IMAD

productivity report 2019

Productivity Report 2019

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Summary

In terms of economic development, Slovenia ranks around the middle among the EU Member States; most of its lag behind the EU average is explained by the productivity gap. Slovenia's convergence with more advanced countries in terms of productivity was interrupted during the crisis and continued only slowly as economic growth picked up again. The relatively high GDP growth rates since 2015 have mainly been achieved through increased employment, while productivity growth remained moderate.

Weaker productivity growth since 2009 has, in addition to lower within-sector productivity growth, also been due to less intense sectoral shifts. At the turn of the millennium Slovenia was still in the process of intense economic restructuring in terms of the reallocation of production factors from less to more productive sectors. In the recent period these changes have been much less intense and the structure of the economy has come very close to that in the EU generally. The impact of the reallocation of production factors to more productive sectors (i.e. the contribution of between-sectoral shifts to overall productivity growth) has therefore also declined significantly since 2009. Also lower than before the crisis has been within-sector productivity growth, this resulting entirely from slower firm-level growth. On the other hand, the reallocation of labour to more productive firms within the same sector (improvement in allocative efficiency) has had a more favourable impact on within-sector productivity growth than before the crisis.

Since 2009 productivity growth has slowed down in most sectors. With relatively faster growth in foreign demand in this period, the strongest productivity growth has been recorded in technologically intensive and export-oriented manufacturing activities and transport. Significant productivity gains have also been seen in administrative and support services, mainly owing to rapid growth in employment agencies related to increased labour demand. The least favourable developments relative to the pre-crisis period have been recorded in ICT services, especially telecommunications, and in the construction sector, which since 2009 has been faced with lower demand as well as changes in its structure. Both sectors also stand out in a negative way compared to the EU as a whole.

In most sectors the productivity slowdown has been a result mainly of a lack of capital deepening. Capital deepening remained weak even during the economic recovery (i.e. after 2013), when the investment environment was already improving significantly. The low level of investment in predominantly domestically oriented services stands out in particular, which is a consequence not only of slower and later recovery of the domestic market following the crisis, but also of lower investment in transport infrastructure and housing construction. Investment decisions have generally also been marked by increased uncertainty related to the past crisis and, more recently, by slowing growth in foreign demand and rising global uncertainty.

Since 2009 lower productivity growth rates than in the pre-crisis period have also been recorded at the level of individual groups of firms according to size, export orientation and technological intensity. The lowest rates have been characteristic of smaller firms, firms oriented predominantly to the domestic market, firms with lower technological intensity and enterprises in knowledge-intensive services. These groups of firms mostly (with the exception of firms in knowledge-intensive service activities) already had relatively low productivity growth in the pre-crisis period, but after the onset of the crisis their gap with other groups widened further. This might be explained by a slower recovery of the domestic market and a lack of access to finance for smaller firms in the first years after the crisis. Unfavourable developments in knowledge-intensive services can, to a great extent, be attributed to a decline in productivity in telecommunications, but also to modest growth in computer programming and data processing. On the other hand, higher productivity growth in more export-oriented and technologically more intensive firms over the whole observed period since 2002 points to a positive impact of the integration of firms in global value chains and the effects of higher technological intensity of production on productivity.

Slovenia, like other countries, has a large number of less productive firms and a smaller share of highly productive ones, but this asymmetry to the right is one of the smallest by international comparison. The differences in productivity between firms are also relatively small, partly due to the absence of large (highly productive) firms by international standards. Data show that these differences have been narrowing, especially since 2009 (a declining ratio between the productivity levels of firms in the 90^{th} and 10^{th} percentiles of productivity distribution), while they have been widening in many other EU Member States. A more detailed analysis shows that the ratio between the average productivity of firms in the top and bottom 10% of productivity distribution has also declined and that their productivity movements are significantly affected by the entry and exit of firms. These effects disregarded, average productivity growth in existing firms in the top 10% has been higher than growth in the bottom 10%.

After the sharp deterioration at the onset of the crisis, the competitiveness of the economy improved in the following years despite only moderate productivity gains. Since 2010 labour costs have been rising at a slower pace than productivity, which – together with increasing import demand from the main trading partners and stronger integration into global value chains – contributed to a rebound in Slovenia's export market share growth after 2012. In the course of 2018 favourable developments came to a halt, mainly due to the geographical orientation of exports to the slower growing EU market, and, amid rising unit labour costs (especially in manufacturing), cost competitiveness indicators also started to deteriorate gradually.

Further economic and hence social development will crucially depend on the capacity of the country to boost productivity growth. The latest cost increases are gradually undermining the competitiveness of the economy, which could, coupled with lower growth in foreign demand, further dampen economic growth in the coming years. Also, because of increasingly scarce labour supply amid current demographic trends, it will no longer be possible to ensure high GDP growth rates with such a high contribution of increase in employment as in previous years. It will therefore be crucial to focus on strengthening long-term drivers of productivity growth in particular. In previous years some of these saw adverse developments (investment in R&D, in particular public investment, innovation activity of enterprises and ICT investment), while in others changes have been slow considering needs (for example adapting knowledge and skills to development challenges).

Economic policies to accelerate productivity growth have to create the conditions for (i) faster productivity growth across all firms, (ii) a further breakthrough of the most productive firms, and (iii) a spillover of knowledge, best practices, etc. from the most productive to smaller, less productive firms. Policy measures should focus on increasing innovation, accelerating digital transformation and further strengthening the internationalisation of companies. It is essential:

- **To increase investments, especially those related to digital transformation and transition to industry 4.0.** This primarily involves investment in knowledge (formal and informal education, lifelong learning), research, development and innovation (public and private funding), and new technologies and knowledge-intensive services. The achievement of these goals could be facilitated by appropriate specification of priority areas in using EU funding, in addition to domestic (public and private) resources. With regard to Slovenia's strategic objectives,[1] it is also necessary to pay attention to the sustainability of development when investing to increase productivity.[2]

1 The primary objective of the Slovenian Development Strategy is to ensure quality of life for all. This can be achieved through balanced economic, social and environmental development that takes into account the limitations and capacities of our planet and creates conditions and opportunities for present and future generations (Slovenian Development Strategy 2030, 2017).

2 It is necessary to take into account both the limitations and the opportunities of environmental investments and, in particular, the urgency of introducing sustainable and circular business models.

- **To create an environment that promotes innovation and entrepreneurship and is predictable in the long term.** The main challenge is to ensure the long-term stability of support measures at all stages of innovation and marketing and to create a conducive business environment (for example by further reducing administrative barriers and the length of proceedings) with an emphasis on appropriate support for smaller enterprises.

- **To strengthen cooperation between firms, the education sector and research institutions, and also between firms of different sizes**, the latter primarily with a view to better exploiting the innovation potential of small enterprises and services. The strategic research and innovation partnerships already established can provide a good basis for strengthening cooperation between the various actors.

- **To ensure appropriately qualified human resources to meet the needs of the future** (including a stimulating environment for this type of workforce), in particular addressing the shortage of science and technology experts (for example ICT specialists and engineers) and strengthening the digital literacy of the population (through formal and informal education and lifelong learning).

- **To ensure appropriate infrastructure and in particular enhance investment in infrastructure for digital connectivity and sustainable development** (for example for sustainable mobility, renewable energy sources, etc.).

Introductory remarks

In 2018 IMAD started performing the tasks of National Productivity Board, chief among which is the publication of annual productivity reports. In response to Council recommendations on the establishment of national productivity boards, in March 2018 the Government of the Republic of Slovenia adopted the Ordinance on the organisation and responsibilities of IMAD. In doing so, it formally confirmed that the monitoring, analysis and reporting of findings on productivity, the main tasks of the productivity board, should be conducted by IMAD.

In the past productivity analyses had been a constituent part of regular IMAD publications; this is the first time they are published in a separate report. Productivity and competitiveness are monitored annually in the Development Report, which is designed as an overview of the implementation of Slovenia's strategic objectives as defined in the framework national development strategy. A highly productive economy which creates value added for all is one of the five strategic guidelines of the Slovenian Development Strategy 2030. The Development Report thus deals with both economic and social and environmental aspects of development. In the 2017 publication "Economic Issues", we published an expanded analysis of productivity with a focus on allocative efficiency. In 2019 we are starting to release regular annual reviews of productivity in the independent publication "Productivity Report".

This report presents a regular overview of productivity trends and factors and an analysis of labour productivity based on firm-level data. For the first independent report we decided to provide a two-part general overview. The first part highlights productivity trends based on macro data and international comparisons, analyses the impact of productivity on the competitiveness of the economy, and presents the features of key long-term productivity factors. The second part sheds additional light on productivity trends by providing an analysis of firm-level data. Here we examine the characteristics of the distribution of firms with regard to their productivity levels and analyse productivity trends for individual groups of firms depending on size, export propensity, and technology and knowledge intensity. The macro data analysis of productivity includes data until 2018; the analysis of firm-level data uses datasets through 2015 or 2016.

I. Overview of Slovenia's productivity and competitiveness

1 Importance of productivity and national goals

Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.

Paul Krugman, The Age of Diminishing Expectations (1994)

Productivity[3] is the key long-term factor of economic development and a society's prosperity. It is reflected in higher value added created as a result of a more efficient combination of utilised inputs due to new ideas and both technological and non-technological innovations, for example innovations in business models, organisation and workflow. Such innovations improve the competitiveness of firms (at the micro level) and the economy (at the macro level), which, combined with policies providing a more equal distribution of income, facilitates higher standards of living and prosperity. At a time when numerous countries have committed to fighting climate change, so-called ecological innovations are becoming an increasingly important part of innovation, which means that productivity may be improved in lockstep with a reduction of the ecological footprint. The long-term importance of productivity stemming from development and innovations has been recognised by Slovenia as one of the key factors of prosperity and enshrined as such in the national strategic framework. One of the objectives of Slovenia's Development Strategy is to achieve 95% of average EU productivity by 2030; in 2017, the year the strategy was adopted, the gap stood at around a fifth.

Higher productivity may be the result of improved efficiency at firm level or changes in the structure of the economy. At country level, productivity growth is the result of advances in the productivity of individual firms and changes in the allocation of production factors from less to more productive firms or industries, which alters the structure of individual industries and the entire economy. This indicates that the scope of factors which affect productivity is broad. The most important factors may be divided roughly into: (i) research and development activity, innovation and human resources, (ii) performance of the labour market and production markets, (iii) access to finance, and (iv) business environment.[4] Another major factor determining long-term economic development is the efficiency of institutions.

3 It is defined as the ratio between what is created (e.g. value added) and the utilised resources (e.g. labour and capital).

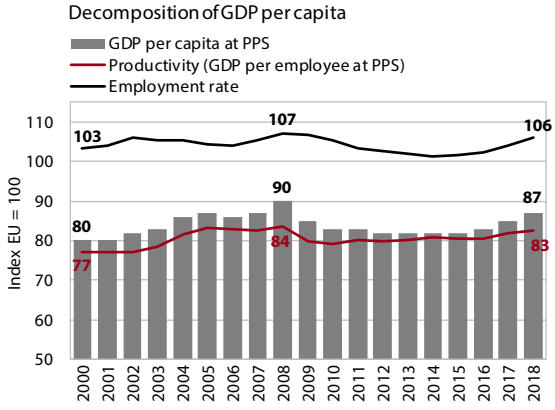
4 "Reviving productivity growth in the post-crisis context: Challenges and drivers" (European Commission, 2018).

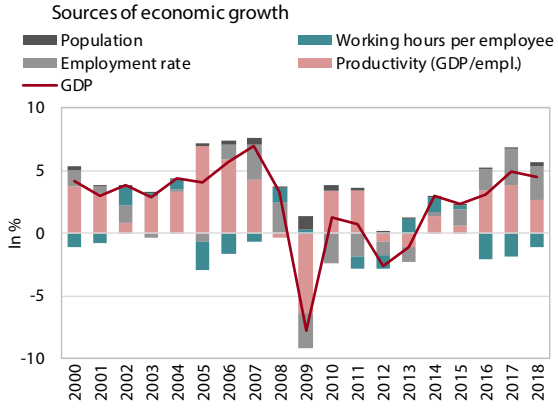
2 Situation and trends in productivity and competitiveness

Slovenia places in the middle of EU rankings in terms of economic development, whereby the gap to the most developed countries is associated with lower productivity. In 2018 labour productivity[5] was 17% below the EU average and accounted for the entire economic development gap to the EU average as measured with per capita GDP. In economic development and productivity, Slovenia ranks above most new EU Member States and below the majority of old Member States.[6] Convergence with the EU average is relatively slow. In 2000–2018 the productivity gap to the EU average narrowed by only six percentage points. The catch-up process slowed after 2008, when the productivity gap initially widened with the onset of crisis; during the period of economic recovery, productivity gains slowed and were not sufficient to substantially narrow the gap to the EU. In the long term, productivity growth is the key source of Slovenia's economic growth, but high GDP growth rates post-2015 were to a large extent a result of increased employment. In the future, when the size of the working age population contracts due to demographic change, it will be essential to accelerate productivity growth in order to preserve the high rates of economic growth and household income growth.

The slowing of productivity growth, and consequently of the pace of catching up to the EU average, stems largely from a standstill in capital deepening. Average annual productivity growth,[7] which was at 3.4% in 2000–2008 (3.0% measured with value added per employee) slowed to 1% in 2009–2018 (0.5%) and 1.8% in 2010–2018 (1.3%). Decomposition of trend productivity growth shows that, compared to the multi-year period prior to the crisis, the contributions of total factor productivity and capital decreased. Total factor productivity has been strengthening since 2013, but the contribution of capital deepening remains at the lowest levels even in the growth period. This is partially associated with a relatively slow recovery of the domestic market and lower investment in transport infrastructure and housing, which is reflected in lower investment by the services sector.[8] In general, investment decisions have also been influenced by heightened uncertainty due to the previous crisis and, more recently, a slowing of foreign demand and increased uncertainty in the international environment. In the initial years after the crisis certain investments were probably deferred due to the relatively good availability of labour associated with high unemployment at the end of the crisis.[9] The low contribution of capital is to a large extent a reflection of the lacklustre level of construction investments in buildings and civil-engineering works, which contracted sharply following the brisk growth pre-2008 and have not recovered until the last few years. Despite several years of gradual growth, growth rates of investment in machinery and equipment also remain below pre-crisis levels.

Figure 1: Slovenia's economic development hinges on reducing the labour productivity gap



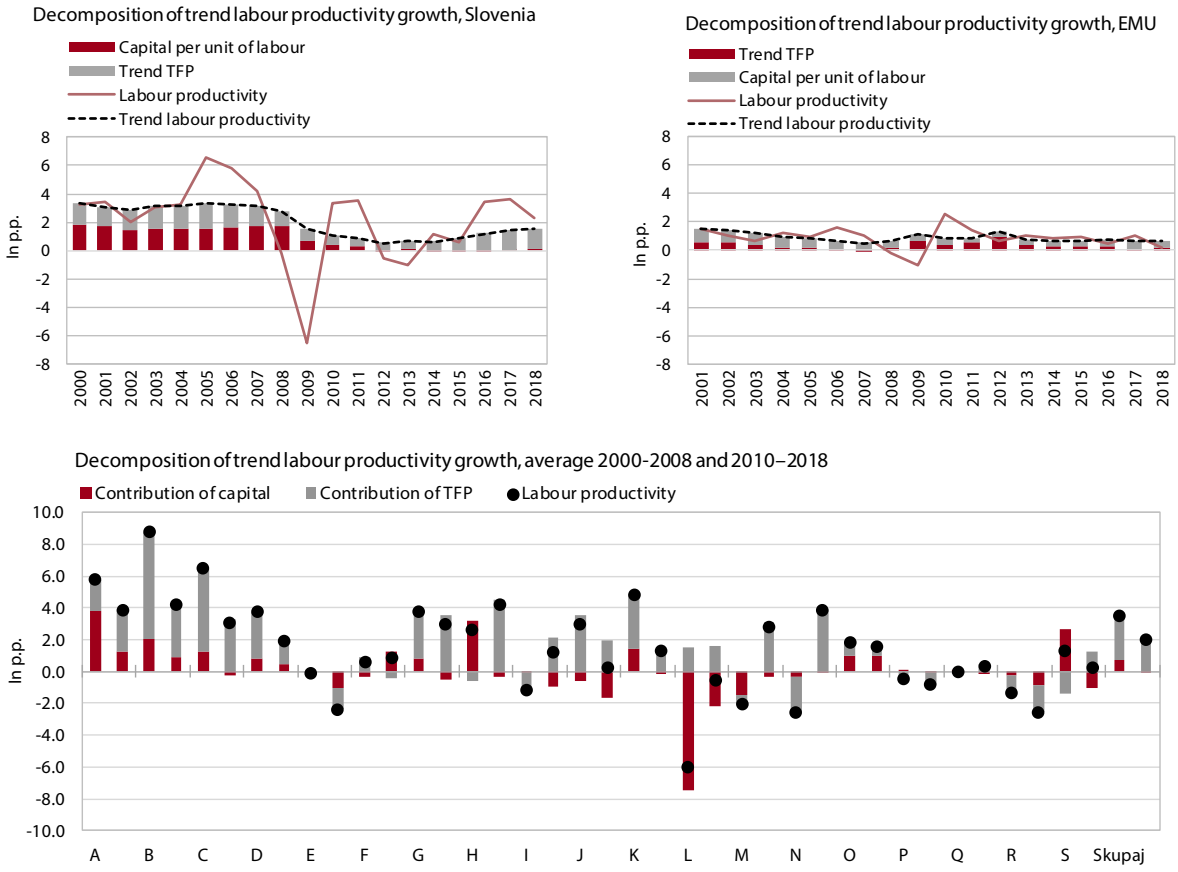


Source: Eurostat; calculations by IMAD.

5 GDP at purchasing power standards per employee.
6 See Annex 1, Figure 39.
7 Measured with value added per *hour worked*.

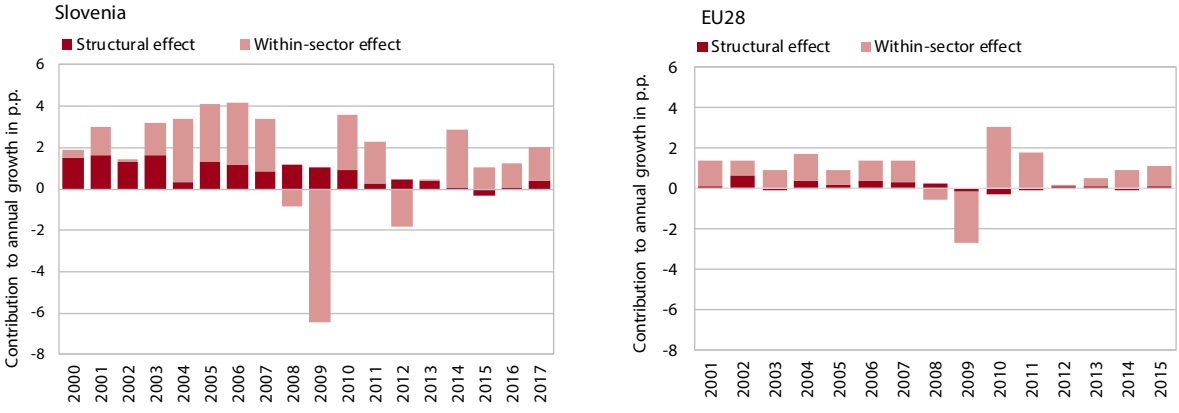
8 Break-down by sector shows that the contribution of capital is low in the majority of activities, most notably in accommodation and food services activities, wholesale and retail trade, real estate activities, and ICT. In some activities this may be associated with an absence of more significant investment in commercial buildings and other constructions (e.g. in stores, hotels etc.), which had been strong during the previous upturn. The strongly negative contribution of capital in the ICT sector is probably a reflection of low investment in the telecommunication sector.
9 In the initial years of the crisis the price of capital was relatively high against a backdrop of high corporate leverage and weakened stability of the banking sector, whereas when unemployment levels were high, the price of labour was relatively low, which may have affected some investment decisions (e.g. in the automation of production).

Figure 2: Significant decline in capital deepening after the crisis



Source: Eurostat, 2019; calculations by IMAD. Notes: Trend productivity growth is adjusted to the effects of the economic cycle, whereas productivity growth includes the cyclical component. Trend growth is defined as potential GDP relative to potential employment expressed in hours worked. Potential GDP is calculated using the production function method, while potential employment is employment under the assumption of normal utilisation.

Figure 3: The impact of between-sector shifts on productivity growth has been weakening



Source: Eurostat; calculations by IMAD. Note: For description of methodology, see Box 1.

Prior to the crisis, between-sector shifts significantly affected the growth and the narrowing of the productivity gap to the EU average, whereas after the crisis these structural shifts have gradually worn off. Productivity levels differ significantly across sectors. In Slovenia they ranged from 7 thousand to 455

Box 1: Shift-share analysis of aggregate productivity growth

The decomposition was carried out using Eurostat annual data for 64 activities based on the Standard Classification of Activities (NACE Rev. 2). Productivity is defined as value added per person employed. Change in productivity between year T and 0 is calculated as:

$$LP_T - LP_0 = \sum_{i=1}^{n}(LP_{iT} - LP_{i0})w_{i0} + \sum_{i=1}^{n}(w_{iT} - w_{i0})LP_{i0} + \sum_{i=1}^{n}(LP_{iT} - LP_{i0})(w_{iT} - w_{i0}),$$

where (LP_i) is productivity of the economy (individual sector) and w_i the share of employment in sector i. The first term on the right is the *within-industry* contribution to overall productivity growth, the second is the *static shift effect* and the third the *dynamic shift effect*. The last two were combined into the *structural effect* for the purpose of graphic representation.

thousand euros per person employed in 2017 (4–288 euros per hour worked).[10] The share of employment in individual sectors strongly affects the aggregate level and, potentially, productivity differences between countries.[11] *Structural changes* in the sense of labour transitioning into sectors with higher productivity levels and/or growth had a significant impact on aggregate productivity growth prior to the crisis and on the narrowing of the gap to the EU average. After the crisis, these structural effects gradually wore off. Whereas the employment share continued to rise in more productive knowledge-intensive services, while contracting in less productive low-technology industries and construction,[12] employment at the same time also rose in some sectors that typically have lower productivity. More precisely, in 2009–2013 the employment share in the public sector rose substantially,[13] and, with a rebound in the economy (2014–2017), hiring accelerated in certain market services with below-average levels of productivity in terms of value added per person (e.g. accommodation and food services and administrative and support services). The bulk of post-crisis productivity growth has thus been based on *within-sector growth* (i.e. growth of individual sectors, excluding the structural effects), but even this has slowed down.

After the crisis productivity growth slowed in the majority of activities; among business sector activities, the trends were particularly unfavourable in construction and ICT services (also compared to the EU). Manufacturing, the part of the *business* sector that is the most exposed to foreign competition, quickly compensated for the losses of productivity incurred in 2009,[14] but in subsequent years productivity growth was lagging behind pre-crisis rates. Both before and after the crisis, productivity was rising fastest in high-tech manufacturing activities, where growth even outpaced the EU average.[15] Productivity gains were comparable to those before the crisis in the transport sector (H), which is strongly integrated with manufacturing and increasingly export-oriented, while stronger gains were made by administrative and support service activities (N), in particular in the segment of employment agencies. There is still a considerable gap in construction, which remains significantly below the (otherwise high) pre-crisis levels despite favourable trends in recent years. Another industry that stands out negatively (also by international comparison) is ICT services. These services make it possible for firms in different industries to adopt new technologies and processes and are therefore an important driver of productivity of different sectors and the economy as a whole. Productivity growth in ICT services lagged behind the EU average across all segments, in particular in telecommunications.[16] Total productivity is also held back by the *non-business* part of the economy, but these activities have their own specifics and their productivity is harder to measure statistically.

Firm-level data show that the slowdown in sectoral productivity growth stems from slower growth of surviving companies. Productivity differences between firms within the same sectors are significant, even when these are narrowly defined. Shifts of employment from one firm to another within the same sector and the entry and exit of firms thus have a major impact on sectoral productivity. The Melitz and Polanec (2015) decomposition of productivity growth shows that in surviving companies in general (i) productivity growth

10 Data for the business sector, which exclude agriculture, real estate agency activities and public services due to their specifics, show that in 2017 productivity ranged from 17 thousand to 111 thousand euros per person (11–68 euros per hour worked).

11 A simple calculation shows than in 2000 productivity would have been 20% higher if Slovenia had the same sectoral structure of the economy as the EU average; by 2016 this would have narrowed to less than 5% (see Annex 1, figure 40).

12 Prior to the crisis the share of employees working in construction was rising.

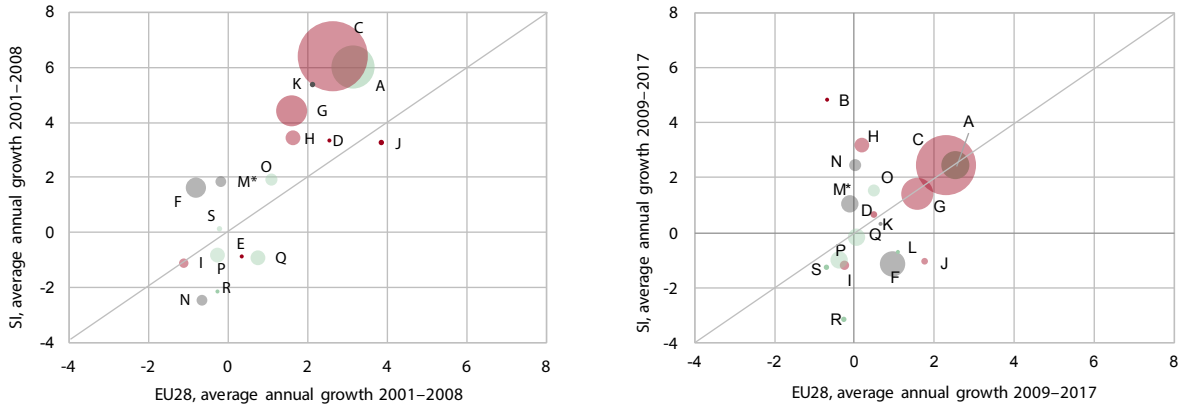
13 Employment increased in particular in education and healthcare, whose share rose significantly due to the general contraction of employment in the economy. Below-average productivity of public services is also typical of other countries, as public services are labour-intensive services, in which the adoption of new technologies may even increase the demand for labour rather than reduce it (e.g. in healthcare). Apart from this, public sector productivity is more difficult to evaluate statistically.

14 Including at the expense of job losses.

15 See Annex 1, Figure 41.

16 See Annex 1, Figure 42. Stagnation of productivity growth in ICT services (telecommunications) is the consequence of slower capital deepening in the industry.

Figure 4: Labour productivity growth slowed in the majority of sectors compared to the pre-crisis period.



Source: Eurostat; calculations by IMAD. Note: Figure shows average growth of real productivity (value added at constant prices per hour worked). The **tradeable** part of the **business sector** (**red**): mining (B) manufacturing (C), energy supply (D), water supply, sewage, waste management and remediation activities (E), wholesale and retail trade (G), transport (H), accommodation and food services (I), and information and communication activities (J); the **non-tradeable** part of the **business sector** (**grey**): construction (F), financial services (K), professional, scientific and technical activities (M), administrative and support services activities (N); **non-business sector** (**green**): agriculture (A), real estate activities (L), public administration (O), education (P), human health and social work (Q), arts, entertainment and recreation (R), and other service activities (S). Circle size represents the employment share (in hours worked) in individual activity in Slovenia in 2001 (left) and 2008 (right). Average annual productivity growth in activity M refers to the period 2003–2008 due to a break in the employment series in 2002, which was strongly affected by the inclusion of contractual workers in this activity.

Box 2: Dynamic decomposition of productivity with entry and exit of firms (Melitz and Polanec, 2015) and its extended method (Fonseca et al., 2018)

Productivity trends in individual groups of firms are affected not just by productivity at firm level but also by reallocation of employees among them and firms entering and exiting the group. Melitz and Polanec (2015) extended the Olley–Pakes (1996) decomposition of productivity change by taking into account entry and exit of firms:[1]

$$\Delta\phi = \Delta\overline{\phi_S} + \Delta cov_S + S_{E2}(\phi_{E2} - \phi_{S2}) + S_{X1}(\phi_{S1} - \phi_{X1}) \quad (1)$$

where $\Delta\overline{\phi_S}$ is change of average non-weighed productivity of surviving firms; Δcov_S represents change of covariance between productivity and the share of employees among surviving firms; ϕ_E, ϕ_S, ϕ_X are average productivities of entering, surviving and exiting firms; and S_E and S_X shares of employees among entering and exiting firms, respectively.

Fonseca et al. (2018)[2] additionally extended the method in that they differentiate between actual entering and exiting firms (due to the opening and closing of firms) and firms that transition in and out of the group (e.g. predominantly exporting firms or large firms) from other groups (e.g. predominantly domestically oriented firms or small firms):

$$\Delta\phi = \Delta\overline{\phi_S} + \Delta cov_S + S_{E2}(\phi_{E2} - \phi_{S2}) + S_{X1}(\phi_{S1} - \phi_{X1}) + s_{E_{tr}2}\left(\Phi_{E_{tr}2} - \Phi_{S2}\right) + s_{X_{tr}1}\left(\Phi_{S1} - \Phi_{X_{tr}1}\right) \quad (2)$$

where $s_{E_{tr}2}\left(\Phi_{E_{tr}2} - \Phi_{S2}\right)$ represents the contribution of firms entering from other groups (transitions entrants) and $s_{X_{tr}1}\left(\Phi_{S1} - \Phi_{X_{tr}1}\right)$ the contribution of firms exiting into other groups (transitions exitors).

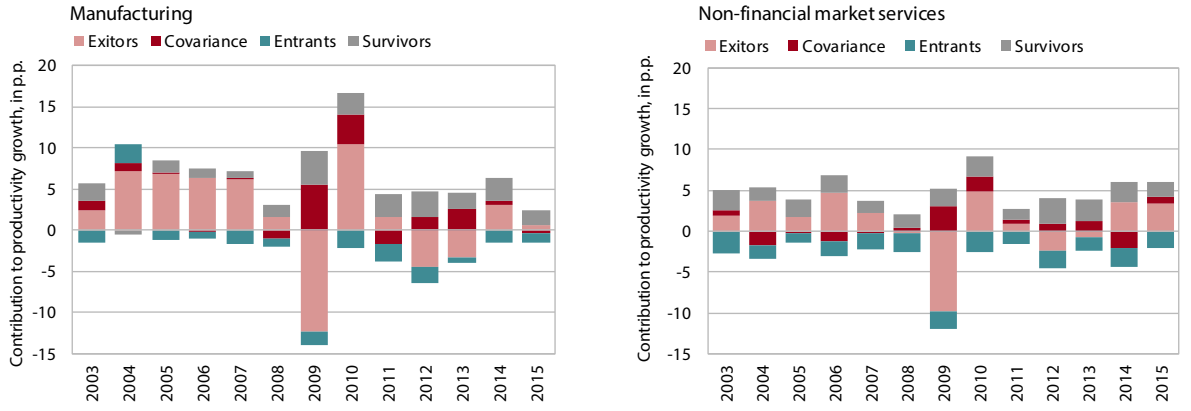
1 In the article the authors set out to demonstrate that this solves the problem of bias in previous decomposition methods, which account for entering and exiting firms.
2 Hereinafter called the extended Melitz Polanec method.

decreased significantly compared to the pre-crisis period,[17] but was more reliant on (ii) reallocation of employees to more productive firms (i.e. the contribution of covariance increased). A slight increase was also recorded in (iii) the negative contribution of the entry of new and initially mostly less productive firms and (iv) the positive contribution of the exit of low-productive firms[18]. During the economic crisis a faster exiting of

17 For detailed sectoral results, see Annex 1, Figure 43.

18 Actual closing down or opening of a firm is meant here, as firms that may have changed activities are classified under activities in which they were the longest.

Figure 5: After the crisis the productivity growth of surviving firms in particular declined

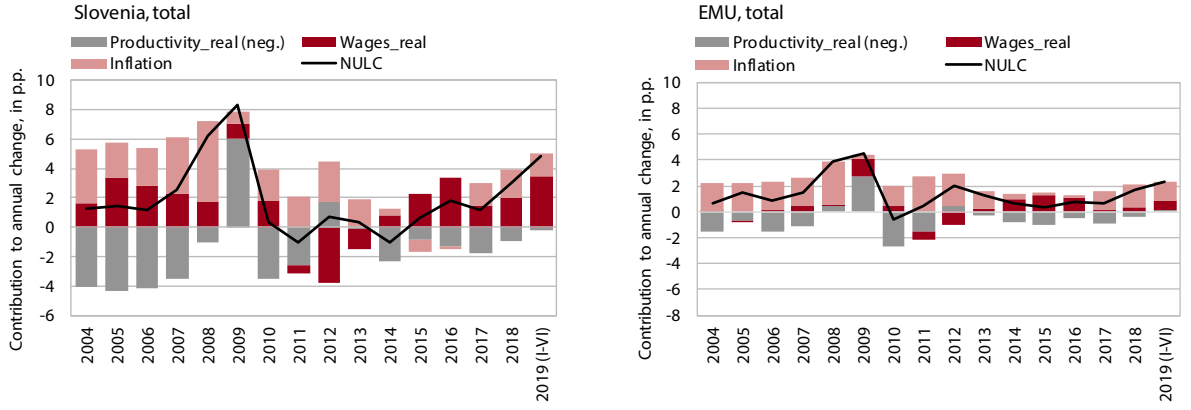


Source: AJPES; calculations by IMAD. Note: For description of methodology, see Box 2.

firms was expected, but after the crisis this may also have been due to changes to insolvency legislation[19] in mid-2013 that simplified the procedures for closing down a firm and probably contributed to freeing up production factors and reallocating them to better-performing firms with higher potential.

Productivity growth, although slower, allowed wage growth while maintaining cost competitiveness in 2014–2017, but in 2018 favourable trends came to an end. During the period of economic crisis, Slovenia's cost competitiveness deteriorated sharply due to productivity losses (2009) and relatively high wage growth (2010[20]) considering the economic situation at the time. What followed was an adjustment period on the labour market (restrained wage growth and a decline in employment) and a rebalancing of cost-competitiveness indicators.[21] After 2014 *wage growth* accelerated again and the purchasing power of employees rose against the backdrop of moderate inflation. Wage growth also outpaced the EMU average, while maintaining cost competitiveness,[22] since *productivity growth* of the Slovenian economy was faster as well. After the crisis productivity gains were initially generated by the tradeable sector (in particular manufacturing) and became more broad-based around 2014.[23] During 2018 and the first half of 2019 productivity growth slowed sharply, under the impact of a stronger easing of foreign

Figure 6: In 2014–2017, slower productivity growth, albeit higher than in the euro area overall, made wage growth possible while still preserving cost competitiveness



Source: Eurostat; calculations by IMAD. * Wages_real = nominal compensation of employees/employees, defl. with HICP; (harmonised index of consumer prices; productivity real = value added at constant prices/employment; NULC = (nominal compensation of employees/employees)/(value added/employment).
** Higher NULC value contributes to deterioration of competitiveness. Data for the period since Slovenia joined ERM II.

19 Amendments to the Financial Operations, Insolvency Proceedings, and Compulsory Dissolution Act – ZFPPIPP-E (Official Gazette RS, No. 47/2013).

20 In 2010 wage growth was buoyed by an increase in the minimum wage. Cost competitiveness had started to deteriorate even before the crisis, in 2008, when wages grew sharply due to indexation with high past inflation and productvity, and the elimination of wage disparities in the public sector.

21 See also Figure 7 (Slovenia's cost competitiveness).

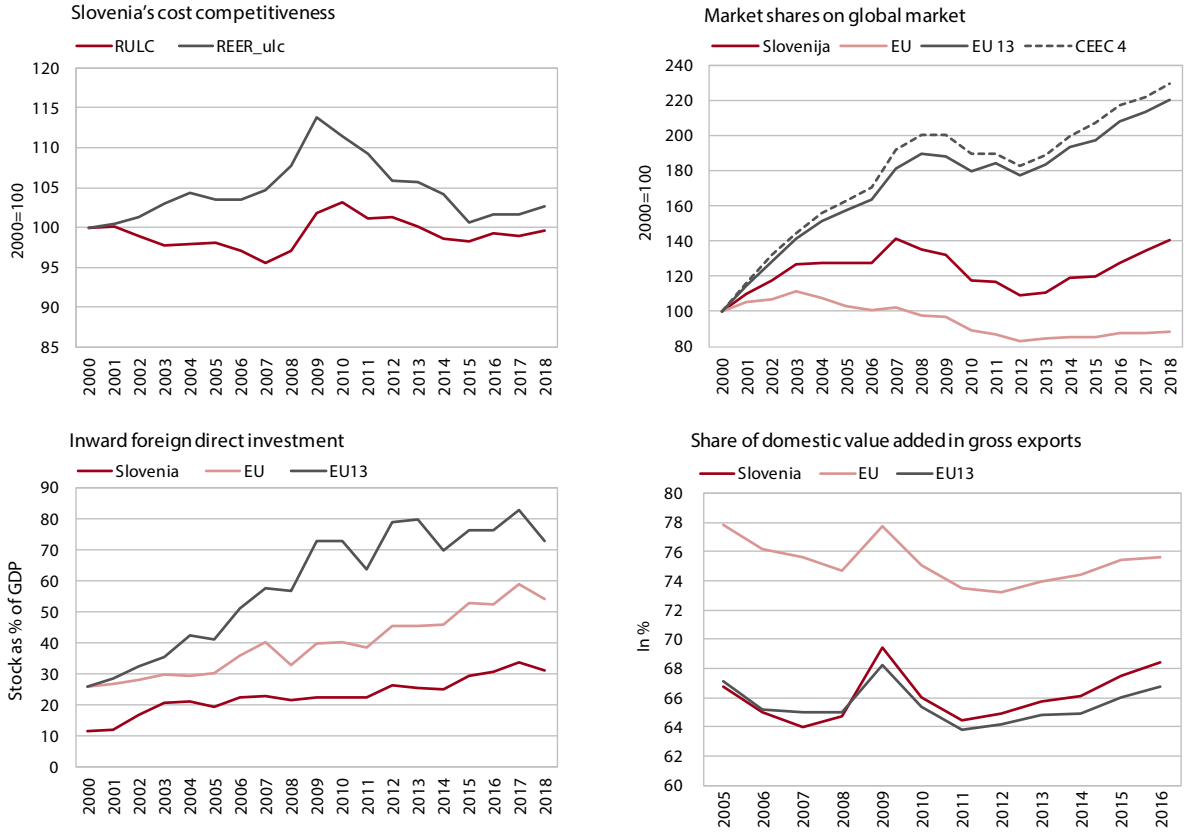
22 Measured with unit labour costs.

23 With the gradual recovery of domestic demand and improvement of

demand, particularly in manufacturing. Unit labour costs grew at a faster pace than in the EMU on average and even relative to trading partners outside the single currency area, which led to deterioration of the cost competitiveness indicator (REER_ulc).

The dynamics of export market share were affected, in particular during the crisis, by deterioration in cost competitiveness and the geographical orientation of Slovenian exports; over the long term, integration in global value chains also played an important role. In 2007 Slovenia satisfied roughly 0.2% of global import demand for goods, whereafter its global market share plunged in 2008–2012, in what was one of the steepest declines among EU countries. To a significant extent, this was the result of an unfavourable (in particular geographical) orientation of exports and the severe deterioration in competitiveness at the onset of the crisis.[24] After 2013, as price and cost competitiveness rebalanced and import demand by major trading partners recovered, the market share rebounded and reached the pre-crisis peak in 2018. In 2013–2018 the pace of growth was comparable to that of the Visegrad Group of countries and other new EU Member States, but these countries increased their market shares significantly more than Slovenia over the long-term. This was partially due to a substantial increase in foreign investment in these countries, which was stronger than in Slovenia. Since market shares are calculated from gross exports, they do not explain how much domestic value added is actually contained in exports.[25] In Slovenia the content of domestic value added in exports increased in

Figure 7: The dynamics of Slovenia's export market share have been strongly influenced by the deterioration of cost competitiveness during the crisis; over the long run, slower market share growth compared to competitors from the region is also a consequence of lower inflows of foreign capital



Sources: ECB, SURS, UN Comtrade, OECD Tiva indicators, UNCTAD Statistics; calculations by IMAD. Real effective rate deflated with unit labour costs (REER_ulc) shows changes in Slovenian NULC compared to NULC of 37 trading partners, adjusted for exchange rate movements and weighed by importance of partner. RULC represents real unit labour costs (i.e. adjusted share of labour costs in value added). Share of global market is the ratio between a country's (or group of countries' goods exports and total global goods exports.

the situation in construction, it also accelerated across the majority of the rest of the market-oriented economy.

24 If the impact of geographical orientation of exports had been lower, the contraction of Slovenia's export market share would have been less severe although still substantial. See also next paragraph.

25 For example, they can overstate the export performance of countries specialised in products and services at the lower part of global value chains, i.e. countries where the ratio between value added and gross exports is lower (OECD, 2019).

Box 3: Methodology of market share growth decomposition (shift-share)

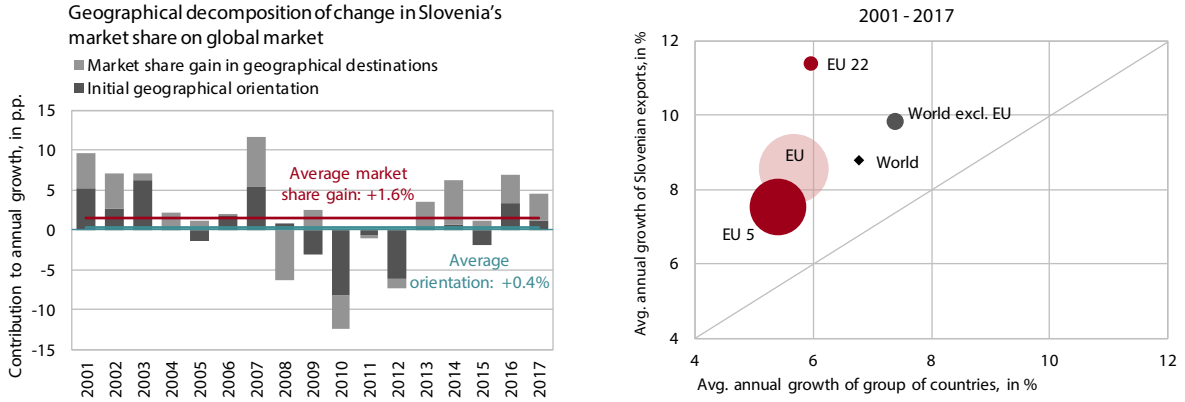
Geographical decomposition of export market share is carried out using annual UN Comtrade data in nominal terms (USD). Data for Slovenia are from the SURS foreign trade statistics (in USD). Global exports include all countries in the world, whereby missing values were replaced with other data sources or assigned the previous year's values. *Production decomposition* is based on Unctad data, in nominal values (USD) at the level of 3-digit Standard International Trade Classification (SITC). Geographical (production) decomposition is subject to the following identity:

$$g^{SI} - g^{W} = \sum_{c} w_c^{SI} (g_c - g^{W}) + \sum_{c} w_c^{SI} (g_c^{SI} - g_c),$$

$$g^{SI} - g^{W} = \sum_{i} w_i^{SI} (g_i - g^{W}) + \sum_{i} w_i^{SI} (g_i^{SI} - g_i)$$

where g^{SI} is growth of Slovenia's total goods exports, g^{W} growth of global imports, w_c^{SI} (w_i^{SI}) share of Slovenia's exports to country c of all products (of product i to all destinations) in Slovenia's total exports, g_c (g_i) growth of country c total imports (growth of global imports of product i, and $g_c^{SI}(g_i^{SI})$ growth of Slovenia's exports to country c of all products (of product i to all countries). The first component in the decomposition shows the impact of *initial geographical orientation (initial product specialisation)*. The second part is *market share gain in geographical (product) markets*. It shows export performance within geographical and product markets and reflects the country's export competitiveness.

Figure 8: Traditional Slovenian export markets are not among the most dynamic markets



Sources: UN Comtrade and SURS; calculations by IMAD. Notes: Circle size represents share of group of countries in Slovenian goods exports in starting year 2000. EU 5 – Germany, Italy, Croatia, Austria and France; EU 22 – other EU countries.

2012–2016 and is relatively high, considering the small size of the domestic market.

The Slovenian export market share is strongly affected by import demand of individual and in the last decade not highly dynamic markets (individual EU countries in particular). Slovenia exports approximately three-quarters of goods to EU countries, whereby over half of all exports are destined to its top five markets (Germany, Italy, Croatia, Austria and France[26]). The large share of exports to the EU, especially to the euro area, reduces exposure to exchange rate fluctuations but increases exposure to shocks within the EU.[27] During the crisis (2009–2012) Slovenia's above-average reliance on markets with modest import demand (individual countries in the EU and the former Yugoslavia) accounted for over half of the market share decline.[28] Since 2013 Slovenia's market share has been increasing and in 2016 and 2017 the improvements in export performance, amid stronger demand in major trading partners, were joined by the positive impact of geographical orientation.[29]

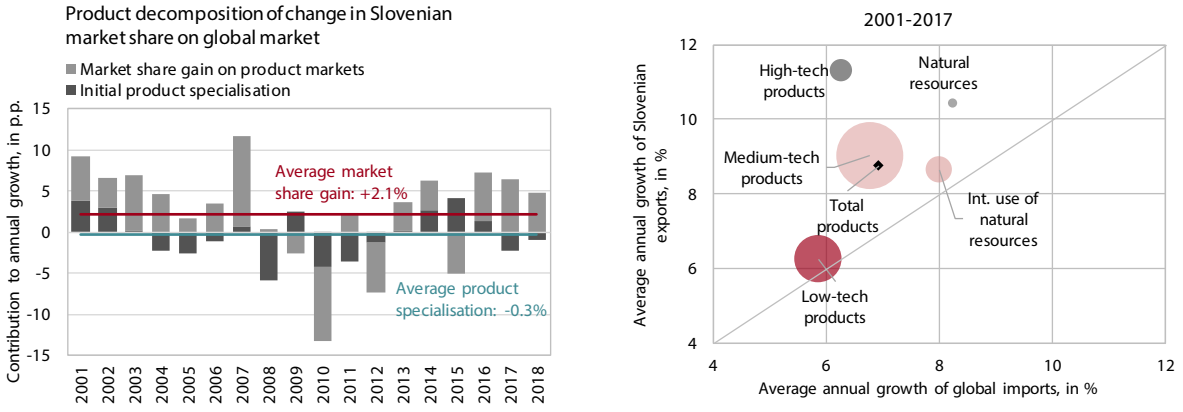
26 See Annex 1, Figure 44.

27 HHI index of geographical concentration indicates above-average exposure among EU Member States, although exposure is lower than in any Visegrad Group country and several other (in particularly smaller) new and old Member States (See Annex 1, Figure 45).

28 See Annex 1, Figure 46. Slower recovery of key export markets compared to global export demand in 2009–2012 is also confirmed by data on real merchandise imports, which excludes the impact of prices and exchange rates.

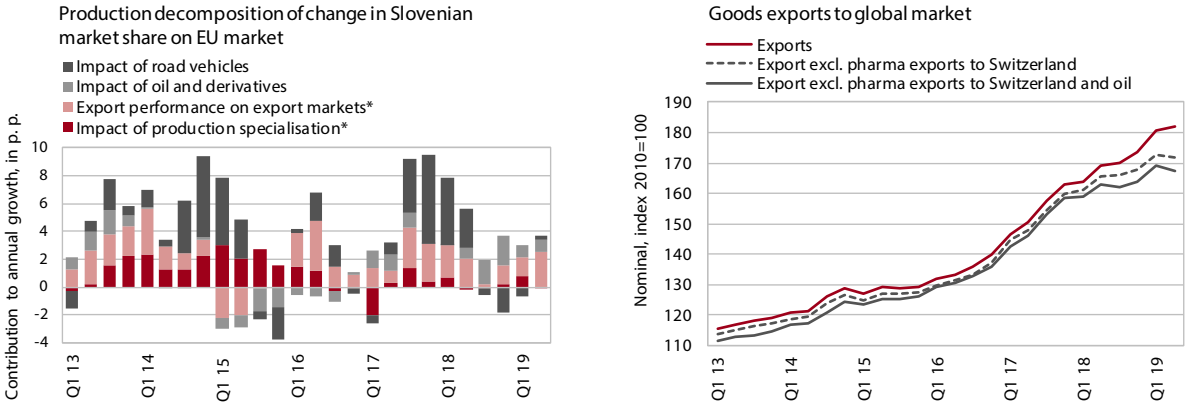
29 In 2014 and even more so in 2015 the structural effect of geographical distribution was strongly negative in particular due to a sharp decline in Russian imports, which account for a relatively significant

Figure 9: Market share growth was significantly affected by improved export performance in high-tech products, whereas export specialisation had a negligible impact in the long run



Sources: UN Comtrade, Unctad, SURS; calculations by IMAD. Circle *size* represents *share* of product group according to Lall classification in Slovenia's merchandise exports in initial year 2000; circle *colour* represents revealed comparative advantage (RCA) index in initial year 2000; **red** (RCA between 1.5 and 2.0), **pink** (RCA between 1.0 and 1.5), **dark grey** (RCA between 0.5 and 1.0), **light grey** (RCA between 0.0 and 0.5).

Figure 10: Individual products strongly affected the dynamics of export and market share growth in the last two years



Sources: SURS, Comext; calculations by IMAD. Note: * Excluding the effect of road vehicles, oil and oil derivatives.

Over the last 15 years the structure of Slovenia's exports has changed in favour of high-tech products, whereas global import demand grew fastest in the segment of natural resources. In terms of the structure of global import demand, Slovenia's export product specialisation was unfavourable in particular in 2004–2012, a period of high global demand for, and growing prices of, natural resources,[30] which account for a smaller part of Slovenia's exports given its natural endowments. The core of Slovenia's exports (with almost 40% share in goods exports) are medium-tech products. The RCA index, however, shows Slovenia's greatest comparative advantage in low-tech products, although this advantage has declined and shifted in favour of high-tech products, mostly as a result of fast-growing pharmaceuticals exports.[31] The share of natural resources, albeit still small by global standards, increased significantly, but largely as a consequence of increased re-exports, which have little influence on net exports and economic growth.

Since mid-2018 the growth of Slovenia's export market share has been slowing, in particular on the global market. Following two years of relatively high growth, Slovenia's export market share on the global market rose by 4.4% in 2018. Slovenian exporters also recorded relatively fast growth of export market share (almost 4%) on *EU markets*, although quarterly dynamics show a strong slowdown in the second half of last year. The dynamics of export and market share growth were significantly affected by *specific factors* associated with only few products. A particularly strong factor was the

share of Slovenian merchandise exports (significantly higher than in the structure of global imports). Russia's effect excluded, the impact of geographical distribution over those two years would

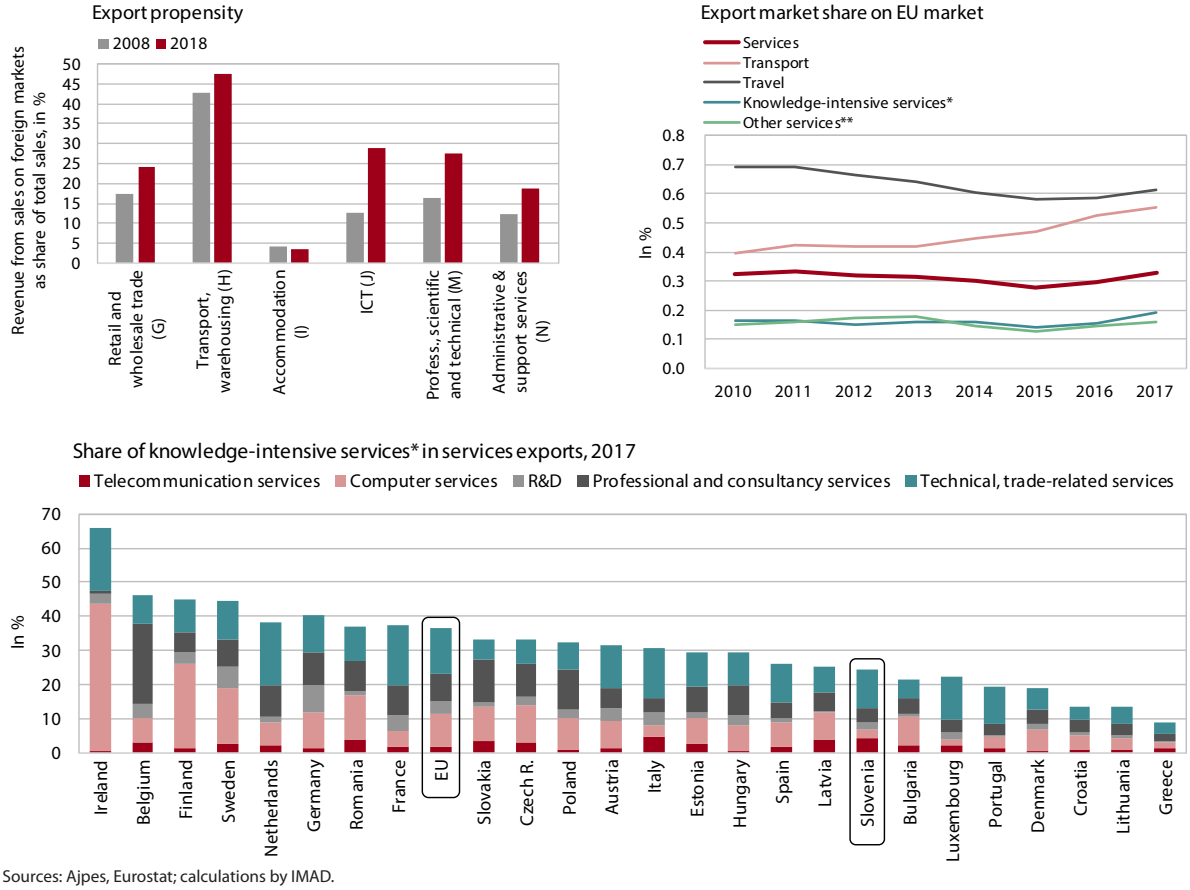
30 See also Annex 1, Figure 48.

31 See Annex 1, Figure 49.

wearing off of the impact of a new vehicle production line which had been introduced during 2017. On the other hand, in 2018 and in early 2019 exports and market share growth were positively affected by strong gross exports of oil derivatives. Since these are previously imported goods, we estimate that their contribution to economic activity is modest. Similarly, gross exports of pharmaceutical exports to *non-EU countries*, in particular to Switzerland, strongly accelerated. Excluding the effect of these individual factors, a *general slowing* of growth of exports and market shares *on the global market* occurred in the second half of last year and first half of this year.[32] This is probably partially a consequence of the geographical orientation of exports on the decelerating EU market;[33] to a lesser extent it may also be associated with the gradual deterioration of cost and price competitiveness in the recent period.

Services exports, including the relatively small share of knowledge-intensive services, rose substantially in the post-crisis period, but their export market share did not increase. The bulk of Slovenia's services exports are destined to European markets (92%; 80% to the EU market), comprising predominantly traditional services such as travel and transport (which together account for around 60% of services exports). In these

Figure 11: Increased export propensity of services but stagnation of export market shares and low share of knowledge-intensive services in exports



Sources: Ajpes, Eurostat; calculations by IMAD.

Notes: The low export propensity of accommodation and food services activities is the consequence of the fact that in this sector all revenue created on the domestic market, even sales to foreign tourists, are recorded as domestic revenue. * In balance of payments statistics, knowledge-based services include telecommunications, computer and information services, and administrative and support services activities. In the standard classification of activities, they include ICT activities (J) and professional, scientific and technical activities (M). ** Other services: processing, maintenance and repair of goods, construction, insurance, pension and financial services, compensation for the use of intellectual property, personal, cultural, recreational and state services.

32 IMAD estimate based on provisional data. Quarterly dynamics indicate that in the second half of 2018 the market share in fact contracted slightly year on year, but due to high growth in the first six months, average annual growth was still solid. Data for the first half of 2019 shows that Slovenia's export market share on the global market increased by 1%.

33 This would explain the still robust growth of market share in the EU, excluding the impact of individual factors.

services Slovenia also has comparative advantages on foreign markets, which means that they account for a higher share of Slovenian exports than in global services exports. Among major services, this also applies to construction services. The share of knowledge-intensive services in services exports (which includes telecommunications, computer and information services, and other business services[34]) is low compared to the EU average. After the crisis, against a backdrop of a slower recovery of the domestic market and growing global demand for services, exports of services and hence their export propensity rose sharply, but it took until 2017 for the export market share to increase somewhat more noticeably following several years of stagnation; in 2018 the growth did not continue. Since knowledge-intensive services are playing an increasingly important role globally, also due to their growing contribution to manufacturing efficiency, developing knowledge-intensive services and improving their competitiveness in the global arena represents significant potential for increasing productivity in the entire economy. After 2008 exports and export propensity also increased at a fast pace in other major services sectors, but a more pronounced market share increase was recorded only for transport services, which are strongly related to transport of goods.

34 In the balance of payment statistics, these services include telecommunications, computer and information services, and other business services; according to the standard classification of activities, they include ITC activities (activity J) and professional, scientific and technical activities (M).

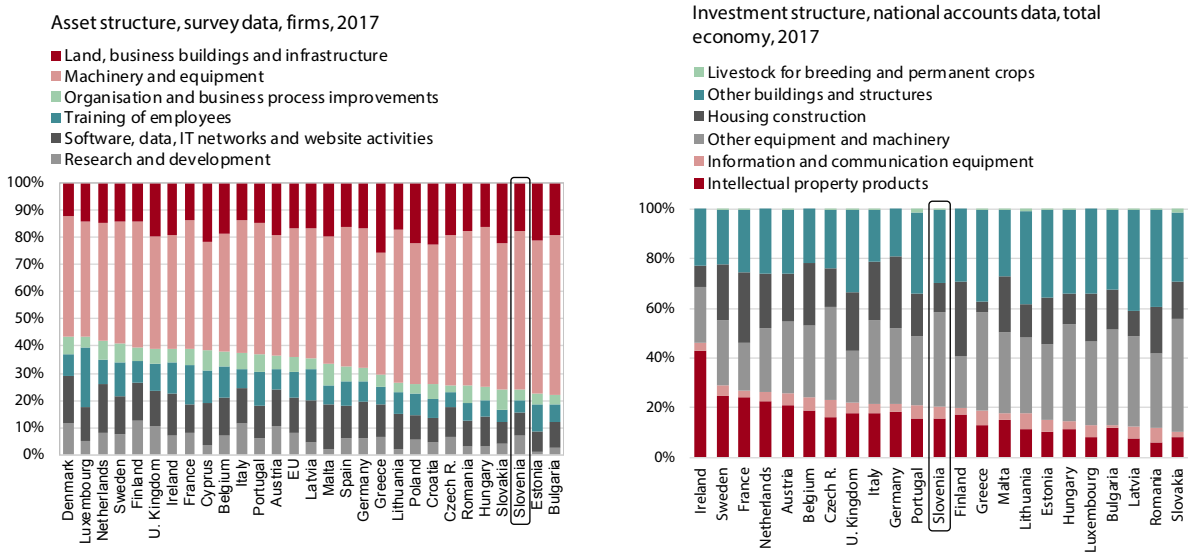
3 Long-term productivity factors

Innovation is the key long-term factor of productivity growth. Innovation – the use of new technologies and non-technological innovations – increases value added with unchanged quantity of utilised production resources. Key instruments for the promotion of innovation activity include investment in research and development, acquisition of knowledge and skills, and the creation of a conducive business environment (which includes access to finance and a functioning labour market), which is important not only for the performance of existing firms but also for the creation of new firms and smooth transition of production factors (labour and capital) among firms.[35]

Investment in innovation accounts for a relatively small share of total investment in Slovenia. Innovations may include a new or improved product, procedure, service, organisation or management, patent, or intellectual property. Accordingly, innovation hinges not only on investment in research and development but also on investment in other intangible assets such as ICT, education and training of employees or improvement of organisational and business processes.[36] In Slovenia such investment, called in simplified terms investment in innovation, accounts for roughly a third of all corporate investment, which is one of the lowest shares among EU countries (survey data). Measured by total investment in intellectual property and information and telecommunications equipment (national accounts data), Slovenia ranks close to the EU average.

The innovation activity of Slovenian firms has decreased significantly over the last several years. The decline in the share of innovative companies[37] was among the sharpest in the EU after 2010. The most severe contraction of innovation activity was recorded in small and medium-sized firms; moreover, in small firms the gap to the EU average is widest. The share of innovative large firms is slightly above the EU average despite the unfavourable trend. Low innovation activity of small firms is associated with their focus on cutting costs and routine process improvements and with a lack of human and financial resources to implement innovations and increase competitiveness.[38] Small and medium-sized firms also report that they do not take sufficient advantage of government business incentives, as they are not familiar with them or do not have the human resources to deal with overly complex calls for applications.[39] Among sectors, the widest gap to the EU average is in services companies, which have also performed worst post-2010.

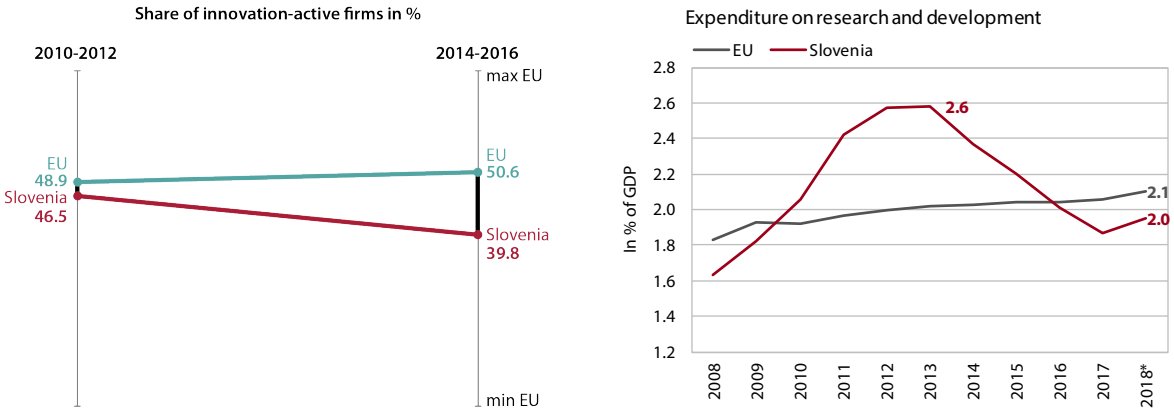
Figure 12: By international standards, Slovenian firms earmark a relatively small share of total investment for innovation



Sources: EIB Investment survey, 2018, and Eurostat data portal, 2019.
Note: The figure on the left ranks countries by total investment in research and development, software, data, IT networks, online activities, employee training, organisation and business process improvements. The figure on the right ranks countries by total investment in intellectual property and ICT equipment.

35 "How does innovation lead to growth?" (ECB), 2017.
36 "Investment in the Euro Area, Focusing on research and innovation", 2019.
37 Firms that introduce a technological or non-technological innovation.
38 Development Report 2019 (IMAD), 2019.
39 Brečko, Bučar, Udovič, 2018.

Figure 13: Unfavourable trends in innovation and R&D activity



Sources: SURS, Eurostat. Note: Expenditure on research and development had increased until 2012 not just as a % of GDP but also in nominal terms. * Provisional data.

In 2012–2017 investment in research and development also contracted considerably. Contraction of *public investment* in 2012–2016 was associated with the necessity to consolidate public finances in that period. In 2015–2017 there was also a decline in *business sector investment,* which accounts for the bulk of research and development investment (almost two-thirds). The dynamics of business sector investment were also strongly affected by a late start and sluggish drawing on EU funds at the start of the new multiannual financial framework 2014–2020.[40] In the past EU funds constituted an important incentive for companies to invest own funds in research and development, and they also strengthened cooperation between the research and business sectors and hence the overall innovation activity of the economy. In the last few years certain changes were also implemented concerning tax relief for investment in research and development, which may have made firms more cautious about undertaking such investments.[41] On the other hand, a series of recently adopted measures (e.g. the creation of Strategic Research and Innovation Partnerships in 2017, establishment of the Fund of Funds in 2017 managed by the Slovenian Export and Development Bank[42], and introduction of Slovenian Enterprise Fund vouchers in 2019 covering multiple fields of SME competitiveness[43]), if implemented efficiently, could improve the transfer of knowledge from the R&D sector to firms and increase innovation activity across the entire economy.

The deployment of new technologies at firms is roughly on par with the EU average, with large companies ranking highest in international comparisons. Just like in the EU generally, the bulk of firms use a subset of new technologies which have been available for some time. Measured by use of most technologies, Slovenian firms are relatively comparable with the EU average. They are, however, much more likely to use e-invoices, which are suitable for automatic processing, since e-invoicing has been mandatory in Slovenia since 2015 for transactions with budget users. A smaller share of firms than in the EU has an automated customer relationship management (CRM) system. This is true in particular of SMEs. Technology use among large firms is above the EU average in almost all analysed technologies. Firms in Slovenia list lack of skilled workers, technical know-how and financial incentives (e.g. from the state) and high cost of deployment as the principal obstacles to the uptake of new technologies.[44] Given that digital transformation is a global economic megatrend, effective bridging of such obstacles will have a large impact on the productivity and competitiveness of the Slovenian economy in the future.

In education Slovenia has made some headway in recent years, but there is a growing need for faster adaptation of knowledge and skills to development challenges. The educational structure of the population has been improving for a number of years and the shares of the population with at least secondary and with tertiary education are above the EU average. Science, maths and reading achievements by 15-year-olds as measured by

40 This was partially due to the relatively late completion of key documents required to draw on EU funds, in particular in research and innovation (Operational Programme for the Implementation of the EU Cohesion Policy in 2014–2020 and Slovenian Strategy of Smart Specialisation 2014–2020 adopted by the government in October 2015). The first government measures for the promotion of innovation in firms were not carried out until 2016 (Reply by the Government of the Republic of Slovenia to an MP question by Franc Breznik concerning the decline in Slovenia's innovation performance - proposal for debate, 8 July, 2019).

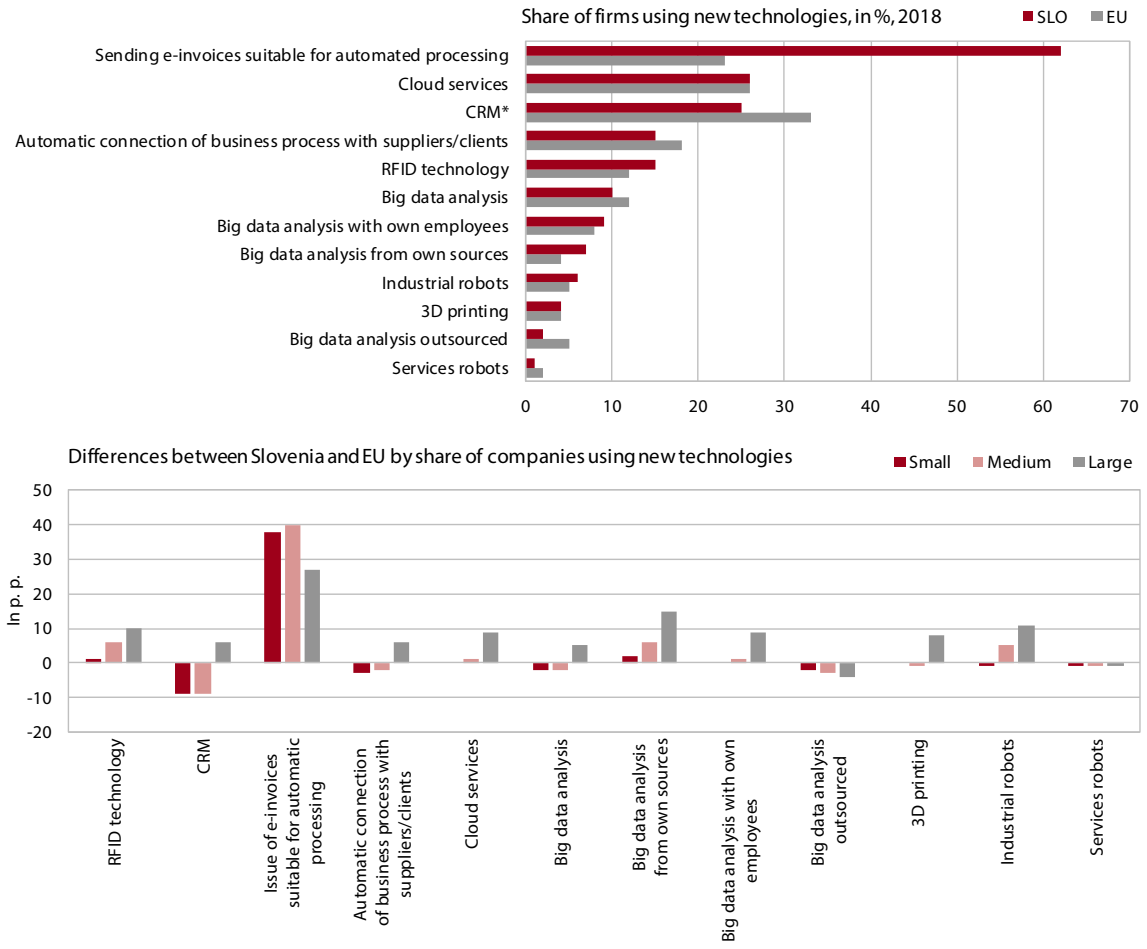
41 In 2017 detailed instructions for claiming these deductions were prepared after an audit of the claims for 2016 established that the previous interpretation had been too lax (Development Report 2019, 2019).

42 The purpose of the fund is the promotion and financing of sustainable economic growth and development and current operations through debt and equity financing focused on research, development and innovation, small and medium-sized enterprises, energy efficiency and urban development.

43 Source: "Voucher-based small-scale incentives", 2019.

44 Čater, T,. et al., 2019.

Figure 14: Deployment of new technologies at firms is relatively comparable to the EU average



Source: Eurostat. Note: * Data for 2017. RFID – radio frequency identification, CRM – customer relationship management; small firms: 10–49 employees, medium-sized firms: 50–249 employees; large firms: 250+ employees.

the PISA study have improved strongly as well.[45] These changes are reflected in Slovenia's high ranking among EU countries according to the synthetic estimation of knowledge and skill development. Slovenia performs slightly worse regarding mismatches of knowledge and skills. Even though not among the highest in the EU, knowledge and skill mismatches are exacerbating the lack of skilled labour against the backdrop of the overall contraction of the working-age population as a result of demographic factors. In narrowing the knowledge and skill mismatch, lifelong learning is becoming an increasingly important factor in an environment of rapid technological progress and longer working lives. Participation of the adult population in lifelong learning has dropped considerably since the crisis, with significant differences between population groups. Among EU Member States, Slovenia ranks lowest in the participation of low-skilled persons and older persons in lifelong learning.

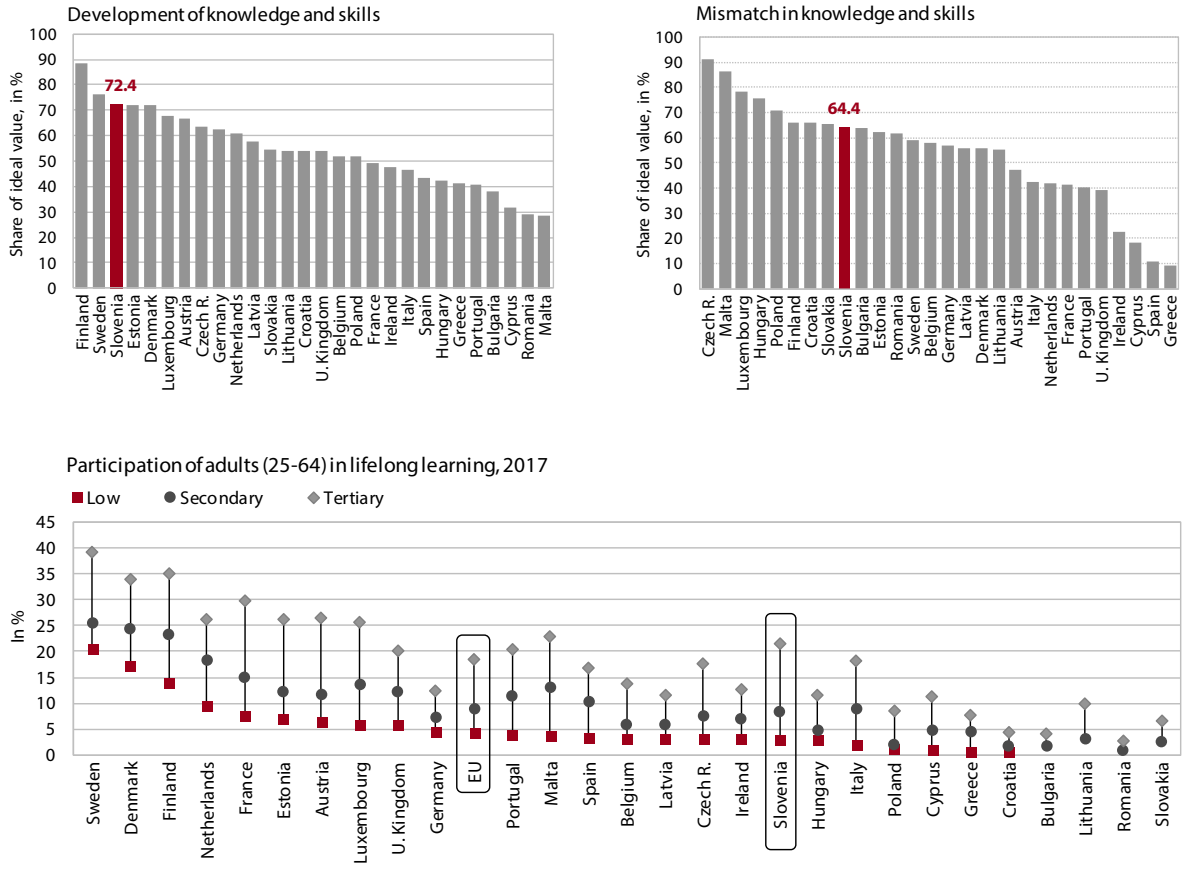
The business environment has improved, but change is nevertheless needed in certain areas. In the last decade significant headway has been made towards simpler and faster incorporation of companies, while insolvency law changes[46] have simplified procedures for the dissolution of firms. This has reduced obstacles to the transfer of production factors from less to more productive firms.[47] On both these counts Slovenia ranks relatively high among EU Member States as measured by the ease of doing business index calculated by the World Bank. Surveys among businesses show the main obstacles to doing business in Slovenia in recent years are associated with taxes and tax policy, excessive red tape, and length of certain procedures (such as execution of contracts, acquisition of building permits and registration of real estate).

45 The survey is conducted by the OECD. According to the last survey, for 2015, Slovenia ranked between 3rd and 6th place among EU countries in these three areas.

46 Amendments to the Financial Operations, Insolvency Proceedings, and Compulsory Dissolution Act were adopted in 2013.

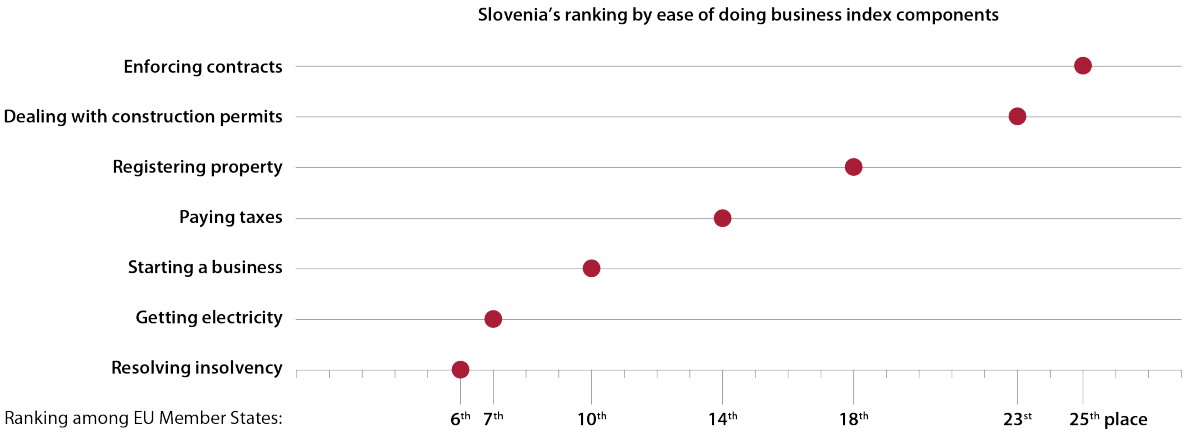
47 See also Box 2.

Figure 15: With knowledge and skills levels relatively high, adaptation to development challenges is key



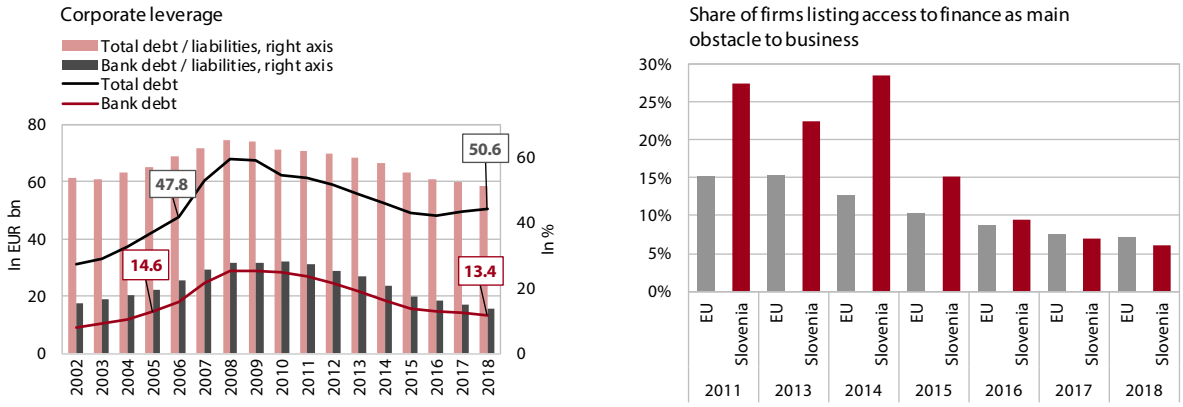
Sources: Cedefop, The European Skills Index (ESI), 2018; Eurostat – Education and training. Notes: The *development of knowledge and skills index* comprises the following indicators: ratio between number of children from age three to school entry and the number of teaching staff in pre-school education; share of the population aged 15–64 with at least secondary education; achievements of 15-year-olds in reading, maths and science in the PISA study; participation of adults in lifelong learning; share of enrolees in vocational education at secondary level; and digital skills (share of adults aged 16–74 who correctly completed 5 or 6 assignments in the study). The value x% means the country has achieved x% of the ideal value. Higher is better (lower mismatch). The *knowledge and skills mismatch index* comprises the indicators: share of the long-term unemployed; share of the involuntarily underemployed; share of persons with tertiary education not working in ISCO 1–3 professions; share of persons with tertiary education receiving minimum wage; qualification mismatch. The value x% means the country has achieved x% of ideal value. Higher is better (lower mismatch).

Figure 16: Simplifications in opening or closing a business, procedures still long in some areas



Sources: World Bank, "Doing Business"; calculations by IMAD.

Figure 17: Access to finance is relatively good



Sources: Statistical data from balance sheets and income statements, AJPES, 2019; Survey on the access to finance of enterprises, ECB, 2018

Access to finance has been a relatively small barrier to doing business in the last few years. The years prior to the crisis were characterised by good access to finance for firms, but with the onset of the crisis the situation deteriorated sharply. Worsening economic conditions, coupled with banks' high dependence on foreign finance at the time and inefficient allocation of credit in the pre-crisis period, undermined the stability of the banking system. Another reason why access to finance was very tight was high corporate leverage at the outbreak of the crisis. Following the bank bailout in 2013[48], the banking system became stable again, and by 2018 corporate financial leverage, which peaked at the start of the crisis, had dropped to the level it was prior to acceleration in 2005. Accordingly, the share of firms whose operations are significantly affected by limited access to finance started to decline sharply after 2014 and is already below the EU average (in 2014 it was approximately twice the EU average). Firms' ability to pay down debt has also improved and is at the highest level over a multi-year period.[49] Nevertheless, there are differences depending on firm size. SMEs face a relatively higher share of non-performing claims, mostly due to their greater focus on the domestic market (slower recovery after the crisis), more limited access to finance and the late timing of measures to facilitate the financial restructuring of this size group of firms.[50]

In terms of job security, the labour market is relatively flexible; the challenge is to reduce the mismatch between existing and desired employee skills by strengthening the role of active employment policy. Sustainable and long-term productivity growth requires, among other things, a well-functioning labour market and a labour market policy that ensures the necessary resilience and adaptability of the economy to various shocks. Labour market policy may affect productivity with measures such as i) loosening the rigidity of employment protection legislation to facilitate the transition of labour between less and more productive firms, and ii) promoting investment by firms and employees in education and reducing the mismatch between available and required job-seeker skills. Until 2013 Slovenia had a relatively high level of employment protection, but the introduction of the new Labour Relationships Act made individual dismissal more flexible than in the OECD on average.[51] For active employment policy, which could help reduce mismatches in knowledge and skills, Slovenia allocates a relatively small share of funds compared to other OECD countries (0.24% of GDP in 2016 compared to 0.52% of GDP in the OECD). The system for anticipation of skill needs has also not been established yet. The estimate of matching efficiency[52] has otherwise increased in recent years, but it is still lower than before the crisis. This may be attributable to a significant increase in the number of the long-term unemployed, since long-term unemployment can have a negative impact on the already acquired skills and makes it difficult to obtain new skills due to the absence from the labour market.

48 Bank recapitalisation and incorporation of the Bank Assets Management Company.
49 The analysed period is 2002–2018.
50 More in Lušina, 2019.
51 The new act resulted in a drop in the OECD index which measures the protection of regular workers against individual dismissal (EPR) and the index of regulation of temporary contracts (EPT).
52 The estimate of matching efficiency shows how efficient the matching process between job seekers and vacant jobs is. In the event unemployment drops and the number of vacant jobs remains unchanged, matching efficiency increases (and vice versa). For a description of methodology, see Labour Market Developments in Europe 2013 (EC), 2013.

II. Analysis of productivity on the basis of firm-level data

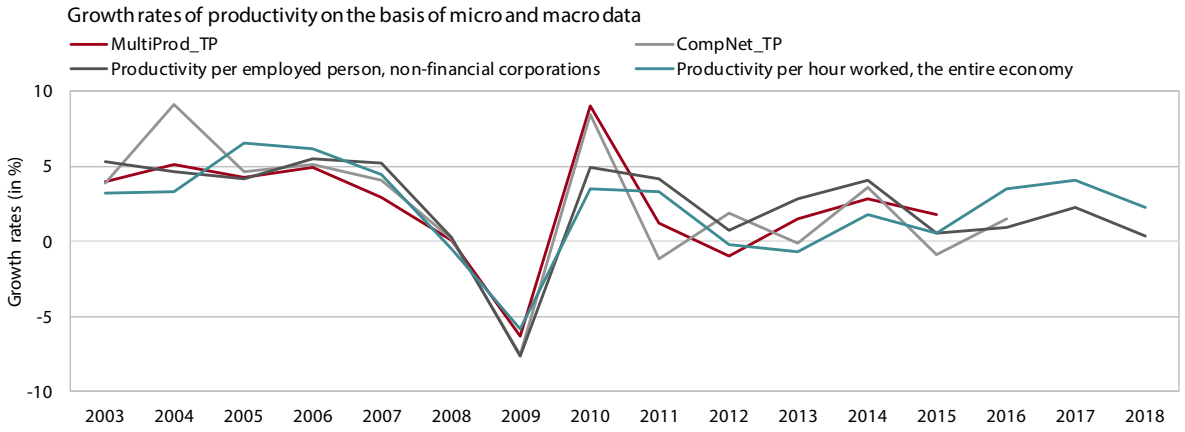
1 Methodology and data

Our analysis of productivity at micro level is based on data collected by the Agency for Public Legal Records and Related Services.[53] The indicators of productivity are mostly calculated using the MultiProd or ComptNet code. The former was developed by the OECD and the latter by the Competitiveness Research Network (ComptNet),[54] both with the purpose of analysing productivity movements using microdata. Multiprod is a project of the OECD's Committee for Industry, Innovation and Entrepreneurship and the Working Party on Industry Analysis aimed at studying productivity patterns across countries and over time. It provides harmonised micro-aggregated data important for investigating the extent to which different frameworks can shape firm productivity and examining the way resources are allocated to more productive firms.[55] The Competitiveness Research Network (CompNet) was founded by the European System of Central Banks in 2012 with the objective of analysing competitiveness in the EU from a more comprehensive perspective encompassing micro, macro and cross-border dimensions. Its ultimate goal was and remains to be identifying a robust, theoretical and empirical link between drivers of competitiveness and macroeconomic performance to enable frontier research and policy work. The results of both codes enable international comparison for around 20 countries,[56] but only data for countries within the CompNet are publicly available. Despite certain differences, the codes are relatively similar, which makes it possible to check the robustness of their outcomes (for a more detailed comparison of the approaches and their results, see Annex 2).[57]

After the preparation and cleaning of data, a representative sample of around 60% of firms from the represented NACE Rev. 2 sections was left in the databases,[58,59] which represent 97% of value added of all firms in these sections in the case of MultiProd and 65% in the case of CompNet.[60] Input data are otherwise available for the 2002–2018 period, but due to the requirements for more detailed input data, the results of the MultiProd code are available from 2002 to 2015, while the results of the CompNet code are available until 2016. Our dataset thus ranges from 38,051 firms in 2002 to 65,603 firms in 2016, which makes 792,649 observation units in total. The final sample of both databases (for a more detailed explanation of differences between

53 AJPES (Statistical data from balance sheets and profit and loss statements).
54 For more details see https://www.comp-net.org.
55 For more details see https://www.oecd.org/sti/ind/multiprod.htm.
56 The set of countries can change over the period.
57 The codes calculate indicators at firm level and then aggregate the outcome to a certain level to preserve confidentiality.
58 In the case of MultiProd, all NACE Rev. 2 sections excluding K and O.
59 In the case of CompNet, NACE Rev. 2 sections C, F and G–N (excluding K).
60 This applies only to firms for which data on labour productivity are available.

Figure 18: Growth rates of productivity based on firm-level data are comparable to those based on macro data, which confirms the representativeness of the sample



Sources: Ajpes, MultiProd, CompNet, SURS; calculations by IMAD.
Note: WA – weighted average.

the codes and between the cleaning procedures, see Annex 2) consists only of firms for which data on labour productivity (defined as value added per employed person) are available.[61] A significant difference in the final sample lies in the 1-digit sections covered – in the case of CompNet, C, F and from G to N (without K) and in the case of MultiProd also A, B, D, E, P, Q, R and S.[62] In the MultiProd database, 25,641 firms thus remain in the sample in 2002 and their number increases to 34,729 in 2015 (19,680 observation units in total). This is approximately 60% of all firms in Slovenia in the represented (NACE Rev. 2) sections (in 2002–2015), which account for almost 97% of nominal value added of firms in these 1-digit sections. In the CompNet database, the number of firms increases from 23,906 in 2002 to 33,117 in 2016, i.e. 420,642 units in total. This is more than 59% of all firms in the represented NACE Rev. 2 sections (in 2002–2016), which account for more than 65% of value added in these 1-digit sections.[63] With regard to the very similar movements of year-on-year productivity growth in both databases in comparison to macro data from national accounts, we can conclude that our sample is representative.[64]

Our productivity analysis is based on the indicator of labour productivity. The indicator of total factor productivity (TFP) is, in theory, a more appropriate measure of productivity, but due to the underestimated value of capital in our database (see Box 4), we included only labour productivity into the analysis in this part of the report. In interpreting labour productivity data, it should be taken into account that labour productivity is also affected by changes in the use of capital,[65] in addition to other factors (while TFP explains the portion of output growth that is not a consequence of increased use of labour and capital).

61 Value added is defined as gross operating yield, minus costs of goods, material and services, minus other operating expenses; the number or employed persons is defined as the average number of employees calculated on the basis of hours worked in an accounting period.

62 The letters denote the following sections according to the Statistical Classification of Economic Activities in the European Community: A – Agriculture, B – Mining, C – Manufacturing, D – Electricity, gas, steam and air-conditioning supply, E – Water supply, sewerage, waste management and remediation activities, F – Construction, G - Wholesale and retail trade, repair of motor vehicles and motorcycles, H – Transportation and storage, I – Accommodation and food service activities, J – Information and communication, K – Financial and insurance activities, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities, P – Education, Q – Human health and social work activities, R – arts, entertainment and recreation, and S – Other service activities.

63 A lower share of value added in the case of CompNet is mainly a consequence of a different data cleaning procedure (see Annex 1).

64 Similar is found by Bajgar et al. in comparing the results of the MultiProd code with macro data.

65 For the MultiProd code, the capital input is defined as all tangible fixed assets, intangible fixed assets and investment properties, for the CompNet code as all tangible fixed assets and investment properties.

Box 4: Problems in estimating TFP at firm-level for Slovenia

Labour productivity is one of the basic and most common measures of productivity. It is calculated simply as the ratio between output (typically value added) and a unit of labour input (typically the number of persons employed). The simplicity of the calculation is both a weakness and a strength. The main weakness is that the measure does not take into account capital intensity.

Total/multi factor productivity explicitly also includes capital intensity. In the literature, total factor productivity is most commonly estimated with the Cobb-Douglas production function:

$$VA_{i,t} = TFP_{i,t} L_{i,t}^{\alpha} K_{i,t}^{\beta}$$

where VA is value added, TFP total factor productivity, L the labour input, K the capital input, α the output elasticity coefficient of labour, β the output elasticity coefficient of capital, i the index for firms and t for time – years.

Estimating total factor productivity is not as simple as calculating labour productivity. While labour and capital inputs can be correlated with total factor productivity, there can also be a correlation between capital and labour and productivity shocks, which may change over time. Estimating total factor productivity thus requires advanced methods that also address these problems. Recently the Wooldridge (2009) method has become widely used for estimating total factor productivity. This is also the method applied by both CompNet (CompNet Task Force, 2014) and MultiProd (Berlingieri et al., 2017a).

The results show that the elasticity of production (value added) to capital is very low in Slovenia, often very close to 0, meaning that the increase in capital input has no (or a very low) impact on a firm's value added. At the same time, the estimates of total factor productivity are correlated with the amount of capital. A comparison between different sectors with different levels of capital intensity thus shows significant differences between their average total factor productivities. The average total factor productivity in the energy sector appears to be 50 times that in manufacturing according to these results. The unusual estimates of total factor productivity are related to difficulties in measuring capital, according to our assessment. Collard-Wexler and De Loecker (2016) show that in the case of measurement errors in capital, the commonly used estimation techniques fail.[66] The solution lies in using lagged investments as instrumental variables for capital, which remains a subject of future research.[67]

66 They show, also on data for Slovenia (manufacturing activities in 1994–2000), that due to measurement errors in capital stock the value of the coefficient of elasticity to capital is half lower.

67 In the AJPES database, which includes data obtained from firms' balance sheets and profit and loss statements, information on investment is not available. For further work in this area, it will therefore also be necessary to merge the SURS and AJPES databases.

2 Productivity dynamics and distributions

The growth of private sector productivity in 2010–2015 was lower than the average annual growth rates in the pre-crisis period. The average annual labour productivity growth of the private sector totalled a solid 3% before the crisis. With the onset of the crisis in 2009, labour productivity declined sharply, relatively more in smaller firms. The decline in median productivity was thus even more pronounced than the decline in the weighted average.[68] The average annual productivity growth in the 2010–2015 period (at around 2%) lagged below the pre-crisis level. The difference between the growth of weighted averages and medians (in favour of weighted averages) increased further in comparison to the pre-crisis period, which could be a consequence of stronger productivity growth of larger firms, which was also present in the period after 2009. However, the lower values of medians than weighted averages could also be due to the increased entry of new (at first less productive) firms.[69]

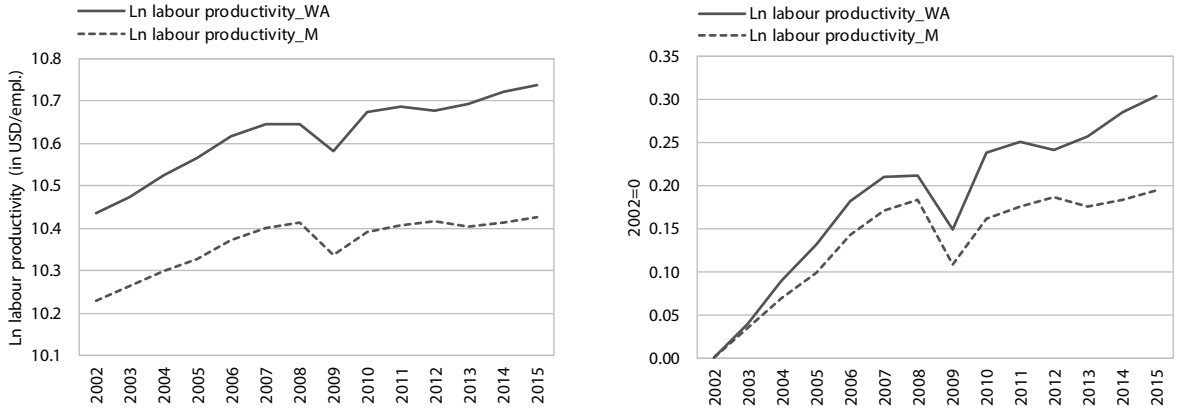
Table 1: Average annual growth rates of labour productivity

	Weighted averages	Medians
Total (2003–2015)	2.3%	1.5%
Before the crisis (2003–2008)	3.5%	3.1%
2009	-6.3%	-7.6%
After 2009 (2010–2015)	2.6%	1.5%

Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.

density around low productivity levels, which indicates a large number of less productive firms, while a long right-tail of distribution indicates a small number of highly productive ones. The mean is greater than the median in a given year, which is also typical for right-skewed distribution. During the period observed, productivity distribution shifted to the right, indicating productivity growth, especially on account of the pre-crisis period (see Annex 3 for more details).[72] In addition, the majority of indicators point to a decline in labour productivity dispersion, particularly after 2009.

Figure 19: Before the crisis productivity was rising faster than after 2009



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: WA – weighted average, M – median.

Slovenia's economy has a large number of less productive firms and a smaller number of highly productive firms, but especially after 2009 the differences in productivity between firms have been narrowing. Labour productivity distribution[70] is skewed right whether we use MultiProd or CompNet results.[71] Kernel density function points to the accumulation of

Asymmetry and dispersion in Slovenia are in the second half compared to other EU countries analysed. Distributions of other countries are also skewed right (see Figure 21).[73] Comparisons based on the

68 Firms with more employees have a higher weight and thus a greater influence on the weighted average.

69 For more details on the increase in the number of firms over time see Section 1. For more details on the contribution of entrants to productivity growth, see Figure 5 in Chapter I of the report and the following Section 2.2.

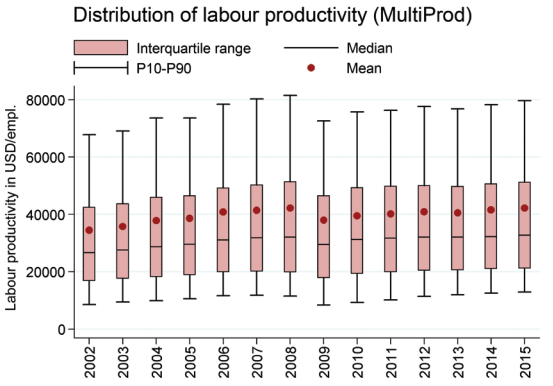
70 In the following text we describe the unweighted distribution.

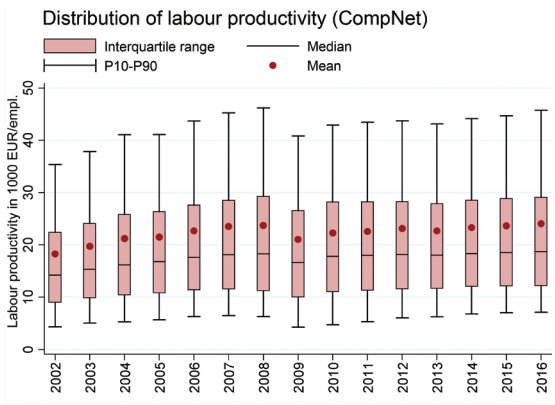
71 The CompNet and MultiProd data for Slovenia otherwise differ slightly. For more details see Chapter I and Annex 2.

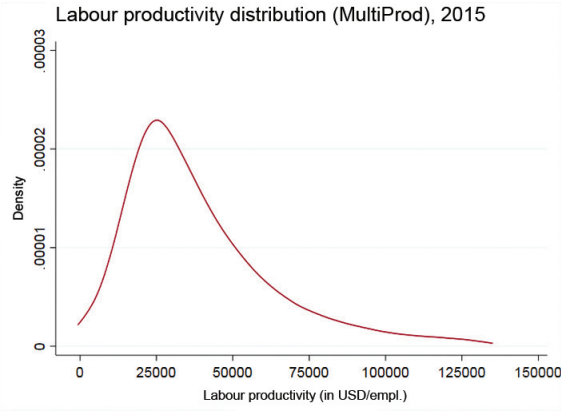
72 With the decline in productivity in 2009 it shifted to the left, but it remained practically unchanged between 2008 and 2015.

73 The figure is made on a restricted sample (firms with 20 or more employees). The sample for Slovenia includes 6% of firms in the represented sectors (in 2002–2016), which generate almost 66% of value added of firms in these sectors. In this way, countries can be compared more reliably, since data collection and representativeness for small and micro firms vary by country. The intention in Figure 21 is therefore not to compare country productivity levels, but rather to point to the large within-country dispersion of productivity and the high skewness of the distribution. Looking at the country mean labour productivity, CompNet firm-level data mimic the rankings calculated at the macro level across countries. Nonetheless, cross-

Figure 20: Labour productivity is skewed right and similar in both databases

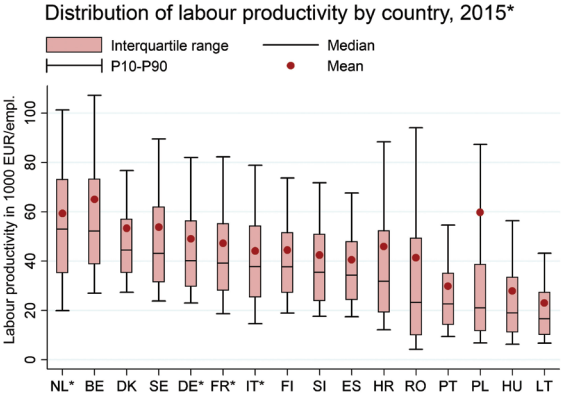






Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: P – percentile. The extreme values at both ends of the distribution (top and bottom 3%) are excluded for better presentation of the distribution shape.

Figure 21: Asymmetry and dispersion in Slovenia are among the smallest in international comparisons



Sources: Ajpes, CompNet (a sample with more than 20 employees); calculations by IMAD.
Note: Labour productivity distributions across countries are for 2015 or 2014* (excluding the Czech Republic and Slovakia). The intention in Figure 21 is not to compare country productivity levels, but rather to point out the large within-country dispersion of productivity and the high skewness of the distribution.

CompNet database on a sample of firms with 20 or more employees show that asymmetry in Slovenia is among the smallest (see Table 9 in Annex 4). Similar holds if we compare all firms. Different measures of dispersion using an internationally more comparable sample (firms with 20 or more employees) show that Slovenia is also in the second half in comparison to other analysed EU countries in productivity dispersion. The main reason for lower productivity dispersion than in other countries is lower productivity of the most productive firms (the 90–50 ratio is among the lowest). Similar holds if we compare all firms.

2.1 Productivity of firms at the extreme ends of the distribution

The globally observed phenomenon of higher productivity growth of the most productive firms (90th percentile) compared to the least productive ones (10th percentile) is not confirmed in Slovenia. In the majority of analysed countries, we observe gradual divergence in productivity growth of firms in the 90th percentile (the top of the labour productivity distribution) compared to those in the 10th percentile (the bottom of the distribution). Similar is also found by Papa et al. (2018) for Ireland and by Berlingieri et al. (2017) for some OECD countries. Divergence was more pronounced for just a few analysed countries (Denmark, Sweden, Belgium and France; Figure 52 in Annex 5). On the other hand, in Slovenia, productivity growth of firms in the 10th percentile was higher compared to

country comparisons of labour productivity levels have to be made with great caution for several reasons: (i) labour productivity differences can be largely driven by differences in capital intensity and (ii) even if the restricted sample (above 20 employees) is more suitable for comparisons, there still remain important sample differences that might be affecting these rankings (Valdec, Zrnc, 2017). The sample of countries that have data available for firms with 20 or more employees is larger than the sample of countries that have data available for all firms. The additional countries included are Germany, Slovakia and Poland.

Table 2: Average annual growth rates of labour productivity

	P10		Median		P90	
	MultiProd	CompNet	MultiProd	CompNet	MultiProd	CompNet
Total (2003–2015)	2.4%	2.6%	1.5%	1.8%	1.2%	1.5%
Before the crisis (2003–2008)	3.5%	4.0%	3.1%	3.9%	3.1%	3.7%
2009	-13.3%	-13.6%	-7.6%	-7.6%	-11.8%	-11.4%
After 2009 (2010–2015)	4.0%	3.9%	1.5%	1.3%	1.5%	1.5%

Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.

those in the 90th percentile (and also the median). The 90–10 ratio therefore decreases over the whole period, especially after 2009 (see Figure 23, where it is compared to ratios for other countries).[74] The exception is the year of the crisis, 2009, when firms in the 10th percentile suffered higher losses than those in the 90th percentile. This was the reason for the expected somewhat higher productivity growth of firms at the bottom of the distribution, although the decrease in the 90–10 ratio was also due to the noticeably slower productivity growth of firms at the top.

After the beginning of the crisis, firms from the most productive (90th) percentile did not contribute as much to reducing the productivity gap with more developed countries. Slovenia had one of the highest productivity growth rates before the crisis, but the slowdown in growth in the 90th percentile after 2009 worsened its position in international comparison. Over the entire period, Slovenian firms in the 10th and 90th and in the 50th percentile were in 3rd or 4th place among the 15 EU Member States covered in the CompNet database[75] (see Table 10 and Figure 53 in Annex 5). Their high ranking was mainly due to pre-crisis growth (3rd place on average), which was followed by one of the strongest declines in productivity in 2009. Firms in the top (90th) percentile lost the most relative to the pre-crisis period in international comparison (6 places). Their productivity growth was therefore no longer among the highest, but fell to the lower half among the countries analysed. On the other hand, firms in the bottom (10th) percentile lost only one place with regard to their position before the crisis.

Productivity dynamics in the 90th and 10th percentiles are crucially affected by the entry and exit of firms and employees. In addition to the 90th and 10th percentiles (i.e. firms at the border of the top and bottom 10% of productivity distribution), we also analysed the weighted averages of the top and bottom 10%. Although this is a different analysis, the 10th and 90th percentiles have similar growth dynamics to the weighted averages of the top and bottom 10%. The movements of the ratio are also similar (Figure 24). The analysis of the 10% of the least and most productive firms allows a decomposition of their average weighted productivity growth with the extended Melitz Polanec method. We find that the majority of productivity growth of the bottom 10% of firms was due to the entry of more productive firms from other groups (entrants from transitions) and the exit of less productive firms, while the contribution of survivors (including the impact of the reallocation of employees between firms or the covariance) was negative. The average weighted growth of labour productivity of the top 10% of firms was lower compared to the bottom 10% especially after 2009. This was a consequence not only of the expected absence of a noticeable positive contribution of exitors from the most productive group, but also of a lower net contribution of transitions between groups, as firms entering from less productive groups slowed down the total average growth of the most productive group. Ignoring the effects of firm entry and exit (both actual and through transitions), the productivity growth of survivors (both with or without the covariance) in the top 10% was higher compared to the bottom 10% over the period analysed.

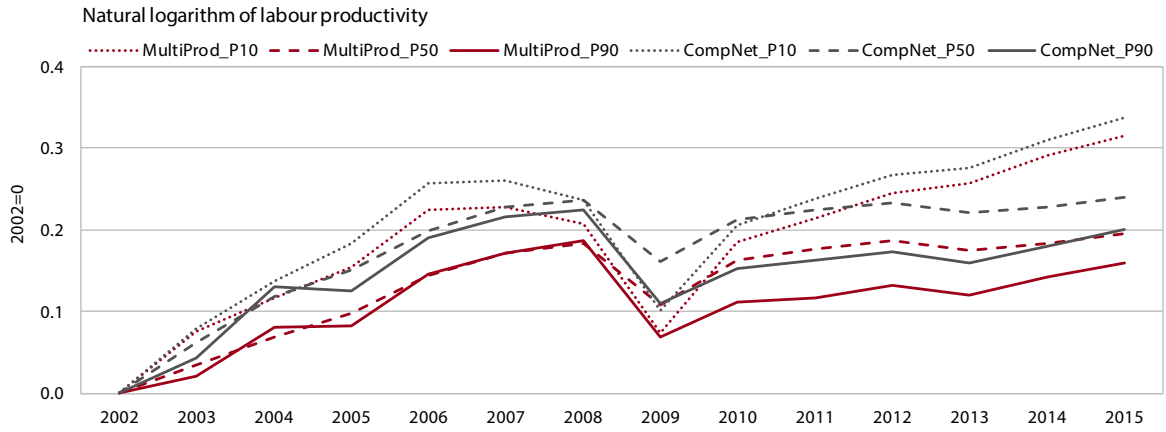
The most productive 10% of firms form a very heterogeneous group. Slightly faster productivity growth of survivors in this group (i.e. if we ignore firm entries and exits) is expected, as large, export-oriented and high-technology firms, which reach the highest productivity levels on average, also recorded higher productivity growth compared to other firms after the beginning of crisis[76] (see Section 2.2). The group of the top 10% of firms is nevertheless fairly heterogeneous. Around half of employment in this group is, in addition to large and highly export-oriented firms, accounted for by firms focused mainly on the domestic market. Broken

74 The 90–10 ratio decreases regardless of the minimum number of employees included in the sample (we also tested a sample with at least 1, 5, 10 or 20 employees). The results are robust whether we use the MultiProd or CompNet code. We also find that the ratio decreases regardless of whether the number of firms in the sample changes. This indicates that the entry of new firms has no significant effect on the 90–10 ratio.

75 We compare Slovenia with 14 other EU countries, for which data in the CompNet database are available for the full sample. The ranking is however also affected by the selection of countries compared. The ranking, which is calculated on the basis of average productivity growth rates, is, however, an approximation, as the averages are not fully comparable due to different time periods for which data for individual countries are available. Slovenia and Croatia have data for 2002–2016, Finland, Hungary, Lithuania and Denmark for 2002–2015, Italy and the Netherlands for 2002–2014, the Czech Republic and Sweden for 2003–2015, France for 2004–2014, Belgium for 2004–2015, Romania for 2005–2015, Portugal for 2006–2015 and Spain for 2009–2015.

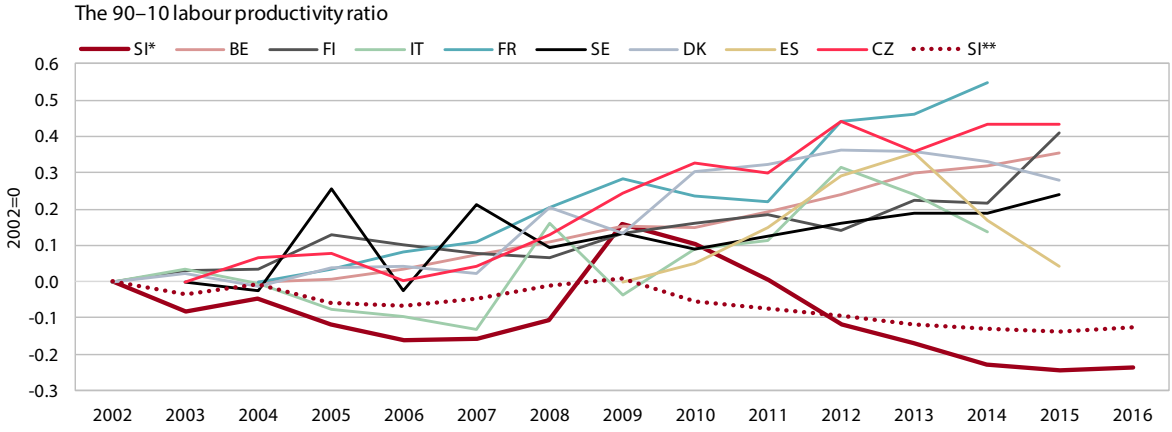
76 However, particularly high-technology firms and strong exporters recorded a significant slowdown in growth towards the end of the analysed period.

Figure 22: Firms in the 10th percentile are growing the fastest



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.

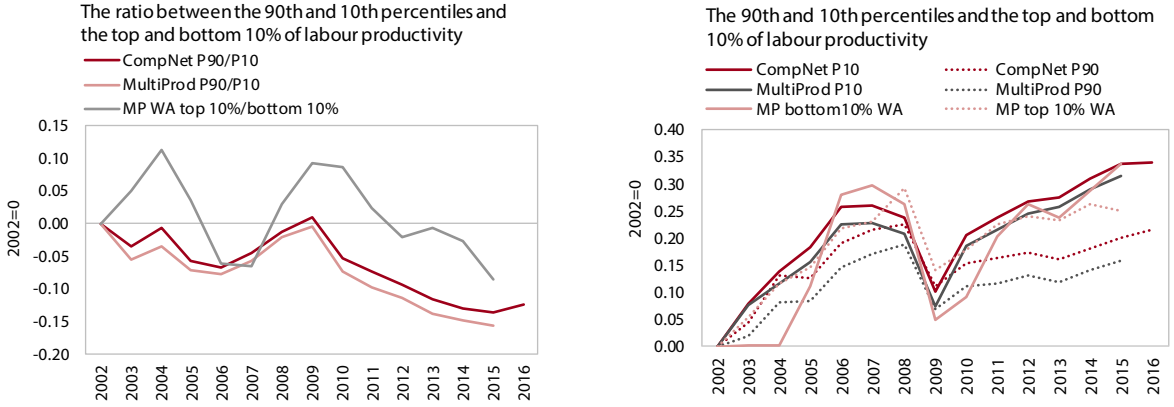
Figure 23: The 90–10 ratio decreases in a smaller number of countries



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: We show the 90:10 labour productivity ratio. It is normalised to 0 in 2002 or the closest year available. The overview does not include Romania, Hungary, Lithuania, Portugal, the Netherlands and Croatia, which would distort the picture in other countries due to their high ratios. SI* represents the output, which is made in the same way as in other analysed countries with percentiles of the level labour productivity; SI** is the output used in the rest of the text with percentiles of the logarithmic data. Note that the percentiles of the level and the natural logarithm of labour productivity are different due to the presence of negative value added firms. As standard in the literature, we analyse the natural logarithm of labour productivity in the rest of the text. The fact is, however, that in particular during the crisis, the share of negative value added firms increased. If these firms were removed from the sample (which is essentially done by logarithm), the 90–10 ratio could be underestimated (Berlingieri et al., 2017a). Accordingly, we can see that the output from non-logarithmic (level) data results in a sharp drop in the 10th percentile in 2009 and rapid growth in subsequent years, which makes the 90–10 ratio decline at a faster pace compared to logarithmic data.

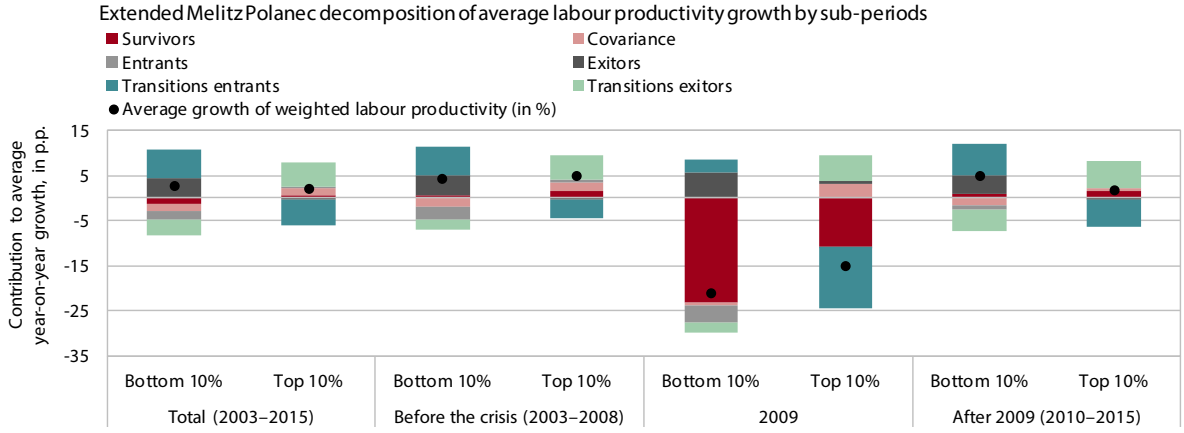
down by size, small and micro firms represent slightly less than one third. These groups of firms have been recovering more gradually since 2009, partly owing to slower growth of the domestic than export markets (see Section 2.2). An overview of the characteristics of the top 10% of firms at the same time shows that they are profitable firms with relatively high levels of capital intensity, which can be a good basis for further growth. However, only a relatively small share of these firms are from high-technology activities (less than one fifth of total employment in the top tenth), which are generally defined as activities with relatively high R&D investment as an important long-term driver of productivity growth.

Figure 24: The 10th and 90th percentiles have similar growth dynamics to the weighted averages of the bottom and top 10% of firms respectively; the ratio movements are also similar



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: WA – weighted average, MP – MultiProd and CN – CompNet.

Figure 25: Productivity movements in the bottom and top 10% of productivity distribution are strongly influenced by the entry and exit of firms or employees



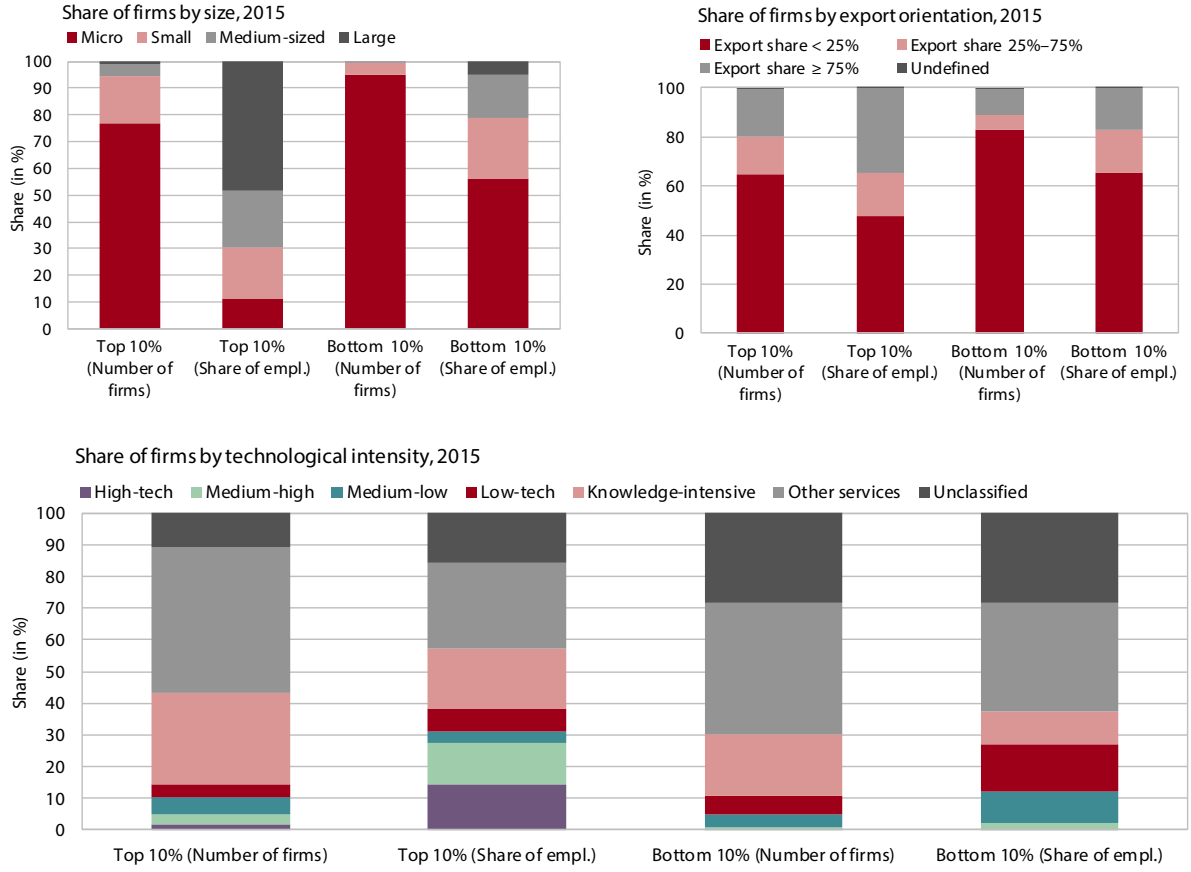
Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.

Table 3: Median values of various indicators for the 10% of the most and least productive firms, 2015

	Top 10%	Bottom 10%
Capital*	287,959	10,213
Total operating revenue*	1,411,710	56,066
Capital intensity (K/L)*	76,777	4,671
Return on assets (ROA in %)	9.6	-14.7
Age	13	5

Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: * real in US dollars or derived from real data in US dollars.

Figure 26: The structure of the top 10% of firms is very heterogenous



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: Micro firms = 1–9 employees, small = 10–49, medium-sized = 50–249, large = 250 or more. Unclassified exporters are firms for which export orientation cannot be calculated because of a lack of data on revenue from sales on the domestic market and net sales revenue not available). Their share in value added tends to be negligible. The aggregation of the manufacturing industry (NACE Rev. 2 Section C) according to technological intensity is based on Eurostat methodology. The classification of services is based on OECD definition, according to which knowledge-intensive non-financial market services include information and communication (NACE J) and professional, scientific and technical activities (NACE M), while other non-financial market services include trade (NACE G), transportation (NACE H), accommodation and food service activities (NACE I), real estate activities (NACE L), and administrative and support services (NACE N). Activities that are not classified according to technology intensity are the following: agriculture (NACE A), mining (NACE B), energy supply (NACE D), water supply, sewerage, waste management and remediation activities (NACE E), construction (NACE F), education (NACE P), human health and social work activities (NACE Q), arts, entertainment and recreation (SKD R), and other service activities (SKD S).

2.2 Productivity by firm size, export orientation and technological intensity

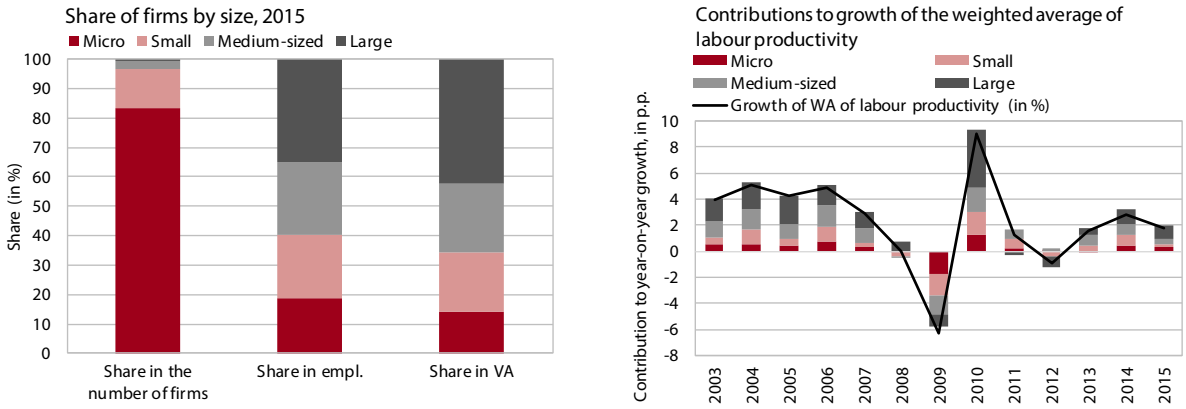
In the following sections we analyse productivity movements by firm size, export orientation and technological or knowledge intensity.

2.2.1 Overview by size

As expected, larger firms are more productive on average and have higher productivity growth. The movements of productivity in smaller firms (micro and small) had already been less favourable compared to large firms (medium-sized and large) before the crisis. This was followed by a deeper decline in productivity of smaller firms in 2009 and a slower recovery of the smallest (micro) firms in subsequent years. The relatively weak productivity growth of micro firms is also reflected in international comparisons, as this is the size group that has the largest productivity gap with the EU average (see Figure 29). Besides cyclical factors, which, after 2009, probably had a relatively greater negative impact on the smallest firms (for example because of their greater orientation to the domestic market, which recovered more slowly than export markets, and relatively greater difficulties in access to funding in times of bank instability)[77] (see Chapter I, Section 3), the

77 The measures for financial restructuring of small and medium-sized firms have been formulated only in recent years, owing to the fragmentation of claims and hence the need for a different approach. The measures adopted after 2009 were mainly aimed at large firms, but since 2015 similar measures have also been available for small and medium-sized firms.

Figure 27: Larger firms make the greatest contribution to productivity growth



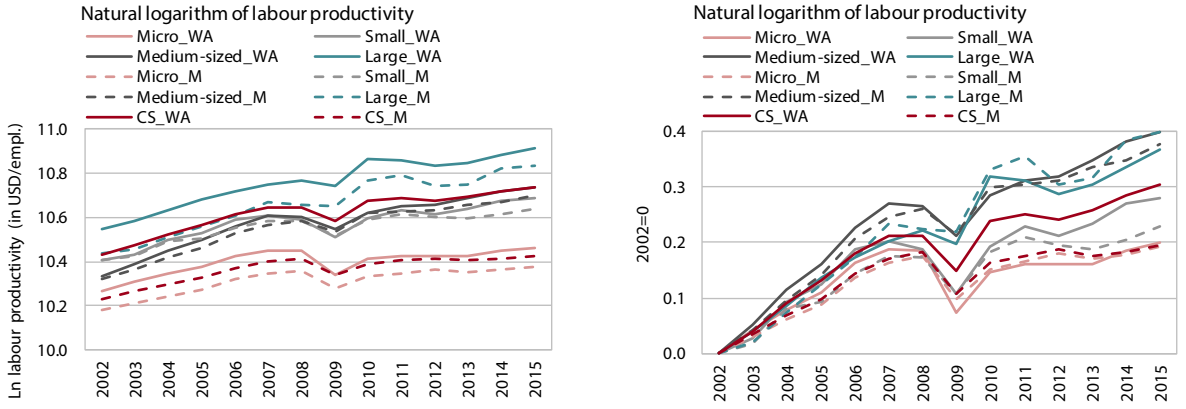
Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: VA - value added, WA – weighted average. Micro firms = 1–9 employees, small = 10–49, medium-sized = 50–249, large = 250 or more.

Table 4: Average annual growth rates of labour productivity, by firm size

	Weighted averages				Medians			
	Micro	**Small**	**Medium-sized**	**Large**	**Micro**	**Small**	**Medium-sized**	**Large**
Total (2003–2015)	1.5%	2.2%	3.1%	2.8%	1.5%	1.8%	2.9%	3.1%
Before the crisis (2003–2008)	3.1%	3.1%	4.4%	3.7%	2.9%	2.9%	4.4%	3.7%
2009	-11.1%	-8.0%	-5.4%	-2.5%	-7.8%	-6.6%	-4.6%	-0.5%
After 2009 (2010–2015)	2.1%	2.9%	3.1%	2.8%	1.6%	2.0%	2.7%	3.0%

Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: Micro firms = 1–9 employees, small = 10–49, medium-sized = 50–249, large = 250 or more.

Figure 28: Larger firms have higher productivity levels and higher productivity growth

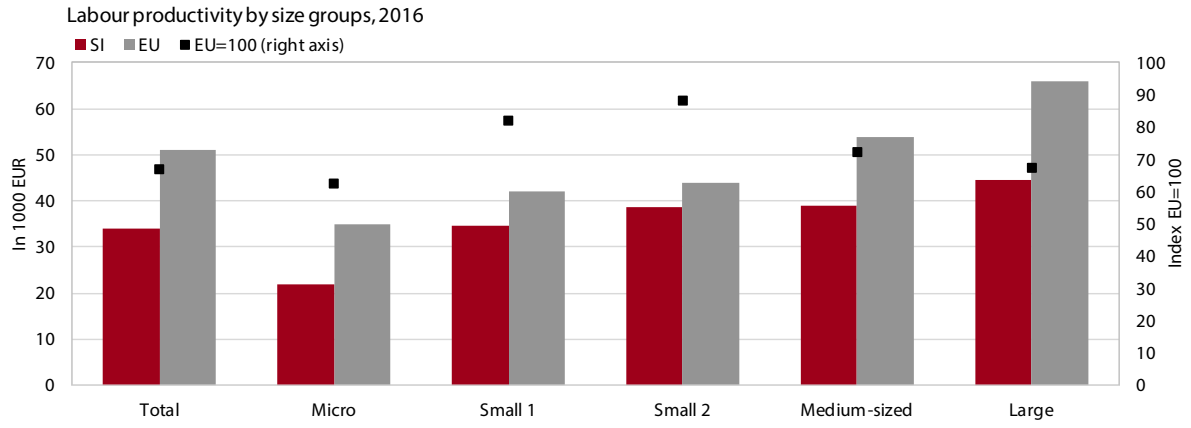


Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: WA – weighted average, M – median; CS – corporate sector; micro firms = 1–9 employees, small = 10–49, medium-sized = 50–249, large = 250 or more.

capacity of smaller firms for faster growth is also limited by weaknesses in some long-term productivity drivers. Smaller firms lag behind in international comparisons particularly in terms of innovation activity, digitisation and the introduction of new technologies (see Chapter I). A significant productivity gap with the EU average is also observed for the group of large firms (which are relatively small in Slovenia by international standards).

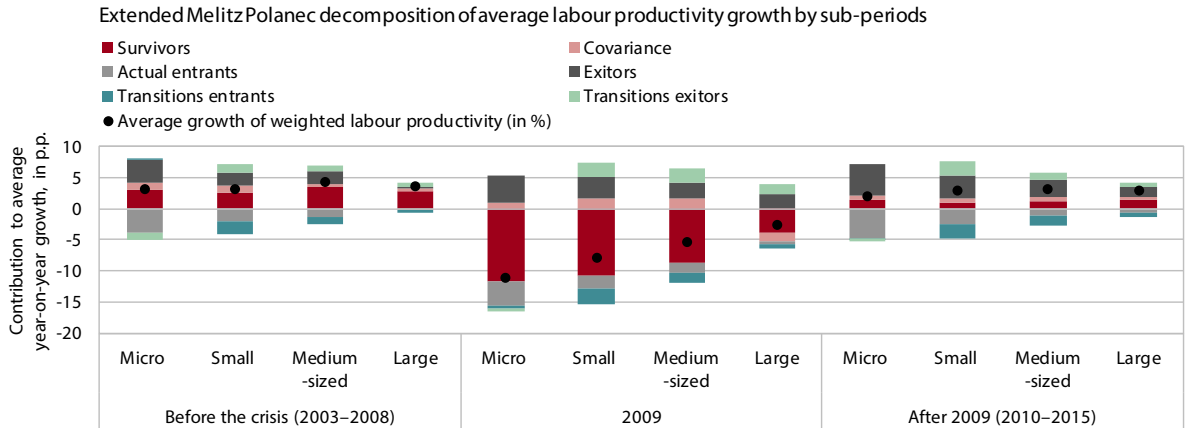
After the outbreak of the crisis, productivity growth lagged behind the pre-crisis average in all size groups, mainly owing to the lower productivity growth of survivors in the group. A decomposition of productivity growth using the extended Melitz Polanec methodology (see Box 2) shows that in all size groups, the slowdown in productivity growth after the onset of the crisis was mainly due to the lower average contribution

Figure 29: Micro and large enterprises have the largest productivity gaps with the EU



Source: Eurostat.
Note: Micro firms = 1–9 employees, small 1 = 10–19, small 2 = 20–49, medium-sized = 50–249, large = 250 or more.

Figure 30: Lower productivity growth after the onset of the crisis in 2009 was mainly due to lower growth of survivors



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: The extended Melitz Polanec decomposition of labour productivity weighted by employment. For the decomposition on annual data, see Figure 54 in Annex 6.
Micro firms = 1–9 employees, small = 10–49, medium-sized = 50–249, large = 250 or more.

of productivity growth of surviving firms.[78] The exit of less productive firms, which increased more than the entry of new firms on average, had the opposite effect on productivity in the period after 2009. In all size groups the increased exit of firms was mostly a consequence of firm closures rather than their transition to other groups.[79] With regard to the pre-crisis period, the average positive contribution of firm exit increased relatively the most in the group of large firms, where it had been the smallest before the crisis compared to other groups.[80] More specifically, the crisis accelerated the closing of some large less-productive low-technology firms[81] and large firms in construction, a sector that was strongly affected by the crisis (Figure 31).

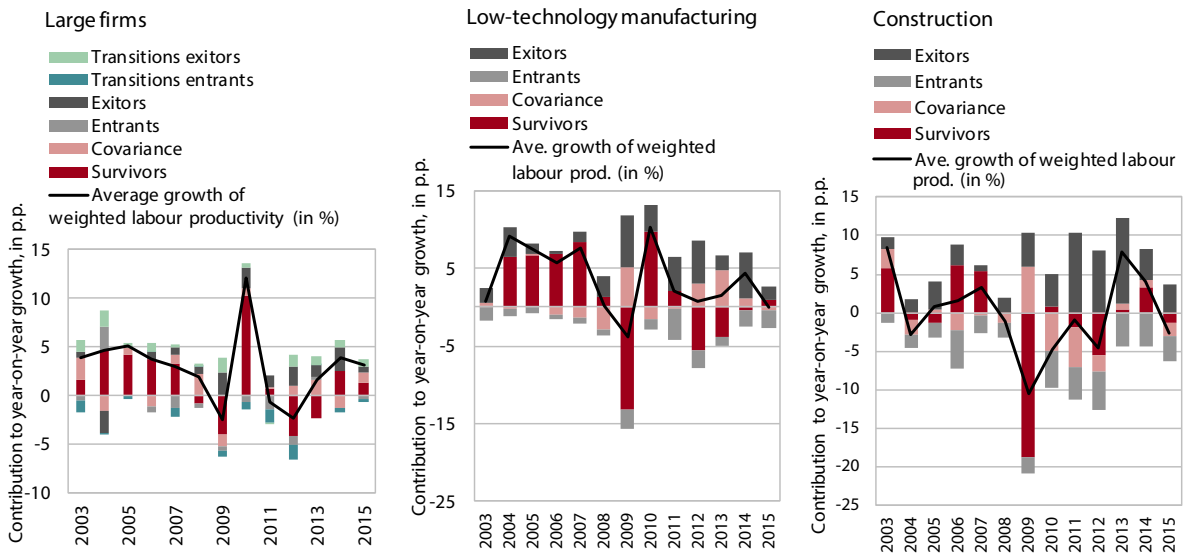
78 The unweighted average of productivity growth in survivors. The productivity fall in surviving firms was also the main reason for the decline in productivity in 2009.

79 The average negative contribution of the entry of firms with below-average productivity increased as well, but this change was less pronounced than that on the exit side.

80 Despite the increase, it remained significantly lower after 2009 than in other groups, which have significantly higher entry and exit rates.

81 The lower productivity of exitors is also evident from the fact that between 2008 and 2015 the share of large firms declined by 0.3 p.p. and their share in employment by 4.9 p.p., while their share in value added dropped only by 2.1 p.p.

Figure 31: The crisis accelerated the closure of some larger less productive firms from technologically less intensive manufacturing activities and construction.



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: The extended Melitz Polanec decomposition of labour productivity weighted by employment. Large firms employ more than 250 people; the aggregation of the manufacturing industry (NACE Rev. 2 Section C) according to technological intensity is based on Eurostat methodology.

2.2.2 Overview by export orientation

More export-oriented firms are more productive and had higher productivity growth in the period analysed. Before the crisis, productivity was rising fastest in firms that are mainly oriented to foreign markets and slowest in those serving the domestic market. In 2009 productivity of both moderate exporters and domestically oriented firms declined sharply.[82] Productivity of strong exporters, in contrast, did not fall significantly in the first year of the crisis, which can be mainly attributed to a smaller cyclical decline in demand in the pharmaceutical industry. In the period after 2009, the higher productivity growth of firms with at least 25% export share continued, albeit with a slowdown in the group of strong exporters. In spite of their low productivity growth, firms that are mainly focused on the domestic market make the greatest contribution to the overall productivity growth in the corporate sector due to their large share.

The average productivity growth of strong exporters eased significantly after the onset of the crisis, but the surviving firms in the group retained their strong growth on average. The slowdown relative to the pre-crisis period is otherwise observed across all firm groups irrespective of export orientation, but a decomposition analysis of productivity growth according to the extended Melitz Polanec method (see Box 2) shows significant differences in the reasons for the slowdown. The average growth of survivors in the group of strong exporters was even higher than before the crisis.[83] The overall growth of this group was lowered by (i) an increase in the share of less productive firms in the group[84] and (ii) the entry of new firms (newly established firms or firms from other groups). In other words, owing to the slow recovery of the domestic market, some of the moderate exporters moved into the group of strong exporters during this period.[85] In the other two groups (moderate exporters and domestically oriented firms), the average contribution of growth of surviving firms,[86] especially those mainly oriented to the domestic market, decreased relative to the pre-crisis period, which is to a great extent attributable to the negative impact of cyclical factors during this period (a slow recovery of the domestic market). On the other hand, the average positive contribution of the exit of less productive firms was significantly higher than in the other two groups.[87]

82 These firms are often dependent on demand from export-oriented firms. Also, the crisis severely affected some activities that are predominantly focused on the domestic-market (such as construction).

83 The unweighted average of productivity growth of surviving firms in the group.

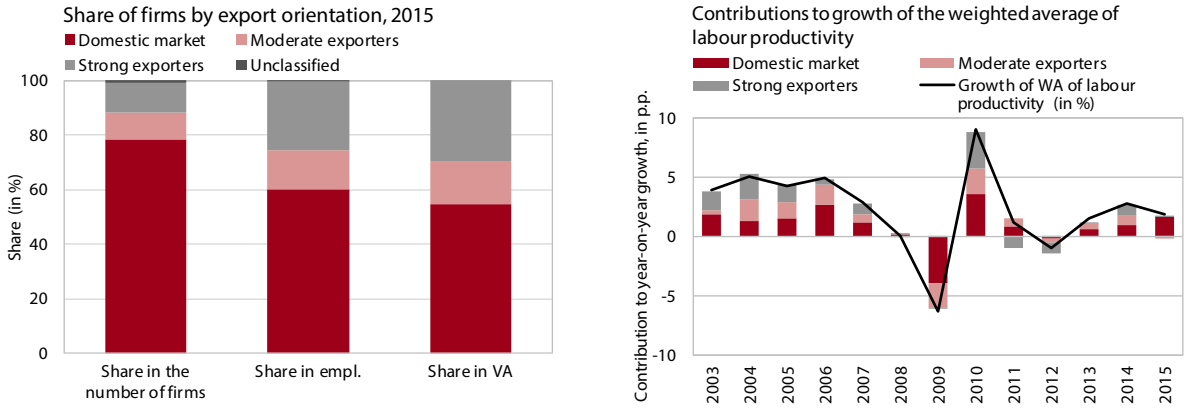
84 This could also be related to the increased past entries into the group.

85 This is also reflected in a considerable increase in the number of strong exporters in that period. The entry of new, mostly somewhat less productive, firms into this group also contributed to a relatively larger decline in the median of strong exporters relative to the weighted average (see Figure 33).

86 The decline in productivity of survivors was also the main reason for the decline in productivity in 2009 in all groups analysed.

87 The difference between the average positive contribution of exits and the average negative contribution of entries increased with regard to the pre-crisis period.

Figure 32: The majority of firms in Slovenia are oriented mainly to the domestic market and therefore have a significant impact on total productivity growth



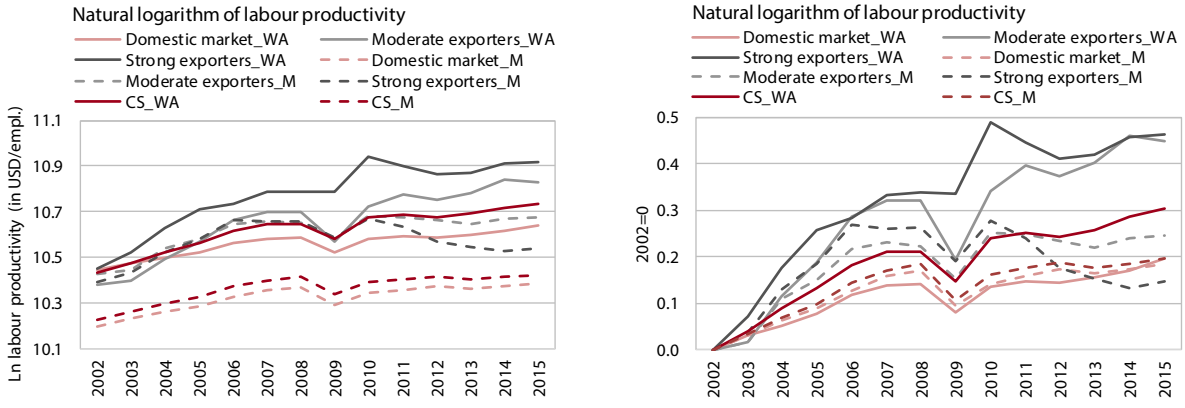
Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: VA - value added, WA – weighted average. Domestic-market-oriented firms – export share < 25%, moderate exporters – export share 25%–75%, strong exporters – export share ≥ 75%. Unclassified exporters are firms whose export orientation cannot be calculated because of a lack of data (data on revenue from sales on the domestic market and net sales revenue are not available). Their share being so small, they are not included in the contributions to average growth.

Table 5: Average annual growth rates of labour productivity, by export share

	Weighted averages			Medians		
	Domestic-market-oriented	Moderate exporters	Strong exporters	Domestic-market-oriented	Moderate exporters	Strong exporters
Total (2003–2015)	1.5%	3.4%	3.6%	1.4%	1.9%	1.1%
Before the crisis (2003–2008)	2.3%	5.4%	5.6%	2.8%	3.7%	4.4%
2009	-6.0%	-12.9%	-0.3%	-7.6%	-7.0%	-1.4%
After 2009 (2010–2015)	1.9%	4.2%	2.1%	1.5%	1.6%	-0.8%

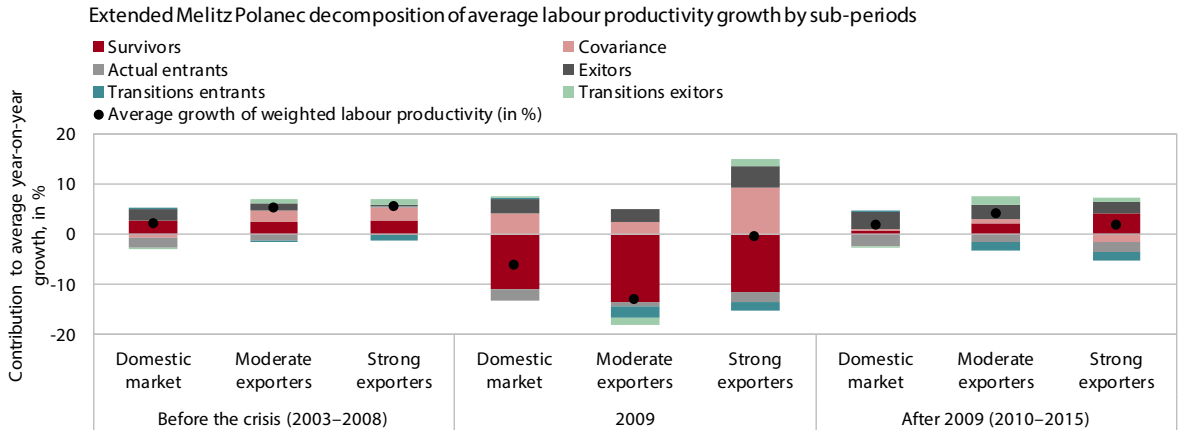
Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: Domestic-market-oriented firms – export share < 25%, moderate exporters - export share 25%–75%, strong exporters – export share ≥ 75%.

Figure 33: Firms with at least 25% of revenue earned on foreign markets are more productive and show higher productivity growth



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Notes: WA – weighted average, M – median. CS denotes the corporate sector; domestic-market-oriented firms – export share < 25%, moderate exporters - export share 25%–75%, strong exporters – export share ≥ 75%.

Figure 34: After 2009, productivity growth of strong exporters slowed mainly due to the entry of less productive firms and their increased share, while the slowdown in the other two groups was primarily due to the lower growth of survivors



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Notes: The extended Melitz Polanec decomposition of labour productivity weighted by employment. For the decomposition on annual data see Figure 55 in Annex 6. Domestic-market-oriented firms – export share < 25 %, moderate exporters – export share 25%–75%, strong exporters – export share ≥ 75%.

2.2.3 Overview by technological intensity and knowledge intensity

In the manufacturing sector, the highest productivity levels are seen in high-technology firms on average; these also stand out in terms of productivity growth. In the analysed period, productivity growth was much higher in manufacturing than in services. The group of high-technology industries stood out both in the pre-crisis period and after 2009.[88] The differences in productivity growth between other technology groups were smaller. Given their high share in total employment, low-technology industries contributed the most to overall productivity growth before the crisis, despite slower growth. Owing to the restructuring of the economy, particularly the closing of firms in the textile and wood-processing industries, the share of low-technology industries in total employment fell from 18.2% in 2002 to 8.9% in 2015. After 2009, medium-high-technology industries thus made the largest contribution to overall productivity growth.

Among non-financial market services, the highest productivity levels are recorded for firms in knowledge-intensive services on average, although these have lagged significantly behind other services in productivity growth after 2009. The increase in productivity of knowledge-intensive services over the entire 2002–2015 period was otherwise similar to that in other non-financial market services, but their growth slowed notably after the onset of the crisis in 2009 and lagged behind that in other services. The slowdown was mainly due to lower productivity growth in information and communication activities, primarily on account of a standstill in telecommunications (see Chapter I) and a decline in publishing. The moderation of productivity growth in knowledge-intensive services also reflected lower growth in professional, scientific and technical activities,[89] mainly as a consequence of low investment activity during this period. The relatively large contribution of other services (which include transportation, accommodation and food services, trade, and administrative and support service activities) to total productivity growth thus increased further after 2009.

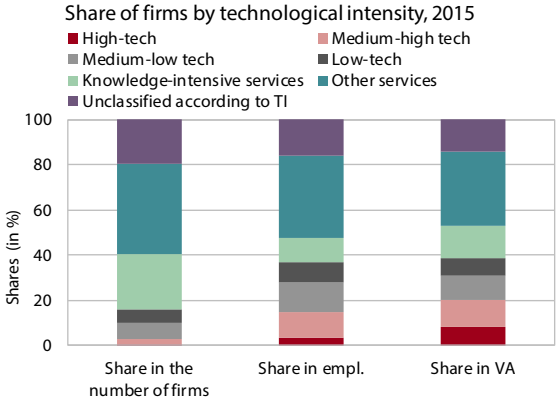
Although after 2009 productivity growth slowed the most in the group of industries with the highest technological intensity, their growth remained the highest of all groups. High-technology manufacturing industries had the strongest productivity growth before the crisis. This is the only group in which productivity did not decline in 2009. In 2010–2015, productivity growth of this group slowed significantly. Towards the end of this period it even came to a halt, which could be a consequence of the crisis on the Russian market (2014 and 2015) and its impact on the pharmaceutical industry, which accounts for a significant part of high-technology manufacturing. Despite a strong moderation of growth, this group of firms nevertheless increased productivity more than other groups in the 2010–2015 period as a whole. As in most other manufacturing groups, the majority of growth arose from increased productivity of survivors (in a narrower sense),[90] while the entry and exit of firms played a much smaller role. After 2009, firm exits had a significant impact on productivity dynamics particularly in the group of low-technology firms. A significant effect of firm exits was also observed in

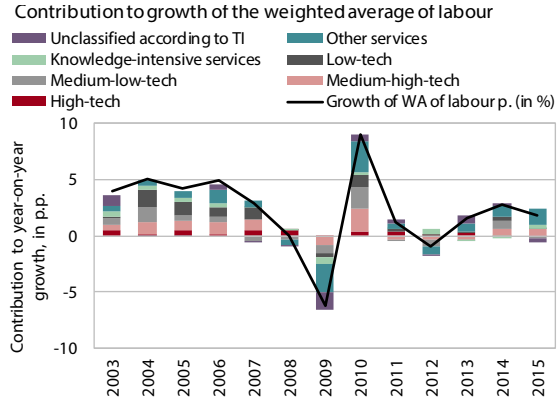
88 At the end of the period analysed, productivity growth in the group of high-technology firms came to a halt, reflecting the crisis on the Russian market and its impact on the pharmaceutical industry, which represents a significant part of high-technology industries.

89 Particularly on account of the moderation in architectural and engineering activities, technical testing and analysis.

90 Without the covariance.

Figure 35: After 2009, the greatest contribution to productivity growth came from medium-high-technology manufacturing industries and less knowledge-intensive services





Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Notes: VA – value added, TI – technological intensity, WA – weighted average. The aggregation of the manufacturing industry (NACE Rev. 2 Section C) according to technological intensity is based on Eurostat methodology. The classification of services is based on the OECD definition, according to which knowledge-intensive non-financial market services include information and communication (NACE J) and professional, scientific and technical activities (NACE M), while other non-financial market services include trade (NACE G), transportation (NACE H), accommodation and food service activities (NACE I), real estate activities (NACE L) and administrative and support services (NACE N). Activities that are not classified by technology intensity are the following: agriculture (NACE A), mining (NACE B), energy supply (NACE D), water supply, sewerage, waste management and remediation activities (NACE E), construction (NACE F), education (NACE P), human health and social work activities (NACE Q), arts, entertainment and recreation (SKD R), and other service activities (SKD S).

Table 6: Average annual growth rates of labour productivity, by technology intensity

	Weighted averages				Medians			
	High-technology	Medium-high-technology	Medium-low-technology	Low-technology	High-technology	Medium-high-technology	Medium-low-technology	Low-technology
Total (2003–2015)	7.8%	3.7%	2.1%	3.6%	7.3%	3.3%	2.0%	2.3%
Before the crisis (2003–2008)	11.8%	6.0%	2.9%	5.1%	14.0%	7.1%	4.0%	5.4%
2009	-0.1%	-7.6%	-5.6%	-3.7%	-5.3%	-11.1%	-5.5%	-6.8%
After 2009 (2010–2015)	5.1%	3.2%	2.6%	3.2%	2.6%	1.8%	1.3%	0.7%

Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: The aggregation of the manufacturing industry (NACE Rev. 2 Section C) according to technological intensity is based on Eurostat methodology.

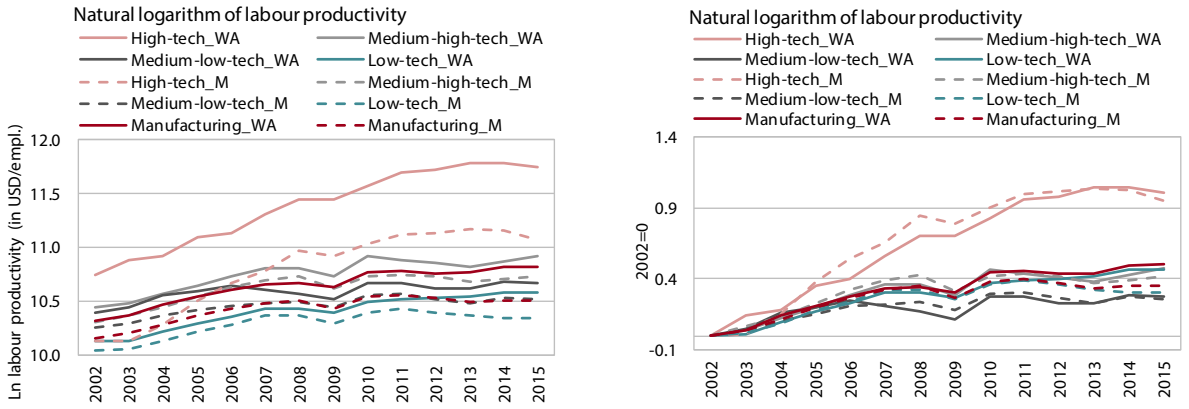
Table 7: Average annual growth rates of labour productivity, by knowledge intensity

	Weighted averages		Medians	
	Knowledge-intensive services	Other services	Knowledge-intensive services	Other services
Total (2003–2015)	1.7%	1.4%	1.1%	1.7%
Before the crisis (2003–2008)	3.5%	1.6%	2.8%	2.6%
2009	-6.3%	-6.9%	-6.1%	-8.2%
After 2009 (2010–2015)	1.3%	2.6%	0.7%	2.4%

Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: The classification of services is based on the OECD definition, according to which knowledge-intensive non-financial market services include information and communication (NACE J) and professional, scientific and technical activities (NACE M), while other non-financial market services include trade (NACE G), transportation (NACE H), accommodation and food service activities (NACE I), real estate activities (NACE L), and administrative and support services (NACE N).

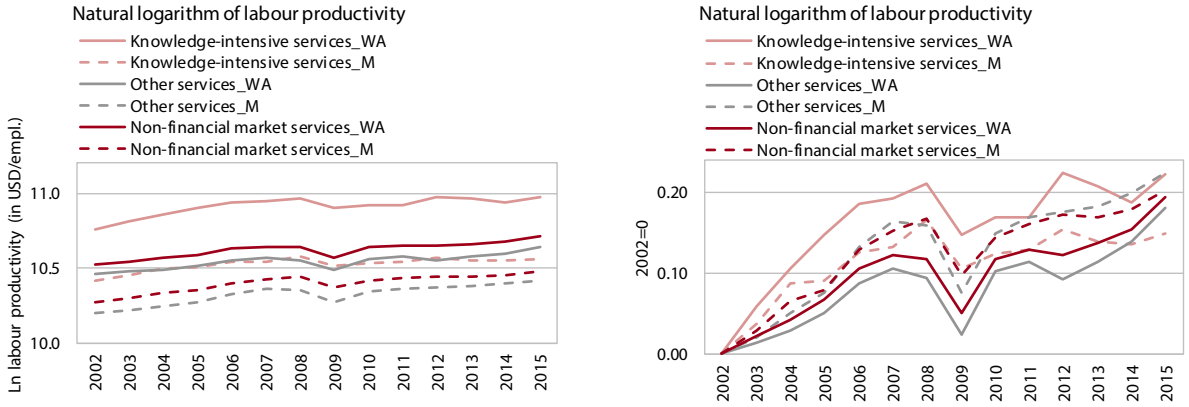
the group of knowledge-intensive services, alongside an even greater opposite effect of entries. In the group of other services, productivity growth was even higher than before the crisis and higher than in knowledge-intensive services. It was a consequence of a somewhat larger contribution of productivity growth in surviving firms, but also a larger positive contribution of firm exits.

Figure 36: Firms with the highest technological intensity are the most productive and have the highest productivity growth



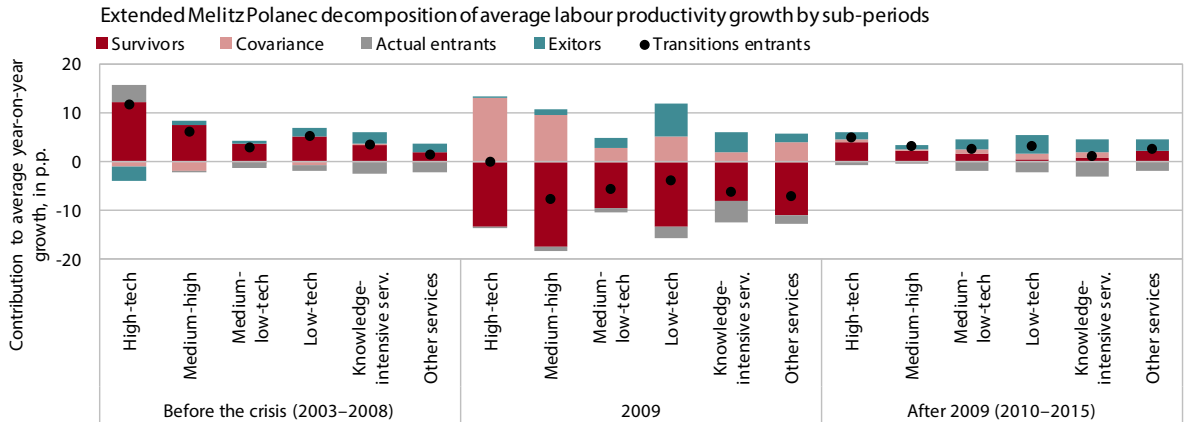
Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: WA – weighted average, M – median. The aggregation of the manufacturing industry (NACE Rev. 2 Section C) according to technological intensity is based on Eurostat methodology.

Figure 37: Firms in knowledge-intensive services are more productive but were outpaced in productivity growth by other service firms after the onset of the crisis



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Notes: WA – weighted average, M – median; the classification of services is based on the OECD definition, according to which knowledge-intensive non-financial market services include information and communication (NACE J) and professional, scientific and technical activities (NACE M), while other non-financial market services include trade (NACE G), transportation (NACE H), accommodation and food service activities (NACE I), real estate activities (NACE L), and administrative and support services (NACE N).

Figure 38: After 2009 productivity growth slowed in most groups of firms particularly due to lower growth of surviving firms



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Notes: The Melitz Polanec decomposition of labour productivity weighted by employment. In this decomposition there are no entries or exits from other groups because of the characteristics of the MultiProd database, where firms are classified into the same section in the entire period (see Section 1). For the decomposition on annual data, see Figure 56 in Annex 6. The aggregation of the manufacturing industry (NACE Rev. 2 Section C) according to technological intensity is based on Eurostat methodology. The classification of services is based on the OECD definition, according to which knowledge-intensive non-financial market services include information and communication (NACE J) and professional, scientific and technical activities (NACE M), while other non-financial market services include trade (NACE G), transportation (NACE H), accommodation and food service activities (NACE I), real estate activities (NACE L), and administrative and support services (NACE N).

Concluding remarks with policy recommendations

Slovenia ranks around the middle of the EU Member States in terms of economic development; most of its lag behind the EU average is explained by the productivity gap, which has been narrowing only slowly since the crisis. The growth of productivity slowed after the crisis in the majority of sectors (and in most groups of firms according to size, export orientation or technological intensity). The impact of the reallocation of production factors to more productive sectors on productivity growth has also declined significantly since 2009. From the aspect of the impact of individual production factors, the low contribution of capital deepening stands out in particular. It has remained modest even in times of economic recovery and a significant improvement in the investment environment. A more modest contribution of capital in comparison with the pre-crisis period, which is typical of most sectors, is to some extent related to the more cautious investment decisions of firms in view of the past crisis, but also to their lower expectations of future economic activity. It also reflects the impact of a relatively slower recovery of the domestic market (low investment activity of service activities) and lower investment in transport infrastructure and housing construction. The differences in productivity levels are also evident between individual groups of firms. The highest growth rates are recorded by more export-oriented, larger and technologically more intensive firms, which points to a significant positive impact of international integration and technological intensity on productivity. The increase in these differences after 2009 has to some extent also been a consequence of a slower recovery of the domestic market and relatively poor access to funding for smaller firms in the first years following the crisis.

Further economic and hence social development will crucially depend on the capacity of the country to boost productivity growth. The period following the beginning of the crisis was marked by relatively favourable unit labour cost movements, which, together with a strengthening of demand in trading partners and other non-cost factors, enabled a renewed increase in Slovenia's global market share after its decline during the crisis. Since 2008, unit labour cost movements have been less and less stimulating for the competitiveness of the economy, which could additionally hamper economic growth in circumstances of weaker growth in foreign demand in the coming years. Moreover, due to the increasingly scarce labour supply as a result of demographic trends, it will no longer be possible to achieve high GDP growth rates with such a large contribution of the increase in employment as in previous years. It will therefore be essential to strengthen long-term drivers of productivity growth in particular. In previous years, some of these have seen adverse developments (for example investment in R&D, innovation activity of enterprises and ICT investment), while in others changes have been too slow considering needs (for example adapting knowledge and skills to development challenges).

Economic policies for accelerating productivity growth have to create the conditions for (i) faster productivity growth across all firms, (ii) a further breakthrough of the most productive firms, and (iii) a spillover of knowledge, best practices, etc. from the most productive to smaller, less productive firms. We grouped them into two sets, depending on whether they affect productivity growth mainly by increasing the contribution of capital or total factor productivity. In practice, both sets are intertwined and interconnected.

The first set of priority measures for enhancing productivity stresses the urgency of increasing investment activity, which would strengthen the *contribution of capital to productivity growth*, which has been exceptionally low for many years. The achievement of these goals could be facilitated by appropriate specification of priority areas in using EU funding, in addition to domestic (public and private) resources. According to Slovenia's strategic objectives,[91] it is also necessary to pay attention to the sustainability of development when investing to increase productivity.[92] The areas that will require increased investment are mainly related to:

91 The primary objective of the Slovenian Development Strategy 2030 is to ensure quality of life for all. This can be achieved through balanced economic, social and environmental development that takes into account the limitations and capacities of our planet and creates conditions and opportunities for present and future generations (Slovenian Development Strategy 2030, 2017).

92 It is necessary to take into account both the limitations and the opportunities of environmental investments and, in particular, the urgency of introducing sustainable and circular business models.

- digital transformation and transition to industry 4.0, which requires a strengthening of investment in knowledge (formal and informal education, lifelong learning), research, development and innovation (public and private funding), new technologies, and knowledge-intensive services;
- ensuring appropriate infrastructure, in particular for digital connectivity and sustainable development (for sustainable mobility, renewable energy sources, etc.).

The second set of priority measures for raising productivity should be focused on an increase in innovation activity, acceleration of digital transformation and a further strengthening of the internationalisation of firms, which would enable higher growth in *total factor productivity*. In addition to the strengthening of investment (the first set of measures), it is essential:

- to create an environment that promotes innovation and entrepreneurship and is predictable in the long term. The main challenge is to ensure the long-term stability of support measures at all stages of innovation and marketing and to create a conducive business environment (for example by further reducing administrative barriers and the length of proceedings) with an emphasis on appropriate support for smaller enterprises;
- to strengthen cooperation between firms, the education sector and research institutions, and also between firms of different sizes, the latter primarily with a view to better exploiting the innovation potential of small enterprises and service activities. A good basis for the strengthening of cooperation between the various actors can be the already established strategic research and innovation partnerships;
- to ensure appropriately qualified human resources to meet the needs of the future (including a stimulating environment for this type of workforce), to address the shortage of science and technology experts in particular (for example ICT specialists and engineers), and to strengthen the digital skills of the population (through formal and informal education and lifelong learning).

Bibliography and sources

Aglio, D., Christophori, M., van de Kerke, J. P., Marder, F., Sartori, M., Schramm, V., Trofimenkov, D., and Zona Mattioli, A. (2018). "User Guide for the 6th Vintage of the CompNet Dataset". The Competitiveness Research Network. Obtained at www.comp-net.org.

Allan Collard-Wexler and Jan De Loecker. (2016). "Production Function Estimation with Measurement Error in Inputs", NBER Working Papers 22437, National Bureau of Economic Research, Inc.

Bajgar, M., Berlingieri, G., Calligaris, S. and Criscuolo, S. (2019). "Can firm micro data match macro trends? Comparing MultiProd and STAN". OECD Science, Technology and Innovation Policy Papers, No. 2. Paris: Organisation for Economic Cooperation and Development. Obtained at https://doi.org/10.1787/2b0ac915-en.

Berlingieri, G., Blanchenay, P., Calligaris, S., and Criscuolo, C. (2017b). "The Multiprod project: A comprehensive overview". OECD Science, Technology and Industry Working Papers, No. 2017/04. Paris: Organisation for Economic Cooperation and Development. Obtained at https://doi.org/10.1787/2069b6a3-en.

Berlingieri, G., Blanchenay, P., and Criscuolo**, C.**. (2017a). "The great divergence(s)". OECD Science, Technology and Innovation Policy Papers, No. 39. Paris: Organisation for Economic Cooperation and Development. Obtained at https://doi.org/10.1787/953f3853-en.

Brečko, B., Bučar, M., and Udovič, B. (2018). "Analiza trga za potrebe oblikovanja novih konceptov/vsebin instrumentov v letih od 2019 dalje. Pilotna študija" (Analysis of the market for the purpose of designing new concepts/contents of instruments in the years from 2019 onward. Pilot study). Ljubljana: University of Ljubljana, Faculty of Social Sciences.

Čater T., Čater B., Černe M., Koman M., **and Redek T.** (2019). "Industrija 4.0 v Sloveniji" (Industry 4.0 in Slovenia). Ljubljana: Faculty of Economics. Material for the presentation of preliminary results of the study at IMAD 12 June 2019.

Collard-Wexler, A., and De Loecker, J. (2016). "Production Function Estimation with Measurement Error in Inputs". NBER Working Papers 22437, National Bureau of Economic Research, Inc.

CompNet Task Force. (2014). "Micro-based evidence of EU competitiveness: The CompNet database", Working Paper Research 253, National Bank of Belgium.

CompNet. (2018). "Assessing the reliability of the CompNet micro-aggregated dataset for policy analysis and research: Coverage, representativeness and cross-EU comparability". The Competitiveness Research Network. Obtained at www.comp-net.org.

Desnoyers-James, I., Calligaris, S., and Calvino, F. (2019). "DynEmp and MultiProd: Metadata". OECD Science, Technology and Innovation Policy Papers, No. 3. Paris: Organisation for Economic Cooperation and Development. Obtained at https://doi.org/10.1787/3dcde184-en.

Dynamic Olley-Pakes productivity decomposition with entry and exit (2015). RAND Journal of Economics. Vol. 46, No. 2. pp. 362–375.

EIB Investment Survey. (2018). Luxembourg: European Investment Bank.

Enterprise size. (2016). Available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Enterprise_size.

Eurostat Data Portal. (2018, 2019). Luxembourg: Eurostat. Obtained at: https://ec.europa.eu/eurostat/.

Fonseca, T., Lima, F., and Pereira, S. C. (2018). "Understanding productivity dynamics: A task taxonomy approach". Research Policy. Vol. 47, No. 1., pp. 289–304. Obtained at https://EconPapers.repec.org/RePEc:eee:respol:v:47:y:2018:i:1:p:289-304.

Giuseppe Berlingieri, Patrick Blanchenay and Chiara Criscuolo. (2017). "The Great Divergence(s)", CEP Discussion Papers dp1488, Centre for Economic Performance, LSE.

High-tech classification of manufacturing industries. (2018). Available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:High-tech_classification_of_manufacturing_industries.

How does innovation lead to growth? (2017). Frankfurt: ECB. Obtained at: https://www.ecb.europa.eu/explainers/tell-me-more/html/growth.en.html.

Investment in Euro Area. Focusing on research and innovation. (2019). Technical note for the EPC in euro area composition. Brussels: European Commission.

Labour Market Developments in Europe 2013. (2013). Publications Office of the European Union. Luxembourg: European Commission.

López-Garcia, P., Aglio, D., Bräuer, R., Haug, P., van der Kerke, J. P., Mertens, M., Sartori, M., Serafini, R., Soares, A. C., and Zona Mattioli, A. (2018). "CompNet's 6th vintage of data: Novelties and main stylised facts". The Competitiveness Research Network. Obtained at www.comp-net.org.

Lušina, U. (2019). "Corporate sector indebtedness. Short analyses". Ljubljana: Institute of Macroeconomic Analysis and Development.

Melitz, M. J., and Polanec, S. (2015). "Dynamic Olley-Pakes productivity decomposition with entry and exit". RAND Journal of Economics. Vol. 46, No. 2., pp. 362–375. Obtained at https://doi.org/10.1111/1756-2171.12088.

Odgovor Vlade RS na pisno poslansko vprašanje Franca Breznika v zvezi z zmanjšanjem inovacijske uspešnosti v Sloveniji – predlog za obravnavo, 8. 7. 2019 (Reply by the Government of the Republic of Slovenia to an MP question by Franc Breznik concerning the decline in Slovenia's innovation performance – proposal for debate). (2019). Ljubljana: Government of the RS – Ministry for Economic Development and Technology.

OECD Compendium of Productivity Indicators 2019. (2019). Paris: OECD.

OECD Science, Technology and Industry Scoreboard 2013. (2013). Paris: Organisation for Economic Cooperation and Development. Obtained at http://www.oecd.org/sti/scoreboard-2013.pdf.

OECD Tiva Indicators. (2019). Paris: OECD. Obtained at: https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm.

Olley, G. S., and Pakes, A. (1996). "The dynamics of productivity in the telecommunications equipment industry". Econometrica. Vol. 64, No. 6. pp. 1263–1297. Obtained at https://www.jstor.org/stable/2171831?seq=1#page_scan_tab_contents.

Papa, J., Rehill, L., and O'Connor, B. (2018). "Patterns of Firm Level Productivity in Ireland". OECD Productivity Working Papers, No. 15. Paris: Organisation for Economic Cooperation and Development. Obtained at https://doi.org/10.1787/1a04730d-en.

Development Report 2019 (2019). Ljubljana: IMAD.

Reviving productivity growth in the post-crisis context: challenges and drivers. 2018. Brussels: European Commission.

SI-STAT Data Portal. (2019). Ljubljana: SURS.

Slovenski računovodski standardi 2016 (Slovenian Accounting Standards). Official Gazette of the RS, No. 95/2015.

Spodbude malih vrednosti preko vavčerjev (Low-value incentives via v voucher system). (2019). Ljubljana: Slovene Enterprise Fund. Obtained at: https://podjetniskisklad.si/sl/produkti-sklada/sps-dvojcekdpora-pri-produktih/vavcerski-sistemi.

Standard Classification of Activities 2008. (2010). Available at https://www.stat.si/doc/pub/skd.pdf.

Statistical Data from Companies' Balance Sheets and Profit and Loss Statements. (Various years). Ljubljana: AJPES.

Statistical Data from Balance Sheets and Profit and Loss Statements for the financial year. (2002–2018). Ljubljana: AJPES.

Survey on the access to finance of enterprises. (2018). Frankfurt: European Central Bank.

UNCTAD Statistics. (2019). Geneva: United Nations Conference on Trade and Development. Obtained at: https://unctadstat.unctad.org.

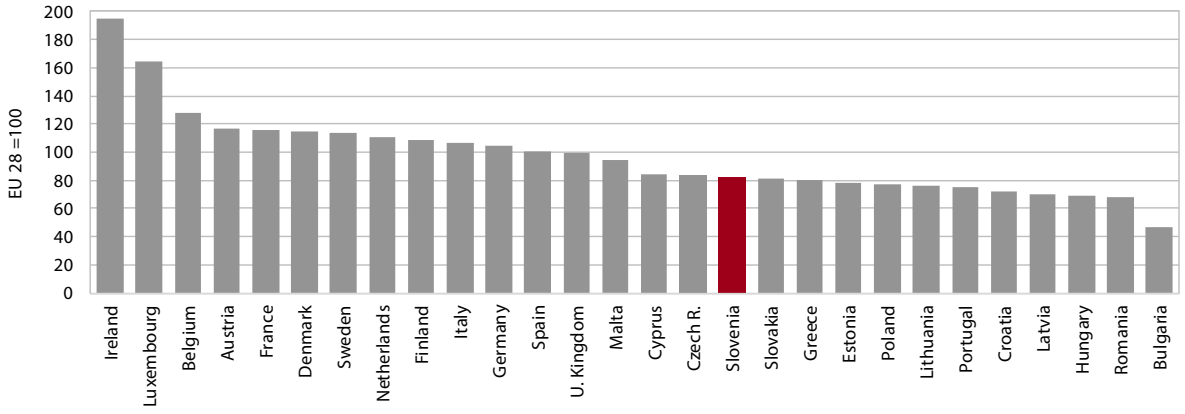
Valdec, M., and Zrnc, J. (2017). "Macroeconomic Aspects of Productivity Developments during the Great Recession in Croatia – the CompNet Productivity Module Research Results". Surveys S-22. Zagreb: Croatian National Bank. Obtained at https://www.hnb.hr/documents/20182/2004569/s-022.pdf/0c984fd5-879a-4dc5-8b85-aa3bf050c39a.

Wooldridge, Jeffrey M. (2009). "On estimating firm-level production functions using proxy variables to control for unobservables", Economics Letters, Elsevier, vol. 104(3), pp. 112–114, September.

Zakon o gospodarskih družbah (Companies Act) (ZGD-1), Official Gazette of the RS, No. 65/2009.

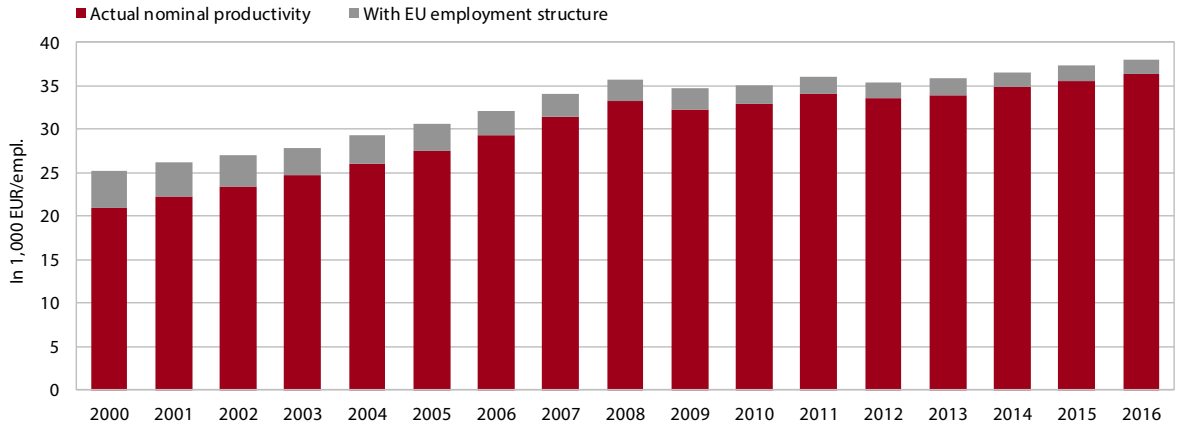
Annex 1
Detailed figures and methodological explanations to Productivity Report, Chapter I

Figure 39: The level of productivity in Slovenia is lower than in most older and higher than in most new EU Member States



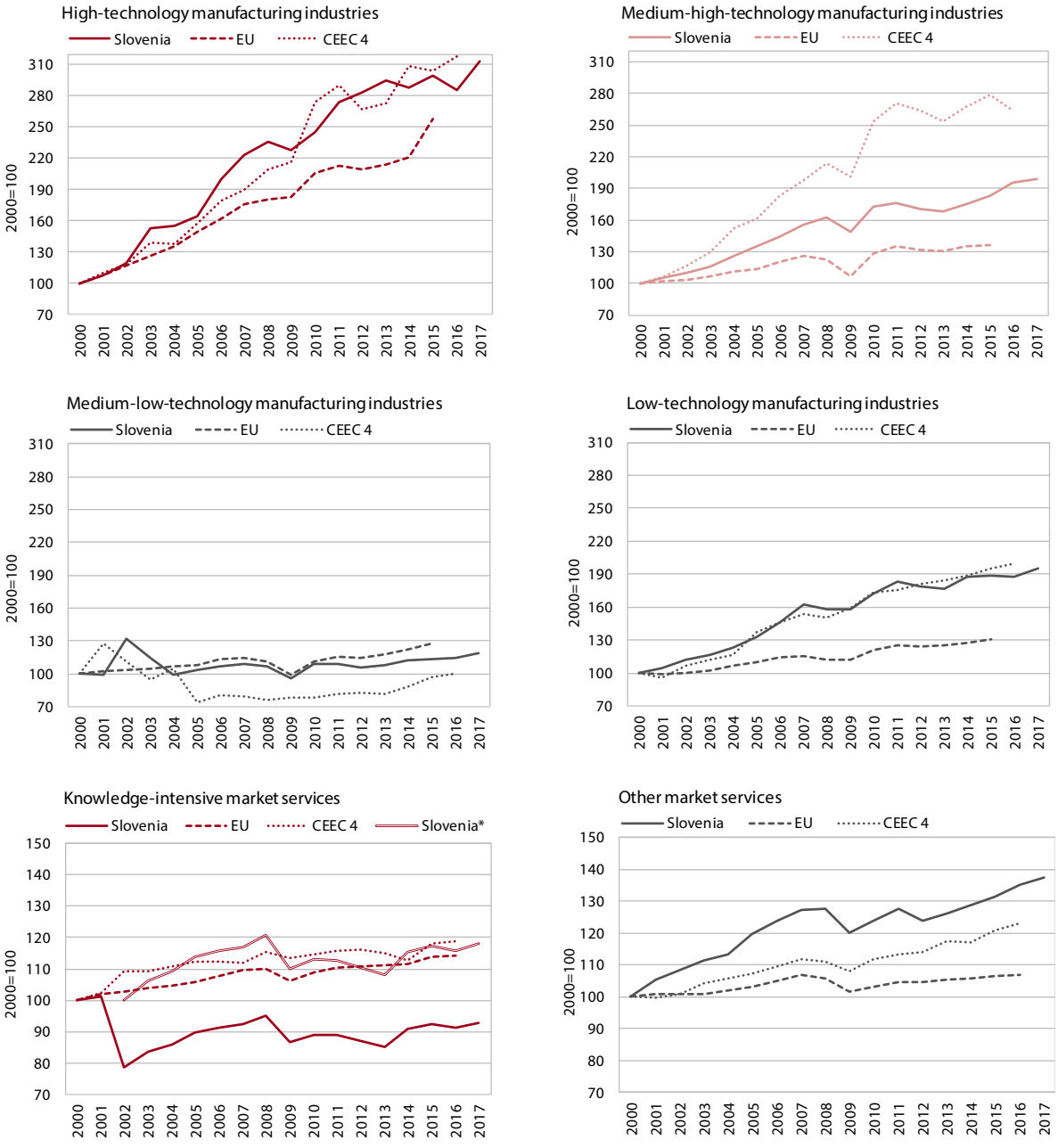
Source: Eurostat; calculations by IMAD. Note: Presentation of data for 2018. To enable cross-country comparisons, the productivity level is calculated in GDP per employed person (in purchasing power standards).

Figure 40: Level of productivity in Slovenia with EU sectoral employment structure



Source: Eurostat; calculations by IMAD. Note: In 2000 Slovenia's productivity would have been one fifth higher if we had had the same sectoral structure as the EU on average, ceteris paribus (measured by the share of people employed in an individual sector), in 2016 only somewhat less than 5% higher.

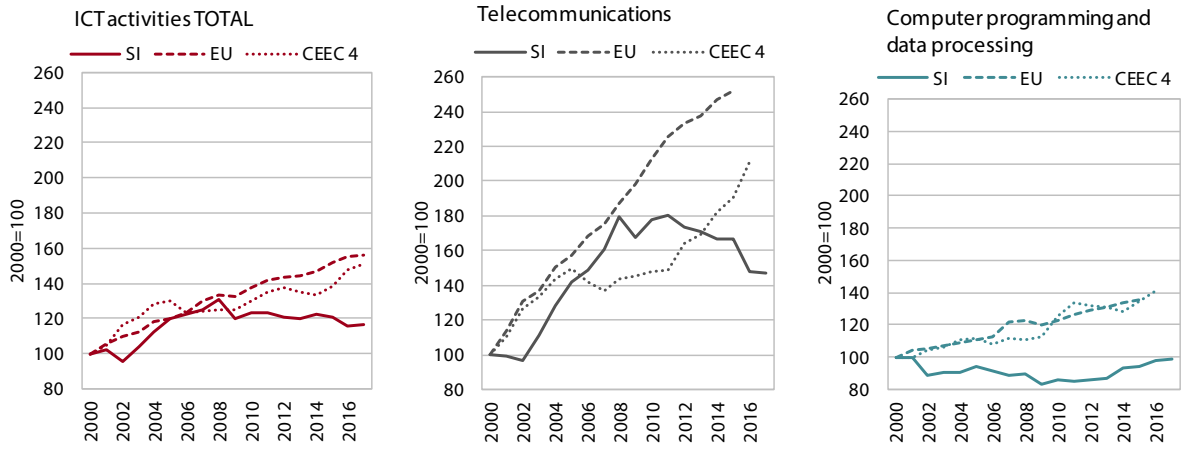
Figure 41: Productivity growth is highest in high-technology manufacturing industries



Source: Eurostat; calculations by IMAD.

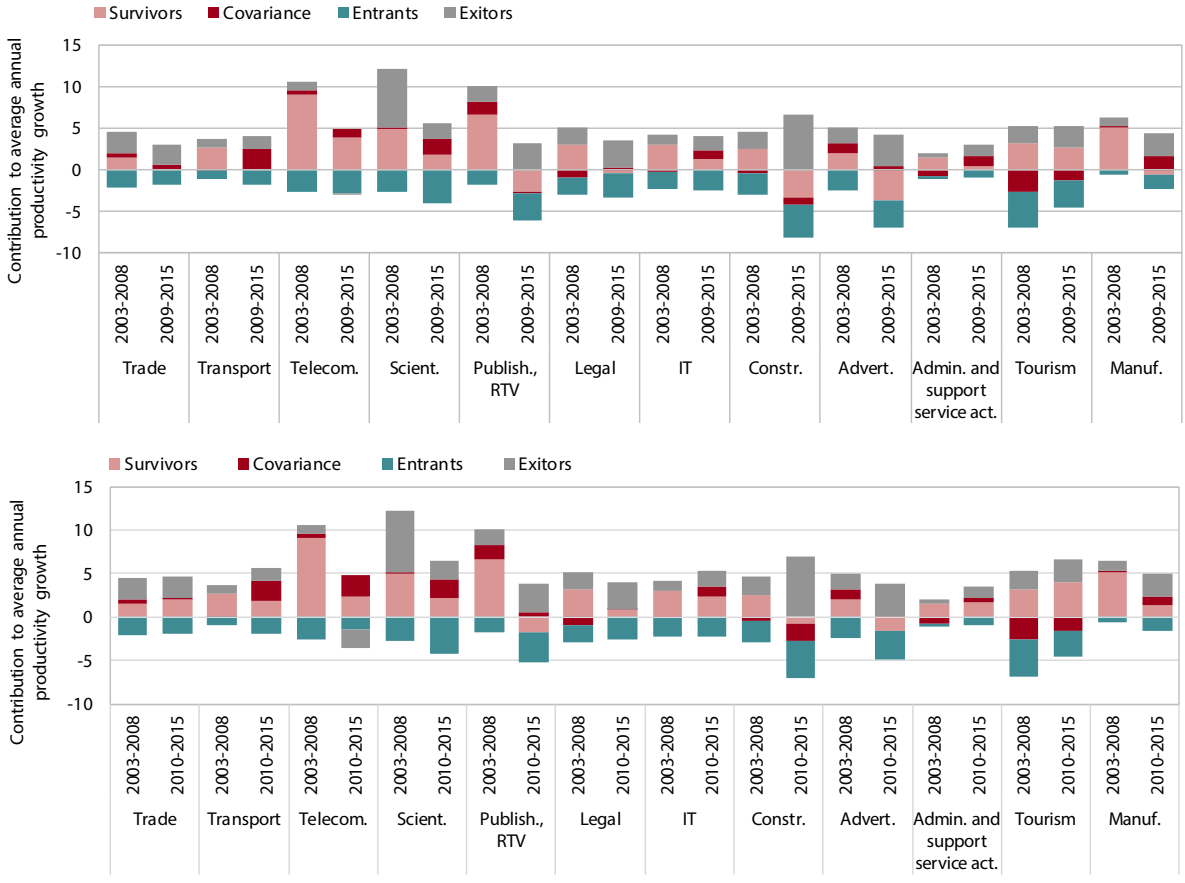
Note: The figure shows real productivity movements (value added at constant prices per employee). According to Eurostat's classification of manufacturing industries based on NACE Rev. 2 at 2-digit level, *high-technology manufacturing industries* include: manufacture of basic pharmaceutical products and pharmaceutical preparations (21) and manufacture of computer, electronic and optical products (26); *medium-high-technology industries*: manufacture of chemical products (20), manufacture of electrical equipment (27), manufacture of other machinery and equipment (28), manufacture of motor vehicles (29) and manufacture of other transport equipment (30); *medium-low-technology industries*: manufacture of coke (19), manufacture of rubber and plastic products (22), manufacture of non-metallic mineral products (23), manufacture of basic metals (24), manufacture of fabricated metal products (25), and repair and installation of machinery and equipment (33); and *low-technology industries*: manufacture of food products (10), manufacture of beverages (11), manufacture of tobacco products (12), manufacture of textile (13), manufacture of wearing apparel (14), manufacture of leather and related products (15), manufacture of wood (16), manufacture of paper (17), printing (18), manufacture of furniture (31), and other manufacturing (32). According to OECD classification, knowledge-intensive market services include information and communication (J) and professional, scientific and technical activities (M). Other market services include trade (G), transportation (H), accommodation and food service activities (I), financial services (K), and administrative and support service activities (N). * To avoid a break in series due to the inclusion of contract work into the employment in M activities, the baseline year is 2002.

Figure 42: Productivity growth in ICT services lags behind the EU average, particularly in telecommunications



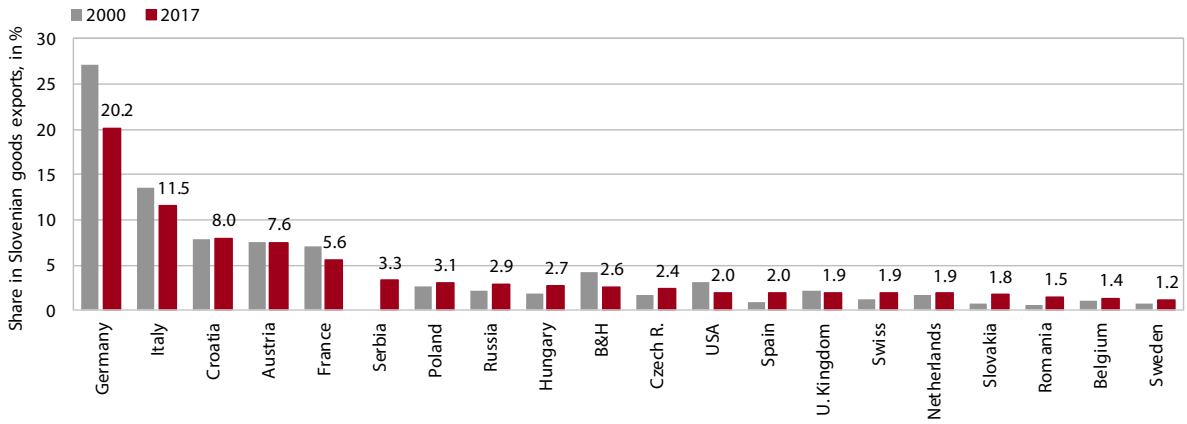
Source: Eurostat; calculations by IMAD.
Note: The figure shows real productivity movements (value added at constant prices per employed person). ICT activities (J) include telecommunications (J 61), computer programming and data processing (J 62 and J 63), publishing activities (J 58), and motion picture, video and television programme production, and programming and broadcasting activities (J 59 and J 60).

Figure 43: The slowdown in sectoral productivity growth rates arises from weaker growth of survivors



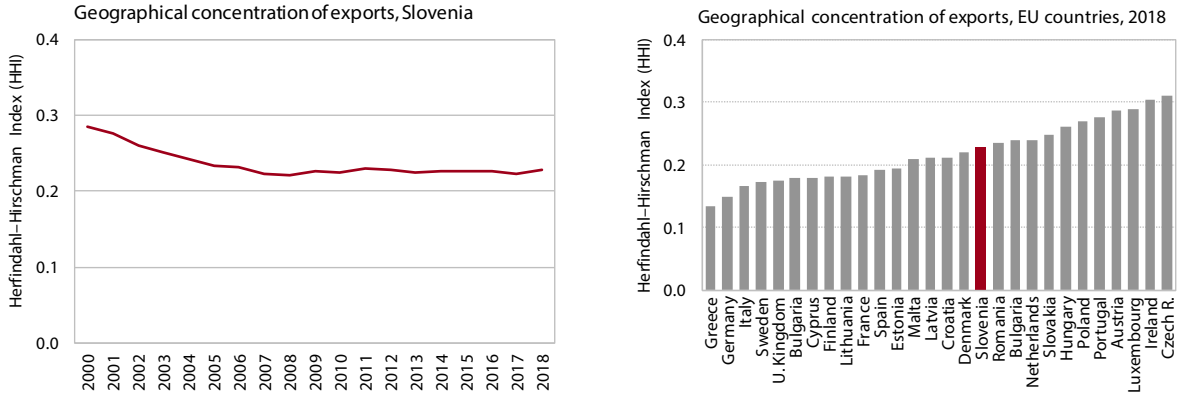
Source: AJPES; calculations by IMAD.
Note: The figure shows the average annual productivity growth rates for firms in 2003–2008 and 2009–2015 (2010–2015 below) on the basis of Melitz Polanec decomposition (see also Box 2).

Figure 44: The most important export markets for Slovenian goods



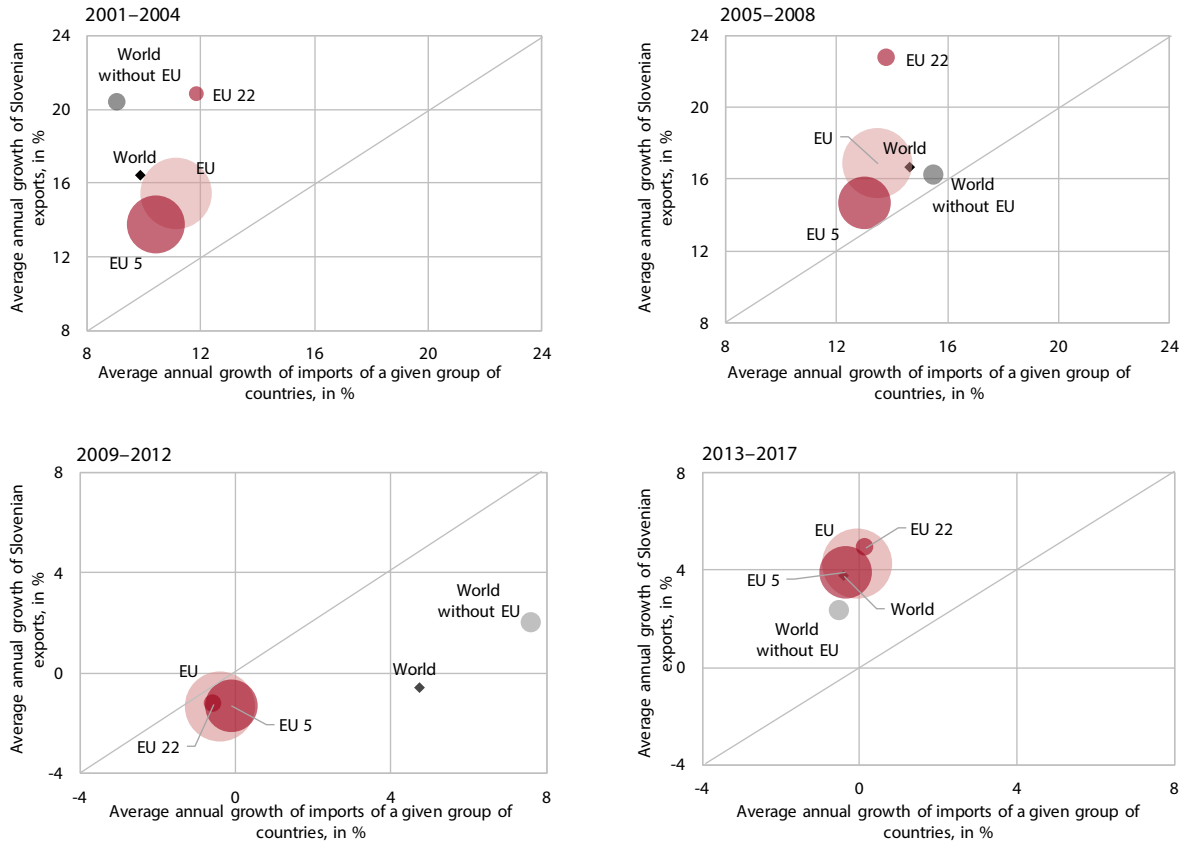
Sources: UN Comtrade and SURS; calculations by IMAD.

Figure 45: The geographical concentration of Slovenian goods exports is declining



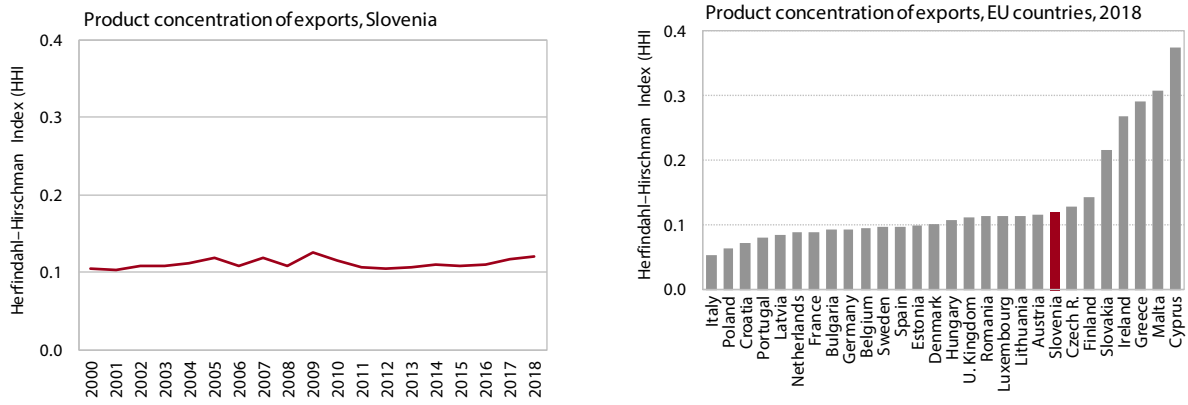
Source: UN Comtrade; calculations by IMAD.
Note: A higher value of the normalised Herfindahl–Hirschman Index (HHI) means higher export concentration.

Figure 46: Geographical distribution of Slovenia's goods exports was unfavourable particularly in 2009–2012



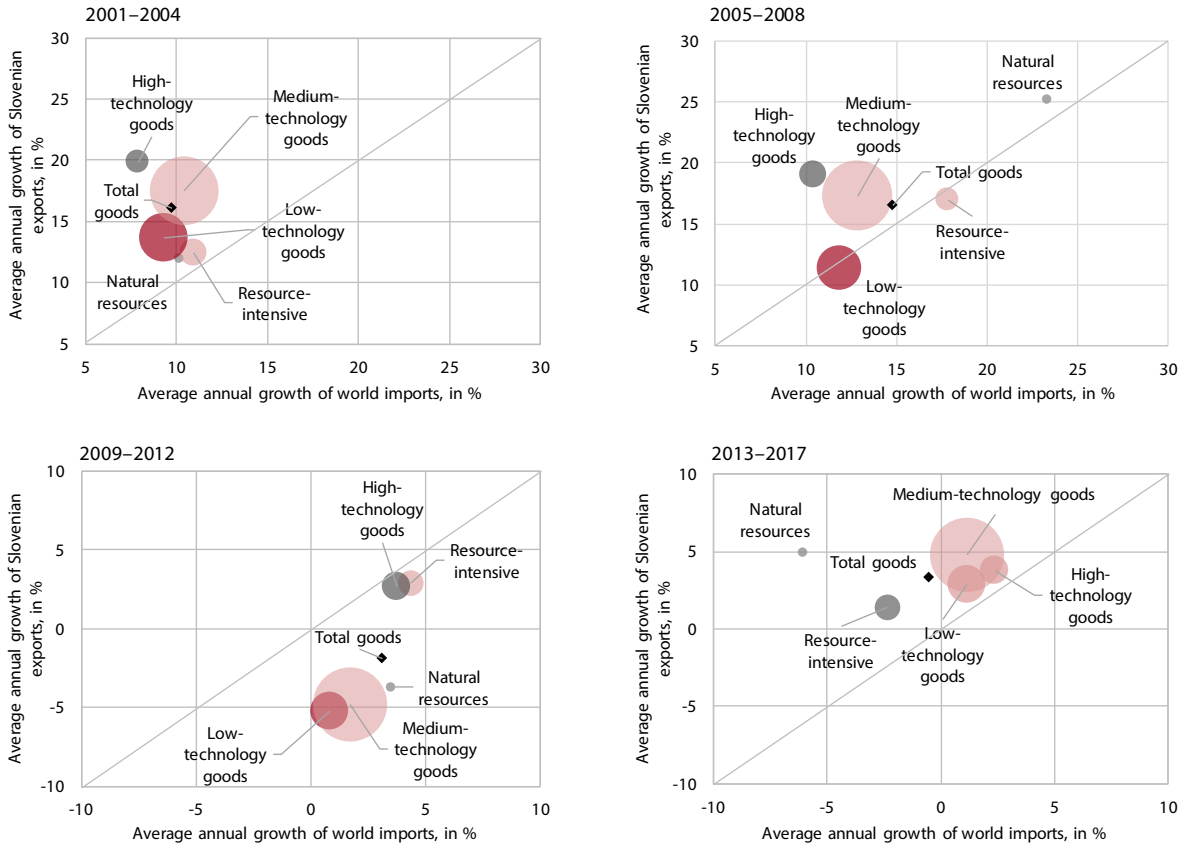
Sources: UN Comtrade and SURS; calculations by IMAD. Circle size represents the share of the group of countries in Slovenian goods exports in the baseline year. EU 5 – Germany, Italy, Croatia, Austria and France; EU 22 – other EU Member States.

Figure 47: The product concentration of Slovenian exports increased somewhat in the last few years



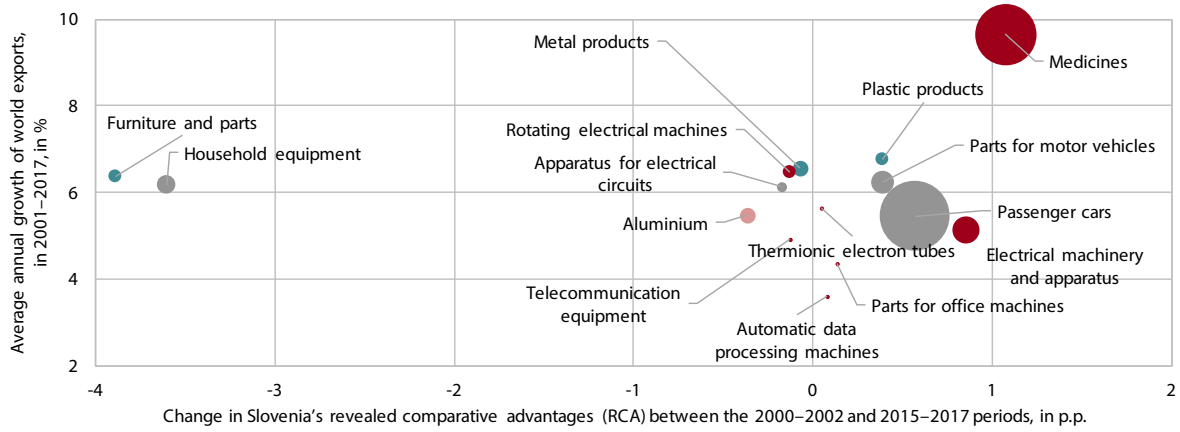
Source: UN Comtrade; calculations by IMAD.
Note: A higher value of the normalised Herfindahl–Hirschman Index (HHI) means higher export concentration. The index is calculated at level 3 of the Standard International Trade Classification (SITC).

Figure 48: The product specialisation of Slovenian exports has been changing from low-technology products in favour of high-technology ones



Sources: UN Comtrade, UNctad; calculations by IMAD. Circle *size* represents the *share* of product group according to Lall classification in Slovenia's goods exports in the baseline year; circle *colour* represents *revealed comparative advantage* – RCA – in the baseline year, **red** (RCA between 1.5 and 2.0), **pink** (RCA between 1.0 and 1.5), **dark grey** (RCA between 0.5 and 1.0), **light grey** (RCA between 0.0 and 0.5).

Figure 49: A significant contribution to the change in Slovenia's export specialisation towards high-technology products was made by exports of medicines



Sources: Unctad, SURS; calculations by IMAD. Circle *size* represents the *share* of product group in Slovenian goods exports (SITC categories 5–8); the figure shows only major product groups, i.e. those with at least 2% share in Slovenian or global goods exports in 2017. Circle *colour* represents the technology group of the product according to *Lall classification*: **grey** (medium-high-technology), **turquoise** (low-technology), **pink** (natural resources).

Annex 2
The differences between the MultiProd and CompNet codes, input variables and results

The codes differ slightly in data coverage and data cleaning procedures. Because of the requirements for more detailed input data, the results of the MultiProd code are available from 2002 to 2015, while the results of the CompNet code are available up to 2016.[93] In both databases, we used firms with at least one employee as input data (on the basis of hours worked).[94] To ensure cross-country comparability, we also used a sample of firms with 20 or more employees as input data in the case of CompNet (based on hours worked). This sample is more internationally comparable, since data collections and representativeness for small and micro firms vary by country.[95] There are differences in data coverage, as CompNet covers NACE Rev.2 sections C, F and from G to N (without K), while MultiProd also includes NACE Rev.2 sections A, B, D, E, P, Q, R and S.[96] The data are also additionally cleaned. The MultiProd code sets zero or negative values of most of the remaining nominal variables to missing.[97] Similar holds true for the CompNet code, which also checks if certain accounting identities and typical relationships between variables hold (for example whether value added is equal to the difference between revenue and intermediate inputs). The MultiProd code drops the observation (firm)[98] in the case of implausible consecutive one-off jumps in the input variables by a factor of 10–50 (depending on the variable) and in the case of a drop of an input variable by a factor of 10 in the two years after entry (for more details see Berlingieri et al., 2017b). Both codes also remove outliers from final computed variables, replacing them by missing values using the standard deviation method.[99] This is the default method for the identification of outliers in the MultiProd code.[100] In this case, it was mainly applied on different growth rates of log final computed variables and also on the (log-)levels of final computed variables. Apart from that, CompNet also uses the percentile method, eliminating outliers in two ways: (i) on levels of variables and (ii) on annual growth rates.[101] If the value is considered extreme according to at least two methods, the CompNet code turns it to missing. The CompNet code cleans non-logarithmic variables only, unlike the MultiProd code, which cleans both non-logarithmic and logarithmic variables (for more details see Berlingieri et al., Desnoyers-James at al., 2019, Aglio et al., 2018, and López-Garcia et al., 2018).

The databases also differ in some other characteristics, but their results are very similar. Input and output monetary variables in the CompNet database are denominated in thousands of euros, while in the MultiProd database input nominal monetary variables are in euros and output variables in US dollars.[102] The MultiProd code assigns a single 2-digit sector (2-digit level of NACE Rev.2) to each firm (the mode, i.e. the most frequently recorded sector for each firm – for more details see Berlingieri et al., 2017), while in the CompNet database a firm can switch from one 2-digit sector to another (for more details see Berlingieri et al., 2017b, and Aglio et al., 2018). Irrespective of the differences, the results of both codes are very similar (see the figure below).

93 Input data are otherwise available for the 2002–2018 period. In the case of MultiProd, all variables are deflated using their own deflator with the exception of capital and investment, which are deflated using the same deflator (for more details see Berlingieri et al., 2017b); CompNet uses only sector-specific deflators for value added and capital.

94 Originally, both codes take more than 0 employees as input data. The ideal data would be the number of employees rather than the number of hours worked, but the latter is the only data available for Slovenia.

95 Out of 38 sources for 18 countries, 7 derive from samples (i.e. they do not include the entire population), which are generally representative. For more details see CompNet, 2018.

96 The letters denote the following sections according to the Statistical Classification of Economic Activities in the European Community: A – Agriculture, B – Mining, C – Manufacturing, D – Electricity, gas, steam and air-conditioning supply, E – Water supply, sewerage, waste management and remediation activities, F – Construction, G – Wholesale and retail trade, repair of motor vehicles and motorcycles, H – Transportation and storage, I – Accommodation and food service activities, J – information and communication, K – Financial and insurance activities, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities, P – Education, Q – Human health and social work activities, R – arts, entertainment and recreation, and S – Other service activities.

97 The only exception is value added because the code keeps also negative values of VA to characterise the overall distribution in levels of VA/L. Similarly, the CompNet code also allows negative value added.

98 The observation is dropped entirely rather than simply setting the relevant variable to missing because it is difficult to assess whether the problem is related to the singe variable or to the entire record. The CompNet code, on the other hand, does not drop any observation during the cleaning procedure, as is only turns problematic variables or outliers to missing values.

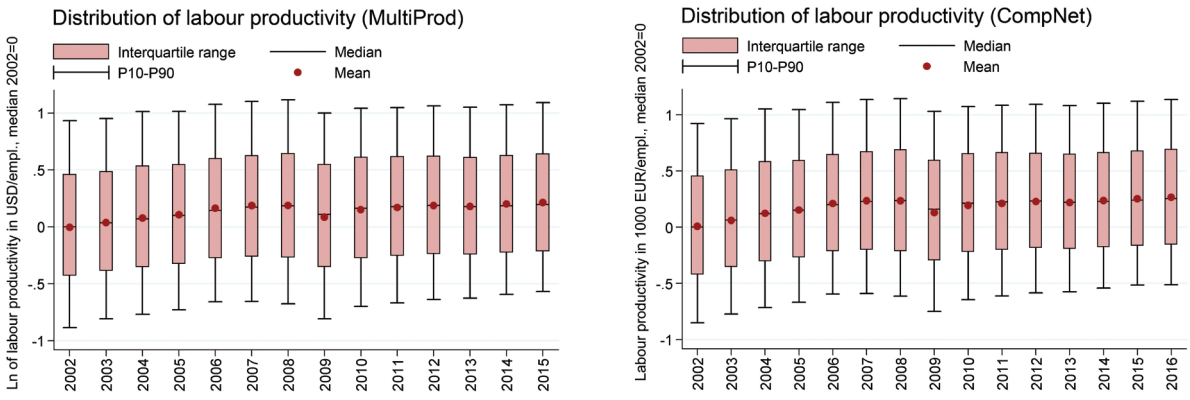
99 This method identifies as outliers the observations that lie beyond a certain number of standard deviations from the mean (MultiProd) or the median (CompNet).

100 Two other methods could also be used: the percentile method and the Tukey method (quartile distance).

101 This method defines as outliers the values that are in the bottom or top 1 percentile of the distribution of the variable and the values whose growth with respect to the previous year is in the bottom or top 1 percentile.

102 To ensure international comparability, every key nominal monetary variable is transformed into US dollars using the exchange rate and PPPs for 2005 (since most of the manufacturing sector is usually traded internationally, the series for manufacturing are simply adjusted using the nominal exchange rate (an average over 2005)). In order to improve cross-country comparability, the results of the CompNet code are also adjusted using country-specific PPPs (in the case of the MultiProd code, sector- and country-specific PPPs).

Figure 50: The distributions of natural logarithm of labour productivity in CompNet and MultiProd are similar, irrespective of differences in data coverage and codes



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: P – percentile. Both distributions are made on logarithmic data.

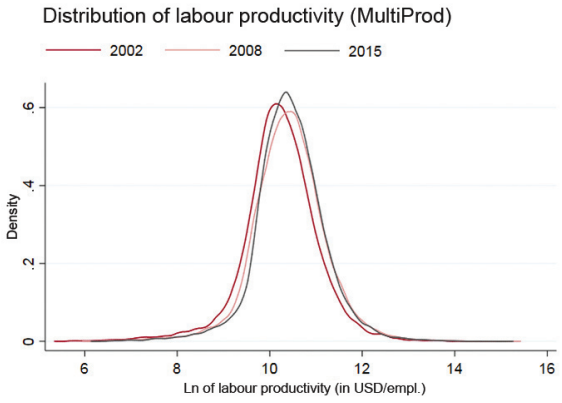
Table 8: The main differences between the MultiProd and CompNet codes and their input data

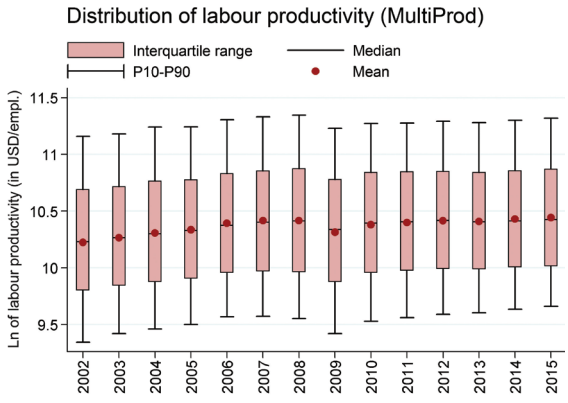
	MultiProd	CompNet
Input variables	in EUR	in 1,000 EUR
Output variables	in USD	in 1,000 EUR
Different sections	A–S (without K and O)	C, F & G–N (without K)
Inclusion of firms into 2-digit sectors	The code assigns a single 2-digit sector to each firm (the mode)	Firms can switch from one 2-digit sector to another
Different definitions of capital	Tangible fixed assets, intangible fixed assets and investment properties	Tangible fixed assets and investment properties
Cleaning	On non-logarithmic and logarithmic variables.	Only on non-logarithmic variables.

Sources: Berlingieri et al., 2017b, Aglio et al., 2018, and López-Garcia et al., 2018.
Note: The letters denote the following sections according to the Statistical Classification of Economic Activities in the European Community: A – Agriculture, B – Mining, C – Manufacturing, D – Electricity, gas, steam and air conditioning supply, E – Water supply, sewerage, waste management and remediation activities, F – Construction, G - Wholesale and retail trade, repair of motor vehicles and motorcycles, H – Transportation and storage, I – Accommodation and food service activities, J – Information and communication, K – Financial and insurance activities, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities, P – Education, Q – Human health and social work activities, R – arts, entertainment and recreation, and S – Other service activities.

Annex 3
Distributions of the logarithm of labour productivity for Slovenia

Figure 51: The shifts of distribution reflect productivity growth





Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: P – percentile. The distribution is made on logarithmic data, which enable a better presentation of productivity shifts.

Annex 4
Cross-country comparison of asymmetry and dispersion of productivity

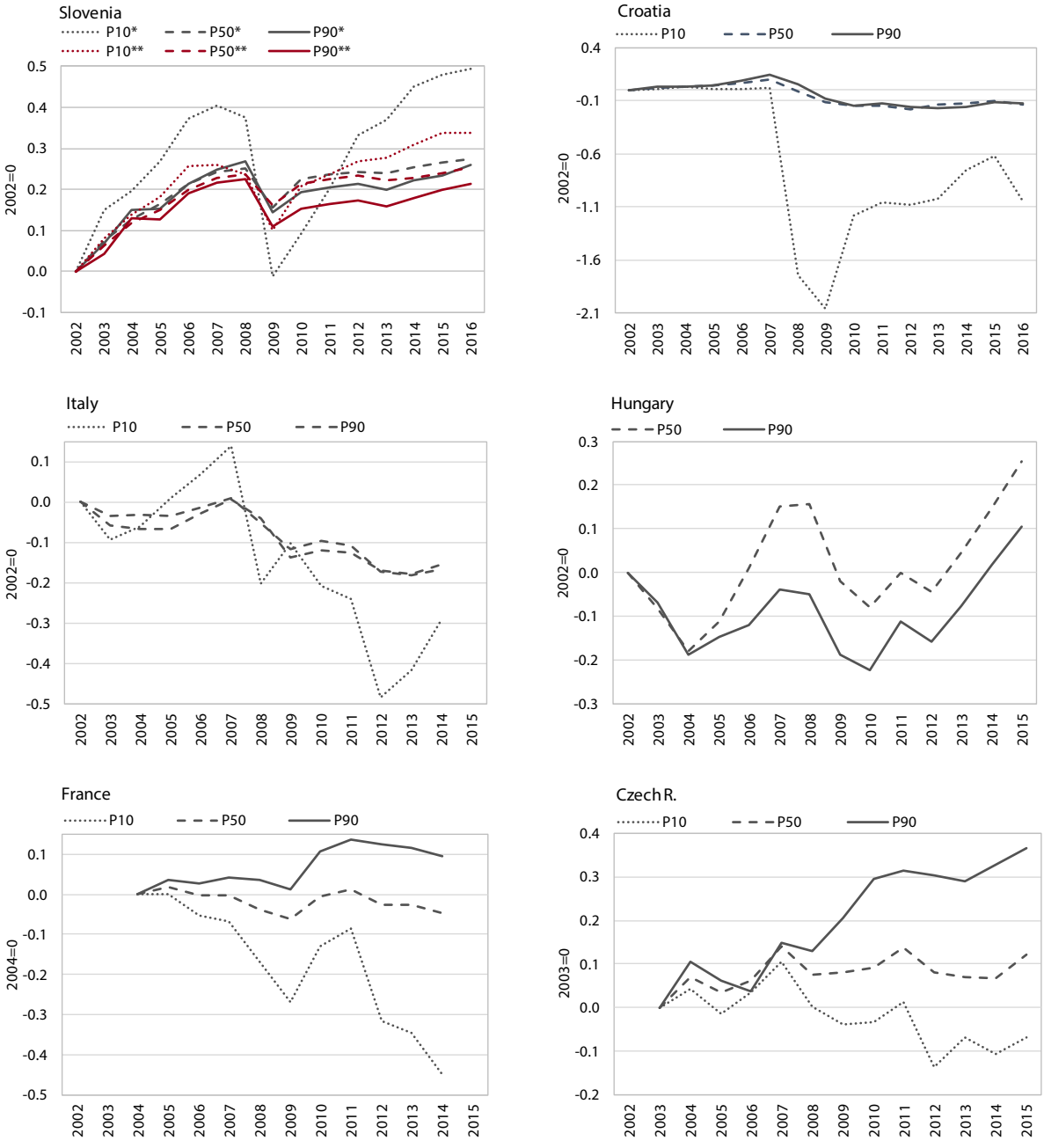
Table 9: In 2015* both asymmetry and dispersion in Slovenia were in the lower half in comparison to other countries analysed

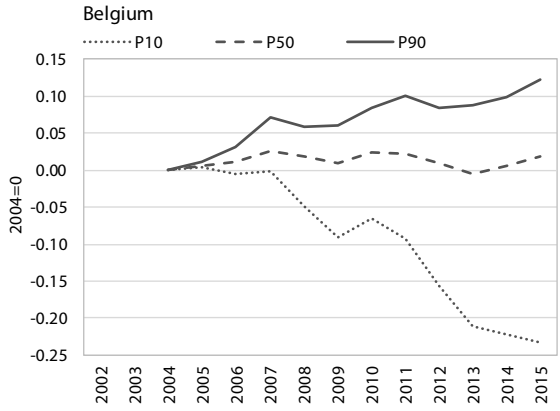
	Asymmetry		Dispersion measures							
			P90/P10		P75/P25		CV		P90/P50	
	20+ emp.	1+ emp.	20+ emp.	1+ emp.	20+ emp.	1+ emp.	20+ emp.	1+ emp.	20+ emp.	1+ emp.
SI	4.3	5.7	4.1	6.4	2.1	2.4	0.8	1	2.0	2.4
BE	56.1	5.9	4.0	7.3	1.9	2.5	1.6	1.2	2.1	2.5
HR	8.0	5.8	7.3	25.3	2.7	3.8	1.3	1.5	2.8	3.4
CZ	21.3	19.1	10.1	21.9	3.1	4.7	1.7	3.3	3.2	5.7
DK	17.9	11.2	2.8	12.3	1.6	3.5	1.3	1.9	1.7	2.4
FI	13.8	38.2	3.9	7.4	1.9	2.2	1.0	4.8	2.0	2.6
FR*	12.2	7.2	4.4	9.8	2.0	2.7	0.9	1.1	2.1	2.5
DE*	22.9		3.6		1.9		0.9		2.0	
HU	8.3	13.7	8.9	-125.3	3.0	6.4	1.3	1.9	3.0	3.8
IT*	9.4	3.3	5.4	10.5	2.1	2.6	0.9	1.3	2.1	2.4
LT	33.8	7.7	6.4	-38.7	2.7	7.0	1.6	2.4	2.6	4.5
NL*	16.9	3.0	5.1	10.5	2.1	2.8	0.8	1.0	1.9	2.7
PL	39.6		12.8		3.3		4.9		4.2	
PT	17.3	14.0	5.8	-22.4	2.5	4.6	2.2	1.6	2.4	3.0
RO	12.5	6.4	21.8	57.8	4.9	5.7	1.8	1.8	4.0	4.4
SK	19.2		18.6		4.0		3.0		5.6	
ES	13.8	5.4	3.9	9.6	2.0	2.6	0.9	1.1	2.0	2.4
SE	49.6	5.8	3.7	8.1	2.0	2.6	1.4	1.1	2.1	2.5
R(SI)	**18**	**12**	**12**	**12**	**10**	**14**	**18**	**14**	**14**	**14**

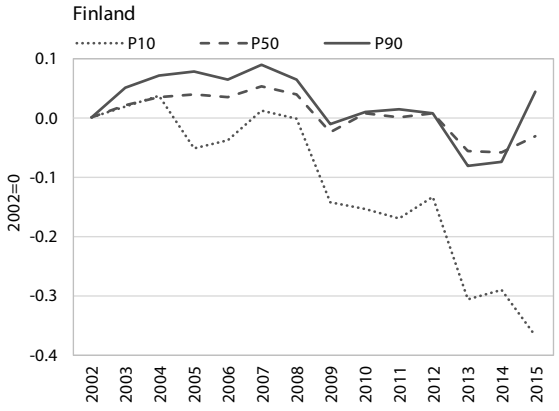
Source: CompNet; calculations by IMAD.
Note: R – ranking, CV – coefficient of variation, P – percentile. Data refer to 2015 or 2014 (*).

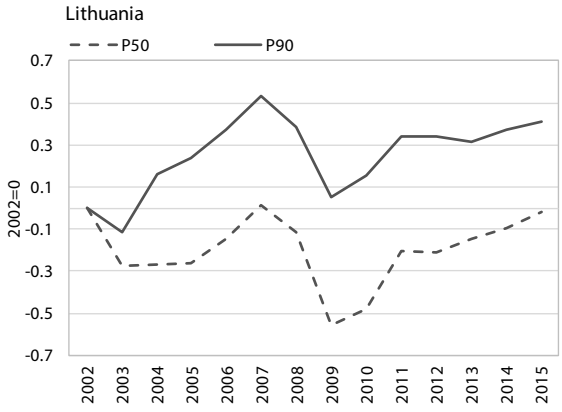
Annex 5
Cross-country comparison of productivity movements in the median, 10th and 90th percentiles

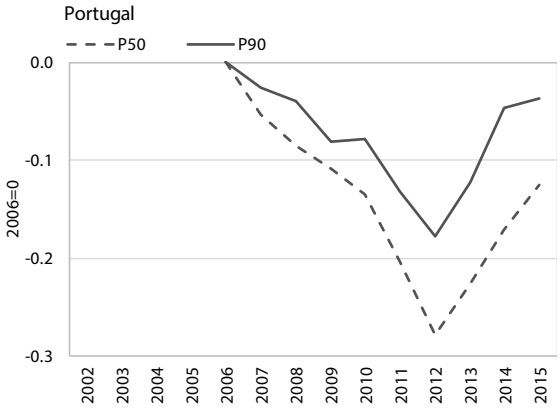
Figure 52: In the majority of analysed countries we can observe gradual divergence in the productivity growth of firms in the 90th percentile compared to those in the 10th percentile.

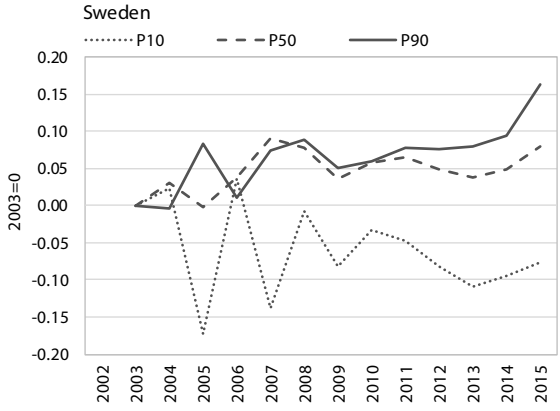


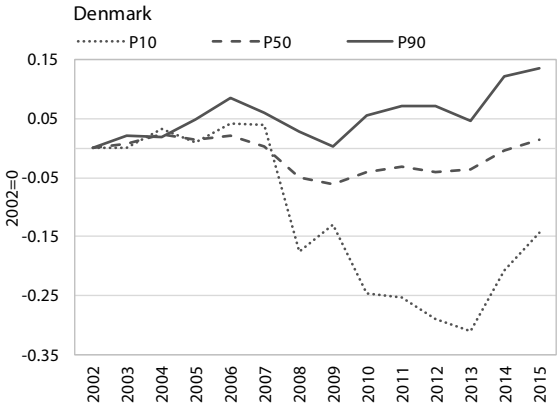

Belgium
P10
P50
P90
2004=0
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

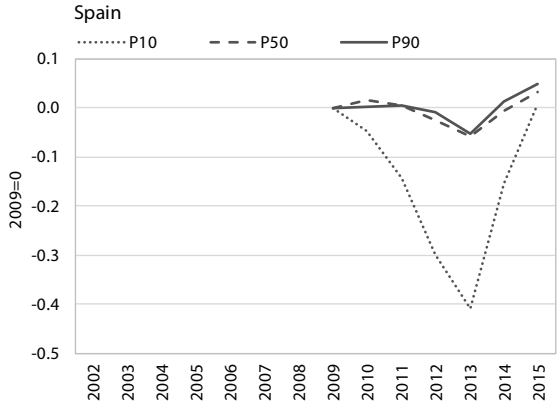

Finland
P10
P50
P90
2002=0
0.1
0.0
-0.1
-0.2
-0.3
-0.4
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

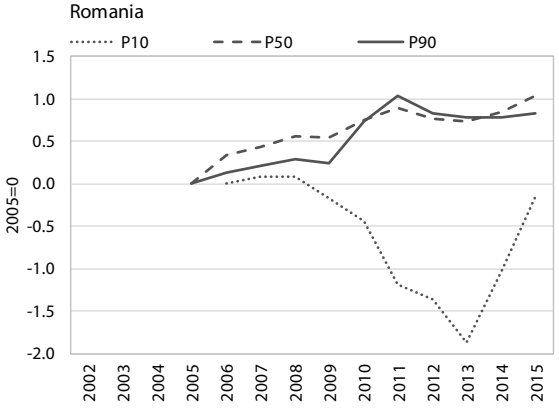

Lithuania
P50
P90
2002=0
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
-0.7
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

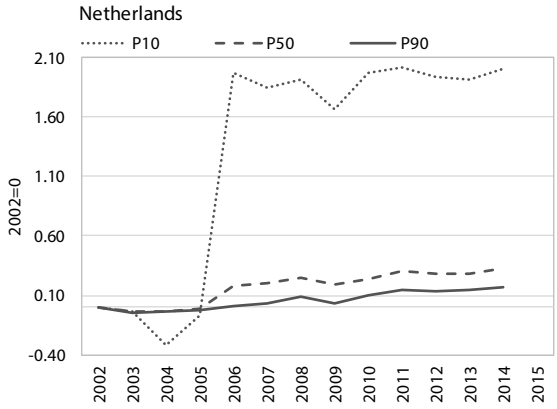

Portugal
P50
P90
2006=0
0.0
-0.1
-0.2
-0.3
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


Sweden
P10
P50
P90
2003=0
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


Denmark
P10
P50
P90
2002=0
0.15
0.05
-0.05
-0.15
-0.25
-0.35
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


Spain
P10
P50
P90
2009=0
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


Romania
P10
P50
P90
2005=0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015



Sources: Ajpes, CompNet; calculations by IMAD.
Note: P-percentile. * represents the output, which is made in the same way as in other analysed countries with percentiles of the level labour productivity; ** is the output used in the rest of the text with percentiles of the logarithmic data. The percentiles of the level and the natural logarithm of labour productivity are different due to the presence of negative value added firms. As standard in the literature, we analyse the natural logarithm of labour productivity in the rest of the text. The fact is, however, that in particular during the crisis, the share of negative value added firms increased. If these firms were removed from the sample (which is essentially done by logarithm), the 90–10 ratio could be underestimated (Berlingieri et al., 2017a). Accordingly, we can see that the output from non-logarithmic (level) data results in a sharp drop in the 10th percentile in 2009 and rapid growth in subsequent years, which makes the 90–10 ratio decline at a faster pace compared to logarithmic data.

Table 10: After 2009 the contribution of firms in the 90th percentile to the narrowing of the productivity gap with EU countries declined

Average annual growth rates in %	Bottom (10th) percentile of labour productivity															R
	SI	BE	HR	FI	HU	IT	LT	PT	RO	ES	FR	CZ	SE	DK	NL	SI
Total	3.6* (2.6**)	-2.1	-7.5	-2.8	6.2	-2.5	-10.2	-26.4	-1.7	0.1	-4.5	-0.6	-0.6	-1.1	16.7	3
Before 2009	6.2* (4**)	-1.2	-29.2	0.0	11.5	-3.4	-34.1	-95.1	4.3		-4.2	0.1	-0.1	-2.9	31.8	3* (4**)
2009	-38.8* (-13.6**)	-4.1	-31.5	-14.1	-70	9.9	-25.5	4.0	-25.4		-10.2	-4.0	-7.6	4.6	-24	13* (8**)
After 2009	8.2* (3.9**)	-2.4	14.6	-3.7	10.4	-3.8	12.5	-9.9	0.2	0.1	-3.6	-0.5	0.1	-0.2	6.8	4* (5**)

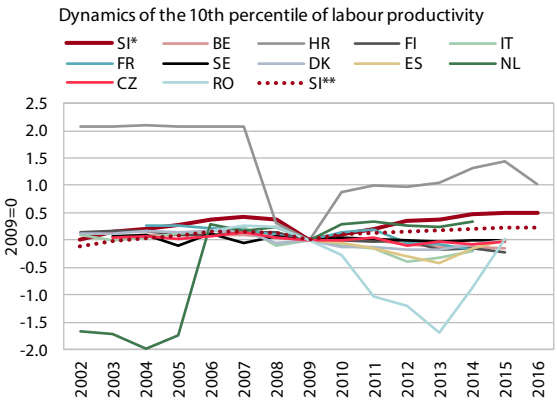
Average annual growth rates in %	Median labour productivity															R
	SI	BE	HR	FI	HU	IT	LT	PT	RO	ES	FR	CZ	SE	DK	NL	SI
Total	2* (1.8**)	0.2	-0.9	-0.2	1.9	-1.4	-0.1	-1.4	10.3	0.5	-0.5	1.0	0.7	0.1	2.7	3* (4**)
Before the crisis	4.2* (3.9**)	0.5	-0.2	0.7	2.6	-0.9	-1.9	-4.2	18.7		-1.0	1.5	1.6	-0.8	4.1	2* (3**)
2009	-9.5* (-7.6**)	-0.9	-10.1	-6.5	-17.6	-6.4	-44.0	-2.3	-1.0		-2.5	0.6	-4.3	-1.3	-4.7	11
After 2009	1.8* (1.3**)	0.1	-0.2	-0.1	4.6	-1.0	9.0	-0.3	8.1	0.5	0.3	0.7	0.7	1.3	2.6	5

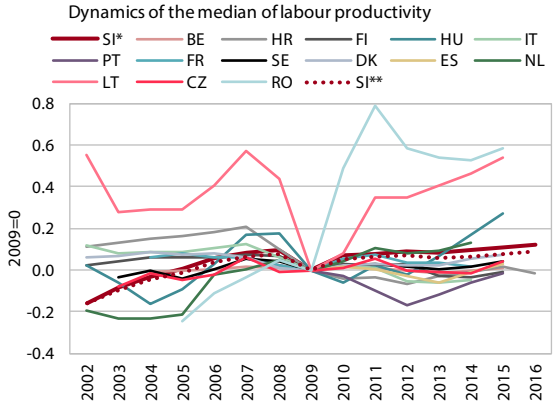
Average annual growth rates in %	Upper (90th) percentile of labour productivity															R
	SI	BE	HR	FI	HU	IT	LT	PT	RO	ES	FR	CZ	SE	DK	NL	SI
Total	1.8* (1.5**)	1.1	-0.9	0.3	0.8	-1.3	3.2	-0.4	8.3	0.8	1.0	3.0	1.4	1.0	1.4	4
Before 2009	4.5* (3.7**)	1.5	0.8	1.1	-0.8	-0.7	6.4	-2.0	9.8		0.9	2.6	1.8	0.5	1.5	3
2009	-12.3* (-11.4**)	0.2	-13.4	-7.6	-13.9	-9.6	-33.0	-4.2	-4.8		-2.3	7.5	-3.8	-2.5	-5.5	11
After 2009	1.5	1.0	-0.5	0.9	4.9	-0.4	6.0	0.7	9.8	0.8	1.6	2.7	1.9	2.2	2.7	9

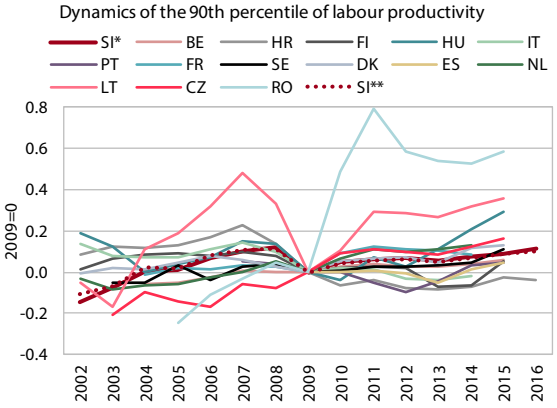
Sources: Ajpes, CompNet; calculations by IMAD.

Notes: The ranking, which is calculated on the basis of average productivity growth rates is, however, an approximation, as the averages are not fully comparable due to different time periods for which data for individual countries are available. Slovenia and Croatia have data for 2002–2016, Finland, Hungary, Lithuania and Denmark for 2002–2015, Italy and the Netherlands for 2002–2014, the Czech Republic and Sweden for 2003–2015, France for 2004–2014, Belgium for 2004–2015, Romania for 2005–2015, Portugal for 2006–2015, and Spain for 2009–2015. * represents the output, which is made in the same way as in other analysed countries with percentiles of the level labour productivity; ** is the output used in the rest of the text with percentiles of the logarithmic data. The percentiles of the level and the natural logarithm of labour productivity are different due to the presence of negative value added firms. As standard in the literature, we analyse the natural logarithm of labour productivity in the rest of the text. The fact is, however, that in particular during the crisis, the share of negative value added firms increased. If these firms were removed from the sample (which is essentially done by logarithm), the 90–10 ratio could be underestimated (Berlingieri et al., 2017a). Accordingly, we can see that the output from non-logarithmic (level) data results in a sharp drop in the 10th percentile in 2009 and rapid growth in subsequent years, which makes the 90–10 ratio decline at a faster pace compared to logarithmic data.

Figure 53: The deceleration in productivity growth of firms in the 90th percentile after the crisis contributed to the deterioration of Slovenia's position in international comparison



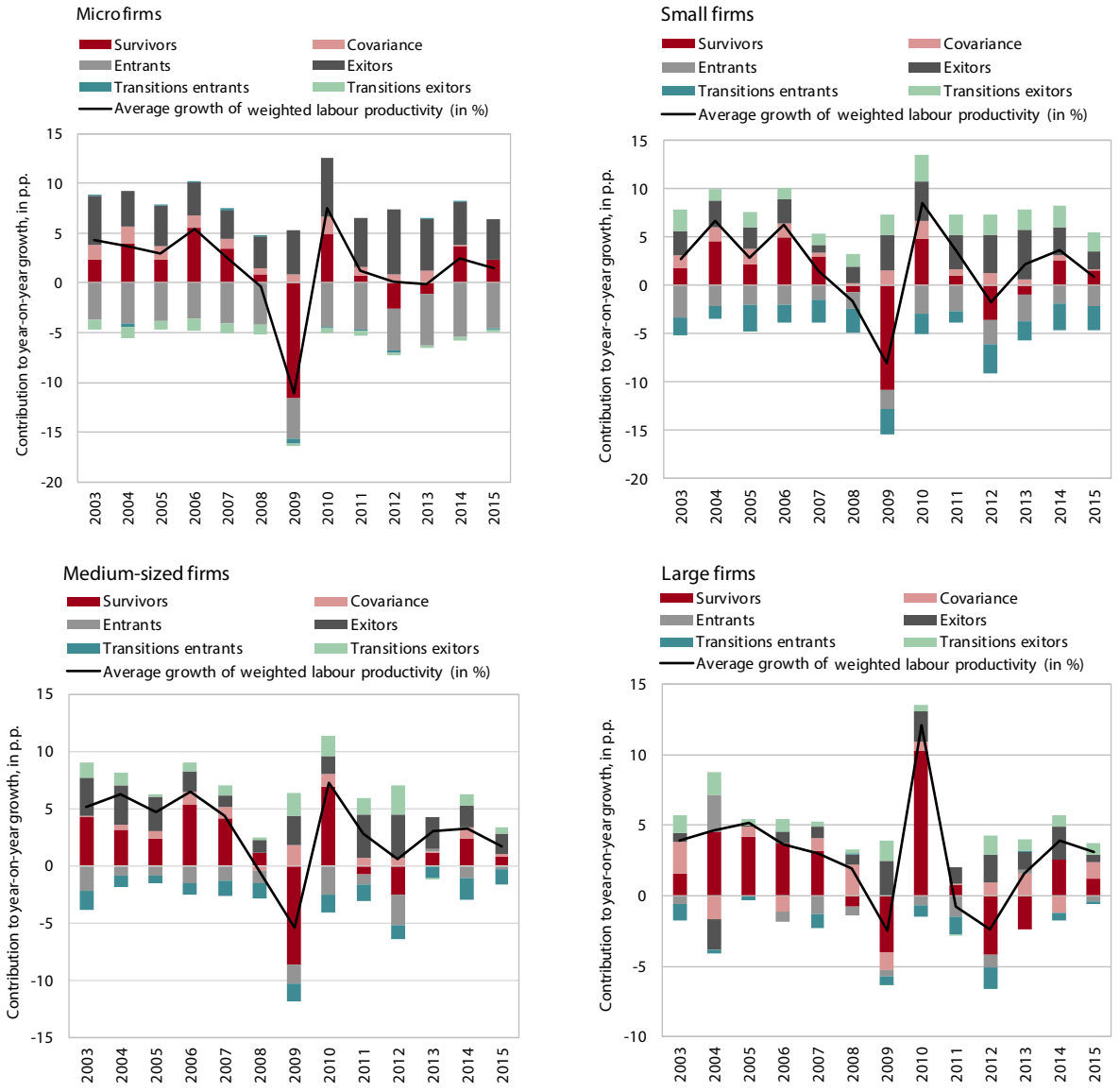




Sources: Ajpes, CompNet; calculations by IMAD.
Note: The series is normalised to 0 in 2009. SI* represents the output, which is made in the same was as in other analysed countries with percentiles of the level labour productivity; SI** is the output used in the rest of the text with percentiles of the logarithmic data. The percentiles of the level and the natural logarithm of labour productivity are different due to the presence of negative value added firms. As standard in the literature, we analyse the natural logarithm of labour productivity in the rest of the text. The fact is, however, that in particular during the crisis, the share of negative value added firms increased. If these firms were removed from the sample (which is essentially done by logarithm), the 90–10 ratio could be underestimated (Berlingieri et al., 2017a). Accordingly, we can see that the output from non-logarithmic (level) data results in a sharp drop in the 10th percentile in 2009 and rapid growth in subsequent years, which makes the 90–10 ratio decline at a faster pace compared to logarithmic data. Lithuania, Hungary and Portugal are excluded from the comparison of the 10th percentile dynamics, as they have negative and positive labour productivity values, which are difficult to compare over time.

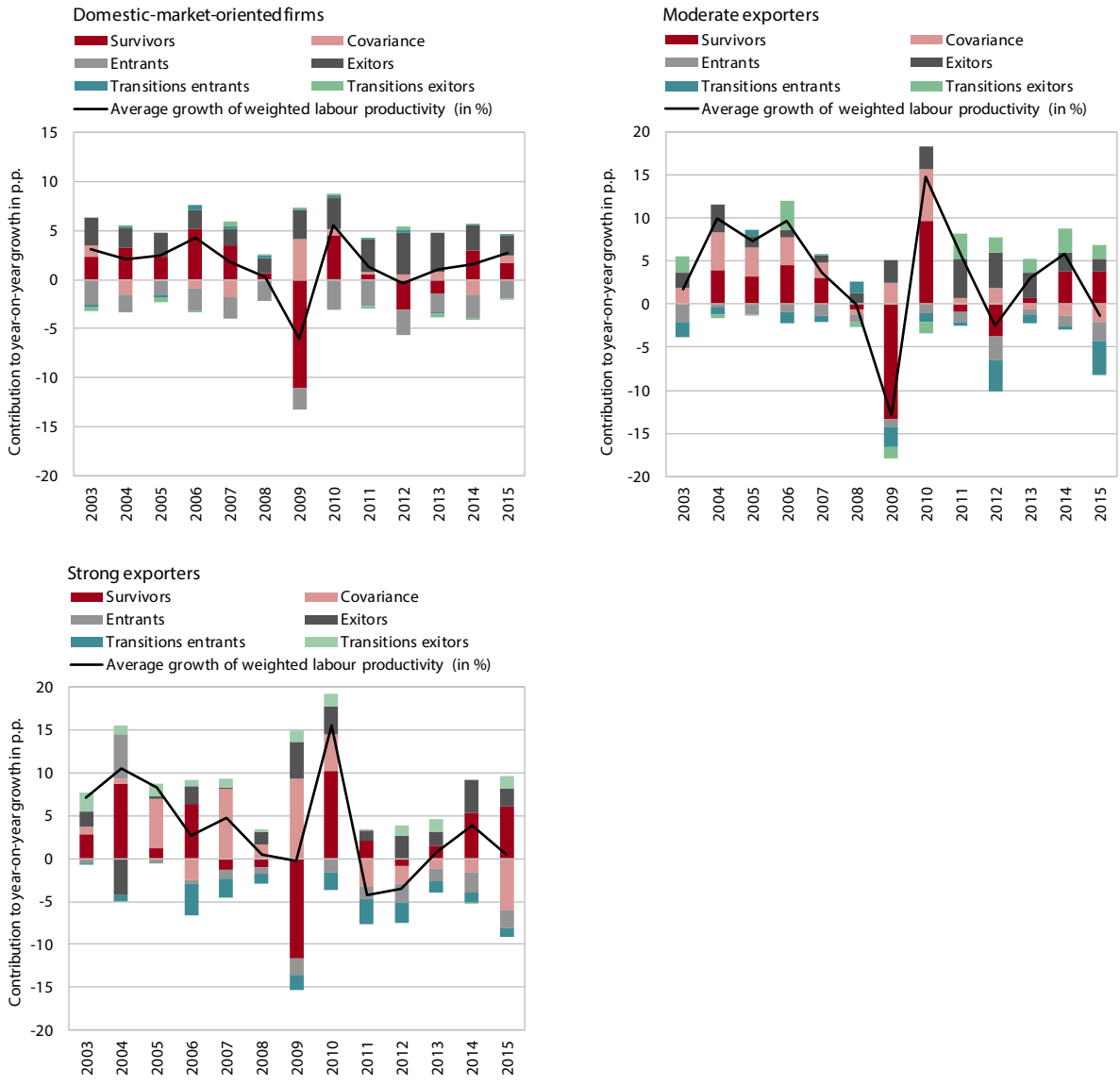
Annex 6
(Extended) cross-sectional Melitz Polanec decomposition

Figure 54: Extended Melitz Polanec decomposition by firm size on annual data



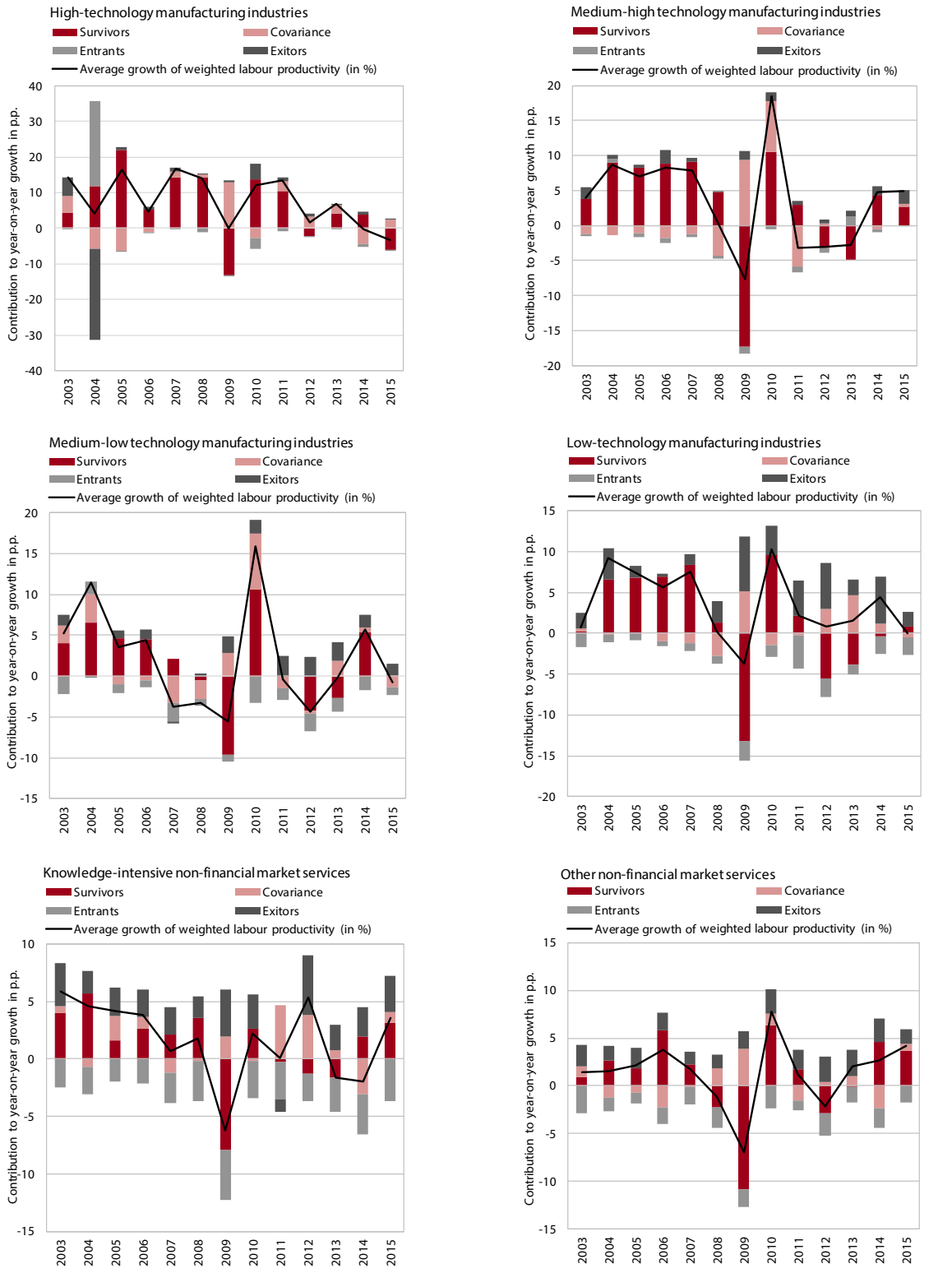
Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: The extended Melitz Polanec decomposition of labour productivity weighted by employment. Micro firms = 1–9 employees, small = 10–49, medium-sized = 50–249, large = 250 or more.

Figure 55: Extended Melitz Polanec decomposition by export orientation on annual data



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Note: The extended Melitz Polanec decomposition of labour productivity weighted by employment. Domestic-market-oriented firms – export share < 25 %, moderate exporters - export share 25%–75%, strong exporters – export share ≥ 75%.

Figure 56: Melitz Polanec decomposition by technological and knowledge intensity on annual data



Sources: Ajpes, MultiProd, CompNet; calculations by IMAD.
Notes: The Melitz Polanec decomposition of labour productivity weighted by employment. The aggregation of the manufacturing industry (NACE Rev. 2, Section C) according to technological intensity is based on Eurostat methodology. The classification of services is based on the OECD definition, according to which knowledge-intensive non-financial market services include information and communication (NACE J) and professional, scientific and technical activities (NACE M), while other non-financial market services include trade (NACE G), transportation (NACE H), accommodation and food service activities (NACE I), real estate activities (NACE L), and administrative and support services (NACE N).

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