FIRM SIZE DISTRIBUTION AND ECONOMIC GROWTH IN THE EUROPEAN UNION

by

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Kyiv School of Economics

Abstract

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This thesis examines the effect of firm size distribution on economic growth in the European Union. Using Eurostat data on 28 countries of the EU, Switzerland and Norway, we estimated co-worker mean variable as a measure of labor concentration due to existing firm size distribution. Using fixed effect regressions, we found no statistical relationship between labor concentration and growth on the aggregate level. Although, on the industrial level we found statistically significant positive relationship between labor concentration and industrial growth in the long run. In the short-run, however result stands only for the Manufacturing industry.

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GLOSSARY

CAGR. Compound average growth rate over given period

Co-worker mean. The average number of employees in randomly picked firm.

HH. High growth and High income countries. Countries with above average CAGR and GDP per capita.

HL. High growth and Low income countries. Countries with above average CAGR and below average GDP per capita.

LH. Low growth and High income countries. Countries with below average CAGR and above average GDP per capita.

LL. Low growth and Low income countries. Countries with below average CAGR and GDP per capita.

HG. High growth countries. Countries, which are represented by HL economies and Ireland.

HI. High income countries. Countries, which are represented by LH economies and Germany and Sweden.

MT. Mediterranean countries. LL countries, with all happened to be situated on the coast of the Mediterranean Sea.

Chapter 1

INTRODUCTION

With the further economic development, countries struggle more with declining economic growth. For example, Canada and Japan reached near 1% growth rates in the 2018, the US was on a similar position as well before the Trump administration[1]. The problem of economic decline in growth rates reached the EU as well as Germany, France, the UK and Italy as the biggest economies show the average near 1% growth rates for several years[2].

The problem of the low growth rates in case of the European Union is even more challenging since economic convergence between members is a priority for the Union. The challenge lies in advantages that more developed members provide. Better life quality and more opportunities for development in the High income economies are perceived to be several of the luring factors for migration from low-income members in the short run. Hence, in the long run latter economies lose the necessary factors of production, implying lower growth in future so again the citizens still have stimuli to leave their countries. Such state encourages divergence instead and it is a potential driver for accumulation of the economic imbalances inside the EU.

But what exactly should the government deal with at the first place: entry or market concentration, trade barriers or tax burden is the problem for the policy makers. Primary focus of our research is analysis of the firm size distribution in the

[1] (World Bank n.d.)

[2] (World Bank n.d.)

economy in 2008-2016, since knowledge of what firm structure stimulates economic upturn on different stages of economic development makes it easier for government understanding of what kind of regulation should be imposed.

At the end of 20th century it was spread in academic literature that small firms were the main boosters for economic growth (Acs and Audretsch 1993, Audretsch et al. 2000, Carree, van Stel, et al. 2002) etc. But it is not clear whether the economic effect of having more small businesses dominates the economies of scale and capital accumulation of the big firms now, so their compound impact is the question for further exploration.

The literature does not provide unified point of view on the issue. According to Chandler (1990), most part of the 20th century could be described as a period of capital accumulation, when big conglomerates exploited economies of scale. But after 1970s, the share of small businesses in Western economies started to rise. Piore and Sabel (1984) assumed that the reason was that "market instability resulted in the demise of mass production and promoted flexible specialization". Brock and Evans (1989) argument this through the increase in labor supply, changes in consumer tastes, relaxation of (entry) regulations, and the fact that this is a period of creative destruction. Carree and Thurik (1998) supplemented the literature by showing that higher share of small businesses at the start of the 1990s led to higher output growth in the subsequent three-four years in European manufacturing. Carree at al. (2002) find evidence of economic losses which resulted from deviation from equilibrium rate of business ownership, which is share of companies in economy owned by founders. Audretsch et al. (2001) show that the countries which moved to the less concentration with faster pace, or which witnessed increase in small-firm share, have higher growth rates.

But some authors believed that every aspect of the distribution is important, so their focus was on the overall effect of the distribution on economic growth as Pagano and Schivardi (2003) showed that increase in the weighted average firm size in the economy lead to higher economic growth.

The most recent literature focuses its attention on "granular" or "superstar" firms. For example, di Giovanni and Levchenko (2017), Autor et al. (2019) argue that in tight competition especial due to the open trade, some starting advantages of the firm may magnify to such extent that firms become to set the direction of the industrial development and even influence on business cycles. Magnification of the advantages leads to higher innovation potential and better lobbying opportunities which help creating the barriers for new entrants.

Unfortunately, the side of theory, connected with average firm size, was not analyzed extensively and we believe that is a promising direction for the analysis, given the availability of the new data.

Thus, these economic puzzles lead us to the research questions: whether the firm size distribution in economy have a significant impact on growth in EU countries on the country and industry level.

Our hypotheses are:

- The economies with higher level of concentration grow slower as a consequence of the high level of economic development on the country level
- The economies with higher level of concentration grow faster on industrial level due to the industry-specific economies of scale. But the growth should be more observable in the long run versus the short run, since the companies need time to adjust.

To test these hypotheses, we will use a combination of techniques that are standard for the empirical growth literature. The data for the study is primarily obtained from the Eurostat, which covers dependent and control variables, and secondarily from the think tanks, such as World Bank.

The results of the research may be useful for the governments of the EU as a guide for policymaking. The findings may be also useful for the other governments of the countries with different level of economic development.

The study is organized as follows. The second section contains literature overview of economic relationships between growth and firm size distribution and other variables that may influence growth. The third section outlines the empirical methodology utilized. The fourth section presents an overview of data used in the research. The fifth section presents the empirical findings and results. Lastly, conclusions are made in the sixth section.

C h a p t e r 2

LITERATURE REVIEW

In general, relationships between economic growth and firm size distribution were broadly discussed in previous literature. Majority of papers were focused on the particular parts of the distribution, either on micro and small firms, or on large firms, whereas other managed to represent properties of the whole distribution. Also, a great deal of the literature was focused on finding the other important factors of the economics growth.

We could aggregate the relevant literature to the following groups: (i) effect of firm size distribution on economic growth, (ii) effect of other variables on economic growth.

2.1 Effect of firm size distribution on economic growth

The relationship between economic growth and industry composition was studied before. Joseph Schumpeter was one of the first to contribute to the topic. In his *Theory of Economic Development* (1934), he introduces small innovative entrepreneur as a driving force of economic development. This agent competes with incumbent enterprises by introducing new invention thus making current technologies, goods or services obsolete. This process called "creative destruction" is the main characteristics of what Nelson and Winter (1982) and Kamien and Schwartz (1982) called Schumpeter Mark I regime.

Schumpeter Mark II regime was introduced in another work *Capitalism, Socialism and Democracy* (1942). This regime is characterized by prevalence of large firms over the small firms through utilization of positive feedback from innovative R&D activities. Benefiting from economies of scale, big firms accumulate financial resources and new knowledge, which stimulate new R&D activities, creating entry barriers for new firms. This process of "creative allocation" was the essential characteristic of the first half of the 20th century, which was the time of writing the book. And the period from the Second Industrial revolution to 1970s was labeled as period of "Scale and Scope" by Chandler (1990).

But since 1970s numerous researches report that economic development in developed countries becomes more of Schumpeter Mark I type (Carree et al. 2002), as the share of small business in manufacturing in the Western countries started to rise. Acs and Audretsch (1993) showed that in the US the sales's share of firms with fewer than 100 employess increased from 15.6% in 1976 to 22.0% in 1986 and reported a decrease in the average plant size and value added. Loveman and Sengenberger (1991), after analyzing employment in the US, Japan, France, Germany, the UK and Italy in 1980s, concluded that employment inrease in the small and medium enterprises (SME) sector was neither the result of sectoral change toward the service sector, nor the effect of the business cycle. As the main reasons for such a shift they suggest the vertical disintegration and formation of small business comunities due to increased demand for more differentiated and customised goods and services.

Since then, numerous papers claimed that having more SMEs is beneficial for the economy, or that there exists some penalty for having an underrepresentation in the number of small enterprises.

Carree and Thurik (1998) contributed to the literature by analyzing the rate of the industrial transformations described before. Using a sample of 14 industries in 13 European countries and treating the share in employment of large companies (more than 500 employees) as the firm size distribution variable, they showed that higher share of small businesses at the start of the 1990s led to higher output growth in the subsequent three-four years in European manufacturing.

Audretsch et al. (2000), by utilizing sample of 23 OECD countries between 1974-1998, show that the countries which moved to the less concentration with faster pace, or which witnessed increase in small-firm share, have higher growth rates. The authors apply equilibrium time-series model in which economic growth is the function of optimal growth rate, when economy reached optimal market structure, and growth penalty, which is the difference of market structure in the previous period and optimal market structure. By utilizing the first differences approach in estimations and assuming that the differences of market structures are approximated by the differences in the growth of value-added by small companies and large firms, they arrived at the conclusion that consequences for economic growth of not shifting the industry structure away from large businesses towards smaller ones are rather serious.

Carree et al. (2002) utilized a simultaneous equations model in order to find whether there exists a long-term relationship between proportion of business owners in total labor and economic growth. Analyzing 23 OECD countries in 1976-1996 years, they found that a 5% deviation from long-run share of business-owners may lead to a 3% growth loss over the period of 4 years. Thus, they concluded that low barriers of entry and exit of business were a necessary condition for equilibrium-seeking behavior to exist. Therefore, they do not impose any conditions on shares of small, medium or large business but by construction they

require higher share of small businesses as they are the main "source" of business owners in an economy.

However, more recent developments showed the evidence of importance of large firms for economic growth generation. Lee et al. (2013) showed that the increase in the number of firms represented in Fortune 500 list by 1% led to significant increase in growth rates, which is around 3% in the sample of 38 developed and developing countries, utilizing Mankiw, Romer, Weil (1992) (MRW) type of regression. They also found evidence that big businesses have a more definite and robust effect on economic growth than SMEs by showing statistical insignificance or rather negative influence of share of employment in SMEs on economic growth. At the same time, the variable referring to the companies' sales to GDP ratio showed negative coefficient, implying that increase in the number of the large firms is beneficial until they do not eat out the share of SME sector. Thus, the articles focused on the one of the sides of the distribution.

Giovanni, Levchenko and Mejean (2017) showed that in industries with higher concentration the idiosyncratic shock to the biggest firms matters for fluctuation in the whole industries, meaning that such shocks may either positively or negatively influence the whole industries of the country, or it is ambiguous whether high concentration is desirable for economy or not.

In addition, Autor et al. (2019) developed a theoretical model of "Superstar firms", implications of which they proved empirically. Under their model, tougher competition magnifies advantages of more productive firms which become dominant "superstars" over time. Using the micro data on the US firms in different industries, they showed that concentration rose across a large set of industries but the industries that became concentrated were also relatively more productive and innovative in cost of the decrease of incomes' share attributed to labor.

Alternatively, Pagano and Schivardi (2003) chose the "co-worker mean" as the measure of firm size distribution (Davis and Henrekson 1999), which is average size of the firm by employment within a size-class weighted by the employment share of the class, using 5 size classes (0, 1-9, 10-49, 50-249, 250+). Their MRW regression analysis of 8 EU countries in 1989-1998 showed that increase in the size of co-worker mean by 1% leads to 0.5-2% economic growth. They also showed that size matter for growth through its influence on innovation. Their results are in line with more recent research of Lee et al (2013) and Autor et al. (2019).

To our opinion, the sign of the coefficient on co-worker mean will shed a light on the current state of the economy, in a sense whether economies closer to Schumpeter Mark I or II type. As the previous literature on the topic of the EU countries usually covers at most beginning of the 21st century, it would be useful to update the findings, as some features of the economies could have changed. Thus, co-worker mean as a definition of the size distribution seems the most relevant for the aims of our research, thus we will use it in our future analysis.

2.2 Effect of other variables on economic growth

Though the existing literature suggest that firm size distribution is related to economic growth, this is by far not the only important variable that affects it. In particular, a financial sector is a major source of investment activity, and Levchenko, Ranciere, Thoenig (2007) showed that there was a strong correlation between financial liberalization and increase in both growth and volatility of industrial output. They also noted that this effect vanished almost entirely in 6 year after liberalization. They also found that liberalization exerts procompetitive pressures on the product market through increase in the entry of firms and a permanent drop in the price to cost margin.

International trade is also an important source of additional demand for industry output. Therefore, omitting trade from the growth model may lead to distorted results. Piguillem and Rubini (2012) showed that countries had lower innovation costs than closed economy analysis would predict.

The regulatory environment is by all means an important factor for the growth of an economy. The most frequently applied technique for analyzing the influence of regulations on economic growth is a MRW-type of regression, in which changes in Total Factor Productivity are linked to changes in regulation environment. And since defining a regulation can be a challenging task, economic research focused on creating the indices which could represent a quality of regulation environment and calculate the impact on the economic growth.

Thus, Loayza, Oviedo and Serven (2005) used indices of labor regulations (Rama and Artecona 2002), fiscal burden, trade barriers, financial markets regulation, bankruptcy, contract enforcement (currently all Doing Business Indicators) and showed that regulation which set additional constraints for businesses tends to reduce growth – unambiguously so for product market regulation. They also find that the quality of regulation matters, as measured by their regulation indicators. Messaoud and El Ghak Teheni (2014) verified the findings on the newer dataset of 162 countries in 2007-2011 by using Total Doing Business Indicator as the independent variable of interest, using legal origin, absolute latitude, religion, language as instruments for the index.

Jalilian, Kirkpatrick and Parker (2007) extended literature by using both pooled OLS and fixed effect estimation on the first stage of MRW model in order to estimate impact of regulations, represented by Doing Business indicator as well. The result showed that improvement in the value of regulatory indices brings positive economic growth. But comparing pooled OLS and fixed effect

coefficients, they showed that fixed effect-based regression shows lower value coefficients than pooled OLS, though both had the same signs.

Haidar (2012) showed that regulatory reforms that improved the position in the Doing Business ranking bring economic growth and each additional reform during 2006–2010 is associated, on average, with a 0.15% increase in economic growth.

In order to quantify the regulations, Coffey, McLaughlin and Peretto (2016) build a theoretical model in which they used the number of restriction words ("shall," "must," "may not," "prohibited," and "required") in the legislation as the proxy for the regulation in the US. They found evidence that economic growth in the United States slowed, on average, by 0.8 percent per year since 1980 owing to the cumulative effects of regulation, implying that the core for improving regulatory environment should be a deregulation process.

Therefore, regulation is an important factor of economic development which can both promote and discourage economic growth. The created indices of regulation analysis are frequently used as a convenient tool of regulatory environment analysis. The research shows that improvement of regulatory environment including the deregulation is the important driver of economic growth.

To sum up, majority of papers were focused on the particular parts of the distribution, either on micro and small firms, or on large firms. Also, a great deal of the literature was focused on finding the other important factors of the economics growth. Our approach is based on Pagano and Schivardi (2003) as this is one of the few examples of study that captured different aspects of the whole distribution of firms in Manufacturing industries. Our contribution is in expansion of their analysis on all the EU countries. Also, we extend our analysis to other 1-digit industries. Finally, we improve their approach by adding country-specific controls for the growth analysis.

Chapter 3

METHODOLOGY

The main empirical model for our growth exercise will be MRW-type of model (Mankiw, Romer and Weil 1992), since the model is the most commonly used in relevant empirical literature.

Assume that the production function of the country is:

$$Y_{it} = A_{it}{K_{it}}^{\alpha}{L_{it}}^{\beta}, \quad (1)$$

where Y_{it} is output, A_{it} – productivity, L_{it} –labor in country i, time t.

Then in per capita terms, assuming constant returns of scale, the production function looks like

$$y_{it} = A_{it}k^{\alpha} \quad (2)$$

Assume the simple capital accumulation rule in the following specification:

$$\frac{dk}{dt} = sy - (n + \delta)k, \quad (3)$$

where, s is the savings ratio, n – population growth rate, δ – depreciation rate.

In the steady state, we need to set (3) to zero, which results in the following expression for optimal output:

$$\ln(y_{it}^{*}) = \frac{1}{1-\alpha}[\ln(A_{it}) + \alpha \ln\left(\frac{s_{it}}{n_{it} + \delta_{it}}\right)] \quad (4)$$

Let's assume that economies move toward the steady state according to MRW approximation:

$$\ln(y_{it}) - \ln(y_{i0}) = \lambda\,[\ln(y_{it}^{*}) - \ln(y_{i0})], \quad (5)$$

where $\lambda = (1 - e^{-\eta t})$, and η is a speed of convergence.

From (5) we can solve for the growth rate:

$$g_{it} = \frac{\lambda}{t}\,[\ln(y_{it}^{*}) - \ln(y_{i0})] \quad (6)$$

Replacing optimal output from (5) by its equivalent from (4), we obtain the alternative expression of growth:

$$g_{it} = \frac{\lambda}{t(1-\alpha)}\left[\ln(A_{it}) + \alpha \ln\left(\frac{s_{it}}{n_{it} + \delta_{it}}\right) - \ln y_{io}\right] \quad (7)$$

We can eliminate the time dimension by transforming expression (7) as:

$$\bar{g}_i = \frac{\lambda}{t(1-\alpha)}\left[\ln(\bar{A}_i) + \alpha \ln \bar{s}_{it} - \alpha \ln\left(\overline{n_{it} + \delta_{it}}\right) - \ln y_{io}\right] \quad (8)$$

This expression shows that growth rate of country i is determined by saving ratio, depreciation rate, rate of population increase, initial level of output and total factor productivity.

In order to understand the influence of other factors on growth, one can assume that technology is driven by other factors like firm size distribution, development of financial sector, export etc.

The difficulty with the firm size distribution variable is that it can be legitimately represented by various measures, like shares of employment, average number of workers employed, amount of assets, volume of total sales etc. In our approach, we follow Pagano and Schivardi (2003) in choosing the "co-worker mean" as a variable which represents firm size distribution, which is the average number of employees in randomly picked firm. The reason why their approach is chosen is that this variable accounts for the different aspects of the firm size distribution, which are average labor concentration in enterprise groups and the share of the employment in those groups.

The methodology of calculation is the following. Firstly, we divide the population of firms into four size categories:

- Micro firms – 0-9 employees,
- Small firms – 10-49 employees,
- Medium firms – 50-249 employees,
- Big firms – 250+ employees.

Then, we estimate the average size of firm by employment s_{ij} in country i for every size bin j as:

$$s_{ij} = \frac{L_{ij}}{N_{ij}} \tag{9}$$

Where L_{ij} is a number of employees working in country i for firms in size bin j, N_{ij} is a number of all enterprises that belong to size bin j.

Then, we estimate the probability of being in size bin j in country i, w_{ij}, as:

$$w_{ij} = \frac{L_{ij}}{L_{ij} + L_{i,-j}} = \frac{L_{ij}}{L_i} \tag{10}$$

Thus, the final expression for the co-worker mean S_i is:

$$S_i = \sum_{j=1}^{4} s_{ij} w_{ij} \tag{11}$$

This measure of the firm size distribution is constructed in such a way that economies, in which employees are distributed between firms of different sizes in the same way, get higher value when average number of employees in large firms is relatively bigger. In the same fashion, if economies have the same average firm sizes, but different allocation of employees among enterprises of different sizes, co-worker mean is higher for countries with greater share of employees, which work for large companies. In other words, our measure is not strongly influenced by changes on the level of micro and small firms but influenced when there are some shifts of employment shares from medium and big firms toward small and micro ones.

Alternatively, assume that some medium companies increase their number of employees in such a way that in the next period they are classified as large. Then, if other companies kept status quo, we have four effects on the co-worker mean:

- share of labor employed in medium firms decreases
- share of labor employed in large firms increases
- average firm size in medium firms rather decreases, since those companies probably had some of the highest sizes

- average firm size in large firms rather decreases as well, since those companies probably have not grown to the average bin size yet, and the average firm size among big firms is considerably higher than the border value of 250 employees.

The overall effect of such change depends on all these four smaller effects but is expected to be positive since an increase in the share of labor employed in large firms multiplied by average firm size in large firms is usually bigger than other effects. This conclusion can also be derived in a more formal way.

Assume that changes in a co-worker mean are due to changes only in two size bins: j and $-j$. The changes in co-worker means, ΔS_{ij} and $\Delta S_{i,-j}$, then:

$$\Delta S_{ij} = s_{ij}\Delta w_{ij} + w_{ij}\Delta s_{ij} - \Delta s_{ij}\Delta w_{ij} \quad (12)$$

$$\Delta S_{i,-j} = s_{i,-j}\Delta w_{i,-j} + w_{i,-j}\Delta s_{i,-j} - \Delta s_{i,-j}\Delta w_{i,-j} \quad (13)$$

Assuming that $s_{ij} = k s_{i,-j}$, where $k > 1$, which is obtained from the data. Let's Δ denote the absolute change of variable in time. Then using previously discussed signs of changes and assuming that $(\Delta s_{ij}\Delta w_{ij} - \Delta s_{i,-j}\Delta w_{i,-j})$ approximately equals to zero, the total effect $\Delta S_{ij} - \Delta S_{i,-j}$ is

$$s_{i,-j}\left(k\Delta w_{ij} - \Delta w_{i,-j}\right) - \left(w_{ij}\Delta s_{ij} + w_{i,-j}\Delta s_{i,-j}\right) \quad (14)$$

And since w_{ij} and $w_{i,-j}$ are from 0 to 1, their changes are relatively small. The other variable $s_{i,-j}$ is more than 50 by definition and k is more than 1 but empirically varies up to 10. But Δs_{ij} and $\Delta s_{i,-j}$ are rather relatively small, since some new entrants cannot change the industry employment structure significantly over one period. Therefore, the overall effect (14) of increase in number of large firms should be positive.

The other variables that explain growth are savings, human capital, and other controls that we used based on the literature review. As a measure of savings, we use the investment ratio as a gross capital formation to GDP ratio. As a measure of human capital, we use the average number of years of education for individual older than 25 years old which is common for literature (Mankiw, Romer and Weil 1992, Barro and Sala-i-Martin 1995, Pagano and Schivardi 2003). Since the development of financial system plays important role for the investment activity, we add private sector loans to non-financial entities to GDP ratio as a proxy for level of financial development as in Levchenko, Ranciere and Thoenig (2007). We also add trade variable in order to proxy for the external demand, since the economies with higher trade have larger demand, which is a potential driver for additional growth.

Therefore, in order to analyze whether the firm size distribution has an impact on the aggregate level, we make use of the estimation strategy from (7):

$$g_{it} = \ln(S_{ij}) + \ln s_{jt} + \ln (n_{jt} + \delta_{jt}) + \ln y_{ijo} + \boldsymbol{X_{jt}}, \qquad (15)$$

where i denotes industry, j – country, $\boldsymbol{X_{jt}}$ – set of controls.

In order to estimate whether the firm size distribution has an impact on the industrial level in the long run, we utilize specification from (8), which is:

$$\bar{g}_{ij} = \ln(\bar{S}_{ij}) + \ln \bar{s}_{jt} + \ln (\overline{n_{jt} + \delta_{jt}}) + \ln y_{ijo} + \overline{\boldsymbol{X}}_{\boldsymbol{j}} + a_i, \qquad (16)$$

where $\overline{\boldsymbol{X}}_{\boldsymbol{j}}$ is the set of controls, averaged over given the period of time, a_i – industrial fixed affect.

In order to estimate the influence of firm size distribution on the industrial level over the short run, we use the estimation strategy similar to (15), instead using the industrial level where appropriate. Therefore, the specification is:

$$g_{it} = \ln(S_{it}) + \ln s_{jt} + \ln (n_{jt} + \delta_{jt}) + \ln y_{ijo} + \boldsymbol{X_{jt}} + a_i \qquad (17)$$

The positive sign and statistically significant coefficient on the co-worker mean variable means that firm size distribution with higher involvement of employees in large companies drives the economic growth. The insignificant coefficient means that there is no influence of higher labor concentration in larger firms on industrial growth.

Chapter 4

DATA DESCRIPTION

The main source of data for this research is the Eurostat database, from which we retrieved information on the number of enterprises, value added, number of employees by the size group in 1-digit industries by NACE (2nd revision), economic growth, GDP per capita, human capital. This data is in the form of an annual balanced panel data on 28 countries of the European Union, Switzerland and Norway from 2008 to 2016. The data on the European Union were chosen since this is a group of advanced and developing market economies which allows to control for the level of economic development. All monetary data were deflated (see APPENDIX B, Table 14).

The dependent variables differ across the regressions since the hypotheses requires testing on the different level of aggregation. On the macro level, real GDP growth is the dependent variable. On the industrial level, on the other hand, real growth of value added per employee is the variable of interest.

The independent variable of interest is the co-worker mean. The co-worker mean, according to our methodology, is the average number of employees in the firm of certain size bin, weighted by share of the total employment working in the firms of these bins. The 4 bins are defined: micro (0-9 employees), small (10-49 employees), medium (50-249 employees, and large enterprises (250 and more employees).

4.1 Growth of the GDP and aggregate co-worker mean in the EU, Norway and Switzerland

The European Union is a group of some of the largest and most developed economies in the world pooled together with countries that undergo transition from the communist regimes to market economies. Hence, the EU is extremely diverse in terms of the level of economic development and economic growth rates.

Figure 1 shows the distribution of GDPs per capital and cumulative average growth rates for these economies over the period we focus on. As we can notice, lower-income countries tend to grow faster than higher-income economies by 1-3.5% on average every year. At the same time, Mediterranean countries, which have lower GDP per capita than the EU average, demonstrate the lowest growth rates, meaning that they did not manage to recover after the Global Financial Crisis.

In an attempt to control for potential endogenous heterogeneity, we grouped all countries by their GDP and growth rates. Countries, which demonstrated above average growth and GDP per capita over 2008-2016, were classified as High growth – High income countries (HH). The ones, which demonstrated above average growth but had lower than overage income, were classified as High growth – Low income (LH) and so on. Thus, we obtained four groups of countries: HH, HL, LH and LL.

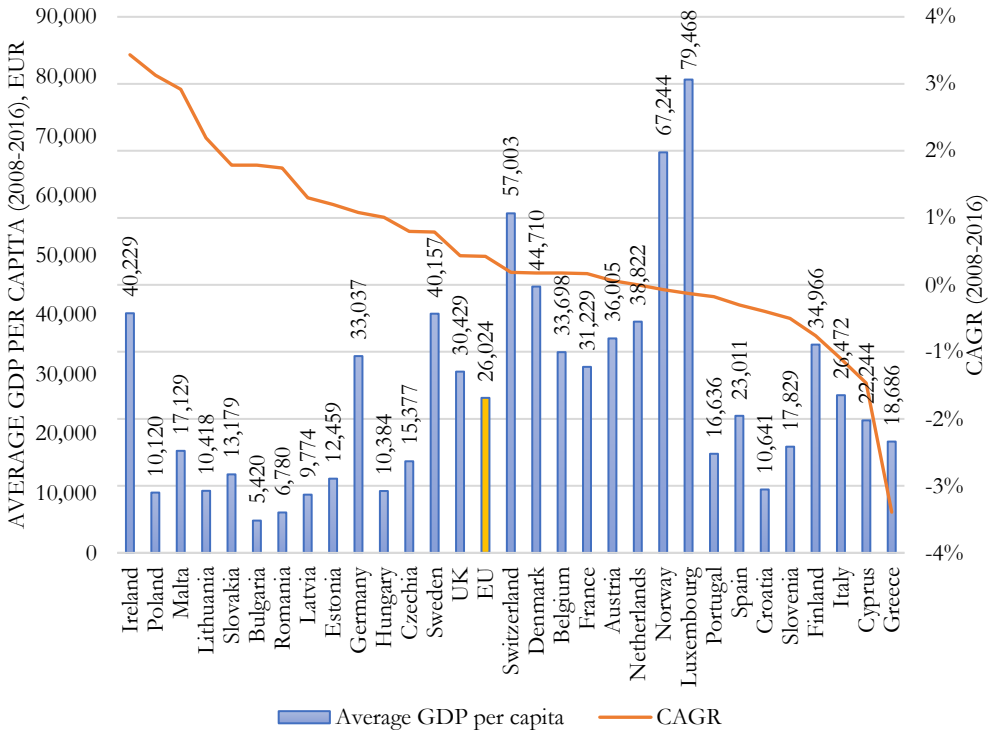

Figure 1. Average GDP per capita and Compounded average growth rate (CAGR) in 2008-2016 in the EU, Norway and Switzerland

As demonstrated on Figure 2, there are only 3 countries which enter the HH group, so it is more convenient to reduce the number of country groups to 3. Therefore, for our purposes we treat Ireland as High growth (HG) country as it exhibited the highest growth rate among its peers, while Germany and Sweden are treated as High income (HI) countries as they are much closer to LH group than to HL.

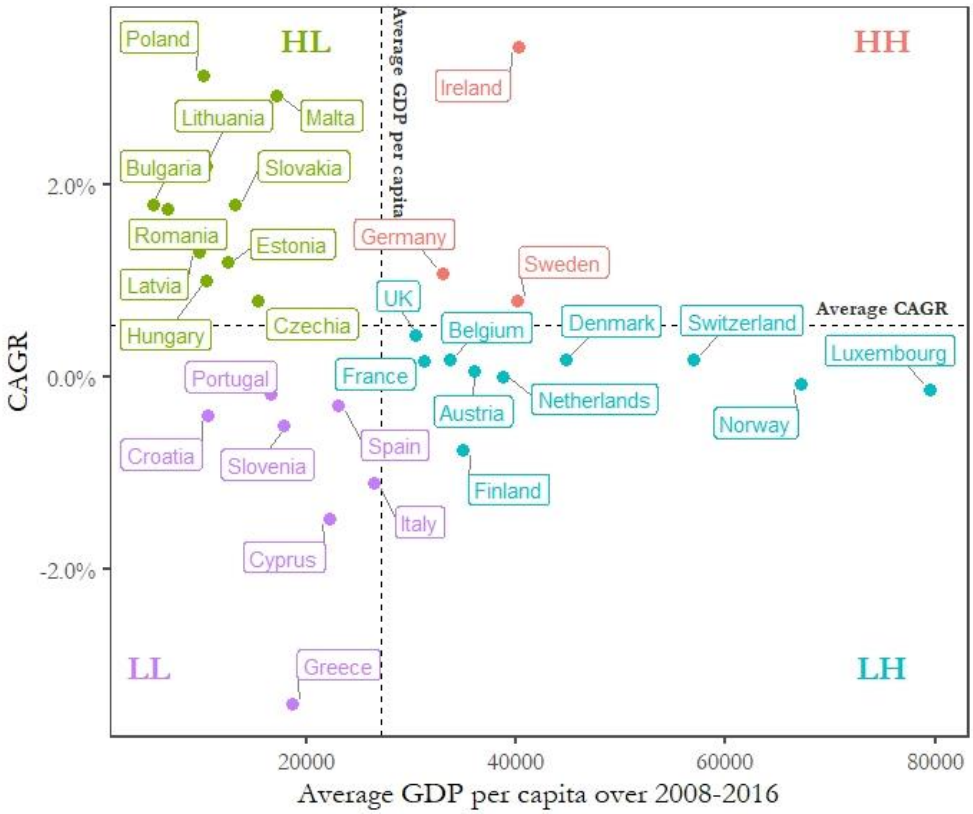

Figure 2. Countries' position based on Average GDP per capita and Compounded average growth rate (CAGR) in 2008-2016

Interestingly enough, the Low growth – Low income economies (LL) are all situated on the Mediterranean coast, thus, for our convenience, we call Low growth – Low income economies as Mediterranean countries. Thus, we end up with 3 groups of countries which are High growth (HG), Mediterranean (MT) and High income (HI). The full list of the countries represented in each group can be found in Table 1.

Table 1. List of countries by a country group

High Income	*High Growth*	*Mediterranean*
Austria	Bulgaria	Croatia
Belgium	Czechia	Cyprus
Denmark	Estonia	Greece
Finland	Hungary	Italy
France	Ireland	Portugal
Germany	Latvia	Slovenia
Luxembourg	Lithuania	Spain
Netherlands	Malta	
Norway	Poland	
Sweden	Romania	
Switzerland	Slovakia	
United Kingdom		

According to the descriptive statistics on GDP per capita and GDP growth (Table 2), High growth countries have lower GDP per capita and are more dispersed than Mediterranean but grow faster with average rate of 1.88%, whereas MT countries had on average negative growth rates.

Yet High income economies are 3 times richer in terms of GDP per capita than HG countries and the group's minimum GDP per capita is higher than maximum GDP per capita of the MT countries. However, the MT countries are the least heterogenous inside the group as they have the smallest standard deviation, while HG are the most heterogeneous, as the standard deviation almost equals the mean.

Table 2. Descriptive statistics on GDP per capita and GDP growth over 2008-2016 in the EU, Norway and Switzerland

Measure	*Statistics*	*Countries*			
		EU	*High Growth*	*High Income*	*Mediter-ranean*
GDP per capita	Mean	27,083	13,752	43,897	19,360
	St. Dev.	17,594	9,158	15,110	4,881
	Minimum	5,068	5,068	29,215	10,283
	Maximum	81,981	50,647	81,981	28,379
GDP growth	Mean	0.9%	1.9%	0.9%	-0.7%
	St. Dev.	3.7%	4.9%	2.3%	3.1%
	Minimum	-14.8%	-14.8%	-8.3%	-9.1%
	Maximum	25.2%	25.2%	6.0%	4.8%

The structural differences among these economies can be observed when analyzing the structure of their employment across different firm size bins. In 2008, roughly equal number of employees were employed in micro and small-sized firms from the one side and medium- and big- sized firms from another side across the EU. However, medium and big enterprises captured more than 50% of the employees in the High income economies (Figure 3). Thus, 39.6% of employees work for the big firms in Germany and 48.6% – in the UK.

In the Mediterranean countries the opposite picture is observed. Most of their labor force is involved in micro and small firms: 61% in Spain, Portugal – 64%, 69% in Italy and 74% in Greece (Figure 3, Figure 4).

In the High growth countries, the employment between Micro-Small and Medium-Big firms is spread more evenly than in HI and MT countries. But the share of medium-sized firms is usually higher than in other country groups (Figure 4).

Therefore, different groups of countries are characterized by prevalence of employment in different firm size bins that suggests the existence of relationship between distribution of employment in the economy and economic development.

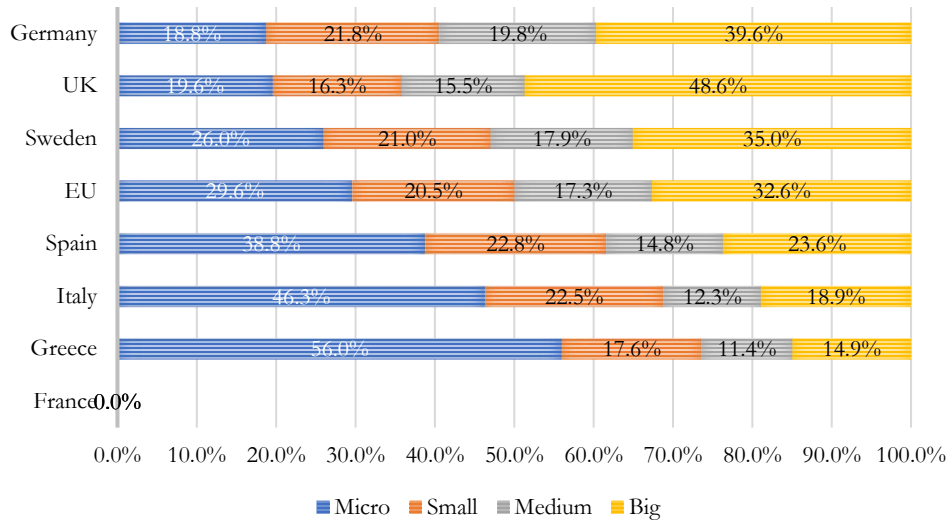

Figure 3. Total employment shares in 2008 in the EU, High income and Mediterranean countries

Comparing 2016 to 2008, the share of employment in small firms in Mediterranean and High growth countries was "eaten out" by medium and big firms, whereas in the UK, Germany and France the processes are reversed, and the share of small firms in employment increased by around 1% (Figure 5).

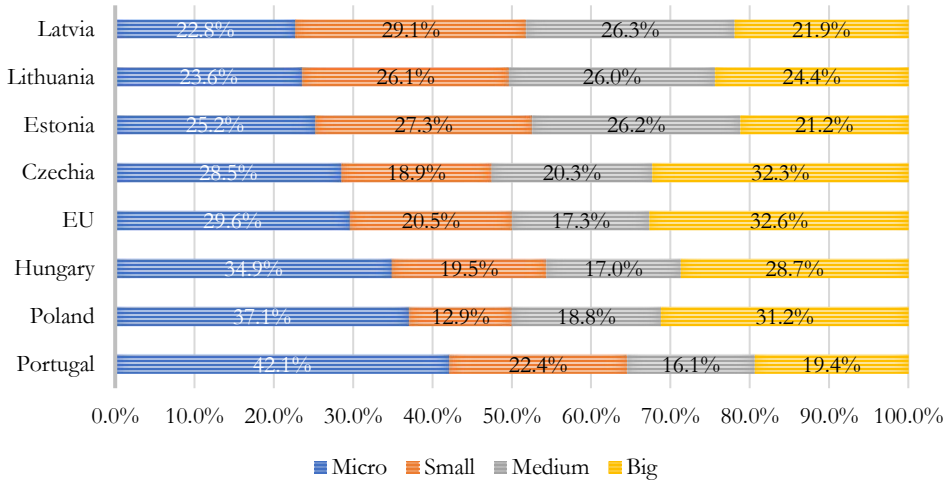

Figure 4. Total employment shares in 2008 in the EU, High Growth and Mediterranean countries

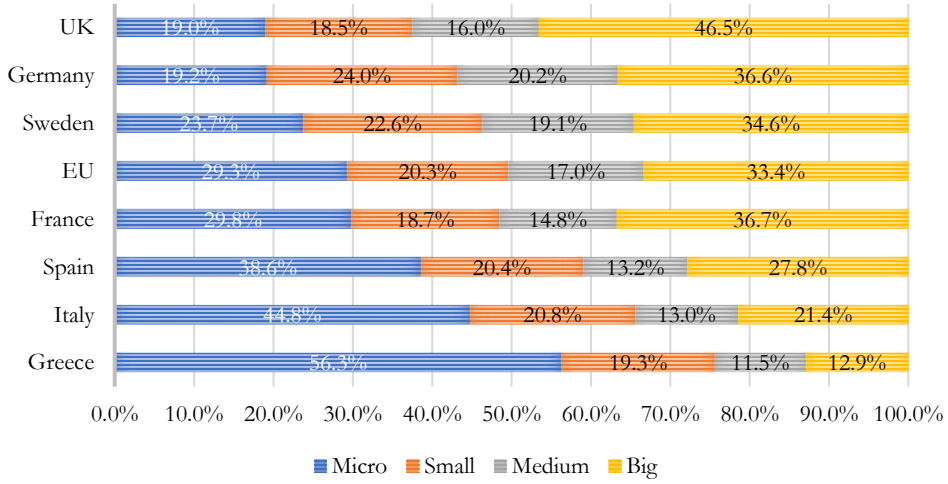

Figure 5. Total employment shares in 2016 in the EU, High income and Mediterranean countries

While comparing the employment structures in 2008 and 2016, we find that less developed countries move toward higher employment concentration, whereas the more developed countries move toward the employment decentralization (Figure 5 and Figure 6). This empirical fact suggests that more concentrated industry structure in terms of employment should lead to the higher growth rates. This also may well mean that there exists some non-linear relationship, according to which the higher income countries reached certain level of centralization after which the economy cannot concentrate anymore. The first conclusion we are aimed at testing, while second one we leave out of our discussion for now.

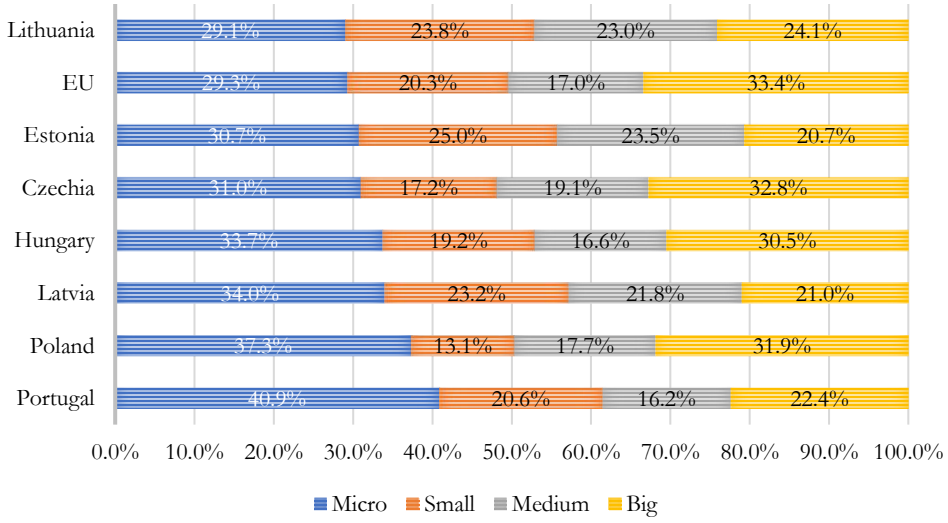

Figure 6. Total employment shares in 2016 in the EU, High growth and Mediterranean countries

Therefore, there are signs that higher concentration of employment in larger firms is correlated with economic development and may positively influence the growth of an economy. However, the problem of the reverse causality must be acknowledged, as one may argue that the growth of the economy can drive the firm size distribution. We believe that in period t rather firm size distribution influence growth and not vice versa since growth leads to reallocation of current period income toward the next period, as information is obtained at the end of period t. Therefore, growth should affect firm size distribution in the next period but not current. But this problem matters when the growth process is a non-stationary process.

4.2 Firm size distribution at the industrial level

The cross-country differences in the aggregate firm size distribution stem from different level of technologies, trade specializations and economic history. All these aspects contributed to the dissimilarities in distribution of labor and, consequently, value added in different sectors of the economies.

The Knowledge-intensive services (KIS) (APPENDIX A, Table 13) is the set of industries that generates the most value added for High income countries. Manufacturing and Wholesale and Retail are the second and the third in terms of size. The three sectors combined generated 65-75% of all value added among chosen industries. On the contrary, in 2009, the Mediterranean countries did not demonstrate the clear pattern of their economic structure. Greece generated the most in Trade, Italy – in Manufacturing. In Spain these three sectors generated value added almost equally, while the share of Construction was unproportionally large (Figure 7).

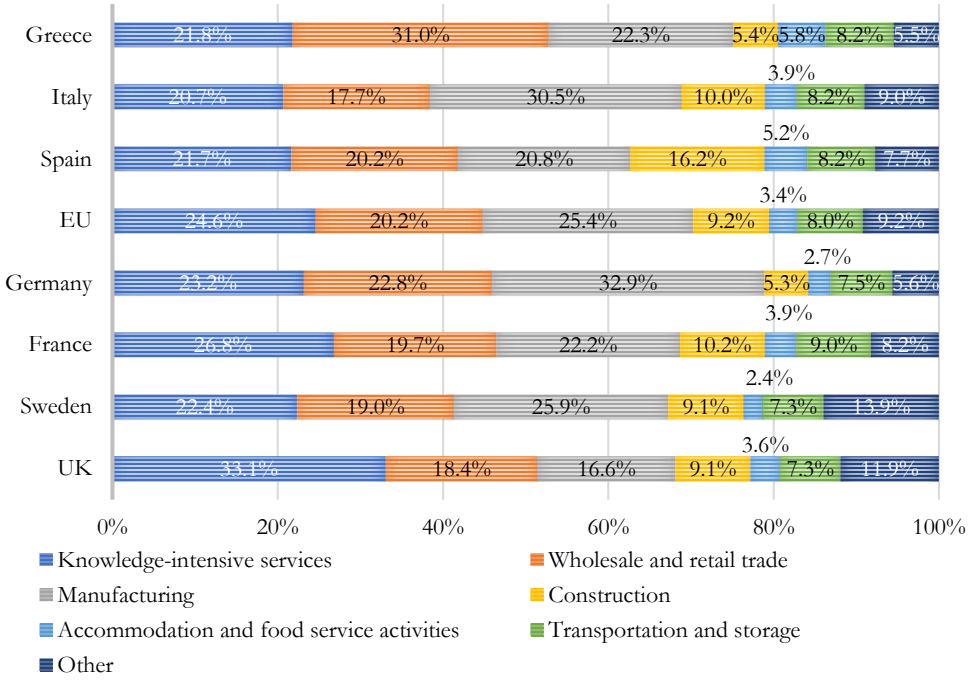

Figure 7. Value added shares on the industrial level in 2009 in High income and Mediterranean countries

From 2009 till 2016, High growth countries began to rely even more on KIS and Transportation, and less on Trade and Construction. The Mediterranean countries, instead, benefited from higher Trade (except Greece), Manufacturing, Accommodation and Transportation services, but the share of KIS remained lower than the EU average (Figure 8).

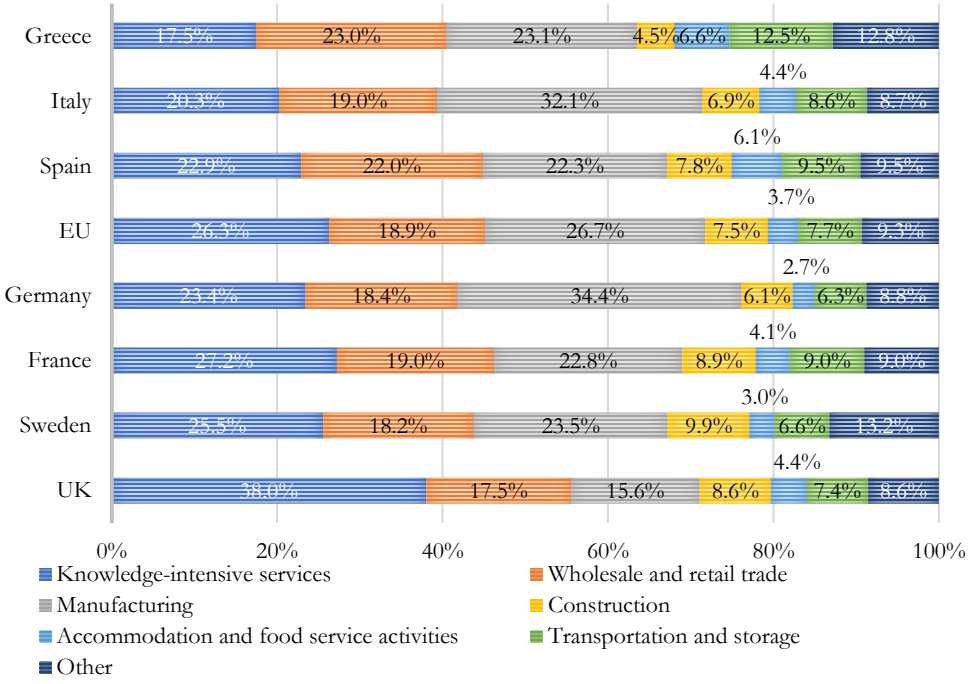

Figure 8. Value added shares on the industrial level in 2016 in High income and Mediterranean countries

For High growth countries in 2019, Manufacturing is the industry with higher share value added in an economy. Wholesale and retail trade usually generate more value added than KIS as well. Also, High growth countries usually generate more in Other industries. Baltic countries demonstrate unproportionally large share in Transportation services (Figure 9).

Since 2009, High growth countries continued to expand in Manufacturing and Wholesale and retail trade, keeping KIS lower than in the EU on average (Figure 10).

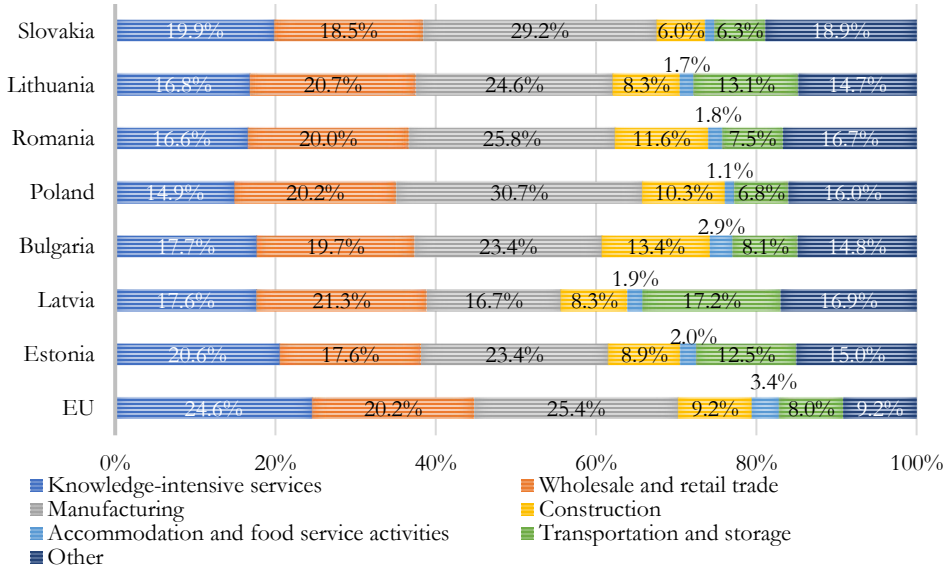

Figure 9. Value added shares on the industrial level in 2009 in High growth countries

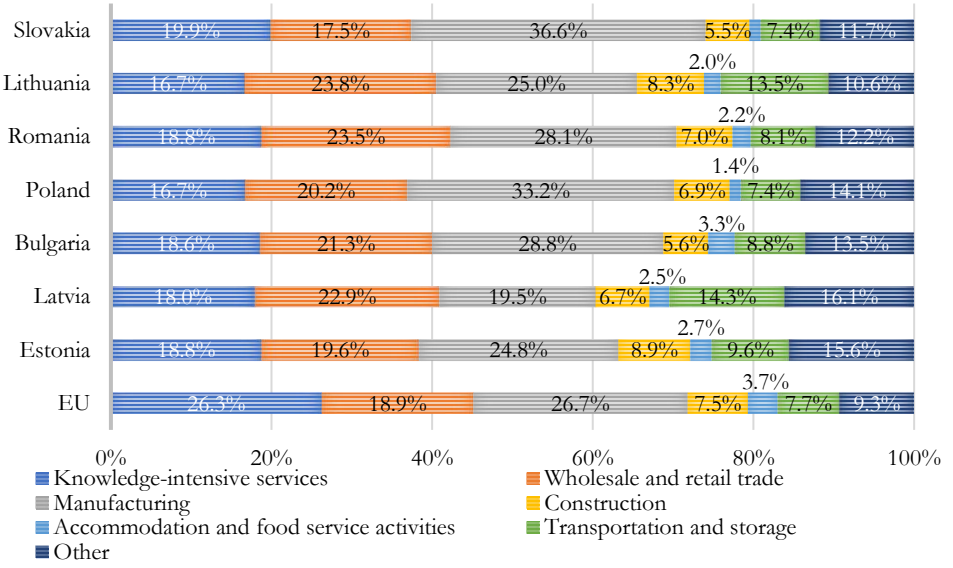

Figure 10. Value added shares on the industrial level in 2016 in High growth countries

In order to determine what the relative efficiency of an employee is in Mediterranean, High growth and High income countries in different industries groups and under different firm sizes, we estimate an OLS regression. The dependent variable is the share of value-added generated by firms of certain size in certain type of country and industry group. The independent variable is the share of labor employed in the respective sector. Then, if the production function depended only on labor and had a property of the constant returns to scale, the coefficient would be one, meaning that coefficient less than one indicates on diminishing returns. Therefore, the coefficient shows average productivity of labor.

Table 3. Average value added generated by additional employee in different country types, industry groups and firm sizes in 2008-2016

Country type	*Industry*	*Size*				
		Micro	Small	Medium	Big	***Average***
Mediter-ranean	KIS	0.82*+	-0.19	0.47	1.11*+	***0.74****
	Manufacturing	0.56	-0.37	0.55	0.98*+	***0.79****
	Production	0.76	0.15*	1.04*+	1*+	***0.64***
	Services	0.97*+	0.05*	0.92*+	1.12*+	***0.67***
	Utilities	0.49	0.33*	0.95*+	0.87	***0.9****
	Average	***0.82+***	***0.02***	***0.86+***	***0.95+***	***0.73***
High Growth	KIS	0.59	-0.08	0.51	0.85+	***0.63***
	Manufacturing	0.36	0.78*	1.71*+	1.42	***1.48****
	Production	0.71	0.25*	1.1*+	0.98*+	***0.84****
	Services	1.11*+	0.66*	1.24*+	1.03*+	***0.76***
	Utilities	0.59	0.34*	1.06*+	0.79	***0.99****
	Average	***0.79***	***0.03***	***0.93+***	***0.97+***	***0.83***
High Income	KIS	0.58	-0.08	0.76+	0.65	***0.75***
	Manufacturing	0.52	0.44*	1.08	0.78	***1.43****
	Production	0.69	0.18*	1.04*+	0.73+	***0.71***
	Services	1.04*+	0.29*	0.94*+	0.99*+	***0.92****
	Utilities	1.21*+	0.55*	0.92*+	0.84	***0.87****
	Average	***0.88+***	***0.12***	***0.85***	***0.85***	***0.87***

* – coefficient is higher than firm-size group average
+ – coefficient is higher than industry group average

As demonstrated in Table 3, High income countries are the most efficient, or every additional employee in the firm of some size brings additional 870 Euro, while in the High growth countries an additional employee creates additional 830 Euro. In Mediterranean countries, productivity is relatively lower since an additional worker generates additional 730 Euro.

There are also signs that Medium and Big companies usually are more productive than Micro firms in Mediterranean and High growth countries, whereas vice versa in High income economies. Surprisingly, the small firms of 10-49 persons came up to be the least productive across all the country types in terms of employment.

In the Mediterranean countries, the most productive groups of industry are the KIS, Manufacturing and Utilities. Alternatively, KIS are of the lowest productivity in High growth and High income countries. Manufacturing is the most productive industry for both HG and HI, and Utilities demonstrate above average productivity. In Services industry, employees are on average more productive in HI but, on the firms' level in HG countries workers are the most productive in Micro, Medium and Big firms.

Overall, according to the data, MT countries optimize productivity on the firm-size level and on the industrial level when the labor is engaged in Big firms in KIS and Services and in Medium-sized firms in Production. HG countries benefit the most from having medium-sized firms in all industry groups except KIS. HI countries enhance when have more employees in Medium-sized firms in Production and Manufacturing, and Micro firms in Services and Utilities.

4.3 Growth of real value added per employee

As a measure of growth on the industrial level, the real value added per employee was chosen as it is closer to the definition of income than total turnover. Among the industries in our sample the Accommodation and Food Service Activities is industry with the lowest value added whereas the Mining and Quarrying has the highest total value added in the EU, Norway and Switzerland (Appendix C, Table 15).

On the other hand, in terms of growth, Mining and Quarrying is the industry with highest volatility and highest decline whereas Manufacturing is the sole industry with the positive growth since 2008 (Appendix C, Table 16; Figure 11 and Figure 12).

The Mining and Quarrying industry all over the Europe witnessed the harshest decline in growth rates and after recovery in 2010-2012 fell again after to 53% comparing to 2008. Electricity, Gas, Steam and Air-conditioning supply was the only industry to increase in 2009 by 8%. The general growth trend for majority of industries was to decrease till 2010, weakly increase till 2015 and decline in 2016. But Manufacturing and Wholesale trade managed to steadily increase from 2013 till 2016 further on (Figure 11 and Figure 12).

The main reason for the declines in real value added per employee is higher increase in the number of persons employed comparing to the increase in Value Added. In Construction and Mining and Manufacturing the increase of Value Added was negative.

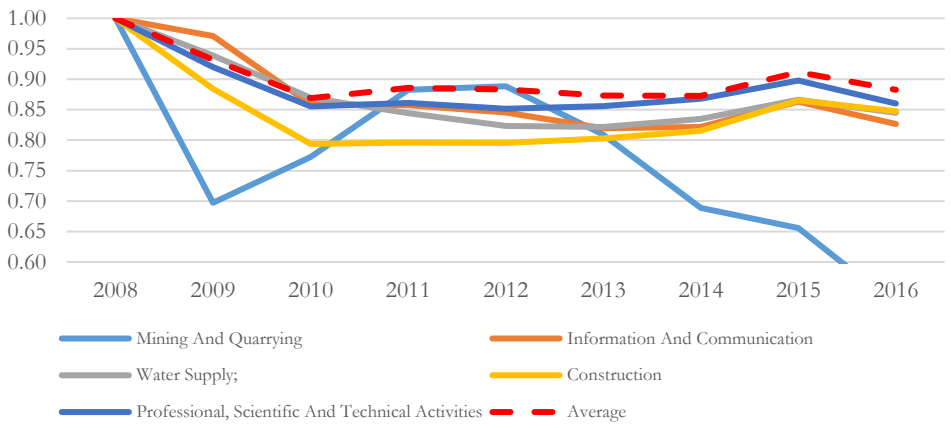

Figure 11. Real Value Added per Employee Index over EU in 2008-2016 for below average industries, 2008 = 1

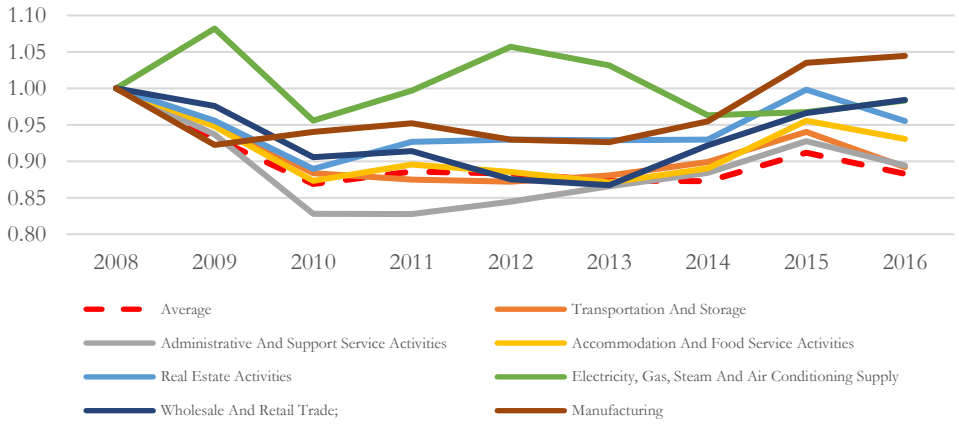

Figure 12. Real Value Added per Employee Index over EU in 2008-2016 for above average industries, 2008 = 1

4.4 Co-worker mean

4.4.1 Co-worker mean on the aggregate level

On the aggregate level, co-worker mean was calculated as the weighted average of average firm size by employment by firm size with weights that are the share of total employment of respective firm size bins. On aggregate basis, in High income economies the co-worker mean is 1.6 times higher than in High growth ones, and 1.8 times higher than in Mediterranean countries (Table 4, for additional information Appendix D, Table 17). Although the Mediterranean countries demonstrate higher GDP per capita than High growth on average, their aggregate firms size distribution is lower, meaning that there may not be a one-to-one relationship between level of GDP and labor concentration in an economy.

Table 4. Descriptive statistics on aggregate Co-worker mean over 2008-2016 in the EU, Norway and Switzerland

Countries	*Time Average*	*Standard deviation*	*Minimum*	*Maximum*
High Growth	**221**	**68**	**69**	**365**
Poland	293	3	290	298
Romania	309	4	302	315
High Income	**359**	**134**	**84**	**712**
France	515	19	493	546
Germany	372	12	356	399
Sweden	388	12	377	415
UK	684	24	629	712
Mediterranean	**196**	**60**	**102**	**302**
Croatia	250	16	221	276
Greece	113	10	102	135
Italy	207	10	193	222
Spain	283	19	251	302

The economies with the highest co-worker mean are the UK, France and the Netherlands, which all represent the High income economies. Malta, Greece, Cyprus and Luxembourg, on the contrary, are the countries with the lowest value of the variable, pointing to relatively low labor concentrations in their firms (Table 4, for additional information Appendix D, Table 17).

Although there is a high variance of co-worker mean between economies of certain country groups, the time variance for each country is quite small, suggesting that its employment structure, which is based on the firm size, is relatively rigid.

Table 5. Average co-worker mean over 2008-2016 in the EU, Norway and Switzerland

Countries	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
High Growth	**232**	**225**	**215**	**216**	**214**	**216**	**218**	**223**	**225**
Poland	292	290	296	291	290	294	295	296	298
Romania	310	313	313	307	302	306	305	310	315
High Income	**371**	**342**	**361**	**361**	**360**	**360**	**360**	**358**	**358**
France			501	493	502	501	536	546	525
Germany	399	380	373	372	370	373	362	363	356
Sweden	415	384	377	386	379	379	377	401	392
UK	711	629	707	676	688	683	684	669	712
Mediter-ranean	**190**	**183**	**189**	**192**	**198**	**197**	**203**	**206**	**206**
Croatia	241	221	242	238	276	245	258	267	264
Greece	135	102	109	109	102	115	115	122	109
Italy	193	196	200	206	207	200	218	222	222
Spain	251	255	266	282	290	299	301	301	302

In the time dimension, decrease in firm size distribution is observed after the Global Financial Crisis in 2008-2009. The following dynamics is quite diverse, since

for Mediterranean countries the trend was reversed and employment concentration in bigger-sized firm have been increasing in general, whereas in High growth and High income countries different examples of development are witnessed (Table 5, for additional information Appendix D, Table 17).

4.4.2 Co-worker mean on the industrial level

On the industrial level, the co-worker mean reveals important differences in technologies across industries (Table 6, for additional information Appendix D, Table 19).

Table 6. Average co-worker mean on the industrial level by countries over 2008-2016 in the EU, Norway and Switzerland

	Industries											
Countries	**Adminis-trative**	**Construction**	**Electricity**	**Information**	**Manufac-turing**	**Mining**	**Real Estate**	**Science**	**Tourism**	**Trade**	**Transpor-tation**	**Water Supply**
HG	**307**	**79**	**710**	**279**	**274**	**843**	**30**	**55**	**81**	**195**	**598**	**253**
Poland	431	89	1,421	364	311	3,525	56	74	129	226	605	184
Romania	317	146	1,264	381	318	1,918	74	92	79	163	637	390
HI	**625**	**151**	**1,129**	**410**	**387**	**449**	**76**	**175**	**166**	**419**	**729**	**272**
France	1,220	219	5,639	790	448	63	86	183	308	419	1,345	494
Germany	446	65	682	420	515	969	86	205	93	365	612	284
Sweden	724	302	452	459	473	790	97	204	114	318	703	383
UK	769	224	3,671	733	363	764	303	330	700	1,363	1,403	974
MT	**385**	**75**	**1,120**	**349**	**199**	**614**	**10**	**81**	**100**	**209**	**428**	**229**
Croatia	246	124	1,852	360	267	2,888	29	201	108	268	675	108
Greece	236	48	762	336	133	195	5	49	25	137	271	209
Italy	556	33	1,045	488	193	1,360	6	45	114	154	625	248
Spain	769	115	749	484	230	158	15	113	136	308	439	638
Total	**455**	**108**	**978**	**350**	**302**	**642**	**44**	**110**	**120**	**290**	**610**	**255**

For example, the electricity sector has usually the biggest average firm sizes across majority of countries. The mining industry, where present, is characterized by large average firm size, as in Poland and Croatia. On the contrary, Real estate and Construction do not demand large firms to operate.

As demonstrated in Table 6, general trends on the aggregate level coincide with those on industrial level. Firstly, the firms in High income economies are usually more labor concentrated than in High growth and Mediterranean countries. The exceptions are Electricity and Mining. In the Electricity industry, the technologies are quite diverse between the countries, but the HI average is driven by super-concentrated industries in France and the UK. In other HI countries firms are usually less concentrated than in MT and HG economies.

Table 7. Average co-worker mean on the industrial level by industries over 2008-2016 in the EU, Norway and Switzerland

Industries	***Years***								
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
High Growth	**350**	**294**	**318**	**319**	**310**	**276**	**296**	**295**	**292**
Administrative	298	248	309	317	318	275	326	333	335
Mining	1,139	927	898	930	860	740	702	715	699
Trade	186	176	183	188	194	199	206	210	215
High Income	**405**	**393**	**375**	**385**	**428**	**423**	**428**	**425**	**436**
Administrative	526	611	669	663	636	637	620	612	635
Mining	713	657	384	350	340	340	442	511	497
Trade	429	419	420	405	408	416	416	428	430
Mediterranean	**272**	**267**	**294**	**324**	**328**	**375**	**317**	**305**	**276**
Administrative	349	317	341	334	390	373	427	459	474
Mining				1,023	970	831	832	735	399
Trade	194	188	195	201	202	205	226	231	236
Total	**350**	**326**	**336**	**348**	**364**	**361**	**355**	**350**	**348**

The Mining industry development is, firstly bound by presence of the natural resources. Secondly, those countries which have the mineral deposits have had different starting points of extraction. Thirdly, the technology influences the labor requirements. As a result, Norwegian and German companies are less concentrated than those in Poland or Croatia due to these reasons.

Table 7 represents dynamics of co-worker mean and it disclose different trends for different industries (for additional information Appendix D, Table 20). The most pronounced trend for all types of countries is decrease in labor concentration in Mining after Global Financial Crisis, which is in line with the trend of decrease in value added per employee. On the contrary, average employment larger firms in Administrative and support service activities increased. Additionally, co-worker mean in Wholesale and retail trade increased for High growth and Mediterranean countries, although the industry is on average twice less concentrated than in High income markets. These structural changes indicate the long-term shift from production to service economy.

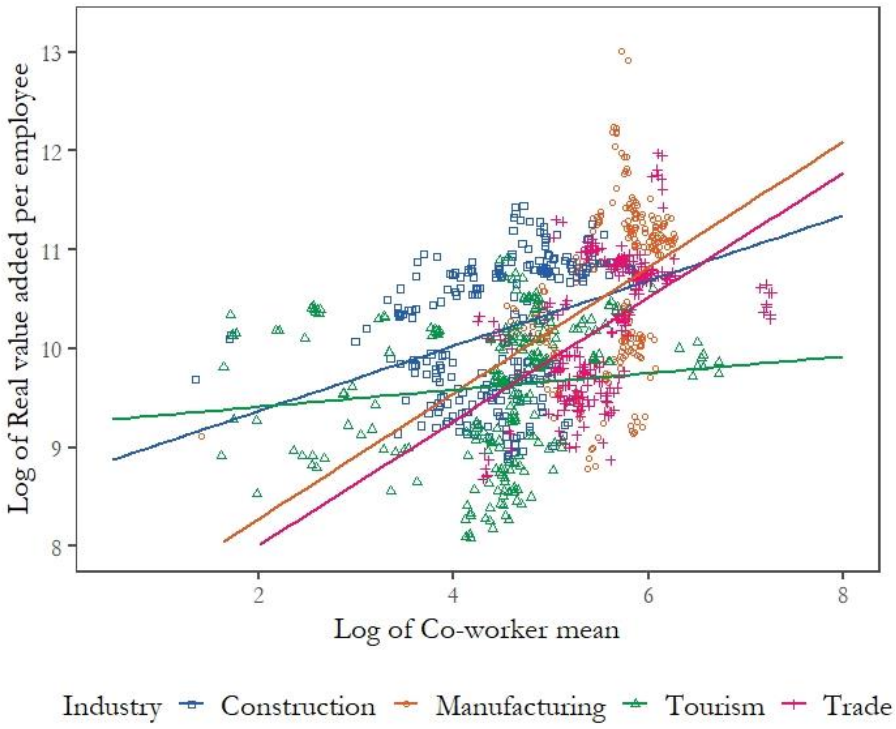

Figure 13 Co-worker mean vs real value added per employee in Construction, Manufacturing, Tourism and Trade industries

On the industrial level, there is a positive relationship between firm size distribution concentration and real value added per employee in some industries. As demonstrated on the Figure 13 and Figure 14, Manufacturing and Wholesale and retail trade are the industries, in which the relationship between co-worker mean and real value added per employee is strongest, meaning that higher labor concentration is the most beneficial for these industries. The Professional and scientific services and Construction are also the industries with significant positive relationship, whereas the other industries demonstrate weaker positive correlation.

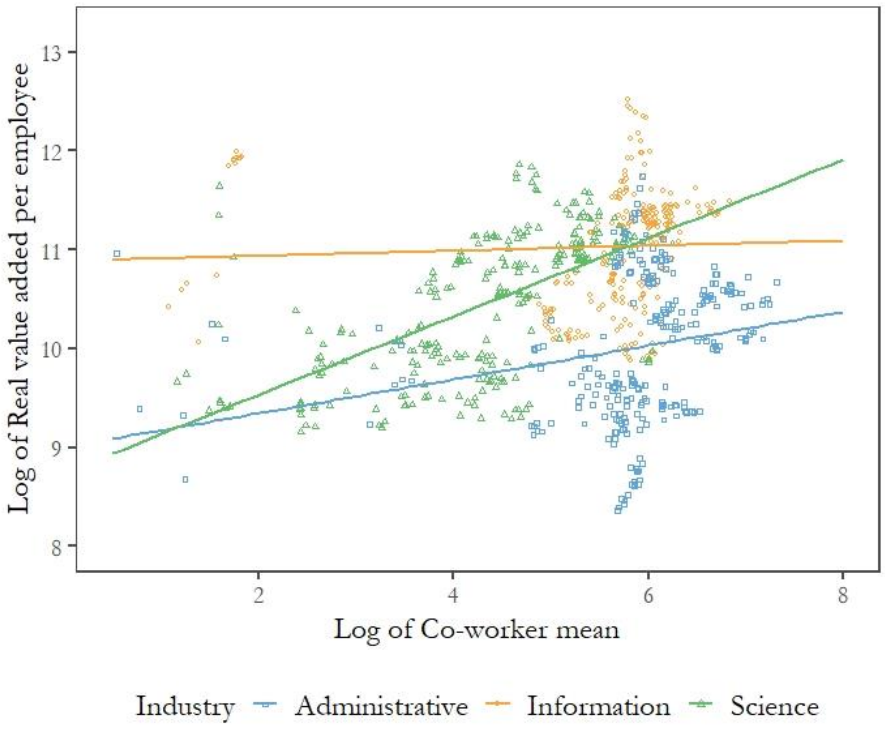

Figure 14 Co-worker mean vs real value added per employee in Knowledge-intensive services

The relationship between growth and firm size distribution is close to zero for majority of the industries. Yet in Manufacturing there is positive relation between firm size distribution and growth (Appendix D, Figure 15 and Figure 16). For Electricity and Construction sectors the slope between growth and firm size distribution is even negative. Therefore, this relationship is far from evident, and the multifactor analysis might shed additional light on its nature.

Chapter 5

EMPIRICAL RESULTS

The section is organized in the following way. Firstly, we introduce our aggregate cross-country regression which determines whether there is a relationship between aggregated firm employment concentration and growth of GDP. Secondly, we estimate a long run economic effect of the firm size distribution on industry growth. Thirdly, we explore a short run effect of firm size distribution on separate industries through time. Then, we overview the results of robustness checks of our results. Finally, we indicate the limitations of our approach. And finally, we suggest our policy recommendations.

5.1 Aggregate cross-country regression

In order to test whether the firm size distribution in an economy has a significant impact on growth in the EU countries on an aggregate level, we utilize MRW cross-country regression with time variability. Hence, in such interpretation we test the relationship between growth of GDP and the average number of employees in randomly picked firm, not considering what industry the worker is involved in.

In order to deal with the cross-country time sample, the Fixed Effects OLS method was utilized. Since the Fixed effect does not allow for the unchanging traits like initial level of GDP, the present value of GDP was utilised instead. According to the estimation results, Co-worker mean has a negative sign but statistically insignificant, suggesting that FSD should not have statistical impact on the growth

of GDP. All the other variables, except GDP per capita has the expect signs, yet only log of depreciation + Population growth + δ is statistically significant, showing that indeed factors GDP per capita-diminishing factors indeed decrease it. The results suggest that there is no growth convergence over 2008-2016, since in countries with higher GDP per capita by 1% the growth is accelerated by 0.269 percentage points. In addition, the higher net entry rate indeed accelerates GDP growth by 0.005 percentage points. The proxy for human capital (Average years of Schooling for adults of age 25+) and investment ratio both show positive but insignificant impact on growth (Table 8).

Table 8. Estimation results of aggregate cross-country regression

Independent variables	Dependent variable Growth of GDP
Log (GDP per capita)	0.269**
	(0.092)
Log (Co-worker mean)	-0.040
	(0.025)
Log (Average years of Schooling for adults of age 25+)	0.161
	(0.201)
Log (Investment to GDP ratio)	0.003
	(0.035)
Log (Depreciation + Population growth + δ^)	-0.094*
	(0.044)
Log (Net entry of firms divided by Number of firms in t-1)	0.005+
	(0.003)
Country Fixed effect	Yes
_cons	-3.125**
	(0.895)
N	148
R^2	0.252
adj. R^2	0.220

Robust standard errors in parentheses
$^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$
^ - according to the literature depreciation + δ is 5%, therefore δ is estimated around 0.9%

The other specification reaffirmed the absence of statistical relationship between aggregate co-worker mean and growth of GDP per capita. This result is expected, and it supports the idea that different industries have respective technologies and they should be accounted for separately. Although, the estimation results suggested that in countries in which share of KIS in total value added increased by 1%, the growth fell by 0.34 p.p., confirming our empirical findings about comparatively lower productivity in Knowledge intensive services (Appendix E, Table 21).

5.2 Cross-country cross-industry estimation

In the third section, we described a methodology that we make use of in the study. Our estimates in shortened version are represented in Table 9 (the full regression output is placed in Appendix C, Table 22). We found that statistical significance of result depends on method which we utilize, yet not lower than 90% of confidence.

The estimates on firm size distribution show the positive sign and statistical significance meaning that more employment in bigger firms stimulate industries to grow faster. Still, the economic effect seems to be quite small, since ceteris paribus increase in firm-size distribution measure by 1% leads to increase of the growth of value added by 0.005 percentage points

Also, the negative coefficient on initial value added per employee indicates that there exists convergence in growth rates for industries with different levels of initial production capacities. In addition, the growth of the value added per employee positively depends on financial development of the country (Table 9).

Interestingly enough, investment and Depreciation + Population growth + δ variable demonstrated the signs which are opposite to what theory predicts. Hence,

these variables are omitted since the estimated coefficients are not in line with the theory.

The additional regression estimations suggest that the positive relationship between growth and co-worker mean should be in the MT Countries since the coefficient on co-worker mean variable is positive and statistically significant, although the number of observations is small for surely stating such fact (Appendix E, Table 22).

Table 9. Estimation results of averaged cross-country and cross-industry regression

Independent variables	Dependent Variable Average growth of value added per employee	
Log (Co-worker mean)	0.005* (0.002)	0.005* (0.002)
Log (Average country trade to population)	0.020*** (0.003)	0.018*** (0.003)
Log (Initial Value added per employee)	-0.032*** (0.006)	-0.027*** (0.006)
Log (Average Private Credits to non-financial institutions to GDP)	0.014*** (0.003)	0.022*** (0.004)
Log (Average years of Schooling for adults of age 25+)	0.007 (0.010)	0.025+ (0.011)
Log (Investment to GDP ratio)	-0.022* (0.009)	
Log (Average (Depreciation + Population growth + δˆ)	0.044** (0.013)	
Industry FE	Yes	Yes
_cons	0.167+ (0.077)	-0.071 (0.063)
N	311	323
R^2	0.279	0.251
adj. R^2	0.262	0.240

Robust standard errors in parentheses
$^{+}p < 0.10, ^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$

Therefore, we can state that there is evidence that, controlling for the country trade per capita, human capital, investment ratio, development of financial sector, over 2008-2016 the industries with higher employment and concentration of employment in large enterprises benefited from higher average growth rates.

5.3 Effect of firm size distribution on the level of individual industries

Finding the evidence of the firm size distribution effect on average industrial growth over 2008-2016 was the test whether the FSD has a long-run effect on the growth. Now, we focus on testing whether the result is going to stand in the short run when the change in time unit is 1 year instead of 9 years.

In particular, we now try to identify whether the firm size distribution of the industry has an influence on industrial growth over time, controlling for the macroeconomic variables and using the same regression specification as for the cross-country regressions, yet switching from the dimension of countries to the dimension of groups industries.

The results of these regressions are presented in Table 10. The coefficient on firm size distribution is insignificant when all the industries are pooled together. However, the coefficient on co-worker mean in Manufacturing is positive and statistically significant, indicating that more labor concentration in the larger firms here matters. Furthermore, this implies that concentration is not only the historical consequence of economic development but also the growth driver for the whole industry. In the numeric equivalent, ceteris paribus additional 1% increase in co-worker mean variable leads to the 2 percentage points increase in growth of real value added per employee.

Table 10. Estimation results of industry specific cross-country regressions

Independent variables	Dependent variable Growth of value added per employee	
	all industries	Manufacturing
Log (Co-worker mean)	0.002 (0.002)	0.022** (0.007)
Log (Initial Value added per employee)	0.010* (0.005)	0.523*** (0.089)
Log (Investment to GDP ratio)	-0.011 (0.028)	-0.028 (0.064)
Log (Average Private Credits to non-financial institutions to GDP)	-0.098** (0.033)	0.096+ (0.051)
Log (Average years of Schooling for adults of age 25+)	-0.050 (0.132)	-0.140 (0.213)
Number of firms entered the industry in the given year (in mln)	-0.544* (0.264)	1.291+ (0.731)
Log (Average (Depreciation + Population growth + δ^)	-0.085*** (0.023)	-0.134** (0.043)
Year dummies	Yes	Yes
Country dummies	Yes	Yes
_cons	0.138 (0.360)	-6.382*** (1.270)
N	2227	199
R^2	0.106	0.691
adj. R^2	0.090	0.615

Robust standard errors in parentheses
$^{+}p < 0.10, ^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$

From the estimation results we also find that across all industries, and especially in Manufacturing, there are no signs of convergence as the bigger the industry is, the faster the growth is. We also find that the higher the depreciation rate is, the more growth slows down, especially on the industrial level. But increase in the number of firms in the industry does not have any impact on the growth rate.

Regressions on data of other industries show that the short-term impact of change in firm size distribution is not statistically different from zero (Appendix E, Table 23).

5.4 Robustness checks

In this subsection, we provide a brief overview of the robustness of our result for estimations presented in section 5.2 and 5.3. We reach quite similar outcomes by using the elements, from which we constructed the co-worker mean variable.

As we showed in (11), the co-worker mean is a sum of 4 elements which represent each size group in the industry. Hence, we used these elements instead of the co-worker mean to check whether they influence the industrial growth individually. The result of our baseline estimation is perceived to stand if the employment structure in medium and large firms positively benefits the industrial growth.

At first, we test our conclusions made in section 5.2. As it demonstrated on Table 11, the sign of large firms' co-worker mean element is positive and statistically significant when all countries taken into estimation. The sign of the coefficient in MT countries also positive and statistically significant. This estimation supports the conclusion that employment involvement in the large-sized firms drives industrial growth in the EU in the long run, especially in the MT countries.

Table 11. Robustness check estimation results of averaged cross-country and cross-industry regression

Independent variables	Dependent variable (according to the data splits by type of the countries) Average growth of value added per employee	
	All countries	MT countries
Log (Average co-worker mean micro firms' element)	0.005	0.004
	(0.007)	(0.017)
Log (Average co-worker mean small firms' element)	0.011	0.003
	(0.006)	(0.014)
Log (Average co-worker mean medium firms' element)	-0.009	-0.011
	(0.006)	(0.021)
Log (Average co-worker mean large firms' element)	0.011**	0.024***
	(0.003)	(0.005)
Log (Average country trade to population)	0.016***	0.030**
	(0.002)	(0.009)
Log (Initial Value added per employee)	-0.022***	-0.032***
	(0.004)	(0.005)
Log (Average Private Credits to non-financial institutions to GDP)	0.024***	0.024*
	(0.004)	(0.009)
Log (Average years of Schooling for adults of age 25+)	0.039*	-0.005
	(0.014)	(0.026)
Industry FE	Yes	Yes
_cons	-0.158***	-0.148
	(0.031)	(0.111)
N	282	73
R2	0.261	0.467
adj. R2	0.239	0.400

Robust standard errors in parentheses
$^{+}p < 0.10, ^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$

In order to check results obtained in section 5.3, we applied the same strategy as before. As it demonstrated in Table 12, all elements of co-worker mean are statistically insignificant, when all industries are taken. On the contrary, when we take the Manufacturing industry into consideration, we observe the positive and statistically significant coefficient on the medium firms' element of the co-worker

mean, which suggest that the employment concentration in medium-sized firms should be encouraged rather than in large-sized firms.

Table 12. Robustness check estimation results of industry specific cross-country regressions

Independent variable	Dependent variable (according to the data splits by type of the industry) Real growth of value added per employee	
	All industries	Manufacturing
Log (Co-worker mean micro firms' element)	-0.004 (0.007)	-0.033 (0.063)
Log (Co-worker mean small firms' element)	0.011 (0.011)	0.005 (0.175)
Log (Co-worker mean medium firms' element)	-0.008 (0.010)	0.309* (0.125)
Log (Co-worker mean large firms' element)	0.003 (0.003)	-0.082 (0.107)
Log (Initial Value added per employee)	0.016** (0.005)	0.550*** (0.090)
Log (Investment to GDP ratio)	-0.029 (0.030)	-0.055 (0.056)
Log (Average Private Credits to non-financial institutions to GDP)	-0.123*** (0.031)	0.078 (0.055)
Log (Average years of Schooling for adults of age 25+)	-0.117 (0.132)	-0.044 (0.203)
Number of firms entered the industry in the given year (in mln)	-0.617* (0.261)	1.546* (0.650)
Log (Average (Depreciation + Population growth + δ^)	-0.087*** (0.024)	-0.111* (0.045)
Year dummies Country dummies	Yes Yes	Yes Yes
_cons	0.396 (0.381)	-7.156*** (1.453)
N	1897	192
R^2	0.154	0.718
adj. R^2	0.135	0.639

Robust standard errors in parentheses
$^{+}p < 0.10, ^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$

Such a results is also in line with our estimation of the relative productivity (Table 3), which demonstrated that medium-sized firms have the highest per-employee productivity in HI and HG economies.

5.5 Shortcomings and Limitations of our approach

Our approach is based on the MRW-type of the regression, which is better suited for the longer-term analysis than our data allows us to do. In the original paper, Mankiw, Romer and Weil (1992) formally derived growth as a function of steady state level of capital. Since the process of convergence to steady state demands a lot of time, authors estimated the empirical relationship between growth and technology used 35 years of observations, whereas we possess only 9 years of data. Thus, our results may be potentially influenced by business cycle, which vary from 6 to 11 years, showing rather present trend than long-term relationship.

As the measure of human capital, the average number of years of education for population over 25 years old. Although, it was used in MRW (1992) and subsequent articles, it is not an ideal measure, since it does not represent the quality of obtained knowledge. In addition, other aspects that influence quality of human capital, like quality of healthcare system, crime levels etc., are not accounted for.

Also, by using fixed effects in our regressions, we assumed that regulatory environment was not changing across the years of the observation, it was not necessarily correct assumption. Even harder problem is to quantify the regulatory environment. Thus, this our shortcoming is the potential for the future research.

5.6 Policy implications

Our findings suggest that the effect of the firm size distribution on growth is observed on the industrial level in the long run. Moreover, the short-term effect of the higher labor concentration is present in Manufacturing industries. This result is supported by our estimations of labor efficiency in the previous chapter. This collection of findings points out to the presence of increasing returns to scale in manufacturing with respect to labor.

Our measure of firm size distribution constructed in such a way that the fastest way to boost it is to increase either average number of employees in the large firms or the share of employment in the large firms. The co-worker mean expands when more labor flows from Micro and Small firms to the Medium and Bigger firms. Thus, manipulation with employment in that way is a challenging task.

The policy suggestions with respect to our result depend on the objective function of the policy maker. The output-maximization strategy would suggest that stimulation of the labor concentration be beneficial for an economy. Therefore, inside the economy, for instance, loosening of the anti-monopoly law could be beneficial. But this obvious choice might clash with conventional economic theory as the general economic welfare might actually decrease in the long run as a result of such policies. But there exist other measures to promote higher concentration in the industry.

The possible way to manipulate the distribution without harming the competition is to provide better conditions for operation inside the market, luring the foreign successful businesses with well-established business models. Then, labor is expected to switch from less to more successful companies, which are usually larger

in size. But the problem is that according to new evidence from literature[3] and specifically Autor et al (2019), the labor share in value-added generated by "superstar", or exceptionally large firms tend to decrease, meaning that it is not clear whether benefits from such concentration will stimulate the overall consumption and, consequently, the overall welfare.

Alternatively, the government may promote the transition from small to medium-sized firms. As we showed in the previous chapter, medium-sized firm are often more productive in labor than other types of firms, whereas small firms are the least productive. For example, Garicano, Lelarge and Reenen (2016) showed that labor regulations in France create distortions and, as a result, welfare losses due to underemployment by more productive firms who choose to be just below the regulatory threshold, and allocating too little employment to more productive firms that bear the implicit labor tax (whereas small firms do not). Thus, too many agents with low managerial ability are encouraged to become small entrepreneurs rather than being employed by more productive entrepreneurs. Therefore, such regulations that implicitly punish more productive medium-sized agents should be revised and reassessed considering our findings.

[3] (e.g., Blanchard 1997, Elsby, Hobjin and Sahin 2013, Karabarbounis and Neiman 2013, Piketty 2014).

Chapter 6

CONCLUSION

The study investigates whether concentration of labor in the bigger sized firms is beneficial for the economies of the European Union. Previous studies are not unanimous in answering this question. At the end of 20th century it was not uncommon in academic literature to perceive the growth of the share in large firms as undermining factor for the total growth of output in the economy. However, the latest evidence claims quite the opposite.

The data description confirms that both micro-firms and large firms may be both equally productive in terms of output per worker, however there is a lot of heterogeneity across industries in which the firms operate. Furthermore, the productivity in the same industry varies across different types of countries. High income countries have the highest productivity in Manufacturing and Services. The High growth economies in Manufacturing and Production industries. Utilities and Manufacturing are the most productive sectors in the Mediterranean countries. The micro and small firms in High income countries are usually more productive than in Mediterranean and High growth countries.

The firm size concentration is 1.6-1.8 times higher in High income than in High growth and Mediterranean countries. After the crisis, the High income countries exhibited no changes in this indicator, whereas in HI and MT countries increased it considerably, which suggest that they have potential to increase the labor concentration in larger firms even further. In addition, the co-worker mean is positively correlated with size of the real value added per employee in

Manufacturing and Professional and Scientific services, and weakly correlated with other industries.

The estimation results showed that on the aggregate level there are no signs that labor concentration influences growth, although there are signs that higher share of value added generated in Knowledge-intensive services negatively influences GDP growth. This conclusion is supported by industry efficiency estimations which suggested that KIS are the industries with the lowest productivity per additional employee.

On the industrial level, there are signs that higher firm-size concentration positively influences growth in the long-run. Increase in concentration is the most beneficial for Mediterranean countries, whereas effect on the High income and High growth countries is ambiguous. In the short run, the positive effect of the more concentrated firm size distribution is present in Manufacturing.

The results suggest that higher concentration should bring faster growth with involving more labor in the biggest firms in the long run. Yet, the focus on the biggest firms may threaten the competition. Therefore, the government should focus their attention on the transfer of the employment from small to the medium-sized firms.

WORKS CITED

Acs, Zoltan J., and David B. Audretsch. 1993. *Small Firms and Entrepreneurship: An East-West Perspective.* Cambridge: Cambridge University Press.

Ardagna, Silvia, and Annamaria Lusardi. 2010. "Explaining International Differences in Entrepreneurship: The Role of Individual Characteristics and Regulatory Constraints." In *International Differences in Entrepreneurship*, by Josh Lerner and Antoinette Schoar, 17-62. National Bureau of Economic Research.

Audretsch, David A., Martin Carree, Andre J. van Stel, and Thurik Roy. 2000. "Impeded Industrial Restructuring: The Growth Penalty." Discussion paper No. 2648.

Autor, David, David Dorn, Lawrence F. Katz, Christina Patterson, and John Van Reenen. 2019. "The Fall of the Labor Share and the Rise of Superstar Firms." *Quarterly Journal of Economics, Forthcoming.*

Barro, Robert J., and Xavier Sala-i-Martin. 1997. "Economic growth." *Journal of Economic Dynamics and Control* 895-898.

Blanchard, Olivier. 1997. "The Medium Run." *Brookings Papers on Economic Activity* 89-158.

Carree, Martin, and Roy Thurik. 1998. "Small Firms and Economic Growth in Europe." *Atlantic Economic Journal* 137-146.

Carree, Martin, André van Stel, Roy Thurik, and Sander Wennekers. 2002. "Economic Development and Business Ownership: An Analysis Using Data of 23 OECD Countries in the Period 1976–1996." *Small Business Economics* 271-290.

Chandler, Alfred D. 1990. *Scale and Scope: The Dynamics of Industrial Capitalism.* Cambridge: Harvard University Press.

Ciccone, Antonio, and Elias Papaioannou. 2007. "Red Tape and Delayed Entry." *Journal of the European Economic Association* 444-458.

Coffey, Bentley, Patrick A. McLaughlin, and Pietro F. Peretto. 2016. *The Cumulative Cost of Regulations.* Duke I&E Research Paper No. 2016-45, Duke University.

Davis, S., and M. Henrekson. 1999. "Explaining National Differences in the Size Industry Distribution of Emploment." *Small Business Economics* 59-83.

di Giovanni, Julian, Andrei A. Levchenko, and Isabelle Mejean. 2017. "Large Firms and International Business Cycle Comovement." *The American Economic Review* 598-602.

Djankov, Simeon, Rafael La Porta, and Florencio Lopez-de-Silanes. 2002. "The Regulation of Entry." *The Quarterly Journal of Economics* 1-37.

Elsby, Michael, Bart Hobijn, and Ayseful Sahin. 2013. "The Decline of the U.S. Labor Share." *Brookings Papers on Economic Activity* 1-63.

Feenstra, Robert C., Robert Inklaar, and Marcel P. Timmer. n.d. "Penn World Table version 9.1." *Official Web Site of the University of Groningen.* Accessed January 26, 2020. https://www.rug.nl/ggdc/productivity/pwt/.

Fisman, Raymond, and Virginia Sarria Allende. 2010. "Regulation of entry and the distortion of industrial organization." *Journal of Applied Economics* 91-111.

Garicano, Luis, Claire Lelarge, and John Van Reenen. 2016. "Firm Size Distortions and the Productivity Distribution: Evidence from France." *American Economic Review* 39-79.

Haidar, Jamal Ibrahim. 2012. "The Impact of Business Regulatory Reforms on Economic Growth." *Journal of the Japanese and International Economies* 285-307.

Jalilian, Hossein, Colin Kirkpatrick, and David Parker. 2007. "The Impact of Regulation on Economic Growth in Developing Countries: A Cross-Country Analysis." *World Development* 87-103.

Kamien, Morton I., and Nancy L. Schwartz. 1982. *Market Structure and Innovation.* Cambridge: Cambridge University Press.

Karabarbounis, Loukas, and Brent Neiman. 2013. "The Global Decline of the Labor Share." *The Quarterly Journal of Economics* 61-103.

Klapper, Leora, Luc Laeven, and Raghuram Rajan. 2006. "Entry regulation as a barrier to entrepreneurship." *Journal of Financial Economics* 591-629.

Kumar, Krishna B., Raghuram G. Rajan, and Luigi Zingales. 1999. *What Determines Firm Size?* Working Paper No. w7208, NBER.

Lee, Keun, Byung-Yeon Kim, Young-Yoon Park, and Elias Sanidas. 2013. "Big businesses and economic growth: Identifying a binding constraint for growth with country panel analysis." *Journal of Comparative Economics* 561-582.

Levchenko, Andrei, Romain Ranciere, and Mathias Thoenig. 2007. "Liberalization, Growth and Risk at the Industry Level: the Real Effects of Financial." *Conference on New Perspectives on Financial Globalization.* Washington, DC: International Monetary.

Loayza, Norman V., Ana Maria Oviedo, and Luis Serven. 2005. *Regulation and macroeconomic performance.* Working Paper No. WPS3469, Washington, DC: World Bank.

Loveman, Gary, and Werner Sengenberger. 1991. "The Re-Emergence of Small-Scale Production: An International Comparison." *Small Business Economics* 1-37.

Mankiw, Gregory N., David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." *The Quarterly Journal of Economics.*

Messaoud, Boudhiaf, and Zribi El Ghak Teheni. 2014. "Business regulations and economic growth: What can be explained?" *International Strategic Management Review* 69-78.

Nelson, Richard R., and Sidney G. Winter. 1982. *An Evolutionary Theory of Economic Change*. Campridge, Massachusetts: The Belknap Press of Harvard University Press.

Pagano, Patrizio, and Fabiano Schivardi. 2003. "Firm Size Distribution and Growth." *The Scandinavian Journal of Economics* 255-274.

Piguillem, Facundo, and Loris Rubini. 2012. "International Trade and the Firm Size." *2012 Meeting Papers 857, .* Society for Economic Dynamics.

Piketty, Thomas. 2014. *Capital in the Twenty-First Century*. Cambridge, Massachusetts: Belknap Press of Harvard University Press.

Rama, M., and R. Artecona. 2002. *A Database of Labor Market Indicators across Countries, Unpublished*. Washington, DC: World Bank.

Schumpeter, Joseph A. 1942. *Capitalism, Socialism, Democracy*. New York: Harper.

—. 1934. *The Theory of Economic Development*. Cambridge, Massachusetts: Harvard Economic Studies.

The UNESCO Institute for Statistics. n.d. "Mean years of schooling." *Official Web Site of The UNESCO Institute for Statistics*. Accessed January 25, 2020. http://data.uis.unesco.org/index.aspx?queryid=242.

World Bank. n.d. *GDP per capita growth (annual %)*. Accessed 12 13, 2019. https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG.

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APPENDIX A. DEFINITION OF INDUSTRIES

Table 13. Description of industries and their classification

Level	*Code*	*Description*	*Dataset*	*Industry's short name*	*Industry type*
1	A	Agriculture, forestry and fishing	No		
1	B	Mining and quarrying	Yes	Mining	Production
1	C	Manufacturing	Yes	Manufacturing	Manufacturing
1	D	Electricity, gas, steam and air conditioning supply	Yes	Electricity	Utilities
1	E	Water supply; sewerage, waste management and remediation activities	Yes	Water Supply	Utilities
1	F	Construction	Yes	Construction	Production
1	G	Wholesale and retail trade; repair of motor vehicles and motorcycles	Yes	Trade	Services
1	H	Transportation and storage	Yes	Transportation	Services
1	I	Accommodation and food service activities	Yes	Tourism	Services
1	J	Information and communication	Yes	Information	KIS
1	K	Financial and insurance activities	No		
1	L	Real estate activities	Yes	Real estate	Services
1	M	Professional, scientific and technical activities	Yes	Professional	KIS
1	N	Administrative and support service activities	Yes	Administrative	KIS
1	O	Public administration and defense; compulsory social security	No		
1	P	Education	No		
1	Q	Human health and social work activities	No		
1	R	Arts, entertainment and recreation	No		
1	S	Other service activities	No		
1	T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	No		
1	U	Activities of extraterritorial organizations and bodies	No		

APPENDIX B. DEFLATORS

Table 14. Values used to deflate monetary variables in this thesis

Country	*Year*								
	2008	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Austria	1.000	1.004	1.021	1.058	1.085	1.108	1.125	1.134	1.145
Belgium	1.000	1.000	1.023	1.058	1.085	1.098	1.104	1.110	1.130
Bulgaria	1.000	1.025	1.056	1.092	1.118	1.122	1.104	1.092	1.078
Croatia	1.000	1.022	1.033	1.056	1.092	1.117	1.119	1.116	1.109
Cyprus	1.000	1.002	1.028	1.064	1.097	1.101	1.098	1.082	1.069
Czechia	1.000	1.006	1.018	1.040	1.077	1.092	1.096	1.100	1.106
Denmark	1.000	1.010	1.032	1.060	1.086	1.091	1.095	1.098	1.098
Estonia	1.000	1.002	1.029	1.082	1.127	1.163	1.169	1.170	1.179
EU 28	1.000	1.010	1.031	1.063	1.091	1.107	1.114	1.115	1.117
Finland	1.000	1.016	1.033	1.067	1.102	1.126	1.139	1.137	1.142
France	1.000	1.001	1.018	1.041	1.064	1.075	1.081	1.083	1.086
Germany	1.000	1.002	1.013	1.038	1.061	1.078	1.087	1.094	1.099
Greece	1.000	1.013	1.061	1.093	1.104	1.094	1.079	1.067	1.067
Hungary	1.000	1.040	1.089	1.131	1.196	1.216	1.216	1.217	1.222
Ireland	1.000	0.983	0.967	0.979	0.997	1.002	1.005	1.005	1.003
Italy	1.000	1.008	1.024	1.054	1.089	1.102	1.104	1.105	1.104
Latvia	1.000	1.033	1.021	1.063	1.088	1.088	1.096	1.098	1.099
Lithuania	1.000	1.042	1.055	1.098	1.133	1.146	1.149	1.141	1.149
Luxembourg	1.000	1.000	1.028	1.066	1.097	1.116	1.123	1.125	1.125
Malta	1.000	1.018	1.038	1.064	1.098	1.109	1.118	1.132	1.142
Netherlands	1.000	1.010	1.019	1.045	1.074	1.102	1.105	1.107	1.108
Norway	1.000	1.023	1.047	1.060	1.064	1.086	1.106	1.128	1.172
Poland	1.000	1.040	1.067	1.109	1.150	1.159	1.160	1.152	1.150
Portugal	1.000	0.991	1.005	1.041	1.070	1.074	1.072	1.078	1.084
Romania	1.000	1.056	1.120	1.185	1.226	1.265	1.283	1.278	1.263
Slovakia	1.000	1.009	1.016	1.058	1.097	1.113	1.112	1.109	1.103
Slovenia	1.000	1.008	1.029	1.051	1.080	1.101	1.105	1.096	1.094
Spain	1.000	0.998	1.018	1.048	1.074	1.090	1.088	1.081	1.078
Sweden	1.000	1.019	1.038	1.053	1.062	1.067	1.069	1.076	1.088
Switzerland	1.000	0.993	0.999	1.000	0.993	0.994	0.994	0.986	0.981
UK	1.000	1.022	1.056	1.103	1.134	1.164	1.181	1.181	1.189

APPENDIX C. VALUE ADDED BY INDUSTRIES

Table 15. Average Value Added per Employee over EU, EUR

Industries	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	***Average***
Accommodation and Food Service Activities	22,101	20,947	19,300	19,795	19,570	19,249	19,674	21,118	20,566	***20,227***
Administrative and Support Service Activities	35,590	33,334	29,459	29,455	30,057	30,809	31,471	33,017	31,817	***31,574***
Wholesale and Retail Trade	39,346	38,388	35,635	35,963	34,440	34,121	36,265	38,014	38,714	***36,723***
Construction	47,015	41,562	37,319	37,419	37,406	37,732	38,334	40,682	39,839	***39,675***
Transportation and Storage	51,397	48,920	45,427	44,975	44,821	45,271	46,209	48,330	45,844	***46,705***
Professional, Scientific and Technical Activities	59,218	54,465	50,665	50,985	50,428	50,690	51,404	53,171	50,947	***52,264***
Manufacturing	56,322	51,951	52,967	53,630	52,367	52,171	53,781	58,304	58,831	***54,504***
Water Supply	74,577	70,013	64,864	62,975	61,413	61,275	62,249	64,595	63,003	***64,638***
Information and Communication	98,170	95,320	84,327	84,161	82,990	80,454	80,684	84,761	81,153	***85,299***
Real Estate Activities	96,156	91,906	85,533	89,110	89,397	89,332	89,417	95,990	91,856	***90,888***
Electricity, Gas, Steam and Air Conditioning Supply	169,694	183,619	162,188	169,187	179,406	175,063	163,413	164,172	166,887	***170,160***
Mining and Quarrying	263,311	183,591	203,410	232,436	233,871	213,103	181,403	172,670	139,319	***204,137***
Average	***51,543***	***48,106***	***45,360***	***45,824***	***45,268***	***45,072***	***45,953***	***48,393***	***47,505***	***46,945***

Table 16. Real Value Added per employee index, 2008=1

Industries	*2008*	*2016*	*Min*	*Max*	*σ*	*⊿ in Value Added*	*⊿ in Emplo yment*	*CAGR*
Mining and Quarrying	1	0.529	0.53	1.00	*14.3%*	*-55.3%*	*-15.5%*	*-7.65%*
Information and Communication	1	0.827	0.82	1.00	*6.6%*	*10.2%*	*33.3%*	*-2.35%*
Water Supply;	1	0.845	0.82	1.00	*6.0%*	*13.4%*	*34.2%*	*-2.09%*
Construction	1	0.847	0.79	1.00	*6.7%*	*-14.7%*	*0.7%*	*-2.05%*
Professional, Scientific and Technical Activities	1	0.860	0.85	1.00	*4.9%*	*21.0%*	*40.7%*	*-1.86%*
Average	1	0.883	0.87	1.00	*4.2%*	*8.8%*	*18.1%*	*-1.55%*
Transportation and Storage	1	0.892	0.87	1.00	*4.4%*	*8.2%*	*21.3%*	*-1.42%*
Administrative and Support Service Activities	1	0.894	0.83	1.00	*5.7%*	*27.5%*	*42.7%*	*-1.39%*
Accommodation and Food Service Activities	1	0.931	0.87	1.00	*4.4%*	*25.9%*	*35.3%*	*-0.90%*
Real Estate Activities	1	0.955	0.89	1.00	*3.6%*	*20.3%*	*25.9%*	*-0.57%*
Electricity, Gas, Steam and Air Conditioning Supply	1	0.983	0.96	1.08	*4.4%*	*17.1%*	*19.1%*	*-0.21%*
Wholesale and Retail Trade	1	0.984	0.87	1.00	*4.9%*	*12.3%*	*14.1%*	*-0.20%*
Manufacturing	1	1.045	0.92	1.04	*4.7%*	*8.3%*	*3.7%*	*0.55%*

APPENDIX D. CO-WORKER MEAN

Table 17. Extended descriptive statistics on aggregate Co-worker mean over 2008-2016 in the EU, Norway and Switzerland

Countries	*Time Average*	*Standard deviation*	*Minimum*	*Maximum*
High Growth	**221**	**68**	**69**	**365**
Bulgaria	201	7	192	213
Czechia	261	9	251	279
Estonia	133	5	126	141
Hungary	276	15	256	302
Ireland	228	5	217	235
Latvia	169	6	160	179
Lithuania	179	12	169	203
Malta	103	22	69	141
Poland	293	3	290	298
Romania	309	4	302	315
Slovakia	272	50	237	365
High Income	**359**	**134**	**84**	**712**
Austria	276	15	240	292
Belgium	298	22	243	327
Denmark	331	12	315	356
Finland	338	18	312	369
France	515	19	493	546
Germany	372	12	356	399
Luxembourg	122	28	84	161
Netherlands	423	23	387	474
Norway	285	7	276	295
Sweden	388	12	377	415
Switzerland	302	10	288	319
UK	684	24	629	712
Mediter-ranean	**196**	**60**	**102**	**302**
Croatia	250	16	221	276
Cyprus	114	3	110	119
Greece	113	10	102	135
Italy	207	10	193	222
Portugal	195	12	174	212
Slovenia	210	5	205	222
Spain	283	19	251	302

Table 18. Extended average co-worker mean over 2008-2016 in the EU, Norway and Switzerland

Countries	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
High Growth	**232**	**225**	**215**	**216**	**214**	**216**	**218**	**223**	**225**
Bulgaria	208	192	204	195	193	194	203	208	213
Czechia	279	257	254	257	251	253	261	265	272
Estonia	141	136	131	135	140	126	135	131	126
Hungary	266	256	261	274	272	275	281	300	302
Ireland	223	228	230	229	229	229	233	235	217
Latvia	179	171	165	176	172	170	160	161	167
Lithuania	197	203	172	176	169	170	172	174	183
Malta	89	69	100	97	83	98	116	133	141
Poland	292	290	296	291	290	294	295	296	298
Romania	310	313	313	307	302	306	305	310	315
Slovakia	363	365	241	244	260	257	241	241	237
High Income	**371**	**342**	**361**	**361**	**360**	**360**	**360**	**358**	**358**
Austria	292	284	283	286	283	281	272	264	240
Belgium	327	243	311	311	294	291	298	302	306
Denmark	315	318	323	330	330	329	343	340	356
Finland	337	355	324	347	350	369	329	317	312
France			501	493	502	501	536	546	525
Germany	399	380	373	372	370	373	362	363	356
Luxembourg	161	153	159	119	113	112	111	84	86
Netherlands	474	435	387	409	417	403	420	435	431
Norway	277	276	278	281	288	295	293	289	285
Sweden	415	384	377	386	379	379	377	401	392
Switzerland		305	308	319	307	302	289	288	297
UK	711	629	707	676	688	683	684	669	712
Medi-terranean	**190**	**183**	**189**	**192**	**198**	**197**	**203**	**206**	**206**
Croatia	241	221	242	238	276	245	258	267	264
Cyprus	116	114	110	112	110	115	117	114	119
Greece	135	102	109	109	102	115	115	122	109
Italy	193	196	200	206	207	200	218	222	222
Portugal	174	181	188	188	193	201	206	210	212
Slovenia	222	209	205	208	211	208	208	209	214
Spain	251	255	266	282	290	299	301	301	302

Table 19. Extended average co-worker mean on the industrial level by countries over 2008-2016 in the EU, Norway and Switzerland

Countries	*Industries*											
	Adminis-trative	**Construction**	**Electricity**	**Information**	**Manufac-turing**	**Mining**	**Real Estate**	**Science**	**Tourism**	**Trade**	**Transpor-tation**	**Water Supply**
HG	**307**	**79**	**710**	**279**	**274**	**843**	**30**	**55**	**81**	**195**	**598**	**253**
Bulgaria	326	97	1,229	333	233	852	5	17	65	83	658	362
Czechia	318	88	364	287	321	1,530	19	48	81	220	698	301
Estonia	352	45	249	140	154	3	5	13	63	163	203	49
Hungary	320	52	543	275	379	8	41	43	94	195	1,055	342
Ireland	349	38		363	295	148	34	109	100	296	550	97
Latvia	140	67	763	161	154	109	51	16	79	171	468	242
Lithuania	289	96	198	185	197	75	3	36	106	266	329	166
Poland	431	89	1,421	364	311	3,525	56	74	129	226	605	184
Romania	317	146	1,264	381	318	1,918	74	92	79	163	637	390
Slovakia	222	75	829	306	377	15	10	101	12	168	780	358
HI	**625**	**151**	**1,129**	**410**	**387**	**449**	**76**	**175**	**166**	**419**	**729**	**272**
Austria	414	140	543	328	338	152	46	53	45	385	728	241
Belgium	1,022	61	1,343	358	352	63	5	77	33	227	722	97
Denmark	320	115	468	444	411	295	63	286	115	367	601	111
Finland	505	192	306	386	437	158	11	104	171	366	502	64
France	1,220	219	5,639	790	448	63	86	183	308	419	1,345	494
Germany	446	65	682	420	515	969	86	205	93	365	612	284
Luxembourg	428	88	34	6	426		1	167	13	53	135	7
Netherlands	1,014	170	136	403	239	48	116	177	195	489	727	445
Norway	397	140	194	312	337	998	20	198	129	230	444	114
Sweden	724	302	452	459	473	790	97	204	114	318	703	383
Switzerland	346	107	440	363	310	41	68	118	101	450	988	73
UK	769	224	3,671	733	363	764	303	330	700	1,363	1,403	974
MT	**385**	**75**	**1,120**	**349**	**199**	**614**	**10**	**81**	**100**	**209**	**428**	**229**
Croatia	246	124	1,852	360	267	2,888	29	201	108	268	675	108
Cyprus	81	34	2,253	413	107	19	4	86	118	83	199	43
Greece	236	48	762	336	133	195	5	49	25	137	271	209
Italy	556	33	1,045	488	193	1,360	6	45	114	154	625	248
Portugal	593	116	855	244	139	126	8	54	105	207	361	253
Slovenia	213	54	202	117	317	21	4	20	91	304	428	102
Spain	769	115	749	484	230	158	15	113	136	308	439	638
Total	**455**	**108**	**978**	**350**	**302**	**642**	**44**	**110**	**120**	**290**	**610**	**255**

Table 20. Extended average co-worker mean on the industrial level by industries over 2008-2016 in the EU, Norway and Switzerland

Industries	*Years*								
	2008	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
High Growth	**350**	**294**	**318**	**319**	**310**	**276**	**296**	**295**	**292**
Administrative	298	248	309	317	318	275	326	333	335
Construction	99	96	84	83	80	67	72	68	63
Electricity	768	653	735	725	770	672	728	695	651
Information	298	256	282	285	280	246	282	285	294
Manufacturing	288	237	264	272	272	274	278	285	296
Mining	1,139	927	898	930	860	740	702	715	699
Real Estate	37	30	32	45	28	23	20	30	22
Science	62	56	54	54	53	44	54	56	64
Tourism	85	73	82	84	82	71	84	83	83
Trade	186	176	183	188	194	199	206	210	215
Transportation	740	665	695	640	599	493	519	531	502
Water Supply	280	243	221	233	219	213	280	284	293
High Income	**405**	**393**	**375**	**385**	**428**	**423**	**428**	**425**	**436**
Administrative	526	611	669	663	636	637	620	612	635
Construction	157	148	147	150	149	146	158	156	148
Electricity	946	835	573	744	1,354	1,419	1,406	1,358	1,510
Information	456	423	437	429	414	397	389	388	369
Manufacturing	387	368	375	380	386	391	396	397	400
Mining	713	657	384	350	340	340	442	511	497
Real Estate	84	80	86	85	72	70	65	68	75
Science	179	167	172	174	181	184	182	166	175
Tourism	172	172	172	181	172	173	168	152	134
Trade	429	419	420	405	408	416	416	428	430
Transportation	717	714	784	763	739	730	700	695	712
Water Supply	320	280	280	263	281	248	274	255	250
Mediterranean	**272**	**267**	**294**	**324**	**328**	**375**	**317**	**305**	**276**
Administrative	349	317	341	334	390	373	427	459	474
Construction	92	86	79	75	77	74	69	67	61
Electricity	1,071	1,237	1,214	1,191	1,040	1,635	956	916	858
Information	382	354	364	388	381	364	344	288	274
Manufacturing	198	193	194	205	196	199	198	203	207
Mining				1,023	970	831	832	735	399
Real Estate	11	8	9	7	6	4	20	13	14
Science	64	47	105	108	107	109	63	65	61
Tourism	101	104	100	104	100	81	100	102	105
Trade	194	188	195	201	202	205	226	231	236
Transportation	462	476	463	418	419	406	420	404	386
Water Supply	147	165	281	228	234	288	218	233	266
Total	**350**	**326**	**336**	**348**	**364**	**361**	**355**	**350**	**348**

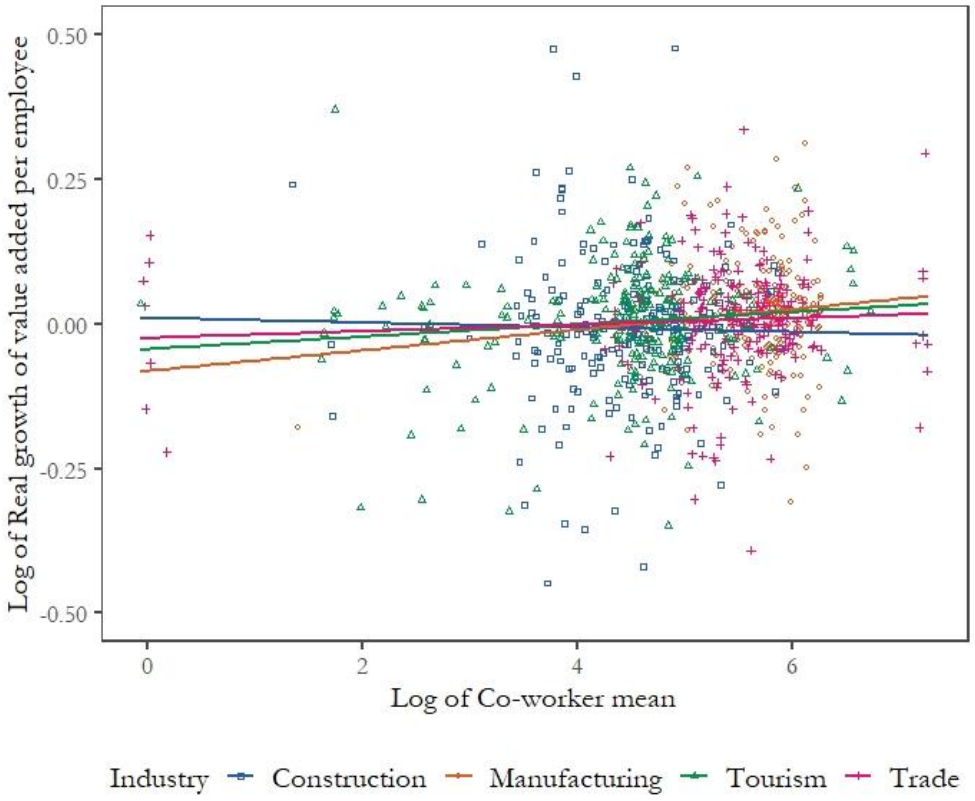

Figure 15 Co-worker mean vs growth of real value added per employee in Construction, Manufacturing, Tourism and Trade industries

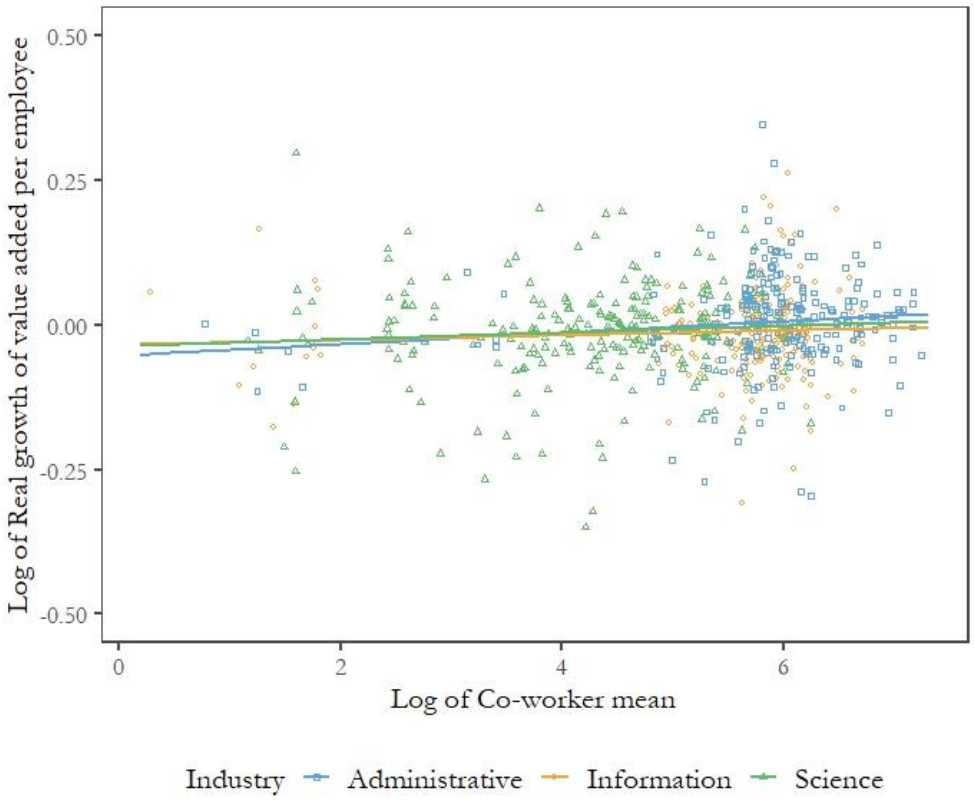

Figure 16 Co-worker mean vs growth of real value added per employee in Knowledge-intensive services

APPENDIX E. ESTIMATION RESULTS

Table 21. Complete estimation results of aggregate cross-country regression

Independent variable	Dependent variable Growth of GDP			
Log (GDP per capita)	0.269**	0.164+	0.288**	0.242**
	(0.092)	(0.080)	(0.081)	(0.075)
Log (Co-worker mean)	-0.040	-0.051	-0.037	-0.024
	(0.025)	(0.032)	(0.034)	(0.028)
Log (Average years of Schooling for adults of age 25+)	0.161	0.109	0.073	0.194+
	(0.201)	(0.195)	(0.171)	(0.113)
Log (Investment to GDP ratio)	0.003	0.026	0.011	-0.008
	(0.035)	(0.029)	(0.031)	(0.025)
Log (Depreciation + Population growth + δˆ)	-0.094*	-0.115**	-0.057	-0.063
	(0.044)	(0.040)	(0.037)	(0.039)
Log (Net entry rate of firms)	0.005+	0.004	0.004+	
	(0.003)	(0.003)	(0.002)	
Log (Private credit to non-financial institution to GDP)		-0.113*		
		(0.043)		
Log (Share of Value added in KIS)			-0.343***	
			(0.090)	
Log (Share of Value added in Manufacturing)			0.002	
			(0.117)	
Log (Share of Value added in other industries)			-0.304	
			(0.206)	
Net entry rate of micro firms				0.005+
				(0.003)
Net entry rate of small firms				0.081
				(0.055)
Net entry rate of medium firms				0.049
				(0.060)
Net entry rate of large firms				0.075
				(0.046)
Country Fixed effect	Yes	Yes	Yes	Yes
constant	-3.125**	-1.530	-3.755***	-2.910***
	(0.895)	(0.872)	(0.708)	(0.655)
N	148	140	148	218
R^2	0.252	0.322	0.417	0.429
adj. R^2	0.220	0.286	0.379	0.404

Robust standard errors in parentheses
$^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 22. Complete estimation results of averaged cross-country and cross-industry regression

Independent variables	Dependent variable (according to the data splits by type of countries) Average growth of value added per employee				
	All countries		HI	HG	MT
Log (Average co-worker mean)	0.005*	0.005*	-0.001	-0.001	0.014**
	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)
Log (Average country trade to population)	0.020***	0.018***	0.002	0.021**	0.022*
	(0.003)	(0.003)	(0.005)	(0.006)	(0.009)
Log (Initial Value added per employee)	-0.032***	-0.027***	-0.044***	-0.028*	-0.034***
	(0.006)	(0.006)	(0.004)	(0.009)	(0.005)
Log (Average Private Credits to non-financial institutions to GDP)	0.014***	0.022***	0.017***	0.038***	0.013
	(0.003)	(0.004)	(0.003)	(0.007)	(0.009)
Log (Average years of Schooling for adults of age 25+)	0.007	0.025+	0.056+	0.005	-0.012
	(0.010)	(0.011)	(0.027)	(0.069)	(0.017)
Log (Investment to GDP ratio)	-0.022*				
	(0.009)				
Log (Average (Depreciation + Population growth + δ^)	0.044**				
	(0.013)				
Industry FE	Yes	Yes	Yes	Yes	Yes
_cons	0.167+	-0.071	0.269*	-0.085	0.045
	(0.077)	(0.063)	(0.097)	(0.107)	(0.116)
N	311	323	119	120	84
R^2	0.279	0.251	0.423	0.400	0.303
adj. R^2	0.262	0.240	0.398	0.373	0.259

Robust standard errors in parentheses
$^{+}p < 0.10, ^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$

Table 23. Complete estimation results of industry specific cross-country regressions

Independent variable	Dependent variable (according to the data splits by type of industries) Real growth of value added per employee					
	All industries	Manufac-turing	Production	Services	Utilities	KIS
Log (Co-worker mean)	0.002 (0.002)	0.022** (0.007)	-0.011 (0.016)	0.002 (0.003)	0.009+ (0.005)	0.003 (0.003)
Log (Initial Value added per employee)	0.010* (0.005)	0.523*** (0.089)	0.020 (0.022)	0.022** (0.007)	0.018+ (0.009)	-0.003 (0.007)
Log (Investment to GDP ratio)	-0.011 (0.028)	-0.028 (0.064)	0.192* (0.097)	-0.072 (0.045)	-0.061 (0.078)	-0.011 (0.034)
Log (Average Private Credits to non-financial institutions to GDP)	-0.098** (0.033)	0.096+ (0.051)	-0.005 (0.135)	-0.179*** (0.052)	-0.010 (0.080)	-0.133** (0.045)
Log (Average years of Schooling for adults of age 25+)	-0.050 (0.132)	-0.140 (0.213)	0.134 (0.441)	-0.051 (0.202)	-0.177 (0.376)	-0.075 (0.183)
Number of firms entered the industry in the given year (in mln)	-0.544* (0.264)	1.291+ (0.731)	-0.577 (0.660)	-0.447 (0.366)	-18.818 (12.857)	-1.507** (0.468)
Log (Average (Depreciation + Population growth + δˆ)	-0.085*** (0.023)	-0.134** (0.043)	-0.278** (0.100)	-0.073+ (0.038)	0.034 (0.063)	-0.070* (0.032)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
_cons	0.138 (0.360)	-6.382*** (1.270)	-2.019 (1.241)	0.566 (0.560)	0.538 (1.042)	0.539 (0.488)
N	2227	199	336	740	359	593
R^2	0.106	0.691	0.155	0.238	0.176	0.214
adj. R^2	0.090	0.615	0.043	0.196	0.076	0.159

Robust standard errors in parentheses
$^{+}p < 0.10, ^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$

Table 24. Complete robustness check estimation results of averaged cross-country and cross-industry regression

Independent variables	Dependent variable (according to the data splits by type of countries) Average growth of value added per employee				
	all	all	HI	HG	MT
Log (Average co-worker mean micro firms' element)	0.005	0.005	0.007	0.005	0.004
	(0.006)	(0.007)	(0.004)	(0.012)	(0.017)
Log (Average co-worker mean small firms' element)	0.016*	0.011	0.002	0.003	0.003
	(0.007)	(0.006)	(0.012)	(0.006)	(0.014)
Log (Average co-worker mean medium firms' element)	-0.009	-0.009	-0.006	-0.001	-0.011
	(0.006)	(0.006)	(0.008)	(0.008)	(0.021)
Log (Average co-worker mean large firms' element)	0.012**	0.011**	-0.005	0.005	0.024***
	(0.003)	(0.003)	(0.005)	(0.007)	(0.005)
Log (Average country trade to population)	0.017***	0.016***	-0.004	0.021**	0.030**
	(0.002)	(0.002)	(0.006)	(0.005)	(0.009)
Log (Initial Value added per employee)	-0.028***	-0.022***	-0.045*	-0.021+	-0.032***
	(0.005)	(0.004)	(0.019)	(0.010)	(0.005)
Log (Average Private Credits to non-financial institutions to GDP)	0.016**	0.024***	0.028*	0.037***	0.024*
	(0.004)	(0.004)	(0.010)	(0.008)	(0.009)
Log (Average years of Schooling for adults of age 25+)	0.016	0.039*	0.067*	-0.026	-0.005
	(0.012)	(0.014)	(0.029)	(0.066)	(0.026)
Log (Investment to GDP ratio)	-0.015				
	(0.010)				
Log (Average (Depreciation + Population growth + δ^)	0.052**				
	(0.014)				
Industry FE	Yes	Yes	Yes	Yes	Yes
_cons	0.084	-0.158***	0.297	-0.091	-0.148
	(0.066)	(0.031)	(0.210)	(0.119)	(0.111)
N	272	282	105	104	73
R2	0.283	0.261	0.262	0.415	0.467
adj. R2	0.256	0.239	0.201	0.366	0.400

Robust standard errors in parentheses
$^{+}p < 0.10, ^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$

Table 25. Complete robustness check estimation results of industry specific cross-country regressions

Independent variable	Dependent variable (according to the data splits by type of industries) Real growth of value added per employee					
	All industries	Manufac-turing	Production	Services	Utilities	KIS
Log (Co-worker mean micro firms' element)	-0.004 (0.007)	-0.033 (0.063)	-0.056 (0.116)	-0.004 (0.010)	0.015 (0.025)	-0.028 (0.018)
Log (Co-worker mean small firms' element)	0.011 (0.011)	0.005 (0.175)	0.162^{+} (0.094)	0.029 (0.023)	-0.015 (0.028)	0.013 (0.025)
Log (Co-worker mean medium firms' element)	-0.008 (0.010)	0.309* (0.125)	-0.053 (0.084)	-0.034 (0.022)	0.001 (0.037)	-0.005 (0.017)
Log (Co-worker mean large firms' element)	0.003 (0.003)	-0.082 (0.107)	-0.018 (0.044)	0.004 (0.004)	-0.008 (0.029)	-0.008 (0.008)
Log (Initial Value added per employee)	0.016** (0.005)	0.550*** (0.090)	0.237** (0.073)	0.028* (0.012)	0.029 (0.018)	-0.002 (0.009)
Log (Investment to GDP ratio)	-0.029 (0.030)	-0.055 (0.056)	0.275* (0.116)	-0.107* (0.046)	-0.033 (0.110)	-0.041 (0.039)
Log (Average Private Credits to non-fin institutions to GDP)	-0.123*** (0.031)	0.078 (0.055)	-0.098 (0.105)	-0.182*** (0.049)	-0.068 (0.099)	-0.131** (0.046)
Log (Average years of Schooling for adults of age 25+)	-0.117 (0.132)	-0.044 (0.203)	0.152 (0.407)	-0.091 (0.205)	-0.233 (0.431)	-0.097 (0.193)
Number of firms entered the industry in a given year, mln	-0.617* (0.261)	1.546* (0.650)	-1.058* (0.531)	-0.368 (0.358)	-14.047 (15.222)	-1.406** (0.465)
Log (Average (Depreciation + Population growth + δ^)	-0.087*** (0.024)	-0.111* (0.045)	-0.197 (0.132)	-0.076^{+} (0.039)	-0.020 (0.098)	-0.066^{+} (0.034)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
_cons	0.396 (0.381)	-7.156*** (1.453)	-4.251* (1.785)	0.742 (0.588)	0.672 (1.372)	0.720 (0.524)
N	1897	192	210	654	288	553
R^2	0.154	0.718	0.324	0.291	0.194	0.225
adj. R^2	0.135	0.639	0.154	0.242	0.063	0.161

Robust standard errors in parentheses
$^{+}p < 0.10, ^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$