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Milan Vaňko, Vladimír Novák

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Contact
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Stylised facts of Slovak productivity and business demography (1995 - 2019) *

Milan Vaňko† Vladimír Novák ‡

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Abstract

This study explores and documents the patterns of productivity growth in Slovakia from 1995 until 2019. By doing so we identify the drivers of its rapid growth prior to the financial crisis but also the factors contributing to its economic slowdown since then. As of today, Slovakia faces the risk of falling into the middle-income trap. While structural changes, such as labor reallocation between sectors, played a limited role in productivity growth, improvements within sectors, particularly through foreign direct investment in manufacturing, were crucial during the country's transition to a market economy. However, the current high reliance on manufacturing, specifically automotive, poses risks of premature deindustrialization due to automation and the shift towards electromobility. The business demography in Slovakia is dominated by small firms, and the widening gap between large and small firms may affect value-added creation. Despite high business dynamism, declining productivity growth suggests a need for a more dynamic business environment. Productivity developments vary across sectors, with some experiencing significant declines. Addressing the disparities in productivity among firms and sectors, improving market concentration, and implementing necessary reforms are crucial for reversing the negative resource allocation and fostering productivity growth in Slovakia.

Keywords: productivity; business dynamism; productivity growth; frontier and laggard firms.
JEL-Codes: D24, D22, F21.

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†National Bank of Slovakia. E-mail: milan.vanko@nbs.sk
‡National Bank of Slovakia and Prague University of Economics and Business. E-mail:vladimir.novak@nbs.sk

Non-technical Summary

After experiencing strong economic growth before the Global Financial Crisis, Slovakia's growth model began to falter, and the country's progress in catching up to the living standards of advanced EU countries came to a near standstill. This slowdown was even more pronounced than that of Slovakia's peers in the V4. Therefore, Slovak policymakers are increasingly concerned about the stagnating convergence and the risk of falling into the middle-income trap. Weaker long-term economic growth can primarily be attributed to a slowdown in productivity, with the decline in TFP growth serving as the main cause of weaker productivity.

Given Slovakia's rapid transition to a market economy, we explored to what extent structural change contributed to Slovakia's high productivity growth in the earlier periods of transformation and whether it could also explain the subsequent productivity slowdown once the transition was completed. However, structural change measures such as labor reallocation between sectors of the economy cannot explain the productivity slowdown in Slovakia, as it contributed little to aggregate productivity growth between 1995 and 2019. On the contrary, the fall in within-sector productivity growth in recent years was partly offset by labour reallocation to more productive sectors.

A possible partial explanation for the low impact of sectoral reallocation in V4 countries (with the exception of Poland to some extent) is that CEE economies inherited a relatively complex industrial structure from the centrally planned economy era. Despite this, their firms were less technologically advanced and less competitive than their Western counterparts. Therefore, the main driver of productivity growth during the transition was not sectoral changes but productivity improvements within sectors, particularly FDI-led improvements in manufacturing. As Slovakia (and other V4 economies) already resemble their Western European counterparts in terms of the high complexity of production, there is little scope for sectoral reallocation to kickstart productivity growth. On the contrary, the high reliance on manufacturing, particularly automotive, presents the risk of premature deindustrialization related to automation and the shift towards electromobility.

The Slovak business demography is dominated predominantly by very small firms, even in comparison to other European countries. Despite their share in the total number of firms and their sizable role in employment, firms with less than 10 employees have a limited role in value-added creation. On the other hand, firms with more than 250 employees generate a relatively high share of total value added. Not only is the gap between the largest and smallest firms in Slovakia relatively large, but it has also been increasing over time. Slovakia's growth model, based on foreign direct investment, manifests itself in a relatively strong role of foreign-owned firms in its business demography, even when compared to its V4 peers. Like other V4 countries, Slovakia's business dynamism is high but declining. The less dynamic business environment in Slovakia may be a contributing factor to the declining productivity growth. However, the developments in Slovakia are not at odds with those of other V4 countries, so the slowdown of business dynamism is unlikely to explain the unfavorable aggregate productivity developments in Slovakia relative to its peers.

Productivity developments within individual sectors have been quite heterogeneous. Prior to the financial crisis, agriculture, industry, construction, professional services, and wholesale and retail recorded all relatively fast productivity growth, but it has since slowed down significantly or even turned negative. The information and communications sector displayed weak productivity growth even before the crisis and has declined further. Productivity in the arts, entertainment, and recreation sector has experienced

a significant decline in recent years. Public services, on the other hand, have grown moderately over the whole period. The financial sector experienced a significant decline in labor productivity prior to the crisis, and while it has recovered, it has fallen short of the performance of the Polish and Czech financial sectors. The real estate sector's productivity was slowly declining until 2015, and since then, it has grown modestly.

Furthermore, several sectors exhibit the highest dispersion in labor productivity among the V4 countries and Germany. The disparity in productivity between the leading and lagging firms is not only significant, but it has also increased during the last decade, which contrasts with other V4 countries. This highlights the pressing need to improve the productivity growth of median and laggard firms. However, even the firms at the very forefront (99th percentile) display signs of declining productivity growth, suggesting exhaustion of their productivity growth model based on foreign technological imports and their role in globalized value chains. While there is still room for improvement in the concentration of the Slovak market, its contribution to productivity developments is ambiguous. It is also essential to understand why only the manufacturing sector presents positive resource reallocation, resembling the behavior of the developed sector in Western Europe, and to undertake sufficient reforms to reverse the negative resource allocation demonstrated by some sectors.

1 Introduction

A stark slowdown of Slovakia's economic convergence, represented by GDP per capita levels, towards Western European living standards in recent years has been increasingly capturing the attention of Slovak policy-makers. Following a period of strong economic growth prior to the Global Financial Crisis, Slovakia's growth model—primarily driven by foreign direct investment (FDI) into manufacturing, particularly in the automotive sector—began to weaken. This shift caused the country's progress in closing the gap with the living standards of advanced EU nations to nearly stall. The slowdown was even more pronounced than that of its Visegrad (V4) peers. As a result, Slovak policymakers are increasingly concerned about stagnating convergence and the potential risk of falling into the middle-income trap. The primary factor behind weaker long-term economic growth is a slowdown in productivity, driven largely by a decline in total factor productivity (TFP) growth.

Against this background, the paper aims to present stylized facts on the productivity slowdown in Slovakia between the Global Financial Crisis (GFC) and the COVID-19 crisis, providing a foundation for further research on the topic. We begin by examining Slovakia's aggregate productivity performance in comparison to Germany and other regional peers within the V4 group. The study then explores the impact of structural changes across sectors using sectoral national accounts data. Additionally, it leverages microdata from Structural Business Statistics and CompNet to analyze business dynamics, the distribution of productivity, and the mechanisms of resource reallocation.

We find that Slovakia's productivity growth slowdown may have been driven by a range of factors. While structural changes, business dynamism, and market concentration were assessed, they appear to have played a limited role in the slowdown. Instead, the findings point to sectoral disparities, resource misallocation, and constraints on knowledge diffusion as key contributors. The study emphasizes the need for a comprehensive policy approach to facilitate the growth of productive firms, support innovation at the technological frontier, and enhance knowledge dissemination across the economy.

2 Literature review

The slowdown in productivity growth has emerged as a critical challenge for Europe, as emphasized by Draghi (2024) and Modery et al. (2021). This underscores the importance of addressing Slovakia's underperformance relative to its Central European peers and its stalled convergence, highlighted for instance in the Slovak Resilience and Recovery Plan (2021). In addition, productivity growth can be further challenged by the digitalization (see, e.g. Anderton, Reimers and Botelho, 2023) and the climate change (see, e.g. Bijnens et al., 2024). At the same time Slovakia has a hard time to overcome the threat of falling into the middle-income trap[1] has likewise been emphasized by NBS (2021), who identify education, innovation capacity, and the business environment as critical reform areas for reviving the convergence process. Taken together, these issues pose a substantial challenge to Slovakia's long-run

[1] The middle-income trap refers to a situation in which a middle-income country can no longer compete internationally in standardized, labor-intensive commodities because wages are relatively too high. It also cannot compete in higher value-added activities on a broad enough scale because productivity is relatively too low (Paus, 2014). The result is slow growth, stagnant or falling wages, and a growing informal economy (Paus, 2017). For further discussion, see Griffith (2011); Aiyar et al. (2013) and Glawe and Wagner (2016).

growth.

Long-run economic growth is deeply intertwined with productivity. According to Jones (2016), total factor productivity (TFP) has accounted for around 80% of U.S. economic growth since 1948. However, a major slowdown in productivity growth emerged between 1973 and 1995. Although productivity growth in the United States partially rebounded from the mid-1990s onward, the Great Recession of 2008–09 stalled this recovery, rendering it short-lived. Beyond the deceleration at the frontier, many low- and middle-income countries have failed to converge toward higher-productivity economies, a phenomenon Cusolito and Maloney (2018) refer to as the twin productivity puzzles.

So far, the literature offers no definitive consensus on the root causes of these puzzles (see also Cusolito and Maloney, 2018). Gordon (2012) and Gordon (2015) argue that the major gains from three industrial revolutions have run their course, leaving subsequent innovations with diminishing returns. Likewise, Bloom et al. (2020) detects a steep decline in research productivity, as ever-greater research effort is required to generate the same volume of new ideas. By contrast, other authors take a more optimistic stance on emerging technologies such as artificial intelligence. For instance, Aghion, Jones and Jones (2017) views AI as the next wave of automation, capable of taking on a far wider range of tasks—including idea generation—than past technologies. Another branch of research leverages newly available firm-level data to pinpoint misallocation at the micro level as a major driver of cross-country productivity gaps (Hsieh and Klenow, 2009). In a similar vein, Andrews, Criscuolo and Gal (2016) shows that the global productivity slowdown primarily reflects a growing disparity between frontier firms and laggards, potentially stemming from higher adoption costs or rising barriers to entry. Meanwhile, Davis and Haltiwanger (2014) and Decker et al. (2016) emphasize that declining business dynamism may also contribute to subdued productivity growth.[2]

In the Slovak context, Peciar and Wittermann (2019) apply the Hsieh and Klenow (2009) model to firm-level data and conclude that moving allocative efficiency closer to German levels could boost Slovak TFP by as much as 50%. Tibor (2004) likewise identifies allocative efficiency as one of Slovakia's main obstacles to bolstering productivity, a finding echoed by Habrman, Habodászová and Šrámková (2022), who consider allocative efficiency to be the principal factor behind Slovakia's economic gap with Germany. Further challenges arise from Slovakia's growth model, rooted in foreign direct investment (FDI)-driven integration of manufacturing—particularly in the automotive sector—into global value chains (GVCs) (OECD, 2019*b*; IMF, 2019). Although this model has spurred productivity and employment, Slovakia's participation in GVCs remains primarily downstream, resulting in relatively low domestic value added. The country must therefore capture higher-value stages of production, enhance spillovers from highly productive multinational firms to the broader economy, and stimulate innovation and growth among local enterprises. Indeed, the gap between these export-oriented multinationals and a relatively weak domestic sector, with minimal spillovers from the former to the latter, may partly manifest as micro-level resource misallocation.

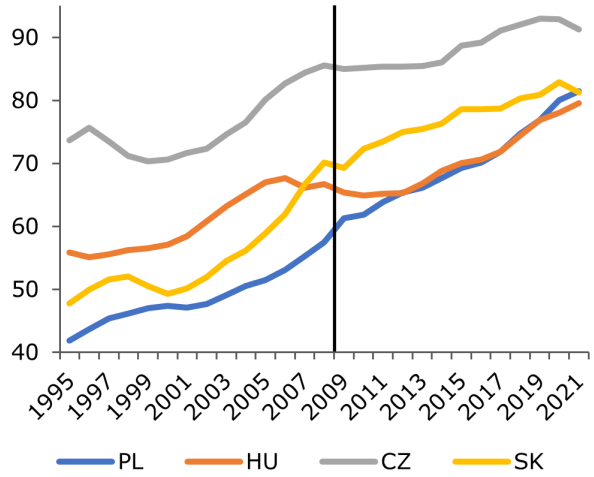
Because global findings in the literature do not adequately capture Slovakia's specific situation, this paper aims to present stylized facts on the country's productivity slowdown between the Global Financial Crisis (GFC) and the COVID-19 crisis. By laying out these broad patterns and pinpointing areas that warrant deeper analysis, the paper provides a foundation for further research into how Slovakia can address its productivity challenges and secure sustained long-run growth.

[2]Business dynamism relates to the rate at which firms enter the market, expand, contract, and exit. A steady level of dynamism is typically considered crucial for sustained productivity and economic growth.

3 Aggregate developments

CEE countries underwent a rapid transition to market economies, which led to rapid catching up to the living standards of advanced EU countries, particularly in the run-up to the GFC. However, following the crisis Slovakia's growth model began to falter, and the country's convergence came to a near standstill. This slowdown was even more pronounced than that of Slovakia's peers in the Visegrad Four (V4) group (Figure 1)[3]. Similarly, Figure 2 plots counterfactual GDP per capita levels following the GFC based on historical performance against actual performance, further demonstrating significant slowdown in convergence.

Figure 1: Adjusted GDP per capita in PPP (EU27=100)



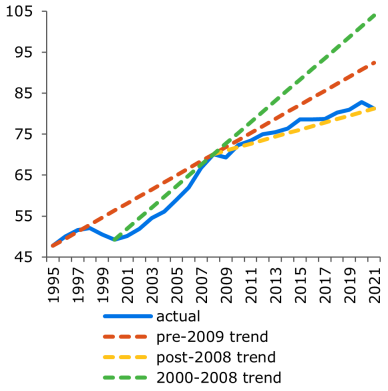
Note: Comparison of convergence, in terms of GDP per capita in PPP, to the EU27 average. Each line shows the GDP per capita in PPP in each country between 1995-2021, as a percentage from 100%, corresponding to the average GDP per capita in PPP in EU27.

Source: Eurostat, own calculations. From 2016 onwards, per capita PPP levels were estimated using real per capita GDP growth rates.

Figure 3 looks at the drivers of the GDP per capita growth in Slovakia, Germany as well as other V4 countries. The figure shows that productivity growth (and as we will later show, TFP) was the key driver of successful convergence prior to the GFC. Similarly, the post-GFC period saw a significant slowdown in productivity growth which, together with aging, had a negative effect on economic growth. While economic growth was supported by growing employment rate, there are limits to labour market improvements and with only deepening negative impacts of aging, Slovakia's long-run growth prospects rely on recovery of productivity growth.

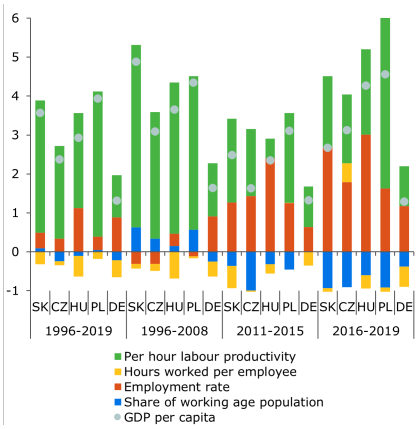
[3]According to Eurostat data on GDP per capita in PPP Slovakia has even experienced divergence relative to EU27 in recent years, driven mainly by a significant increase in the comparative price level of housing costs. However, PPP data seems to be at odds with real GDP as well as housing prices developments. Therefore, we construct adjusted GDP per capita levels by taking Eurostat's GDP per capita PPP levels up to 2015 as given and use the growth in GDP per capita in constant prices to estimate the adjusted levels from 2016 onwards. While the adjusted data does not suggest divergence against EU 27, it nevertheless confirms a significant slowdown in Slovakia's convergence following the financial crisis. As Hlaváč (2023) and Dujava (2023) show this adjustment comes with its own problems given uncertain 'true' PPP level in 2015 as well as due to conceptual differences between development of GDP per capita in PPP and real terms over time.

Figure 2: Projected linear trends of PPP GDP per capita based on historical averages (EU27=100)



Source: Eurostat, own calculations

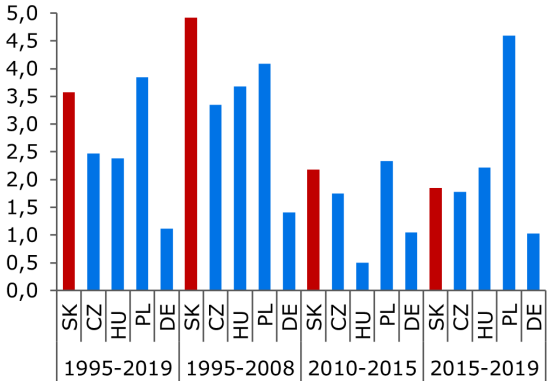
Figure 3: Contributions to average per capita growth



Source: Eurostat, own calculations

Slovak labour productivity growth per hour worked averaged 3.6% between 1995 and 2019 (figure 4). It was thus more than threefold faster than in Germany. Similarly, except for Poland, Slovakia outperformed its V4 peers. Following the financial crisis Slovakia has experienced a significant productivity slowdown even relative to its V4 peers, with productivity growth slowing down markedly from 4.9% to 2.2% over the 2010-2015 period. While this development was common among all V4 countries, contrary to them, Slovakia's productivity performance continued to worsen also over the 2015-2019 period, with Slovakia's productivity growth trailing that of Poland and Hungary and only growing at around the pace of Czechia.

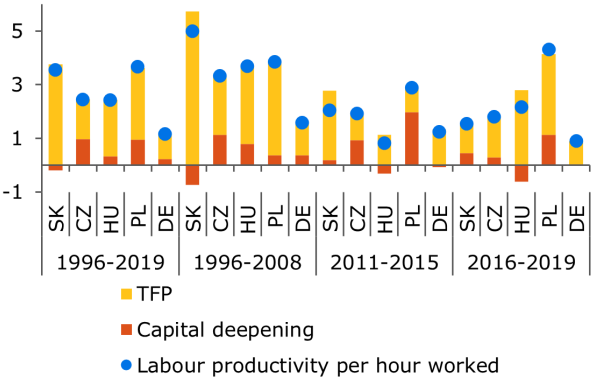
Figure 4: Average productivity growth per hour worked



Source: Eurostat, own calculations

Note: Geometric mean over respective periods.

Figure 5: Contributions to per hour labour productivity growth



Source: EU Klems database Jan 2022, Vienna Institute for International Economic Studies, own calculations.

Note: Mean of annual growth rates and contributions.

Looking at productivity per hour in more detail using the EU Klems database, the main culprit was a slowdown in TFP growth. Over the period 1995-2019, Slovak productivity per hour worked was driven mainly by TFP growth, with capital deepening having a marginally negative contribution. Negative capital deepening represented a negative drag on productivity growth prior to the financial crisis; later, its contribution turned marginally positive.

Box 1: Labor productivity definition and measurement

In general, productivity is defined as a ratio of a volume measure of output to a volume measure of input use. This study utilizes mostly the single factor productivity measure - labour productivity (LP). In a firm context, LP captures the amount of output produced by a firm for a given amount of labour input. It is computed as the (real) value-added (VA) per worker

$$LP_{it}^{VA} = \frac{VA_{it}}{L_{it}},$$

where VA_{it} is the value-added of firm i at time t and L_{it} is its employment.

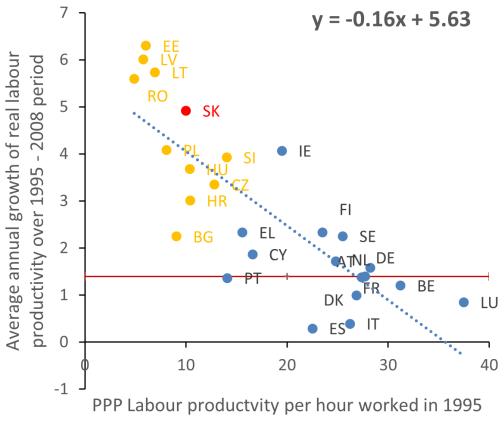
The formula above represents the simplest single-factor version. By aggregating the LP across firms, it is possible to produce sectoral or country-level LP straightforwardly. We direct a reader for further reading and extensions of productivity measurements to Pilat and Schreyer (2003) for a thorough overview.

The productivity slowdown was not limited to Slovakia but it was more significant than the post-GFC slowdown related to developments at the productivity frontier in the EU and the slowdown in convergence in the within the EU. André and Gal (2024) show that for OECD countries the productivity slowdown stems from both declining productivity growth at the frontier as well as slower convergence process. Figures 6 and 7 show this for sample of EU countries. More specifically, the figures plot initial productivity levels against subsequent average real growth in productivity for EU countries, depicting the pre-GFC and post-GFC periods, respectively. Both figures illustrate a negative relationship between initial productivity levels and subsequent productivity growth for the relevant periods, indicating economic convergence. However, the red lines, which represent average growth at the productivity frontier (defined as the three most productive countries at the beginning of each period, excluding Ireland and Luxembourg), suggest a halving of the productivity frontier within the EU after the GFC. Additionally, the slope of the regression line became flatter, indicating a slowdown in convergence. Notably, Slovakia's pre-GFC performance exceeded expectations based on its initial productivity level, but this advantage diminished in the post-GFC period. While Slovakia still performed better than its initial productivity level would suggest in the post-GFC period, it is important to note that its productivity development continued to deteriorate over the post-GFC period as shown previously.

4 The role of structural change

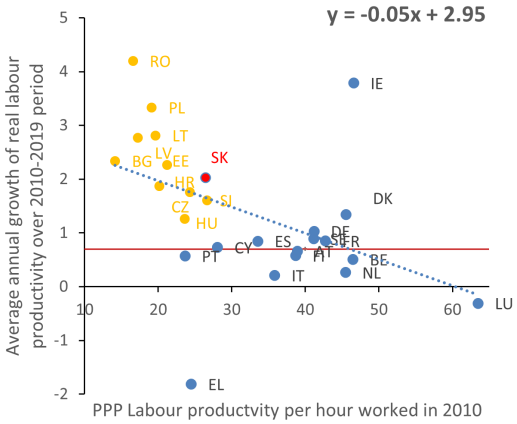
Given their rapid transition to market economies, it is of high interest to explore to what extent sectoral reallocation of labour contributed to Slovakia's high productivity growth and whether it can also explain subsequent productivity slowdown once the transition was completed. McMillan and Rodrik (2011) show that large gaps in labour productivity between traditional and modern sectors are prevalent in developing countries, and that reallocation of labour into more productive activities is a key driver of development. However, structural change can be also growth-reducing, as it has been in many countries in Africa and

Figure 6: Initial productivity level and average annual growth in labour productivity (1995-2008)



Source: Eurostat, own calculations.

Figure 7: Initial productivity level and average annual growth in labour productivity (2010-2019)

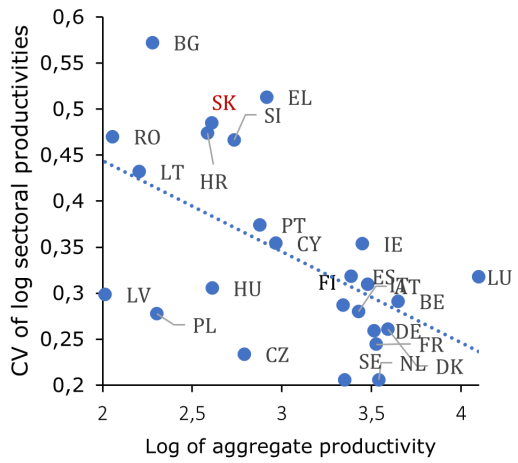


Source: Eurostat, own calculations.

Red line shows average annual growth in real per hour labour productivity at the productivity frontier within EU countries. This is defined as the three most productive countries at the start of each period disregarding Ireland and Luxembourg given their structure of economy. These are Germany, Netherlands and Belgium and Netherlands, Denmark and Belgium for the pre and post GFC periods respectively. CEE countries apart Slovakia are highlighted in yellow.

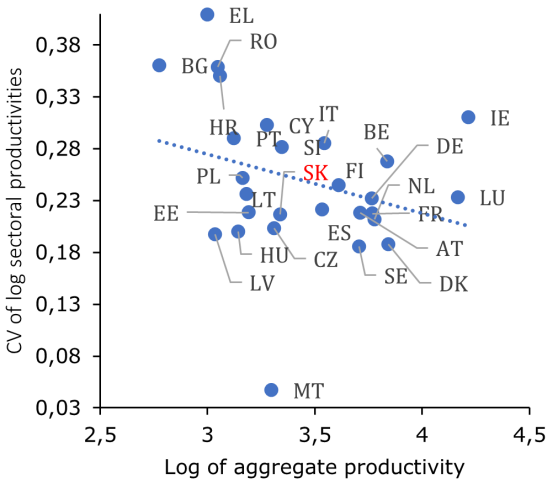
Latin America since 1990. In particular, they find that the structural change component in Latin America declined from 2 percent during 1950-1975 to -0.2 percent in 1990-2005 despite continuing within sector growth. This may be related to the manufacturing sector becoming more competitive and productive (e.g., as a result of trade liberalization), with the least productive firms exiting the sector and more productive firms shedding excess labour. In countries with large inter-sector productivity gaps, such as those in Latin America, the displaced workers may end up in sectors with low productivity, leading to the negative growth effect of structural change.

Figure 8: Sectoral dispersions and aggregate labour productivity (1995, per hour worked)



Source: Eurostat, own calculations.

Figure 9: Sectoral dispersions and aggregate labour productivity (2019, per hour worked)



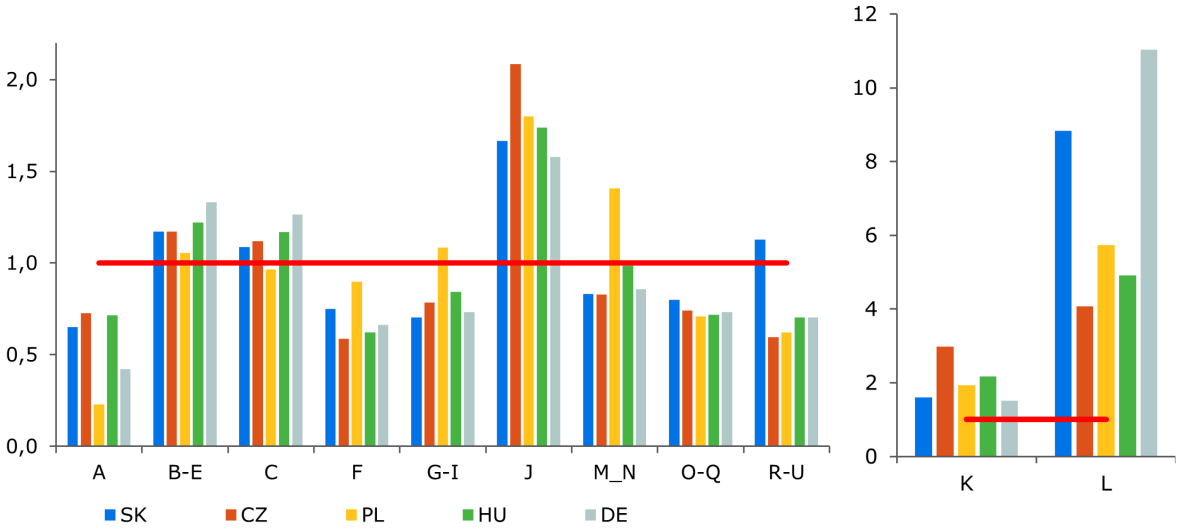
Source: Eurostat, own calculations.

Figures 8 and 9 show that even within EU countries, we can observe that the dispersion of sectoral productivities - measured as coefficient of variation of sectoral log productivities - is negatively related

to overall aggregate productivities[4]. Comparing the relation in 2019 against 1995, we can note in the case of Slovakia not only an improvement of aggregate productivity but also a significant reduction in the dispersion of sectoral productivities. Indeed, by 2019 the sectoral dispersions became somewhat lower than suggested by its aggregate productivity level. Thus, Slovakia, similarly to its V4 peers, has similar productivity dispersions as more advanced economies despite their lower aggregate productivity.

Figure 10 plots the ratios of productivities in individual sectors against aggregate productivity for V4 countries and Germany in 2019. In particular, for a given country and sector, a ratio of 1 represents a situation where the individual sector operates at the same level of productivity as the aggregate economy. By 2019 sectoral productivity gaps in V4 resembled those in Germany in most cases, with general industry, information and communication, finance and real estate sectors recording positive productivity gaps and remaining sectors having productivity lower than the economy as a whole. In Poland, exceptions to this were the wholesale and retail as well as professional services sectors with positive productivity gaps. Similarly, the positive productivity gap of the arts, entertainment, and recreation sector in Slovakia was at odds with negative productivity gaps in the remaining V4 countries and Germany.

Figure 10: Ratios of sectoral per hour worked productivities relative to aggregate productivity, 2019



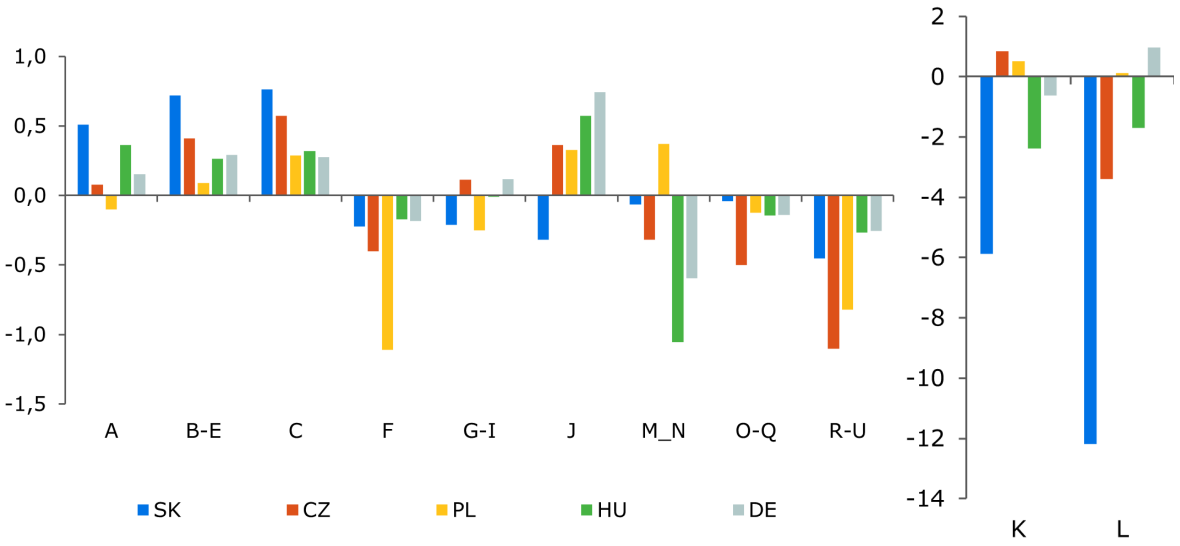
Source: Eurostat, own calculations

Note: A Agriculture, forestry and fishing; B-E Industry (except construction); F Construction; G-I Wholesale and retail trade, transport, accommodation and food service activities; J Information and communication; K Financial and insurance activities; L Real estate activities; M_N Professional, scientific and technical activities; administrative and support service; O-Q Public administration, defence, education, human health and social work activities; R-U Arts, entertainment and recreation; other service activities.

Figure 11 shows the change in productivity ratios between 1995 and 2019. Since 1995 Slovakia saw significant improvement in relative productivity in agriculture, industry, and construction. On the other

[4]In what follows labour productivities at the level of NACE sectors were calculated as gross value added in chain-linked volumes in national currencies (Eurostat table NAMA_10_A10) divided by employment (domestic concept, in persons as well as hours worked) into corresponding sectors (Eurostat table NAMA _10_PE). To allow cross-country comparisons, chain-linked volumes were converted into ”common” currency using 2015 PPPs (Eurostat table PRC_PPP_IND). Note that aggregating sectoral productivities based on gross value added results in somewhat different aggregate productivities to those based on GDP, as the latter also includes net taxes as well due to the problem of non-additivity of chain-linked volumes. Thus, in the following decompositions, total productivity growth, as well as the individual contributions, were rescaled to match productivity growth based on GDP.

Figure 11: Change in ratios of sectoral per hour worked productivities to aggregate productivity between 1995 and 2019



Source: Eurostat, own calculations
Note: A Agriculture, forestry and fishing; B-E Industry (except construction); F Construction; G-I Wholesale and retail trade, transport, accommodation and food service activities; J Information and communication; K Financial and insurance activities; L Real estate activities; M_N Professional, scientific and technical activities; administrative and support service; O-Q Public administration, defence, education, human health and social work activities; R-U Arts, entertainment and recreation; other service activities.

hand, relative productivity dropped massively in financial and insurance activities as well as real estate activities. In 1995 these sectors had much higher relative productivity than in Germany or other V4 countries. However, the relative productivity of the real estate sector remains the highest in the V4, albeit lower than in Germany. On the contrary, the relative productivity of financial and insurance activities trails now those in Germany and the remaining V4 countries.

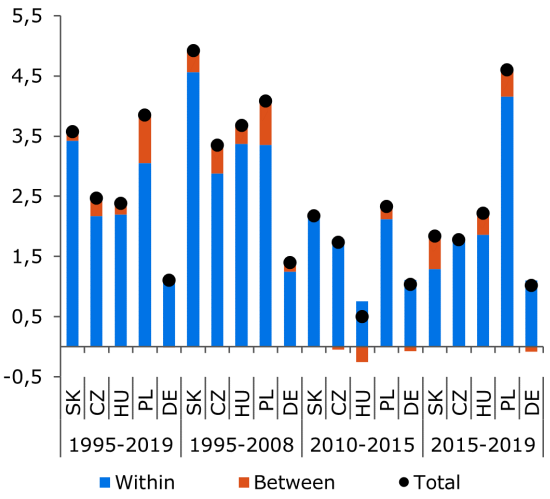
How quantitatively important were these structural changes in terms of aggregate productivity developments? To answer this question, we follow McMillan and Rodrik (2011) and decompose the aggregate labour productivity growth into productivity growth within individual economic sectors and structural change. In the case of the former growth is achieved through capital accumulation, technological improvements, or reduction of misallocation within individual sectors. The latter captures the movement of labour from less to more productive sectors. Formally, this can be described with the following equation:

$$\Delta Y_t = \sum_{i-1}^{n} \theta_{i,t-k} \Delta y_{i,t} + \sum_{i-1}^{n} y_{i,t} \Delta \theta_{i,t}. \quad (1)$$

where Y_t and $y_{(i,t)}$ refer to aggregate and sector-specific labour productivity levels respectively and $\theta_{(i,t)}$ denotes the employment share of sector i. The Δ operator corresponds to the change in productivity or employment shares between periods t and $t-k$. Thus, the first term of the equation captures the growth in productivity originating from within the sectors, while the second term represents structural change.

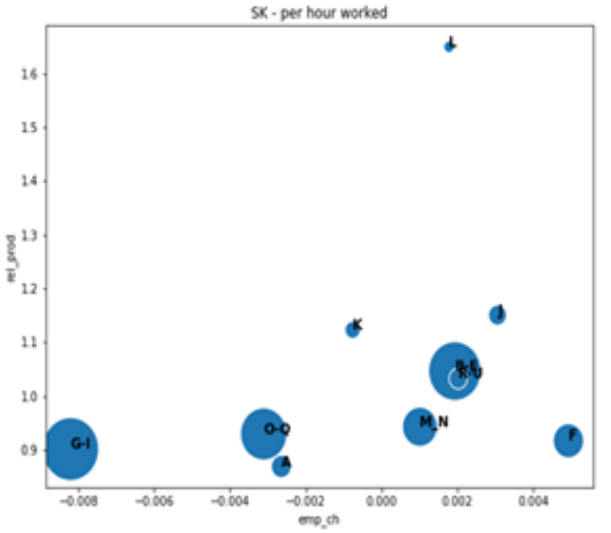
The observed structural changes over the transition period, with the notable exception of Poland, con-

Figure 12: Decomposition of average growth in labour productivity per hour worked



Source: Eurostat, own calculations.

Figure 13: Relative productivity per hour worked of sectors and the change in their share in hours worked in Slovakia (2015-2019)



Source: Eurostat, own calculations.
Note: The size of circles represents the relative share of sectors on total hours worked.

tributed only negligibly to aggregate productivity developments of V4 countries over the 1995-2019 period. Figure 12 shows the decompositions of average productivity growth into within-sector and between-sector components for V4 countries and Germany. Tables 2 and 3 in Annex 1 replicate the decompositions for all EU countries (as well as for labour productivity per employed person). Among V4 countries, structural change had the largest impact on Polish productivity growth, adding 0.8 p.p. to its average annual labour productivity growth over the whole period, with the contribution being the largest in the period prior to the GFC. In Germany as well as in other V4 countries, sectoral labour reallocation had only a negligible effect on productivity growth. Looking at all EU countries, structural change had a non-negligible contribution to the productivity growth of Romania, Bulgaria, and Lithuania. On the other end, sectoral labour reallocation exhibited a relatively large drag on Irish productivity growth over this period.

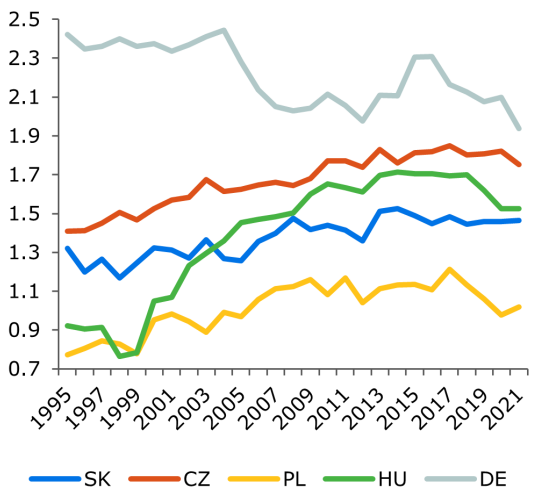
Overall structural change (or at least its manifestation through labour reallocation between sectors) cannot explain the productivity slowdown in Slovakia, as it contributed little to aggregate productivity growth between 1995 and 2019. On the contrary, the fall in within-sector productivity growth in recent years was partly offset by labour reallocation. In particular, between 2015 and 2019, labour reallocation added 0.6 p.p. to the average growth of labour productivity per hour worked, while the contribution of the "within" component stood at 1.3%. Figure 13 plots the relative productivity of a sector in 2019 against the change in its share of total hours worked between 2015 and 2019, with sizes of the circles representing relative shares of sectors on total hours worked. We can observe that productivity growth was supported by labour reallocation from relatively low productivity sectors (mainly wholesale and retail services[5]) to sectors with higher productivity (real estate; information and communication; finance and insurance; arts, entertainment and recreation and industry).[6]

[5]Sector G-I: Wholesale and retail trade, transport, accommodation, and food services activities.

[6]Annex 2 reproduces the figure for V4 countries and Germany over the period 1995-2019. Overall, Poland is the only country with a more significant role in labour reallocation over the full period. Polish productivity growth was mainly boosted by the reallocation of labour from agriculture, which had a very

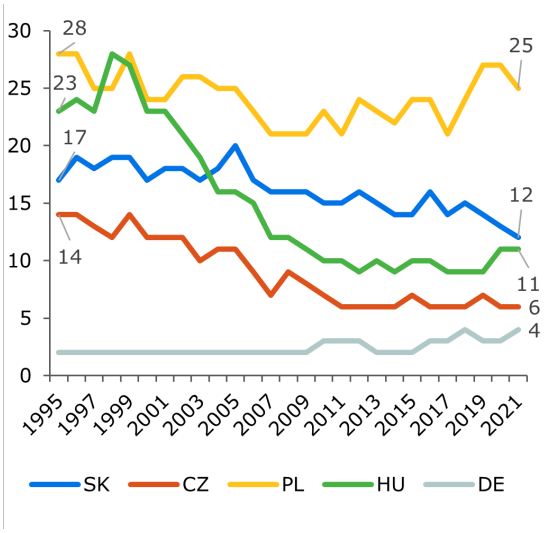
The relatively limited impact of structural change on productivity growth among Visegrád Group (V4) countries may be attributed, in part, to the inheritance of a relatively complex industrial structure from the socialist era. Figures 14 and 15 illustrate this complexity through the development of the Harvard Atlas of Economic Complexity Index (ECI) and the corresponding economic complexity rank for V4 countries compared to Germany. The rankings provide insight into the diversity and sophistication of each country's export basket, reflecting the diversity of productive knowledge embedded within each economy. Countries with a high degree of productive know-how, especially in specialized and complex sectors, are better positioned to produce a broad array of sophisticated products. In 2021, Czechia stood as the sixth most complex economy globally, followed by Hungary (11th), Slovakia (12th), and Poland (25th). Despite varying levels of improvement across the 1995–2021 period, most significantly in Hungary, all V4 countries showed signs of an already complex economic structure by the mid-1990s. This evidence suggests that productivity dynamics in V4 countries may be more accurately analyzed at the intra-sectoral or firm level, rather than by focusing on broader sectoral shifts in the economy.

Figure 14: Economic Complexity Index



Source: The Atlas of Economic Complexity, The Growth Lab at Harvard University.

Figure 15: Economic Complexity Index rank



Source: The Atlas of Economic Complexity, The Growth Lab at Harvard University.

5 Business demography and dynamism

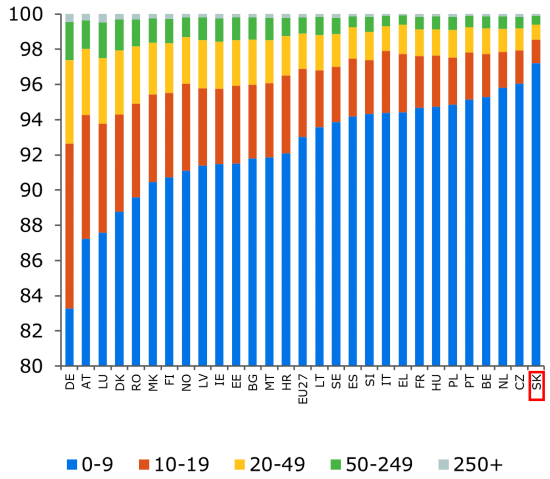
Having explored aggregate productivity developments and sectoral reallocation, the following sections will shed some light on business demography and distribution of productivity developments at the micro-level. We start by looking at the structure of Slovak businesses and their dynamism compared to other European countries through the lens of Eurostat's Structural business statistics (SBS).

Slovak business demography is dominated predominantly by very small firms (figure 16). With 97% Slovakia had in 2019 the highest share of firms under 10 employees in the sample of available European countries. On the contrary, larger firms, particularly in the 10 – 19 and 20 – 49 employee categories, make up a relatively small part of Slovak business demography. By legal form, most firms are sole proprietorships and, to a lesser extent, limited liabilities enterprises. Partnerships, co-operatives, and

large negative productivity gap relative to the remaining sectors in 1995.

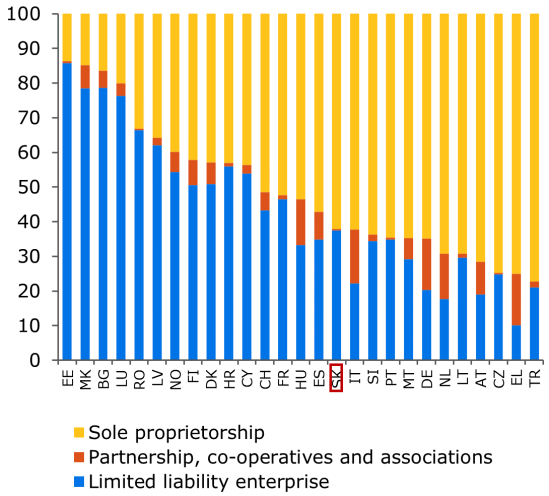
associations play a very limited role.

Figure 16: Business demography by the size of firms (2019, %)



Source: Eurostat Structural Business Statistics, own calculations

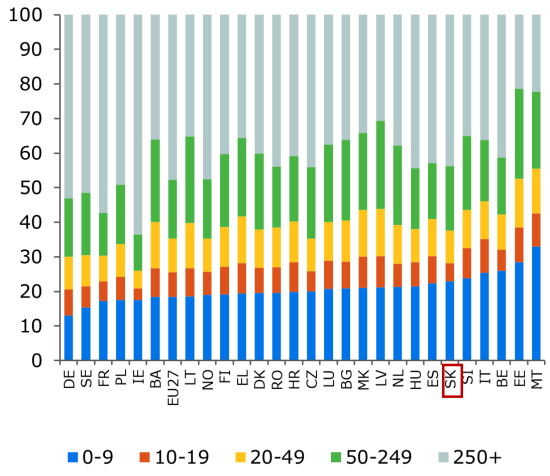
Figure 17: Business demography by legal form (2019, %)



Source: Eurostat Structural Business Statistics, own calculations.

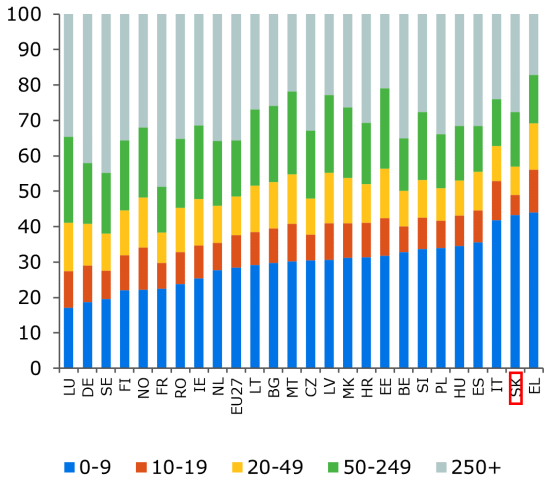
Despite the dominant role of businesses under ten employees in overall business demography and sizable role in employment, they have a more limited role in value-added creation. Small businesses provide employment for 43% of the Slovak labour force, which is the second highest share in our sample of available European countries. Despite this, they create only 23% of value-added (6th highest share). On the other end of the distribution, firms with more than 250 employees, despite their negligible share in overall business demography and compared to other European countries relatively low employment share, generate only a slightly lower share of value added than their counterparts in the EU27.

Figure 18: Share of value added by firm size (2019, %)



Source: Eurostat Structural Business Statistics, own calculations.

Figure 19: Share of employment by firm size (2019, %)

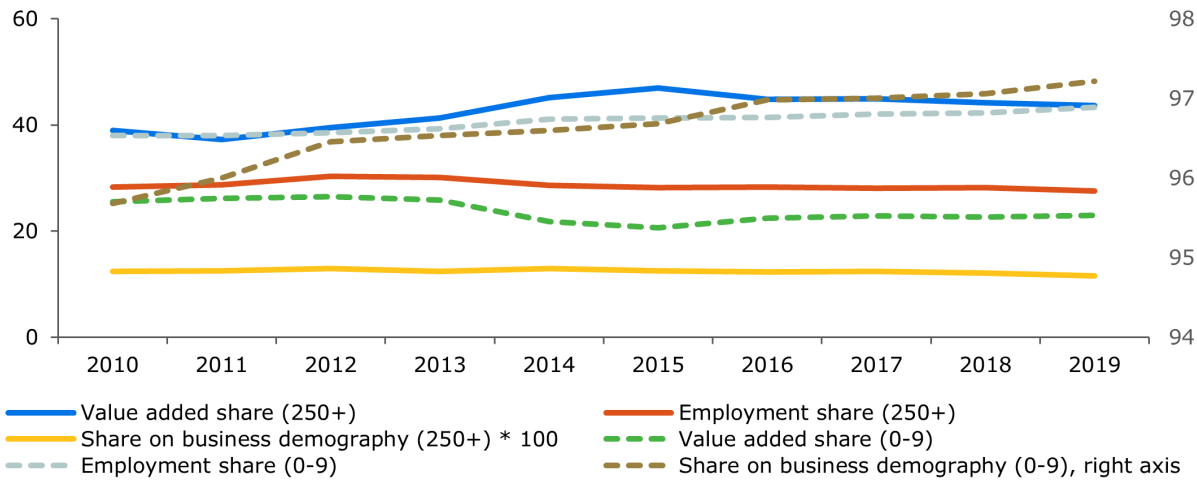


Source: Eurostat Structural Business Statistics, own calculations.

Not only is the gap between the largest and smallest firms in Slovakia relatively large, but it has also been increasing over time. Despite the increasing share of firms under 10 employees between 2010 and

2019 in overall business demography and employment, their share in value added decreased between 2010 and 2015 and only recovered partly thereafter. The developments in the case of firms with more than 250 employees were the mirror opposite of those in the smallest category. Similarly, the importance of small businesses for employment has been growing over time.

Figure 20: Share of Slovak firms in value-added, employment and business demography (2010-2019, %)



Source: Eurostat Structural Business Statistics, own calculations.

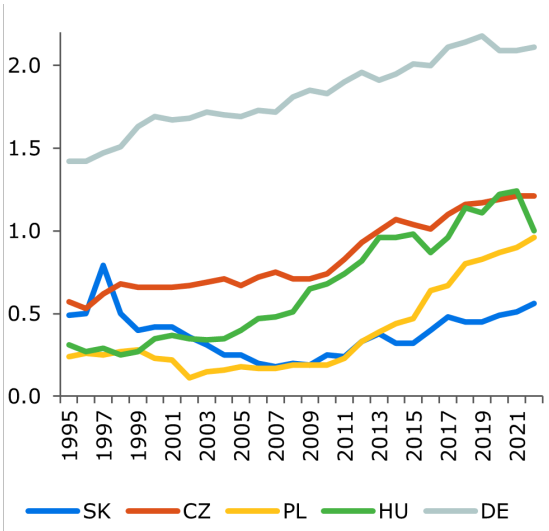
Slovak firms are markedly underperforming in business R&D expenditure and innovation activity. Although there has been some progress in recent years, Slovakia's business R&D spending remains significantly below that of Germany and even lags behind other V4 countries (figure 21). Similarly, while the share of Slovak firms reporting innovation activities in 2020 (36.6 %) is slightly higher than in Hungary and Poland, it remains considerably lower than in Germany and Czechia, where 68.8 % and 56.9 % of firms, respectively, engaged in innovation (figure 22). Notably, larger firms in Slovakia are also underperforming in this area: among those employing more than 250 people, only 65.6 % reported engagement in innovation activities relative to 92.5 % and 83.3 % in Germany and Czechia respectively.

Slovak's FDI-led growth model manifests itself in the high and increasing role of foreign-owned firms in its business demography. Among the V4 countries, Slovakia had in 2019 the highest share of foreign-owned companies, with at least 20 employees, in each sector. As we can see from Figures 23 and 24, the share of foreign-owned companies has increased between 2008 and 2019 for each sector, except Accommodation. For the Czech Republic, Hungary, and Poland, the change in the share of foreign-owned firms is less significant than for Slovakia.

As shown by Vladová and Bolčo (2024), foreign-owned companies were consistently 1.7 times more productive than their domestic counterparts between 2014 and 2022, after excluding micro-firms from the analysis. Furthermore, foreign-owned companies consistently generate more resources to support wages and maintain a broader safety net to weather crises, while also being better positioned to manage the triple transition—ecological, digital, and toward economic security.

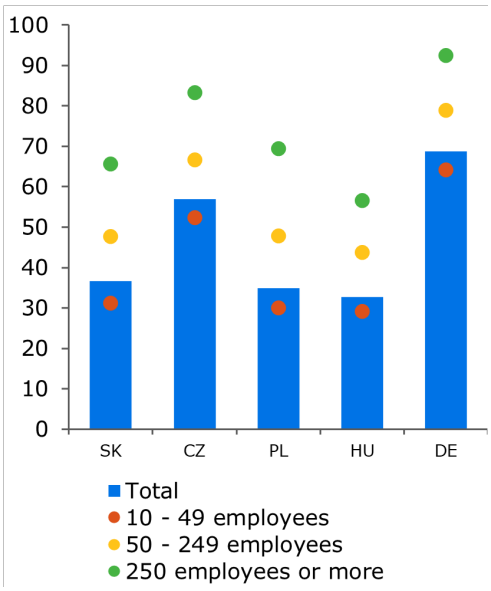
From a regional point of view, foreign investment has favoured the western regions of the country. The Bratislava region has the highest share of foreign-owned firms, and Eastern Slovakia has the lowest. The second highest share has Western Slovakia, and Central Slovakia is next to the last in the share of foreign-owned companies. Central and Eastern Slovakia exchanged their last place in 2011 (Figure

Figure 21: Business R&D expenditure (percentage of GDP)



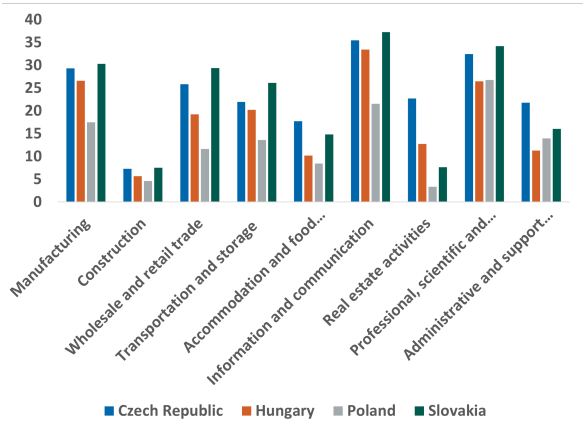
Source: Eurostat

Figure 22: Firms with innovative activities (%; 2020)



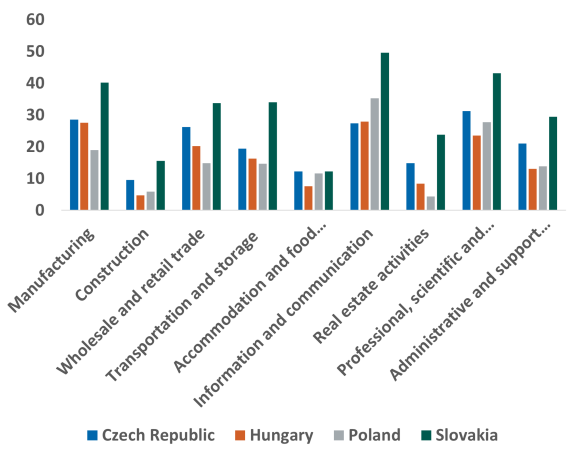
Source: Eurostat - Community Innovation Survey

Figure 23: Share of foreign-owned firms in 2008 (%)



Source: CompNet, own calculations.

Figure 24: Share of foreign-owned firms in 2019 (%)

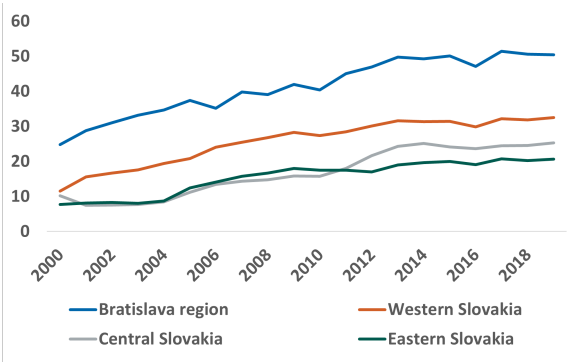


Source: CompNet, own calculations.

25). The differing share of foreign-owned businesses may help partly explain the productivity differences between regions. As Figure 26 shows, mean labor productivity across regions closely copies the ordering based on the shares of foreign-owned firms.

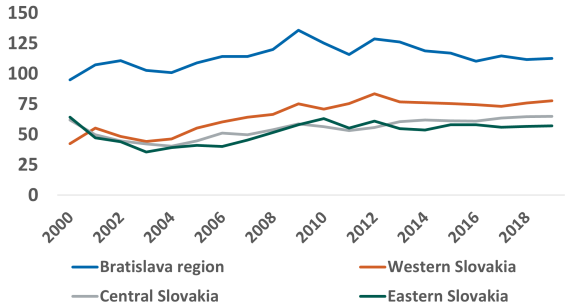
While the structure of the firm sector in Slovakia provides us with useful stylized facts about the Slovak economy, it is also necessary to examine the underlying dynamism of the business sector. According to Gordon (2015), declining business dynamism, which he defines as the process of creative destruction through which young firms introduce new technologies and methods and shift resources from incumbent lower productivity firms, is one of the factors contributing to slowing productivity growth in the US. Recent research on the United States, including studies by Davis and Haltiwanger (2014) and Decker et al. (2016), are also showing a slowing US business dynamism, with declining job reallocations, firm turnover,

Figure 25: Share of foreign-owned firms across regions -NUTS 2 (%)



Source: CompNet, own calculations.

Figure 26: Mean labor productivity across regions -NUTS 2 (%)

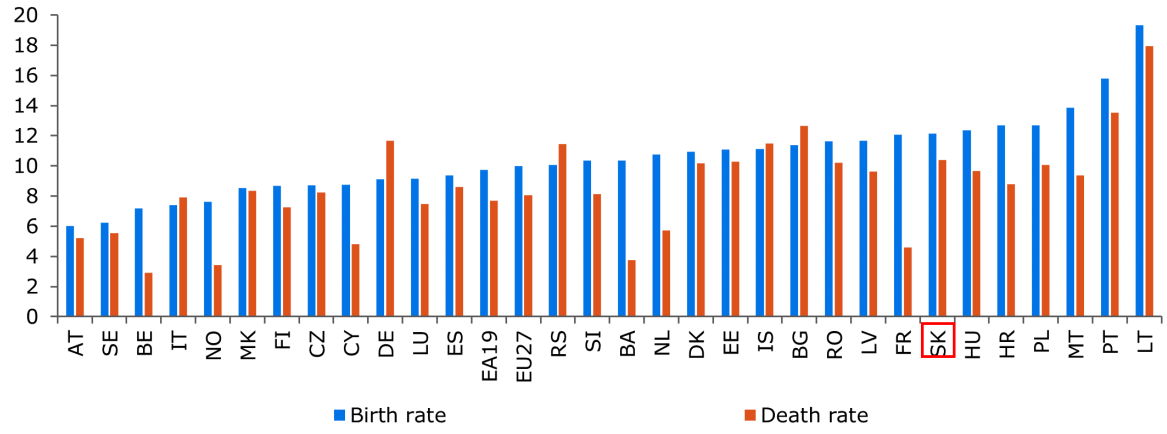


Source: CompNet, own calculations.

and entrepreneurial activity including in sectors such as ICT[7].

Looking at the business sector in Slovakia, we can observe that its dynamism is high but declining. According to Figure 27 Slovakia belongs to European countries with relatively high birth and death rates of firms. Among V4 countries, Poland and Hungary had only a slightly more dynamic business environment in 2019.

Figure 27: Business dynamism (2019, %)

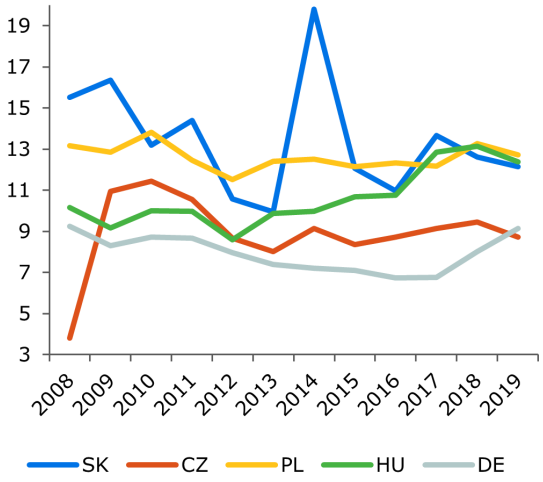


Source: Eurostat Structural Business Statistics.

However, similarly to the developments in other countries, Slovakia has been experiencing a slowdown in business dynamism over time. Figures 28 and 29 plot the development birth and death rates of firms, respectively, over the 2008-2019 period in V4 countries and Germany. The firm birth rate in Slovakia declined from 15.5% in 2008 to 12.1% in 2019. A similar trend can be observed also in Czechia, Poland, and up until 2017 in Germany. Hungary is the only V4 country at odds with the global trend of declining business dynamism, with the birth rate improving between 2008 and 2019. Germany has, since 2017, experienced an increase in business creation, but compared to Poland, Hungary, and Slovakia, the rate remains low. In the case of death rate of firms, it is also possible to observe a declining trend in death rates but also a spike in business destruction in recent years in all V4 countries as well as Germany.

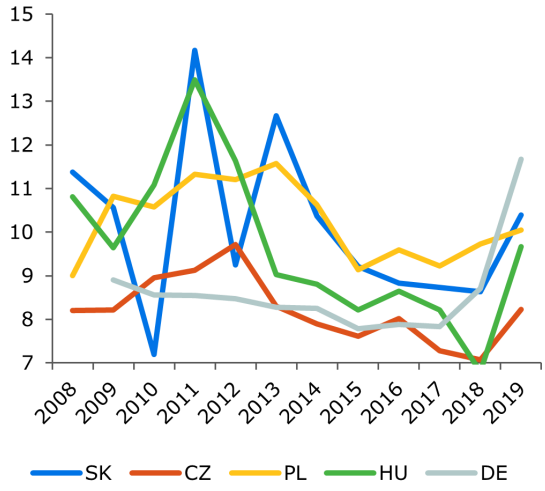
[7] See also the discussion in Cusolito and Maloney (2018)

Figure 28: Birth rate of firms (%)



Source: Eurostat Structural Business Statistics.

Figure 29: Death rate of firms (%)



Source: Eurostat Structural Business Statistics.

Overall, the less dynamic business environment in Slovakia may be contributing to declining productivity growth. However, the developments in Slovakia have not been at odds with those of V4 countries. Thus, the slowdown of business dynamism is unlikely to explain unfavorable aggregate productivity developments in Slovakia relative to its peers.

6 Intra-sector developments

While in Section 3 we found only a limited role for sectoral reallocation to explain Slovakia's productivity developments, within sector developments have been quite heterogeneous (figure 30).[8] Prior to the financial crisis, agriculture, industry, construction, and professional services[9] as well as wholesale and retail recorded relatively fast productivity growth. Productivity growth in these sectors has either slowed down significantly or even turned negative (agriculture, construction, and professional services in 2015 – 2019; wholesale and retail in 2010-2015). The information and communications sector displayed relative to V4 peers and Germany's weak productivity growth already prior to the financial crisis, and its performance has declined further. Productivity in the arts, entertainment, and recreation sector has grown modestly up to 2015, but recently, it has experienced a significant decline in productivity. Measured productivity in public services[10] was at odds with other sectors since it grew moderately over the whole period (except for the 2010 – 2015 period).

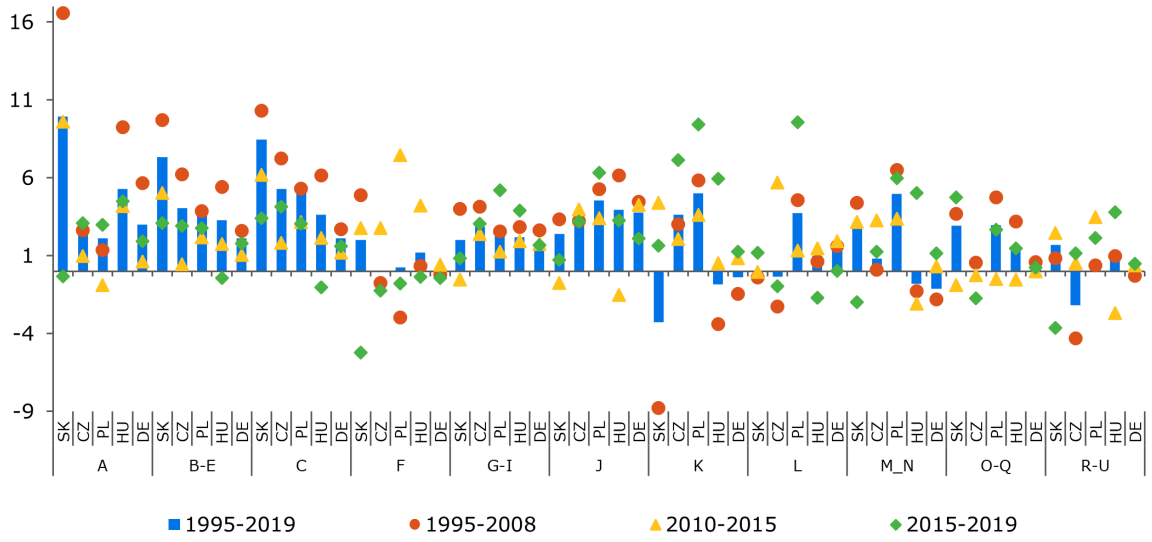
Developments in Slovakia's financial and real estate sectors, which enjoyed significantly higher productivity than the remaining sectors in 1995, are also notable. Labor productivity in the Slovak financial sector fell significantly prior to the financial crisis, which also led to negative average productivity growth over the whole 1995-2019 period. While productivity growth in this sector recovered following the financial crisis, it fell short of the performance of the Polish and Czech financial sectors, particularly in recent

[8] See also annex 3 for more detailed sectoral development of both per person employed productivity and per hour worked productivities.

[9] Sector M_N: Professional, scientific, and technical activities; administrative and support service.

[10] Sector O-Q: Public administration, defense, education, human health, and social work activities.

Figure 30: Average growth rates of sector productivity per hour worked (%)



Source: Eurostat, own calculations.
Note: A Agriculture, forestry and fishing; B-E Industry (except construction); F Construction; G-I Wholesale and retail trade, transport, accommodation and food service activities; J Information and communication; K Financial and insurance activities; L Real estate activities; M_N Professional, scientific and technical activities; administrative and support service; O-Q Public administration, defence, education, human health and social work activities; R-U Arts, entertainment and recreation; other service activities.

years. In the case of the real estate sector, productivity was slowly declining until 2015, and since then, it has grown modestly.

To gain a better understanding of developments within sectors, we employ the 8th vintage of the Comp-Net dataset. The dataset provides micro-aggregated firm-level data for several European countries. The drawback of the dataset is that for Slovakia, it is limited to a sample of firms with more than 20 employees, which, as Section 5 showed, covers a negligible part of overall business demography (albeit represents roughly 72% of value added). Similarly, the dataset does not include information on hours worked. Thus, aggregate productivity developments may not perfectly match those previously obtained on the basis of national accounts data.

Significant and persistent labor productivity dispersion exists both between sectors and among firms within the same sector, as supported by extensive literature (e.g., Bartelsman, Haltiwanger and Scarpetta, 2013). In this section, we first illustrate within-sector labor productivity dispersion by presenting selected productivity level percentiles for each sector. We then explore the productivity evolution of the manufacturing and information and communication sectors across multiple percentiles, not just for frontier and laggard firms. The manufacturing sector is highlighted due to its prominence and substantial fraction of FDIs. The information and communication sector is chosen for its strong connection to recent technological advancements and its highest share of intangible assets across sectors.

First, in table 1, we present an average value[11] of labor productivity dispersion between frontier (90th percentile) and laggard firms (10th percentile) between years 2016-2018. In addition, we display in table 1 the difference (Δ) between the average value of labor productivity dispersion between 2016-

[11] We consider the average values over the window of three years in order to overcome potential noise in the data collected in the CompNet database.

2018 and the average value for years 2007-2009. The comparison of productivity dispersion evolution sheds light on the extent to which the diffusion of technology from frontier firms to the rest of the economy could play a role in productivity growth differences between countries.

	Manufacturing		Construction		Wholesale and retail trade		Transportation and storage		Accommodation and food service activities		Information and communication		Real estate activities		Professional, scientific and technical activities		Administrative and support service activities	
	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ
Czech Republic	4,38	-0,03	3,39	-0,06	6,44	-0,66	3,90	-0,50	4,18	-0,52	3,94	-0,21	6,52	-0,82	5,00	0,23	5,25	0,20
Germany	3,55	0,20	2,92	0,16	7,16	-25,02	4,78	-1,82	4,68	-20,45	4,91	-0,24	11,01	-0,53	3,75	-0,12	5,60	-0,62
Hungary	5,44	-0,26	5,34	0,30	6,64	-0,37	3,66	-1,23	4,33	0,34	6,22	-0,95	9,09	-1,01	8,05	-0,83	8,17	-0,09
Poland	4,96	-0,43	3,80	-0,26	5,72	-0,16	3,52	-0,52	4,10	0,19	4,68	-0,46	4,03	0,38	5,14	-0,39	7,83	-0,40
Slovakia	8,30	1,68	5,09	-0,43	11,49	1,29	3,59	-0,71	4,48	-0,16	4,52	-0,44	6,95	0,34	6,05	-1,94	6,69	1,14

Table 1: Average labor productivity ratio for 90th- and 10th-percentile firms between 2016 and 2018, along with its difference (Δ) relative to the same ratio between 2007 and 2009. The green color indicates an increase in the average productivity ratio ($\Delta > 0$), while the red color indicates a decrease ($\Delta < 0$).

Slovakia has the highest labor productivity dispersion in the wholesale and retail trade sector among V4+Germany countries, followed by the manufacturing sector. This ranking has remained unchanged since 2007. In the Czech Republic, Hungary, and Germany, the real estate activities sector is the most dispersed. In Germany and the Czech Republic, this is followed by wholesale and retail trade, while in Hungary, it is followed by administrative and support services. In Poland, the most dispersed sectors are administrative and support services and wholesale and retail trade. Notably, only Slovakia has manufacturing as one of the top two most dispersed sectors.

Over the past nine years, the dispersion in manufacturing, wholesale and retail trade, real estate activities, and administrative and support services has increased. This widening gap in productivity between frontier and laggard firms indicates insufficient technology diffusion. Each V4+Germany country has at least one sector with increased dispersion, but Slovakia has four such sectors. In Slovakia, the dispersion increased from 0.34 to 1.68, whereas in other countries, it rose from 0.16 to 0.38. This suggests that in Slovakia, labor productivity growth is predominantly driven by frontier firms, exacerbating the gap with lagging firms. Therefore, enhancing productivity in laggard firms and improving reallocation and business dynamism in these sectors should be a priority.

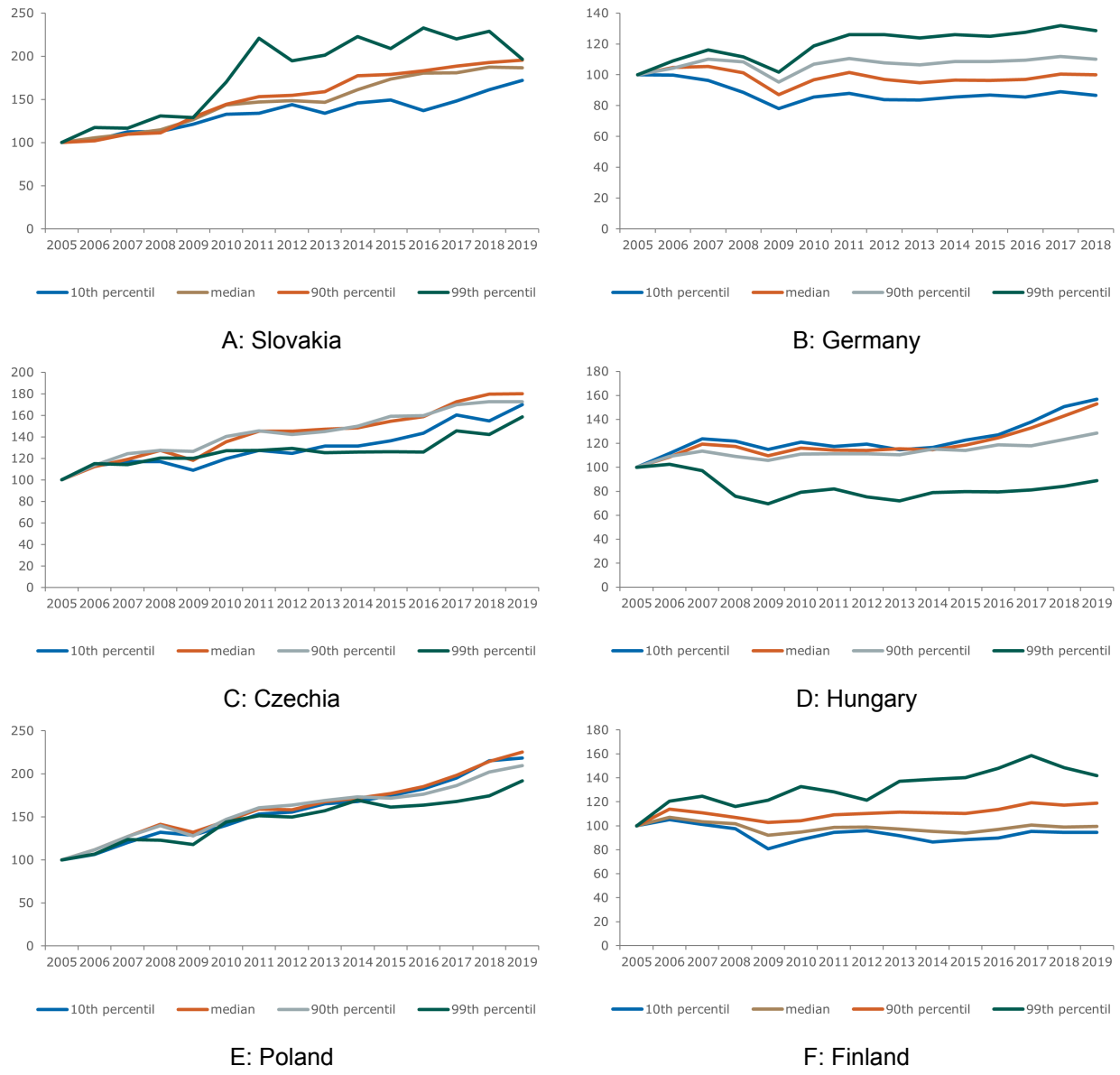
Conversely, the lowest productivity dispersion is observed in the transportation and storage sector in Slovakia, Hungary, and Poland. In Germany and the Czech Republic, the construction sector has the lowest dispersion. Germany experienced a notable decrease in labor productivity dispersion in the wholesale and retail trade and accommodation and food service sectors, with reductions of 25.02 and 20.45, respectively. Slovakia's most significant decrease, at 1.94, occurred in the professional, scientific, and technical activities sector.

We explore the evolution of productivity in greater detail for Slovakia by depicting the median (50th percentile) and the very frontier firms (99th percentile), in addition to the frontier (90th percentile) and laggard firms (10th percentile). For better comparability, we normalized productivity levels in 2005 to 100 for all percentiles. This approach helps us to understand further the labor productivity dispersion between frontier and laggard firms, the evolution across the productivity distribution, and what is happening at the very frontier.

We then compare this productivity evolution across the V4 countries, Germany, and Finland. Germany

and Finland were chosen as representatives of Western economies from among the countries available in the CompNet dataset, which share the same year coverage as the V4 countries. While Germany represents one of Europe's major economies, Finland was selected because its population size is similar to that of Slovakia. For this comparison, we have selected two prominent sectors: manufacturing (figure 31) and information and communication (figure 32). In Appendix 6, we depict the evolution of labor productivity across the productivity distribution for all available sectors in figure 45.

Figure 31: Manufacturing sector's labour productivity per employed person (2005 = 100)

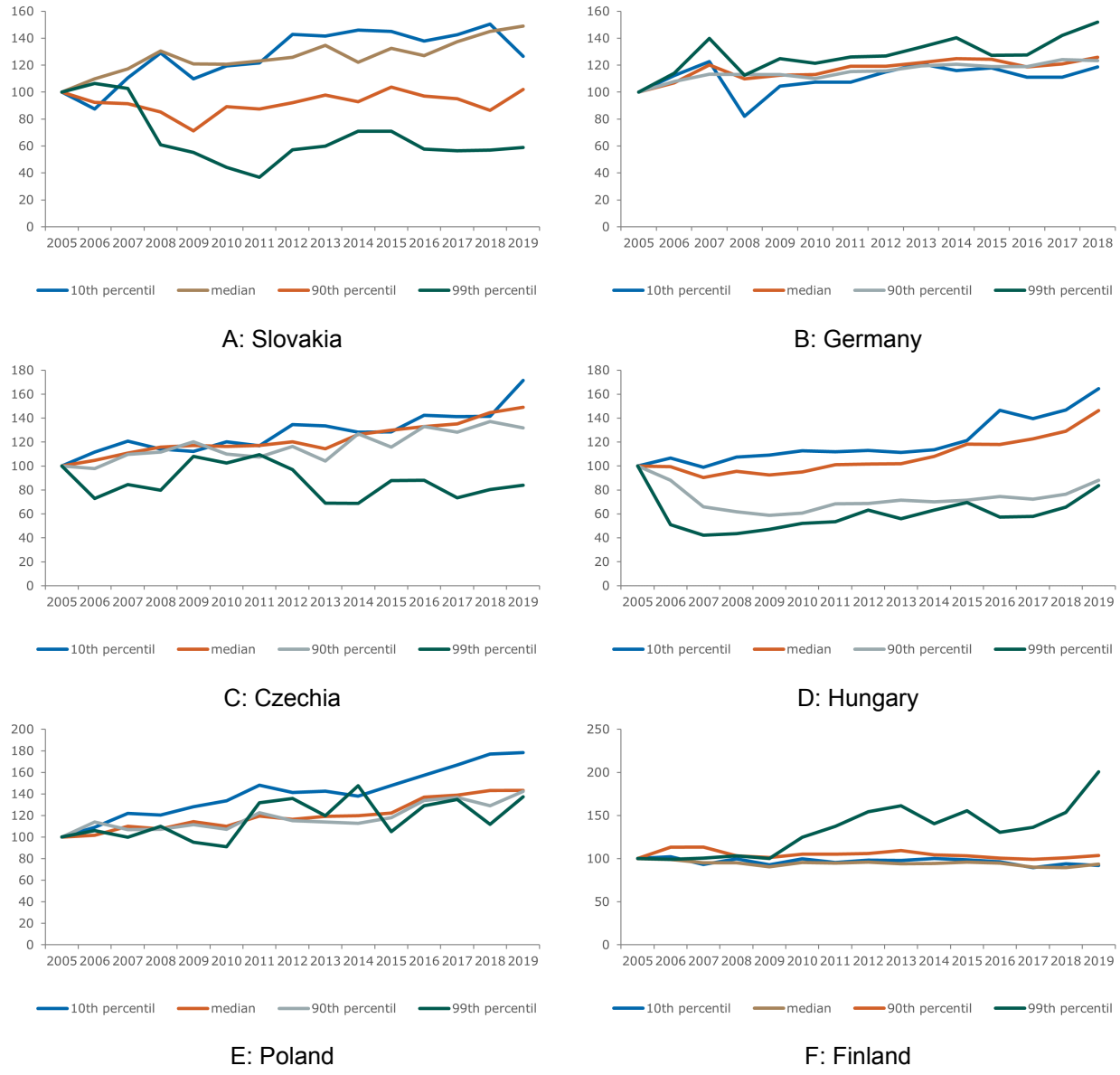


Source: CompNet, own calculations.

In Slovakia's manufacturing sector, labor productivity has been increasing for all percentiles except the 99th percentile in the last three to four years. Since 2010, productivity at the 99th percentile has stagnated more than at the 90th and 50th percentiles (figure 31A). This trend is also observed in Finland, suggesting that the manufacturing sector in Slovakia is quite developed in terms of productivity evolution. However, frontier firms may have reached a technological barrier or are facing other structural obstacles that limit further productivity growth. Meanwhile, median and laggard firms are still able to increase their

productivity, catching up to the 99th percentile and demonstrating more significant growth. In contrast, in the Czech Republic, Hungary, and Poland, most frontier firms show the lowest productivity growth among the percentiles but do not exhibit signs of a growth slowdown like in Slovakia. In these countries, the median and laggard firms' productivity is growing the fastest, decreasing the dispersion in productivity between frontier and laggard firms. This reflects that laggards are growing faster than the frontier, contributing to overall productivity growth across the entire distribution.

Figure 32: Information and communication sector's labour productivity per employed person (2005 = 100)



Source: CompNet, own calculations.

In Slovakia's information and communication sector, firms in the 99th and 90th percentiles have shown a decrease in labor productivity since 2005, with the 90th percentile only recently showing signs of recovery. Productivity growth in this sector is mainly driven by median and laggard firms, though laggard firms are experiencing a slowdown. Overall, this sector is growing less substantially across the whole

distribution than the manufacturing sector, which is surprising given its high share of intangible assets[12] and significant technological advances over the past 20 years (OECD, 2019*a*).

Hungary exhibits a similar pattern to Slovakia, but with laggard firms showing faster productivity growth. In contrast, the Czech Republic sees positive productivity growth even among 90th percentile firms, and Poland shows productivity growth across the entire distribution. Finland stands out, with productivity growth dominated by frontier firms, while other firms stagnate at levels similar to 2005.

Our investigation highlights the need to focus on sectors beyond manufacturing. While the manufacturing sector faces its own challenges, it is at least comparable in productivity distribution to other developed economies. To ensure long-term productivity growth in Slovakia, it is crucial to understand why frontier productivity growth is lacking and why laggard firms are also seeing declining productivity in sectors like information and communication. This stagnation at both ends of the distribution may indicate serious structural issues. Additionally, sectors with high demand for intangible assets are not showing significant productivity growth among either frontier or laggard firms, posing a concern for future economic growth.

[12] See Annex 4 for the share of intangible assets per sector for Slovakia. The importance of intangible assets for catching up in productivity between frontier and laggard firms, as well as the role of intangible assets in widening the gap between these two groups of firms, is explained in Berlingieri et al. (2020), CompNet (2020), among others.

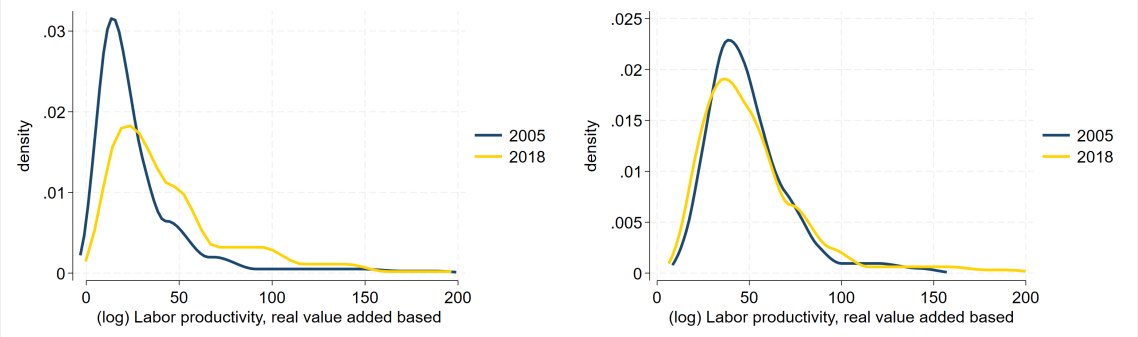
Box 1: Labor productivity distributions

A well-documented phenomenon in most firm-level productivity analyses is the significant and persistent dispersion of productivity, even among firms within the same industry. However, simply noting this dispersion may be insufficient without examining the underlying productivity distributions and their evolution. To shed light on the industry-level productivity distribution, we can approximate it using available productivity percentiles from the CompNet database.

The figure below presents the labor productivity distributions of manufacturing firms in Slovakia and Germany, comparing two points in time: 2001 and 2018. Both countries' manufacturing sectors exhibit a large right-hand tail, indicating the presence of exceptionally high-productivity firms. The distributions are right-skewed, with a small number of highly productive firms and a majority of firms possessing lower productivity. In general, for right-skewed (positively skewed) data, the mean exceeds the median, which in turn exceeds the mode; thus, relying on the mean alone may present an overly optimistic portrayal. Notably, the mode productivity level in Slovakia was considerably lower in 2001, though it showed improvement by 2018.

Between 2001 and 2018, the proportion of highly productive firms increased in both countries, with Slovakia experiencing a more substantial shift relative to its 2001 baseline. By contrast, Germany's distribution remained relatively stable over time, albeit with a significant mass of lower-productivity firms that still outperform comparable firms in Slovakia. The fact that Slovakia's distribution has evolved much more rapidly in all dimensions than Germany's may indicate substantial structural changes in the Slovak manufacturing sector, rather than mere capital reallocations.

Figure: Labour productivity distributions for manufacturing in 2001 and 2018/2019 for a) Slovakia b) Germany



Source: CompNet, own calculations.

7 Market concentration

We aim to investigate the extent to which a small group of large firms contributes to aggregate productivity in Slovakia. The degree of concentration can have important implications for labor productivity. In highly concentrated markets, large firms may benefit from economies of scale, greater access to capital, and increased capacity for research and development—all of which can enhance productivity. However, concentrated markets may also reduce competitive pressures, potentially dampening innovation and efficiency gains across the broader industry. These countervailing forces underscore the importance of studying the nuanced relationship between market concentration and productivity outcomes.

In addition, understanding market concentration is critical for grasping the propagation of microshocks in the economy. It is generally assumed that in large economies, uncorrelated microshocks cancel one another out on average. However, when a small group of large firms dominates an economy, aggregate variation is more likely to be driven by firm-level shocks. This phenomenon is often referred to as the granular hypothesis (Gabaix, 2011).

Thus, in this section, we examine market concentration and its potential impact on productivity, noting that Slovakia's levels of market concentration have generally declined, albeit not uniformly across sectors. While progress has been made in reducing concentration, certain sectors—particularly Manufacturing—remain highly concentrated, underscoring the need for continued structural reforms. Our findings further suggest that resource allocation efficiency, rather than market concentration, may be of greater importance.

In particular, the manufacturing, information, and communication sectors are Slovakia's most concentrated, based on value-added and employment. Figures 33 and 34 display the market share (in terms of both value added and employment) for the top decile of firms and the rest of the distribution, ranked according to productivity. For comparison, the shares in Germany in 2017— the latest year with complete data in the used CompNet database—are also shown.

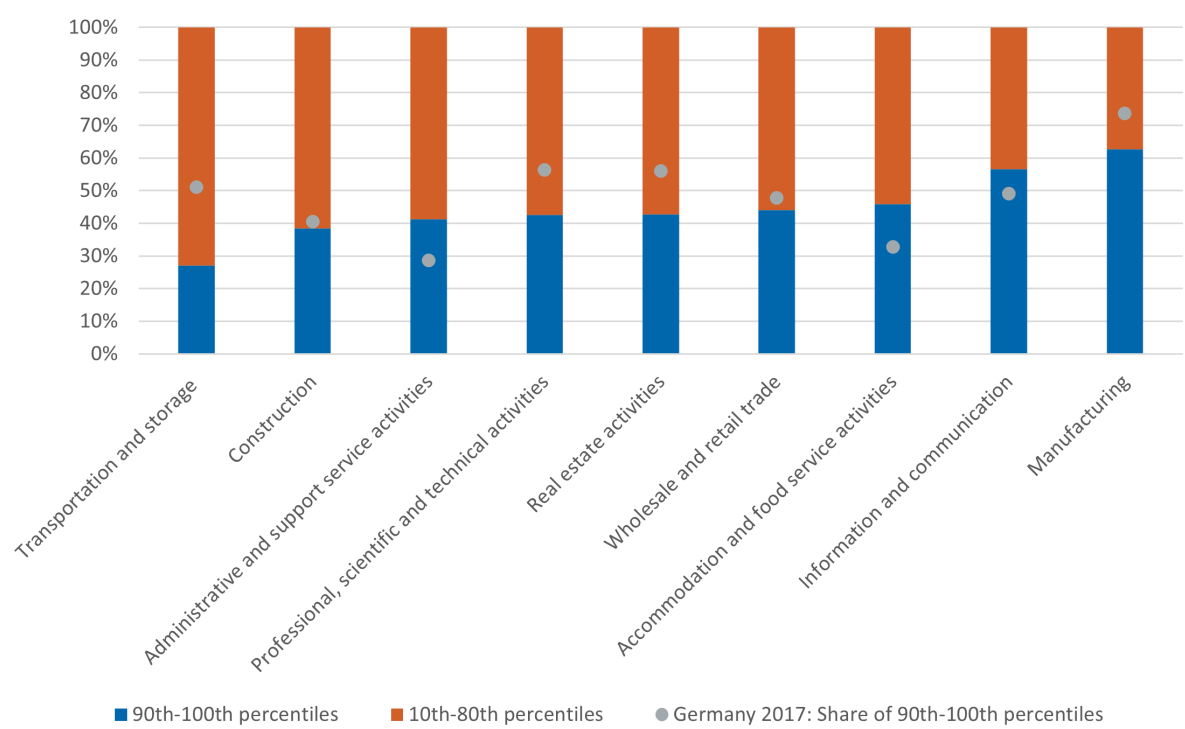
The top 10% most productive firms in 2019 accounted for 27% to 63% of the value added across sectors, while their employment share ranged from 13% to 31%. This is not surprising, as the most productive firms can generate more output with less capital. However, it raises the question of whether there is enough capital reallocation towards these firms. We will address this question in the next section.

Another way to measure market concentration is the Herfindahl-Hirschman Index (HHI), which sums the squared market shares (by gross output) of all firms in a given industry. The HHI ranges from 0 to 1, with higher levels indicating greater concentration and market power. Positive changes in the HHI over time suggest an increase in concentration.

Slovakia has the highest level of market concentration overall, but the Czech Republic has more sectors with the highest market concentration among the considered countries. The difference is more significant in sectors where Slovakia leads in market concentration, such as Manufacturing and Information. In 2018, Slovakia's HHI for these sectors was 0.0358 and 0.489, respectively, while the Czech Republic's HHI was 0.0134 in both cases. However, in Administrative and Support Services, where the Czech Republic has a more concentrated market, the difference is only 0.0046.

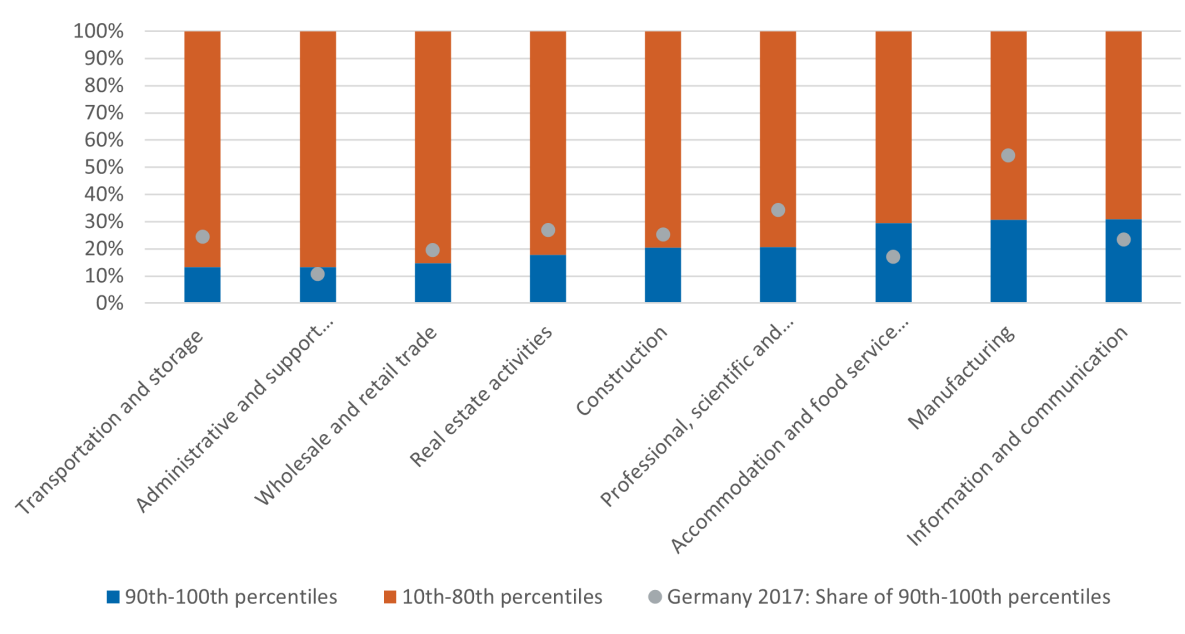
Except for Manufacturing, where market concentration was at the same level in 2018 as in 2003, market concentration is decreasing in each sector of Slovakia's economy. Manufacturing is a compelling case

Figure 33: Value-added shares by labor productivity percentiles (2019)



Source: CompNet, own calculations.

Figure 34: Employment shares by labor productivity percentiles (2019)



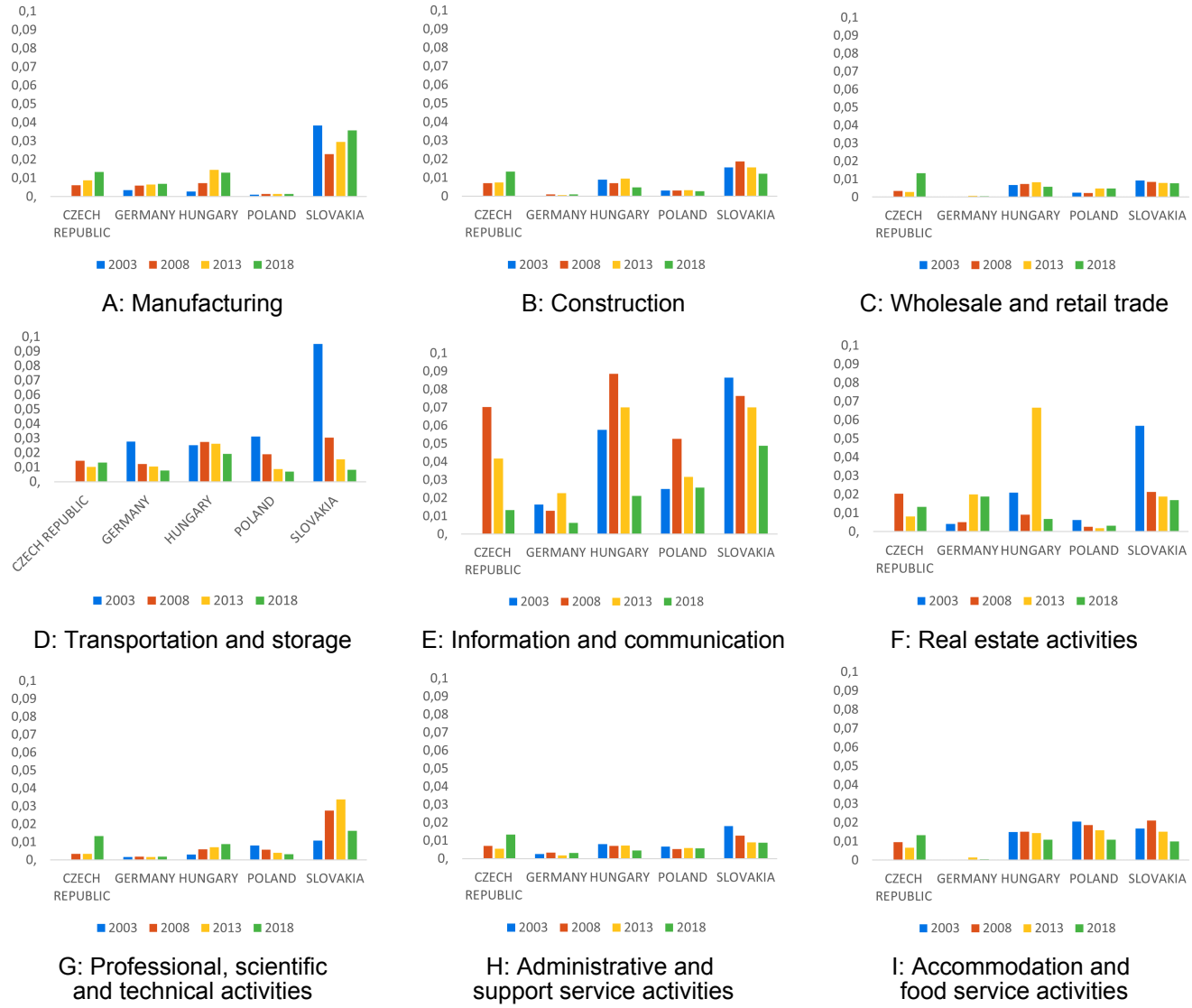
Source: CompNet, own calculations.

for Slovakia, as its market concentration decreased rapidly in 2008 and has been gradually climbing back up since then. In contrast, the Professional, Scientific, and Technical Activities sector experienced a gradual increase from 2003 to 2013, followed by a sudden decline in 2018. All other sectors are

decreasing gradually.

While Slovakia initially faced the challenge of the highest market concentration across all sectors in 2003, it has made commendable strides in reducing concentration across most sectors, with the exception of Manufacturing. Nevertheless, there remains a need for further enhancement to attain market concentration levels comparable to those in Germany. Furthermore, it's worth noting that in certain instances, Hungary has outpaced Slovakia in rapidly reducing market concentration despite starting from similar levels and accomplishing this over a shorter time frame.

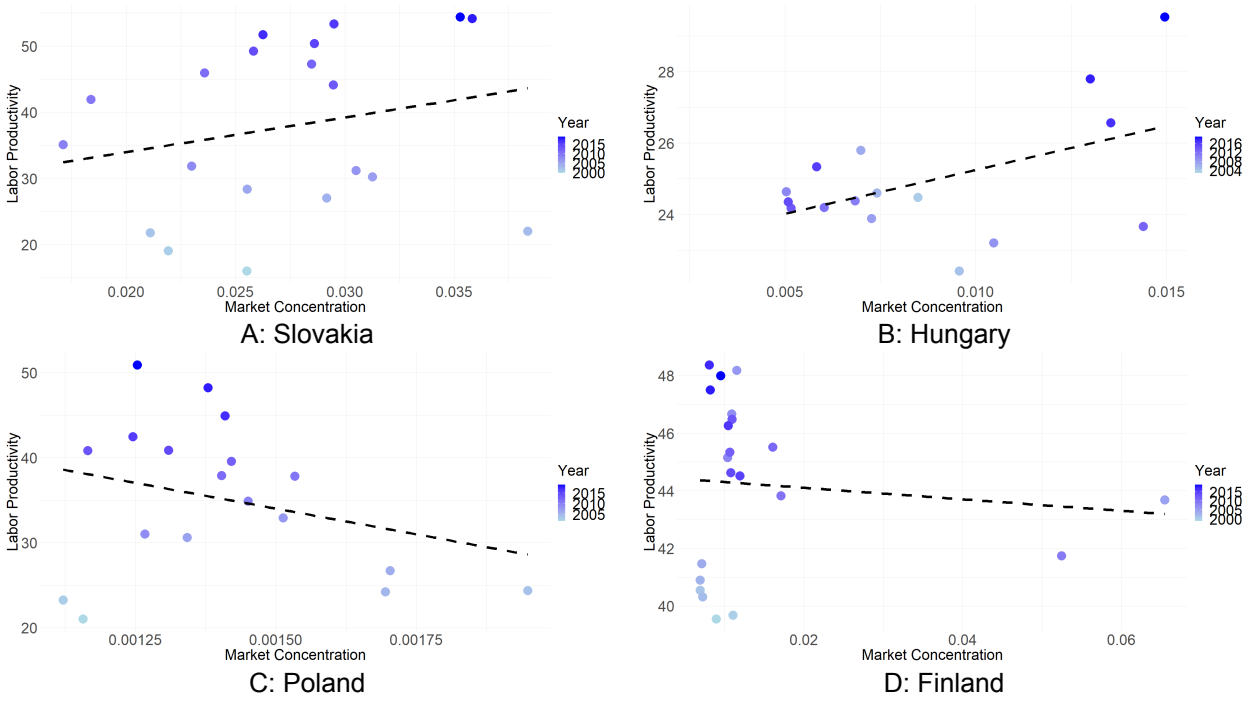
Figure 35: The Herfindahl-Hirshman index by sector for V4 countries + Germany



Source: CompNet, own calculations.

Determining whether higher concentration leads to greater or lower labor productivity is crucial. Growing concerns about rising markups and concentration suggest potential adverse effects on competition. While most research has focused on the United States, similar trends have been reported in the European Union. Notably, Battiati et al. (2021) argue that the risks posed by increased concentration may be less severe in the EU than in the U.S., implying that empowering the most efficient firms could bolster overall efficiency.

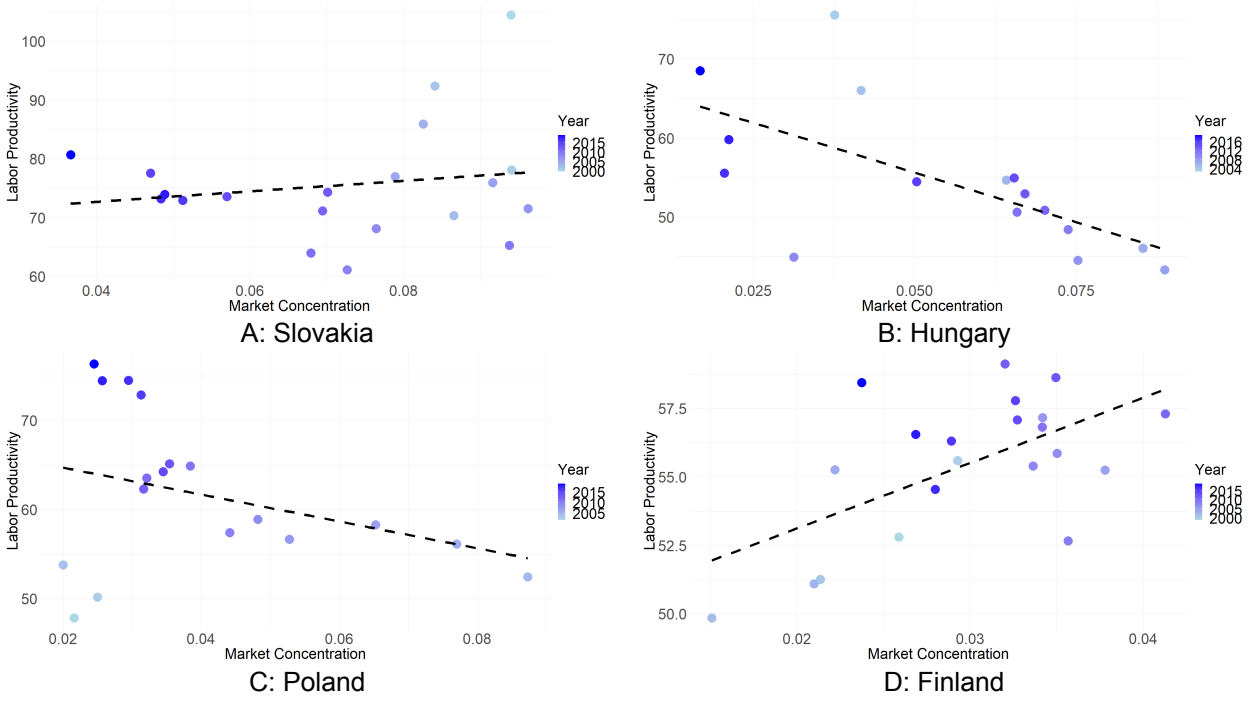
Figure 36: Manufacturing sector - market concentration (HHI) and labor productivity



Source: CompNet, own calculations.

Note: We selected two V4 countries and Finland—a Western economy with a population size comparable to Slovakia's—to illustrate different trajectories of market concentration and labor productivity.

Figure 37: Information and communication sector - market concentration (HHI) and labor productivity



Source: CompNet, own calculations. Note: We selected two V4 countries and Finland—a Western economy with a population size comparable to Slovakia's—to illustrate different trajectories of market concentration and labor productivity.

Figures 36 and 37 illustrate the correlations between market concentration (as measured by the HHI) and

labor productivity for Slovakia, Hungary, Poland, and Finland in the Manufacturing and Information and Communication sectors. The findings differ across countries. In Slovakia's manufacturing sector, both productivity and market concentration have risen over time, indicating enhanced efficiency. Conversely, in the information and communication sector, both market concentration and labor productivity have slightly declined, suggesting that resource allocation efficiency, rather than market concentration, may be the primary issue—an aspect examined in the next section.

8 The efficiency of resource allocation

The allocation of resources among firms can significantly impact aggregate productivity and growth when capital and labor flow from low- to high-productivity firms. Conversely, if inputs are allocated from high- to low-productivity firms, aggregate productivity will be adversely affected. While the previous sections focused on comparing productivity between frontier and laggard firms and market concentration, this section examines how resources are allocated across firms of varying productivity levels.

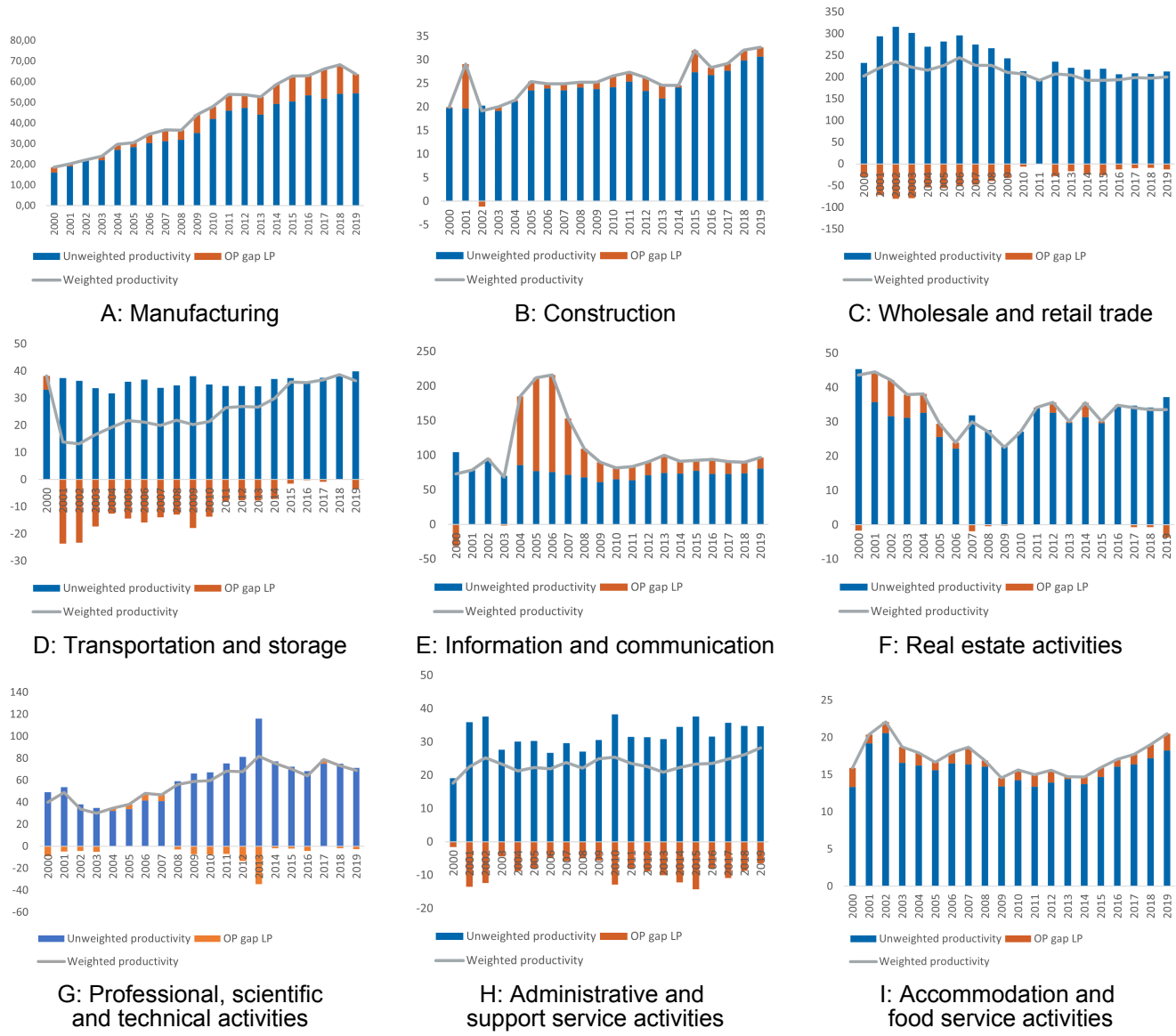
We use the Olley and Pakes (1996) method for static productivity decomposition by sectors to measure the relationship between productivity and firm size at a particular time. The weighted aggregate productivity is decomposed into contributions from unweighted within-firm productivity and the efficiency of resource allocation, measured by the covariance between firm size and productivity. The covariance term is known as the OP gap and is a measure of allocative efficiency, increasing if more productive firms capture a larger share of resources in the sector. Figure 38 depicts the static productivity decomposition for all sectors.

Manufacturing is the only sector in Slovakia that shows significant and increasing positive productivity reallocation from low- to high-productivity firms (positive OP gap) over time. Compared to similar studies, this reallocation could be even more substantial. Other sectors with at least some positive reallocation are Construction, Information and Communication, and Accommodation and Food Services, but the reallocation is relatively small.

Five sectors of the economy have almost permanent negative resource allocation, which is a significant negative sign for productivity evolution in Slovakia. This underscores that investigating how to increase resource allocation alone is insufficient for achieving greater productivity growth. It is crucial to understand why the reallocation goes in the opposite direction from high- to low-productivity firms in so many sectors and how it can be reversed. However, reversing this trend may require more demanding interventions. This also raises a viable research question about whether the health of some economic sectors was driven by foreign direct investments into those sectors, prompting policymakers to pay more attention to them and develop an adequate regulatory framework.

The Information and Communication sector experienced significant positive resource allocation from 2004 to 2008. Further research is needed to understand why there was a boom and bust only in these sectors. However, preliminary signs suggest that such significant but limited in-time positive resource reallocation may not be sufficient to ensure permanent productivity growth in this sector.

Figure 38: Resource allocation OP gap



A: Manufacturing | B: Construction | C: Wholesale and retail trade

D: Transportation and storage | E: Information and communication | F: Real estate activities

G: Professional, scientific and technical activities | H: Administrative and support service activities | I: Accommodation and food service activities

Source: CompNet, own calculations.

9 Concluding remarks and policy implications

This study offers an insightful overview of the key trends in productivity growth and business demography in Slovakia. It places particular emphasis on investigating the factors contributing to the observed deceleration in productivity growth, a phenomenon that heightens the risk of Slovakia falling into the middle-income trap. The results presented here yield valuable lessons for enhancing productivity, with some being widely recognized, while others warrant further exploration. Additionally, we highlight areas demanding more extensive research to draw well-founded conclusions.

Notably, the prevalent economic model, reliant on foreign direct investment (FDI) for driving productivity improvements, appears to be encountering its current limitations. Although it played a pivotal role in bolstering economic growth prior to the Global Financial Crisis, the positive spillover effects on medium and small local businesses from fewer large firms are limited. Fostering the diffusion of technology and knowledge among firms to narrow the gap between large and small enterprises, as well as frontier and laggard firms, emerges as an imperative, representing a significant unexplored opportunity. Research into the barriers impeding technology and knowledge diffusion is paramount, as addressing this challenge will necessitate a multifaceted approach. Overcoming financial and managerial obstacles is only part of the equation; it also requires building trust among stakeholders, reshaping prevailing social norms, and cultivating suitable entrepreneurial ambitions.

As the impediments to productivity growth affect not just laggard firms but also frontier firms, policy interventions must be tailored to cater to the diverse needs of firms across the entire spectrum. This ranges from helping laggard firms catch up to the frontier (as discussed earlier) to assisting frontier firms in innovating and keeping pace with global standards. Frontier firms already contend with various issues hindering their expansion plans, such as securing the right talent, making it necessary to adopt a mission-oriented approach to improve innovation. This also underscores the need for a deeper understanding of resource allocation challenges identified in this context.

In summary, we hope that this study serves as a foundational stepping stone for further research and productive discussions. The ultimate goal is to develop practical and scalable policy interventions capable of addressing the impending productivity slowdown. Failing to do so would risk Slovakia falling further behind Western Europe in terms of economic development.

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A Appendix 1

Table 2: Decomposition of average real labour productivity (per person) percentage growth into within and between sector components

	1995-2019			1995-2008			2010-2015			2015-2019		
	within	between	total	within	between	total	within	between	total	within	between	total
BE	1.1	-0.2	0.9	1.4	-0.1	1.2	0.9	-0.2	0.8	0.3	0.0	0.3
BG	1.4	0.8	2.2	1.3	0.9	2.2	2.0	0.3	2.2	2.0	0.5	2.5
CZ	2.1	0.3	2.4	2.7	0.5	3.2	1.2	0.0	1.2	2.3	0.0	2.3
DK	1.2	-0.2	1.0	1.1	-0.1	1.1	1.1	-0.1	1.0	0.8	0.0	0.9
DE	0.7	-0.1	0.7	0.9	0.1	1.0	0.8	-0.1	0.7	0.6	-0.1	0.5
EE	3.8	0.2	4.0	5.7	0.3	6.0	1.1	-0.4	0.7	2.4	0.4	2.8
IE	3.5	-0.4	3.1	2.3	0.0	2.3	5.0	0.3	5.2	3.4	-0.3	3.0
EL	-0.9	1.1	0.2	1.3	1.1	2.3	-3.1	0.8	-2.3	-2.2	0.8	-1.3
ES	0.4	0.1	0.5	-0.3	0.5	0.2	1.3	-0.2	1.1	-0.2	0.3	0.2
FR	1.0	-0.1	0.9	1.1	0.0	1.1	0.8	-0.1	0.6	0.6	0.2	0.8
HR	1.4	0.5	1.9	2.7	0.4	3.0	-0.6	1.8	1.2	1.2	0.0	1.2
IT	-0.1	0.0	0.0	-0.1	0.3	0.2	-0.3	-0.1	-0.5	0.0	0.1	0.1
CY	0.8	0.4	1.1	1.3	0.4	1.7	-0.8	1.1	0.2	0.6	0.4	1.0
LV	3.8	0.3	4.0	4.9	0.6	5.5	2.2	0.2	2.4	2.8	0.0	2.8
LT	3.8	0.7	4.5	5.4	1.3	6.6	2.2	0.1	2.3	2.7	0.3	3.0
LU	0.4	-0.3	0.1	-0.2	0.9	0.7	-0.4	0.1	-0.3	-1.1	0.2	-0.9
HU	1.9	-0.1	1.9	3.1	-0.1	3.0	0.5	-0.2	0.3	1.7	0.2	1.9
MT							1.0	0.4	1.4	-0.1	0.8	0.7
NL	1.1	-0.3	0.8	1.5	-0.2	1.3	1.0	-0.3	0.7	1.0	-0.9	0.1
AT	0.9	-0.1	0.8	1.4	0.0	1.5	0.2	0.0	0.2	0.6	0.0	0.6
PL	2.8	0.9	3.7	3.1	0.9	4.0	2.0	0.4	2.3	3.4	0.5	3.9
PT	0.7	0.4	1.1	1.2	0.2	1.3	0.1	0.3	0.4	-0.8	1.5	0.8
RO	3.3	1.2	4.4	4.7	1.0	5.7	1.5	1.8	3.3	4.1	0.8	4.8
SI	1.9	0.3	2.2	2.8	0.8	3.6	0.8	0.0	0.8	1.1	0.3	1.3
SK	3.1	0.1	3.2	4.3	0.4	4.7	1.5	0.1	1.6	0.3	0.6	0.9
FI	1.2	-0.2	1.1	2.0	0.0	2.0	-0.1	-0.1	-0.2	0.7	-0.1	0.6
SE	1.6	-0.1	1.6	2.2	0.0	2.2	0.9	-0.1	0.8	0.5	0.0	0.5

Source: Eurostat, own calculations.

Note: Sectoral productivities were calculated based on gross value added. As a result, aggregate productivities differ somewhat from those based on GDP per person. Thus, the data in this table was rescaled to match productivity growth based on GDP per employed person.

Table 3: Decomposition of average real labour productivity (per hour worked) growth into within and between sector components

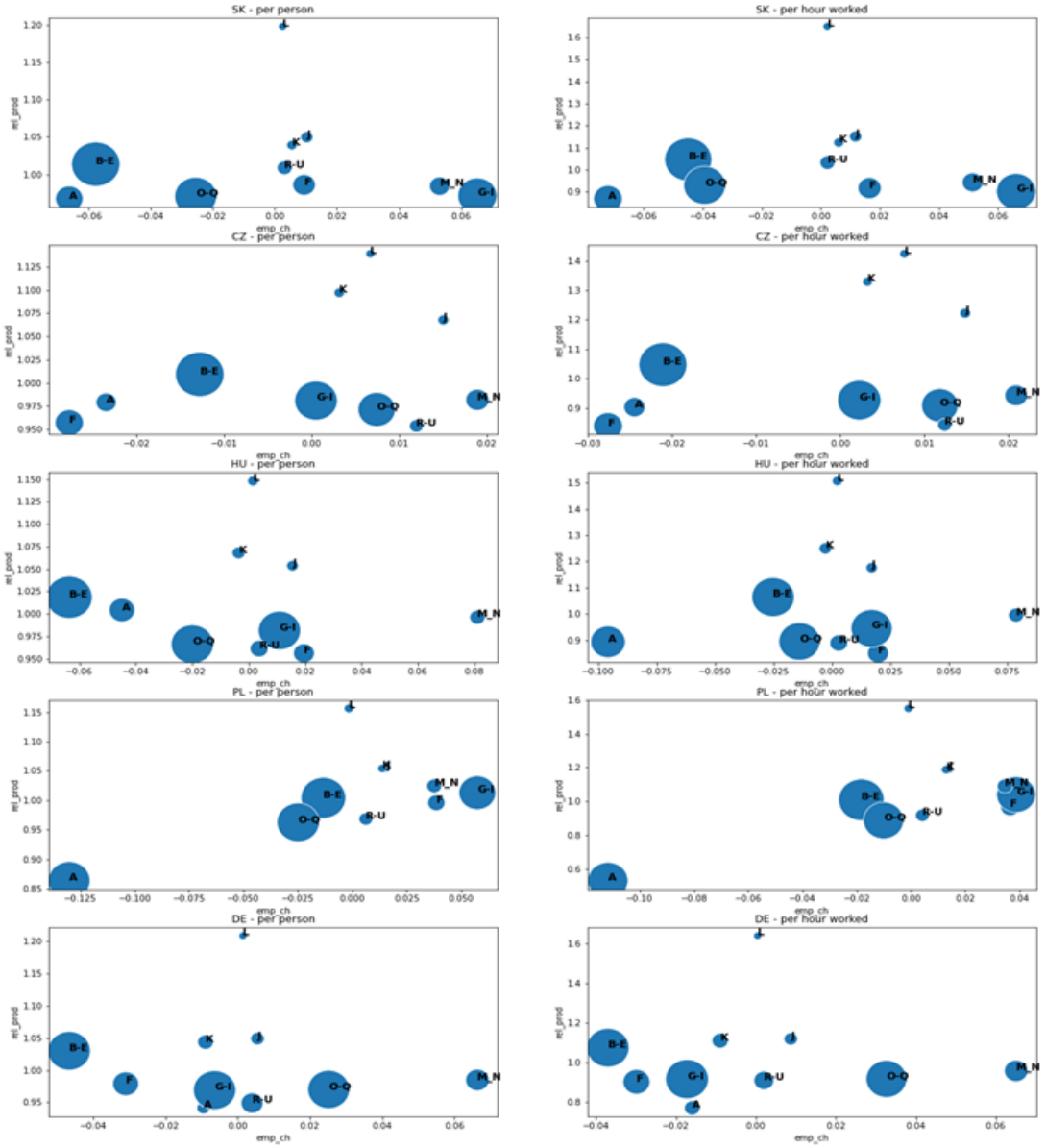
	1995-2019			1995-2008			2010-2015			2015-2019		
	within	between	total	within	between	total	within	between	total	within	between	total
BE	1.1	-0.2	0.9	1.5	-0.3	1.2	0.9	-0.1	0.7	0.2	0.1	0.2
BG	1.6	0.8	2.4	1.5	0.8	2.3	2.0	0.3	2.3	2.1	0.4	2.5
CZ	2.2	0.3	2.5	2.9	0.5	3.4	1.8	-0.1	1.7	1.8	0.0	1.8
DK	1.3	-0.1	1.2	1.0	0.0	1.0	1.3	-0.1	1.2	1.6	-0.1	1.5
DE	1.1	0.0	1.1	1.3	0.2	1.4	1.1	-0.1	1.0	1.1	-0.1	1.0
EE							1.7	-0.7	1.0	3.3	0.6	3.8
IE	4.0	-0.4	3.6	3.0	-0.2	2.8	4.7	0.3	5.0	2.4	-0.2	2.1
EL	-0.4	0.9	0.4	1.2	1.1	2.3	-3.1	0.8	-2.4	-2.2	1.1	-1.1
ES	0.5	0.2	0.7	0.0	0.3	0.3	1.3	-0.1	1.2	0.0	0.4	0.4
FR	1.1	-0.1	1.1	1.3	0.1	1.4	0.9	0.0	0.9	0.6	0.2	0.8
HR	1.7	0.4	2.1	2.7	0.3	3.0	1.3	1.1	2.4	1.4	-0.4	1.0
IT	0.2	0.1	0.3	0.1	0.3	0.4	0.3	-0.1	0.2	0.1	0.1	0.2
CY	0.8	0.5	1.3	1.4	0.5	1.9	-0.5	1.0	0.5	0.6	0.5	1.1
LV	4.4	0.2	4.6	5.7	0.4	6.0	2.8	0.0	2.7	3.2	0.1	3.3
LT	3.6	0.6	4.2	4.7	1.1	5.7	2.6	0.0	2.6	2.7	0.3	3.1
LU	-0.2	0.6	0.4	-0.1	0.9	0.9	-0.5	0.2	-0.3	-0.8	0.3	-0.5
HU	2.2	0.2	2.4	3.4	0.3	3.7	0.8	-0.3	0.5	1.9	0.4	2.2
MT							3.0	0.3	3.4	-1.4	0.4	-1.0
NL	1.2	-0.3	0.9	1.7	-0.2	1.6	0.8	-0.2	0.6	0.2	-0.3	-0.2
AT	1.1	0.1	1.2	1.5	0.3	1.7	0.8	0.1	0.9	0.3	0.0	0.4
PL	3.1	0.8	3.9	3.4	0.7	4.1	2.1	0.2	2.3	4.2	0.4	4.6
PT	0.7	0.3	1.1	1.2	0.2	1.4	0.3	0.3	0.6	-0.8	1.3	0.6
RO	3.4	1.1	4.5	4.7	0.9	5.6	2.1	1.8	3.9	4.0	0.6	4.6
SI	2.0	0.5	2.6	2.7	1.2	3.9	0.7	0.0	0.7	2.4	0.3	2.7
SK	3.4	0.2	3.6	4.6	0.4	4.9	2.1	0.0	2.2	1.3	0.6	1.8
FI	1.5	-0.1	1.4	2.2	0.1	2.3	-0.4	0.6	0.2	1.0	-0.1	0.9
SE	1.7	0.0	1.6	2.2	0.0	2.3	1.2	-0.2	1.0	0.7	0.0	0.7

Source: Eurostat, own calculations.

Note: Sectoral productivities were calculated based on gross value added. As a result, aggregate productivities differ somewhat from those based on GDP per hour worked. Thus, the data in this table was rescaled to match productivity growth based on GDP per hour worked in figure 3.

B Appendix 2

Figure 39: Relative productivity per hour worked of sectors and the change in their share in total hours worked (1995-2019)



Source: Eurostat, own calculations.

Note: Size of the circles represent shares of sectors in total hours worked. A Agriculture, forestry and fishing; B-E Industry (except construction); F Construction; G-I Wholesale and retail trade, transport, accommodation and food service activities; J Information and communication; K Financial and insurance activities; L Real estate activities; M_N Professional, scientific and technical activities; administrative and support service; O-Q Public administration, defence, education, human health and social work activities; R-U Arts, entertainment and recreation; other service activities;

C Appendix 3

Figure 40

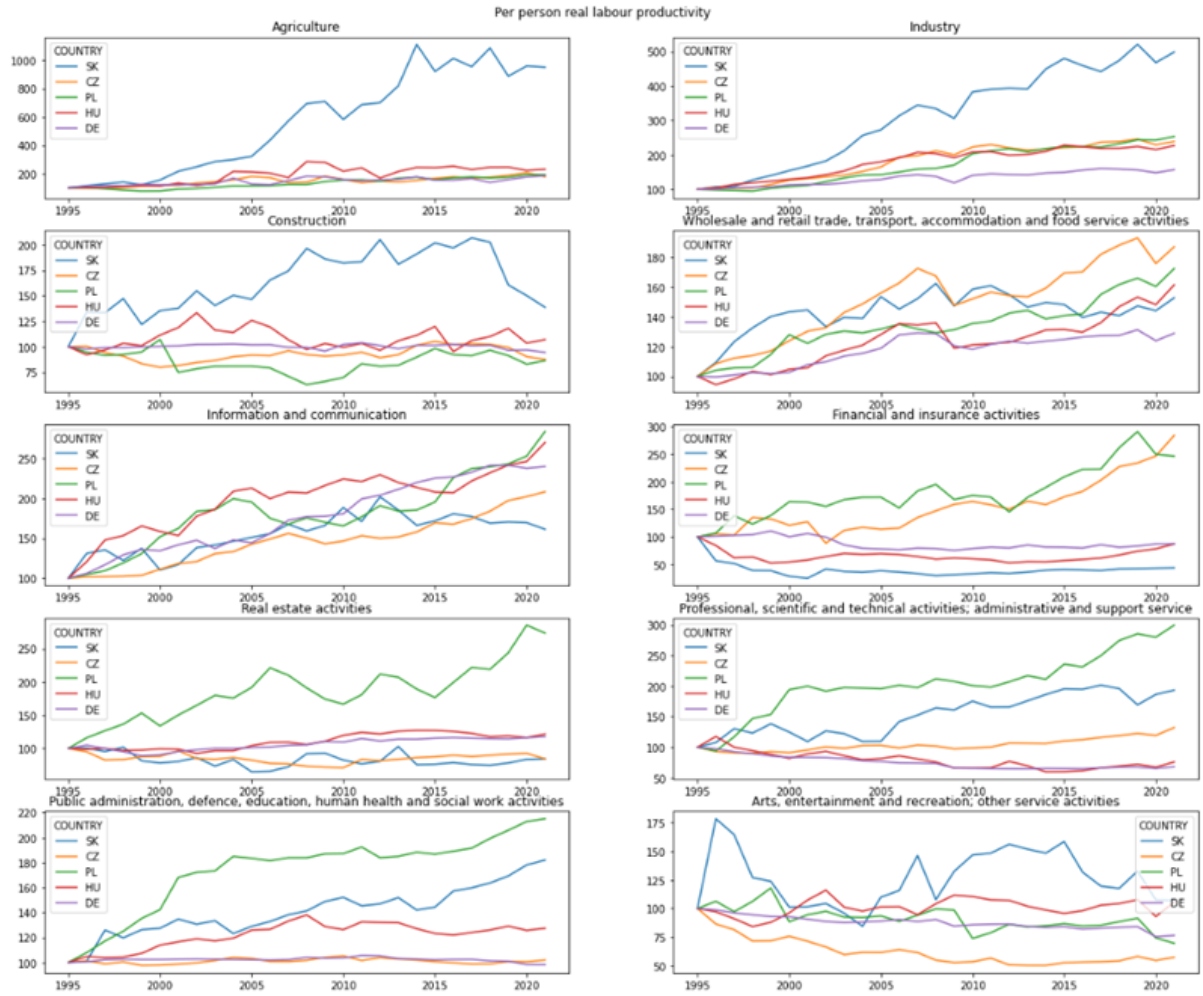
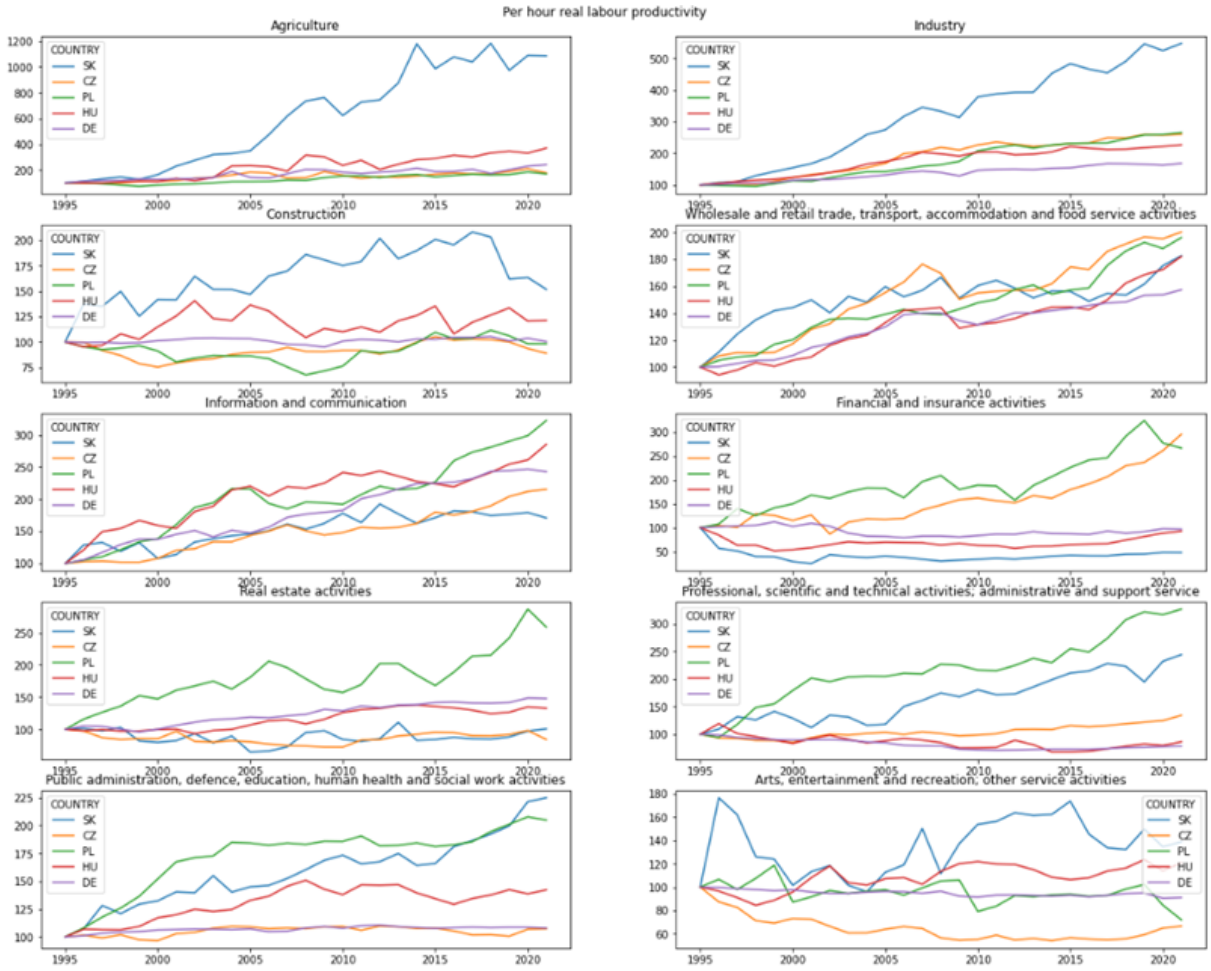
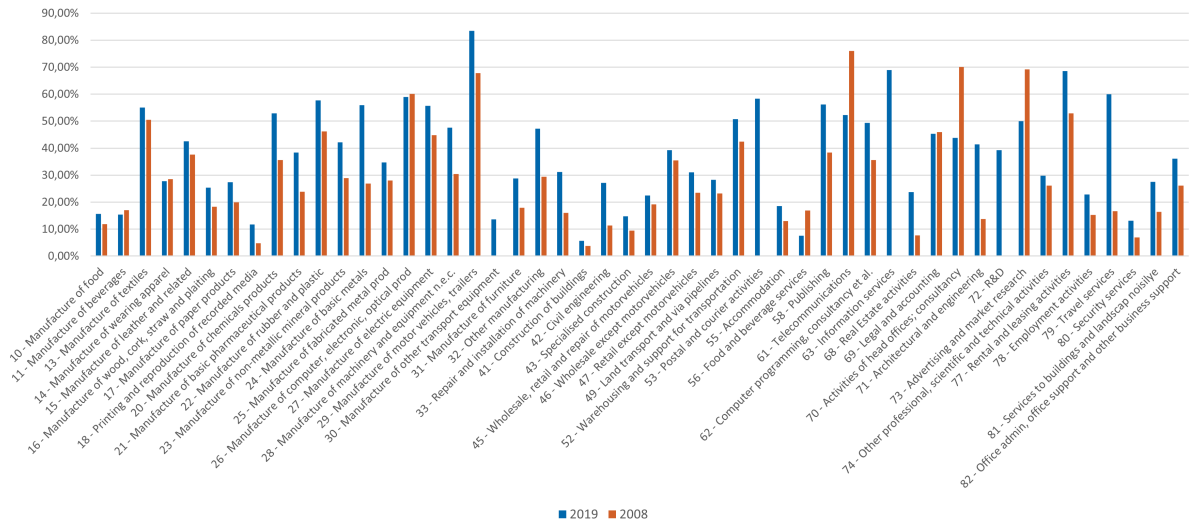


Figure 41



D Appendix 4

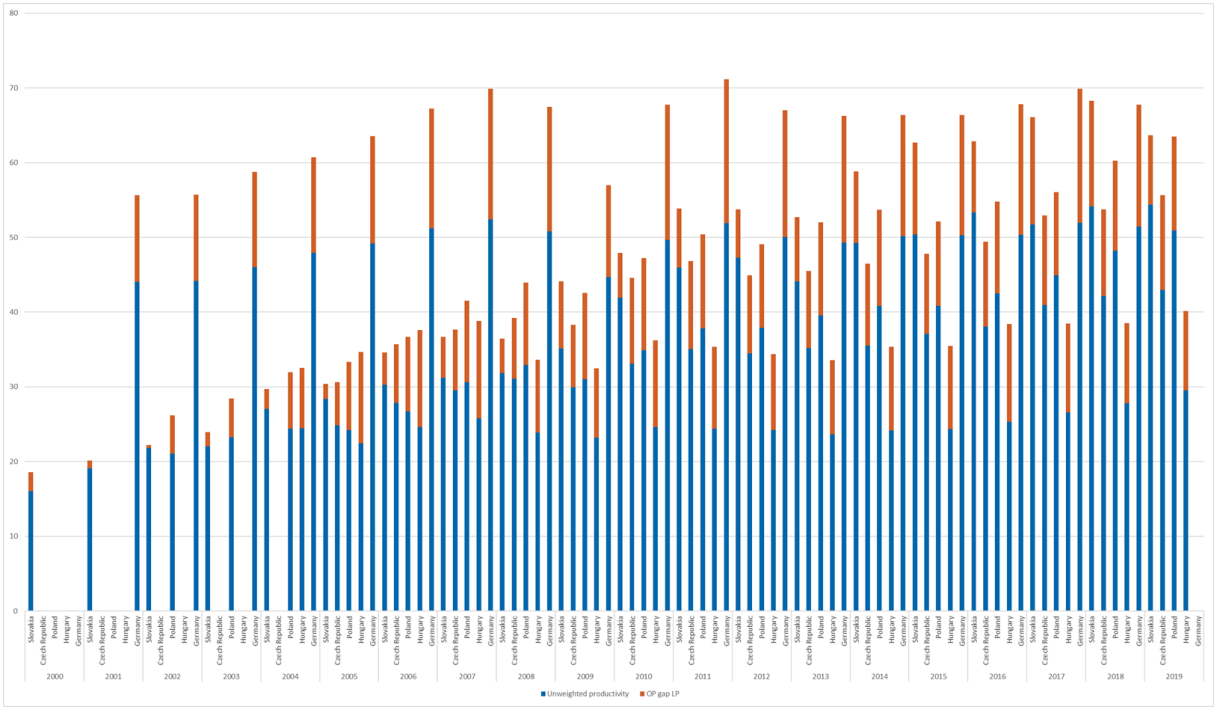
Figure 42: Percentage of foreign-owned companies by 2-digit industry aggregation (2008, 2019)



Source: CompNet, own calculations.

Note: The firm is recognized to be foreign-owned if more than 50% of the firm's shares are owned by foreigner(s).

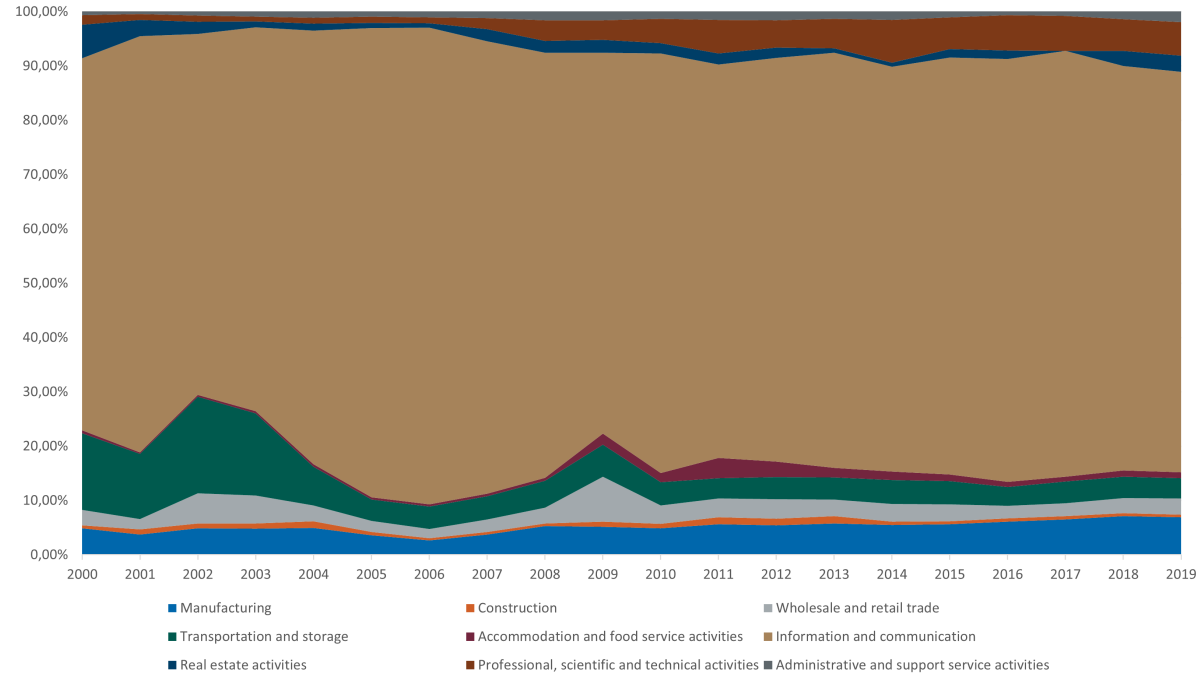
Figure 43: Static OP gap across countries for manufacturing



Source: CompNet, own calculations.

E Appendix 5

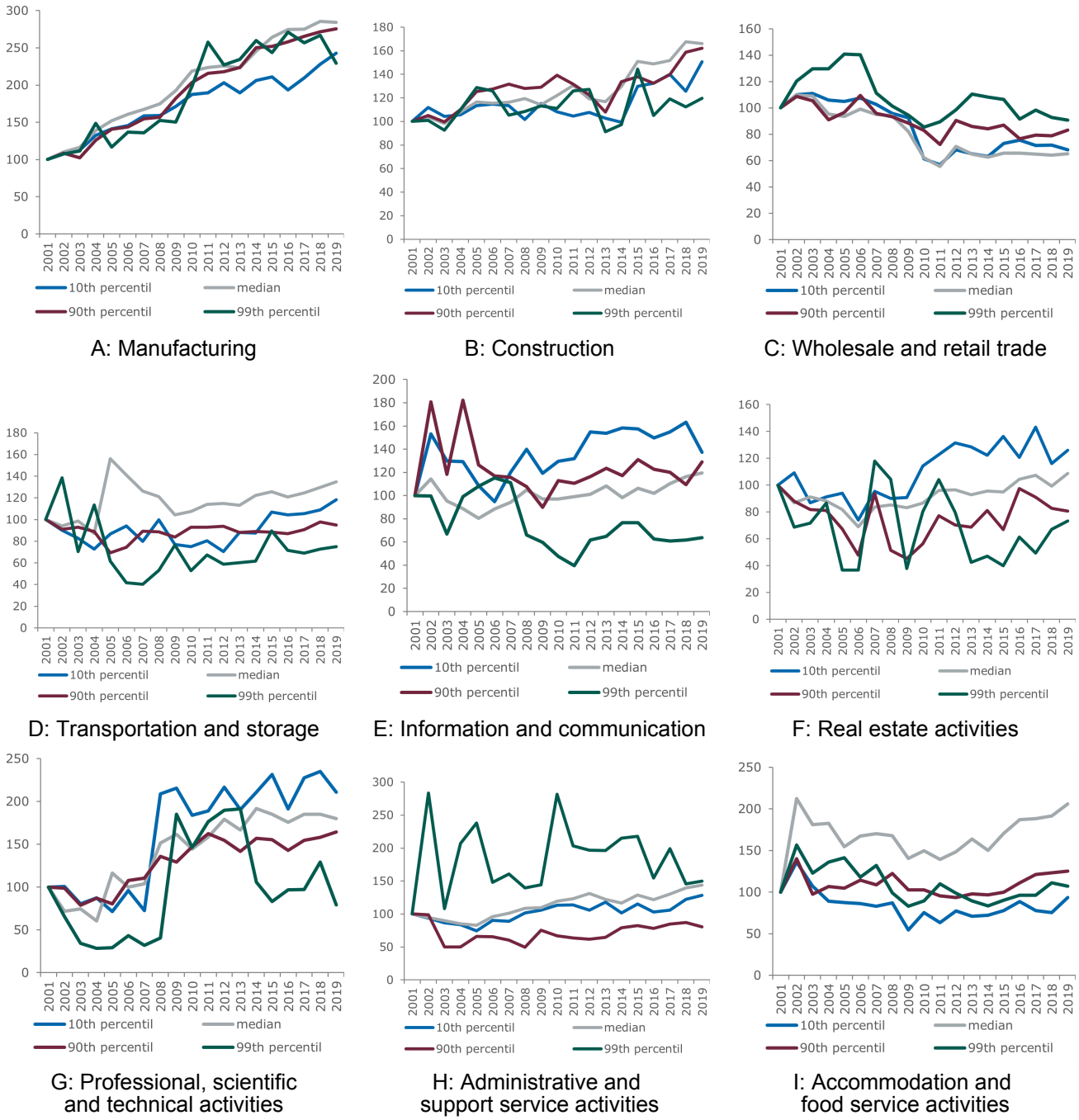
Figure 44: Share of intangible assets across industries for Slovakia



Source: CompNet, own calculations.

F Appendix 6

Figure 45: Labour productivity per employed person (2001 = 100)



A: Manufacturing | B: Construction | C: Wholesale and retail trade

D: Transportation and storage | E: Information and communication | F: Real estate activities

G: Professional, scientific and technical activities | H: Administrative and support service activities | I: Accommodation and food service activities

Source: CompNet, own calculations.