NATIONAL RESEARCH UNIVERSITY
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SOURCES OF LONG RUN ECONOMIC GROWTH OF THE RUSSIAN ECONOMY BEFORE AND AFTER THE GLOBAL FINANCIAL CRISIS

BASIC RESEARCH PROGRAM
WORKING PAPERS

SERIES: ECONOMICS
WP BRP 179/EC/2017

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SOURCES OF LONG RUN ECONOMIC GROWTH OF THE RUSSIAN ECONOMY BEFORE AND AFTER THE GLOBAL FINANCIAL CRISIS

Although a productivity slowdown of the global economy was observed before 2008, it was the 2008 crisis that stimulated studies on its origins. Recent literature suggests inefficient investments in machinery, human capital and organizational processes. This includes skill mismatches and a lack of technology diffusion from advanced to laggard industries and firms. To what extent is this global view helpful in understanding recent productivity slowdown of the Russian economy?

The present study reports that at least some of these origins can be observed in Russia. Using conventional industry growth accounting, it compares the pre- and post-crisis sources of growth in the Russian economy. Specifically, it represents aggregate labour productivity growth as the sum of capital deepening and total factor productivity (TFP) growth in industries, and the contribution of labour reallocation between industries. It shows that the stagnation of 2008-2014 is more an outcome of the TFP slowdown and a deterioration of the allocation of labour rather than a lack of capital inputs. The TFP slowdown started in Russia a few years before the crisis, as in other major global economies, such as OECD countries, China and Brazil. Russia demonstrated relatively stable capital deepening makes the Russian pattern similar to resource abundant Australia and Canada. Next, the contribution of information and communication capital to labour productivity growth in Russia after 2008 declined, which could have hampered technology diffusion. Finally the structure of the flow of capital services in Russia changed after 2008. Before the crisis the contribution of machinery and equipment dominated, while after the crisis construction provided the most capital inputs.

JEL: O47; O57

Keywords: Russia, industry growth accounting, global financial crisis, World KLEMS

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1. Introduction

Although the productivity slowdown of the world economy was observed and documented before 2008, it is the crisis itself that fuelled debates on its sources and its economic nature (McGowan, Andrews, & Nicoletti, 2015). Van Ark et al. (2015) summarize the causes of this global slowdown as inefficient investments in machinery, human capital and organizational processes. This can include the skill mismatches and a lack of technology diffusion from advanced to laggard firms. To what extent is this global view helpful in understanding the productivity slowdown in Russia?

The present paper considers the post-transition and resource abundant Russia and compares the pre- and post-crisis productivity patterns. The standard tool kit of Solow (1957) and Jorgenson et al. (1987; 2005) to answer these questions is industry growth accounting decomposition, which represents output growth rates as the sum of contributions of *proximate* sources of growth – labour, capital and total factor productivity (TFP). The latter characterises the ability of an economy to diminish real costs of production. Much of the current literature on the growth accounting of the Russian economy at the macro level pays particular attention to TFP as the main source of growth. Using various sources of data on labour and capital[2], paying special attention to such measurement aspects as capacity utilization (Entov & Lugovoy, 2013), terms of trade (Kaitila, 2016) or taking into account its natural capital (Brandt, Schreyer, & Zipper, 2016), it points to TFP as the main driver of Russian growth. Recent studies of this strand of the literature also report the productivity slowdown after 2008 (Timmer & Voskoboynikov, 2016; World Bank, 2017), which can reflect the impact of both global and country-specific factors.

So far, however, there has been little discussion of the changes in these proximate sources of the long run growth of the Russian economy after the global crisis of 2008 in the comparative perspective. The study aims to fill this gap using the update of the Russia KLEMS dataset, released in March 2017 (Russia KLEMS, 2017).

The present study reports that at least some of the origins of the global slowdown can be observed in Russia, comparing the pre- and post-crisis sources of growth of the Russian economy. Specifically, it represents aggregate labour productivity growth as the sum of capital deepening and TFP growth in industries, and the contribution of labour reallocation between industries. It shows that the stagnation of 2009-2014 is more the outcome of a TFP slowdown and the deterioration of the allocation of labour rather than a lack of capital inputs. Moreover, it was found that the TFP slowdown started in Russia a few years before the crisis, as in major global economies, such as

[2] See literature review in (Timmer & Voskoboynikov, 2016)

OECD countries, China and Brazil. At the same time, relatively stable capital deepening makes the Russian pattern similar to resource abundant Australia and Canada, which raised investments in the mining sector in response to the capital intensive boom in China and India (McGowan et al., 2015). Next, the contribution of ICT capital to labour productivity growth in Russia after 2008 declined, which hampers technology diffusion. Finally the structure of capital services in Russia changed after 2008. Before the crisis the contribution of machinery and equipment dominated, while after the crisis constructions and infrastructure provided the most capital inputs.

The paper is structured as follows. The second section provides a short description of the data and the industry-level growth accounting approach. The third section summarizes the main results, starting from the aggregate view of sources of growth of the global economy in the long run (subsection 3.1), then proceeds with the impact of labour reallocation in comparison with the intra-industry sources of labour productivity growth after 1995 (3.2), and then develops the sectorial structure of capital intensity and TFP (3.3). The fourth section summarizes and concludes.

2. Data and Approach

There are two main sources of data for the present study. The first is the Conference Board Total Economy Database™ (TED).[3] TED is a comprehensive database with annual data covering Gross Domestic Product (GDP), population, employment, hours, labour quality, capital services, labour productivity, and TFP for 123 countries, including Russia, at the total economy level. For most countries the TED productivity series start from 1950. For Russia they are available from 1961 for GDP per worker and from 1992 for GDP per hour worked. TED provides data for the representation of labour productivity growth $\Delta \ln z$, where labour productivity is defined as the ratio of real value added and hours worked ($z = Z/H$), as the sum of the contributions of capital intensity (the flow of capital services per hour worked, $k = K/H$), labour composition effect (LQ) and TFP growth rate ($\Delta \ln A$) (Vries & Erumban, 2016, pp. 16–18):

$$(1) \qquad \Delta \ln z = \bar{s}_K \Delta \ln k + \bar{s}_L \Delta \ln LQ + \Delta \ln A,$$

where $\bar{s}$ are yearly averaged shares of capital (K) and labour (L) compensation in value added.

[3] The dataset is available at https://www.conference-board.org/data/economydatabase/index.cfm?id=27762 . Detailed methodology description is provided by de Vries and Erumban (2016).

TED is based on national accounts from the official sources, such international sources as OECD or UN, and in some cases on alternative estimations in academic publications. For example, for China two sets of the series are present, the official and the alternative one. This reflects debates in the literature on the reliability of the official statistics for China.[4] For Russia TED uses official real GDP series, starting from 1990. For years before 1990 the real GDP series employ data of Kuboniwa and Ponomarenko (2000) and Ponomarenko (2002).

Next, for comparisons of GDP levels across countries purchasing power parities (PPP) are used in TED. Unless otherwise stated, I use the GDP series in constant 1990 US dollars converted at Geary Khamis PPPs from the TED release of June 2015.

The second source is the Russia KLEMS dataset (Russia KLEMS, 2017). It includes the dynamic series of value added, hours worked, labour and capital shares, and capital services for 34 industries in the industrial classicisation NACE 1 starting from 1995. The dataset is nearly consistent with the official Russian National Accounts at the aggregate level for the whole period, and at the level of industries starting from 2005. It is also harmonized with similar datasets for other countries within the World KLEMS framework, which makes possible comparisons between countries at the level of industries. A more detailed description of the dataset and its construction can be found in (Voskoboynikov, 2012).

TED and Russia KLEMS are partially consistent. They use the same Solow-Jorgenson growth accounting framework. Moreover, starting from 2016 TED uses Russia KLEMS as one of the sources of its Russian segment (Vries & Erumban, 2016, p. 21). Regarding employment in Russia, TED uses the Russian labor force survey, which leads to an upward bias in labour productivity levels.[5] Russia KLEMS data uses employment series, which cover the whole economy within the SNA production frontier.

$$(2)\qquad \Delta \ln z = \sum_j \bar{v}_{Z,j}^{GDP} \cdot \Delta \ln z_j + \left(\sum_j \bar{v}_{Z,j}^{GDP} \cdot \Delta \ln H_j - \Delta \ln H\right) =$$

$$= \sum_j \bar{v}_{Z,j}^{GDP} \cdot \Delta \ln z_j + R =$$

$$= \sum_j \bar{v}_{Z,j}^{GDP} \cdot \bar{v}_{K,j}^{Z} \Delta \, ln \, k_j + \sum_j \bar{v}_{Z,j}^{GDP} \cdot \Delta \, ln \, A_j + R,$$

[4] Unless otherwise stated, the alternative set for China is used in this paper.

[5] In 2005-2011 the number of hours worked in TED is lower than in the balance of labour inputs, which is harmonized with GDP, by 6.3% - 8.2%.

where $\bar{v}_{Z,j}^{GDP}$ is the annual average share of industry *j* in total value added, and $\bar{v}_{K,j}^{Z}$ is the annual average capital share in value added of industry *j*. The reallocation term *R* captures changes in labour productivity growth caused by the difference of the share of an industry in value added and hours worked. It is positive if industries with an above average share of value added show positive growth of employment shares.

3. Results and discussion

3.1. Long run growth of the Russian economy in the comparative perspective

The labour productivity of the global economy accelerated from early 1990s until the eve of the crisis (Figure 1a) fuelled by the intensive development of emerging economies and partially offset by OECD countries. However, productivity trends in the post-crisis period changed. Labour productivity in emerging economies continued growing at a moderate annual pace of 2-3%, while in OECD countries it dropped below 1%. Comparing the dynamics of labour productivity (Figure 1a) and TFP (Figure 1b) it is possible to see the role of capital deepening in the post-crisis labour productivity slowdown, which was strong in emerging economies and negligible in the OECD zone. Overall, the global economy after 2008 demonstrates low TFP growth. In other words, the impact of efficiency improvements, which include management and organization of production processes, R&D and innovation, was lower than in previous decades (McGowan et al., 2015).

[Figure 1. Global labour productivity growth since 1990 is about here]

Figures 1c and 1d zoom in on productivity growth patterns, presenting the largest emerging economies, including Russia. The fact that the labour productivity slowdown in emerging economies was not as deep as in the OECD area is confirmed by the patterns of all members of the BRIC club, except India. China demonstrates relatively stable labour productivity growth after 2008 (Figure 1c) and a fall in TFP (Figure 1d).[6] To a lesser degree this is applicable to Brazil and Russia. The case of Russia is also presented in Figure 2 by the growth rates of labour productivity and its components, TFP and capital deepening. The figure shows that the relatively stable labour productivity growth rates 2003-2008 masked the slowdown in TFP against the acceleration of capital deepening. Moreover, the possible impact of the global crisis of 2008 was more serious for TFP than for labour productivity because the rate of capital deepening remained stable and varied

[6] See more about TFP slowdown in China in (Wu, 2016).

around 5%. Finally, as follows from Figure 2, this pattern differs from the experience of the transformational recession and early recovery of 1995-2002, which were characterized by negative growth rates of capital intensity.

[Figure 2. Growth of labour productivity, capital deepening and TFP in the market sector of the Russian economy in 1995-2014]

There are three important points for the Russian economy which can be derived from these preliminary observations. First, the slowdown of labour productivity growth is driven mostly by the fall of TFP. Second, the fall of TFP is observed not only in Russia, but in most of the leading economies of the world. Finally, this TFP slowdown started before 2008 both in Russia and in many major economies, and its roots can be found not only in the specific features of the Russian economy, but also in long run trends of global development. The crisis of 2008 could also have contributed to this stagnation and accelerate the TFP fall.

In what follows I consider all of these three issues, starting from the long run global productivity pattern of major economies in terms of the convergence theory (Acemoglu, Aghion, & Zilibotti, 2006).

[Figure 3. Labour productivity performance in the long run]

The long run comparative perspective of labour productivity trends since 1950 are presented in Figure 3.[7] This long time span is split into four sub-periods in line with structural breaks of the US productivity pattern (see, for example, Fernald (2015)). Figure 3a represents annual labour productivity growth rates of leading *market* economies and economic regions, while Figure 3c shows productivity levels of these countries and regions relative to the United States and ranked by their initial (1950) productivity gaps. Figures 3a and 3c provide evidence that most of the regions match the conditional convergence pattern 1950-1995. Economies with an initial labour productivity level below the United States grew faster. This can be explained by the recovery process after the Second World War and the technology catch-up in Old Europe (Crafts & Toniolo, 2010). There are also exceptions, such as Latin America, which confirm that convergence does not always occur. This observation is also applicable to countries of the Socialist camp.

[7] Analyzing the conditional convergence of major market economies and regions I follow McGowan et al. (2015, pp. 21–23).

The economies of Central and Eastern Europe (CEE) were also involved in the recovery after the Second World War. For example, the convergence pattern can be seen for Poland, Hungary, Albania and Romania in 1950-1974 (Figure 3 b and d). However, as Crafts and Toniolo (2010) point out, convergence in the Socialist camp before the early 1970s was less sound, and even worse in the decades before the collapse of the Socialist system in early 1990s. Both the CEE economies and the Soviet Union, being on average below the US level in comparison with Old Europe, failed to catch up before 1990. The main cause of this was a lack of incentive to adapt new technologies and use them to make production more efficient. Further, the transformational recession in some of these economies (e.g. Russia and the Czech Republic in Figure 3d) extended the gap in 1995 relative to 1990. Summing up, on the eve of the transition, the technological backwardness of CEE economies and Russia remained a serious obstacle for sustainable development. The years after transition included both a transformational recession and a catch-up with the West (Havlik, Leitner, & Stehrer, 2012).

McGowan et al. (2015, p. 21) noted that the process of convergence in the global economy halted after 1995 for two main reasons. First, as economies approach the technology frontier, the importance of their ability to adopt innovations increases. Second, the biggest innovations of 1995-2004 were in ICT. The nature of ICT is "winner take all", which helps the leaders in the technology sphere increase their lead. The pattern of post-transition economies (Figure 3d) reflects not only the global impact of ICT, but also the post-transition recovery and catch-up due to the elimination of multiple imbalances and distortions of the planned economy period.

By 2004 the benefits of the global diffusion of ICT and the post-transition recovery potential in CEEs and Russia began to wane. This can explain the slowdown of labour productivity and TFP growth in different regions of world, including Russia, represented in Figures 1-3. This raises the issue of the ability of different regions of the world in general, and Russia in particular, to adopt new technologies and allocate resources efficiently at the present time, which is characterized by a broad-based decline of the contribution of labour composition; the slowdown of capital deepening (excluding such natural resource abundant countries as Australia, Canada, and also China and India); and the contraction of TFP (excluding Korea, Japan and India). Equally important, the global financial crisis of 2008 itself can have longer run productivity consequences, such as the fall of tangible investments, the impact on investments in knowledge-based and human capital, and on labour reallocation (McGowan et al., 2015, pp. 24–32).

In this context, there are three potential explanations of this post-crisis stagnation in Russia. The first is the global productivity slowdown. Second is the structural transformation of the Russian economy, from the sectors of material production, overinvested in before transition, to

market services. Using Baumol's terminology, such a structural change can shift activities from progressive manufacturing to stagnant services (Baumol, Blackman, & Wolff, 1985). Finally, the slowdown can be rooted in the fall of oil and gas revenues after the fall of oil prices in the late 2000s. Further analysis of the proximate sources of growth can help clarify which of the three explanations will be born out by the evidence.

3.2. Aggregate growth, structural change and labour reallocation in Russia since 1995

The economic structure of command economies was unbalanced in favour of manufacturing and agriculture. That is why the extension of market services and shrinking manufacturing was one of a few basic facts, common for all economies in transition (Campos & Coricelli, 2002). Russia is no exception. Table 1 reports changes in the shares of value added in major sectors of the Russian economy. The share of agriculture and manufacturing shrank from 30% in 1995 to 19% in 2014, which could reflect the comparative disadvantages of Russian manufacturing in comparison with its main trading partners, reported by Garanina (2009). At the same time, finance and business services, including retail, construction, telecom and hotels, expanded from 24% to 31%. In contrast with many other post-transition economies, Russia is a resource exporting country. The growth of global oil prices after 1999 led to the remarkable extension of its mining and mining-related industries, combined in the table in the sector "Oil, Gas and Wholesale trade"[8], from 20% in 1995 to almost a quarter in 2014. The increasing role of the extended mining and services predetermines the leading contribution of these sectors to aggregate growth.

[Table 1. Aggregate GDP Growth and Structural Change in 1995-2014]

Table 1 also provides summary statistics for sectoral growth rates and contributions. Finance and business services demonstrate the best performance with yearly average growth rates of 8.4%. However, its contribution is a more modest 0.7 p.p., giving place to oil and gas, and market services (RCT) sectors, because the average share of the finance industry is only 8.6% (0.7 = 8.41 ×

[8] The true size of mining in the Russian economy and its contribution to economic growth were widely discussed in the literature (see, e.g., (Gurvich, 2004)). An extended oil and gas sector includes organizations, which are involved in the process of extraction, transportation and wholesale trade of oil and gas. Some of them have establishments in different industries, such as mining, wholesale trade, fuel and pipeline transport. Because of strong vertical integration and transfer pricing its share in total value added exceeds mining. Following Timmer and Voskoboynikov (2016) the present study assumes that all this extended mining sector includes mining, wholesale trade and fuel. At the same time, I recognize limitations of this split. On the one hand, many firms in wholesale trade are not related with energy exports. On the other hand, some pipeline transportation organizations fall within transport in sector "market services".

½ × (5.1%+12.0%)). These three sectors provide the most real value added growth, while the role of traditional industries of material production is relatively modest. Agriculture and manufacturing contribute only 0.5 p.p. of the 3.5% aggregate growth.

The periods for the comparative analysis are important, because short term changes in input utilization can bias TFP estimations (Hulten, 1986). Realizing this, I opted for years of sub-periods, which are neither the trough, nor the peak of the cycle. The first year in question is 1995, which belongs to the period of the transformational recession. 2002 is one of the first recovery years after the financial crisis of 1998. Finally, 2007 is the eve of the global financial crisis, which can be considered as the final point of the recovery period. In all cases these years did not belong to local minimum points of capital capacity utilization for Russian manufacturing (Bessonov, 2004; Galimov, Gnidchenko, Mikheeva, Rybalka, & Salnikov, 2017).

[Table 2. Growth accounting decomposition of the market sector of the Russian economy in 1995-2014]

Table 2 presents major sources of economic growth of the market sector of the economy in these three periods. What stands out is the remarkable difference in the structure of these sources. While early in the transition (1995-2002) growth was intensive with TFP providing two-thirds of labour productivity growth, in the stagnation period (2007-2014) TFP fall and growth was driven by inputs. Another remarkable difference is the role of capital services. In years of early transition the shortage of capital can be seen at the aggregate level in the form of the negative growth of capital intensity. Both in the recovery (2002-2007) and in the post-crisis stagnation (2007-2014) capital intensity was the key growth driver. Next, machinery and equipment provided the highest contribution in the recovery period, while constructions dominated in years of stagnation. The contribution of the ICT capital became smaller.[9] This could reflect the global tendency that, starting from mid-2000s, ICT does not drive labour productivity growth anymore. Moreover, McGowan et al. (2015) point out that the slowdown of ICT capital, as a component of the so-called knowledge-based capital, can influence TFP negatively by diminishing technology diffusion. Finally, labour reallocation, being one of the most important growth factors early in the transition, slowed down

[9] It is important to note here that estimations of ICT capital are rough, because it is sensitive to quality change in investment deflators, which have not been adapted in the official statistics yet and not taken into account in Russia KLEMS data.

and disappeared during the years of stagnation, which can illustrate both the end of the transition and the worsening of labour mobility in years following the global crisis.[10]

I suggest two different explanations for this. The contribution of structural change to labour productivity growth, which is also referred to as a structural bonus, is higher in economies with higher initial variation of labour productivity levels across industries. In developed economies this variation is usually small and the structural bonus is also marginal, while in developing economies it can be substantial. From this perspective, being industrialized, the CEE economies and Russia did not have much room for the structural bonus. It follows from the fact that in 1995 the variation coefficients of labour productivity levels in industries were significantly lower in CEE and Russia than in market economies with a similar level of development (Timmer & Voskoboynikov, 2016). The second explanation comes from the observation that structural change in post-transition countries shifts the structure of these economies to services. In turn, long run productivity growth in services can be lower than in, say, manufacturing (Baumol et al., 1985). That is why the expansion of services can lead to the slowdown of the aggregate labour productivity growth (the Baumol effect). However, both in Russia and in the post-transition economies of CEE the Baumol effect, being negative, is cancelled out by labour reallocation to industries with higher productivity levels (the Denison effect) (Voskoboynikov, 2018).

Taken together, the results of this section suggest that the influence of structural change on aggregate labour productivity growth is more sophisticated than might be expected from decomposition (2). The relatively small contribution of reallocation can be the net effect of two different phenomena, the Denison effect and the Baumol effect, which work in different directions and cancel each other out. These opposing contributions of the two types of labour reallocation are common for all post-transition economies. Finally, the expansion of informality also weakens growth enhancing structural change (Voskoboynikov, 2017).

However, the main conclusion of the aggregate shift share analysis remains unchanged. Namely, intra-industry sources of productivity growth are stronger than the reallocation effects. In what follows I consider these sources in detail, paying special attention to the proximate sources of labour productivity growth in industries and the sectoral contribution of capital services and TFP to the aggregate.

[10] We overlook labour reallocation within industries and between firms. At the same time, considering CEE economies, Kuusk et al. (2017) demonstrated that labour reallocation within industries are dominant in comparison with the inter-industry reallocation.

3.3. Labour productivity slowdown in industries after 2008: lack of capital or efficiency loss?

The sources of intra-industry labour productivity growth include the accumulation of human and physical capital, intangible assets, and TFP. The latter is usually interpreted as the outcome of technological change, but could be also explained by temporary disequilibrium caused by the delayed reaction to technological changes in previous periods, terms of trade, low mobility of labour and capital, as well as various competitive barriers (Reinsdorf, 2015).

The growth accounting decomposition of the market sector of the economy sheds light on the differences in the proximate sources of growth before and after 2008. Table 2 shows that the fundamental change, which explains the fall, is the role of TFP. In 2002-2007, TFP contributed 4.2 p.p. of the total 7.1 p.p. of aggregate labour productivity growth, while in the following years its contribution became negative and the dropped by 5.6 p.p. from 4.2 p.p. to -1.4 p.p. In other words, the sharp decline of TFP growth rates can fully explain the fall of aggregate labour productivity growth. Nevertheless, it is worth mentioning other factors. The slowdown of labour productivity was not as sharp as real value added, because the employment trend also changed negatively by -1.1 p.p. Surprisingly, capital deepening accelerated by 0.7 p.p. in the years of stagnation. This makes the Russian pattern in some degree similar to resource abundant Australia and Canada. McGowan et al. (2015, p. 24) point out that these two economies raised investments in the mining sector, responding to the capital intensive boom in China and India. The positive contribution of capital deepening then cancelled the negative influence of labour reallocation. Finally, the relatively stable capital deepening masks substantial changes in its structure (see, e.g., Berezinskaya (2017)). While before 2008 machinery provided the most growth, after 2008 its contribution came down by 0.3 p.p., which is lower than the contribution of constructions. All in all, the extensive, capital deepening-driven component of labour productivity growth has become dominant after the crisis.

The level of industries, represented in Appendices A2 and A3, adds more details to the picture. Before 2008 labour productivity in most industries grew because of TFP. Remarkable exceptions were two industries of the extended oil and gas sector, which are mining and fuel, and post, telecom, utilities and transportation services. In contrast, after 2008 only a few industries remained intensive: agriculture, machinery, rubber & plastics, transport equipment, textile and water transport.

[Figure 4. Sectoral structure of aggregate TFP growth]

The analysis of sectoral components and the contribution of different types of assets might be helpful in understanding the origins of this labour productivity decline. Figure 4 shows that the TFP fall happened mostly because of efficiency losses in the oil and gas sector. Taking into account industry-level patterns of productivity growth (Appendices A2 and A3) this could happen because of the TFP fall in wholesale trade only. Almost all other sectors are also in the negative zone. The only exception is agriculture, which demonstrates high TFP growth rates both before and after 2008.[11] Unfortunately, the value added share of agriculture is just above 4% (Table 1) and its contribution to the aggregate TFP growth is also negligible. Summing up, it seems that the sources of TFP growth (catching up in financial and business services, converging in manufacture) do not play a remarkable role in 2007-2014.

[Figure 5. Sectoral structure of aggregate capital intensity growth]

More attention is also expected, dealing with capital intensity. The transmission of oil and gas export revenues to the supply side sources of growth should be identified not only because of a substantial capital contribution at the aggregate level, but also in the sectoral composition of the aggregate capital input. It is confirmed by the data reported in Figure 5. The extended oil and gas sector demonstrates the second largest yearly average contribution among sectors of the market economy in 2002-2007. It contributes almost one quarter of the market economy capital intensity growth rates. Market services enjoyed the highest capital inflow. This is also not surprising. Large investments were made in retail, which was underdeveloped in early transition. McKinsey (1999, p. 5, 2009, p. 65) reports that by 1999 only 1% of retail occurred in modern supermarkets, while in 2009 this share increased to 35%. Huge investments were made in telecommunications both because of its technological backwardness in the planned economy period and the IT revolution. Last, but not least, financial and business services also expanded during these years.

[Figure 6. Contributions of types of assets to aggregate capital intensity growth]

Finally, Figure 6 illustrates changes in the contribution of different types of assets to labour productivity growth. In 1995-2002 capital deepening was negative despite the substantial labour outflow. In contrast, in the post-crisis recovery years, capital intensity grew mostly because of

[11] The substantial increase of productivity in agriculture seems to be common for former Soviet republics after transition (Swinnen & Vranken, 2010).

contributions of oil and gas, RCT and manufacturing. However, if RCT sector and oil and gas grew mostly because of the inflow of investment, capital intensity in manufacturing and agriculture grew also because of continuing labour outflow. Finally, in the period of stagnation capital intensity continues growing with the increasing role of oil and gas.

The structure of asset contributions to aggregate capital intensity, presented in Figure 6, also reflects, to a certain extent, the role of capital in industries. Machinery, the backbone of manufacturing, dominated before 2008, while construction, more relevant for oil and gas, plays a remarkable role in years of stagnation. This could reflect the fact that the slowdown of investment inflow after 2008 hit the contribution of machinery with short service lives more than long lived construction. As a result, the capital deepening acceleration in 2009 (Figure 2) could take place because of new construction projects, launched before the crisis and put into operation after 2008, and also the drop of hours worked during the crisis.

4. Conclusion

There are global factors, which accelerate and decelerate long-run productivity of national economies. After the Second World War such factors were the post-war recovery and technology catching up to the level of the United States. From the 1990s ICT picks up the slack. At present the key to sustainable productivity growth is the efficient reallocation of resources and an institutional environment which stimulates technology diffusion among firms, as summarized by McGowan et al. (2015).

The present study has established that from the supply side perspective, the recent stagnation 2009-2014 in the Russian economy is more the outcome of the TFP slowdown and the deterioration of labour allocation rather than a lack of capital inputs. Capital intensity continued growing, which makes the Russian pattern in some degree similar to resource abundant Australia and Canada. The contribution of ICT capital to labour productivity growth in Russia after 2008 declined, which could interfere technology diffusion.

This study has suggested considering the post-crisis stagnation of the Russian economy from a comparative perspective. This could shed new light on the causes of the stagnation, because at least some of them are global in nature.

Acknowledgements

The article was prepared within the framework of the Academic Fund Program at the National Research University Higher School of Economics (HSE) in 2017 (grant № 17-05-0035) and supported within the framework of a subsidy granted to the HSE by the Government of the Russian Federation for the implementation of the Global Competitiveness Program. Early versions of this paper were presented in the 18th International Academic Conference and the 2nd World Congress of

Comparative Economics at HSE, and in research seminars at HSE and the Bank of Finland Institute for Economies in Transition (BOFIT).

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Appendix

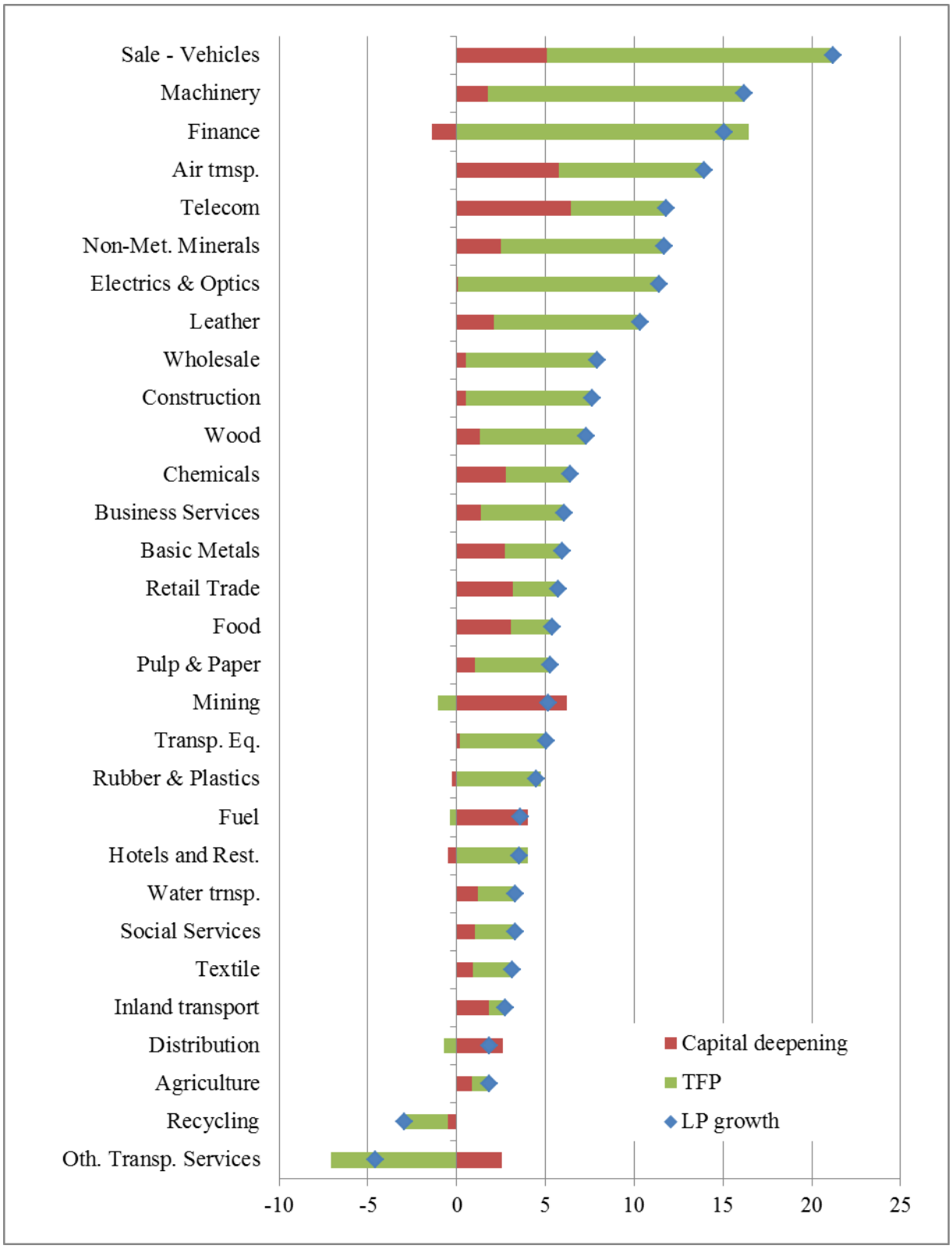
A1. List of industries and sectors

#	Code*	Industry, short	Industry, full	Sector	Aggregated Sector
1	AtB	Agriculture	Agriculture, hunting, forestry and fishing	Agriculture	Market economy
2	23	Fuel	Coke, refined petroleum products and nuclear fuel	Extended gas and oil	Market economy
3	C	Mining	Mining and quarrying	Extended gas and oil	Market economy
4	51	Wholesale	Wholesale trade and commission trade, except of motor vehicles and motorcycles	Extended gas and oil	Market economy
5	15t16	Food	Food products, beverages and tobacco	Manufacturing	Market economy
6	17t18	Textile	Textiles, textile products	Manufacturing	Market economy
7	19	Leather	Leather and footwear	Manufacturing	Market economy
8	20	Wood	Wood and products of wood and cork	Manufacturing	Market economy
9	21t22	Pulp & Paper	Pulp, paper, paper products, printing and publishing	Manufacturing	Market economy
10	24	Chemicals	Chemicals and chemical products	Manufacturing	Market economy
11	25	Rubber & Plastics	Rubber and plastics products	Manufacturing	Market economy
12	26	Non-Met. Minerals	Other non-metallic mineral products	Manufacturing	Market economy
13	27t28	Basic Metals	Basic metals and fabricated metal products	Manufacturing	Market economy
14	29	Machinery	Machinery, nec	Manufacturing	Market economy
15	30t33	Electrics & Optics	Electrical and optical equipment	Manufacturing	Market economy
16	34t35	Transp. Eq.	Transport equipment	Manufacturing	Market economy
17	36t37	Recycling	Manufacturing, nec; recycling	Manufacturing	Market economy
18	E	Distribution	Electricity, gas and water supply	Manufacturing	Market economy
19	F	Construction	Construction	Retail, Construction, Telecom	Market economy
20	50	Sale - Vehicles	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	Retail, Construction, Telecom	Market economy
21	52	Retail	Retail trade, except of motor vehicles and motorcycles; repair of household goods	Retail, Construction, Telecom	Market economy
22	H	Hotels & Rest.	Hotels and restaurants	Retail, Construction, Telecom	Market economy

23	64	Telecom	Post and telecommunications	Retail, Construction, Telecom	Market economy
24	O	Social Services	Other community, social and personal services	Retail, Construction, Telecom	Market economy
25	J	Finance	Financial intermediation	Fin. & Business Services	Market economy
26	71t74	Business Services	Renting of machinery and equipment and other business activities	Fin. & Business Services	Market economy
27	60	Inland Transp.	Inland transport	Transport	Market economy
28	61	Water Transp.	Water transport	Transport	Market economy
29	62	Air Transp.	Air transport	Transport	Market economy
30	63	Oth. Transp. Services	Supporting and auxiliary transport activities; activities of travel agencies	Transport	Market economy
31	70	Real estate	Real estate activities	Non-market services	Non-market economy
32	L	Publ. Adm.	Public admin and defence; compulsory social security	Non-market services	Non-market economy
33	M	Education	Education	Non-market services	Non-market economy
34	N	Health	Health and social work	Non-market services	Non-market economy

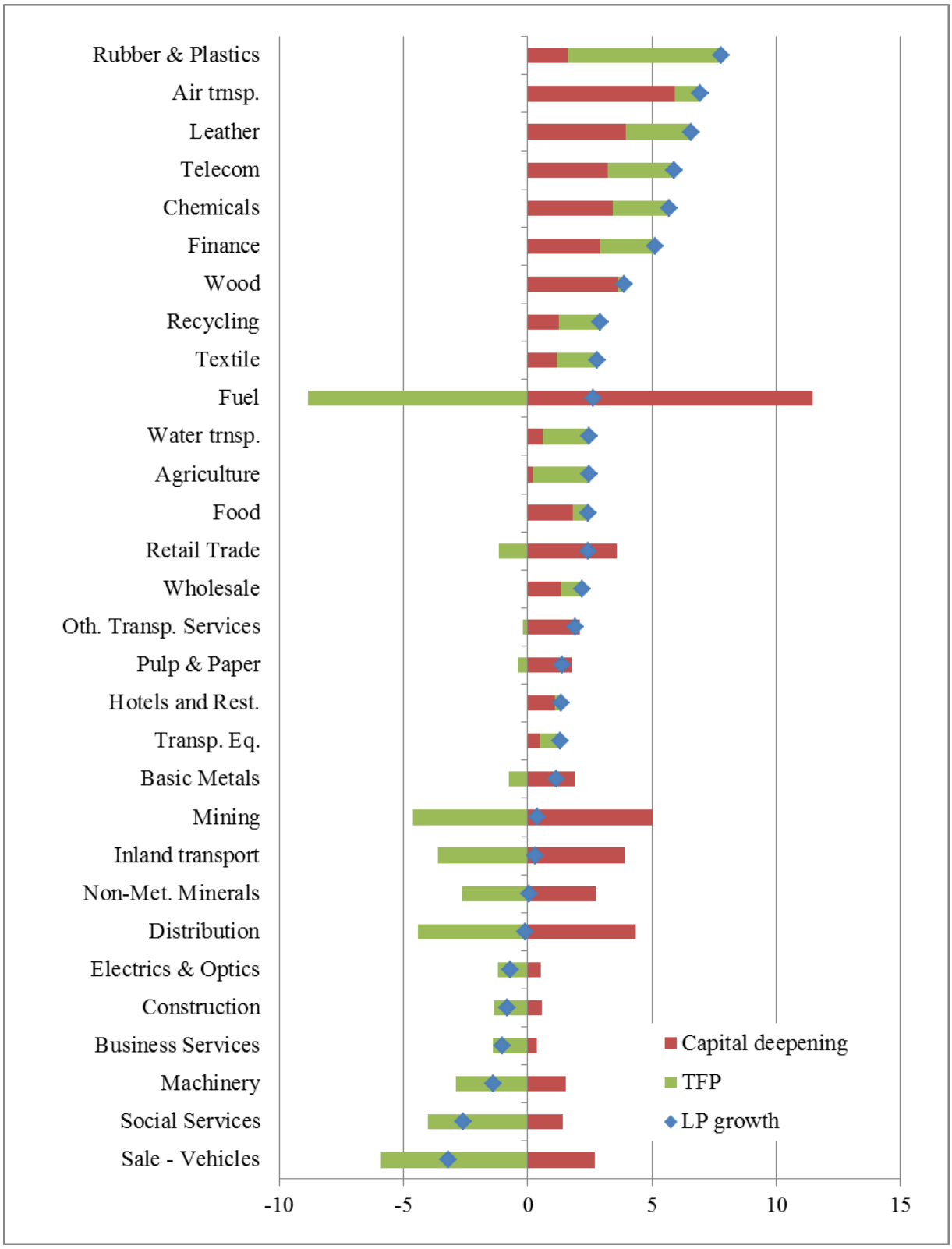
Notes: * These codes refer to the industrial classification, adapted in EU KLEMS project (Timmer et al., 2007, pp. 11–12). It is consistent with NACE 1.0.

A2. Labour productivity growth decomposition in industries of the Russian economy in 2002-2007
(Annual growth rates)



Source: own calculations on the basis of ('Russia KLEMS', 2017)
Note: arranged with labour productivity growh rates.

A3. Labour productivity growth decomposition in industries of the Russian economy, 2007-2014
(Annual growth rates)



Source: own calculations on the basis of ('Russia KLEMS', 2017)
Note: arranged with labour productivity growh rates.

Tables

Table 1. Aggregate GDP Growth and Structural Change in 1995-2014

	Share of value added (%)		Growth rates (%)	Contributions (pp)
	1995	**2014**	**1995-2014**	**1995-2014**
Total	100.0	100.0	3.47	3.47
Market Economy	86.1	80.9	3.60	3.00
Agriculture	7.6	4.2	1.39	0.08
Extended Oil and Gas sector	20.1	24.2	3.59	0.80
Manufacturing	22.4	14.9	2.15	0.40
Retail, construction, telecom, hotels & restaurants (RCT)	19.2	18.6	4.07	0.77
Finance & Business Services	5.1	12.0	8.41	0.72
Transport	11.7	6.9	2.55	0.24
Nonmarket services	13.9	19.1	2.79	0.46

Sources: own calculations based on ('Russia KLEMS', 2017).
Notes: Extended Mining includes Mining, Fuel and Wholesale Trade; Other Goods includes Utilities and Construction; Market Services incorporates Retail, Hotels and Restaurants, Transport, Post and Telecom, Financial and Business Services

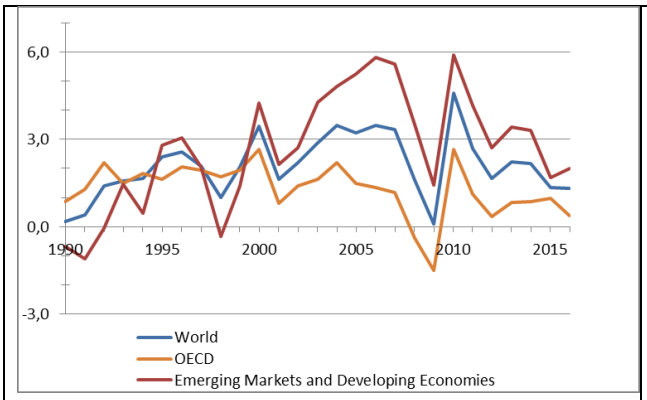
Table 2. Growth accounting decomposition of the market sector of the Russian economy in 1995-2014
(p.p.)

	1995-2002	2002-2007	2007-2014	1995-2014
Real Value Added	2,66	8,03	1,58	3,60
Hours worked	-0,34	0,96	-0,12	0,08
Labour productivity total	3,00	7,07	1,70	3,51
Labour reallocation	1,36	0,80	0,35	0,73
Intra-industry labour productivity	1,64	6,27	1,35	2,78
Capital intensity	-0,35	2,10	2,76	1,52
ICT	0,21	0,19	0,09	0,12
Machinery and Equipment	0,10	1,19	0,92	0,59
Constructions	-0,43	0,50	1,43	0,68
Other assets	-0,23	0,22	0,32	0,13
Total factor productivity	1,99	4,17	-1,41	1,26

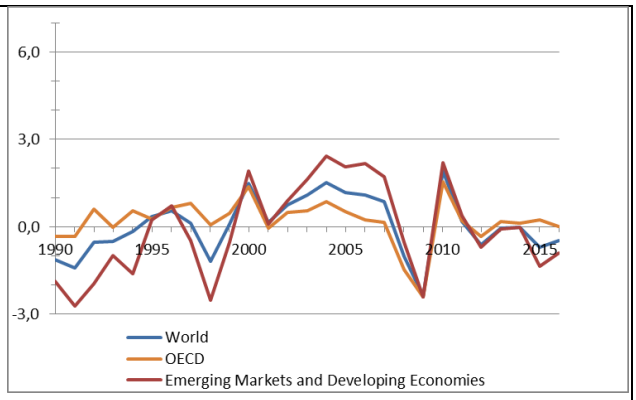
Sources: own calculations based on ('Russia KLEMS', 2017).

Figures

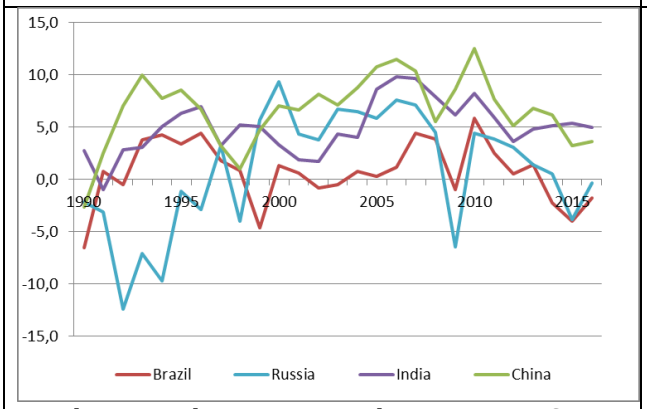
Figure 1. Global productivity growth since 1990
(Annual growth rates)



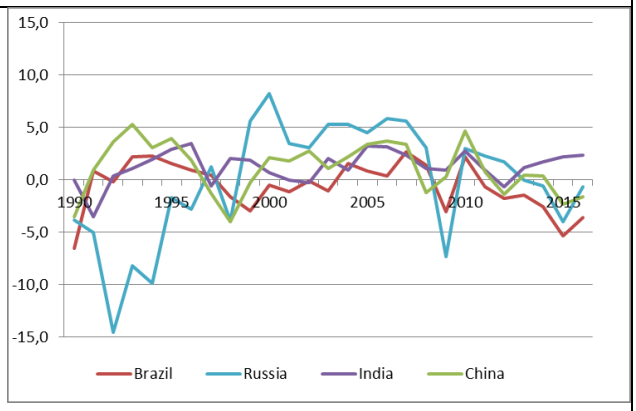
a. Labour productivity growth rates in the World, the OECD region and emerging markets and developing economies



b. TFP growth rates the World, the OECD region and emerging markets and developing economies



c. Labour productivity growth rates in BRIC economies

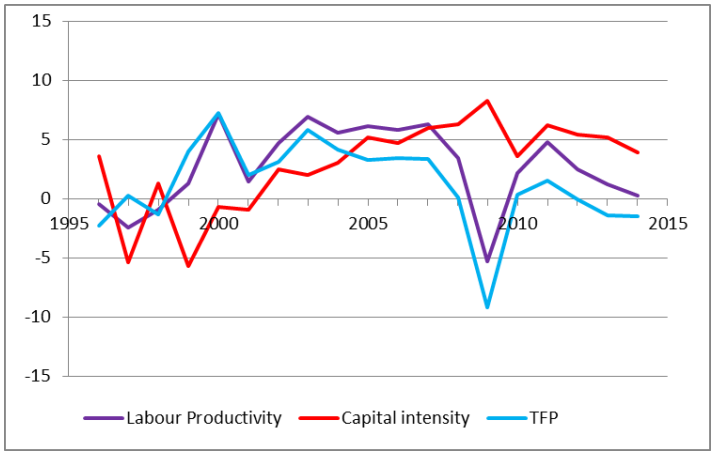


d. TFP growth rates in BRIC economies

Source: The Conference Board Total Economy Database™ (Adjusted version), May 2017

Notes: Labour productivity growth is measured as GDP per person employed. Total factor productivity growth measures GDP growth over the weighted average of total hours worked, taking into account labour skills, and also machinery, structures and ICT capital. World refers to 122 countries, which are present in the Database. Emerging market end developing countries include China, India, the other developing Asia economies, Latin America, Middle East, North Africa, Sub-Saharan Africa, Russia, Central Asia and Southern East Europe.

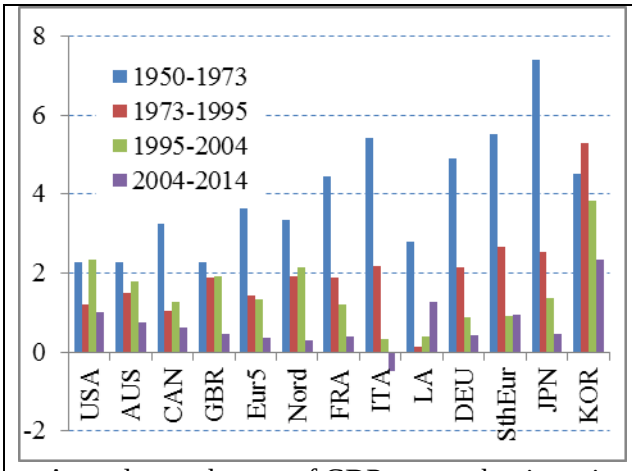
Figure 2. Growth of labour productivity, capital deepening and TFP in the market sector of the Russian economy in 1995-2014
(Annual growth rates)



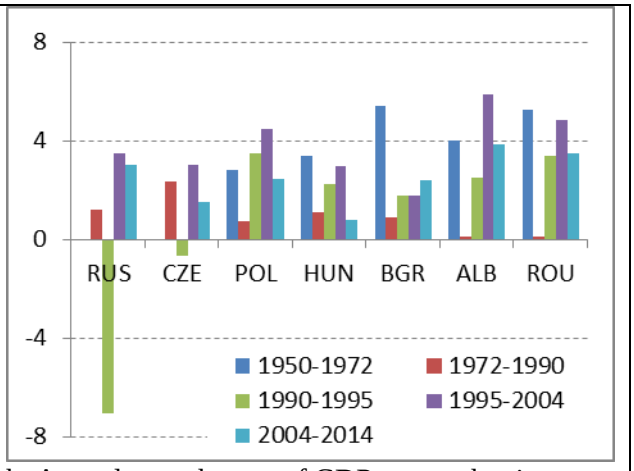
Source: ('Russia KLEMS', 2017)

Note: Labour productivity growth is measured as GDP per hour worked. Capital intensity is the flow of capital services per hour worked. Total factor productivity growth measures GDP growth over the weighted average of total hours worked, machinery, structures, IT, CT, software, transport equipment and other assets.

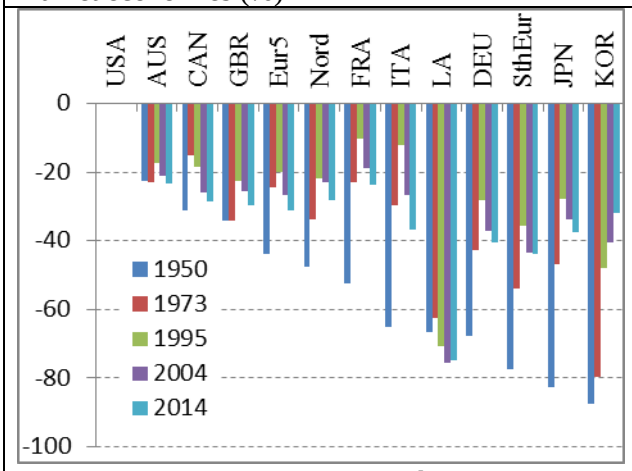
Figure 3. Labour productivity performance in the long run



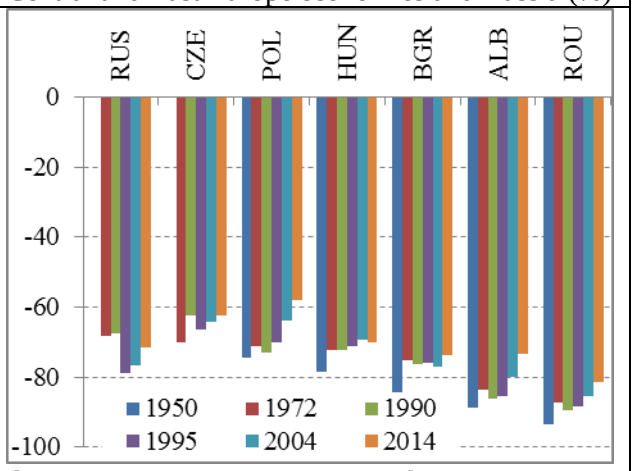
a. Annual growth rates of GDP per worker in major market economies (%)



b. Annual growth rates of GDP per worker in some Central and East Europe economies and Russia (%)



c. Percentage gap in GDP per worker in major market economies relative to US, arranged by levels in 1950 (% gap relative to US)



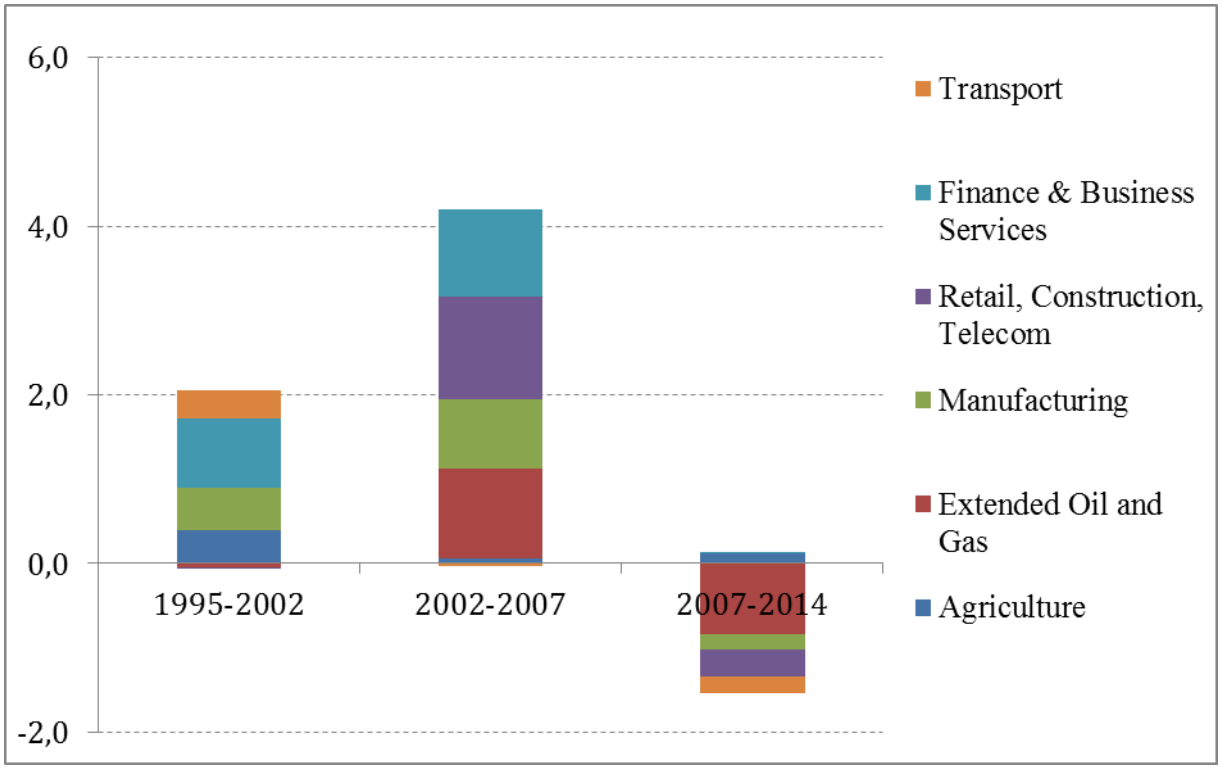
d. Percentage gap in GDP per worker in some Central and East Europe economies and Russia, arranged by levels in 1972 (% gap relative to US)

Sources: The Conference Board Total Economy Database™; May 2015

Notes: The following countries and regions are presented in the figure: United States (USA); Australia (AUS); Canada (CAN); the United Kingdom (GBR); Austria, Belgium, Switzerland, Luxembourg, the Netherlands (Eur5), Denmark, Finland, Iceland, Norway, Sweden (Nordics); France (FRA); Italy (ITA); 17 countries of Latin America (LA), including Argentina, Brazil, Chili, Mexico, Peru, Uruguay and Venezuela; Germany (DEU); Greece, Spain, Portugal (SthEur); Japan (JPN), South Korea (KOR); Russia (RUS); the Czech Republic (CZE); Poland (POL); Hungary (HUM); Bulgaria (BGR); Albania (ALB) and Romania (ROU).

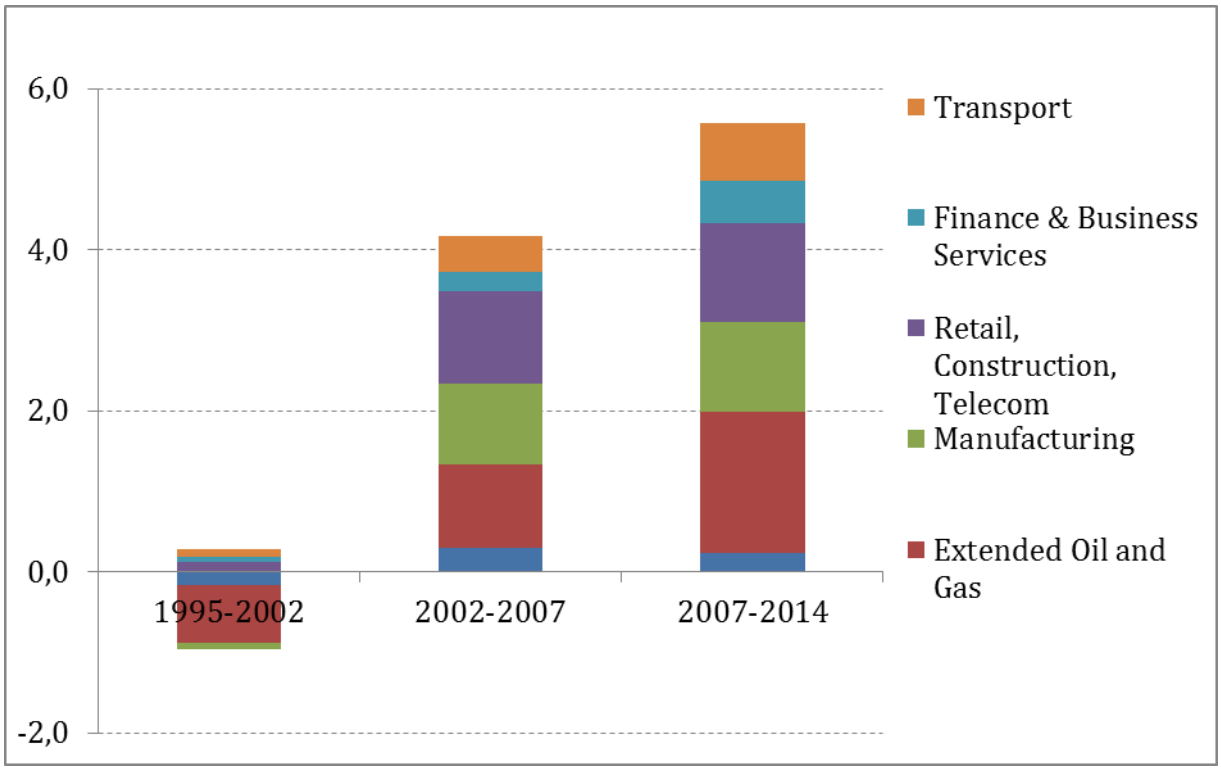
GDP is measured in 1990 US$, converted at Geary Khamis PPPs.

Figure 4. Sectoral structure of aggregate TFP growth



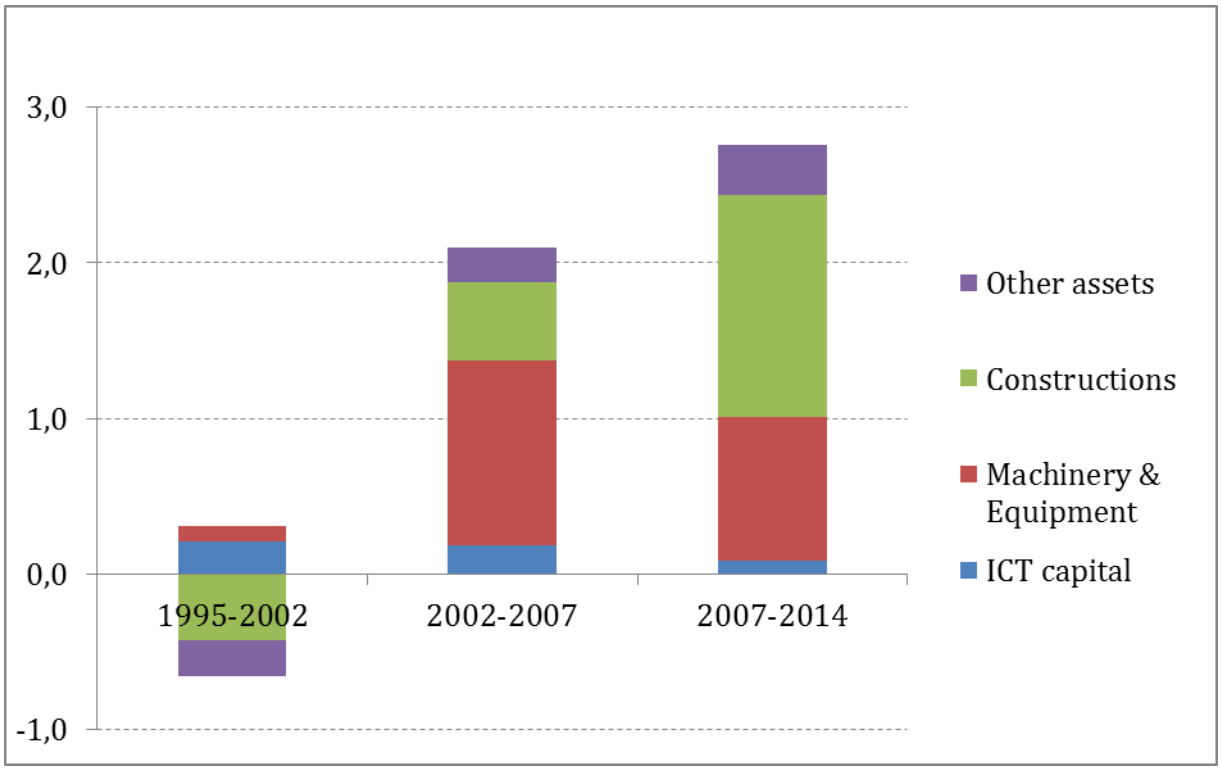
Source: own calculations on the basis of ('Russia KLEMS', 2017)

Figure 5. Sectoral structure of aggregate capital intensity growth,
Market economy (p.p.)



Source: own calculations on the basis of ('Russia KLEMS', 2017)

Figure 6. Contributions of types of assets to aggregate capital intensity growth
p.p.



Source: own calculations on the basis of ('Russia KLEMS', 2017)

Note: market economy

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