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Fatma M. Utku-ismihan and M. Teoman Pamukçu

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Fatma M. Utku-ismihan[1] and M. Teoman Pamukçu[2]

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Send correspondence to:
Fatma M. Utku-ismihan
Ministry of Agriculture and Forestry
fmutku@yahoo.com

[1] EU Expert, Ministry of Agriculture and Forestry and part-time lecturer, Department of Economics, Middle East Technical University, Ankara, Turkey.
[2] Corresponding author. Department of Science and Technology Policy Studies, Graduate School of Social Sciences, Middle East Technical University, Ankara, Turkey (pamukcu@metu.edu.tr) .

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Abstract

Due to their important contribution to overall growth performance of economies policy makers have attributed great importance to high growth firms (HGFs). In order to examine and support their efforts, researchers have tried to identify the factors that initiate and promote the growth performance of HGFs. However, this is not a simple task since the factors that contribute to the growth performances of firms seem to vary across sectors and countries. This study examines the characteristics of HGFs and attempts to identify those factors that stimulate HGFs in the Turkish manufacturing sector using a rich firm-level dataset over the period 2003-2014.

Keywords: High growth firms, firm growth, firm size and R&D.
JEL Classifications: L25, L26 and D24.

1. Introduction

Sustainable economic growth and factors that promote economic growth have always been at the centre of the policy makers agenda. Due to their important contribution to overall growth performance of economies, high growth firms (HGFs) are considered to be powerful engines of both employment and output growth. Moreover, due to their potential in creating job opportunities HGFs are particularly important for countries with high unemployment rates.

The main focus of research on HGFs are on the factors that initiate and promote the growth performance of HGFs so as to understand the potential growth areas in the economy and accordingly develop public policy that would promote further growth.

However, one of the biggest drawback and. at same time, the merit of doing research in this area is the amount of controversy among different studies. As will be discussed in the proceeding parts of the article the most important drawback is that there is no general consensus on the definition and thus the measurement methods of HGFs. The merit on the other hand is that this situation provides researchers an opportunity to further investigate HGFs and determinants of their growth performance in different economic and institutional structures without any boundaries.

In this study we attempt to examine those factors (i.e. innovation, worker skills and global linkages) that stimulate HGFs in the manufacturing sector in Turkey during 2003-2014 period. Three surveys from Turkish Institute of Statistics (TurkStat) will be merged and used in this study. These databases are the Research and Development Survey, Structural Business Survey and Foreign Trade Survey and were made available to us within the premises of Turkstat.

The paper is organized as follows. The second section will provide a brief literature survey and the third section will give background information on the Turkish manufacturing sector. The fourth section will provide the model, the data, provide and evaluate the empirical results and the final section will provide the concluding remarks.

2. Literature Review

Following the ground breaking study of Birch (1979), due to their ability to create new employment opportunities, firms with high growth levels have been considered as the driving engines of economic growth. Birch (1979) in his study defines these firms as young, small fast-growing firms that create new employment opportunities.

But later, other studies have shown that the definition of firms with high growth levels, and of their growth performance, varies across sectors and countries. This variation, in turn, has resulted in different definitions of firms with high growth levels. As has been highlighted by Parker et al. (2010) this led to a confusion and lack of commonly accepted denomination. For

example, in some studies these firms are referred to as *gazelles* (Birch and Madoff, 1994)[3], *HGFs* (Schreyer, 2000), *high-growth impact firms* (Acs et al., 2008), *fast-growth firms* (Almus, 2002 and Storey, 1994) and so on. Not surprisingly, these different denominations lead to different definitions and to growth indicators aimed at measuring the performances of firms with high growth performance. For example, Acs et al. (2008) added revenue growth variable alongside employment and he referred to these firms that showed both revenue and employment growths as "high-impact firms" in order to distinguish them from gazelles. The major conclusion of Acs et al. (2008) is that in contrast to "gazelles" (Birch and Madoff, 1994) the high-impact firms are relatively old and rare and moreover contribute to the overall economic growth performance of countries.

However, as Delmar and Davidsson (1998) emphasize, when measuring firm growth there are several factors that one must take into account. First the indicator of growth, secondly the measurement of growth, thirdly the period studied and finally the process of growth.

The choice of the measurement (sales or employment) affects the selection of HGFs and whether growth is measured in relative or absolute terms does make a difference on the size of HGFs. Almus (2002) and Daunfeldt et al. (2013) show that the selection of HGFs using different growth measures is primarily driven by whether high growth is measured as absolute or relative growth. In the literature the most popular method of measurement is using the combination of the two measurements, i.e. Birch index.[4] So, even though Brich (1979) had defined HGFs to be new established small firms majority of the studies confirm that the choice of measurement determines the size and the age of HGFs. In terms of the relationship between HGFs and size, while some researchers did not find any relationship between firm size and employment opportunities, some researchers, such as Audretsch (2012), found that there was a strong relationship between large firms and employment growth. There are very different methods used to define HGFs. These are utilizing variation in turnover (Birch, 1987), average employment growth rate (OECD, 1998) and growth of at least 100% in four years (Acs et al., 2007). There is also a diversity of approaches regarding the time period during which the growth performances of HFGs is analyzed. As Delmar et al. (2003) and Acs and Mueller (2008) have demonstrated high growth is something that firms could not sustain for a very long time period.

Despite the controversy on the definition of HGFs there have also been attempts to establish a common definition. For example, as an attempt to bring a common definition OECD has defined high-growth firms as "firms with 10 or more employees that have average annualized growth greater than 20 percent per year over a 3-year period, as measured by employment levels or employee turnover" (OECD, 2008: 61).

[3] Birch and Madoff (1994) define gazelles as firms that "move between small and large quickly—at various times in either direction—and to classify them by their size is to miss their unique characteristics of great innovation and rapid job growth" (Birch and Madoff 1994: p.163).

[4] Birch index is a growth index that measures the change in absolute and relative numbers of employees. $(E_t-E_{t-k})(E_t/E_{t-k})$ where E_t is the number of employees in year t.

Another important debated issue in the literature is about sectors that have the potential to promote HGFs. In general, policy makers have the tendency to view high-tech industries as generators of HGFs.[5] The main reason for this tendency seems to be the belief that firms grow faster in this sector due to their comparatively higher R&D potential and capabilities (OECD, 2010) and there seems to be more start-ups (i.e. young firms) with exceptional growth performance in these sectors compared to other sectors. But in the literature there seems to be virtually no evidence to prove that HGFs operate mainly in high-tech industries.[6] For example, while some researchers, such as Brown and Mason (2014), have found empirical evidence that supports the relationship between high technology industries and HGFs, other researchers, such as Daunfeldt et al. (2015), have findings pointing to the contrary.

In the literature it is also argued that regions (see, Table 1)– especially in terms of agglomeration and networks- are important in the performances of HGFs (Acs and Mueller, 2008) due to spillovers generated by nearby firms for HGFs (Sena et al., 2013). In a more recent study Goswami et al. (2019) also acknowledge the importance of regions for increasing the probability of firms to pursue their high growth performance along with other factors such as innovation, managerial capabilities and human capital, global linkages and financial development.

[5] See, Mason and Brown (2013) for more detail.
[6] See, Henrekson and Johansson (2010) for a thorough analysis.

Table 1. Some Studies on HGFs[7]

Author(s)	Findings
Acs and Mueller (2008)	Gazelles and regions are important for employment growth.
Arrighetti and Lasagni (2013)	HGFs are small firms and financial constraints and profitability are not associated with HGFs.
Birch (1979)	Small firms contribute to job generation.
Birch and Madoff (1994)	Small firms contribute to job generation and there is no link between HGFs and high tech industries.
Brown et al. (2017)	There is a clear mismatch between how policy makers perceive HGFs and what they are in reality
Coad et al. (2014)	Different growth indicators lead to the selection of different sets of firms; small number of HGFs create a large share of new jobs; HGFs tend to be young but are not necessarily small; HGFs are not more common in high-tech industries; high growth is not to be persistent over time; and difficult to predict which firms are going to grow.
Daunfeldt et al. (2016)	HGFs are overrepresented in knowledge-intensive service industries, such as service industries with high share of human capital.
Henrekson and Johansson (2010)	Even though small firms are overrepresented among HGFs in general HGFs are of all sizes.
Keen and Etemad (2012)	HGFs are mainly small-sized and medium-sized enterprises.
Schreyer (2000)	HGFs are overrepresented in some of the medium-tech industries such as pharmaceuticals, electronics, and rubber. The probability of a HGFs being in the service sector is significantly higher than manufacturing sector. R&D activities contribute to the growth performance of firms.
Sena et al. (2013)	Spillovers generated by nearby firms are important for HGFs.
Goswami et al. (2019)	Factors that contribute significantly to firms' high growth episode are considered to be innovation, agglomeration and networks, managerial capabilities and worker skills, global linkages and financial development.

[7] It is important to note that there is an enourmous amount of research in this area and since our aim was to draw attention to conflicting results in this literature only few prominent studies are presented in this table.

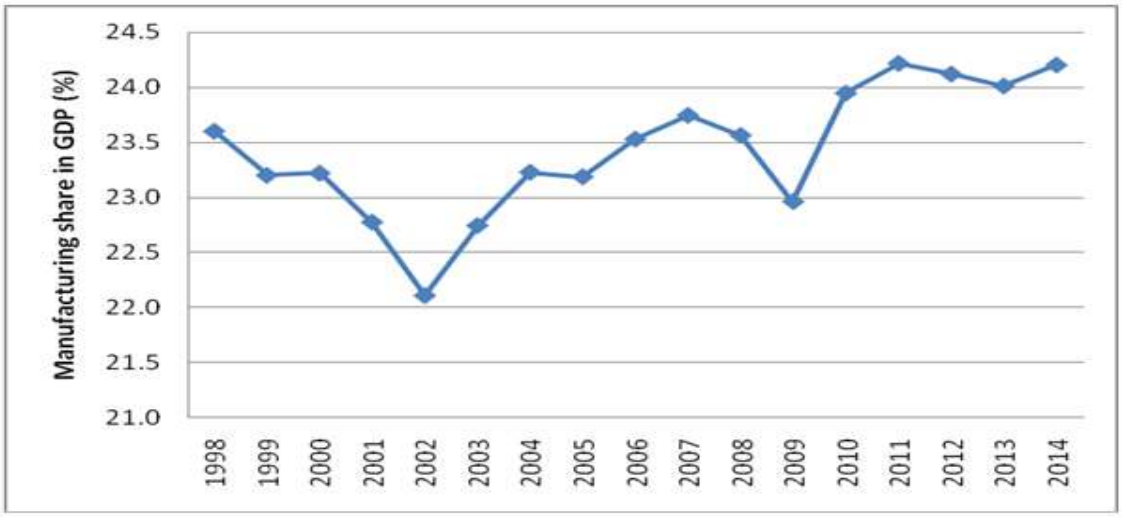
So, as can be seen from Table 1, there are contradictions in the related literature concerning the impact of factors such as size, age, industry, regional proximity (i.e. agglomeration and networks), R&D involvement, access to foreign markets etc. on firms' high growth performance and the possible persisting high growth episodes.

There are both merits and drawbacks arising from the contradictions that exists in the literature of HGFs. The most important drawback is that there is no general consensus on the definition and thus the measurement methods of HGFs. As Coad et al. (2014) underlines different growth indicators leads to the selection of different set of firms as HGFs. The merit on the other hand is that this situation provides researchers an opportunity to further investigate HGFs and their determinants in different economic and institutional structures. However, it is important to note that the choice of growth indicator will influence the selection of firms and thus the result. For example, Daunfeldt et al. (2013) showed there are trade-offs between HGFs defined in terms of employment growth and productivity growth. Moreover, as has been underlined by Delmar et al. (2003) using employment growth presents resource growth whereas sales growth presents product (or service) sales in the market, i.e. market share.

3. The Manufacturing Sector of Turkey

Manufacturing sector is one of the major drivers of the growth performance in Turkey. Factors such as geographical proximity to export markets, developed infrastructure and communications technology (ICTs), availability of young skilled human capital and a large domestic market contributes to the competitive strength of the manufacturing sector. The share of manufacturing sector in Gross Domestic Product (GDP) has been generally above 23% with the exception of crisis periods, such as 2001-2 and 2008-09. In 2014, the manufacturing sector accounted for 24.2% of total GDP (see Figure 1).

Figure 1. Share of Manufacturing Sector in Turkish GDP (%)

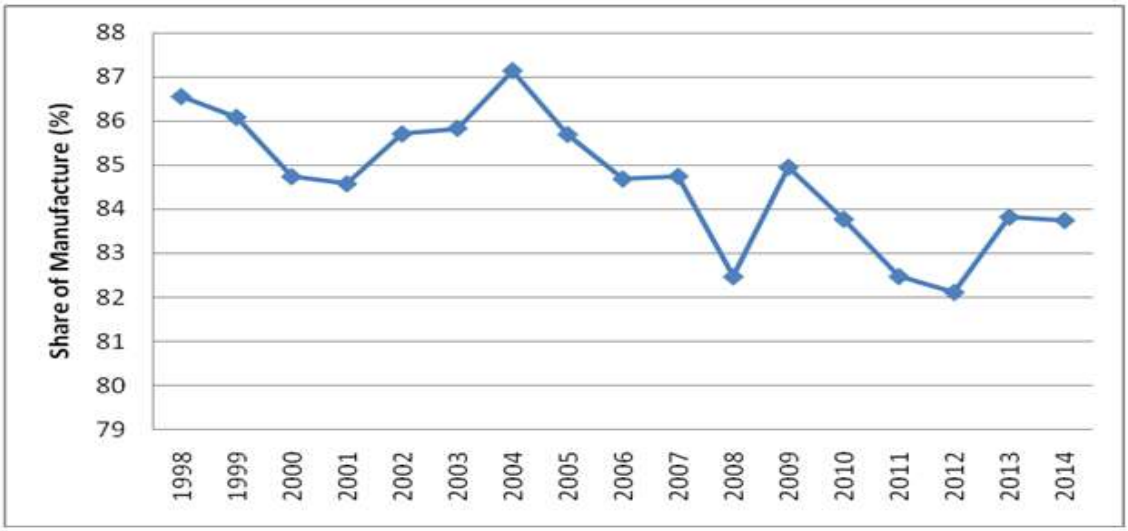


Source: Prepared by the authors using the information in www.tüik.gov.tr.

The manufacturing sector has the largest share in foreign trade. As can be seen from Figure 2 even though the share of manufacturing in total trade has slightly decreased from approximately 87% (1998) to 84% in 2014, its share is still very high. At this point it is important to note that in 2017 the share of manufacturing sector in total exports was 93.7% and 81.6% in total imports. Thus, this sector has been and still continues to be the main engine of the Turkish economy.

From 1996 onwards there has been substantial transformation in the sub-sectors of the manufacturing sectors.[8] The main cause of this transformation has been competition pressure coming from India and China. As a result of this pressure there has been a decrease in the share of garments, textile products and food sub-sectors in the manufacturing production while the share of automotive, machinery, home appliance goods, electronics, petroleum and rubber-plastic sub-sectors have considerably increased. However, garment and textile sub-sectors are still important in the economy due to its high share in GDP, employment and exports. For example, Turkey was among the world's top ten exporters of garment and textile products in 2016. The share of this sub-sector in total exports was 19.3% in 2016.

Figure 2. Share of Manufacturing Sector in Foreign Trade of Turkey (%)



Source: Prepared by the authors using the information in www.tüik.gov.tr.

The most significant increase has been in the automotive production. Turkey is the 14th biggest producer of motor vehicles in the world and 5th and in Europe. The electronics sub-sector with its intensive R&D efforts and export (market) oriented production has made it another important sub-sector its share in Turkey's exports was 6.5% in 2017. The machinery and equipment sub-sector is another sector that has continued its progress throughout the years. During the last 15 years, by adapting international manufacturing standards and using high quality inputs it has almost doubled its production and its share in Turkey's total export reached 6% in 2017 (Ministry of Trade, 2018).

[8] The manufacturing sector has transformed from low technology driven sectors to relatively medium-technology driven sectors.

However, even though the share of the manufacturing sector in foreign trade there is a crucial point that needs to be underlined. The sub-sectors of the manufacturing sector have high dependence on imported inputs, that is, the share of domestic inputs used during the production process is very low. So in actual fact one needs to be aware of this reality while praising the high share of the manufacturing sector in the total foreign trade.

4. Data, The Model and Empirical Results

4.1. The Data

Our data set is obtained by matching and merging the Structural Business Surveys (SBS), the R&D Surveys and Foreign Trade Statistics of Turkish Institute of Statistics (Turkstat) from 2003 to 2014. The three surveys were matched at firm level for the 2003-2014 period.

There are basically two reasons for using this time period: first, the R&D survey starts from 2003 and secondly, TurkStat has started only recently to compile the data on Structural Business from the administrative records (only available from 2009 to 2015) and it is impossible to merge it with the previous Structural Business Surveys. As can be seen from Table 2 our data set includes a total of 452,604 firms.

Table 2. Distribution of Firms by Ownership, by R&D and by Export Performance

Year	R&D performers		State Firms		Foreign firms		Exporting firms		Total*
	Number	%	Number	%	Number	%	Number	%	
2003	551	2	129	0.41	489	1.4	8135	25,9	31381
2004	572	2	98	0.29	607	1.8	9296	27,6	33723
2005	803	2	90	0.26	639	1.9	10290	29,8	34558
2006	731	2	80	0.23	736	2.1	10869	31,6	34431
2007	852	3	69	0.20	751	2.0	10266	30,5	33703
2008	970	3	88	0.25	761	2.2	10347	29,9	34660
2009	1140	3	80	0.21	764	1.9	10388	27,9	37244
2010	1319	4	63	0.19	820	1.9	11485	33,9	33890
2011	1458	4	61	0.15	939	2.0	12266	29,8	41194
2012	1604	4	63	0.15	933	2.1	13490	31,2	43281
2013	1593	3	152	0.32	1016	2.2	14480	30,8	47024
2014	1623	4	150	0.33	1067	2.4	14759	32,6	45316
Total	**13216**	**3**	**1123**	**0.25**	**9522**	**2.1**	**136071**	**30,1**	**452604**

*Note: The difference between state and foreign firms equals to the number of domestic private firms.
Source: Prepared by the authors using the Structural Business Survey, the R&D Survey and Foreign Trade Survey of TurkStat.

When we analyze our sample in terms of firms engaged in R&D activities, ownership and global interactions (export and import activity) during the sample period we see that the total number of firms engaged in R&D activities has increased from 31,381 (2003) to 45,316 (2014). Out of 452,604 firms only 0.25% are public firms. The number of firms owned by foreigners have increased from 489 (2003) to 1067 (2014) and the share of foreign firms in total is

approximately 2% over this period. Even though the number of firms engaged in R&D activities have more than doubled from 551 (2003) to 1623 (2014) and the share of firms conducting R&D in total is 3%. In terms of global interaction, as can be seen from Table 2, 30% of firms in our sample engaged in export activity on average over the period 2003-2014 and the number of these firms increased approximately by 45% from 2003 to 2014.

In terms of percentage share of employees in total manufacturing employment (Table 3) with 33.3% textile and leather sectors are the largest sub sectors followed by metal (10.8%), food (9.8%), machinery (8.7%), mineral (6.8%), transport and plastic (5.8%), paper and publishing (5.5%), electrical (4.3%), chemicals (3.1%), coke and petroleum (0.2%) and recycling (0.1%). When we look at the distribution of foreign firms, the largest concentration is in textile and leather (15%) followed by chemicals (13%), food (12%) and transport (12%). Similarly, with 34% textile and leather sub-sector has the highest share of domestic firms followed by metal (11%) and food (10%).

Table 3. Percentage Share of Employees in Sub-Sectors (%)

Sectors	Domestic	Foreign	Total
Food	9.8	11.7	9.8
Textile and Leather	34.0	14.6	33.3
Paper and Publishing	5.6	4.9	5.5
Coke and Petroleum	0.1	0.4	0.2
Chemicals	2.7	12.8	3.1
Plastic	5.7	8.0	5.8
Mineral	6.8	5.9	6.8
Metal	10.9	9.5	10.8
Machinery	8.7	7.7	8.7
Electrical	4.2	7.7	4.3
Transport	5.6	11.6	5.8
Furniture	5.7	4.0	5.6
Recycling	0.1	0.1	0.1

Source: Prepared by the authors using the Structural Business Survey and the R&D Survey of TurkStat.

Since size of firms are one of the most debated issues in the literature of HGFs we also wanted to analyze the firms in our data set in terms of firm size. In order to do so, we have used Eurostat's definition of firm size. Eurostat's groups firms as follows:

- Micro enterprises are firms with less than 10 employees
- Small enterprises are firms with 10-49 employees
- Medium-sized enterprises are firms with 50-249 employees
- Large enterprises are firms with 250 or more employees[9]

According to our sample majority of the firms in the manufacturing sector are small firms (43%) followed by micro firms (36%), medium firms (19%) and large firms (3.7%) (Table 4). The

[9] In addition to these classifications Eurostat also provided a classification of small and medium sized enterprises (SMEs), defined as firms with 1-249 persons employees.

number of micro firms in total has decreased gradually from 47% (2003) to 29% (2014). In contrast to micro firms the share of small firms in total has increased from 33% (2003) to 46% (2014).

Table 4. Distribution of Firms by Size over 2003-2014

Year	Large		Medium		Small		Micro		Total
	Number	%	Number	%	Number	%	Number	%	
2003	1057	3	5396	17	10292	33	14636	47	31381
2004	1124	3	5588	17	12140	36	14871	44	33723
2005	1165	3	5622	16	14069	41	13702	40	34558
2006	1223	4	6165	18	14932	43	12111	35	34431
2007	1294	4	6441	19	14106	42	11862	35	33703
2008	1323	4	6793	20	13968	40	12576	36	34660
2009	1189	3	6265	17	13052	35	16738	45	37244
2010	1292	4	6888	20	15771	47	12138	36	36089
2011	1457	4	7691	19	18351	45	13695	33	41194
2012	1571	4	8387	19	20358	47	12965	30	43281
2013	1668	4	9018	19	21867	47	14471	31	47024
2014	1776	4	9739	21	20717	46	13084	29	45316
Total	**16139**	**4**	**83993**	**19**	**189623**	**42**	**162849**	**36**	**452604**

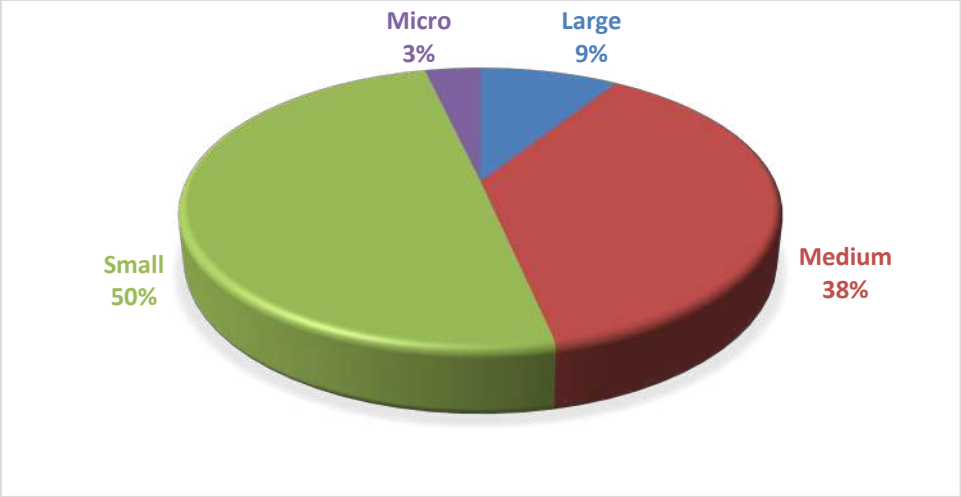
Source: Prepared by the authors using the Structural Business Survey and the R&D Survey of TurkStat.

When we analyse the distribution of HGFs in terms of size, we see that half of the HGFs in the manufacturing sector are small-sized firms followed by medium- (38%), large- (9%) and micro- (3%) sized firms (Figure 3).

As has been mentioned previously Delmar and Davidsson (1998), when measuring firm growth one should attach importance to following issues: selection of the indicator of growth; choosing relative or absolute change as measurement of growth; the period studied; and the process of growth.

Widely used growth indicators in the literature are sales or number of employee. Daunfeldt et al. (2013) found that results did not seem to be sensitive to the selection between these two indicators.

Figure 3. Distribution of HGFs according to firm size (%)



Unlike the case in the selection of growth indicator, the choice of measurement -relative or absolute terms – does change the result. Thus, in order to capturing absolute and relative value of the growth indicator and to reduce the impact for firm size on the growth indicator we used the Birch index. This index weights the absolute growth with relative growth to smooth out the probability of classifying either the large or the small firms as HGFs.

The Birch index is defined as:

$$(E_t - E_{t-k})(E_t / E_{t-k}) \quad (1)$$

where E_t is the number of employees in year t.

In the literature sales are also used as firm growth indicator so the above index becomes:

$$(S_t - S_{t-k})(S_t / S_{t-k}) \quad (2)$$

where S_t is sales in year t.

As mentioned previously the definition of HGFs adopted by the OECD is as follows: those firms whose employment grows on average 20% or more annualy over a period of 3 consecutive years. Goswami et al. (2019) argue that the choice of measurement (employee vs. sales) is more important than the choice of definition (Birch vs. OECD). Thus, following Goswami et. al. (2019) in our analysis we will concentrate on the choice of measurement and use Equation 2 to calculate firm growth.

The decision of selection of the time horizon for the calcutaion of the growth rate is another issue that has not been resolved yet in the literature. This is due to nature of the growth process of firms, which is not expected to be a continuous process. Daunfeldt and Halvarsson (2014) have shown that smoothing the growth process over years to decrease the amount of statistical noise -resulting from the uneven growth trajectories of HGFs- is not a solution since majority of HGFs experience the high growth event in one year. However, in general three or four consecutive years have been used in majority of the studies and since our data set is between 2003-2014 we decided to divide our data into three periods, Period 1: 2003-2006, Period 2:

2007-2010 and Period 3: 2011-2014. This means that firms should have at least four consecutive sales data during periods to be included in the sample.

In terms of the process of growth there are internal and external factors that contribute to the growth process of firms. There are two types the internal (organic) and external (acquired) growth. Internal growth basically refers to new employment while external growth refers to increase in employment that arises as a result of mergers. In our data set we do not have information on whether the increase in the number of employees are due to internal or external growth so we are not in a position to make this type of distinction. Moreover, Spearot (2012) indicates that this distinction is not crucial since firms use decision process on both internal and external growth.

The main variables that are used in this study are presented along with their description in Table 5.

Table 5. Variables and Definitions

Variables	Description
Firm Growth (G)	Firm Growth (G) is calculated using equation (2)
Size (S)	Number of employees
Human capital (H)	Expenditure on employees
R&D (R)	R&D expenditure
Exports (E)	Export of the firm

Table 6 provides the descriptive statistics of the variables used in the analysis and the following table (Table 7) presents the correlation matrix of the variables.

Table 6. Descriptive Statistics of the Variables

Variable	Observation	Mean	Std. Dev.	Min	Max
Growth	112689	15.41222	2.112782	2.4	34.96
Size	441405	57.43521	8.334	1	17229
Human Capital	434669	997494.7	7.806234	0	907,000,000
R&D	13216	1976049	6.60E+00	0	816,000,000
Export	136071	2,93E+09	1,30E+11	132	2,00E+13

Table 7. Correlation Table

	Growth	$Growth_{n-1}$	Size	Human Capital	R&D	Export
Growth	1					
$Growth_{n-1}$	0.0067*	1				
Size	0.5923*	0.0016	1			
Human Capital	0.5852*	0.0039	0.9405*	1		
R&D	0.4978*	0.0368*	0.5154*	0.6040*	1	
Export	0.3750*	0.3727*	0.2731*	0.4822*	0.3675*	1

Note: * indicates 5% significance level.

4.2. The Model and Empirical Results

As indicated previously there is no common ground for either the definition of HGFs or the explanatory variables that help us understand the changes in growth of firms. Thus, we started our analysis with the specification used by Coad et al. (2009). So our base model is:

$$\mathbf{G_{i,t} = \alpha_0 + \alpha_1\ G_{i,t-1} + \alpha_2\ S_{i,t}} \quad \mathbf{(3)}$$

where $\mathbf{G_{i,t}}$ is growth of firm i in year t, $\mathbf{G_{i,t-1}}$ is growth of firm i at t-1 and $\mathbf{S_{i,t}}$ is size of firm i at time t.

In this model the constant term (α_0) gives us the average growth rate The second term, α_1, shows the effect of previous years' growth performance. If $|\alpha_1| > 0$ this means that previous year's growth influences the growth performances of firms. Otherwise we can conclude that previous year's growth performance has no effect on firm's future growth. The last term α_2 gives us the effect of firm size. If $\alpha_2 = 0$ this means that size does not affect firm's growth performance; if $\alpha_2 > 0$ this means that as firms size increases firm growth faster; and if $\alpha_2 < 0$ this means that small firms grow faster.

Then we will examine the impact of widely acclaimed high growth factors in the literature, i.e. human capital, innovation (R&D) and global linkages (exports). We will first introduce them one by one, then all of them together to see their impact on the growth performance of firms in the manufacturing sector of Turkey. That is, we will extend equation 1 and use the following models

$$\mathbf{G_{i,t} = \alpha_0 + \alpha_1\ G_{i,t-1} + \alpha_2\ S_{i,t} + \alpha_3\ H_{i,t}} \quad \mathbf{(4)}$$

where $\mathbf{H_{i,t}}$ is the human capital stock of firm i in year t and rest of the variables are as defined before.

$$\mathbf{G_{i,t} = \alpha_0 + \alpha_1\ G_{i,t-1} + \alpha_2\ S_{i,t} + \alpha_3\ RD_{i,t}} \quad \mathbf{(5)}$$

where $\mathbf{RD_{i,t}}$ is the R&D expenditure of firm i in year t and rest of the variables are as defined before.

$$\mathbf{G_{i,t} = \alpha_0 + \alpha_1\ G_{i,t-1} + \alpha_2\ S_{i,t} + \alpha_3\ E_{i,t}} \quad \mathbf{(6)}$$

where $\mathbf{E_{i,t}}$ is the total export amount of firm i in year t and rest of the variables are as defined before.

After analyzing individual impact of each variable on the growth performance of firms we also wanted to see how they influence the growth performance of the firm when they are introduced together as follows:

$$\mathbf{G_{i,t} = \alpha_0 + \alpha_1\ G_{i,t-1} + \alpha_2\ S_{i,t} + \alpha_5\ H_{i,t} + \alpha_6\ RD_{i,t} + \alpha_4\ E_{i,t}} \quad \mathbf{(7)}$$

where all of the variables are as defined before.

We then have transformed the above model into log-log form and then used the following stochastic forms in our empirical analysis:

$$\mathbf{lnG_{i,t} = \alpha_0 + \alpha_1 lnG_{i,t-1} + \alpha_2 lnS_{i,t} + \alpha_5 lnH_{i,t} + \alpha_6 lnRD_{i,t} + \alpha_4 lnE_{i,t} + \varepsilon_{i,t}} \quad \textbf{(8)}$$

where $\varepsilon_{i,t}$ is the disturbance term and all of the variables are as defined but in natural log form.

We estimated each model separately using dynamic panel data analysis, i.e. two step system GMM method (Blundell and Bond, 1998). These estimators are designed for situations with few time periods and many individuals[10], allows for more instruments and improves efficiency. Moreover, this estimation method is consistent even in the presence of unit root (Binder et al., 2003). There are three conditions for System GMM results to hold. The first condition is to have small T and large N. The second condition is to have valid instruments (checked by using Hansen Test).[11] Thirdly, there should be no second order autocorrelation in first differences.[12] The estimation results are provided in Table 9.

Table 8. Two Step GMM System Estimation Results for all Models

	Model 1	Model 2	Model 3	Model 4	Model 5
$Growth_{t-1}$	-0.193***	-0.046***	-0.121*	-0.151***	-0.109*
Size	0.819***	0.318**	0.281*	0.638***	0.224*
Human Capital		0.479***			0.406***
R&D			0.724***		0.343***
Export				0.077***	0.032*
Constant	19.373***	9.687***	9.660***	17.388***	7.629***
AR1p	0	0	0	0	0
AR2p	0.752	0.676	0.319	0.487	0.352
Hansen-Pv	0.413	0.526	0.662	0.442	0.914
Observations	73343	73020	6124	43210	5412
Number of id	21152	20975	2075	12719	1847

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Model 1 is the benchmark model - specification used by Coad et al. (2009) and Models (2)-(5) give us the estimation results when we add each explanatory variable separately to our benchmark model. Model (5) presents the estimation result of our fully specified model, i.e. all explanatory variables of firm growth are introduced together to see their joint impact on the growth performances of firms. In our two step system GMM analysis, the coefficients that represent the endogenous growth ability of firms (human capital, R&D and exports) are statistically significant at conventional critical values and theoretically consistent. Moreover, in all the models the instruments are valid and there is no second order autocorrelation. This result does not change whether the explanatory variables are introduced individually or all jointly (Table 8).

Since all of our models are both statistically significant and theoretically consistent we selected our fully specified model (Model (5)). That is, all explanatory variables have a statistically significant and positive effect on firm growth, except previous year's growth.

[10] This fits our data structure, i.e. our time dimension is twelve years (2003-2014) and we have a large N (452604).
[11] The null hypothesis is that the instruments are valid.
[12] That is, in line with Arellano-Bond test for AR(1) and AR(2), the null hypothesis states that there is no autocorrelation in first differences and there should not be second order autocorrelation in the series.

$$g_{i,t} = 7.629 - 0.109\ lnG_{i,t-1} + 0.224\ lnS_{i,t} + 0.406\ lnH_{i,t} + 0.343\ lnRD_{i,t} + 0.032\ lnE_{i,t} \quad (10)$$

The first interesting insight, from the results in equation 10, is that the effect of previous year's growth performance is negative. This previous year's growth performance does not have impact on the growth performance of the firms.

The positive coefficient on the size of the firms ($\alpha_2 = 0.224$) indicates that as the size of the firms increases firms grow faster, that is, a percentage increase in the size of the firm lead - approximately to 0.2% growth of firms, holding everything else constant.

In our analysis, the variable that seems to have the most important impact on the growth performance of firms is human capital. According to equation 10, a percentage point increase in human capital results in approximately additional 0.4% growth. Interestingly export activity ($\alpha_6 = 0.075$) seems to exert the least important contribution among the three growth inducing variables introduced to the baseline model.

Next we checked whether these results would change when we analyze firms separately in terms of their size using Model 6. The results are presented in Table 9.

Table 9. Two Step GMM System Estimation Results for Firm Types

	Large	Medium	Small
$Growth_{t-1}$	0.299***	0.225**	0.312**
Size	-0.301*	0.110	0.878***
Human Capital	0.415**	0.459*	0.577**
R&D	0.184**	0.010	-0.018
Export	0.056*	0.062	0.048
Constant	3.267*	4.929	5.841*
AR1p	0	0	0
AR2p	0.620	0.490	0.647
Hasen-Pv	0.514	0.317	0.694
Observations	428	614	89
Number of id	252	393	74

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

The first insight is that while the previous year's growth performance exerts a negative effect on the growth performance of firms analysed all together (Table 8) for different size categories the same variable seems to positively contribute to the growth performances of large, medium and small firms (Table 9).

Among all variables human capital has the highest impact on firm growth for all three types of firms. When we look at the role of R&D on the growth performance of firms, it has a positive and statistically significant effect for large firms, positive but statistically insignificant effect for medium firms and a negative effect for small firms. Considering the nature of R&D it is not surprising that large firms would be engaged more intensively in and would receive higher returns from R&D activities.

Even though export seems to have a positive impact on all the three firm types it is only statistically significant for large firms. Size is statistically significant and positive for small firms, positive but statistically insignificant effect for medium firms and a negative effect for large firms.

In sum, human capital and previous years' growth performance are the only variables that have positive and statistically significant affect on the growth performances of all types of firms – classified according to their size - in the Turkish manufacturing sector.

5. Conclusion

This study has examined the characteristics of HGFs and tried to identify those factors that impact of the performance of HGFs in the Turkish manufacturing sector using firm level data over 2003-2014.

Our findings about the factors that contribute to the high growth performance firms in the Turkish manufacturing sector are largely in line with the existing literature and hence with our expectations. Among the factors analysed, all else equal, human capital seems to exert the most significant influence on the growth performance of firms compared to other factors. We also found that previous growth performance of the firms significantly influences the future growth potential of the large, medium and small sized firms.

Both the distribution of HGFs and our empirical results seems to support the argument advanced in Brich (1979) about the positive relationship of small size and high growth performance. Another important finding of the econometric analysis is that HGFs in the Turkish manufacturing sector tend to have more highly educated and trained human capital.

There are mainly three policy implications that this study suggests to policy makers. In encouraging high growth of firms in the manufacturing sector the first and most important insight the overall sector level results in study has revealed is that firms face difficulty in sustaining their high growth performances. Thus, this suggests that policy makers should concentrate on areas where firms face difficulties in strengthening capabilities and provide them with means to overcome these difficulties.

Second implication policy makers should take into account is the importance of differences in firm-specific factors (i.e. size). For the firms in the Turkish manufacturing sector it seems that small and medium sized firms have higher growth potential and impact of growth factors seem to vary according to size. For example, R&D seems to have positive and significant impact on the growth performance of large firms it has minimal (medium firms) or negative (small firms) impact in case of different sized firms. The third implication is that human capital among other factors seems to have the highest contribution to the growth performance of all types of firms with the exception of micro firms. Thus, policy makers should invest in public measures that would increase the capabilities of human capital in the manufacturing sector of Turkey.

The main limitation of this study is that it is concerned with the analysis of HGFs in the overall manufacturing sector. Hence, future studies should analyze the performance of HGFs in sub-sectors to see whether the results differ between high-tech and non-high-tech manufacturing sectors; analyse the horizontal and vertical knowledge spillovers and links of HGFs and the impact of agglomeration (i.e. pool of workers and inputs).

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