

Sources of Long Run Growth of the Russian Economy Before and After the Global Financial Crisis

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Abstract

Although productivity slowdown of the global economy was observed before 2008, it is the 2008 crisis that stimulated studies on its origins. Recent literature mentions in this context inefficient investments to machinery, human capital and organizational processes. This can include the skill mismatch and the 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 the conventional industry growth accounting it compares 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 total factor productivity (TFP) growth in industries, and the contribution of labour reallocation between industries. It shows that stagnation of 2008-2014 is more the outcome of TFP slowdown and the deterioration of the allocation of labour rather than the lack of capital inputs. Moreover, TFP slowdown started in Russia a few years before the crisis, the same as in major global economies, such as the United States, OECD countries, China and Brazil. At the same time, relatively stable capital deepening makes the Russian pattern in some degree similar to resources abundant Australia and Canada. Next, the contribution of information and communication capital to labour productivity growth in Russia after 2008 declined, which can hamper technology diffusion. Finally the structure of the flow of capital services in Russia has changed after 2008. Before the crisis the contribution of machinery and equipment dominated, while after the crisis constructions provided the lions' share of capital inputs.

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

1. Introduction

Although the productivity slowdown of the world economy was observed and documented before 2008, it is the crisis that fuelled debates on its sources and economic nature (McGowan, Andrews, & Nicoletti, 2015). Van Ark et al. (2015) summarize that causes of this global slowdown are inefficient investments to machinery, human capital and organizational processes. This can include the skill mismatch and the 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 resources abundant Russia and compares the pre- and post-crisis productivity pattern. The standard tool kit of Solow (1957) and Jorgenson et al. (1987; 2005) to answer these questions is the 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 the economy to diminish real costs of production. Much of the current literature on growth accounting of the Russian economy at macro level pays particular attention to TFP as the main source of growth. Using various sources of data on labour and capital¹, 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 at TFP as the main driver of Russian growth. Recent studies of this strand of the literature on Russia 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 changes in these proximate sources of long run growth of the Russian economy after the global crisis of 2008 in the comparative perspective. The study aims this gap with the new update of 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 total factor productivity (TFP) growth in industries, and the contribution of labour reallocation between industries. It shows that stagnation of 2009-2014 is more the outcome of TFP slowdown and the deterioration of the allocation of labour rather than the lack of capital inputs. Moreover, it has been found that TFP slowdown started in Russia a few years before the crisis, the same as in major global economies, such as the United States, OECD countries, China and Brazil. At the same

¹ See literature review in (Timmer & Voskoboynikov, 2016)

time, relatively stable capital deepening makes the Russian pattern in some degree similar to resources abundant Australia and Canada, which raised investments in mining sector, responding 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 has changed after 2008. Before the crisis the contribution of machinery and equipment dominated, while after the crisis constructions provided the lions' share of capital inputs.

The paper has the following structure. The second section provides the short description of data and the industry-level growth accounting approach. The third section summarizes 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 intraindustry sources of labour productivity growth since 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 one is the Conference Board Total Economy DatabaseTM (TED).² The TED is a comprehensive database with annual data covering Gross Domestic Product (GDP), population, employment, hours, labour quality, capital services, labour productivity, and total factor productivity for 123 countries in the world, 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. The TED provides data for the representation of labour productivity growth $\Delta \ln z$, where labour productivity defined as the ratio of real value added and hours worked (z = Z/H), as the sum of countributions 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) $\Delta \ln z = \bar{s}_K \Delta \ln k + \bar{s}_L \Delta \ln LQ + \Delta \ln A,$

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

² The dataset is available at <u>https://www.conference-board.org/data/economydatabase/index.cfm?id=27762</u>. Detailed methodology description is provided by de Vries and Erumban (2016).

The 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, in case of China two sets of the series are presents, the official and the alternative one. This reflects debates in the literature on the reliability of the official statistics for China.³ In case of Russia the 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 the TED. Unless otherwise stated, I use the GDP series in constant 1990 US dollars converted at Geary Khamis PPPs from 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, as well as 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 cross-countries comparisons at the level of industries. A more detailed description of the dataset and its construction can be found in (Voskoboynikov, 2012).

The TED and Russia KLEMS are partially consistent. They use the same Solow-Jorgenson growth accounting framework. Moreover, starting from 2016 the TED uses Russia KLEMS as one of the sources of its Russian segment (Vries & Erumban, 2016, p. 21). At the same time, regarding employment and hours worked in Russia, TED uses the data on organizations only, which leads to the upward bias in labour productivity levels and underestimation of labour contributions. Russia KLEMS data uses employment series, which cover the whole economy within the SNA production frontier.

(2)
$$\Delta \ln z = \sum_{j} \bar{v}_{Z,j}^{GDP} \cdot \Delta \ln z_{j} + \left(\sum_{j} \bar{v}_{Z,j}^{GDP} \cdot \Delta \ln H_{j} - \Delta \ln H\right) =$$
$$= \sum_{j} \bar{v}_{Z,j}^{GDP} \cdot \Delta \ln z_{j} + R =$$
$$= \sum_{j} \bar{v}_{Z,j}^{GDP} \cdot \bar{v}_{K,j}^{Z} \Delta \ln k_{j} + \sum_{j} \bar{v}_{Z,j}^{GDP} \cdot \Delta \ln A_{j} + R,$$

³ Unless otherwise stated, the alternative set for China is used in this paper.

where $\bar{v}_{Z,j}^{GDP}$ – the yearly average share of industry *j* in total value added and $\bar{v}_{K,j}^{Z}$ is the yearly 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 the 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

Labour productivity of the global economy accelerated from early 1990-s until the eve of the crisis (Figure 1a), being fuelled by intensive development of emerging economies and partially offsetting by OECD countries. However, productivity trends in the post-crisis period changed. Labour productivity in emerging economies continued growth at a moderate pace around 2-3%, while in OECD countries it dropped below one per cent per year. 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. All in all, 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 innovations, 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 productivity growth patterns, presenting the largest emerging economies, including Russia. The fact that labour productivity slowdown in emerging economies was not as deep as of the OECD area can be confirmed with patterns of all members of the BRIC club, except India. Indeed, China demonstrates relatively stable labour productivity growth after 2008 (Figure 1c) and the fall in TFP (Figure 1d).⁴ To a lesser degree this is applicable to Brazil and Russia. The case of Russia is also presented in Figure 2 by growth rates of labour productivity and its components, TFP and capital deepening. The figure shows that relatively stable labour productivity growth rates in 2003-2008 masked the slowdown of TFP against the acceleration of capital deepening. Moreover, the impact of the global crisis of 2008 was more serious for TFP than

⁴ See more about TFP slowdown in China in (Wu, 2016).

for labour productivity, because capital deepening growth remained stable and varied around 5%. Finally, as it follows from the figure, 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]

Accordingly, 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 it is about 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 could be found not only in specific features of the Russian economy, but also in long run trends of global development. At the same time, the crisis of 2008 could contribute to this stagnation and accelerate TFP fall.

In what follows I consider all 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 is presented in Figure 3.⁵ 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 in 1950-1995. Indeed, economies with the initial labour productivity level further behind the United States grew faster. This can be explained with the recovery process after the Second World war and technology catching up in Old Europe (Crafts &

⁵ Analyzing the conditional convergence of major market economies and regions I follow McGowan et al. (2015, pp. 21–23).

Toniolo, 2010). There are also exceptions, such as Latin America, which confirm that convergence is not always granted. This observation is also applicable to countries of the Socialist camp.

Economies of Central and Eastern Europe (CEE) were also involved in the process of 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 early 1970-s was less sound, and even worse in last decades before the collapse of the Socialist system in early 1990-s. Both the CEE economies and the Soviet Union, being on the average further behind the US level in comparison with the Old Europe, failed to catch up before 1990. Main cause of this was the lack of incentive to adapt new technologies and use them to make production more efficient. More than that, because of the transformational recession 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 transition the technological backwardness of CEE economies and Russia remained one of the serious obstacles for sustainable development. In turn, years after transition included both the transformational recession and catch up with the West (Havlik, Leitner, & Stehrer, 2012).

McGowan et al. (2015, p. 21) noticed that the process of convergence in the global economy halted after 1995 for two main reasons. First, as economies approach to the technology frontier, the importance of the ability to adapt innovations increases. Second, the soundest innovations of period 1995-2004 were Information and Communication Technologies (ICT). The nature of ICT technologies releases "winners take all" processes, which help the leaders in technology competition to stretch their lead. In turn, the pattern of post-transition economies (Figure 3d) reflects not only the global impact of ICT technologies, but also the post-transition recovery and catching up due to elimination of multiple imbalances and distortions of the planned economy period.

In any case, by 2004 benefits of global diffusion of ICT technologies, as well as the posttransition recovery potential in CEEs and Russia began to wane. It is this, which can be used for the interpretation of 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 adapt 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 resources abundant countries as Australia, Canada, and also China and India); contraction of TFP (excluding Korea, Japan and India). Equally important, the global financial crisis of 2008 itself can have the longer run productivity consequences, such as the fall of tangible investments, the impact on investments to 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 one is the outcome of these factors of the global productivity slowdown. Second, this might be caused by the structural transformation of the Russian economy from the sectors of material production, overinvested before transition, to market services. Using the Baumol 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 fact, that the inflow of oil and gas revenues is run out after the fall of oil prices in late 2000-s. Further analysis of proximate sources of growth can help understanding, which of the three explanations will hunt out the evidence.

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

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 stylized facts, common for all economies in transition (Campos & Coricelli, 2002). Russia is not an exception. Table 1 reports changes in shares of value added in major sectors of the Russian economy. As can be seen from the table, the share of agriculture and manufacturing shrank from 30 % in 1995 to 19% in 2014, which could reflect 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 resources exporting country. Growth of global oil prices after 1999 led to the remarkable extension of its mining and mining-related industries, combined in the table to sector "Oil, Gas and Wholesale trade"⁶, 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 in aggregate growth.

⁶ 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 transport in sector "market services".

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

Table 1 provides also the summary statistics for sectoral growth rates and contributions. Finance and business services demonstrate the best performance with yearly average growth rates 8.4 per cent. However, its contribution is more modest and equals 0.7 p.p., giving place to oil and gas, and RCT sectors, because the average share of the finance industry is only 8.6% ($0.7 = 8.41 \times \frac{1}{2} \times (5.1\% + 12.0\%)$). These three sectors provide the lion's share of 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 3.5% aggregate growth, or about one sixth.

Periods for the comparative analysis are important, because short term changes of inputs 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. In turn, 2002 is one of the first recovery years after the financial crisis of 1998. Finally, 2007 is a year on 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 in the table is the remarkable difference in the structure of these sources. While in early 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 extensive. Another remarkable difference is the role of capital services. In early transition the shortage of capital can be seen at the aggregate level in the form of negative growth of capital intensity. At the same time, both in 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. Interestingly, the contribution of the ICT capital became smaller.⁷ This can 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 in early transition, slowed down and disappeared in years of stagnation, which can illustrate both the end of transition and worsening of labour mobility in years after the global crisis.⁸

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 could 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 variation coefficients of labour productivity levels in industries were significantly lower in CEE and Russia than in market economies with the 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 post-transition economies of Central and Eastern Europe the Baumol effect, being negative, is cancelled by labour reallocation to industries with higher productivity levels (Denison effect) (Voskoboynikov, 2018).

Taken together, results of this section suggest that the influence of structural change on aggregate labour productivity growth is more sophisticated than it might be expected from simple decomposition (2). Indeed, 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 compensate each other. Next, these opposite 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).

⁷ 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.

⁸ 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.

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 proximate sources of labour productivity growth in industries and the sectoral contribution of capital services and TFP to the aggregate.

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

The sources of intra-industry labour productivity growth include accumulation of human and physical capital, intangible assets, and total factor productivity. The latter is usually interpreted as the outcome of technological change, but could be also explained by temporary disequilibrium, caused by the delayed reaction on 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 differences in proximate sources of growth before and after 2008. As can be seen from table 2, the fundamental change, which explains the fall, is the role of TFP. Indeed, in 2002-2007 TFP contributed 4.2 p.p. of 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 per cent per year to -1.4. In other words, sharp decline of TFP growth rates can explain the fall of aggregate labour productivity growth in full. 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 resources abundant Australia and Canada. McGowan et al. (2015, p. 24) point out that these two economies raised investments in mining sector, responding to the capital intensive boom in China and India. In turn, the positive contribution of capital deepening cancelled the negative influence of labour reallocation. Finally, relatively stable capital deepening masks substantial changes in its structure (see, e.g., Berezinskaya (2017)). While before 2008 machinery provided the lion's share of growth, after 2008 its contribution came down by 0.3 p.p., giving the pass constructions. All in all, the extensive, capital deepening-driven component of labour productivity growth has become dominant after the crisis.

The level of industries, which is 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 and 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 origins of this labour productivity decline. Figure 4 shows that TFP fall happened mostly because of the oil and gas sector efficiency loss. Taking into account industrylevel patterns of productivity growth (Appendices A2 and A3) this could happen because of the TFP fall in wholesale trade only. At the same time, 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 2008.⁹ 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. 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 data reported in figure 5. As can be seen, 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 market economy capital intensity growth rates. At the same time, market services enjoyed the highest capital inflow. This is also not surprising. Large investments came to retail, which was underdeveloped in early transition. McKinsey (1999, p. 5, 2009, p. 65) reports that by 1999 only 1% of retail fell on modern supermarkets, while in 10 years this share increased to the level of 35%. Huge investments were made in telecommunications both because of its technological backwardness in the planned

⁹ The substantial increase of productivity in agriculture seems to be common for former Soviet republics after transition (Swinnen & Vranken, 2010).

economy period and the IT revolution. Last, but not least, financial and business services expanded 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 years of the post-crisis recovery capital intensity grew mostly because of contributions of oil and gas, market services (RCT) and manufacturing. However, if RCT sector and oil and gas grew mostly because of the inflow of investments, 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 assets' 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 constructions, more relevant for oil and gas, play a remarkable role in years of stagnation. This could reflect the fact that the slowdown of investments inflow after 2008 hit the contribution of machinery with short service lives more than long lived constructions. As a result, capital deepening acceleration in 2009 (Figure 2) could take place due to new construction projects, launched before the crisis and put into operation after 2008, and also the drop of hours worked in the crisis.

4. Conclusion

In the globalized world, 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. Starting from 1990-s ICT technologies pick up the slack. At present the key to sustainable productivity growth is 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 recent stagnation of 2009-2014 in the Russian economy is more the outcome of TFP slowdown and the deterioration of labour allocation rather than the lack of capital inputs. At the same time, capital intensity continued growing, which makes the Russian pattern in some degree similar to resources abundant Australia and Canada. The contribution of ICT capital to labour productivity growth in Russia after 2008 declined, which could interfere technology diffusion.

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

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Appendix

#	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	С	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	Е	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	Н	Hotels & Rest.	Hotels and restaurants	Retail, Construction, Telecom	Market economy

A1. List of industries and sectors

23	64	Telecom	Post and telecommunications	Retail, Construction, Telecom	Market economy
24	0	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	М	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 e
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

	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	

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

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
ІСТ	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.





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