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Investigating the impact of small versus large firms on economic performance of countries and industries

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Abstract

Following earlier work by Audretsch *et al.* (2002), we assume that an optimal size-class structure exists, in terms of achieving maximal economic growth rates. Such an optimal structure is likely to exist as economies need a balance between the core competences of large firms (such as exploitation of economies of scale) and those of smaller firms (such as flexibility and exploration of new ideas). Accordingly, changes in size-class structure (i.e., changes in the relative shares in economic activity accounted for by micro, small, medium-sized and large firms) may affect macro-economic growth. Using a unique data base of the EU-27 countries for the period 2002-2008 for five broad sectors of economic activity and four size-classes, we find empirical support which suggests that, on average for these countries over this period, the share of micro and large firms may have been 'above optimum' (particularly in lower income EU countries) whereas the share of medium-sized firms may have been 'below optimum' (particularly in higher income EU countries). This evidence suggests that the transition from a 'managed' to an 'entrepreneurial' economy (Audretsch and Thurik, 2001) has not been completed yet in all countries of the EU-27.

Keywords: small firms, large firms, size-classes, macro-economic performance

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1. Introduction

Building an economy based on knowledge and innovation is a key target of the European 2020 strategy (European Commission, 2010a). Typically, entrepreneurship is regarded as an essential component of a knowledge-based economy where people start firms to pursue new but uncertain ideas (Audretsch and Thurik, 2001). Although a multi-faceted concept, entrepreneurship is most often understood as the establishment and operation of new and small firms. Since it became apparent that the comparative advantages of the EU in global competition lie in the exploitation of its knowledge base, politicians in many countries try to increase the number of new and small firms in their territory. At the end of the 20th century, researchers started to investigate the changing role of small and new firms in industrial economies (Brock and Evans, 1989; Acs and Audretsch, 1993). Globalization and an increasing importance of knowledge in the production process caused many developed countries to move from a more 'managed' to a more 'entrepreneurial' economy (Audretsch and Thurik, 2000, Thurik et al., 2013). In the former type of economy, large and incumbent firms play a dominant role, exploiting economies of scale in production and R&D in a relatively stable economic environment. In the latter type, small and new firms play an increasingly important role, introducing new products and services in highly insecure economic environments while quickly adapting to rapidly changing consumer preferences (Audretsch and Thurik, 2001).

Following the early stream of research documenting the changing role of small and new firms in industrial economies, a considerable amount of research has now emerged studying the consequences of this change toward smallness for macro-economic performance (Van Stel, 2006; Carree and Thurik, 2010). In particular, several studies have found a positive link between measures of entrepreneurship (e.g. start-ups, small firm presence, number of self-employed, number of entrepreneurs in young businesses) and measures of macro-economic performance (e.g. productivity, GDP growth), e.g. Audretsch and Keilbach (2004) and Van Stel and Suddle (2008). In line with these findings, economists and policy makers are increasingly becoming aware of the importance of entrepreneurship for achieving higher levels of competitiveness and economic growth. Entrepreneurs introduce innovations into the economy thereby challenging incumbent firms to perform better as well (Schumpeter, 1934). A lack of entrepreneurs is harmful for economic growth because it implies a lack of competition, and hence a lack of incentives to innovate.

However, although it is clear that a lack of entrepreneurs is harmful for economic growth, in general less attention is paid to the question whether an economy can also have more entrepreneurs than is good for economic prosperity (Blanchflower, 2004). For instance, when there are many self-employed or very small firms in an economy, it is likely that a considerable proportion of these small firms operates below the minimum efficient scale, and that many of their business owners could be more productive as employees (Carree et al., 2002). The notion that an economy can also have too many entrepreneurs (self-employed) or small firms is important, because in many countries policy measures have been installed based on the (often implicit) assumption that higher self-employment or small firm rates always induce macro-economic performance (European Commission, 2009, Chapter 3). However, it is possible that such measures have an adverse effect in the sense that individuals without the required entrepreneurial skills are attracted into self-employment (Johnson, 2005; Parker, 2007; Shane, 2009; Storey, 2003).

We have seen that economies can have less but also more entrepreneurs than is good for macro-economic performance (Carree et al., 2002). This clearly implies the existence of an *optimal* rate of entrepreneurship. However, to our knowledge, only a few studies have attempted to actually measure what the level of this optimal rate might be, and which factors may determine this level. Carree et al. (2002, 2007) model the equilibrium rate of business ownership (the number of business owners per labour force) as a function of economic development (per capita income), while Van Praag and Van Stel (2013) model the optimal business ownership rate as a function of a country's participation rate in tertiary education. Audretsch et al. (2002) use a completely different measure of entrepreneurship, viz. small firm presence operationalized as the share of small firms in a country's total turnover (i.e., sales). Although they do not explicitly measure the optimal rate of small firm presence, they do show that such an optimal rate exists and moreover, that most countries in their sample of European countries had a level of small firm presence below the optimum in the early 1990s.

The present paper is based on Audretsch et al. (2002) and extends and refines their analysis. In particular, we investigate whether changes in size-class structure affects macro-economic performance of industries and countries in the European Union (EU-27). The underlying assumption is that there exists an optimal size-class structure, where (newer and) smaller firms are strong in flexibility and in *exploration* of innovative ideas (Audretsch, 1995; Geroski, 1995; Caves, 1998), and where larger firms are strong in producing with higher efficiency through scale economies and in *exploitation* of innovative ideas.[1] A well-functioning economy requires a good balance between these core competences of firms of different firm size but can this perfect balance be quantified? We make use of a unique and rich database prepared in part by Panteia/EIM on behalf of the European Commission (see European Commission, 2010b). The database provides information on employment, value added, sales and other variables for all 27 countries of the European Union over the period 2002-2008. The information is also disaggregated by sector and size-class.

We distinguish between 27 EU-countries, five broad sectors of economic activity and four size-classes: micro, small, medium-sized and large. At the country-sector level we first approximate the net growth rate of the share of SMEs as the annual percentage growth of real sales by SMEs minus the annual percentage growth of real sales by large firms. We then approximate the net growth rate of the share of micro firms as the annual percentage growth of real sales by micro firms (as a size-class) minus the annual percentage growth of real sales by all firms (i.e. the industry total). We similarly define net growth of the share of small, medium and large firms. Note that these variables relate to the *distribution* of economic activity over size-classes but not to the *magnitude* of total economic activity.[2] We then estimate two equations where GNP growth of the sector is explained by changes in size-class structure as estimated by (1) the net growth rate of the share of SMEs and (2) the net growth rates of the four separate size-classes. A positive impact of a change in the share of (for instance) small firms on sector growth would imply that the share of small firms is below optimum as an increase of the share in the economy of small firms apparently stimulates macro-economic performance. Such an outcome would

[1] Of course, not all firms are involved in innovation. Moreover, the extent to which small and large firms explore and exploit innovative ideas will differ by sector.
[2] For instance, a positive net growth rate of the share of SMEs may go together with positive but also with negative growth of GNP.

imply that apparently, there is not enough flexibility and exploration of innovative activities (by small firms) present in the economy.

As the importance of small versus large firms for an economy depends on the stage of economic development (Thurik et al., 2013), we also estimate our equation separately for countries within the EU with relatively lower and higher levels of economic development. Our main findings are as follows. We find that increases in the share of real sales by medium-sized firms has a significantly positive influence on sector growth (i.e., growth of value added at the sector level), particularly for higher income EU countries, whereas we find the opposite for micro and large firms, particularly for lower income EU countries. These results suggest that on average, EU-countries have too much economic activity by micro and large firms, but not enough economic activity by medium-sized firms. An explanation for the important role of medium-sized firms for macro-economic growth as implied by our analysis, may be that medium-sized firms are flexible enough to adjust fast to changing economic circumstances while at the same time they have a large enough scale to compete with large firms, thereby also challenging the latter to perform better. Our results suggest that the transformation from a 'managed' (where large firms are relatively more important) to an 'entrepreneurial' economy (where SMEs are relatively more important) has not been completed yet in all EU-countries, at least in 2008, i.e., just prior to the current economic crisis.

2. Models

2.1 Base model

In this section we present a model which enables to test the hypothesis that changes in size-class structure affect macro-economic performance of industries and countries in the European Union (EU-27). We capture changes in industry structure by changes in the relative importance (share of economic activity) of four firm size-classes (micro, small, medium and large) for five broad sectors of economy.

The model of Audretsch et al. (2002) assumes that a country's growth can be decomposed into two components: (1) growth that would have occurred with an optimal industry structure, and (2) the impact on growth occurring from any actual deviations from that optimal industry structure. Audretsch et al. (2002) provide a mathematical derivation of their estimation equation starting from this assumption. For this derivation we refer to Appendix 1, but here we continue directly with their estimation equation:

$$\Delta GNP_{ct} = \Delta GNP_{ct-1} + \sum_{t=1}^{T} \beta_t D_t + k\Delta SFP_{ct-1} + e_{ct} \quad (1)$$

where ΔGNP_{ct} denotes the rate of economic growth in country *c* and year *t*, D_t denote dummy variables for periods *t=1, ..., T*, capturing business cycle effects and ΔSFP represents the change in small firm presence, as approximated by the difference in growth rates of SMEs and large firms in terms of real sales:

$$\Delta SFP_t = \left[\ln\left(\frac{sal_{SME}}{dfl_{SME} * PLI}\right)_t - \ln\left(\frac{sal_{SME}}{dfl_{SME} * PLI}\right)_{t-1}\right] - \left[\ln\left(\frac{sal_{large}}{dfl_{large} * PLI}\right)_t - \ln\left(\frac{sal_{large}}{dfl_{large} * PLI}\right)_{t-1}\right] \quad (2)$$

where *sal* indicates nominal sales, *dfl* indicates a size-class specific deflator, and *PLI* represents a price level index correcting for price level differences across countries. A positive value of this variable reflects a change in size-class structure towards a higher share in industry sales of SMEs and a correspondingly lower share of large firms (as SME sales grow faster than large firm sales).

In equation (1), the effect of changes in size-class structure on economic growth is reflected by k. A positive estimate for parameter k indicates that a relative shift in economic activity towards SMEs (at the expense of large firms) benefits macro-economic growth. Accordingly, a positive (negative) k implies that the share of economic activity of SMEs is below (above) optimum. A non-significant k would indicate that the share of SMEs is around the optimum, indicating that there is good balance between the core competences of large firms (such as exploitation of economies of scale) and those of smaller firms (such as flexibility and exploration of new ideas).

We extend the Audretsch et al. (2002) model in three directions, all of which make the model more flexible. First, instead of estimating the model at country level, we estimate the model at country-sector level. Second, instead of including lagged GNP growth on the right hand side, implicitly fixing its parameter to 1, we allow the impact of lagged growth to be freely estimated. Third, instead of assuming a one year lag between the change in industry structure and economic growth, we also add a contemporaneous term, allowing for the possibility that (part of) the impact is immediate. These three extensions result in the following model:

$$\Delta GNP_{cst} = \alpha\, \Delta GNP_{cst-1} + \sum_{t=1}^{T} \beta_t D_t + k_1 \Delta SFP_{cst} + k_2 \Delta SFP_{cst-1} + e_{cst} \qquad (3)$$

where indicator *s* reflects sector. The use of both a lag operator and a difference operator in equation (3) implies that two years of data are lost. Hence, although our data base covers the period 2002-2008, our estimation sample covers the period 2004-2008.

2.2 Refinement

In a second exercise we refine the model further by splitting the SME size-class in four separate size-classes: micro, small, medium-sized and large. In this second exercise we approximate the net growth of the share of micro firms as the annual percentage growth of real sales by micro firms (as a size-class) minus the annual percentage growth of real sales by all firms (i.e. the industry total):

$$\Delta SFP_{micro_t} = \left[\ln\left(\frac{sal_{micro}}{dfl_{micro} * PLI}\right)_t - \ln\left(\frac{sal_{micro}}{dfl_{micro} * PLI}\right)_{t-1}\right] - \left[\ln\left(\frac{sal_{total}}{dfl_{total} * PLI}\right)_t - \ln\left(\frac{sal_{total}}{dfl_{total} * PLI}\right)_{t-1}\right] \qquad (4)$$

We similarly define net growth of the share of small, medium-sized and large firms (i.e., real sales growth of the respective size-classes in deviation from the real sales growth for the industry total).

We then have

$$\Delta GNP_{cst} = \alpha\, \Delta GNP_{cst-1} + \sum_{t=1}^{T} \beta_t D_t + k_1 \Delta SFPmicro_{cst} + k_2 \Delta SFPsmall_{cst} + k_3 \Delta SFPmedium_{cst} + \qquad (5)$$

$$k_4 \Delta SFPlarge_{cst} + k_5 \Delta SFPmicro_{cst-1} + k_6 \Delta SFPsmall_{cst-1} + k_7 \Delta SFPmedium_{cst-1} + k_8 \Delta SFPlarge_{cst-1} + e_{cst}$$

A positive impact of a change in the share of (for instance) small firms on sector growth would imply that the share of small firms is below optimum as an increase of the share in the economy of small firms apparently stimulates macro-economic performance. Such an outcome would imply that possibly, there is not enough flexibility and exploration of innovative activities present in the economy (as these are typical qualities of small firms).

3. Database and descriptive statistics

We make use of a unique and rich database prepared in part by Panteia on behalf of the European Commission (see European Commission, 2010b). The database provides information on employment, value added, sales and other variables for all 27 countries of the European Union. The information is also disaggregated by sector and size-class[3]. This enables us to compute sales and value added growth rates by sector and size-class.

3.1 Definitions of sectors, size-classes and variables

We will make use of data for the period 2002-2008.[4] We use data for the following sectors[5] and size-classes:

Sectors[6]:

- Manufacturing (sector D)
- Construction (F)
- Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods (G)
- Hotels and restaurants (H)
- Transport, storage and communication (I)
- Non-financial private sector: the aggregate of these sectors

Size-classes:

- Micro: 1-9 occupied persons
- Small: 10-49 occupied persons
- Medium-sized: 50-249 occupied persons
- SMEs: 1-249 occupied persons (aggregate of micro, small and medium-sized)
- Large: 250 or more occupied persons
- Total: the aggregate of these size-classes

We use the following operationalisations for the model variables introduced in section 2.1 (see equations 1 and 2). All variables are available at the sector and size-class level defined above. The main data

[3] The data for a more recent version of the data base are publicly available from the following link: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/index_en.htm (under 'Database for the Annual report'). However, crucially, for these more recent data it is not possible to construct deflator series at the level of sector times size-class, which hampers correct approximation of changes in size-class structure.

[4] For more recent years the data required to construct deflator series at the level of sector times size-class are not available.

[5] In the other parts of economy (e.g., mining; electricity), interplay between small and large firms is less likely to occur.

[6] Sector classification is based on Nace Revision 1.1.

source of the variables is the above-mentioned data base which was prepared for the Annual Report on SMEs in the EU (see European Commission, 2010b).

ΔGNP: growth of real gross national product (also available by sector)

Sal: real sales, in Euros

dfl: deflator

PLI: price level index (purchasing power parities)

In our empirical application we correct nominal sales (*Sal*) for inflation and country differences in purchasing power. Data on purchasing power parities (with EU-27=100) are taken from Eurostat for the year 2005 (the middle year of our estimation sample). Deflator series by sector and size-class are constructed using data of additional variables from the Annual Report database, as well as price indices data from Eurostat. For the methodology to construct these deflator series we refer to Van Stel, De Vries and De Kok (2014).

3.2 Descriptive statistics

Table 1 presents some summary statistics for the relative importance of the different size-classes in the 27-EU countries in 2005 (in terms of sales). The importance of firm-size in the economy is measured by each firm-size share: micro, small, medium, SME (as the sum of the last three), and large. The share of micro firms in the economy[7] is defined as the total volume of sales by micro firms in 2005 divided by total sales in 2005 (in all size-classes). Column 1 reports the share of micro firms in total sales. The lowest value is recorded for Germany, where the share of micro firms accounts only for 9.1% of total sales, while in Greece around 40% of the overall sales is accounted for by micro firms. The average sales share accounted for by micro firms in that year is 19.5%. Column 2 reports the sales share of small firms in the industry. Here, the numbers indicate that the lowest and the highest value are recorded for two neighbour countries, Finland and Estonia, with 14.8% and 30% respectively. However not for medium-sized firms as column 3 shows. Around 16% of overall industry is accounted for by medium-sized firms in Malta, while more than 30% is accounted for by medium-sized firms in Latvia. Column 4 reports the aggregate sales share of the micro, small and medium firms (SMEs) in overall industry. Cyprus is the country with the highest presence of SMEs, more than 85%, while Germany reports the lowest share of economic activity by Small and Medium Enterprises. Furthermore, on average for the EU-27, total sales is formed in most part by small and medium-sized firms. In this sense, the industry structure of Germany is dominated by large firms, while Cyprus, belonging to 12-EU newcomer countries, is the country with the lowest share of this firm-size class. Almost all the 27-EU countries report higher sales shares of SMEs than large firms; Finland, Germany and the United Kingdom are the exceptions to this size-class structure. This suggests that (at least some) higher developed economies are dominated by large firms. Moreover, this table represents an interesting snapshot of the industry structure in 2005 where the 27-EU economies are mostly formed by SMEs (62.8%).

[7] In this paper, 'the economy' refers to the non-financial private sector, i.e., the aggregate of sectors D, F, G, H and I, as listed in Section 3.1.

Table 1: Sales share by firm size-class for the 27 European Union countries in 2005

Country	*Share micro*	*Share small*	*Share medium*	*Share SME*	*Share large*
Austria	0.158	0.226	0.222	0.606	0.394
Belgium	0.204	0.218	0.194	0.616	0.384
Bulgaria	0.221	0.242	0.235	0.698	0.302
Cyprus	0.309	0.276	0.271	0.855	0.145
Czech Republic	0.167	0.185	0.250	0.603	0.397
Denmark	0.180	0.243	0.219	0.641	0.359
Estonia	0.238	0.301	0.282	0.821	0.179
Finland	0.136	0.148	0.178	0.461	0.539
France	0.168	0.202	0.174	0.545	0.455
Germany	0.091	0.158	0.196	0.445	0.555
Greece	0.405	0.200	0.175	0.780	0.220
Hungary	0.184	0.197	0.188	0.569	0.431
Ireland	0.108	0.171	0.256	0.535	0.465
Italy	0.275	0.247	0.197	0.720	0.280
Latvia	0.204	0.282	0.311	0.796	0.204
Lithuania	0.111	0.245	0.266	0.622	0.378
Luxembourg	0.162	0.205	0.187	0.554	0.446
Malta	0.327	0.229	0.161	0.718	0.282
Netherlands	0.145	0.216	0.249	0.610	0.390
Poland	0.239	0.150	0.232	0.621	0.379
Portugal	0.250	0.236	0.232	0.717	0.283
Romania	0.162	0.223	0.231	0.616	0.384
Slovakia	0.131	0.173	0.217	0.522	0.478
Slovenia	0.182	0.190	0.235	0.607	0.393
Spain	0.227	0.247	0.200	0.674	0.326
Sweden	0.161	0.181	0.190	0.533	0.467
United Kingdom	0.124	0.167	0.184	0.475	0.525
Average	0.195	0.213	0.220	0.628	0.372

Source: Self-device from Panteia/EIM database (Database for the Annual Report). See European Commission (2010b).

Correlation matrixes between the dependent and independent variables used in the different models can be found in Appendix 4.

4. Results

In order to analyze whether changes in size-class structure affect macroeconomic performance of industries, we estimate equations (3) and (5) using a pooled data set for five broad sectors of economic activity for the EU-27 countries for the period 2004-2008. However, as the importance of small versus large firms for an economy depends on the stage of economic development (Thurik et al., 2013), we also estimate our equations separately for countries with relatively lower and higher levels of economic development (within a EU context).[8]

As the presence of outliers may distort our empirical strategy, the analysis is performed using Ordinary Least Squares robust regression method which performs an initial screening based on Cook's distance > 1 to eliminate gross outliers before calculating starting values and then performs Huber iterations (Huber, 1964) followed by biweight iterations, as suggested by Li (1985). For a detailed description of the method see Hamilton (1991, 1992).[9]

Estimation results for the 27-EU countries over the period 2002-2008 for the five broad sectors of economic activity are presented in Table 2.[10] Our first specification includes the general variable indicating the net growth of the share of Small and Medium-sized Enterprises approximated by the annual percentage growth of real sales by SMEs minus the annual percentage growth of real sales by large firms (see equation (2)). Both lagged and unlagged terms are included (see equation (3)). Our second specification then adds the net growth rates of the shares of micro, small, medium and large firms (see equation (4)) and also the lagged versions of these variables. The variables included in the second specification allow deeper examination of the effect of changes in size-class structure on macro-economic performance (see equation (5)). Our findings are as follows. For the general sample, i.e., when combining all EU countries in one pooled sample, we find a positive and statistically significant effect (at the 10% significance level) for our first indicator of changes in size-class structure on sector growth. Hence, recent increases in the share of real sales by SMEs relative to large firms has a significantly positive influence on sector growth. However, we find a negative and statistically significant effect (at the 1% significance level) for the lag of our first indicator of changes in size-class structure on sector growth. This last effect is slightly bigger.

[8] Classifications by economic development level are in Appendix 2. For the 'lower' developed countries estimation sample we use the 'relatively lower developed countries' and 'medium developed countries' from Table A1. For the 'higher' developed countries estimation sample we use the 'relatively higher developed countries' and 'medium developed countries' from Table A1. As there is no obvious reason to (exclusively) include the medium developed countries with either the lower developed country sample or the higher developed country sample, we include this middle group in both estimation samples.
[9] Standard errors are calculated using the pseudovalues approach described in Street *et al.* (1988).
[10] Estimation results for each separate sector are available from the authors upon request.

Table 2: Regression results for equations (3) and (5): Relating growth to industry structure[1,2,3]

	Lower developed		*Higher developed*		*General*	
	ΔGNP_{cp}	ΔGNP_{cp}	ΔGNP_{cp}	ΔGNP_{cp}	ΔGNP_{cp}	ΔGNP_{cp}
ΔGNP_{cp-1}	0.250***	0.254***	0.233***	0.236***	0.305***	0.297***
	(0.044)	(0.048)	(0.036)	(0.037)	(0.028)	(0.029)
ΔSFP	0.025		0.035**		0.031*	
	(0.026)		(0.017)		(0.017)	
ΔSFP_{cp-1}	-0.046*		-0.037**		-0.051***	
	(0.024)		(0.015)		(0.015)	
ΔSFP_{micro}		-0.061*		0.019**		0.011
		(0.035)		(0.009)		(0.011)
ΔSFP_{small}		-0.045		0.005		-0.015
		(0.061)		(0.042)		(0.038)
ΔSFP_{medium}		0.034		0.094***		0.099***
		(0.052)		(0.027)		(0.028)
ΔSFP_{large}		-0.109***		-0.054**		-0.059**
		(0.039)		(0.025)		(0.025)
$\Delta SFP_{micro_{cp-1}}$		-0.091***		-0.013		-0.017
		(0.030)		(0.009)		(0.011)
$\Delta SFP_{small_{cp-1}}$		0.017		-0.039		0.005
		(0.029)		(0.031)		(0.019)
$\Delta SFP_{medium_{cp-1}}$		-0.086*		0.084***		0.018
		(0.050)		(0.025)		(0.026)
$\Delta SFP_{large_{cp-1}}$		0.002		0.051**		0.048**
		(0.035)		(0.023)		(0.022)
Constant	0.056***	0.057***	0.025***	0.025***	0.039***	0.039***
	(0.010)	(0.010)	(0.005)	(0.005)	(0.005)	(0.005)
R-squared	0.197	0.240	0.168	0.233	0.251	0.266
Sample size	280	280	336	336	521	521

Notes: [1] Regression for 27 European countries over the period 2002-2008. [2] All specifications include Year dummies. [3] Standard errors in parentheses. ***Significant at 1%, ** Significant at 5%, * Significant at 10%.

Looking at the second specification, we find that recent increases in the share of real sales by medium-sized firms has a significantly positive influence (at the 1% significance level) on sector growth (i.e., growth of value added at the sector level), whereas the lagged impact of medium-sized firms is non-significant. Hence, combining the lagged and unlagged effects, the net-effect of increases of the share of medium-sized firms on sector growth is positive. This may be because medium-sized firms combine a certain level of scale with a certain level of flexibility, allowing them to be very competitive (Van Stel, De Vries and De Kok, 2014). As regards large firms, we find a negative unlagged effect and a positive lagged effect which more or less cancel each other out. Results for micro and small firms are not significant. Overall, these results suggest that on average, EU-countries do not have enough economic activity by medium-sized firms.

By and large, results for the higher developed countries are in line with these findings. We find a positive and statistically significant effect (at the 5% significance level) of recent increases in the share of real sales by SMEs on sector growth. And a negative and statistically significant effect (at the 5% significance level) of lagged increases in the share of SMEs on economic growth. Looking at results per size-class, we again find a positive influence of medium-sized firms, and for large firms a net-effect over time of approximately zero. We also find a small positive impact for micro firms.

When estimating for lower developed countries within the European Union, we find that increases in the share of real sales by large-sized firms has a significantly negative effect (at the 1% significance levels) on sector growth. We also find negative effects for micro firms and medium-sized firms, albeit for the latter only at the 10% significance level. This pattern might indicate that in (former) transition countries, there is still a category of larger firms not operating efficiently. On the other side of the spectrum, there seem to be many micro firms which may also not be as productive as would be desirable. Possibly, entrepreneurs in some of these firms could be more productive as an employee in a somewhat bigger firm (e.g. in the small-scaled size-class).

We conclude, based on the empirical findings, that on average for the (particularly higher income) EU-countries, medium-sized firm presence is below optimum during the period 2002-2008. One has to be careful interpreting the estimation results for different countries. The estimated positive sign found for medium-sized firms must be seen as an average value. So, there may be countries in the sample where the share of medium-sized firms (such as Ireland) is relatively high and consequently, medium-sized firm share might exceed optimum, despite the positive regression coefficient. On the other hand, for countries with low share (such as France), medium-sized firm presence may be expected to be below the optimum, given the positive coefficient.

4.1. Robustness test

Since we include not only lags of our independent variables but also contemporaneous variables, it is conceivable that there is reversed causality, i.e. that high GNP growth may benefit small firms more than large firms (or vice versa). To correct for this possibility, we estimate a version of the model where the variables reflecting the change in size-class structure are ‘cleared’ for business cycle (reversed causality) effects. We apply the following procedure, similar to Audretsch et al. (2002, footnote 12).

We first estimate the following equation using the same sample as in equation (3) but with one extra year (period 2003-2008):

$$\Delta SFP_{cst} = \pi + \mu \Delta GNP_{cst} + \varepsilon_{cst} \qquad (6)$$

The estimated residual of this equation, $\hat{\varepsilon}_{cst}$, can be seen as the variable ΔSFP_{cst}, corrected for business cycle effects.

Related to equation (5), we similarly estimate the net growth of the share of micro, small, medium and large firms:

$$\Delta SFP_{micro_{cst}} = \pi + \mu \Delta GNP_{cst} + \varepsilon_{cst} \quad (7)$$

$$\Delta SFP_{small_{cst}} = \pi + \mu \Delta GNP_{cst} + \varepsilon_{cst} \quad (8)$$

$$\Delta SFP_{medium_{cst}} = \pi + \mu \Delta GNP_{cst} + \varepsilon_{cst} \quad (9)$$

$$\Delta SFP_{large_{cst}} = \pi + \mu \Delta GNP_{cst} + \varepsilon_{cst} \quad (10)$$

where the estimated residuals of these equations, $\hat{\varepsilon}_{micro_{cst}}$, $\hat{\varepsilon}_{small_{cst}}$, $\hat{\varepsilon}_{medium_{cst}}$ and $\hat{\varepsilon}_{large_{cst}}$, are the variables $\Delta SFP_{micro_{cst}}$, $\Delta SFP_{small_{cst}}$, $\Delta SFP_{medium_{cst}}$ and $\Delta SFP_{large_{cst}}$ respectively, corrected for business cycle effects.

Second, we estimate equations (3) and (5), with ΔSFP_{cst}, $\Delta SFP_{micro_{cst}}$, $\Delta SFP_{small_{cst}}$, $\Delta SFP_{medium_{cst}}$ and $\Delta SFP_{large_{cst}}$ replaced by $\hat{\varepsilon}_{cst}$, $\hat{\varepsilon}_{micro_{cst}}$, $\hat{\varepsilon}_{small_{cst}}$, $\hat{\varepsilon}_{medium_{cst}}$ and $\hat{\varepsilon}_{large_{cst}}$, respectively, for the period 2004-2008. These ΔSFP variables are then "cleared" for possible reversed causality effects.

Results are reported in Appendix 3. After correcting for reversed causality, the results remain similar to those in Table 2. Hence, we conclude that omission of the option of reversed causality hardly influences the size and sign of the effects as represented in Table 2. Nevertheless, one notable difference is that in Table A2, the effect for small firms for higher income countries is negative. As the effect for medium-sized firms is positive, this suggests that sector growth could be enhanced if more small firms would grow further to become a medium-sized firm.

5. Conclusions

It is deeply embedded in the current European policy approach that the creativity and independence of the self-employed contribute to higher levels of economic activity (Carree *et al.*, 2002). Moreover, as Audretsch *et al.* (2002) pointed out, an extensive literature has linked the structure of industries to performance. However, little is known about whether changes in size-class structure affect macro-economic performance of industries and countries in the European Union (EU-27).

Our empirical analysis shows that there may be too much economic activity by micro and large firms, particularly for the relatively lower developed countries, including the EU-12 newcomer countries. On the other hand, we also find that there is not enough economic activity by medium-sized firms for member countries of the European Union in the period 2002 to 2008.

An explanation for the important role of medium-sized firms for macro-economic growth as implied by our analysis, may be that medium-sized firms are flexible enough to adjust fast to changing economic circumstances while at the same time they have a large enough scale to compete with large firms, thereby also challenging the latter to perform better. Our results suggest that the transformation from a 'managed' (where large firms are relatively more important) to an 'entrepreneurial' economy (where SMEs are relatively more important) has not been completed yet in all EU-countries, at least not in 2008, i.e., just prior to the current economic crisis. This imbalance may have consequences for economic growth.

Future research may focus on estimating the model at more detailed levels of sectoral aggregation, and on extending the model with a distinction between different types of economic activity within a sector, e.g. R&D versus production.

References

Acs, Z.J. and D.B Audretsch (eds.) (1993), *Small Firms and Entrepreneurship; an East-West Perspective*, Cambridge, UK: Cambridge University Press.

Audretsch, D.B. (1995), *Innovation and Industry Evolution*, Cambridge, MA: MIT Press.

Audretsch, D.B., M.A. Carree, A.J. van Stel and A.R. Thurik (2002), Impeded Industrial Restructuring: The Growth Penalty, *Kyklos* 55(1), 81-98.

Audretsch, D.B. and M. Keilbach (2004), Entrepreneurship Capital and Economic Performance, *Regional Studies* 38(8), 949-959.

Audretsch D.B. and A.R. Thurik (2000), Capitalism and Democracy in the 21st Century: from the Managed to the Entrepreneurial Economy, *Journal of Evolutionary Economics* 10, 17-34.

Audretsch D.B. and A.R. Thurik (2001), What is New about the New Economy: Sources of Growth in the Managed and Entrepreneurial Economies, *Industrial and Corporate Change* 10, 267-315.

Blanchflower, D.G. (2004), Self-employment: more may not be better, *Swedish Economic Policy Review* 11(2), 15-74.

Brock, W.A. and D.S. Evans (1989), Small Business Economics, *Small Business Economics* 1, 7-20.

Carree, M.A., A.J. van Stel, A.R. Thurik and S. Wennekers (2002), Economic Development and Business Ownership: An Analysis Using Data of 23 OECD Countries in the Period 1976-1996, *Small Business Economics*, 19, 271-290.

Carree, M.A., A.J. van Stel, A.R. Thurik and S. Wennekers (2007), The Relationship Between Economic Development and Business Ownership Revisited, *Entrepreneurship and Regional Development* 19(3), 281-291.

Carree, M.A. and A.R. Thurik (2010), The Impact of Entrepreneurship on Economic Growth, in: D.B. Audretsch and Z.J. Acs (eds.), *Handbook of Entrepreneurship Research*, Berlin/Heidelberg: Springer Verlag, 557-594.

Caves, R.E. (1998), Industrial Organization and New Findings on the Turnover and Mobility of Firms, *Journal of Economic Literature* 36, 1947-1982.

European Commission (2009), *European Competitiveness Report 2008*, Brussels: European Commission.

European Commission (2010a), “Europe 2020. A strategy for smart, sustainable and inclusive growth”, Brussels, European Commission.

European Commission (2010b), “European SMEs under Pressure: Annual Report on EU Small and Medium-sized Enterprises 2009”, European Commission, Directorate-General for Enterprise and Industry, Report prepared by EIM Business & Policy Research.

Geroski, P.A. (1995), What Do We Know about Entry?, *International Journal of Industrial Organization* 13, 421-441.

Hamilton, L.C. (1991), srd1: How robust is robust regression? Stata Technical Bulletin (2), 21-26. Reprinted in Stata Technical Bulletin Reprints (1), 169-175. College Station, TX: Stata Press.

Hamilton, L.C. (1992), *Regression with Graphics: A Second Course in Applied Statistics*. Belmont, CA: Duxbury.

Huber, P.J. (1964), Robust estimation of a location parameter, *Annals of Mathematical Statistics* 35, 73-101.

Johnson, P. (2005), Targeting Firm Births and Economic Regeneration in a Lagging Region, *Small Business Economics*, 24, 451-464.

Li, G. (1985), Robust regression, In: D.C. Hoaglin, F. Mosteller, and J.W. Tukey (eds.), *Exploring Data Tables, Trends, and Shapes*. New York: Wiley, 281-343.

Parker, S.C. (2007), Policymakers beware!, In: D.B. Audretsch, I. Grilo and A.R. Thurik (eds.), *Handbook of Research on Entrepreneurship Policy*, Cheltenham UK: Edward Elgar Publishing, 54-63.

Schumpeter, J. (1934), *The Theory of Economic Development*, Cambridge, MA: Harvard University Press.

Shane, S. (2009), Why encouraging more people to become entrepreneurs is bad public policy, *Small Business Economics* 33, 141-149.

Storey, D.J. (2003), Entrepreneurship, Small and Medium Sized Enterprises and Public Policies, In: Z.J. Acs and D.B. Audretsch (eds.), *Handbook of Entrepreneurship Research*, Kluwer Academic Publishers, Boston/Dordrecht, USA/NL, 473-514.

Street, J.O., R.J. Carroll, and D. Ruppert (1988), A note on computing robust regression estimates via iteratively reweighted least squares, *American Statistician*, 42 (2), 152-154.

Thurik, A.R., D.B. Audretsch and E. Stam, (2013), The rise of the entrepreneurial economy and the future of dynamic capitalism, *Technovation*, 33(8-9), 302-310.

Van Praag, C.M. and A.J. van Stel (2013), The more business owners, the merrier? The role of tertiary education, *Small Business Economics*, 41(2), 335-357.

Van Stel, A.J. (2006), *Empirical Analysis of Entrepreneurship and Economic Growth* (International Studies in Entrepreneurship series, Vol. 13), New York: Springer Science.

Van Stel, A.J., and K. Suddle (2008). The Impact of New Firm Formation on Regional Development in the Netherlands, *Small Business Economics* 30(1), 31-47.

Van Stel, A.J., N.E. de Vries and J.M.P. de Kok (2014), The Effect of SME Productivity Increases on Large Firm Productivity in the EU-27, Paper presented at Third GCW ('Governance of a Complex World') Conference, Campus Luigi Einaudi, Turin, Italy, 18-20 June 2014.

Appendix 1: The Audretsch et al. (2002) model

In this appendix we show the derivation of the Audretsch et al. (2002) model. The derivation is taken directly from their article (Audretsch et al. 2002, pp. 88-90):

"We test the hypothesis that the extent of the gap between the actual industry structure and the optimal industry structure influences subsequent growth. We start with the assumption that a country's growth can be decomposed into two components: (i) growth that would have occurred with an optimal industry structure, and (ii) the impact on growth occurring from any actual deviations from that optimal industry structure. This can be represented by

(A1) $$\Delta GNP_{cp} = \Delta GNP^{*}_{cp} - \gamma \left| SFP_{cp-1} - SFP^{*}_{c} \right|,$$

where the dependent variable is the actual rate of economic growth. ΔGNP^{*}_{cp} is the rate of economic growth in country *c* in the case where the actual industry structure, summarized by small firm presence (SFP_{cp}), is at the optimal level at the start of the period *p*. For ease of exposition we assume that the optimal industry structure in a country remains constant for the total period under investigation. This is not vital to our analysis. Since we are considering only short-term periods, this may be a reasonable assumption.

Industry structure is multidimensional and spans a broad array of characteristics that defy measurement by a single statistic. However, as explained elsewhere (Audretsch and Thurik, 2000 and 2001), the most salient characteristic driving the shift in industry structure from the managed to the entrepreneurial economy is that the relative role of small and entrepreneurial firms has increased. Thus, we capture changes in industry structures by changes in the relative importance of small firms.

In equation (1) the parameter γ is positive. Deviations of the actual industry structure from the optimal industry structure negatively affect economic growth, both when the industry structure consists of too few or too many small firms. In either case there is a deviation from the optimal industry structure and number of small firms. Taking the first difference of equation (1) we obtain

(A2) $$\Delta GNP_{cp} = \Delta GNP_{cp-1} + \Delta\Delta GNP^{*}_{cp} - \gamma \left(\left| SFP_{cp-1} - SFP^{*}_{c} \right| - \left| SFP_{cp-2} - SFP^{*}_{c} \right| \right).$$

In case both SFP_{cp-1} and SFP_{cp-2} are above the optimal small-firm share, the expression between brackets reduces to ΔSFP_{cp-1}. Indeed, in case the small-firm share is too high, adding small firms to the industry structure reduces economic growth. In case both SFP_{cp-1} and SFP_{cp-2} are below the optimal small-firm share, the expression between brackets reduces to $-\Delta SFP_{cp-1}$. An increase in the small firm share when this presence is below optimal enhances economic performance. Therefore, the sign of the parameter of ΔSFP_{cp-1} reflects whether the small firm presence is below or above the optimal levels for the countries under consideration. In case the parameter is negative, the industry structure consists of too many small firms. In case the parameter is positive, the reverse holds and the industry structure consists of too few small firms.

We will denote the parameter of ΔSFP_{cp-1} as κ. Note that this is not the same parameter as γ, since the sign of κ is dependent on whether the actual small-firm share is above or below the optimal one. So, κ can be both positive and negative whereas γ is necessarily positive.

We make some further assumptions to transform equation (2) into an equation that can be estimated using the data at hand. First, we approximate ΔSFP_{cp-1} by $\Delta SF_{cp-1} - \Delta LF_{cp-1}$, the difference between the growth of small firms and large firms in terms of value-of-shipments. Second, we assume that ΔGNP^{*}_{cp} is idiosyncratic with respect to time and country. Therefore country dummies and time dummies (the last to correct for European wide business cycle effects) are included. Thus, $\Delta\Delta GNP^{*}_{cp}$ is approximated by time dummies only because the country dummies drop out when taking first differences. Third, we add an error term e_{cp}. Summarizing we have

(A3) $$\Delta GNP_{cp} = \Delta GNP_{cp-1} + \sum_{p=1}^{P} \beta_p D_p + \kappa(\Delta SF_{cp-1} - \Delta LF_{cp-1}) + e_{cp},$$

where D_p denote dummy variables for periods $p = 1,...,P$. Factors specific to each time period are reflected by β_p. A high value of this parameter indicates an unexplained increase in the extent of economic growth. In case of a low β_p the reverse holds. The contribution of the shift in the size class distribution of firms to the percentage growth of GNP is represented by κ."

Note that in the present paper we also have data at sector level. Accordingly, we assume that ΔGNP^{*}_{cp} is idiosyncratic with respect to time, country *and* sector. However, similar to the country dummies, sectoral dummies drop out when taking first differences of equation (1), hence $\Delta\Delta GNP^{*}_{cp}$ is approximated by time dummies only.

Appendix 2: Classification by economic development level

In this appendix we provide a classification of countries based on their GNI per capita in 2005.

Table A1: EU-27 countries, by economic development level, 2005

Relatively lower developed countries	*Gross national income (GNI) per capita in purchasing power parities (current international $), 2005*
Romania	9280
Bulgaria	9840
Latvia	12880
Poland	13470
Lithuania	14050
Slovak Republic	15720
Estonia	15920
Hungary	16060
Medium developed countries	*GNI per capita*
Malta	20070
Czech Republic	20370
Portugal	21050
Slovenia	23280
Cyprus	23400
Greece	23990
Relatively higher developed countries	*GNI per capita*
Spain	27000
Italy	28290
France	29910
Finland	30850

Relatively higher developed countries	*Gross national income (GNI) per capita in purchasing power parities (current international $), 2005*
Germany	31470
Belgium	32400
Sweden	32940
Austria	33300
Ireland	33450
United Kingdom	33490
Denmark	33660
Netherlands	35270
Luxembourg	58640

Source: World Bank, World Development Indicators

Appendix 3: Robustness test: correcting for (the possibility of) reversed causality

This appendix presents the results of the robustness test described in Section 4.1. Independent variables are cleared from (contemporaneous) business cycle influences.

Table A2: Regression results equations (3) and (5), correcting for reversed causality[1,2,3]

	Lower developed		*Higher developed*		*General*	
	ΔGNP_{cp}	ΔGNP_{cp}	ΔGNP_{cp}	ΔGNP_{cp}	ΔGNP_{cp}	ΔGNP_{cp}
ΔGNP_{cp-1}	0.285***	0.275***	0.217***	0.214***	0.311***	0.327***
	(0.049)	(0.049)	(0.043)	(0.043)	(0.029)	(0.032)
ΔSFP	0.046*		0.048**		0.047***	
	(0.026)		(0.019)		(0.017)	
ΔSFP_{cp-1}	-0.044*		-0.040**		-0.049***	
	(0.025)		(0.017)		(0.016)	
ΔSFP_{micro}		-0.061*		0.020**		0.010
		(0.035)		(0.009)		(0.012)
ΔSFP_{small}		0.010		0.027		0.007
		(0.061)		(0.044)		(0.039)
ΔSFP_{medium}		-0.005		0.087***		0.068**
		(0.052)		(0.030)		(0.029)
ΔSFP_{large}		-0.106***		-0.068**		-0.071***
		(0.039)		(0.028)		(0.025)
$\Delta SFP_{micro\,cp-1}$		-0.096***		-0.016*		-0.019*
		(0.031)		(0.009)		(0.011)
$\Delta SFP_{small\,cp-1}$		-0.005		-0.080**		-0.028
		(0.055)		(0.038)		(0.035)
$\Delta SFP_{medium\,cp-1}$		-0.090*		0.094***		0.020
		(0.050)		(0.025)		(0.026)
$\Delta SFP_{large\,cp-1}$		0.001		0.051*		0.039
		(0.038)		(0.026)		(0.024)
Constant	0.055***	0.059***	0.024***	0.024***	0.038***	0.039***
	(0.010)	(0.010)	(0.005)	(0.005)	(0.005)	(0.005)
R-squared	0.203	0.243	0.152	0.212	0.254	0.262
Sample size	279	279	332	332	520	518

Notes: [1] Regression for 27 European countries over the period 2002-2008. [2] All specifications include Year dummies. [3] Standard errors in parentheses. ***Significant at 1% , ** Significant at 5%, * Significant at 10%.

Appendix 4: Correlation matrixes by economic development level

In this appendix we provide the correlation matrixes by level of economic development. The strong significant and negative correlation between the net growth of the share of large firms and the net growth of the share of SMEs is due to the definitions of the variables (see Section 2.1). Notice, however, that we include the net growth of the share of Small and Medium-sized Enterprises approximated by the annual percentage growth of real sales by SMEs minus the annual percentage growth of real sales by large firms and the net growth rates of the shares of micro, small, medium and large firms in two different specifications.

Table A3: Correlation matrix for lower developed countries.

	ΔGNP_{cp}	ΔGNP_{cp-1}	ΔSFP	ΔSFP_{cp-1}	$\Delta SFP_{micro_{cp-1}}$	$\Delta SFP_{small_{cp-1}}$
ΔGNP_{cp}	1					
ΔGNP_{cp-1}	0.3125*	1				
ΔSFP	-0.0338	-0.0608	1			
ΔSFP_{cp-1}	-0.0103	0.0748	-0.0848	1		
$\Delta SFP_{micro_{cp-1}}$	-0.0644	-0.0337	-0.0413	0.5218*	1	
$\Delta SFP_{small_{cp-1}}$	-0.0708	-0.3773*	-0.0722	-0.0488	-0.1020	1
$\Delta SFP_{medium_{cp-1}}$	-0.0797	0.0393	0.0142	-0.2886*	-0.5669*	0.1756*
$\Delta SFP_{large_{cp-1}}$	-0.0048	-0.0545	0.0960	-0.9820*	-0.4577*	0.0139
ΔSFP_{micro}	-0.0163	0.0170	0.5617*	-0.0227	-0.0763	-0.0434
ΔSFP_{small}	-0.0782	-0.0845	0.2616*	0.1256*	0.0808	-0.1079
ΔSFP_{medium}	0.1099	0.0157	-0.2834*	-0.0348	0.0400	0.0510
ΔSFP_{large}	0.0365	0.0705	-0.9841*	0.0927	0.0416	0.0624

Source: Self-device from Panteia/EIM database (Database for the Annual Report). See European Commission (2010b).
Note: * Significant at 5%

	$\Delta SFP_{medium_{cp-1}}$	$\Delta SFP_{large_{cp-1}}$	ΔSFP_{micro}	ΔSFP_{small}	ΔSFP_{medium}	ΔSFP_{large}
$\Delta SFP_{medium_{cp-1}}$	1					
$\Delta SFP_{large_{cp-1}}$	0.3212*	1				
ΔSFP_{micro}	0.0467	0.0269	1			
ΔSFP_{small}	-0.0550	-0.1244*	-0.1225*	1		
ΔSFP_{medium}	-0.0950	0.0317	-0.5915*	0.1217*	1	
ΔSFP_{large}	-0.0126	-0.1036	-0.4980*	-0.2365*	0.3239*	1

Table A4: Correlation matrix for higher developed countries.

	ΔGNP_{cp}	ΔGNP_{cp-1}	ΔSFP	ΔSFP_{cp-1}	$\Delta SFP_{micro_{cp-1}}$	$\Delta SFP_{small_{cp-1}}$
ΔGNP_{cp}	1					
ΔGNP_{cp-1}	-0.1517*	1				
ΔSFP	0.1221*	-0.4419*	1			
ΔSFP_{cp-1}	-0.0027	0.1396*	-0.1637*	1		
$\Delta SFP_{micro_{cp-1}}$	-0.0577	-0.0046	0.0506	0.4096*	1	
$\Delta SFP_{small_{cp-1}}$	-0.0089	0.2636*	-0.2177*	0.3800*	-0.2428*	1
$\Delta SFP_{medium_{cp-1}}$	0.1119*	0.1234*	-0.1265*	0.1984*	-0.2017*	0.4561*
$\Delta SFP_{large_{cp-1}}$	0.0022	-0.0844	0.1354*	-0.9057*	-0.1814*	-0.2379*
ΔSFP_{micro}	-0.0040	-0.1080*	0.4039*	-0.0170	0.0173	-0.0914
ΔSFP_{small}	0.2736*	-0.4572*	0.3999*	0.0005	0.1626*	-0.1735*
ΔSFP_{medium}	0.1130*	-0.2592*	0.2053*	-0.1333*	0.2092*	-0.3034*
ΔSFP_{large}	-0.0587	0.3200*	-0.9025*	0.1613*	0.0445	0.0730

Source: Self-device from Panteia/EIM database (Database for the Annual Report). See European Commission (2010b).
Note: * Significant at 5%

	$\Delta SFP_{medium_{cp-1}}$	$\Delta SFP_{large_{cp-1}}$	ΔSFP_{micro}	ΔSFP_{small}	ΔSFP_{medium}	ΔSFP_{large}
$\Delta SFP_{medium_{cp-1}}$	1					
$\Delta SFP_{large_{cp-1}}$	-0.0158	1				
ΔSFP_{micro}	-0.1022	-0.0081	1			
ΔSFP_{small}	-0.0193	-0.0198	-0.2465*	1		
ΔSFP_{medium}	-0.2579*	0.0998	-0.2014*	0.5119*	1	
ΔSFP_{large}	0.0496	-0.1580*	-0.1716*	-0.2493*	-0.0085	1

Table A5: Correlation matrix for the general sample.

	ΔGNP_{cp}	ΔGNP_{cp-1}	ΔSFP	ΔSFP_{cp-1}	$\Delta SFP_{micro_{cp-1}}$	$\Delta SFP_{small_{cp-1}}$
ΔGNP_{cp}	1					
ΔGNP_{cp-1}	0.1643*	1				
ΔSFP	0.0563	-0.2292*	1			
ΔSFP_{cp-1}	0.0075	0.1286*	-0.0962*	1		
$\Delta SFP_{micro_{cp-1}}$	-0.0442	-0.0060	0.0268	0.4273*	1	
$\Delta SFP_{small_{cp-1}}$	-0.0433	-0.1642*	-0.1371*	0.0887*	-0.1477*	1
$\Delta SFP_{medium_{cp-1}}$	0.0463	0.0576	-0.0650	-0.0078	-0.3223*	0.2722*
$\Delta SFP_{large_{cp-1}}$	-0.0047	-0.0830	0.0796	-0.9383*	-0.2639*	-0.0548
ΔSFP_{micro}	-0.0018	-0.0565	0.4376*	-0.0058	-0.0062	-0.0582
ΔSFP_{small}	0.1423*	-0.2362*	0.3575*	0.0581	0.1413*	-0.1428*
ΔSFP_{medium}	0.0887*	-0.1089*	0.0001	-0.0928*	0.1630*	-0.0852
ΔSFP_{large}	-0.0138	0.1613*	-0.9345*	0.0928*	0.0356	0.0781

Source: Self-device from Panteia/EIM database (Database for the Annual Report). See European Commission (2010b).
Note: * Significant at 5%

	$\Delta SFP_{medium_{cp-1}}$	$\Delta SFP_{large_{cp-1}}$	ΔSFP_{micro}	ΔSFP_{small}	ΔSFP_{medium}	ΔSFP_{large}
$\Delta SFP_{medium_{cp-1}}$	1					
$\Delta SFP_{large_{cp-1}}$	0.1400*	1				
ΔSFP_{micro}	-0.0612	-0.0102	1			
ΔSFP_{small}	-0.0094	-0.0666	-0.2128*	1		
ΔSFP_{medium}	-0.1927*	0.0692	-0.3231*	0.3476*	1	
ΔSFP_{large}	0.0162	-0.0910*	-0.2662*	-0.2566*	0.1467*	1