Of firms and men
Determinants of productivity growth and (mis)allocation of resources among Slovak firms

Vladimír Peciar, Peter Wittemann

Slowdown in convergence in comparison with developed western economies might be caused my inefficient allocation of resources. Misallocation may be driven by inadequate regulation and by sectoral specifics such as lower degree of competition and informality in services. More efficient allocation of resources may increase productivity of Slovak economy by half. Internal firm characteristics such as size, ownership or capital intensity significantly affect productivity of Slovak firms. Foreign firms are significantly more productive than domestic ones. Economic policy measures should focus on elimination of distortive regulations and support adoption of innovative technologies by domestic firms.

Resource allocation is an important determinant of aggregate productivity

Since the cross-section nature of Slovak productivity has already been analyzed (Výškrabka, 2018), this study will incorporate time series dimension and wider structural analysis. It will focus on the allocation of resources (capital and labor) and show that more efficient distribution of production factors can vastly improve productivity of the economy. Further it investigates which firm or sectoral characteristics and policy instruments impact productivity at firm level and draws relevant policy conclusions.

Before the crisis of 2008/2009, Slovak economy was converging and catching-up with the western economies at a fast pace. During more than a decade productivity and GDP growth was higher than in the Euro Area (EA). **It was driven mainly by foreign direct investment, accumulation of capital and labour and fast productivity growth.** After the crisis average productivity growth was cut by half and has not yet returned to its pre-crisis rate. Although it seems that the EA growth rates will stay very low for long period of time, this secular slowing down represents risks for the catching-up of Slovak economy as well.

Productivity growth and convergence slowed down after the crisis

Figure 1: Productivity growth of real value added, SVK vs. EA, percentage points
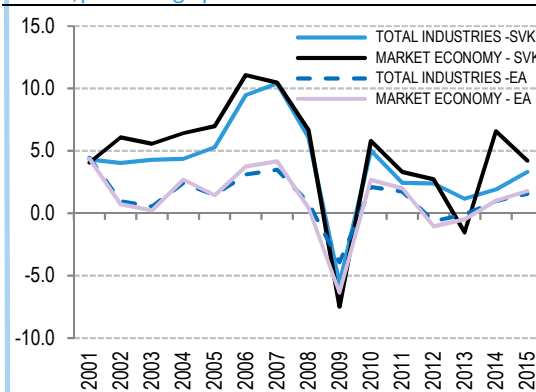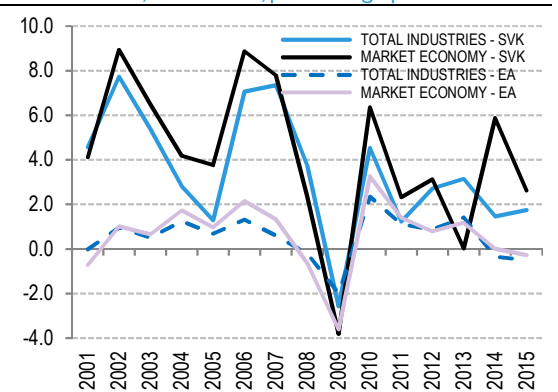

Figure 2: Productivity growth of real value added per hour worked, SVK vs. EA, percentage points

Source: EU KLEMS data

Looking at the data from the Eurostat and the World Bank, convergence of the Slovak economy after 2009 indeed started to slow down.[1] **Recent research shows[2] that for the new EU member states (Slovakia included), main sources of lagging behind are low total factor productivity (TFP)[3] and inefficient allocation of resources.** Days of the growth model based on cheap but skilled workforce, low taxes and favourable economic conditions for multinational companies are over.

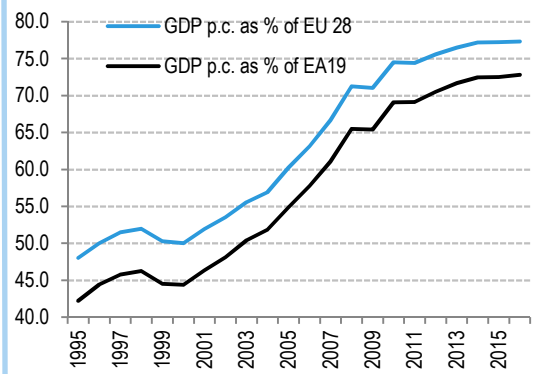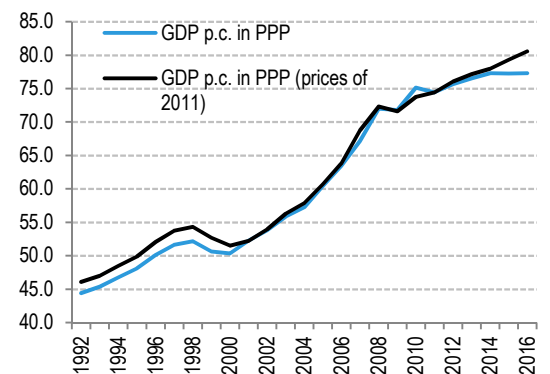Figure 3: Convergence of the Slovak GDP in comparison with EU 28 and EA 19 (%)

Figure 4: GDP p.c. as % of EU 28 according to the World Bank

Source: Eurostat, IFP. GDP in PPP (Figure 3), Dobiehame alebo nedobiahame ten západ ? (Habrman, 2018)

High productive economies can channel resources to sectors in which they exhibit the highest returns. Therefore for a country it is very important to be able to move labour and capital from unproductive to productive industries in order to secure the highest possible welfare for its citizens. The optimal allocation of resources, and for that matter the highest welfare achieved, is defined as when there is no other way of reallocation such that it does not cause reduction of total welfare.[4]

Applying the Hsieh-Klenow (HK) methodology for allocation of resources to Slovak data reveals, that after resources are ideally and optimally allocated, Slovakia's productivity (TFP) may increase by half.[5] Using data on personnel costs instead of number of employees as a labor input shows that productivity would increase by 43 %. Considering small micro firms (less than 10 employees), potential TFP gains amount to substantial 170 %. Thus higher the TFP gains, the less efficient is the allocation of production factors.

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[1] For discrepancies between the Eurostat and the World Bank data on convergence, see Dobiahame alebo nedobiaheme ten západ ? (Habrman, 2018).

[2] DUJAVA, (2017), ECB (2018) or Grela et al. (2017). In general there is a broad consensus in economic literature that differences in productivity are main drivers of divergent economic development.

[3] Total-factor productivity (TFP), also called multi-factor productivity, is the portion of output not explained by traditionally measured inputs of labour and capital used in production. TFP is calculated by dividing output by the weighted average of labour and capital input. Total factor productivity is a measure of economic efficiency and accounts for larger part of the differences in cross-country per-capita income.

[4] The so called Paretto-effective allocation of resources.

[5] For detailed description of the model and the reason why we compare Slovakia to Germany, see Box 1.
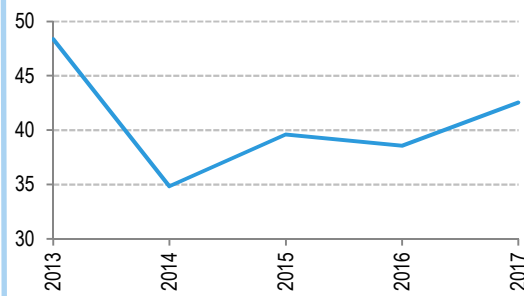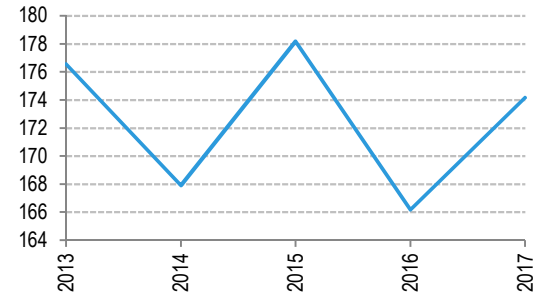
Source: Own calculations based on the HK model

Inefficient resource allocation is aggravated by a large number of small (micro) and unproductive firms. This confirms the unflattering image of the structure of the Slovak economy, namely the dominance of this type of firms. Micro companies in Slovakia make up on average 91% of all companies, but they make up only about 14% of total value added. Capital and labour are inefficiently distributed among micro companies. Assuming maintaining a healthy level of competition, consolidation of the "army" of micro companies into larger and more efficient units has a great potential to increase the TFP of the Slovak economy.[8]

From the perspective of the HK model, the problem of low allocation efficiency among micro firms should be solved by shifting labour and capital to more prospective firms. Moving production factors to more productive entities would make their use more efficient and better rewarded. However, a large number of small businesses are not automatically less productive, but face many regulatory barriers that limit their growth. Freed labour and capital could find better use not only in larger and more productive firms, but also support the growth of small and innovative enterprises.

Deeper look at specific industries reveals that misallocation of resources is prevalent mainly in services, agriculture and construction. Construction and utilities are very volatile and utilities differ markedly among subsectors.[9] Among services, there is a higher inefficiency, especially in wholesale, retail and other personal services.

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[6] Excluding wholesale and retail trade and more detailed matching of sectors and the share of production factors at the 4-digit NACE level indicates a potential growth in TFP of 16-25%. Other model specifications with sector matching and production factors shares at the 4-digit NACE level also point to approximately 25% potential growth in TFP. Specifications with a two-factor value-added production function instead of revenue indicate a 100% potential increase in TFP (sample of companies with 10 or more employees).

[7] Including firms with less than 10 employees (also in Figure 8).

[8] E.g. consolidation towards larger companies could bring benefits in the form of economies of scale. On the other hand it is not desirable to consolidate the sector into a narrow group of productive firms with high oligopolistic or monopoly power.

[9] Average over the period of 2014 - 2017. Overall manufacturing can be characterized by lower and more stable misallocation. Electricity, gas and steam supply (TFP growth potential of 10-15% on average) is characterized by better allocation efficiency than water and waste collection and treatment (TFP growth potential of 90-160% on average).

Graf 7: TFP gains by sectors in %, firms with more than 10 employees, (average over 2014 to 2017)[10]

Source: own calculations
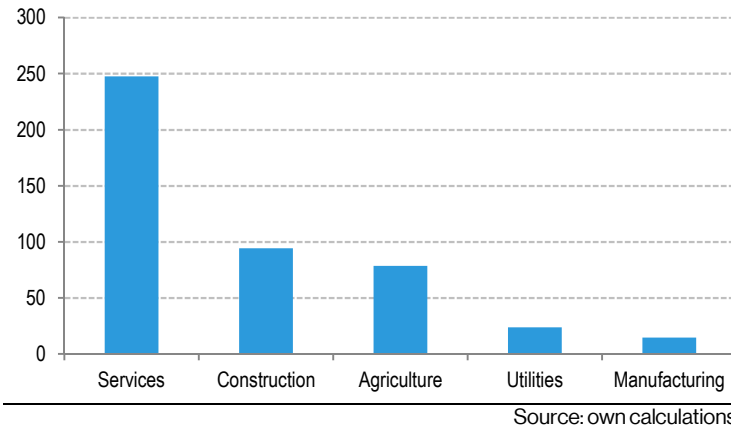
According to the OECD, the process of labour productivity growth and convergence is concentrated mainly in manufacturing. In services, the productivity gap remains high (Figures 8 and 9). The dominance of highly productive foreign firms, strong involvement in global value chains and global competition have a positive impact on resource allocation in the predominantly export-oriented manufacturing.

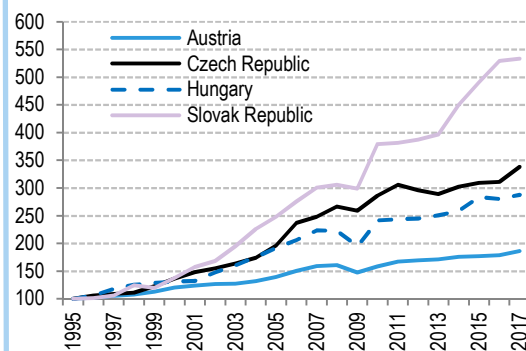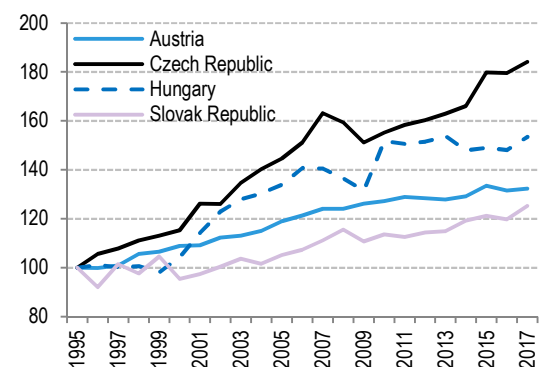Figure 8: Labour productivity growth in manufacturing, comparison, 1995=100

Figure 9: Labour productivity growth in business services[11], comparison, 1995=100

Source: OECD 2019, Gross value added per hour worked at constant prices

Dias et al. (2016) argue that higher misallocation in services may be caused by higher output price rigidity, lower competition and higher informality. They argue that firms in services react less sensitively to productivity shocks and adjust prices with significant lag. Lower competition is characterized by higher product differentiation and lower spatial tradability of services. Informality can be understood via better chances of tax optimization since services are harder to price than manufacturing products. These all factors then contribute to higher misallocation in services compared to manufacturing.

In agriculture, more efficient distribution of resources could result in land consolidation or linking parts of direct payments (agricultural subsidies) to farmers' productivity. Direct payments in Slovakia are mostly paid per hectare of cultivated land and are thus decoupled from production. The land market in Slovakia is characterized by a high fragmentation of ownership, hampering investment. The level of land market regulation in Slovakia is the fourth highest in the EU.[12] Current regulation creates obstacles to the

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[10] TFP gains in manufacturing represent 14 %, in agriculture 78 % and in construction 94 %. In services TFP may be even 3.5 times higher. Results reported over the years of 2014 - 2017. In general manufacturing exhibits lower and stable TFP gains. Construction and utilities are very volatile.
[11] Real estate excluded.
[12] Priebežná správa revízie výdavkov na pôdohospodárstvo a rozvoj vidieka. 2018.

development of agricultural production and to changes in the production structure. The fragmentation of ownership makes it impossible for land owners to consolidate their property, which limits the proper functioning of the land market.

Domestic industries which are regulated or shielded from foreign competition suffer from high inefficient allocation. As in the standard textbook case, when institutions and legal environment are set up to promote competition and many distortions[13] are eliminated, market and price mechanism will ensure optimal allocation of resources. Regulatory barriers substantially limit foreign competition in several services sectors, especially professional services such as civil engineering, legal services and architecture. They tend not just to penalize the efficiency of these sectors, but also to make Slovak enterprises less suited to meeting the needs of foreign clients, thus reducing their capacity to integrate into value chains.

<div style="color:#4aa">Internal firm characteristics affect productivity more than external or policy variables</div>

Microeconomic analysis of Slovak firms shows that internal firm characteristics are better determinants of firm productivity than external or policy variables. Ownership, capital intensity, mark-ups, employment structure and to some extent size, significantly affect firm productivity. Sectoral characteristics or policy participation (e.g. active labor market policies, EU financing or public procurement) in many cases do not have statistically significant or consistent effect.

Foreign firms are significantly more productive than domestic ones. They are 10 to 13 % more productive in terms of TFP and 46 % more productive in terms of labour productivity.[14] On average they are 5 times larger (in terms of employee count), have 2.5 times higher capital intensity and twice as bigger share of intangible assets in firm total assets. **Size, capital intensity and intangibles share (proxy for patents and innovation) have all positive impact on TFP as well as labour productivity.** Although the difference in productivities between domestic and foreign firms does not increase over time, there are no technological spillovers to domestic firms neither.

The structure of corporate employment shows that companies that rely more on part-time workers have lower productivity (a 10 p.p. increase in the share of short-term employees will reduce TFP and labour productivity by 1.4 %). The negative effect of low-skilled temporary workers is also documented by Daveri and Parisi (2015). According to the authors, companies that employ a large proportion of part-time temporary workers are less prone to innovation which in turn weaken productivity growth.

Interestingly, the proportion of university graduates has not shown a clear positive relationship between human capital and productivity. The relationship between the share of university graduates and TFP is inconsistent and positive for labour productivity. The results show that higher quality and level of knowledge of the workforce have at least a partial positive impact on the productivity of companies. On the other hand, it should be noted that highly productive firms tend to hire already highly skilled workers, which may somewhat distort the results. In general, however, there is a consensus in economic literature on the positive relationship between a more educated workforce and higher productivity.

Slovak companies thrive less in more regulated sectors. Increase in an impact of sectoral regulation by 1 p.b. slows down the growth of firm TFP by 0.5 to 0.7% and reduces labour productivity level by 0.4% (based *REGIMPACT* OECD indicator[15]). Ineffective regulation in several sectors can have indirect effects on the rest of the economy. For example

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[13] See Box 1 for the description of potential market failures and distortions.
[14] Labor productivity measure as value added per employees.
[15] Indicator *REGIMPACT* measures to which extent are individual sectors affected by receiving inputs from highly regulated sectors. Based on input-output relationships the indicator measures the rate of exposure which individual sectors face. More on the *REGIMPACT* methodology please see: https://www.oecd-ilibrary.org/content/paper/5jlwz7kz39q8-en

poorly set regulation rules can result in higher prices and lower quality of products and services. Products and services from overregulated industries then enter as inputs to other sectors and artificially increase costs for other businesses. This can increase the barriers to entry for new firms and change the cost structure that affects resource allocation and productivity.

Other "external" characteristics did not demonstrate a significant statistical impact on firms' productivity. Eurofunds, participation in active labor market policies or winning public procurement do not have consistent impacts and are negligible in size. In part, however, Eurofund funding may be the exception. The results of the regressions (Tables II and III, columns 12 and 13) indicate that companies with higher intensity of received EU funds are less productive on average, but such funding helps them to grow faster (Table I, columns 10 and 11). For small and medium-sized enterprises, to whom this form of assistance is primarily addressed, EU funding can help in expansion, innovation or the acquisition of new technologies.

Firms with higher market power (measured through the size of their mark-ups[16]) are more productive and their productivity grows faster.[17] High mark-ups may be related to high quality goods and services therefore firms may charge higher prices. On the other hand high mark-ups might reflect low level of sectoral competition. Low productive firms are able to survive in a weak competition environment and charge higher prices. Under optimal allocation of resources these firms would go bankrupt or higher competitive pressure would force to increase productivity.

Policy recommendations

Increasing global competition and technological advances force states to focus on high value-added sectors and to promote research and innovation. Unfortunately, Slovakia is significantly lagging behind in these areas (Charts 10 and 11). If Slovakia wants to compete globally, it must invest in the quality of human capital, support knowledge spillover, support the creation of companies in high added value sectors and increase the efficiency of public administration. In the near future, increasing global competition will put enormous pressure on efficient resource allocation and productivity growth.

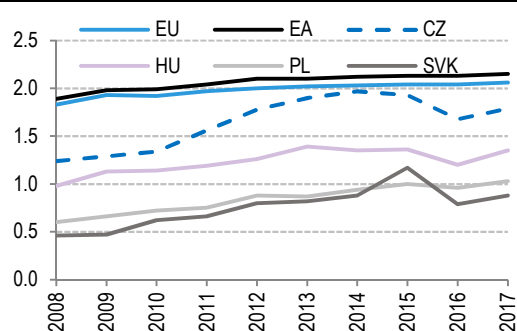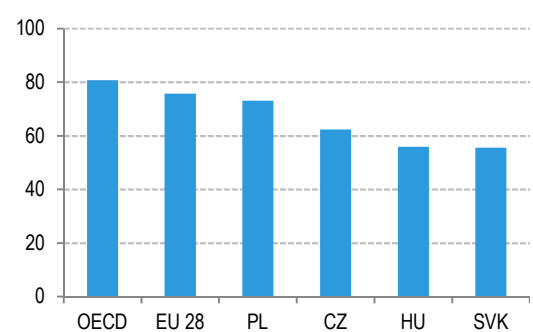Figure 10: R&D expenditure as a share of GDP, in %

Figure 11: Domestic value added share in total exports, in %

From the point of view of economic policy recommendations, the following should be taken into account when addressing the problems of allocative efficiency of the Slovak economy and low productivity of Slovak companies:

- **Removing barriers to the creation and dissolution of companies,** especially the reduction of time and number of procedures for establishing a company.

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[16] Mark-ups calculated as in De Loecker, Eckhout (2018). Global Market Power. Mark-ups measure internal (product quality) as well as external characteristics (changes in preferences or demand).
[17] Holds for TFP. Mark-up growth does not affect labor productivity.

According to the latest Doing Business 2019 report, Slovakia ranks as the 127th (out of 190) in terms of the ease of setting up and starting a business. The ranking is mainly worsened by administrative and time-consuming nature of starting a business. The minimum amount of starting capital is also relatively high. On the contrary, the level of administrative fees is relatively lower. Efficient allocation of resources can be ensured by the rapid disappearance of non-productive firms and the by creation of favourable conditions for the smooth start-up of young businesses.

- **Reviewing regulation and various legislative measures that directly or indirectly limit the size of businesses.** Nowadays, several hundreds of generally binding legal regulations regulate the business of companies and a large part of them is linked to specific size criteria. Regulatory policy set in this way can have a negative impact on business growth. The artificial concentration of companies in several size categories to avoid additional regulation negatively affects the effective allocation of production factors.[18] Compared to Germany, Slovakia has a very low share of companies in the category of 10 to 250 employees (2.9% vs. 17.6%). Thus, Slovakia lacks an important group of small, respectively medium-sized companies

- **Ensure high quality education and better skills acquisition.** A skilled and educated workforce not only positively affects labour productivity, but also increases employment chances, thus reducing frictions (barriers) in the labour market.[19] It is necessary to link practice with education and to adapt the education system to the new needs of the labor market (emphasis on digital skills, higher number of engineering professions and support young entrepreneurship). The OECD (2019) also recommends higher spending on higher education, increased participation of pupils in dual education or improved salary conditions for teachers.

- **Promote labour mobility**. In Slovakia, low regional mobility is one of the sources of labour shortage. In an international comparison, Slovaks move much less to work than in neighbouring EU countries (OECD 2017).[20] The flexibility and mobility of the workforce leads to a more efficient allocation of labour among firms and creates better working opportunities for the economically active population.[21] Regional mobility is also significantly affected by the housing market. While housing ownership has a negative impact on mobility, the availability of rental housing increases it. Measures to support the construction of rental apartments or introduction of housing allowances for working population will improve the accessibility of housing and increase labour mobility.

- **In In the area of investment aid, it would be appropriate to expand the apparatus of the instruments provided.** In addition to tax reliefs or subsidies for the acquisition of fixed assets, the Government could make returnable forms of aid (loans) more

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[18] E.g. entrepreneur employing 3 employees must ensure the payment of license fees, when employing 6 persons the entrepreneur has to fulfil all obligations connected with fire protection, for 11 employees the entrepreneur is obliged to elaborate a policy of health and safety at work, from 20 employees the entrepreneur must employ persons with health disability (or to make a compulsory levy for not employing such persons), for 30 employees, the auditor must verify his or her accounts, etc.

[19] Data from the Labour Force Survey for the fourth quarter of 2018 shows that number of short-term unemployed jobseekers (up to 12 months) with a university degree is 6 times less compared to the other unemployed. In the case of long-term unemployment, the number of university-educated applicants is up to 14 times lower (6325 universities compared to 91 438). Short-term unemployment among university-educated applicants also declines significantly more rapidly after 5 to 6 months of unemployment.

[20] OECD statistics. Regional statistics. Inter-regional migration.

[21] For example about 25 thousand foreigners were employed in Slovakia in 2017 and 2018 (almost exclusively in the western regions with low unemployment). During the same period, on the other hand, only 3 thousand people from Eastern and Central Slovakia (regions Košice, Prešov and Banská Bystrica) were employed in the west (regions Bratislava, Trnava and Nitra).

attractive. Such policy instruments could be used to acquire new technology or to help firms to expand onto new foreign markets. Slovak companies are mostly smaller, less productive and less capital intensive than foreign ones. The promotion of technological innovation should be followed by the elimination of protection from international competition, thus creating additional pressure on productivity growth (especially in services). Research and development should also be supported by stronger cooperation of companies with research institutes or universities.

- **Increase the efficiency of the courts and shorten commercial proceedings**. Since 2011, the average length of business proceedings has been extended by almost 8 months and has an upward trend. Rule of law is an important factor affecting the quality of the business environment. Slow resolution of business disputes between companies is another market friction that Slovak companies face. Long proceedings create additional costs for companies, and for some companies late payment of the invoice and subsequent litigation may be financially very burdensome.

Box 1: Model Hsieh, Klenow (2009) - Misallocation and manufacturing TFP in China and India (HK model)

Introduction:

The theoretical model of C. T. Hsieh and P. Klenow is one of the most widely used tools to evaluate adequacy of distribution of nation's resources. The main features of the model are :

- it relies on simple economic assumptions (constant returns to scale, constant elasticity of substitution and monopolistic competition)
- it is based on firm-level data
- identifying misallocation of resources is based on comparing distributions of nominal (revenue) and real total factor productivities

The main idea behind the model is that wide dispersion of nominal firm productivities (TFPR) is a sign of ineffectively allocated resources. In sectors with very heterogeneous firms (high variance of nominal productivities), it is optimal to "take" capital and labor from unproductive firms and "reallocate" them to productive ones. This is believed to raise aggregate output and productivity which is beneficial for the economy.

The model also identifies the so called "distortions" that affect firm's marginal products of capital and labor. These distortions then cause dispersion in productivities. Therefore elimination of such distortions will equate productivities among all firms in a given sector and bring about raise in productivity.

The list of policies that may generate firm-level distortions is long and varied. For instance, non-competitive banking systems may offer favourable interest rates on loans to some producers based on non-economic factors, leading to a misallocation of credit across firms. Or financial institutions may be unable or unwilling to provide credit to firms that are highly productive but have no credit history or insufficient guarantees, preventing these firms from expanding their activities. Governments may offer subsidies, special tax deals, foreign competition protection or lucrative contracts to specific producers or whole sectors (this may arise not only from government discretion but also from lobbying). Various product and labour-market regulations may drive up the cost of labour in the formal vis-a-vis the informal sector, or in big versus small firms, or drive down the cost of capital in small firms (through special lines of credit). Enforcement activity of tax collection may focus on large and most productive firms implying a subsidy to small potentially less productive ones. Besides distortions on the prices of inputs, wedges may also be interpreted as a stand-in for all of the costs of hiring factors beyond the market price of the factor itself (frictions). Thus, they may also capture the presence of adjustment costs to varying factors or the effect of rationing due to quantity restrictions (Dias et al., 2015).

Data, parametrization and methodology

In order to evaluate (mis)allocation of capital and labor in Slovakia we use detailed firm-level database compiled by Finstat s.r.o. and from the Registry of Financial Statements. We use data on sales, value added, intermediate consumption, capital and number of employees to calculate nominal and real TFP. Price of capital is set to be the average interest rate on loans to non-financial sector (excluding households) as the NBS reports it. Depreciation of capital is set to 5 % per year.

Elasticity of substitution between goods for all sectors is set to 3 as in the original model. In the literature it is common to use labour and capital shares from the USA e.g. from the NBER-CES Manufacturing Database or the Bureau of Economic Analysis. **This is one of the key aspects of the model. In order to calculate the hypothetical increase in productivity with the optimal allocation of resources, the share**

of wages and income from capital must be taken from the economy with the least allocation inefficiency. For Slovakia we use German data from the Eurostat. German factor shares represent our preferred specification because the sectoral classifications are the same as in Slovakia. Also Germany is a major trading partner for Slovakia and globally belongs among the most competitive economies. We consider German economy to be more relevant because American economy is significantly different in structure than the Slovak one. [22]

Public sector, finance and real estate are excluded from the analysis. For the purpose of the analysis sectors are defined at 4-digit NACE Rev. 2 level. Sectors with less than 10 observations are not taken into account. In order to not have the analysis sensitive to outliers we group all firms in a given year and trim the top and bottom 1% of productivity distribution.

We work with three-factor Cobb-Douglass production function (capital, labor, intermediate inputs) as in (Dias et al., 2015) but we abstract from output distortion.

With firm-level data in hand we calculate factors that cause the inefficient allocation and "eliminate" them. We then recalculate TFP in the economy where these negative determinants are eliminated (efficient TFP). Finally we calculate TFP gains that stem from optimal allocation of resources by dividing the optimal efficient TFP with the real observed TFP in a given sector-year pair (sector s and year t). We focus our analysis on the manufacturing sector and on the whole economy.

$$TFP \ gain_{s,t} = \left(\frac{TFP_{s,t}^{efficient}}{TFP_{s,t}^{observed}} - 1 \right) * 100$$

Although the HK model is one of the most widely used, it has also become a centre of strong criticism. See Haltiwanger et al. (2018) or Bils et al. (2018) for criticizing model assumptions and conclusions. E.g. Haltiwanger et al. (2018) show that variations in nominal productivity may also be due to changes in the demand for the company's products and may not only reflect market barriers (distortions). Bills et al. (2018) argue that if measurement errors (if any) are taken into account, an inefficient allocation can be overestimated by up to half. It is therefore important to interpret the results with caution. Despite the above, the model identifies significant shortcomings in the allocation of resources in the Slovak economy. Therefore, the model clearly demonstrated the potential for productivity gains.

Box 2: Determinants of firm level TFP(R)

A variety of econometric models have been used to estimate firm productivity and its determinants:

- **For the calculation of firm TFPR we have used the so-called control function approach.** It is a special type of regression analysis that correctly estimates firm production function taking into account endogeneity of productivity shocks and demand for inputs. The production function is modelled as a Cobb-Douglas production function with three production factors (labor[23], tangible capital and intermediate consumption). Estimation of production

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functions was performed for each 3-digit NACE sector separately. Sectors with less than 100 observations have not been taken into account. The panel covers years between 2004 and 2017.

- **Determinants affecting the growth of TFPR were estimated by panel regression with fixed effects.** The main variables of interest were ownership, the size and growth of firm mark-ups, the share of intangible assets in total assets, the proportion of university-educated workers, the share of part-time employees, the impact of regulation, participation in active labour market policies, the amount of EU funds received or public procurement. All specifications have also taken into account the extent to which growth of TFPR of top 10 % firms in the sector and the 'production' distance from these firms have an impact on productivity growth. The estimate covers the panel of companies between 2010 and 2016.

- **Determinants affecting TFPR and labour productivity were estimated by linear regression with average values over 2014 to 2017.** All relevant firm level variables were averaged and the effect of the same variables was estimated as in the TFPR growth analysis.

The results of the regressions are shown in a separate Annex 4.

Annex 1: TFP gains in manufacturing

Original HK methodology was applied only to manufacturing. If manufacturing was the only sector in the economy potential TFP gains would reach 6 %. If we apply the model to all firms including small firms with less than 10 employees, TFP gains would reach 70 to 105 %. We would therefore again emphasize the fact of large share of small firms with low allocative efficiency.

Figure I: TFP gains in % in manufacturing, firms with 10 and more employees (factor shares defined at 2-digit NACE codes)[24]
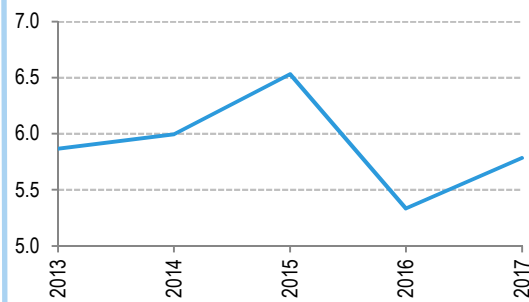
Figure II: TFP gains in manufacturing, including small firms (factor shares defined at NACE 4-digit level, in %)
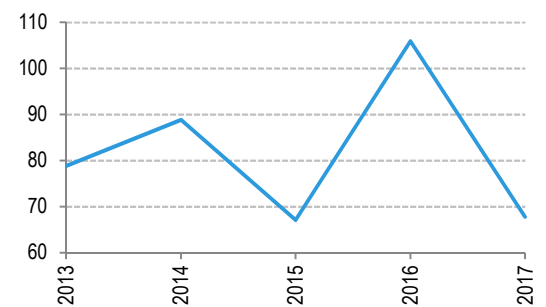
Source: Own calculations based on the HK model

Annex 2: Productivity evolution in manufacturing and services, base year 2010

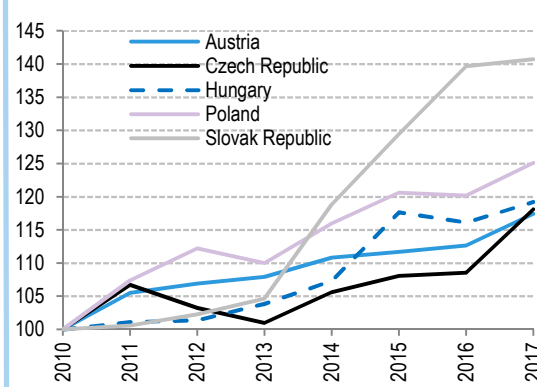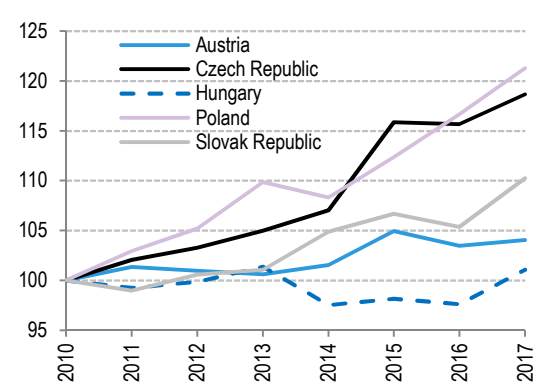Figure III: Productivity growth in manufacturing, V4 + Austria comparison, 2010=100

Figure IV: Productivity growth in business services[25], V4 + Austria comparison, 2010=100

Annex 3: Example of the division of NACE sector codes

- Sector C - Industrial production (manufacturing)
- 2-digit NACE code 29 - Manufacture of motor vehicles, semi-trailers and trailers
- 3-digit NACE code 293 - Manufacture of parts and accessories for motor vehicles
- 4-digit NACE code 2931 - Manufacture of electrical and electronic equipment for motor vehicles

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[24] Results based on the fact that manufacturing is the only sector in the economy (holds also for Figure II).
[25] Real estate excluded.