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An Enterprise Map of Belgium

A guide for industrial policy

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Summary

"An enterprise map of Belgium,[1] a guide for industrial policy" uses a unique dataset of approx. 305,000 Belgian enterprises[2] observed during the period 1997-2013. We study the evolution and dynamics of these firms and develop a framework for industrial policy. The framework can serve as a guide for policymakers to decide which industries to actively develop.

Studying the firm data, we observe manufacturing remains an important pillar of our economy, though its share in private sector employment and (less outspoken) its share in added value is shrinking. Jobs are lost in the manufacturing industry and created in services industries. Within the services industry both knowledge intensive services (KIS) and less knowledge intensive services (LKIS) experience similar growth percentage-wise. In absolute numbers, however, the less knowledge intensive services showed an increase in employment of 3-to-1 compared to the increase in employment of the knowledge intensive services during 1997-2013. The increase in LKIS is to a large extend driven by the system of "service vouchers", a system of government wage subsidies targeted at domestic services.

On average, real remuneration per hour increased over the period, but the underlying re-allocation between industries shows a large heterogeneity with different effect on different groups: higher paying manufacturing jobs are predominantly replaced by lower paying services jobs. Also in Belgium, there is an ongoing trend of job-polarisation between higher wage jobs found in knowledge intensive services and (what is left of) manufacturing on the one hand and lower wage jobs found in less knowledge intensive services (distribution and service vouchers related sectors) on the other hand.

Geography wise, we also find diverging trends. Whilst the less knowledge intensive services experience similar growth across counties (arrondissements), manufacturing and knowledge intensive services do not. This might also lead to a geographical polarisation between different areas.

One potential driver of the these trends is further scrutinised, i.e. the incidence of high growth firms. We know that a limited number of high growth firms play an essential part in job creation and reallocation. We find a clear decline in the amount of high growth firms. This could lead to a loss of dynamism and entrepreneurship in our economy.

Policy makers needn't necessarily remain bystanders as these trends emerge. Recent evidence has shown that industrial policy can in fact result in higher economic performance, provided it is well designed. We develop a framework for an industrial policy based on the level of innovation and specialisation in different manufacturing industries. We find a significant potential for the pharma and transport & automotive industry. The textiles & apparel industry and electronics and electrical equipment manufacturing could be further developed into future key industries. They will need, however, increased levels of innovation and further specialisation.

[1] The title is inspired by the work of Sutton and Kellow (2010) who engaged in various projects describing case studies of firms in a number of African countries.

[2] The total dataset consist of approx. 600,000 enterprises of which almost half has no added value or employees during their entire lifespan.

I. INTRODUCTION

Since the financial crisis, the economic performance of Belgium and most other European countries has remained extremely weak with close to no growth over the last ten years. Despite limited GDP growth there has been quite some private job creation, but also job destruction, resulting is limited aggregate net job growth. While such a process of creative destruction may result in increased productivity as old, unproductive jobs are being replaced by new more productive ones, not much is known about the underlying microeconomic drivers of this process of job creation and job destruction. In particular, is it the large firms that create most jobs and are more productive or is it the small and medium sized enterprises that matter as often claimed by policy makers In this context fast-growing, young and technology driven companies are often seen by many as the recipe to replace the jobs lost in the “old economy”.

Intuitively, we clearly make the distinction between small and large firms, fast growing and slow growing industries. Yet, traditional macroeconomic approaches are driven by models that are based on aggregate variables with little attention paid to understanding the dynamics under the hood. In this paper we therefore follow the insights already noted by Nobel prize winner Ronald Coase, decades ago. In particular, one should look inside the black box of our economy and examine actual businesses and their heterogeneous behaviour, rather than making assumptions about a “representative firm” present in many macroeconomic theoretical models.

We take a microeconomic firm level perspective to obtain a better understanding of competitiveness, job creation and productivity of different industries and regions in Belgium. Firms can differ in many ways such as size, age, location, growth, etc … and these differences matter.

Recent research shows that firm size heterogeneity is an important factor for understanding the impact of idiosyncratic shocks for the overall economy for a number of reasons. For instance, an idiosyncratic shock to one particular product or firm may become important through its central role in the supply chain and hence the inter-linkages between firms can amplify such shocks.[3] This research builds on the insight that when the firm size distribution is fat-tailed, idiosyncratic shocks to large firms contribute more to aggregate fluctuations. This is also known as Gibrat’s law, i.e. when the standard deviation of the percentage growth rate of a firm is independent of its size, individual firms can matter in the aggregate. For instance, Acemoglu et al. (2017) show that large economic downturns may result from the propagation of microeconomic shocks over the input-output linkages across different firms and sectors within the economy. Using Belgian data, Magerman et al. (2016) identify two sources of firm-level heterogeneity that contribute substantially to aggregate fluctuations: asymmetries in supplier-buyer relationships and the skewed distribution of sales to final demand.

[3] While the literature has explored the role of sectoral shocks in aggregate fluctuations (e.g. Long and Plosser, 1983), the *role of firms* in the aggregate business cycle has received relatively little attention until recently. The role of firm heterogeneity has been exploited in recent work explaining fluctuations in GDP growth (Davis, et al., 2007; Gabaix, 2011; Acemoglu, et al, 2012), unemployment (Moscarini and Postel-Vinay, 2012), trade (di Giovannni, Levchenkov, and Mejean, 2014; Bernard, Van Beveren and Vandenbussche, 2014) and aggregate (export) prices (Amiti, Itskohki and Konings, 2014).

Firm heterogeneity is also an important factor for job creation. The prevalent believe that small and young firms account for a disproportionately large share of job creation is rebuked by Henrekson and Johanson (2010). They analyse 20 empirical studies and find that a large share of net employment growth is generated by a few rapidly growing firms, so-called Gazelles or High Growth Firms (HGFs). These Gazelles are not necessarily small and young. Though they tend to be younger than the average firm, they can be of any size or age. Furthermore, Gazelles are not overrepresented in high-technology industries, but there is some evidence that they are overrepresented in services. Using Belgian data, Geurts and Van Biesebroeck (2014) have studied job creation in “de novo” or newly founded firms. They find, that once the data is corrected for spurious entrants, de novo entrants’ contribution to job creation is relatively small and not very persistent. Larger, young firms show higher growth rates than smaller ones, implying Gibrat’s law does not hold. Firm size at start-up does seem to have some predictive power for subsequent job creation.

One might conclude HGFs (young, old, big or small) should be the holy grail for a policy maker in pursuit of growth and jobs. Unfortunately it remains difficult to ignore firm growth episodes are very erratic and seem impossible to predict (see e.g., Moreno and Coad (2015) for an overview of the literature and empirical studies from which they derive, amongst others, this stylised fact). Although, the strategic management literature on how to become and stay better than one’s peers is very broad, it remains a tough task to proof the number of sustained superior performers is higher than one would expect from sheer randomness (see e.g., Henderson et al. 2012).

Firm location is another source of heterogeneity. Since the 1930s, a large literature has developed around the economics of firm location. Arauzo-Carod et al. (2010) summarize the factors influencing the firm location decision: (1) neoclassical factors such as agglomeration economies, transportation infrastructure, human capital characteristics; (2) institutional factors such as taxes and regulation and (3) behavioural factors such as the locational preferences of entrepreneurs which seem to matter for location decisions especially of smaller firms. Larger firms are more driven by “objective” factors. Altomonte and Békés (2016) recently published a European wide study on competitiveness and stated that *“average measurements, which are the parameters on which most policies are generally based, do a poor job of grasping the actual level of competitiveness within countries (regions) and between them.”* They find large heterogeneity in the performance of enterprises. A relatively small group of companies appears to be responsible for the dominant share of innovation and export of a region or country. Li et al. (2016) come to a similar conclusion for the U.S. They conclude that the conditions fostering high-growth firms differ between regions (U.S. counties) and industrial sectors. Furthermore, conditions favouring high-growth firms are likely to be different from those favouring new firms in general.

We use a database from the National Bank of Belgium containing the annual accounts of all Belgian enterprises. We observe these companies during the period 1997-2013. This offers us the unique opportunity to understand firms dynamics over a longer time period.

The next section describes the data set used in more detail. In Section III we document the sectoral and regional economic structure in Belgium. Section IV specifically zooms into one source of firm heterogeneity, i.e. individual firm growth and more particular the impact of High Growth Firms. Section V focuses on the geographical structure. Section VI explains specialisation and comparative advantage which we used for our policy framework introduced in Section VII. Section VIII concludes.

II. DATA

We use a database from the National Bank of Belgium (NBB) containing the unconsolidated annual accounts of all non-financial, for-profit enterprises incorporated under Belgian law that are legally required to file their annual accounts with the NBB. These annual accounts typically include the main figures of the profit and loss statement, balance sheet as well as figures on the number of employees, sector, activity and location. Data is on firm level and does not split figures over multiple establishments of the same legal entity. The dataset does not include data from self-employed workers that do not operate via an incorporated legal entity.

We observe these companies during the time period 1997-2013. New calculation methods to account for the number of employees were introduced starting from 1996. We start our observations in 1997 to ensure all companies (including those whose fiscal year cover two calendar years) report using the same definitions.

Our primary data set consists of 227,512 firms in 1997 and 397,957 firms in 2013. The number of firms reduces to 156,746 (1997) and 215,805 (2013) after we drop firms without employees or added value during their entire lifespan. In Belgium, many self-employed people operate out of a legal entity or so called “management company”. During the total period we observe in total 304,958 firms of which 96,918 are active during the full period 1997-2013.

If we aggregate all firms in our dataset and compute the total employment, we obtain 2,402,532 jobs in 2013 corresponding with 1,996,792 Full Time Equivalents (FTE). For 1997 these figures are 1,806,195 jobs and 1,644,436 FTEs. End 2013, the total Belgian working population amounted to 4,490,827 workers according to the Federal Public Service Economy. We hence cover over 50% of total employment. The approx. 2 million workers not captured by our data are mostly self-employed, employees directly employed by a self-employed person, civil servants or people employed by non-profit organizations or public sector companies and organisations.

The data covers the financial and operational information as reported by the company’s annual accounts filed with the NBB. Only a limited number of companies are required to report turnover. Added value[4], however, is reported by all companies in our dataset.

The uniqueness of our dataset is the fact that we are able to track all companies over a large timespan.

This data set allows us to document a number of stylized facts characterizing the Belgian economy, such as the sectoral and geographic concentration of firms, which is explained in the next sections.

[4] Added value or gross margin is the difference between the total sales revenue and the total cost of components, materials, and services purchased from other firms.

III. SECTORAL ECONOMIC STRUCTURE

We document the relative importance of sectors by aggregating up the number of jobs in private firms by sector. Figure 1 below shows the evolution of the total employment in the main sectors of the economy. We clearly see an upward trend of total private sector employment, only interrupted during the technology crisis of the early 2000's and the financial crisis in 2009. Since 2011 growth remains sluggish. More striking though, is the continuous decline of jobs in the manufacturing sector replaced by jobs in the services sector. It's important to note that this does not necessarily mean these employees are not employed anymore within the premises of a manufacturing firm. It might be due to outsourcing of non-core activities such as catering, cleaning, building management, HR, etc … where these employees would move from the pay-roll of the manufacturing firm to the payroll of a services firm.

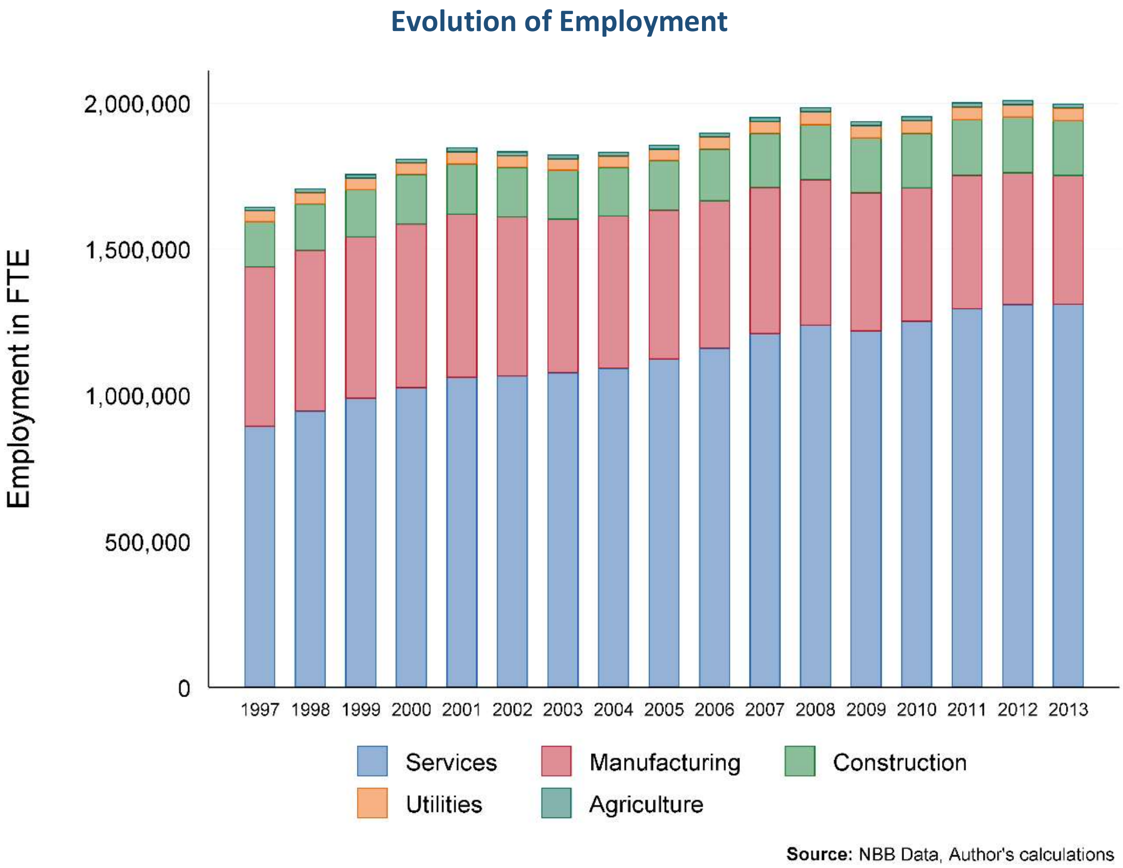

Figure 1: Evolution of employment in the main sectors of the economy in Full Time Equivalent (FTE). Overall private sector employment increases. Employment in manufacturing gradually decreases in favour of employment in services industries.

Figure 2 below enables us to better understand this dynamic. We list the relative importance of each NACE 1-digit industry.[5] We indeed see the rapid decline of the manufacturing industry and the fast rise of admin & support services. The distribution sector gains importance as well. Construction is able to hold its share in total employment. This implies that the perceived trend that construction is

[5] The definition of the different 1-digit and 2-digit NACE codes are given in Appendix 1.

more and more carried out by non-Belgian subcontractors (i.e. by employees of non-Belgian enterprises that do not appear in our dataset) does not lead to a relative decline of jobs within Belgian construction firms.

Evolution of Employment per Industry

As share in Total Private Sector Employment

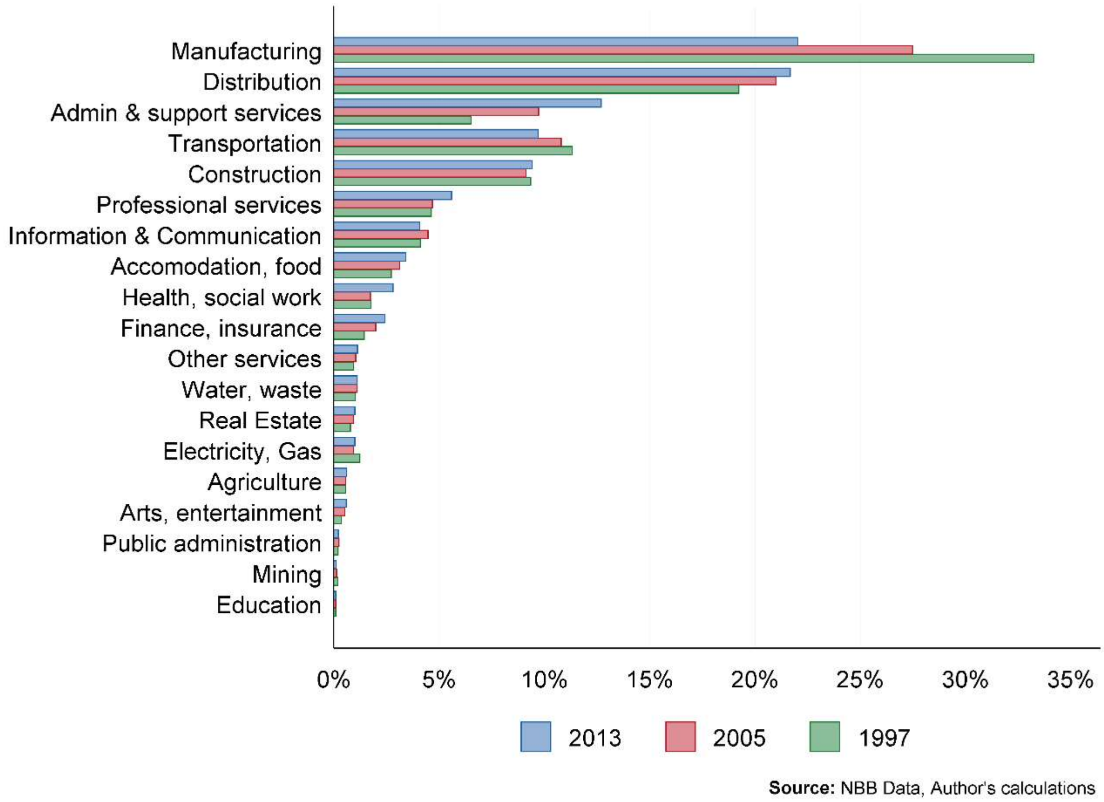

Figure 2: The evolution of the relative importance of different NACE 1-digit industries in total private sector employment (ranked by relative importance in 2013). The decline in manufacturing jobs is compensated by a strong increase in Admin & support services and Distribution.

Health and social work activities also show strong growth, especially since 2005. This NACE 1-digit sector includes, amongst others private sector health and residential care facilities.

A pure "administrative" change from manufacturing to admin & support services cannot explain the large loss of manufacturing jobs. Figure 3 below zooms into the different 2-digit sub-industries of Manufacturing. We see large job losses in industries that are generally perceived having moved to Asian low cost countries (e.g., chemicals, textiles, wearing apparel, furniture, electronics). The decline in industries such as motor vehicles and basic metals might also be explained by a loss of competitiveness of Belgium compared to other European countries.

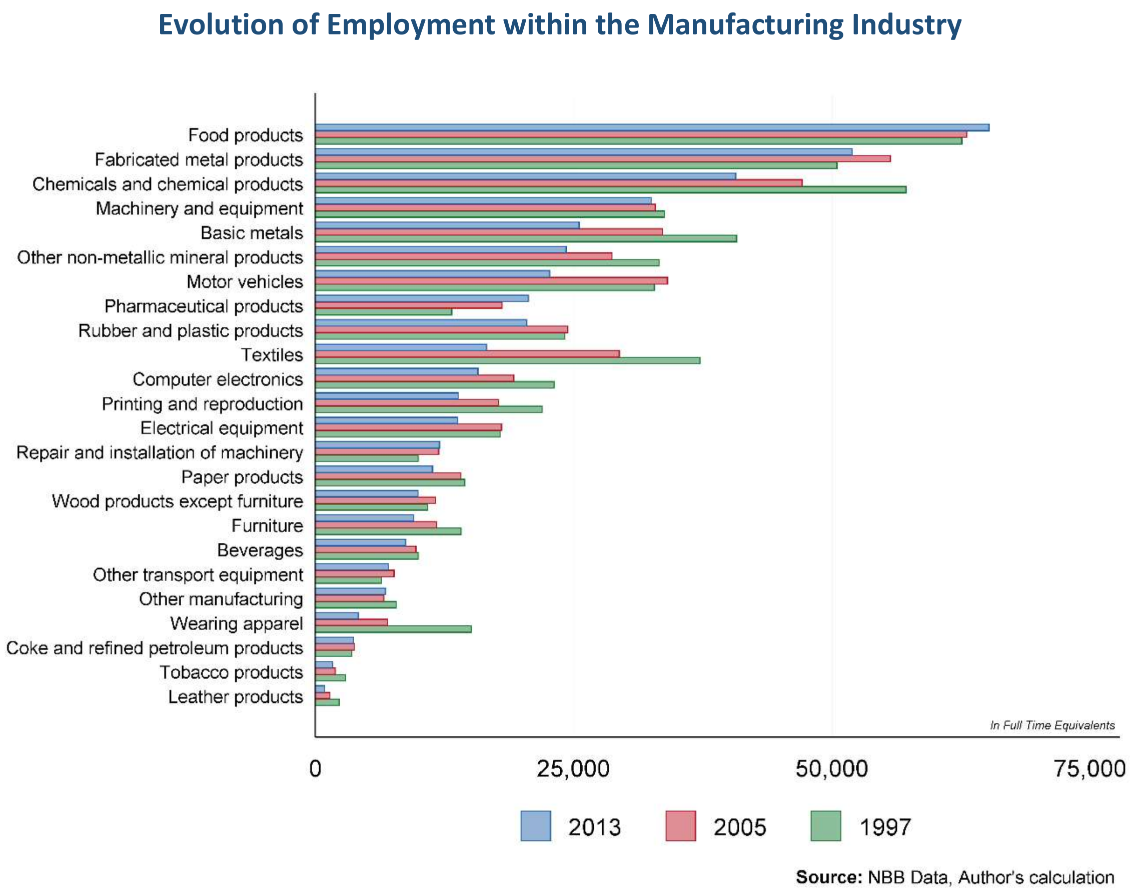

Figure 3: The evolution of employment within the 2-digit Manufacturing sub-industries (ranked by largest employers in 2013). The industries generally perceived to have relocated to low cost countries (chemicals, basic metals, wearing apparel, textiles) show steep declines.

Figure 4 below allows us to better understand job movements between industries in the overall job creation. Losses are indeed predominantly found within manufacturing. The idea that we gradually move jobs from the make-economy to highly skilled services does not hold however. The main job creators are low skilled services jobs found in retail, employment activities and building and landscape services.

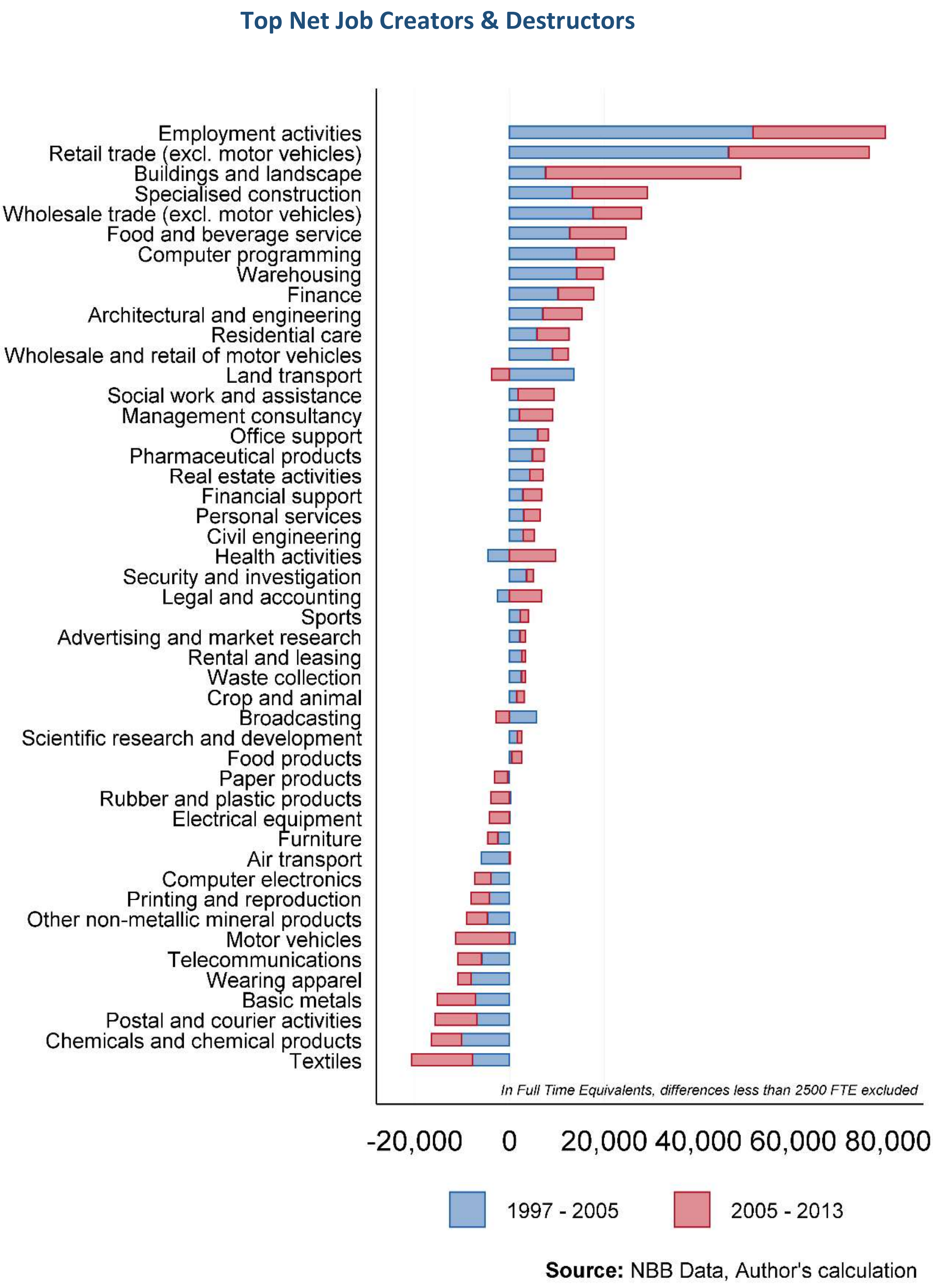

Figure 4: Net job creation 1997-2013 of NACE 2-digit industries (sectors with difference less than 2,500 excluded).The steepest rise can be found in the industries that make use of “service vouchers”, retail and wholesale.

It is important to note that the 2 latter industries account for the so called “service vouchers”, a system introduced in 2004 that allows private persons to flexibly employ domestic help at a subsidized hourly salary. The service voucher system employed 68,414 FTE in 2013 according to the National Social Security Office or approx. half of the net job creation in employment activities, building and landscape services between 1997-2013.[6] Employment activities also include temporary workers directly employed by an employment agency, but outsourced to a company in need of temporary labour. This system accounted for approx.. 35,000 FTE in 1997, 56,000 FTE in 2005 and 58,000 FTE in 2012[7]. Temporary labour hence is responsible for half the gain in employment activities between 1997-2005, but has only a limited impact on the gain during 2005-2013. Another interesting finding is that the land transportation sector was able to significantly increase employment before 2004, but has seen losses since. This might be linked with the increasing presence of Eastern European transportation firms in Belgium since these countries became a EU member in 2004.

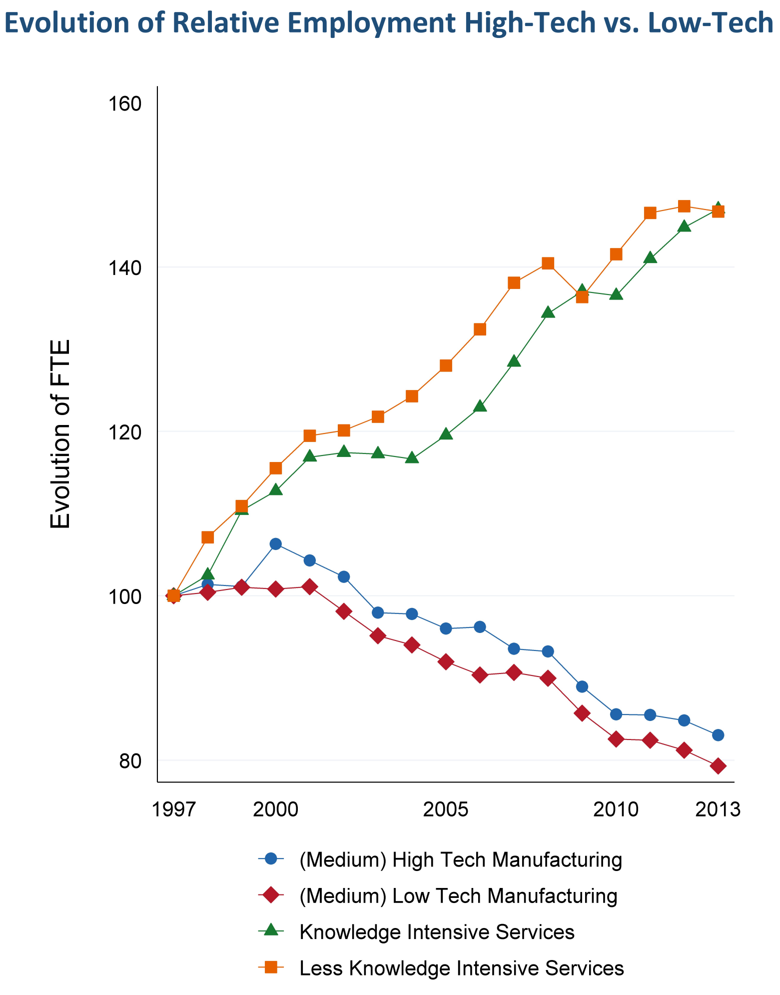

Figure 5: Relative evolution of employment in high-tech and knowledge intensive vs. low-tech and less knowledge intensive industries (1997 = 100)

From Figure 4 we indeed learned that new jobs are not necessarily created in high-tech or knowledge intensive sectors. To get a better understanding of this phenomenon we make a distinction between Knowledge Intensive Services (KIS), Less Knowledge Intensive Services (LKIS), (medium) high-

[6] A limited number of these 68,414 FTE is not captured in our dataset as non-profit organizations and public sector organizations are also allowed to employ service cheque personnel.
[7] Figures for 2013 not available.

tech manufacturing industries and (medium) low-tech manufacturing industrie.[8] Figure 5 shows the relative evolution of employment between these categories. We can clearly see that there are only limited differences in employment growth rates between KIS and high-tech on the one hand and LKIS and low-tech on the other hand.

Looking at absolute employment growth though, we see substantial differences. LKIS indeed showed a strong increase (from 662,441 FTE in 1997 to 972,081 FTE in 2013, increase of 309,641 FTE or approx. 47%). KIS showed a similar percentage-wise increase but coming from a lower base (from 230,162 FTE in 1997 to 338,437 in 2013, an increase of 108,275 or approx. 47%). Table 1 shows that since knowledge intensive industries start from a far smaller base, a similar relative growth results in far smaller number of jobs being created.

	1997-2013
(Medium) High-Tech Manufacturing Industries	-31,324
(Medium) Low-Tech Manufacturing Industries	-74,933
Knowledge Intensive Services (KIS)	+108,275
Less Knowledge Intensive Services (LKIS)	+309,641

Table 1: Change in employment (in FTE) between 1997 and 2013.

We now turn to the total real added value[9] generated by the private sector. Figure 6 clearly shows the strong growth leading to the 2000 technology downturn and the 2008 financial crisis followed by the European sovereign debt crisis since. A striking difference is that the recovery was swift after 2000, but stagnant since 2010. This is not surprising as the overall GDP growth was very sluggish as well during the same period.

Figure 7 (left) shows how the added value of the different industries evolved as share in the total added value. Manufacturing clearly remains the main added value creator and its drop is less outspoken than its drop in employment share. This implies its labour productivity went up (Figure 7 right). “Admin & support services” show a steep drop in labour productivity and is not able to match its strong increase in employment with a similar increase in added value. An industry with high labour productivity indicates high capital intensity and/or high skill intensity. An industry with low labour productivity indicates low capital intensity and/or low skill intensity.

[8] (Medium) High-Tech and (Medium) Low-Tech Manufacturing industries and Knowledge Intensive Services (KIS) and Less Knowledge Intensive Services (LKIS) as defined per 2-digit NACE code by EUROSTAT with the exception of Employment Activities (NACE 78) that we, unlike EUROSTAT, categorise as LKIS for Belgium as the job creation is mainly driven by service cheques.

[9] Added value is deflated to 2005 prices per NACE 2-digit sector using EU KLEMS data until 2011 and output price indices from Statistics Belgium for 2011-2013. Unless stated otherwise, added value refers to real added value.

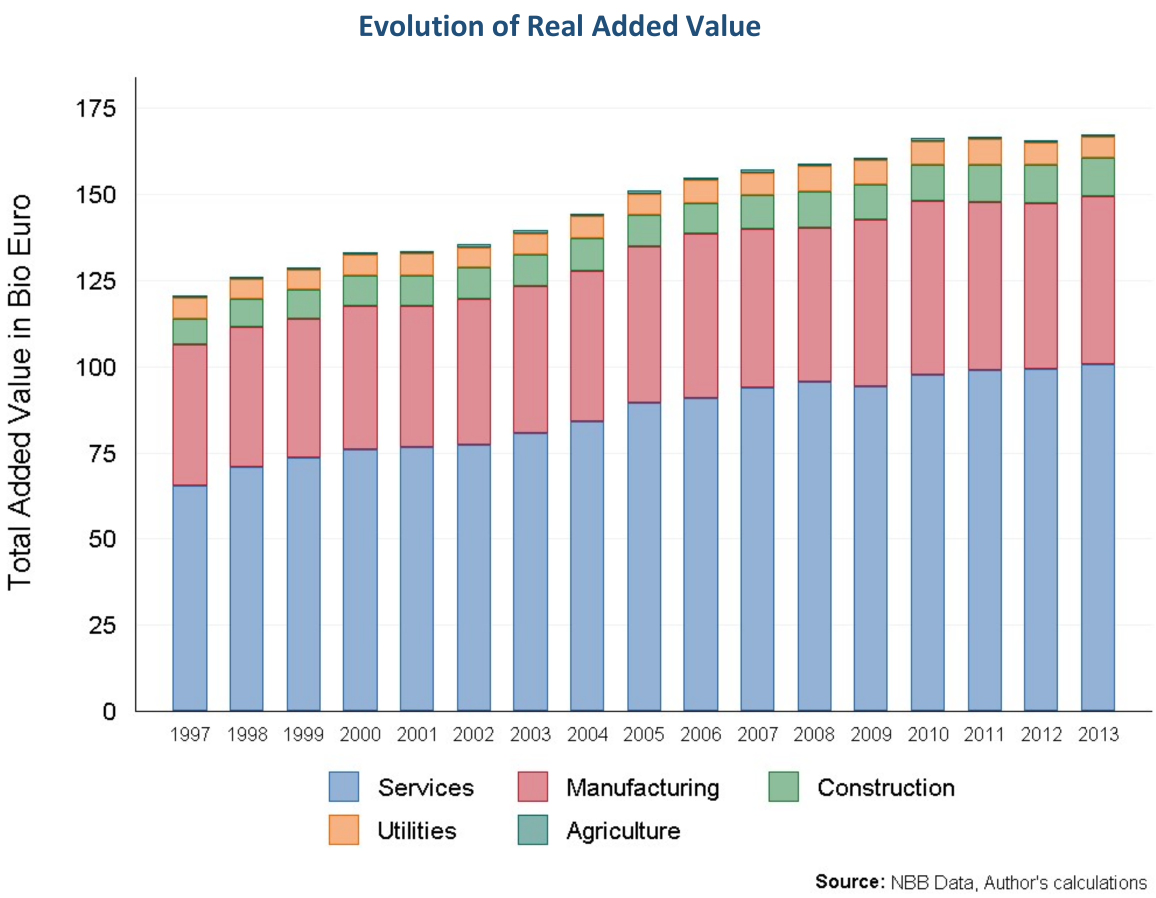

Figure 6: Evolution of real added value in the main sectors of the economy (in Bio Euro, 2005 prices). Services become increasingly important at the expense of manufacturing, though this trends is less outspoken as for the employment evolution over the same period.

The effect of shifting jobs from sectors that experience high productivity growth to sectors with limited productivity increases has intrigued economists for decades. Baumol and Bowen (1966) already introduced the notion of a "cost disease": industries that cannot match the overall economy's productivity gains, but have to match wage increases to attract workers are at risk to gradually decline. As such the use of "service vouchers" for domestic cleaning services is already a sign of this cost disease as many of these jobs would not exist or only exist in the informal economy if the wages weren't government subsidised.

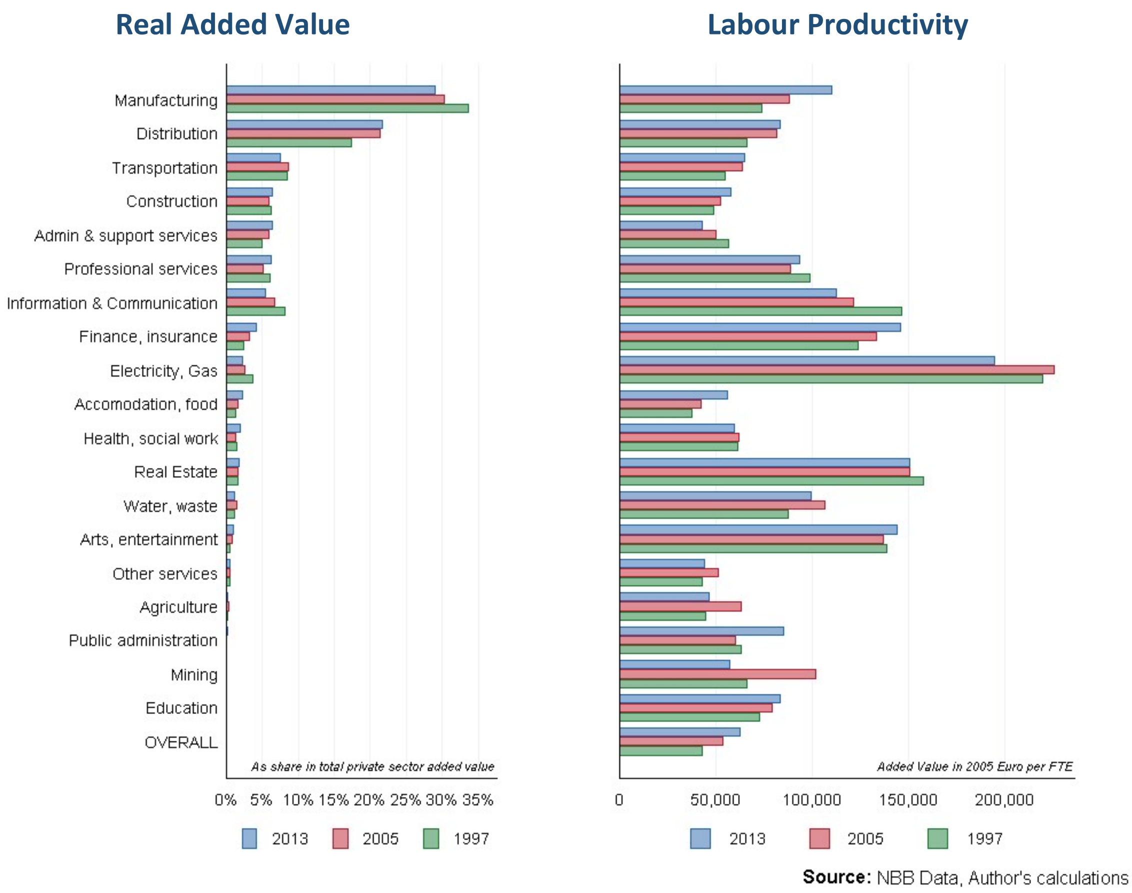

Figure 7: Relative importance of different industries in total private sector real added value (left) as well as labour productivity (€/FTE, 2005 prices) for each of these sectors (right) for the years 1997, 2005 and 2013. Manufacturing remains the main added value creator due to its high labour productivity, Admin & Support Services are not able to convert their strong increase in employment into an evenly strong increase in added value because it labour productivity went down.

The link between real remuneration[10] and productivity therefore matters to better understand the long term effect of the reallocation between manufacturing and services. Neoclassical models on worker compensation suggest that wages should reflect the marginal added value of a worker. Although this not always exactly holds[11], we clearly see in Figure 8 a positive correlation between the natural logarithm[12] of labour productivity and remuneration. Higher labour productivity implies higher wages. Figure 8 (left) includes all NACE 2-digit sectors between 1997 and 2013, Figure 8 (right) excludes outlying sectors with little employment.[13] Fitting a straight line through the observations using Ordinary Leased Squares (OLS) we can see that a change in labour productivity is 10% has an impact of

[10] Deflated to 2005 prices using the average CPI for Belgium as published by Statistics Belgium. Unless stated otherwise, remuneration refers to real remuneration.
[11] See e.g., Van Biesebroek (2015) for an overview of the literature on the link between wages and productivity.
[12] The use of logarithms instead of the original number allows us to spot the correlation between percentage-wise increase rather than absolute increases of the variables.
[13] Excluded sectors (FTE 2013 in brackets): *Arts & Entertainment* (2,443), *Gambling* (1,735), *Water Transport* (1,248), *Mining Support Service* (36), *Mining of Coal and Lignite* (0 FTE after 2000). The sectors *Real Estate Activities* (20,329) and *Rental & Leasing* (8,626) are excluded as outliers because they have very high labour productivity, but low wages, this can be linked to the fact these sector are highly capital intensive.

5.6% on the remuneration. Introducing sector fixed effects into the regression increases the effect of a 10% productivity increase on remuneration from 5.6% to 7.4%.

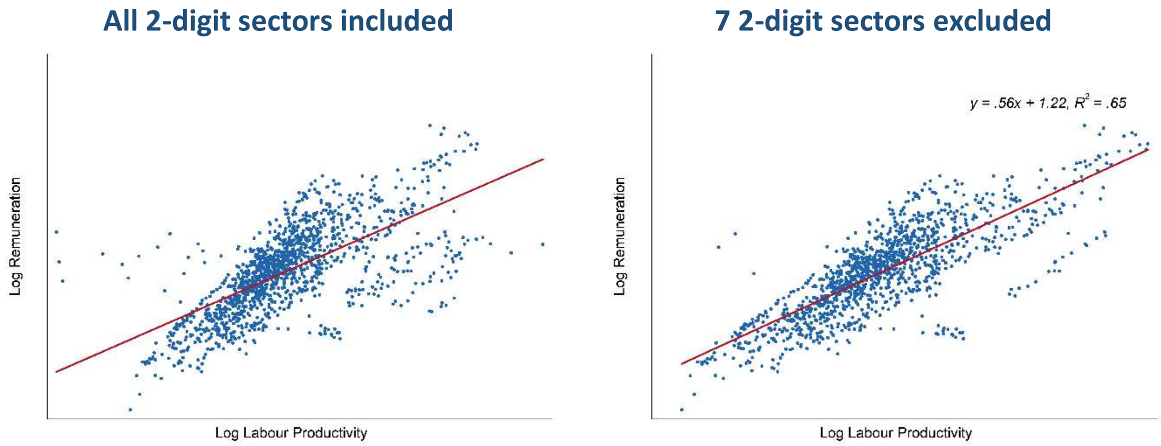

Figure 8: Correlation between the logarithm of Labour Productivity and Remuneration (in €/hour). Each dot represents a NACE 2-digit sector for 1 year between 1997 and 2013. The coefficient 0.56 for the red fitted straight line implies that for an increase in labour productivity of 10%, remuneration goes up with 5.6%

Figure 9 makes the distinction between manufacturing (right) and non-manufacturing sectors (left). We see that a similar increase in labour productivity has a bigger effect on remuneration in manufacturing industries than in non-manufacturing industries. An increase in labour productivity of 10% corresponds to increase in remuneration of 5.4% for non-manufacturing industries and 5.9% for manufacturing industries. Introducing sector fixed effects, this number increases to 7.0% for non-manufacturing and 8.2% for manufacturing. Remuneration in manufacturing hence tends to rise faster with productivity than in non-manufacturing industries.

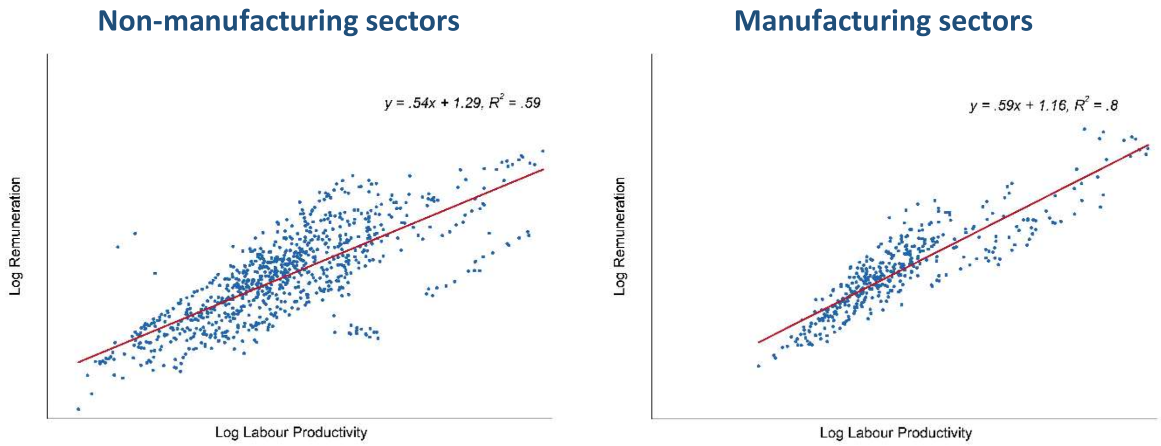

Figure 9: Correlation between the logarithm of Labour Productivity and Remuneration (in €/hour) for NACE 2-digit non-manufacturing industries (left) and manufacturing industries (right).

Figure 10 now shows how the remuneration evolved in the different NACE 1-digit industries (left) and shows how employment evolved in the same sectors (right). We clearly see our economy loses jobs in high paying sectors where there still is real salary growth (manufacturing) to lower paying sector with sluggish real salary growth (admin & support services).

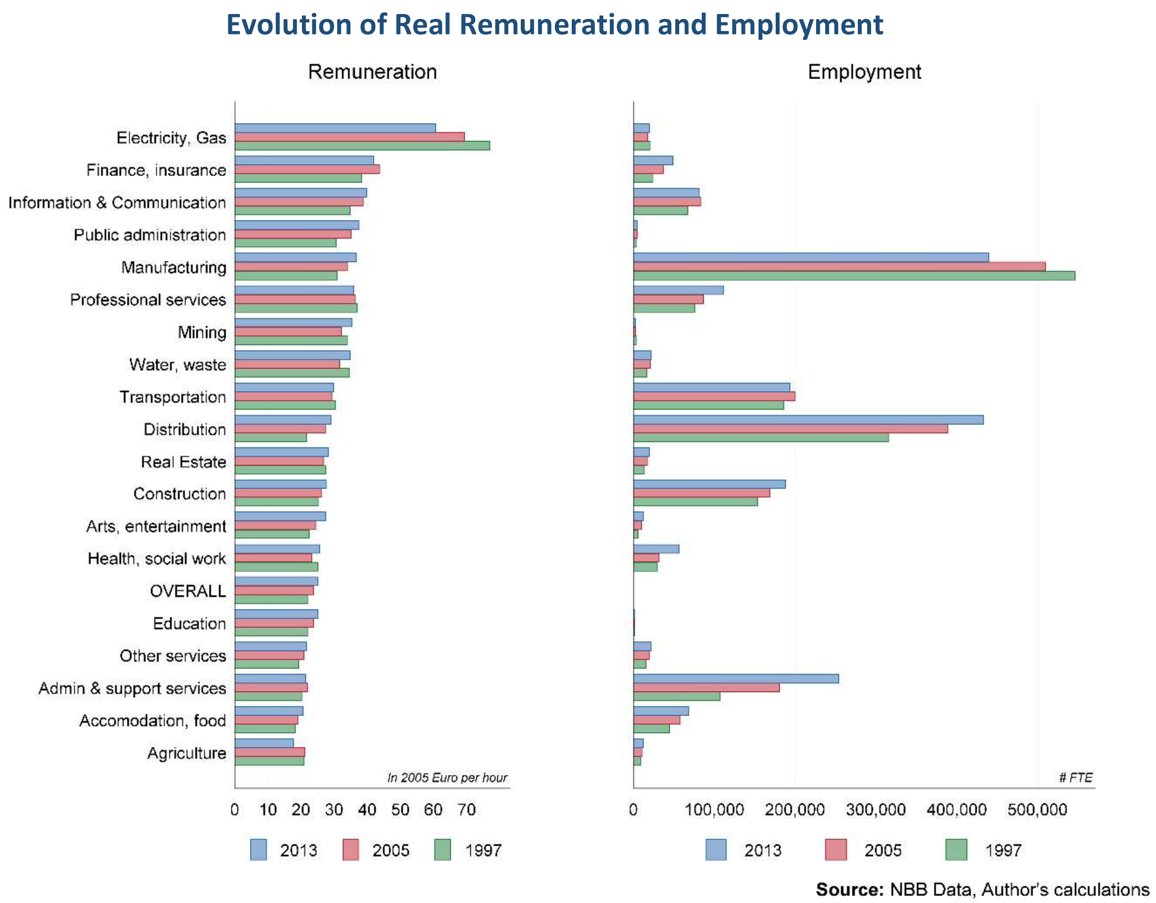

Figure 10: Evolution of Remuneration (left) and Employment (right). Over the years, jobs shifted from high paying sectors such as manufacturing to lower paying services sectors.

To further understand the impact of the trend of moving jobs from higher paid manufacturing to lower paid services, two well described phenomena play an important role as well:

- *Local multipliers* or the fact that when a new job is created this might also lead to additional job creation via increased demand for local goods and services. Moretti (2010) estimates that 1 manufacturing job in a given city, creates 1.6 jobs in non-tradable sectors in the same city. Goos, Konings & Vandeweyer (2015) even estimate this effect to be as large as 5 for high tech jobs. The loss of manufacturing jobs in a city or region is therefore not necessarily compensated by more services jobs in that same region, but might be compensated in another region where there still is a flourishing manufacturing or higher-skilled services industry.
- *Job polarisation* or the fact that we see an increase in employment share in the highest and the lowest paying occupations at the expense of the middle-wage occupations. Goos and Manning (2006) show that this phenomenon can explain a significant part of the rise in wage differentials. The impact of local policies to reverse this global trend of job polarisation is limited. Local policies can have an effect, however, on whether these middle-wage jobs are replaced by higher paying or lower paying jobs.

Figure 11 shows the evolution of the real added value between 1997 (€120.6 Bio) and 2013 (€167.3 Bio) and a simple decomposition with and without reallocation of labour between industries. If employment would have grown evenly across the NACE 2-digit sectors (i.e. there is no labour reallocation between these sectors), added value would have been €179.4 Bio by 2013. €16.5 Bio of the increase is driven by employment growth (more jobs) and €42.3 Bio is driven by the increase in labour productivity (more added value per job).[14]

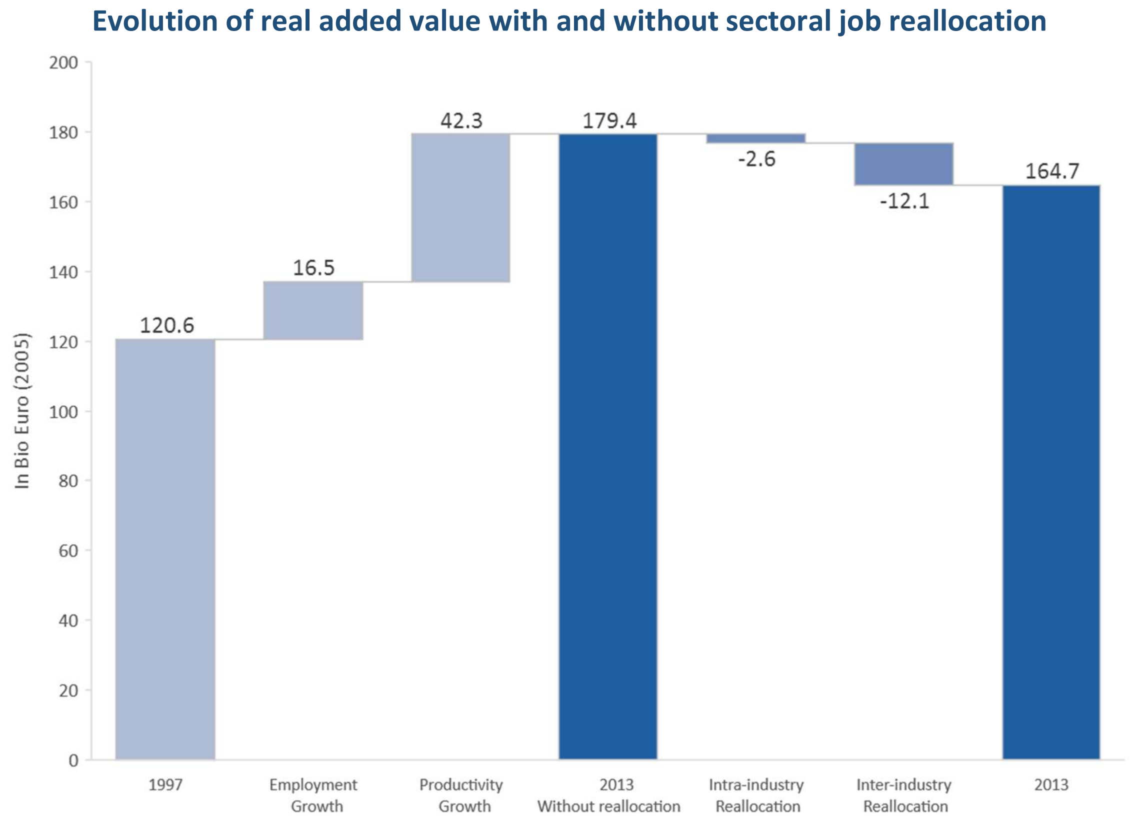

Figure 11: Evolution of real added value (in Bio Euro, 2005 prices) and its drivers between 1997-2013. If there were no job reallocation between sectors, added value could have been larger.

The difference between this *without reallocation* added value and the true 2013 added value is driven by the reallocation of labour between the different industries. Labour market theory suggests that, in the absence of any frictions, labour is reallocated to more productive industries. This implies that the *without reallocation* added value in fact should be lower than the observed 2013 added value. This is not the case and reallocation seems to have a negative impact on added value. Workers switch to less productive industries rather than to more productive one. If we only account for an *intra-industry* reallocation *within* the same 1-digit industry[15] (e.g., a switch from one manufacturing sub-subsector to another) the negative impact on added value is limited. The gap with the actual added value is mainly driven by *inter-industry* reallocation of jobs *between* industries as workers are reallocated to less productive parts of the economy.

Since there is a direct link between labour productivity and worker remuneration and hence welfare, this added value gap driven by reallocation matters. Whether this is a misallocation caused by frictions or simply a new equilibrium after 2 decades of intense globalisation is unclear. Belgium's low labour mobility as described by Neefs and Herremans (2015) and the fact that Belgium has the highest

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[14] It's important to note that this high level analysis does not account for the interlinkages between resource allocation (e.g. labour) and productivity growth. The increase of the productivity of a sector can be driven by reallocation of resources away from less productive firms. Overall productivity then rises without necessarily the productivity of individual firms rising.

[15] Rather than assuming employment grows evenly in each 2-digit sector (the bases for the *without reallocation* calculation), we now assume it grows evenly across each 1-digit sector.

mismatch between labour supply and labour demand in the EU-15 (Zimmer 2012) seem to at least suggest some part of the misallocation is due to frictions. Belgium indeed combines high employment in several regions with a significant number of open vacancies even in the exact same region. Evidence whether trade causes significant inter-sectoral reallocation is double. Revenga (1992) found the effect to be large for the U.S. Goldberg and Pavcnik (2007) found it to be insignificant for developing countries.

Recent models on the dynamics of labour markets and trade such as Dix-Carneiro (2014) and Coşar et al. (2016) do allow for several frictions such at search and switching costs, firing and hiring costs, inter sectoral immobility of acquired skills, etc… A common characteristics of these models is that they do suggest overall growth is not evenly spread between different types of firms and different types of workers.

IV. HIGH GROWTH FIRMS

The previous Section looked at the sectoral diversity in our economy. Another source of diversity is individual firm growth and more particular the impact of High Growth Firms (HGFs). HGFs play an important role in a dynamic economy as they represent a disproportionate share of job creation. The OECD defines HGFs as *"All enterprises with average annualized growth greater than twenty percent per annum, over a three-year period, and with ten or more employees at the beginning of the observation period."* Growth is measured by the number of employees and by turnover. In our dataset, however, turnover is only reported for a limited number of firms and we hence use nominal added value instead[16]. Added value is an important economic metric as this directly translates into GDP. Furthermore, we use compound annual growth rather than average growth. This avoids a firm with yearly employee numbers of e.g., 10 (year 0), 5 (year 1), 10 (year 2) , 11 (year 3) is categorised as a HGF.

Figure 12 shows the incidence of HGFs vs. the total number of firms. Only a small percentage of firms are high growth. More firms are high growers based on added value than based on employment. This is not surprising as nominal added value indeed grows faster than the total workforce due to inflation and productivity gains.

The importance of HGF declines and is especially clear as share of added value that is generated by HGFs. The same trend as we see for the economy as a whole is valid for HGFs: they become increasingly active within sectors with lower labour productivity. HGFs play an important role in job creation and job reallocation from declining firms to growing firms and are therefore an important part of a dynamic economy. Currently too little is known about the drivers of this evolution. We do know this is not a trend exclusive to Belgium, Decker et al. (2015) have shown a decline in high-growth young firms in the U.S. since 2000.

[16] For high growth based on added value, we impose that the added value needs to be at least €300,000 at the beginning of the observation period which roughly corresponds with 10 employees.

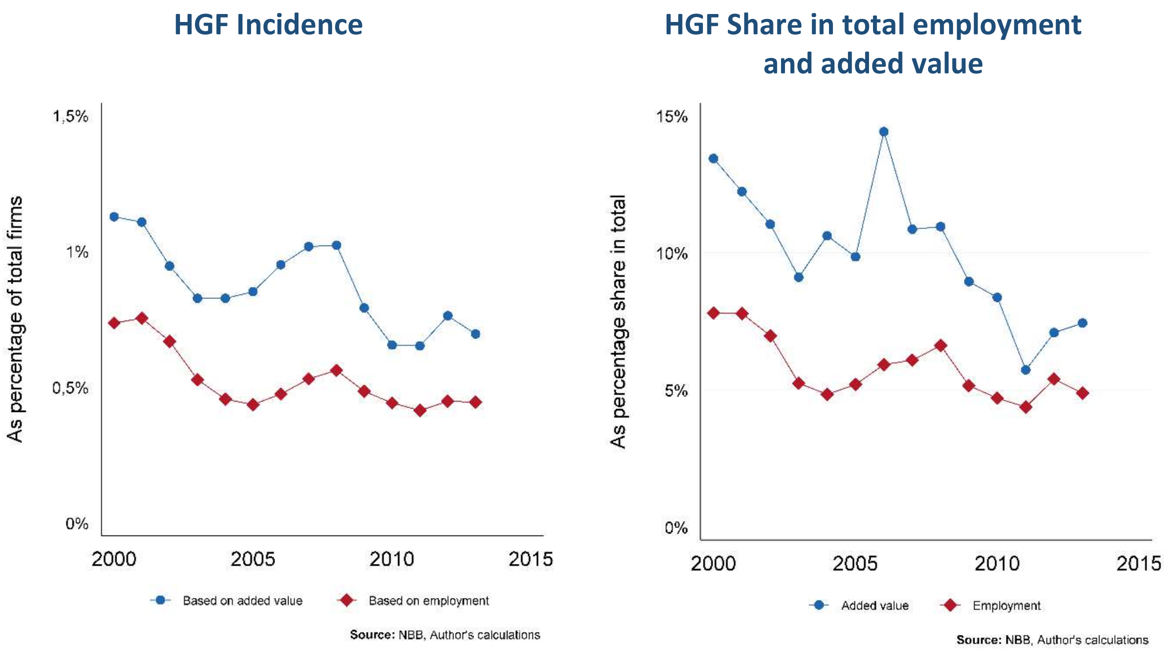


Figure 12: Evolution of HGF incidence as % of total number of firms (left) and HGF share in total employment and total value added (right). The incidence of HGFs and their importance to our overall economy is declining.

Figure 13 gives the same information, but now split between the Services sector and the Manufacturing sector. The HGF incidence in the manufacturing sector shows a steeper decline than in the services sector. Although the HGF incidence still is higher in the manufacturing sector, the contribution of manufacturing HGFs to the overall employment and added value has become very small. Furthermore, there is a significant shift within the services sector. Whereas in the early 2000s the services HGFs were able to generate a significantly larger share of added value than of employment, they now represent a similar share in added value compared to their share in employment.

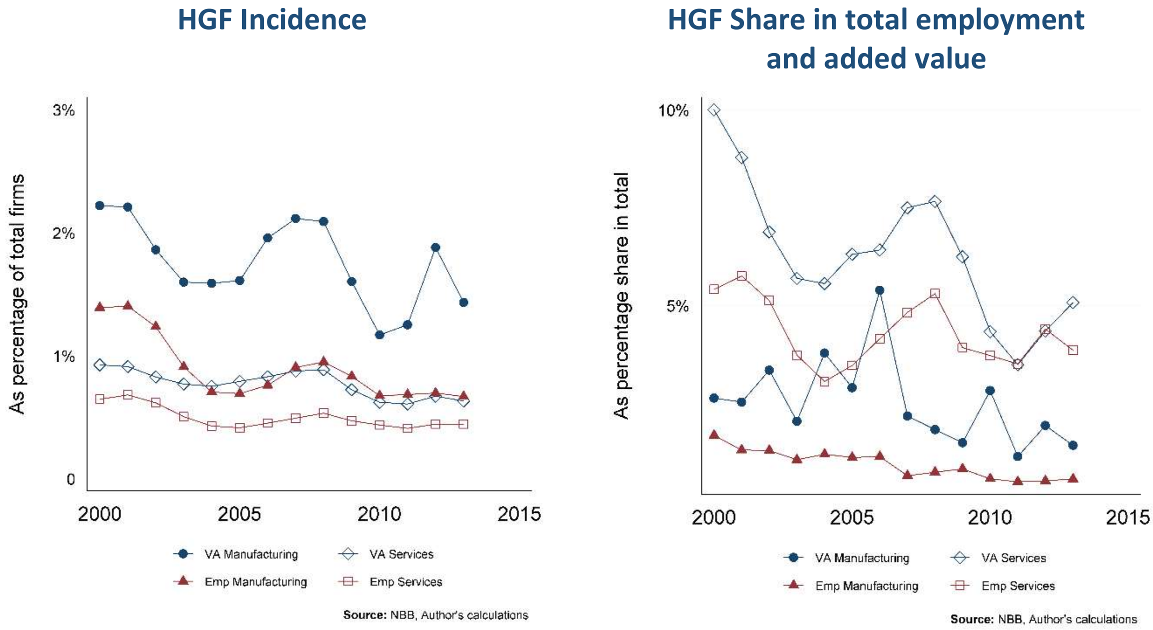
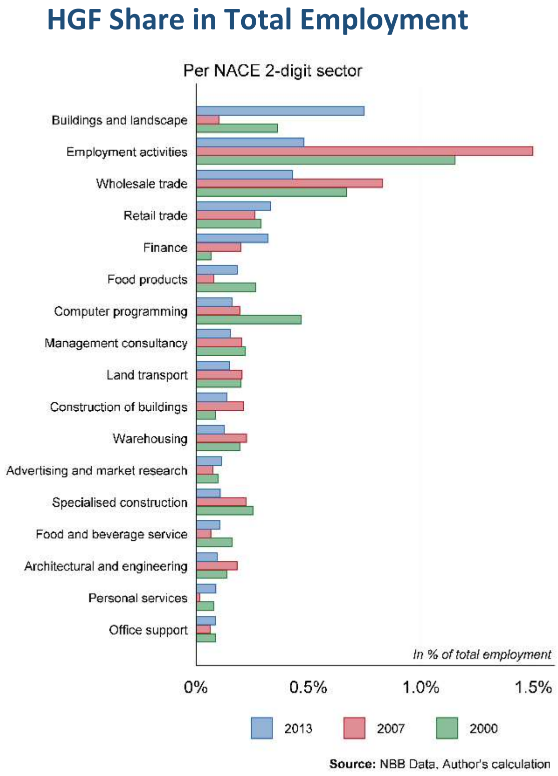


Figure 13: Evolution of HGF incidence as % of total number of firms (left) and HGF share in total employment and total value added (right) for the Manufacturing and the Services sector. The overall importance of HGFs is declining, only their share in service sector employment is increasing.

We now directly turn to the NACE 2-digit level in Figure 14 below. The 2-digit industries where HGFs generate the highest employment are dominated by services, and more specifically the services that fall under "Admin & Support Services" and "Distribution". These are the services with relatively lower labour productivity and remuneration. Ranking 2-digit sectors based on HGF added value share gives a similar result, thought the subsectors of "Admin & support services" are now lower in the list.

The widespread idea that we need to look to high-tech sectors to find HGFs clearly is incorrect. More labour productive services such as "Computer Programming" and "Management Consulting" are in the top 20, but high-tech services and high-tech manufacturing sectors are generally poorly represented in the top.



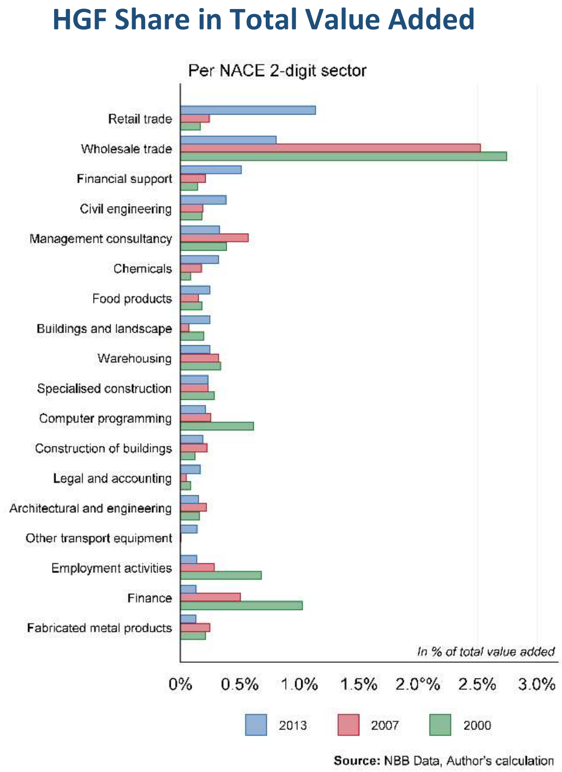


Figure 14: Evolution of the share of HGF in total employment (left) and total real added value (right) for the top 20 NACE 2-digit sectors. The sectors are ranked based on their share in 2013. HGFs are predominantly important in the lower paying services industries.

V. GEOGRAPHICAL ECONOMIC STRUCTURE

From the previous chapter we already understand that there has been a significant increase in total private sector employment (from 1,643,598 FTE in 1997 to 1,996792 FTE in 2013). The increase has not been evenly spread between industries. Manufacturing employment decreased (from 546,618 FTE in 1997 to 440,360 FTE in 2013) whilst employment in services experienced a vast increase (from 892,603 FTE in 1997 to 1,310,519 FTE in 2013). Just like the aggregate movements have not been evenly spread between industries, they have not been evenly spread between regions either.

Figure 15 below shows the evolution of manufacturing employment in the different Belgian counties. Although there was an overall decline in manufacturing employment, several counties did increase manufacturing employment. The area around surrounding Bruges, Brussels (though excluding Brussels itself) and Hasselt performed well. Several counties in the South (Neufchateau, Bastogne) performed extremely well, albeit starting from a small base.

Evolution of Manufacturing Employment

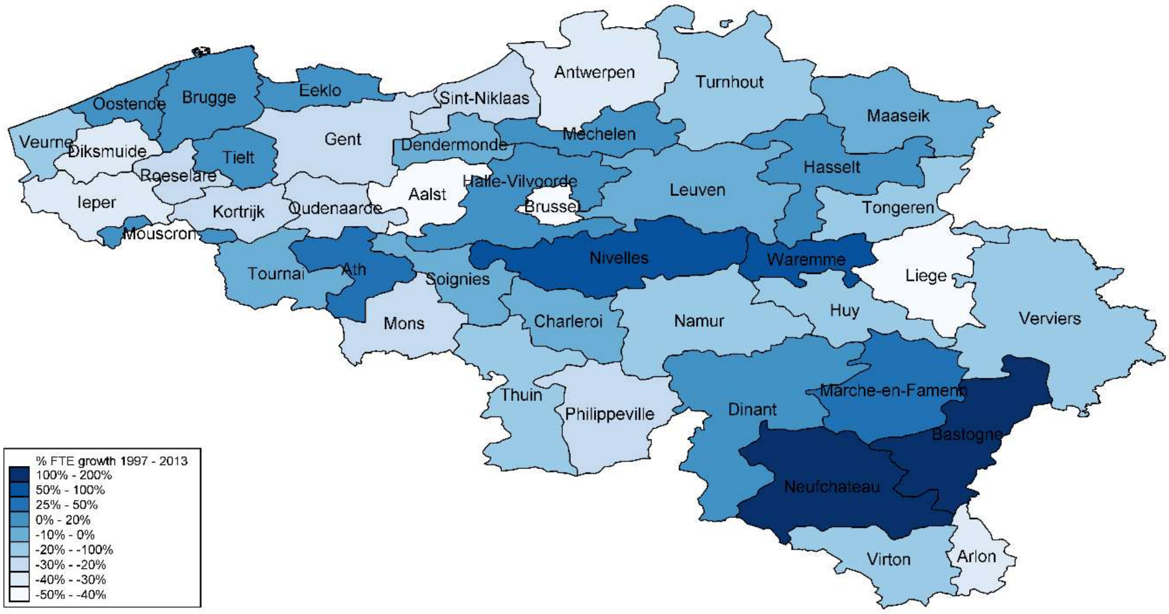
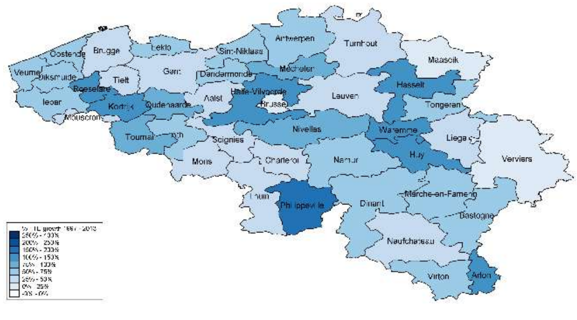


Figure 15: Evolution 1997-2013 of employment in each county (*arrondissement*) in the manufacturing industry between 1997-2013. Although there has been an overall decrease in employment, a significant number of counties showed an increase.

We now turn to services. The previous chapter showed the strongest increase can be found in lower paying services sectors. Therefore we again make a distinction between Knowledge Intensive Services (KIS) and Less Knowledge Intensive Services (LKIS). LKIS showed a strong increase (from 662,441 FTE in 1997 to 972,081 FTE in 2013, increase of 309,641 FTE or approx. 47%). KIS showed a similar percentage-wise increase but coming from a lower base (from 230,162 FTE in 1997 to 338,437 in 2013, an increase of 108,275 or approx. 47%).

Evolution of LKIS employment



Evolution of KIS employment

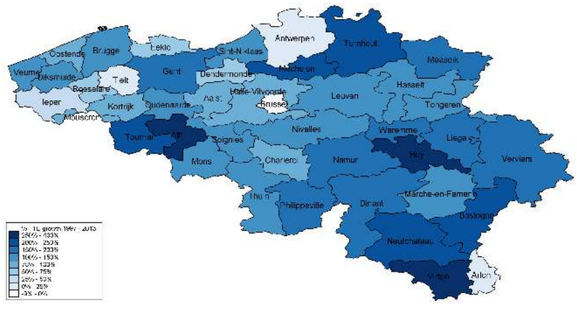


Figure 16: Evolution 1997-2013 of employment in each county (*arrondissement*) for Less Knowledge Intensive Services (LKIS, left) and Knowledge Intensive Services (KIS, right).

Figure 16 shows that although in aggregate both LKIS and KIS grew at the same pace, geographically this clearly is not the case. While for LKIS the differences between the counties are relatively small, for KIS there are significant differences. The reason is that in 2 large counties (Brussels and Antwerp), growth in KIS is small or negative and smaller compared to LKIS growth. This implies KIS growth is higher compared to LKIS growth in most other counties.

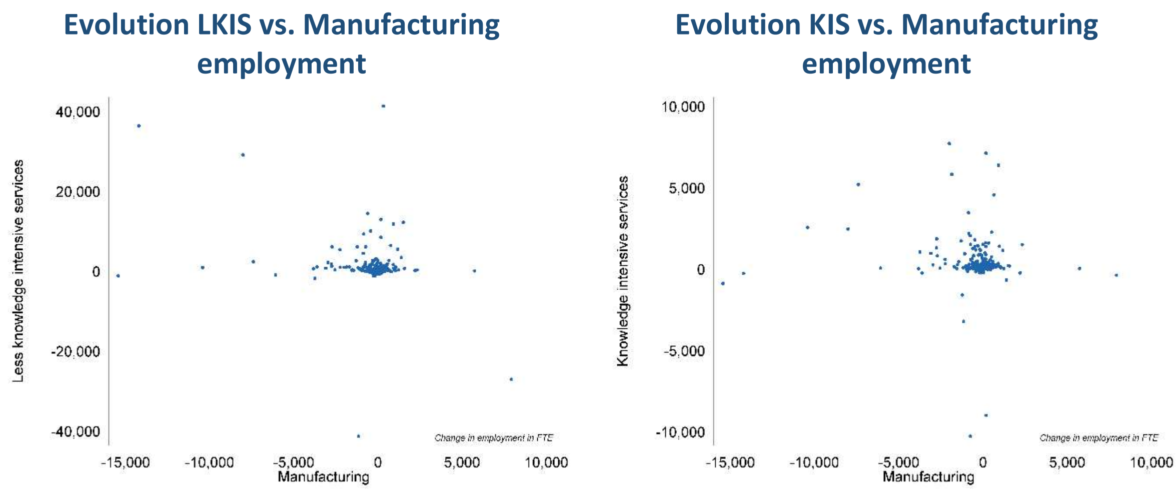


Figure 17: Change in employment (1997-2013 in '000 hours worked) for less knowledge intensive services and manufacturing (left) and knowledge intensive services (right) for each Belgian municipality

Moretti (2010) shows a link between jobs in manufacturing and job in nontradeable services and more specifically the fact that jobs in manufacturing generate jobs in nontradeable services in surrounding area. Therefore it's interesting to plot the evolution jobs in manufacturing vs. LKIS & KIS for a municipality (Figure 17). The link between aggregate manufacturing jobs and LKIS jobs seems to be weak or rather negatively correlated. There are clearly more mechanisms at play to explain this aggregate trend besides a direct link between manufacturing and LKIS jobs at the micro-level. Also for KIS jobs, we do not see a direct link with manufacturing jobs.

Figure 18 below shows the HGF incidence per county. HGF incidence gives the ratio of HGF vs. the total number of firms in a particular county. An enterprise is regarded as HGF if it is a HGF based on employment or added value. Figure 13 above already showed how HGF incidence has gradually come down over the past years. From the geographical analysis we can see that it has come down in almost all counties. The long-term effect of this loss of business dynamism remains yet unclear.

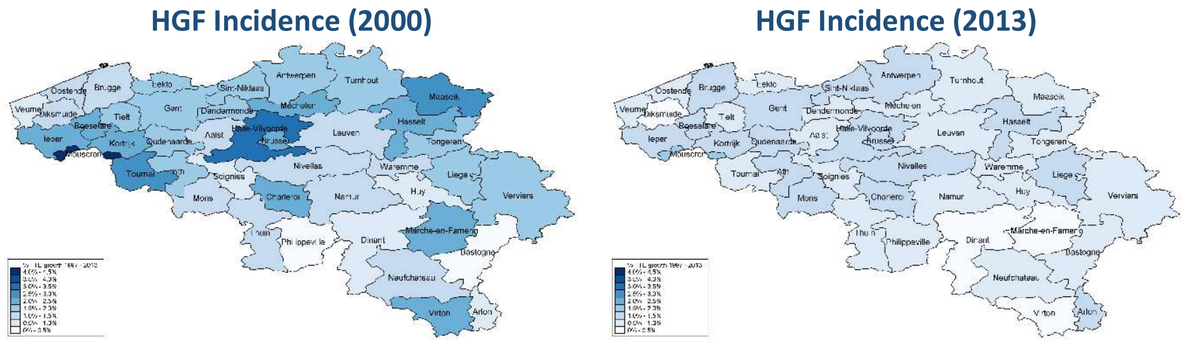


Figure 18: HGF incidence (based on employment and added value) per county in 2000 (left) and 2013 (right). The HGF incidence has come down significantly in almost all counties.

VI. SPECIALISATION AND COMPARATIVE ADVANTAGE

Within Europe

One way to assess whether an economy is able to capture expected gains from a more efficient allocation of resources is the evolution of specialisation. Regions and countries focus on a specific industry where they can exploit a comparative advantage over others and/or economies of scale. Resources will be increasingly allocated towards these industries that become more productive. Tradeable industries with little or no advantage compared to other regions are gradually replaced by imports.

The use of a GINI index to measure geographical specialisation has been already introduced by Krugman (1991) and further refined by others. We follow the approach defined by Amiti (1999) who uses the so called Balassa Index:

$$B_{ij} = \frac{q_{ij}/q_j}{q_i/Q} \qquad (1)$$

where q_{ij} is industry *i* production in country *j*, q_j is total production in country *j*, q_i is total production of industry *i* in the EU and *Q* is total production of all industries in the EU. The Balassa Index can be constructed using both production and employment data. Next, a process similar to the GINI coefficient is used. The Balassa Index is ranked in descending order. and Then the cumulative of the numerator is plotted on the vertical axis against the cumulative of the denominator to get the Lorenz curve. Finally, the specialisation index is equal to twice the area between the 45-degree line and this Lorenz curve. The closer the industry distribution of country *j* resembles that of the overall EU industry distribution, the smaller the index. A country that only has a single industry with a small overall production share within the EU, has an index close to one.

Based on Gross Output **Based on Employment**

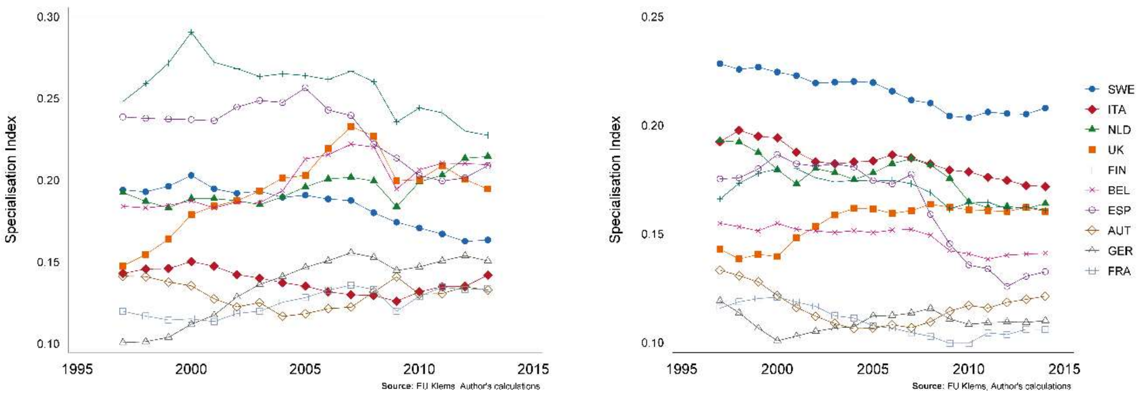


Figure 19: Specialisation Index for the total market economy (10 countries) based on gross output (left) and employment (right). The higher the index, the more specialised a country is.

We clarify the concept of specialisation by means of zooming into country specialisation within Europe. We base ourselves on EUKLEMS data on gross output and employment covering 10 countries since 1997. Data is split up per NACE 2-digit industry, though some are aggregated together resulting in 40 industries instead of the total 88 NACE 2-digit industries. Figure 19 shows the evolution of the specialisation index for the total market economy (NACE section O-U excluded) and Figure 19 shows the data only taking the manufacturing industry into account.

Different countries show different levels of specialisation. Larger economies are expected to be more diversified and less specialised compared to smaller one, though this not always holds. Taking only the level of specialisation into account of the manufacturing industry (Figure 20) we clearly see a trend of a gradual increase of the specialisation within Europe. The UK shows a remarkable rise. This might be linked with the fact that the UK is a late joiner to the EU and the forces of increased EU integration set in at a later time compared to other countries. Belgium and the Netherlands, two small, open economies, remain highly specialised. Finland now is less specialised, possibly linked with the decline of its high-tech sector. Germany, as the largest economy, shows a lower though still increasing level of specialisation. Spain suffers a steep decline in overall specialisation over the great recession which is not reflected by a similar decline in manufacturing specialisation. This might be due to the relatively oversized construction and real estate sectors coming back to the European average.

A remarkable finding is the steep drop in specialisation based on output during the 2009 crisis, especially for countries that were most specialised. More diversified economies were able to absorb the shock of the crisis over many industries, whereas specialised economies were hit in specific sectors.

Based on Gross Output **Based on Employment**

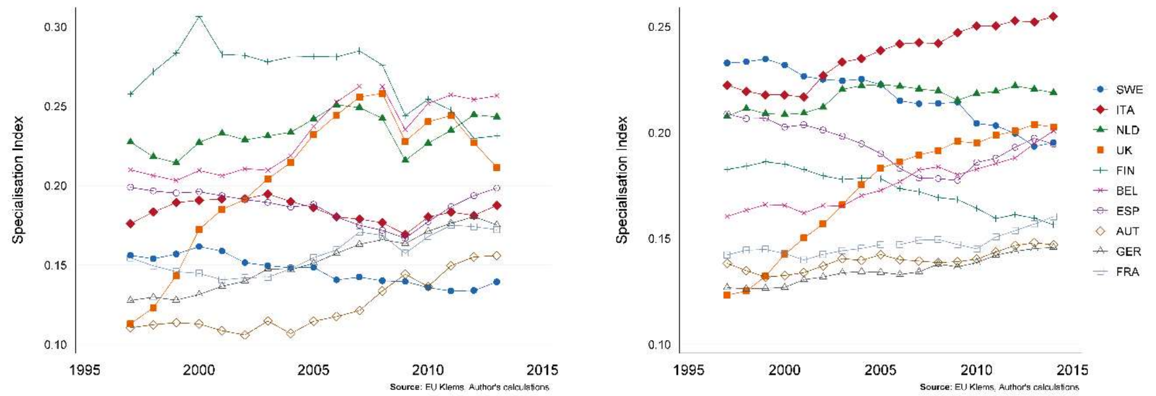


Figure 20: Specialisation Index for the manufacturing industry (10 countries) based on gross output (left) and employment (right). Especially based on employment, we see a gradually increasing level of specialisation in most countries.

Within Belgium

We take a similar approach to study the specialisation within Belgium based on our NBB dataset. The geographic unit is now the NUTS-3 counties or *arrondissements.* Figure 21 shows two specialisation maps (1997 and 2013) in Belgium taking into account the whole economy. The darker the area, the more specialisation compared to the Belgian average. Figure 22 is similar, but now only takes the manufacturing industries into account. Figure 23 gives the year-on-year evolution for Manufacturing specialisation for the 3 largest Flemish (Antwerp, Ghent and Turnhout) and Walloon counties (Liège, Charleroi and Nivelles), as well as the overall average as well as the average for 10 largest and 10 smallest counties.

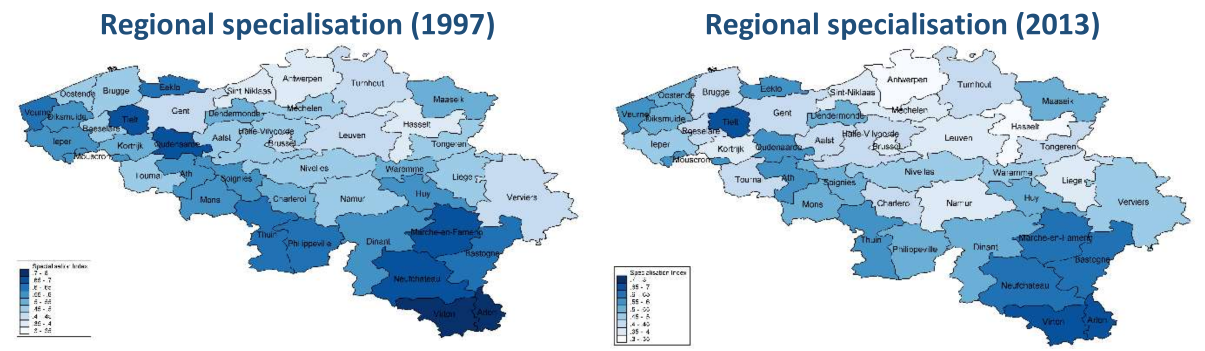


Figure 21: Specialisation between counties across all market sectors.

We see a clear difference in specialisation between counties. Counties in the West and South are more specialised. Some particular trends of specific counties can be observed. A decline in specialisation in Kortrijk possibly reflects the off-shoring of the local textile industry. An increase in manufacturing specialisation in Hasselt is possibly driven by the local efforts to attract a set of new, smaller scale and diversified industries to replace the decline in the local mining and automotive industries. A steep decline can be seen in Liège whilst Nivelles shows a sharp increase.

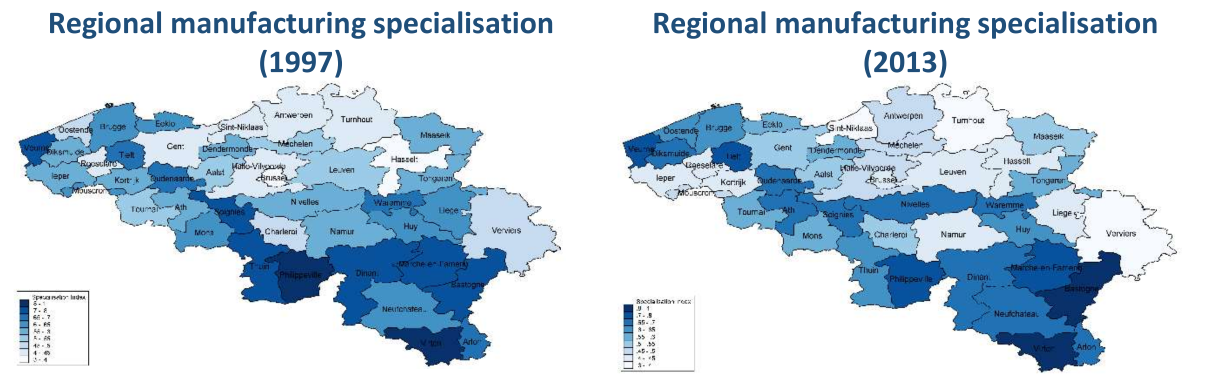


Figure 22: Specialisation between counties across manufacturing sectors.

Larger counties are less specialised than smaller ones. On average, there is a very small decrease in specialisation although the 10 largest counties have increased their level of specialisation.

Evolution of manufacturing specialisation in Belgium

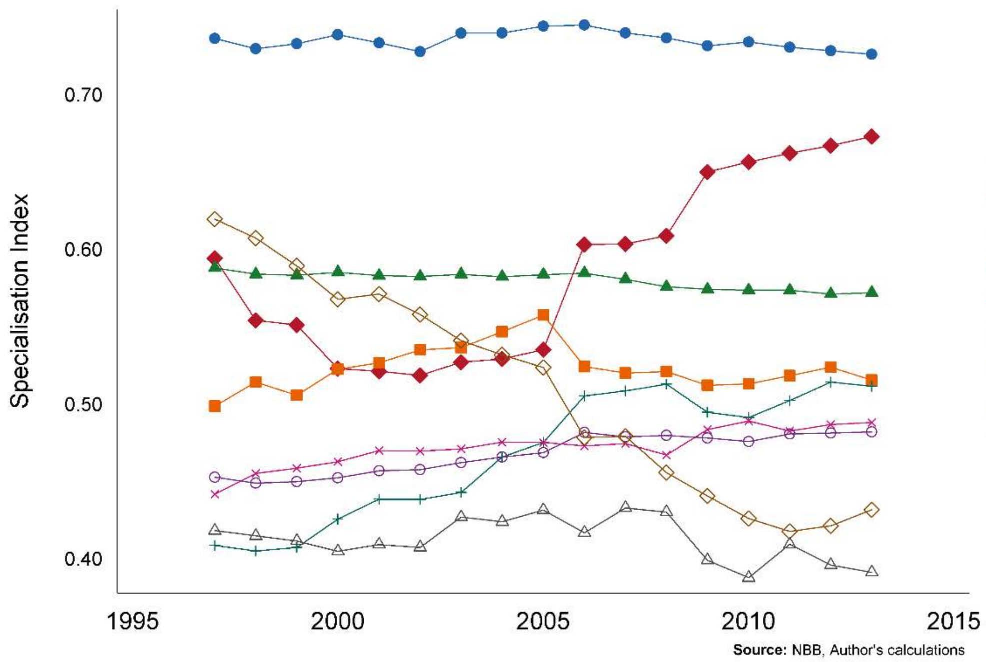


Figure 23: Evolution of manufacturing specialisation in Belgium: main counties, average over all counties as well as 10 largest and smallest counties. On average, there is a very small decline in specialisation although the largest counties of increased their level of specialisation.

We cannot directly link county-by-county success with an increased level of specialisation (e.g., Leuven and Kortrijk remain one of the most affluent counties although they show a relatively low level of specialisation). Nevertheless, overall Figure 24 shows a positive correlation between growth in employment and added value and an increased level of specialisation.

Correlation specialisation and employment / Correlation specialisation and added value

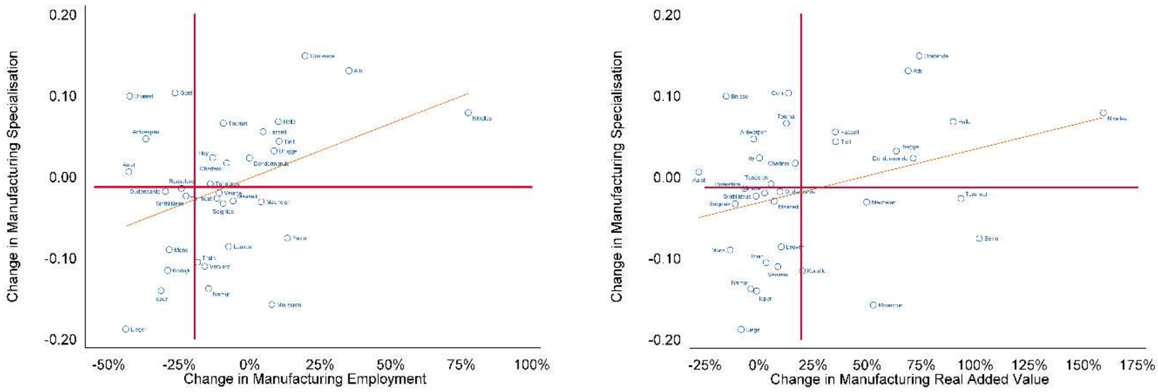


Figure 24: Correlation between change in employment and specialisation (left) and change in added value and specialisation (right) per county taking only manufacturing into account. The red crosses depict the average growth in employment and added value and the average change in manufacturing specialisation. There is a positive correlation between a change in specialisation and a change in employment or added value.

VII. A POLICY FRAMEWORK FOR ECONOMIC GROWTH: INNOVATION AND COMPARATIVE ADVANTAGE

During the last 2 to 3 decades Western countries and Western led international economic organisations developed an almost consensus that the state should not engage in setting industrial policies and should limit itself to regulating markets and correcting market failures. An interventionist industrial policy is thought to be growth constraining as it is impossible to 'pick the winners'. Recent evidence, however, has shown that industrial policy can in fact result in higher economic performance, provided its design takes into account a number of key principles (e.g., Wade 2012). Moreover, with the recent financial crisis, climate change and job destructing caused by Asian (state sponsored) competition, several countries have shown renewed interest in industrial policy.

An important question remains, however, how to constrain politicians from designing industrial policies that serve just a powerful subgroup rather than a broad section of society (see e.g., Besley and Persson 2011). Aghion et al. (2011) provide useful guidelines for EU authorities. In particular, state aid should:

- target skill intensive and competitive sectors and be allocated evenly within the sector, rather than to one or several preselected firms
- redirect production and innovation towards clean technologies
- be designed in such a way non-performing projects are not refinanced
- be overseen by a less legalistic and more pragmatic, evidence-based approach from European competition authorities

In this spirit, we propose therefore a conceptual framework to target Belgium's industrial policy that is driven by two key drivers. The first is innovation, proxied by growth in total factor productivity, the second is comparative advantage, proxied by specialisation.

We summarize this framework in Figure 25. The bottom left quadrant contains sectors and firms characterized by low innovation and the product markets they are active in represent niches in which the country has not much expertise. Arguably these type of sectors and firms have not much growth potential as it would take a lot of resources to gain expertise and trigger innovation. The top left quadrant indicates sectors and firms that innovate a lot, but there is still little expertise or specialization in these type of activities in the country or there simply is limited potential for innovation for these industries. These are sectors and firms that can potentially benefit from lifted barriers or targeted support such that they can expand. By targeting state aid to these type of activities, barriers to growth may be lifted, which can generate increasing returns as the innovation capacity of these sectors is high. So, increasing their relative share would boost macroeconomic productivity growth and hence GDP. The top right quadrant is what we call the 'superstars', it concerns firms that innovate a lot and in which the country has a lot of expertise. They do well and do not require much support. The challenge is to get firms in the top left quadrant to turn into such superstars. And finally, the bottom right quadrant are typically firms and sectors in which a country traditionally has been specializing a lot, but where there is not much innovation or productivity growth taking place. We could also label this the 'old economy'. They are typical candidates to engage in a transformation process, i.e. to make them innovative. The type of state aid going to these sectors is clearly of a different kind as it is about providing incentives to innovate. So, this would typically concern R&D subsidies, setting up networks with science institutions, etc.. We next take this framework to the data.

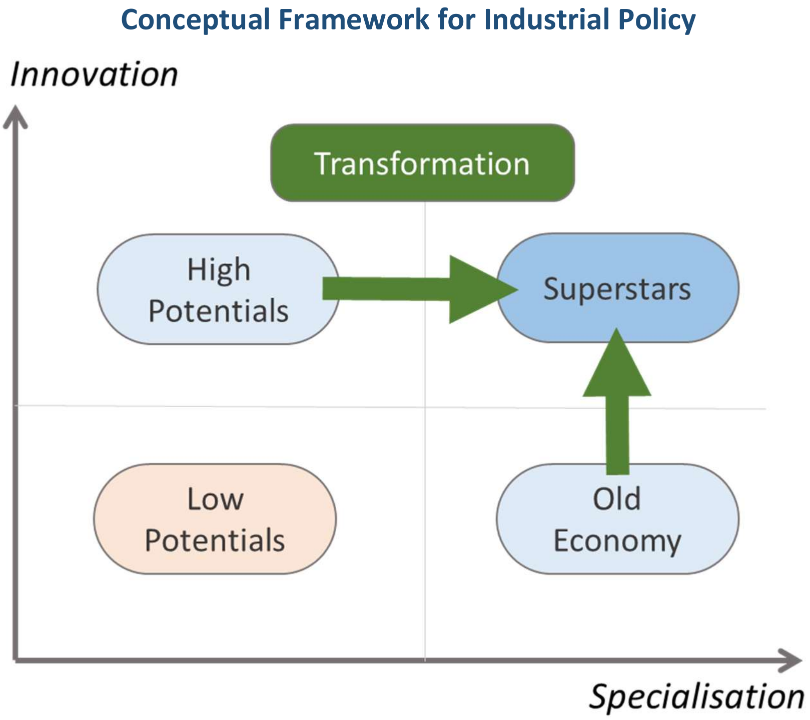


Figure 25: Conceptual Framework Industrial Policy. The framework identifies industries that are or can become both innovative and specialised and can hence be long-term successful.

Innovation

We use a subsample of our NBB dataset including all firms who have their primary NACE code within manufacturing (NACE 2-digit from 10 to 33) which we observe between 1997 and 2013. We measure innovation as the growth rate in total factor productivity. This is a standard approach to measure technological progress, which goes back to Solow (1956). In particular, consider the following production function:

$$Q_{it} = A_{it}F(L_{it}, K_{it}) \quad (2)$$

where subscript *i* and *t* refer to firm *i* at time *t*, *L* is labour input, *K* is capital input, *F* is an increasing function in *L* and *K*. Hence, when a firm uses more labour and capital it will produce more output. The factor A_{it} refers to the "efficiency" or "productivity" of the firm. For instance if two firms use the same amount of labor and capital, but in one firm A_{it}=1, but in the other firm A_{it}=2, then the latter firm produces twice as much despite it uses the same amount of inputs as the first firm. Hence the second firm is more "efficient" or more "productive" than the first one. When *A* increases, we say that there is technological progress or productivity growth, i.e. a firm can produce more with the same amount of inputs.

We assume *F(L, K)* to be of a Cobb-Douglas format and come to the log-linear approximation of (2):

$$q_{it} = a_{it} + \alpha_l l_{it} + \alpha_k k_{it} + \varepsilon_{it} \quad (3)$$

with lower cases denoting the natural logarithm. We introduce year fixed effects to capture any year-on-year changes effecting a whole industry and estimate this function for each of the 24 industries using our firm level data. Q_{it} (quantity) is unobserved and we use real added value as a proxy. For L_{it} we use the number of hours worked. For K_{it} the real tangible fixed assets[17] of the firms are used. We first estimate the parameters of (3) using Ordinary Least Squares (OLS), including year fixed effects.

The OLS method might result in biased estimates as equation (3) suffers from endogeneity, i.e. the inputs chosen by the firm might well be influenced by its perceived level of productivity (a_{it}) as well as any unexpected events captured by the error term (ε_{it}). To overcome these issues we also estimate the coefficients for labour using the L&P method described by Levinsohn & Petrin (2003). This method makes use of material input, which is available for a substantial part of the firms observed in our dataset. Detailed estimates for the coefficient can be found in Appendix 2.

We use the results of this estimation to compute firm level total factor productivity $TFP_{it} = \exp(q_{it} - \alpha_l l_{it} - \alpha_k k_{it})$. We compute sector level total factor productivity (TFP) by aggregating up, with properly weighing each firm with its share in overall added value of the sector it is active in. Figure 26 shows the evolution of TFP for the 24 different manufacturing industries using the 2 described estimation methods, OLS and L&P. Although the 2 methods yield different estimates for the coefficient of the production function, both come to comparable results on actual productivity growth.

The sector showing the highest productivity growth is “Other Transport Equipment” which includes manufacturing of trains, trams and airplanes or parts and components thereof. The food industry, though showing significant employment growth, was not able to improve its underlying productivity. The petrochemicals industries, a manufacturing stronghold in Flanders, sees limited to no productivity growth.

We then take the average growth rate of TFP by sector for the period 2003-2013 as our indicator of innovation.[18]

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[17] Reported tangible fixed assets are deflated with the gross fixed capital formation deflator reported for Belgium by UNECE.

[18] The indicator for innovation is $(TFP_{OLS} + TFP_{L\&P})/2$ with TFP_{method} the average growth rate of TFP for a particular sector using the OLS or L&P estimation method.

Evolution of productivity in the manufacturing industry

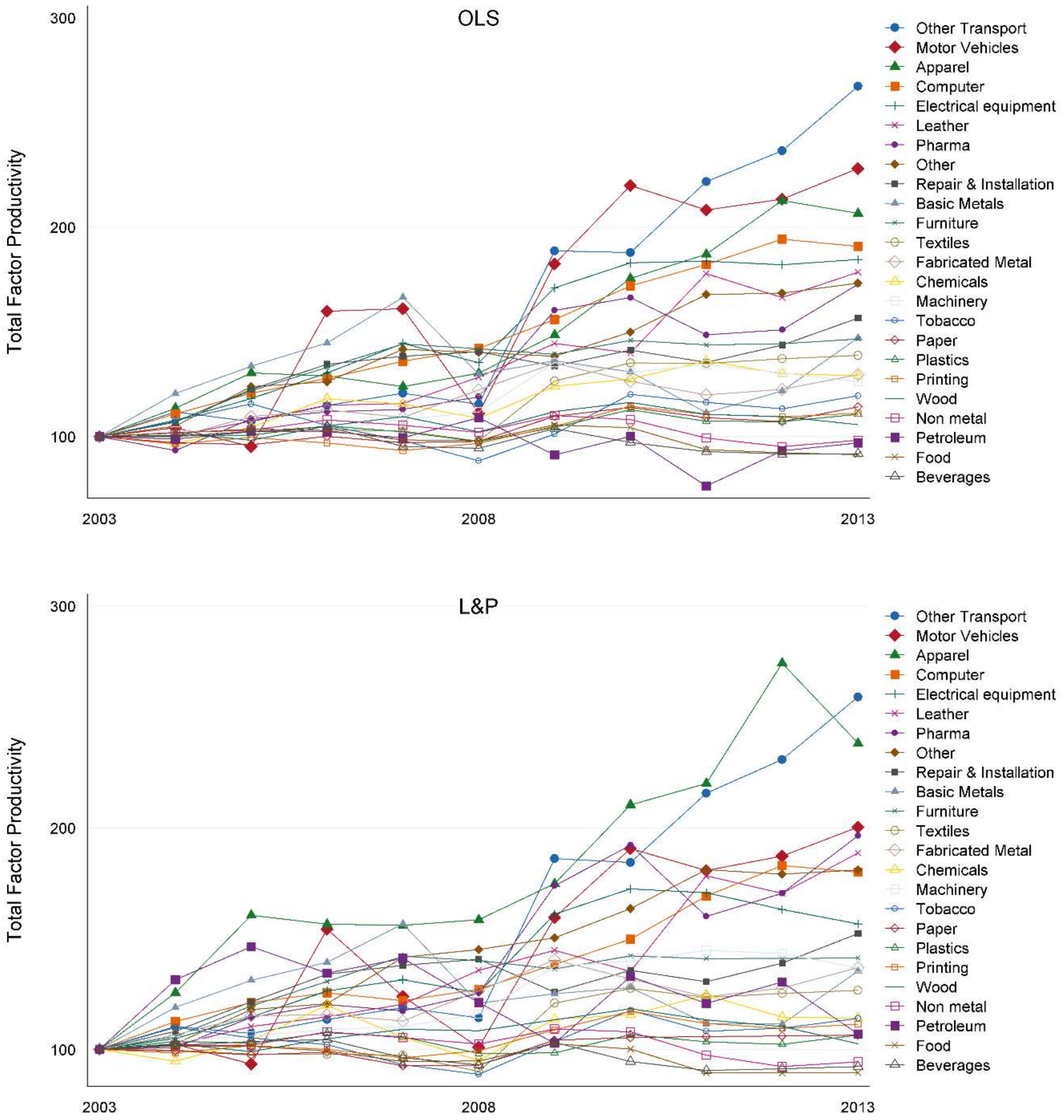

Figure 26: Evolution of Total Factor Productivity (TFP) for the Belgian manufacturing industries (2003=100) using the OLS estimation method (top) and the L&P estimation method (bottom). Both methods yield comparable results for the evolution of productivity.

Specialisation

The use of the Specialisation Index to map the comparative advantage a certain region has for a certain industry has been explained in the previous section. For our policy framework, we use 2 different angels on specialisation: the *need for specialisation* and the *level of specialisation in Belgium*.

The *need for specialisation* is based on how geographically concentrated or specialised an industry is within Europe. The sector level specialisation index is constructed analogously to the country level index. The Balassa Index of equation (1) is rewritten into

$$B_{ij} = \frac{q_{ij}/q_i}{q_j/Q} \quad (4)$$

Note the different subscripts of equation (4) vs. (1). The Balassa Index now measures if an industry in a certain country takes a disproportional share in the EU wide production of this industry vs. what share the country's total manufacturing represents in the EU total. The Balassa index is now aggregated for a certain industry across countries[19] and the GINI index is calculated as explained in the previous section on country specialisation. The need for specialisation now is the average of the Industry Specialisation Index based on employment and production value. The more concentrated an industry is in Europe, the more gains can be expected form specialising in this industry. If an industry is not concentrated at all, less gains can be expected from having a comparative advantage for this industry.

Specialisation matrix for the manufacturing industry

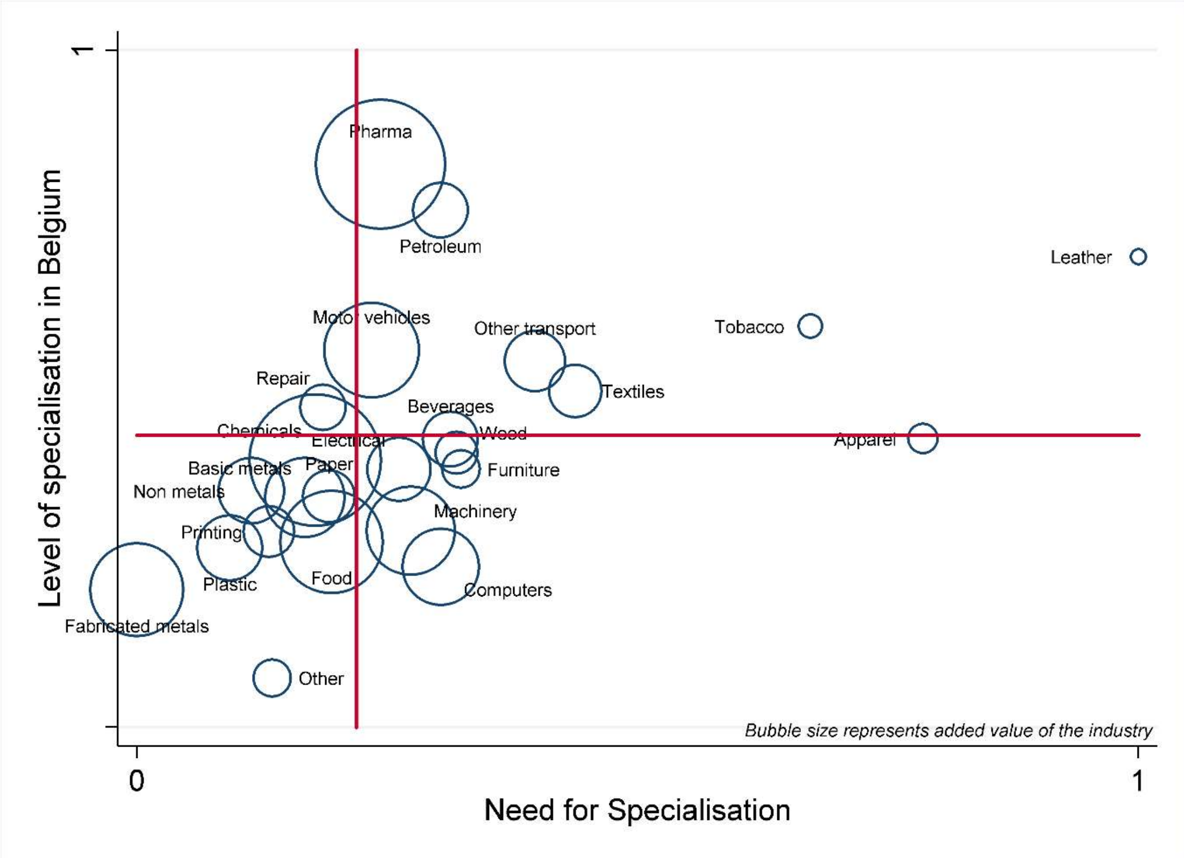

Figure 27: Specialisation matrix for the Belgian manufacturing industry. Industries in the top right corner represent industries that are highly specialised in Belgium and where a comparative advantage can be exploited within Europe.

19 We use EUROSTAT's Structural Business Statistics that provides data on employment and production value on the NACE 2-digit level for Belgium, Germany, France, Netherlands, UK, Italy, Spain, Poland, Sweden, Finland, Austria, Denmark, Portugal and Norway.

The *level of specialisation* in Belgium is proxied by a combination of how specialised the industry is within Belgium, the change of that specialisation and whether Belgium became more specialised in that industry vs. the rest of Europe[20].

Figure 27 now combines these two angles on specialisation into the specialisation matrix. The bubble size represent the relative size of the industry based on added value. Chemicals and pharmaceuticals are the largest industries and leather the smallest. The crossing lines in Figure 27 represent the by added value weighted average for the 2 dimensions. Industries in the top right corner represent industries that are highly specialised in Belgium and where a comparative advantage can be exploited within Europe.

The above 2 measures for specialisation are now combined into 1 specialisation score and plotted together with the Innovation score (TFP growth). This matrix (Figure 28) is our policy scoreboard as initial laid out in Figure 24. Industrial policies should target to move a sector closer to the top right corner.

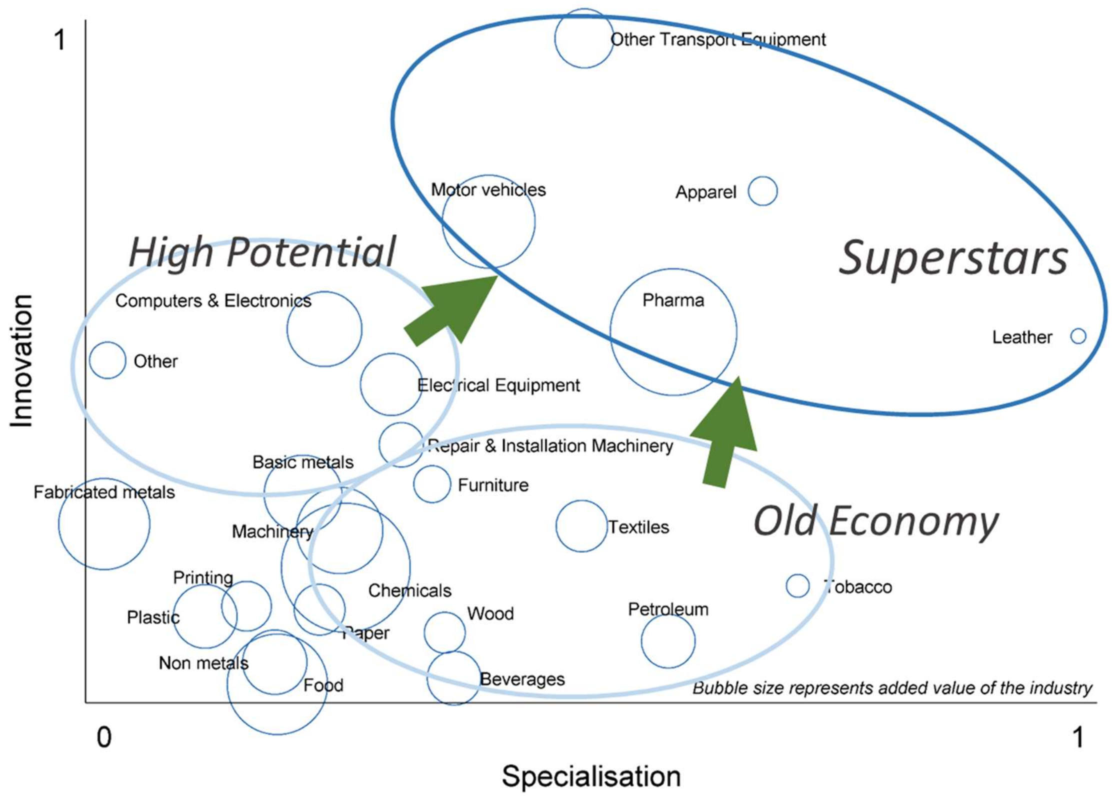

Figure 28: Policy framework rating industrial sectors based on specialisation and innovation. Industrial policies should target to move a sector closer to the top right corner.

At first sight, the results of our scoreboard seem counter intuitive. Sectors with the highest potential in Belgium are not necessarily ICT or what most people would regard as high-tech related. Furthermore, two of the most promising industries according to our framework, Motor Vehicles and

[20] Calculated based on 2003 – 2013 change of the Belgian Balassa Index (eq. 4) for the industry based on production value and employment; 2013 and 2003 – 2013 change of within Belgian Specialisation Index based on added value and employment

Other Transport Equipment, have recently been hit by large closures (Ford) or potential closures (Bombardier). Nevertheless, Agoria, a sector organisation representing amongst other the manufacturing industry, recently announced the automotive industry has a large number of vacancies.[21] Knowledge about electrical vehicles seems to be required for the new recruits. These facts summarise the underlying rationale of our policy framework: there is a future for Belgian manufacturing, as long as it is highly specialised and innovative. Simple assembly where lower cost labour is the main comparative advantage to be exploited, has no future.

Sectors that can benefit from additional innovation stimulus are Pharma, Textiles, Furniture, Repair & Installation of Machinery, Electrical Equipment and to a lesser extend Computers & Electronics. The Leather industry starts from too small a base in Belgium. Furthermore, Computer & Electronics, Electrical Equipment and Repair & Installation of Machinery, will potentially benefit from a larger scale and further specialisation.

VIII. CONCLUSIONS AND POLICY IMPLICATIONS

This paper uses a dataset of more 300,000 Belgian enterprises over the period 1997-2013. We develop insights about sectoral and geographical growth and reallocation and propose a conceptual framework to counter the continued decline of the manufacturing industry. We start by documenting the distribution of employment, added value and entrepreneurship (in the form of high growth firms) across sectors and regions in Belgium.

We observe manufacturing remains the main pillar of our economy, though its share in private sector employment and (less outspoken) its share in added value is shrinking. Jobs lost in the manufacturing industry are shifted towards the services industries. The Distribution sector might well overtake manufacturing as the largest employer over the coming years. Admin & Support services show strong growth as well, especially its subsectors associated with “service vouchers”, i.e. Employment Activities and Building & Landscape Services. Besides Information and Communication, all industries that show employment growth all show lower remuneration and productivity levels than the manufacturing industry. Reallocation of jobs between industries hence lowers overall added value. There must be other driving forces besides the Schumpeterian creative destruction where resources are reallocated to the more productive firms.

The importance of high Growth Firms (HGFs) declines. HGFs play an important role in job creation and job reallocation from declining firms to growing firms and are therefore an important part of a dynamic economy. Currently too little is known about the drivers of this evolution and whether or not this has an impact on overall productivity growth.

Economic activity is also regionally dispersed. We find for instance that, although their growth rate is similar, Less Knowledge Intensive Services (LKIS) show similar growth rates across different counties, growth of Knowledge Intensive Services (KIS) differs substantially between counties.

We have also developed a framework to guide industrial policy, which consists in identifying activities in which the country has a relative comparative advantage and innovation potential. The latter is measured by growth in total factor productivity. The former is measured via (the need for) specialization. We find a significant potential for the pharma and transport & automotive industry. The

[21] https://press.agoria.be/voertuigindustrie-zoekt-600-nieuwe-medewerkers-in-ons-land#

textiles & apparel industry and electronics & electrical equipment manufacturing could be further developed into future key industries although they will need increased levels of innovation and further specialisation. The chosen industrial policy must actively target innovation and specialisation based on the specific needs (summarised via its place in our scoreboard) of the targeted industry.

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Appendix 1 – Overview of NACE Rev 2. (2008) codes

1-digit code	Description	Sector
A	Agriculture, forestry and fishing	Agriculture
B	Mining and quarrying	Agriculture
C	Manufacturing	Manufacturing
D	Electricity, gas, steam and air conditioning supply	Utilities
E	Water supply; sewerage, waste management and remediation activities	Utilities
F	Construction	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	Services
H	Transportation and storage	Services
I	Accommodation and food service activities	Services
J	Information and communication	Services
K	Financial and insurance activities	Services
L	Real estate activities	Services
M	Professional, scientific and technical activities	Services
N	Administrative and support service activities	Services
O	Public administration and defence; compulsory social security	Services
P	Education	Services
Q	Human health and social work activities	Services
R	Arts, entertainment and recreation	Services
S	Other service activities	Services
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	Services
U	Activities of extraterritorial organisations and bodies	Services

Table Appendix 1A: Overview of different NACE Rev. 2 1-digit industries and the broad sector they belong to.

2-digit code	Parent	Description
1	A	Crop and animal production, hunting and related service activities
2	A	Forestry and logging
3	A	Fishing and aquaculture
5	B	Mining of coal and lignite
6	B	Extraction of crude petroleum and natural gas
7	B	Mining of metal ores
8	B	Other mining and quarrying
9	B	Mining support service activities
10	C	Manufacture of food products
11	C	Manufacture of beverages
12	C	Manufacture of tobacco products
13	C	Manufacture of textiles
14	C	Manufacture of wearing apparel
15	C	Manufacture of leather and related products

16	C	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
17	C	Manufacture of paper and paper products
18	C	Printing and reproduction of recorded media
19	C	Manufacture of coke and refined petroleum products
20	C	Manufacture of chemicals and chemical products
21	C	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	C	Manufacture of rubber and plastic products
23	C	Manufacture of other non-metallic mineral products
24	C	Manufacture of basic metals
25	C	Manufacture of fabricated metal products, except machinery and equipment
26	C	Manufacture of computer, electronic and optical products
27	C	Manufacture of electrical equipment
28	C	Manufacture of machinery and equipment n.e.c.
29	C	Manufacture of motor vehicles, trailers and semi-trailers
30	C	Manufacture of other transport equipment
31	C	Manufacture of furniture
32	C	Other manufacturing
33	C	Repair and installation of machinery and equipment
35	D	Electricity, gas, steam and air conditioning supply
36	E	Water collection, treatment and supply
37	E	Sewerage
38	E	Waste collection, treatment and disposal activities; materials recovery
39	E	Remediation activities and other waste management services
41	F	Construction of buildings
42	F	Civil engineering
43	F	Specialised construction activities
45	G	Wholesale and retail trade and repair of motor vehicles and motorcycles
46	G	Wholesale trade, except of motor vehicles and motorcycles
47	G	Retail trade, except of motor vehicles and motorcycles
49	H	Land transport and transport via pipelines
50	H	Water transport
51	H	Air transport
52	H	Warehousing and support activities for transportation
53	H	Postal and courier activities
55	I	Accommodation
56	I	Food and beverage service activities
58	J	Publishing activities
59	J	Motion picture, video and television programme production, sound recording and music publishing activities
60	J	Programming and broadcasting activities
61	J	Telecommunications
62	J	Computer programming, consultancy and related activities
63	J	Information service activities
64	K	Financial service activities, except insurance and pension funding
65	K	Insurance, reinsurance and pension funding, except compulsory social security
66	K	Activities auxiliary to financial services and insurance activities

68	L	Real estate activities
69	M	Legal and accounting activities
70	M	Activities of head offices; management consultancy activities
71	M	Architectural and engineering activities; technical testing and analysis
72	M	Scientific research and development
73	M	Advertising and market research
74	M	Other professional, scientific and technical activities
75	M	Veterinary activities
77	N	Rental and leasing activities
78	N	Employment activities
79	N	Travel agency, tour operator and other reservation service and related activities
80	N	Security and investigation activities
81	N	Services to buildings and landscape activities
82	N	Office administrative, office support and other business support activities
84	O	Public administration and defence; compulsory social security
85	P	Education
86	Q	Human health activities
87	Q	Residential care activities
88	Q	Social work activities without accommodation
90	R	Creative, arts and entertainment activities
91	R	Libraries, archives, museums and other cultural activities
92	R	Gambling and betting activities
93	R	Sports activities and amusement and recreation activities
94	S	Activities of membership organisations
95	S	Repair of computers and personal and household goods
96	S	Other personal service activities
97	T	Activities of households as employers of domestic personnel
98	T	Undifferentiated goods- and services-producing activities of private households for own use
99	U	Activities of extraterritorial organisations and bodies

Table Appendix 1B: Overview of different NACE (Rev. 2) 2-digit industries and the 1-digit parent industry they belong to.

Appendix 2 – Estimates for the labour and capital coefficients of the productivity function

NACE 2-digit	Industry	OLS		L&P	
		α_l	α_k	α_l	α_k
10	Manufacture of food products	.73	.25	.68	.09
11	Manufacture of beverages	.75	.30	.57	.20
12	Manufacture of tobacco products	.73	.27	.59	.07
13	Manufacture of textiles	.74	.21	.64	.08
14	Manufacture of wearing apparel	.81	.19	.62	.01
15	Manufacture of leather and related products	.69	.19	.54	.09
16	Manufacture of wood	.79	.18	.62	.11
17	Manufacture of paper and paper products	.76	.22	.42	.06
18	Printing and reproduction of recorded media	.73	.22	.71	.06
19	Manufacture of coke and refined petroleum products	.69	.34	.46	-.12
20	Manufacture of chemicals and chemical products	.84	.20	.68	.05
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	.89	.17	.59	-.01
22	Manufacture of rubber and plastic products	.79	.19	.65	.03
23	Manufacture of other non-metallic mineral products	.77	.20	.74	.12
24	Manufacture of basic metals	.73	.23	.72	.08
25	Manufacture of fabricated metal products, except machinery and equipment	.77	.18	.65	.07
26	Manufacture of computer, electronic and optical products	.83	.18	.70	.08
27	Manufacture of electrical equipment	.84	.15	.69	.09
28	Manufacture of machinery and equipment n.e.c.	.81	.17	.74	.06
29	Manufacture of motor vehicles, trailers and semi-trailers	.81	.19	.60	.11
30	Manufacture of other transport equipment	.93	.12	.85	.18
31	Manufacture of furniture	.77	.20	.63	.11
32	Other manufacturing	.75	.21	.76	.03
33	Repair and installation of machinery and equipment	.79	.16	.77	.05

Table Appendix 2: Estimates for NACE 2-digit industry production function used to calculate productivity growth. The estimates are for the function $q_{it} = a_{it} + \alpha_l l_{it} + \alpha_k k_{it} + \varepsilon_{it}$. The labour (α_l) and capital (α_k) coefficients are estimated using 2 methods: Oridinary Least Squares (OLS) and Levinsohn & Petrin (L&P).

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