in order to control the individual-specific effects of the panel data.

[1] Best, Linear, Unbiased, Estimator.

If we actually allow the intercept of the fixed effects model to vary between individuals, intercept dummies need to be used in the fixed effects model. Suppose, we have five individuals, and we need to use only four dummy variables for avoiding perfect multicollinearity (dummy variable trap) in the fixed model (Gujarati, 2009 pp. 642).

In this case, our model transforms into least-squares dummy variable model. For instance;

$$Y_{it} = \alpha_1 + \alpha_2 D_{2i} + \alpha_3 D_{3i} + \alpha_4 D_{4i} + \alpha_5 D_{5i} + \beta_2 X_{2it} + \beta_3 X_{3it} + e_{it} \qquad (3.10)$$

D_{2i} = 1 if i=2 D_{3i} =1 if i=3 D_{4i} = 1 if i=4 D_{5i} =1 if i=5

Otherwise D_{2i} = 0 Otherwise D_{3i} = 0 Otherwise D_{4i} =0 Otherwise D_{5i} = 0

If we intent to measure the time effects on the regression model, likely the same approach is used for the panel estimation. Let us assume that we have data for the 10 years from 2000 to 2010, nine dummy variables are added to the panel regression model due to the dummy trap problem. The model looks like:

$$Y_{it} = \lambda_0 + \lambda_1 DUM2000 + \lambda_2 DUM2001 + ... + \lambda_9 DUM2009 + \beta_2 X_{2it} + \beta_3 X_{3it} + e_{it} \qquad (3.11)$$

When the individual number is small, including dummy variables in the equations is a suitable technique, but if we have a large number of individuals, we need to use deviation form for estimating the equation (Hill et al. 2008, pp. 547).

The basic fixed model;

$$y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_3 x_{3it} + e_{it} \qquad (3.12)$$

t = 1, 2, 3….T

If we sum the both sides of the equation and divide by T (taking the average), then we have;

$$\frac{1}{T}\sum_{t=1}^{T}(y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_3 x_{3it} + e_{it}) \tag{3.13}$$

We can assume that the parameters do not vary over time, then the equation becomes;

$$\overline{y_i} = \frac{1}{T}\sum_{t=1}^{T} y_{it} = \beta_{1i} + \beta_2 \frac{1}{T}\sum_{t=1}^{T} x_{2it} + \beta_3 \frac{1}{T}\sum_{t=1}^{T} x_{3it} + \frac{1}{T}\sum_{t=1}^{T} e_{it}$$

$$= \beta_{1i} + \beta_2 \overline{x_{2i}} + \beta_3 \overline{x_{3i}} + \overline{e_i} \tag{3.14}$$

Then, we subtract (3.14) from (3.12) and we obtain;

$$y_{it} = \beta_{1i} + \beta_2 x_{2it} + \beta_3 x_{3it} + e_{it}$$

$$-(\overline{y_i} = \beta_{1i} + \beta_2 \overline{x_{2i}} + \beta_3 \overline{x_{3i}} + \overline{e_i})$$

$$y_{it} - \overline{y_i} = \beta_2 (x_{2it} - \overline{x_{2i}}) + \beta_3 (x_{3it} - \overline{x_{3i}}) + (e_{it} - \overline{e_i}) \tag{3.15}$$

Note that, intercept (β_{1i}) parameter has disappeared in the equation. This is the "deviation from the individual's mean" form. If we repeat the same method for every individual, we have deviation form.

$$\overline{y_i} = \beta_2 \overline{x_{2it}} + \beta_3 \overline{x_{3it}} + \overline{e_{it}} \tag{3.16}$$

To sum up, there are some drawbacks of the fixed effects model. In the regression equation, having too many dummy variables might cause degrees of the freedom problem. Also, having many independent variables in the equation might cause the multicollinearity. Additionally, this might reduce the precision of the estimated model (Gujarati, 2009 pp. 646).

The fixed effects model can be estimated by various techniques. Some of these are maximum likelihood, generalized least squares method, and pooled least squares method and so on.

3.2.3. Random Effects Model

The fixed effects model assumes that the intercept parameter contains all individual differences of the panel data. In the random effects model, intercepts have two parts. First part reflects the fixed fragment of the parameter; the second part is for the randomness of the individuals (Hill et al., 2008 pp.551). This can be specified with this equation;

$$\beta_{1i} = \overline{\beta}_1 + u_i \tag{3.17}$$

In the equation "$\overline{\beta}_1$" represents the fixed part of the intercept, "u_i" represents the random part, which is called random effects. The random error terms have various and standard assumptions. It has zero mean, constant variance and error terms are not correlated with individuals.

$$E(u_i) = 0,\ \mathrm{cov}(u_i, u_j) = 0 \quad i \neq j,\ \mathrm{var}(u_i) = \sigma_u^2$$

If we displace 3.17 into the equation of 3.12 then we have;

$$\begin{aligned} y_{it} &= \beta_{1i} + \beta_2 x_{2it} + \beta_3 x_{3it} + e_{it} \\ &= (\overline{\beta}_1 + u_i) + \beta_2 x_{2it} + \beta_3 x_{3it} + e_{it} \end{aligned} \tag{3.18}$$

We can rearrange the components of 3.18 to make the equation more subtle type. Such as;

$$\begin{aligned} y_{it} &= \overline{\beta}_1 + \beta_2 x_{2it} + \beta_3 x_{3it} + e_{it} + u_i \\ v_{it} &= e_{it} + u_i \end{aligned} \tag{3.19}$$

$\overline{\beta}_1$ represents the intercept parameter and v_{it} represents the combined error components in the random effects model. If we use the assumptions of regression errors and individual errors, we can show the aggregate error's (v) assumptions.

These assumptions are;

1-) The error term has zero mean.

$$E(v_{it}) = E(e_{it} + u_i) = E(e_{it}) + E(u_i) = 0 \tag{3.20}$$

2-) It has homoscedastic variance.

$$\begin{aligned} \sigma_v^2 &= \text{var}(v_{it}) = \text{var}(e_{it} + u_i) \\ &= \text{var}(u_i) + \text{var}(e_{it}) + 2\,\text{cov}(u_i, e_{it}) \\ &= \sigma_u^2 + \sigma_e^2 \end{aligned} \tag{3.21}$$

3-) The correlation between individuals, namely “i” and “j” is zero.

$$\begin{aligned} \text{cov}(v_{it}, v_{ij}) &= E(v_{it} v_{jt}) = E[(u_i + e_{it})(u_j + e_{jt})] \\ &= E(u_i u_j) + E(u_i e_{jt}) + E(e_{it} u_j) + E(e_{it} e_{jt}) = 0 \end{aligned} \tag{3.22}$$

4-) Errors for the individuals (i) are correlated at the different points in time.

$$\begin{aligned} \text{cov}(v_{it}, v_{is}) &= E(v_{it} v_{is}) = E[(u_i + e_{it}) + (u_i + e_{is})] \\ &= E(u_i^2) + E(u_i e_{is}) + E(e_{it} u_i) + E(e_{it} e_{is}) \\ &= \sigma_u^2 + 0 + 0 + 0 \\ &= \sigma_u^2 \end{aligned} \tag{3.23}$$

5-) Correlation between different individuals and different time errors is zero.

$$\begin{aligned} \text{cov}(v_{it}, v_{js}) &= E(v_{it} v_{js}) = E[(u_i + e_{it})(u_j + e_{js})] \\ &= E(u_i u_j) + E(u_i e_{js}) + E(e_{it} u_j) + E(e_{it} e_{js}) \\ &= 0 \end{aligned} \tag{3.24}$$

Another feature of the random effects model the correlation between times is constant. The correlation is constant over time and does not change by the observations.

$$p = corr(v_{it} v_{is}) = \frac{\text{cov}(v_{it} v_{is})}{\sqrt{\text{var}(v_{it})\,\text{var}(v_{is})}} = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_e^2} \tag{3.25}$$

$t \neq s$

In order to test the appropriate model for the data, Lagrange Multiplier (LM) test has been suggested. LM test is utilized to check individual heterogeneity and if there is no individual heterogeneity, LM test suggests that the pooled regression model is more suitable than the random effects model. We can test the individual heterogeneity by conducting two hypotheses.

$$H_0 : \sigma_u^2 = 0$$
$$H_1 : \sigma_u^2 > 0$$

If the null hypothesis is accepted, using a random effects model is feasible, but if the null hypothesis is rejected, the pooled regression is suitable for the model specification.

Test statistic for the LM test is;

$$LM = \sqrt{\frac{NT}{2(T-1)}} \left\{ \frac{\sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{\mu}_{it} \right)^2}{\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{\mu}_{it}^2} - 1 \right\} \tag{3.26}$$

Hausman Test is also applied to the panel data in order to choose which model is suitable for the estimation. This test compares the estimated coefficients of fixed and random models. The consistency of Hausman Test is backed up by a single assumption. This assumption implies that if there is no correlation between u_i and x_{kit}, estimations of ß are consistent. Further, the parameters converge to the true values (Hill et al., 2008 pp.599).

H_0: The random effects model is suitable

H_1: The fixed effects model is suitable

Hausman Test is usually connected with the joint specification test. If we reject the null hypothesis, then we check the model specification and use the fixed effects regression for the panel data.

3.2.4. Dynamic Model

Another panel specification technique is the dynamic model. The dynamic panel model has some differences from other types of equations. In this sense, dynamic panel models contain lagged variables (at least one). According to Baltagi (2005) dynamic model has the form;

$$y_{it} = \gamma y_{i,t-1} + \beta x_{it}^{'} + u_{it} \tag{3.27}$$

$$i = 1, 2, 3.....N$$

$$t = 1, 2, 3.....T$$

$$u_{it} = \mu_i + \nu_{it} \tag{3.28}$$

Where μ_i : $IID(0, \sigma_\mu^2)$ and ν_{it} : $IID(0, \sigma_\nu^2)$

Also this equation can be specified as:

$$y_{it} = \gamma y_{i,t-1} + \beta x_{it}^{i} + \alpha_i^{*} + \lambda_t + \varepsilon_{it} \tag{3.29}$$

α_i^{*} and λ_t are the unobserved individual and time effects and ε_{it} is the error term in the regression.

The dynamic panel models can be estimated through two estimation techniques; generalized method of moments (GMM) and maximum likelihood (ML). In the model, potential autocorrelation and homoscedasticity problems that may arise when examining the relationships between variables are addressed by system GMM method set out by Roodman (2009). At this point, autocorrelation occurs due to the presence of lagged dependent variables among the regressions, whereas individual effects refer to the fact that variables are not homogeneous among themselves. Arellano and Bond (1991) and Blundell and Bond (1998) proposed the GMM method to discard the problems of autocorrelation and heteroscedasticity in the dynamic panel models.

4. DATA AND EMPIRICAL RESULTS

4.1. Data and Measurement

In this study we use net sales growth (*nsg*) as a proxy for firm growth and as for the profitability proxy, we use Return on Assets (*roa*) ratio.

$$nsg = \log(sales_{i,t}) - \log(sales_{i,t-1}) \tag{4.1}$$

$$roa = \frac{net\ income_{i,t}}{total\ assets_{i,t}} \tag{4.2}$$

In addition to the traditional variables, free cash flow (fcf), R&D investments, firm size (*Total Assets*), firm age are added to the control variables. Also, Debt to Equity (*d/e*) is used as a proxy for indebtedness of the firms. The firm age is added for capturing the effects of firm maturity on the firm growth. Firm age is computed as quarterly.

$$d/e = total\ liabilities_{i,t}/(total\ assets_{i,t} - total\ liabilities_{i,t}) \tag{4.3}$$

To determine the relations between R&D and firm growth, R&D investments are measured by dividing to the total sales and total assets.

rdsales = R&D Expenditures / Total Sales (4.4)

rdassets = R&D Expenditures / Total Assets (4.5)

The exchange market pressure (*emp*) and banking sector fragility (*bsf*) are added as the control variables in the study on account of the hazardous effects of macroeconomic fluctuations and exchange rate depreciation on the firm growth and profitability. These variables are computed as quarterly average of the monthly data. Where α, β and γ are the weights of $e_t, (i_t - i_t^*)\ and\ r_t$ respectively. The Δ represents the monthly percentage change. e_t stands for

the Turkish Lira / American Dollar nominal exchange rate. i_t represents the domestic interest rate, i_t^* is the foreign interest rate. r_t is the ratio of international reserves to M1 money supply.

$$EMP = \alpha\Delta e_t + \beta\Delta(i_t - i_t^*) - \gamma\Delta r_t \tag{4.6}$$

CPS, FL and DEP stand for the banking sector's real total claims on the private sector, foreign liabilities of banks and total real deposits of banks, respectively. Simply, Banking Sector Fragility (*bsf*) is the average of these three standardized variables.

$$\boldsymbol{BSF3} = ((\boldsymbol{CPS}_t - \boldsymbol{\mu}_{\boldsymbol{CPS}})/\boldsymbol{\sigma}_{\boldsymbol{CPS}})) + ((\boldsymbol{FL}_t - \boldsymbol{\mu}_{\boldsymbol{FL}})/\boldsymbol{\sigma}_{\boldsymbol{FL}})) + ((\boldsymbol{DEP}_t - \boldsymbol{\mu}_{\boldsymbol{DEP}})/\boldsymbol{\sigma}_{\boldsymbol{DEP}}))/\boldsymbol{3} \tag{4.7}$$

The ratio of free cash flow to total assets is added to the empirical analysis in order to control firms' internal finance conditions on the R&D investments.

$$fcf = \frac{FCF}{TOTAL\ ASSETS} \tag{4.8}$$

In this study based on the firm's investment demand, Tobin's Q value is added to our dataset. In addition, some studies have supposed the Tobin's Q is not an applicable measure to the investment activity. Nevertheless against the previous arguments, we use Tobin's Q measure in our R&D estimations.

$$tq = (firm\ value - total\ liabilities)/(total\ assets) \tag{4.9}$$

The main variables are extracted from FINNET's Turkish Stock Market program, auditing reports and annual statements of firms during the period 2003Q1 – 2017Q1. For the empirical analysis this study employs a longitudinal data which contains 232 Turkish firms. Table 4.1 summarizes the main features of the presented data. As an initial result, we draw scatter-plot graphs to reveal the correlations between the variables. The graphs indicate that there is no distinct relationship between firm growth and profitability. Besides, the unbalanced nature of the data does not change our conclusions for this purpose.

Table 4.1 Summary Statistics

Variable(s)	**Mean**	**Median**	**S.D.**	**Obs.**
nsg	.00378	.35387	1.006	10,363
roa	.11369	.08545	.10786	10,487
d/e	.38768	.77021	71.933	10,487
age	137.38	144	56.793	10,494
emp	.48645	.23729	2.5688	10,480
bsf	.15843	.05957	.65605	10,480
log(totalassets)	19.299	19.156	1.8314	10,487
rdsales	.01776	0	.13859	10,487
rdassets	.00228	0	.01170	10,385
fcf	-.10301	-.10557	.43176	10,412
tq	.19428	-.06579	1.4599	10,487

.

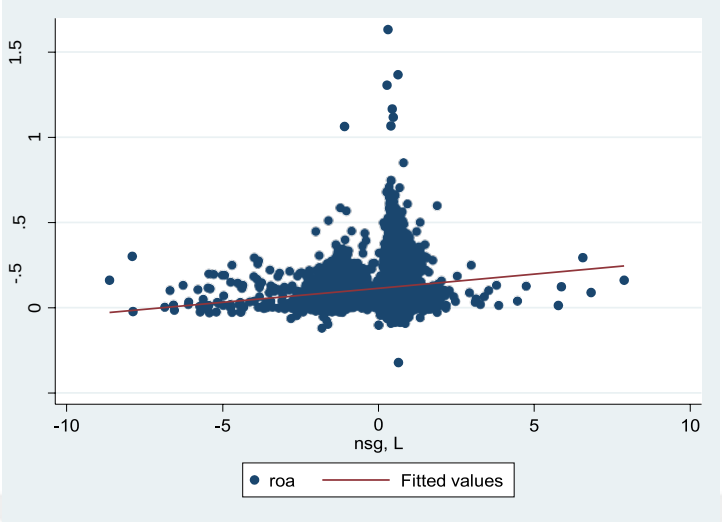

Figure 4.1. The relationship between *roa* and lagged *nsg*

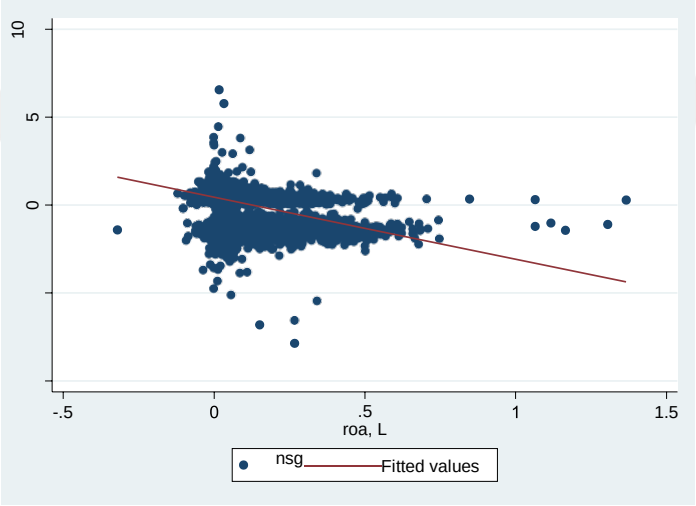

Figure 4.2. The relationship between lagged *roa* and *nsg*

4.2. Empirical Analysis

4.2.1. The Determinants of Profitability and Firm Growth

We determined the relations between firm growth and its determinants by using fixed effects model and GMM models, respectively. We also estimated the non-linear equations to check the relationship between firm growth and profitability. The static relationship between growth and profitability is expressed as:

$$g_{i,t} = a_i + \beta_i \pi_{i,t-1} + \beta_2 Control_{i,t-1} + \varepsilon_{i,t} \quad (4.10)$$

$$\pi_{i,t} = a_i + \beta_1 g_{i,t-1} + \beta_2 Control_{i,t-1} + \varepsilon_{i,t} \quad (4.11)$$

In the static equations, "*g*" refers to the firm growth, *control* to the control variables and π denotes the profitability. *a* and β's are the estimation parameters and ε is the error term of the fixed model. In the static model, the simultaneity between profitability and firm growth can cause the endogeneity problem. To deal with the endogeneity problem, the lagged terms are added on the fixed effects model. Also, White's (1980) estimation technique is employed to handle the possible heteroscedasticity for the error term.

Table 4.2 Fixed Effects Model $nsg = f(\pi)$

Independent Variable(s)	**Coefficient (Robust Std. Error)**			
	I	II	III	IV
roa_{t-1}	-5.676*	-5.763*	-5.463*	-5.551*
	(.4643)	(.4504)	(.4600)	(.4463)
d/e_{t-1}	.0001*	.0001*	.0002*	.0001*
	(.0000)	(.0000)	(.0000)	(.0000)
age_{t-1}	-.0045*	.0010	-.0058*	-.0005
	(.0009)	(.0018)	(.0009)	(.0017)
$Log(totalassets)_{t-1}$		-.1902*		-.1775*
		(.0450)		(.0436)
emp_{t-1}			-.0474*	-.0469*
			(.0042)	(.0041)
bsf_{t-1}			-.1011*	-.0833*
			(.0103)	(.0094)
Prob > F	.0000	.0000	.0000	.0000
R-Sq	.1357	.1408	.1369	.1530
Estimation technique	Fixed	Fixed	Fixed	Fixed
Number of observations	9,794	9,794	9,792	9,792
*: 1% significance **:5% significance ***: 10% significance				

Table 4.2 indicates that the effects of profits on firm growth is negative. All regressions with different control variables have significant estimates of the profitability. The prior year profits tends to decline the current year growth. This finding is also confirmed by Lee (2014) whereas is not consistent with other studies (Goddard, 2006; Coad, 2007; Coad, 2010). This means that the managers are not concentrated on profitability for generating the growth effects. In other words, some managers choose the leverage-oriented growth path instead of generating profits. Additionally, institutional environment may stagger the growth and profitability opportunities of the Turkish firms. The effects of idiosyncratic institutional context may differ across countries, this negative effect may reflect the institutional boundaries of the Turkish business environment.

The causal relationship between growth and profits is related to the institutional adjustments of the investor protection (John et al., 2008). In this sense, Turkish business environment does not encourage the investors to take more value enhancing-risk. Generally, Turkish manufacturing firms expand the investment opportunities with leverage. The profitability on the other hand, is not a sufficient condition for surviving in the competitive market conditions. Altogether, this is a short-term view for the growth opportunities of the Turkish firms.

The leverage ratio (*d/e*) indicates a positive relation with firm growth in all equations. The positive effect of leverage on firm growth indicates a non-linear relationship (Huynh & Petrunia, 2010). The negative coefficient of the size (total assets) implies that the small firms have larger growth rates than large firms. This also means Gibrat's Law does not hold for our sample.

Table 4.3. Fixed Effects Model $\pi = (nsg)$

Independent Variable(s)	**Coefficient (Robust Std. Error)**			
	I	II	III	IV
nsg_{t-1}	.0165*	.0167*	.0194*	.0196*
	(.0009)	(.0009)	(.0011)	(.0011)
d/e_{t-1}	3.51e-06	2.08e-06*	7.28e-06*	5.94e-06*
	(1.23e-06)	(1.39e-06)	(1.41e-06)	(1.50e-08)
age_{t-1}	-.0054*	.0001	-.0006*	.0000
	(.0001)	(.0003)	(.0001)	(.0003)
$Log(totalassets)_{t-1}$		-.0230*		-.0231*
		(.0081)		(.0082)
emp_{t-1}			-.0034*	-.0034*
			(.0003)	(.0003)
bsf_{t-1}			-.0064*	-.0042*
			(.0013)	(.0012)
Prob > F	.0000	.0000	.0000	.0000
R-Sq	.0000	.0140	.0000	.0138
Estimation technique	Fixed	Fixed	Fixed	Fixed
Number of observations	9,788	9,788	9,787	9,787
*: 1% significance **:5% significance ***:10% significance				

Table 4.3 represents the estimation of equation (4.11). In all regressions *nsg* and *d/e* ratio have positive association with profitability. In model II, we have added the logarithmic form of total assets to estimate the marginal effects of firm size. Negative effects of the firm size have clearly given us an empirical support to reject the Gibrat's Law. Also, our model is on the same side with various empirical studies such as Sing & Whittington (1975), Hall (1986), Weiss (1998), Almus & Nerlinger (2000) and Calvo (2008).

In model III, *emp* and *bsf* represent the exchange market and banking sector, respectively. The macro-financial conditions of the countries might affect the firm's profitability and growth as expected. In our model, both *emp* and *bsf* have negative effects on growth and

profitability. The negative sign of *emp* illustrate a transmission channel between exchange market and firm growth. As a result, an increase on *emp* reflects the Turkish lira depreciation and it might cause the intermediate input prices up for Turkish manufacturing firms. Then *emp* lowers down the growth of the firms and profitability. The negative sign of bsf illustrate that the connection between financial sector and real sector. When the financial fragility rises in times of crisis and other downsizing situations, the financial institutions clearly restrain risky credits to the real sector. The restrained credit mechanism for Turkish manufacturing firms is displayed negatively to the investment opportunities.

Table 4.4 Fixed Effects Model $rdsales = (fcf)$

Independent Variable(s)	**Coefficient (Robust Std. Error)**	
	I	II
tq_{t-1}	-.0019	
	(.0017)	
fcf_{t-1}	.0057	.0072
	(.0056)	(.0059)
d/e_{t-1}	9.96e-07	8.17e-07
	(1.29e-06)	(1.40e-06)
age_{t-1}	.0002**	.0001***
	(.0000)	(.0000)
nsg_{t-1}		.0024***
		(.0012)
Prob > F	.0569	.0824
R-Sq	.0002	.0000
Estimation technique	Fixed	Fixed
Number of observations	9,785	9,757
*: 1% significance **:5% significance ***: 10% significance		

In Table 4.4 we checked the investment and cash flow sensitivities on R&D investments for Turkish manufacturing firms. The positive coefficients of the *age* on *rdsales* show the importance of the firm maturity. In an addition, there is a positive correlation between firm growth and R&D investments. As for *fcf* and *tq,* all regression results have shown insignificant results. Apart from the other studies, R&D spending does not have cash flow and investment

sensitivities. All in all, because of the uncertain nature of the R&D investment, Turkish firms do not risk the most liquid assets on that.

Table 4.5 Fixed Effects Model $rdassets = (fcf)$

Independent Variable(s)	**Coefficient (Robust Std. Error)**	
	I	II
tq_{t-1}	.00002	
	(.0001)	
fcf_{t-1}	.0002	.0001
	(.0056)	(.0003)
d/e_{t-1}	4.67e-08	5.79e-08
	(6.41e-08)	(5.61e-08)
age_{t-1}	.0000***	.0000*
	(.0000)	(.0000)
nsg_{t-1}		.0002*
		(. 0000)
Prob > F	.0569	.0014
R-Sq	.0002	.0033
Estimation technique	Fixed	Fixed
Number of observations	9,785	9,777
*: 1% significance **: 5% significance ***: 10% significance		

Table 4.5 summarizes the empirical results of the R&D investments and cash flow sensitivities. In all of the models, *fcf* and *d/e* do not yield significant estimates. In other words, R&D investments do not respond *fcf* variations. On the other hand, there is a positive link between sales growth and R&D investments. Another significant result is the positive relation between age and R&D investments. This study also investigates the non-linear relationship between firm growth and profitability with a quadratic regression model. In this sense, we estimated the growth regressions using roa^2. As Marris (1963, 1964) suggested, there may be a trade-off (U-shaped relationship) between growth and profitability in firm level. Also, when growth of the firm arises rapidly, profitability may decrease due to the owners fail to handle firm operations effectively (Penrose, 1959). The non-linear specification of the growth model is:

$$g_{i,t} = a_i + \beta_1 \pi_{i,t-1} + \beta_2 \pi_{i,t-1}^2 + \beta_2 Control_{i,t-1} + \varepsilon_{i,t} \quad (4.12)$$

Table 4.6 Fixed Effects Model $nsg = (roa^2)$

Independent Variable(s)	**Coefficient (Robust Std. Errors)**
roa_{t-1}	-8.479*
	(.321)
roa^2_{t-1}	5.842*
	(.414)
d/e_{t-1}	.000*
	(.000)
age_{t-1}	-.004
	1.555
Prob > F	.000
R-Sq	.143
Estimation Technique	Fixed
Number of Observations	9,794
*: 1% significance **:5% significance ***: 10% significance	

In Table 4.6, for the effects of *roa* on *nsg* the quadratic regression reports significant negative estimation of linear term and significant coefficient of the quadratic term. This result implies that there is a quadratic (U-Shaped) relationship between profits and growth. We can conclude that Marris' (1963, 1964) managerial theory can be applicable for Turkish manufacturing firms.

4.2.2. Dynamic Results

Due to the inconsistency of the standard panel models on the endogeneity assumption, we conduct the dynamic equations to obtain efficient estimations. In this situation, we employ the system GMM method (Roodman, 2009). We consider three equations. t-2 and t-3 lagged values of the dependent variables are used as instrument variables. In our model, Hansen test and AR (2) test are reported for the instrument validity and second order autocorrelation.

The dynamic regression specification is:

$$g_{i,t} = a_i + \gamma_i g_{i,t-1} + \beta_1 \pi_{i,t-1} + \beta_2 control_{i,t-1} + \varepsilon_{i,t} \quad (4.13)$$

$$\pi_{i,t} = a_i + \gamma_i \pi_{i,t-1} + \beta_1 g_{i,t-1} + \beta_2 control_{i,t-1} + \varepsilon_{i,t} \quad (4.14)$$

$$R\&D_{i,t} = a_i + \gamma_i R\&D_{i,t-1} + \beta_1 \pi_{i,t-1} + \beta_3 control_{i,t-1} + \varepsilon_{i,t} \quad (4.15)$$

Where g denotes the growth of the firm. π refers to the profitability. R&D stands for the R&D spending. A lag for R&D spending is added to independent variables since the lagged value of R&D spending could be the main determinant of the current R&D spending.

Table 4.7 Dynamic Model $\pi = (nsg)$

Independent Variable(s)	**Coefficient (Robust Std. Error)**	
	I	II
roa_{t-1}	-.2154*	-.1993*
	(.0608)	(.0599)
nsg_{t-1}	.0229*	.0250*
	(.0023)	(.0023)
d / e_{t-1}	.0001	.0002
	(.0001)	(.0002)
age_{t-1}	-.0005*	-.0006*
	(.0002)	(.0002)
bsf_{t-1}		-.0057*
		(.0015)
emp_{t-1}		-.0033*
		(.0003)
Prob > chi2	.0000	.0000
Hansen Test	1.000	1.000
AR(1)	.000	.000
AR(2)	.304	.603
Estimation technique	GMM	GMM
Number of Instruments	1596	1596
Number of observations	9564	9563
*: 1% significance **:5% significance ***: 10% significance		

Table 4.7 presents the results of profitability equations. In I-II models, we confirm that there is a positive association between sales growth and profitability, but the lag of the profitability tends to decrease current year's profitability. The age variable is also statistically significant and it has negative coefficient (Evans, 1987). This result implies that as firm gets older, the profitability tends to decline. In model II, *bsf* and *emp* have negative significant estimates. In this situation, the macro-financial conditions clearly have an impact on profitability of the firms. As explained earlier, exchange market pressures (*emp*) reflect the depreciation of Turkish Lira against American Dollar. This could expose the intermediate good prices up. As for the *bsf*, if the credit channel between financial sector and real sector becomes risky, the financial institutions constraint the credit channel to the real sector. This might affect the real investments, sales and profitability.

Table 4.8 Dynamic Model $nsg = (\pi)$

Independent Variable(s)	**Coefficient (Robust Std. Error)**	
	I	II
nsg_{t-1}	.0615*	.0788*
	(.0243)	(.0245)
roa_{t-1}	-11.339*	-11.276*
	(.8973)	(.8834)
d / e_{t-1}	.0010	.0016
	(.0012)	.(0016)
age_{t-1}	-.0064*	-.0074*
	(.0019)	(.0019)
bsf_{t-1}		-.0733*
		(.0154)
emp_{t-1}		-.0293*
		(.0049)
Prob > chi2	.000	.000
Hansen Test	1.000	1.000
AR(1)	.000	.000
AR(2)	.283	.617
Estimation technique	GMM	GMM
Number of Instruments	1596	1596
Number of observations	9552	9551
*: 1% significance **:5% significance ***: 10% significance		

Table 4.8 shows the dynamic growth regression. Model I and II show that the lagged *nsg* affects significantly current year *nsg*. This finding can be interpreted as the rejection of the Gibrat's Law. In this sense, historical growth performance of the firms can be informative for current year's growth. The negative coefficient of *roa* on *nsg* has a unique importance for Turkish business environment and the market structure. According to John et al. (2008), if the business environment is not favorable for investment, the weak relationship between growth and profits might emerge. This issue also refers the country-wide reforms to improve institutional settings of the economy. On the other hand, the market structure could play an important role for growth-profitability relationship. The lack of competition and entry barriers of the market might change the incentives of the managers for generating profits. The managers choose to forgo profit opportunities for generating more growth.

Table 4.9 Dynamic Model $rdassets = (fcf)$

Independent Variable(s)	**Coefficient (Robust Std. Error)**	
	I	II
$rdassets_{t-1}$	.2533*	.2448*
	(.1005)	(.1043)
tq_{t-1}	-.0015	.0007**
	(.0014)	(.0003)
d/e_{t-1}	-3.81e-07	-1.44e-06
	(4.39e-06)	(3.31e-06)
age_{t-1}	.00003	-.0000
	(.0000)	.(0000)
fcf_{t-1}	-.00189	-.0009**
	(.0010)	(.0005)
nsg_{t-1}		.0007**
		(.0003)
emp_{t-1}		-.0001
		(.0000)
bf_{t-1}		-.0016*
		(.0005)
Prob > chi2	.000	.000
Hansen Test	1.000	1.000
AR(1)	0.025	0.027
AR(2)	0.143	0.164
Estimation technique	GMM	GMM
Number of Instruments	1254	1253
Number of observations	8734	8731
*: 1% significance **:5% significance ***: 10% significance		

In the table 4.9 we checked the impacts of control variables on the R&D expenditures. In model I and II, GMM model shows that estimates of $rdassets_{t-1}$ is significant at 1% level. In our dataset we claim that lagged R&D investments of firms is the main determinant of the current R&D. Concerning the control variables, *d/e* ratio and *age* have insignificant estimates in all models. Also, *emp* do not show the significant estimates in II model. Another notable result in model II is that the R&D investments have sensitivities of *fcf* and *tq.* (which represent internal finance conditions and investment demand, respectively) Also, *bf* have negative association with R&D investments.

5. CONCLUSION

In this study, we try to find the determinants of the Turkish firm growth. In the second chapter, we focus on the firm growth theories along with the main empirical studies. The theoretical conjecture on growth of the firms has been greatly defined by various scholars. We speculate that the Gibrat's Law and Resource Based View is on center of the relevant literature. To this extent, most of the empirical studies fail to accept Gibrat's Law, indicating the impact of firm performance variables on the firm growth.

In the third chapter, we illustrate the firm-level dataset and empirical results. Our dataset contains 232 manufacturing firms listed on Borsa Istanbul (BIST) during the period 2003Q1 – 2017Q1. Our static and dynamic equations indicate the negative effect of profits on growth. This result is consistent with Lee (2014) and Steffens et al. (2009) who concludes that young firms may facilitate poorly in terms of generating profitability. However, it contrasts with Coad et al. (2011), Coad (2007) and Delmar et al. (2013). In this case, we have two plausible arguments for why lagged profitability have negative association with firm growth. First, the negative effect of profits on growth may not reflect evolutionary principle of "Growth of the Fitter". In particular, in earlier stages of firm most of enterpreneurs tend to pursue survival in market rather than generating profits (Federico & Capelleras, 2015). Second, the observed negative effects of profits illustrate the difference between growth-oriented managers and profit-oriented manages. In an addition to this argument, John et al. (2008) suggested that the investor protection reforms to maintain the strong connections between firm growth and profitability. The economy-wide reforms on institutional settings of the country may help managers to take more value-enhancing risk. Another possible explanation on this issue is that the market structure. The lacking competition in the sub-sectors and entry barriers might be a cause for this growth-profitability issue.

Another notable result is that we find positive growth effects on the profitability. From empirical based view, this confirms that positive effect of growth on profits is fairly instantaneous. In this line, resource based effects take on critical role for Turkish firms since they do not have well-organized business schemes and continuous resource advantages (Penrose, 1958). For managers, this finding may show that growth itself may not sufficient enough for generating profits.

Due to the nature (uncertainty and information asymmetry) of R&D, the average value of R&D investment is emerged as low as 1.77 % for our dataset. The R&D investment is measured by dividing R&D spending by total sales ($rdsales$) and total assets ($rdassets$). The GMM model shows that the current $rdassets$ have positive association with lagged $rdassets$ and sales growth (*nsg*) but negative with free cash flow (*fcf*), Tobin's Q (*tq*) and banking sector fragility (*bsf*).

Our study makes a marginal contribution to the firm growth literature with a longitudinal dataset. It should be noted that our analysis is limited to Turkish manufacturing firms listed on BIST. One would expect the growth-profit relations might change in different sub-sectors and industries. Hence, additional analysis in this matter might provide broader understanding on the firm growth literature.

It is worth mentioning that through this study, we have examined the relations between growth, profitability and R&D investments with a panel application. Finally, it is clear that the sub-sectors differentials and entrepreneurship characteristics might provide different aspects for firm growth researchers in future. Therefore, we acknowledge that "entrepreneurship characteristics and sub-sector differentials" should be incorporated into different empirical methodologies.

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