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Russia's transition process in the light of a rising economy: Economic trajectories in Russia's industry and agriculture

Peter Voigt[1] and Heinrich Hockmann[2]

Abstract

Over the recent years Russia has faced an astonishing economic growth, coinciding with the era of Vladimir Putin's presidentship. Accordingly, it is not surprising that commonly these rising economic trajectories are attributed to progress in terms of transition initiated and further triggered by Putin's government. This paper is trying to investigate empirically whether the current growth in Russia tends to be caused mainly by (1) success of transition or just by (2) favourable external circumstances such as rising prices for oil, gas, etc.

Thus, analytically, progress in transition has been approximated by efficiency estimates, which are – from a theoretical point of view – expected to be rising in course of transition of a formerly planned economy towards a free market system. In order to capture potentially different trajectories of several sectors and regions industry and agriculture have been considered separately, each at regionally aggregated level over a period of 11 years.

In general, little evidence of the anticipated rising trends could be found. Instead, notable ups, downs and divergences among regions and sectors were uncovered. According to this analysis, Russia's current growth rates cannot be attributed to general success of transition. Instead, besides reaping the benefits of favourable external circumstances at world markets, from an empirical point of view, scale effects and slightly rising productivity appear to be the main causes of the recent track record. Moreover, in the industry the trend is also triggered by technological progress, which may indicate the turnaround after a decade of decline and give a reason to believe in an initiation of a long-term growth process. Unfortunately, in agriculture little evidence for such a sustainable growth process was evident so far. In general, the inter-sectoral integration in Russia's economy seems to be still quite low.

JEL: D24, O11, P27

Keywords: Russia, transition progress, sector / regional comparison, TFP, efficiency

1. Introduction

Russia's economy is currently enjoying substantial growth. However, the determinants of this development are quite unclear. Possible explanations include the favorable development of world market prices for raw materials as well as a successful completion of the transition process and pursuit of trajectories that allows extracting the benefits of functioning markets. If the development occurred because of the latter, any indicators of transition progress are supposed to show significant changes. In fact, this should not only be visible at the macro-economic level but due to factor and product

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market integration, also in all economic sectors. Moreover, since transition affects economic regions according to their comparative advantages, regional differentiation and specialization can be expected too.

In this paper, we focus on two problems. First we investigate how some transition indicators have evolved over time, and, whether significant changes over the years are observable. In particular, we decompose output growth into a scale effect (SE) and the development of total factor productivity (TFP). Thus, the scale effect refers to the question to which extent the observed output changes are due to proportional changes of input quantities (cp.). In contrast, TFP-changes capture output growth corresponding to changes of the general (technological) ability of transforming inputs into outputs. Hence, TFP growth is one of the key indicators of economic dynamics as it provides information about the additional output that might be produced, given a certain set of inputs. In addition, developments in terms of the institutional framework as well as demand-side induced changes find their expression in TFP growth.

In the literature the development in TFP usually is further decomposed into changes of technical efficiency [TE] and technological change [TCH]. In this regard, TCH refers to any change in the production possibilities over time, be it positive or negative, and thus, indicates the effects of innovations as well as the devaluation of obsolete fixed assets and related capabilities (e.g.: accumulated knowledge and network links). Accordingly, significant positive TCH suggests achievement of a rather sustainable trajectory characterized by long-term economic growth. In contrast, changes in TE control for economic success in terms of achieving input-output combinations empirically benchmarked with respect to the (technologically) efficient boundary of the production possibility set; namely the technological frontier. Considered over time, the related trajectories may suggest whether a certain determinant of the production process, e.g. the institutional framework conditions, tends to reduce or increase any wastes of resources prevailing in the production processes. Accordingly, TE is an indicator of assessment whether the coordination of economic activities have improved over time and thus may serve as an approximation for developments capturing the successes and failures of the transition processes. Hence, TE is expected to be significantly rising in the course of transformation of Russia's economy from central planning towards de-central market coordination, given the obvious inefficiencies in the coordination system of a central planned economy.

The second central question this paper is trying to tackle concerns divergences in sector and/or regional developments. In fact, although on the whole Russia seems to be flourishing, it is rather unclear whether this picture also emerges if certain sectors and/or regions are considered separately. Accordingly, we investigate, on a regionally aggregated base, whether agriculture was also able to benefit from overall economic changes or whether there are even after more than 15 years of transition still only limited signs of sectoral economic integration. Empirically we consider the above mentioned measures (TFP, TCH, TE) separately for agriculture and industry in order to point out relevant differences and check whether sectoral co-integration has improved

We will elaborate on the above raised central questions by estimating production functions for Russia's industry and agriculture using regionally and temporally disaggregated data. This procedure has particular consequences for the interpretation of the results. So, only relative measures regarding the successes of the transition process in the two sectors are provided. However, comparing the corresponding developments of

the two sectors allows to identify their determinants, especially those which result from the different progresses in implementing functioning market-oriented co-ordination mechanisms.

The paper is organized as follows. Chapter 2 provides the theoretical background of our estimation procedure. The data base is discussed in the chapter thereinafter. All empirical results are presented and discussed in chapter 4, while chapter 5 provides a comparative assessment of the finding for the different sectors. The conclusions are subject of section 6.

2. Theoretical background and analytical approach

In order to analyze the transition progress by developments in productivity and efficiency, the frontier of the corresponding production possibility set (e.g. by sector) and its development over time has to be estimated. The individual observations then can be assessed in relation to the best practice defined by the frontier. Generally, two approaches for estimating production frontiers are commonly applied: (1) the non-parametric Data Envelopment Analysis (DEA),[3] and (2) the parametric Stochastic Frontier Analysis (SFA).[4] DEA is a quite flexible approach, allowing the consideration of various inputs and outputs without assuming a special functional relationship. However, it does not necessarily provide a coherent picture of the underlying economic structures since it reacts very sensitive to outliers and inconsistencies in the data. This problem is especially severe in rather changing environments typical for countries in transition. In contrast, SFA relies on rather strong theoretical assumptions to be made concerning the structural form of the production function and the distribution of the inefficiencies; it is also quite restrictive with respect to the amount of inputs and outputs that can be considered. However, data problems are less severe in case of the SFA since random variation from a mean function is explicitly accounted for in the estimation. With regard to the particular strengths and limitations of both methodologies, for this study SFA has been selected.[5] Accordingly, sector-specific frontier functions of the following general form were estimated:

$$y_{it}=f(t, x_{it} ;\beta)\ TE_{it} \tag{1}$$

with y_{it} representing output and x_{it} a (1×K) vector of inputs and the subscripts i, with i=1,2,…,N, and t, with t =1,…,T, referring to a certain region and time (year), respectively. β is a (1×J) vector of parameters. Thus, J will be larger than K[6] in order to account for first and second order effects of inputs on production. TE_{it}, with $0 < TE_{it} < 1$, represent deviations from the maximum achievable output (given the existing

[3] For a comprehensive overview see e.g. COOPER et al., (2000).

[4] Introduced by AIGNER, et al., (1977), BATTESE and CORRA (1977), and MEEUSEN and VAN DEN BROECK (1977). For a comprehensive overview see e.g. KUMBHAKAR and LOVELL (2000).

[5] A discussion of the relevant methodological strengths and limitations is given e.g. in VOIGT (2004). See e.g. COELLI et al., (1998) or KUMBHAKAR and LOVELL (2000) for a detailed description of the approaches.

[6] For instance, in the case f represents a Cobb Douglas function with constant term and technological change J=K+2, a corresponding translog specification has J = .5*(K+3)*(K+2). See also below.

technology) attributable to technical inefficiency (in other words: the gap between empirically observed and the maximal achievable – *the frontier* – output).

The total differential of (1) provides the decomposition of output growth:

$$dy_{it} = \left(\frac{\partial f(t, \mathbf{x}_{it}; \boldsymbol{\beta}) TE_{it}}{\partial \mathbf{x}_{it}} \right)' d\mathbf{x}_{it} + \frac{\partial f(t, \mathbf{x}_{it}; \boldsymbol{\beta}) TE_{it}}{\partial t} dt + f(t, \mathbf{x}_{it}; \boldsymbol{\beta}) dTE_{it},$$

or after further transformations:

$$\frac{d \ln y_{it}}{dt} = \underbrace{\left(\frac{\partial \ln f(t, \mathbf{x}_{it}; \boldsymbol{\beta})}{\partial \ln \mathbf{x}_{it}} \right)' \frac{d \ln \mathbf{x}_{it}}{dt}}_{\text{SE}} + \underbrace{\frac{\partial \ln f(t, \mathbf{x}_{it}; \boldsymbol{\beta})}{\partial t}}_{\text{TCH}} + \underbrace{\frac{d \ln TE_{it}}{dt}}_{\text{TE}}. \tag{2}$$

Here, the first, second and third terms on the right hand side of (2) represent the scale (SE), technological change (TCH) and efficiency effects (TE). All effects are in relative terms as indicated by the natural logarithm. The scale effect is a composed effect: it consists of the sum of weighted input changes, where the weights are given by the production elasticities.

Bringing the scale effect on the left side provides the TFP formulation:

$$\underbrace{\frac{d \ln y_{it}}{dt} - \left(\frac{\partial \ln f(t, \mathbf{x}_{it}; \boldsymbol{\beta})}{\partial \ln \mathbf{x}_{it}} \right)' \frac{d \ln \mathbf{x}_{it}}{dt}}_{\text{TFP}} = \underbrace{\frac{\partial \ln f(t, \mathbf{x}_{it}; \boldsymbol{\beta})}{\partial t}}_{\text{TCH}} + \underbrace{\frac{d \ln TE_{it}}{dt}}_{\text{TE}}. \tag{3}$$

Equations (2) and (3) will be computed averaged over all regions and averaged over all years in order to discuss regional and time effects separately.

The production possibilities were approximated by a translog function. It belongs to the group of second order flexible forms, i.e. it puts no a priori restrictions on the parameter of the production technique. Neutral TCH was considered by a linear and a quadratic time trend. Moreover, in order to be able to provide information concerning how TCH affects the productivity of the individual inputs, the time trend was also combined with factor input. This accounts for the bias of technological change.[7] Thus, any change of the frontier in shape and/or scope (any shift or rotation) refers to TCH.

Accordingly, stochastic production frontiers of the following structure were estimated:

[7] For problems related to the accounting of neutral and non-neutral technological progress in an inefficient economic environment, see: GROSSKOPF, (1993), pp. 160-194, or Fried et al., (1993). HOCKMANN and VOIGT (2002) provide an overview on measurement and the impact of TCH bias in empirical studies, as well as a discussion on several aspects of TCH, particularly with respect to the frontier methodology and Russia's agriculture in transition.

$$\ln y_{it} = \beta_0 + \sum_{j=1}^{K} \beta_j \ln x_{ijt} + \frac{1}{2} \sum_{j=1}^{K} \sum_{k=1}^{K} \beta_{jk} \ln x_{ijt} \ln x_{ikt} + \sum_{j=1}^{K} \beta_{jt} \ln x_{ijt} t + \beta_t t + \beta_t t^2 + v_{it} - u_{it} \quad (4)$$

with $v_{it} \sim N(0,\sigma v^2)$, $u_{it} \sim N^+(\mu,\sigma u^2)$, i = 1,…, N, and t = 1,…, T.

In order to obtain time-varying region-specific efficiency measures, i.e. u_{it} instead of u_i, the cross-section and time series data were pooled.[8] In addition, it was assumed that the u_{it} follows a truncated normal distribution, with mean μ and variance σu^2, which allows for more flexibility of the efficiency terms.[9] Furthermore, v_{it} controls for stochastic influences on the production possibilities.

The parameters are obtained by ML estimations (Battese and Coelli, 1993). Standardized series of likelihood ratio tests have been performed in order to obtain statistically plausible specifications of the final models. These are the result of a series of statistical tests performed to revise alternative model specifications and unsupported hypotheses, like e.g. tests regarding the existence of: (1) linear/quadratic neutral TCH, and (2) non-neutral TCH, (3) deterministic vs. stochastic frontier, (4) mean production function vs. frontier, (5) constant returns to scale equal one, (6) homotheticity of the function, (7) functional form: translog vs. Cobb Douglas.

3. Data base

The basic data set consists of aggregated information about production output and factor input for almost every Russian region (75 of total 89 territorial units) for the period 1993 – 2003. All data were taken or calculated from sources of the Russian Committee of Statistics (Goskomstat). During the data collection, several major conceptual issues have been faced: the choice of appropriate proxies for inputs variables, consideration of differences in variables' attributes (e.g. input quality), price changes (in time, across regions), and the problem of missing data. In response to these issues, the data have been adjusted.

The variables of the frontier model(s) were defined as follows:

[Y]-Output: Deflated regional **gross values of production** per sector. Thus, for industry the regional gross values of production in current prices have been taken, deflated with common price deflators (base year 1996). Since for agriculture some data were missing and some statistics seemed to not be reliable, a volume index of production (for agriculture given by Goskomstat) has been applied for constructing the

[8] Due to some methodological problems that occur when time-varying efficiency scores are a matter of particular interest (such as TE-scores as indicators of individual transition progress) it has been decided to treat the data as chronologically unstructured (No. of cross-section observations = N×T). This provides unbiased parameter estimates, but they might be inefficient in a statistical sense. Accordingly, all hypotheses tests (if applicable) are based on estimates of an alternative model under consideration of the panel data structure of the data (by means of these models, only mean TE-trajectories can be calculated).

[9] The models were tested for / and if justified reduced to the special case of half-normal distribution of u_i.

corresponding variable (index based on the 1996 values). Due to the regional differences in absolute price levels, an adjustment by a relative indicator of regional price-levels became necessary as well. Accordingly, in order to provide comparable regional data, all monetary scores (respective the regional deflator-matrix) have been adjusted by a vector of such correction factors (proxy: basket of commodities capturing the value of the regional minimum of existence in 1996).

[X]-Inputs: **Capital** (fixed assets) and **Labor** (employees) were considered as inputs for industry as well as for agriculture. Since no reliable data of 'fixed assets' were available, the variable was constructed using the following equation of motion (Perpetual Inventory Method):

$$C_{it+1} = C_{it} + I_{it} - D_{it+1},$$

where C, I, and D represent capital, investment and depreciation respectively. Thus, investments in assets were available in nominal terms and have been price adjusted as indicated above. Thus, starting with the corresponding Goskomstat' values for 1996[10], all other scores have been obtained by an extrapolation of these values, adding investments, deducting depreciations.[11]

In order to capture the specifics of agriculture **Land** (usable agricultural area in hectares, weighted by soil quality) and purchased mineral **Fertilizer** [tons] were considered as additional inputs for this sector.

For the estimation, all variables are normalized by their geometric mean. Due to this procedure, the first order terms in (3) regarding the inputs can be interpreted as production elasticities at the sample means. The normalization provides a direct economic meaning to the estimated parameters and thus facilitates the interpretation of the regression results significantly.

4. Empirical results

4.1 Parameter estimates

Table 1 (see appendix) provides the parameter estimates by sector. However, signs and magnitudes of the frontiers' coefficients as well as the numerical results obtained were found to be robust even under different model specifications. Moreover, the criteria of theoretical consistency, i.e., the neo-classical assumptions regarding the slope and the curvature of the production function, have been tested for every single

[10] 1996 was chosen as base year as the available data for this year appeared to be the most reliable statistical data as there was a new inventory in 1996 in 1996 prices and it can be assumed that most of the depreciation of outdated machinery occurred before 1996, thus, it can be expected that the values for 1996 are the first without a significant bias.

[11] As no information about depreciation was available, however, corresponding depreciation rates have been calculated based on the average depreciation rates in OECD-countries for similar groups of facilities, like e.g. machinery, vehicles, etc., and the share of these facilities within Russia's fixed assets per sector as given by Goskomstat for 1996). See VOIGT (2004) for more details concerning data adjustments.

observation point and were found to be fulfilled in most of all cases.[12] Insignificant parameters were excluded if the specification test of both the standard as well as the reference model (see footnote 8, above) justified this decision.

All production elasticities are positive at the samples means. In industry, the production elasticity of capital is about double that of labour, reflecting the high capital intensity commonly observed in industrial production. Since agricultural production in Russia appears to be rather industrialized and characterized by large machinery input, it is not surprising that also in agriculture the production elasticity of capital was found to be higher than for labour. However, the estimated production elasticity of labour suggests that over-employment unlike commonly assumed at the beginning of the transition process might not (anymore) be, on average, a severe problem.[13] In contrast, land and fertilizer seem to be limiting factors for the agricultural production to a lesser extent. This may reflect the significant share of fallow land in Russia and the comparably low application of production enhancing inputs, like e.g. pesticides, feedstuff and other material inputs (due to limited access and/or budget constraints).

Another difference between industry and agriculture concerns the existence of economies of scale. As expected, the scale elasticity in industry is greater than one. Despite the relatively high degree of mechanization, agriculture in contrast operates with decreasing returns to scale. This has a severe implication for the development of farm size. Consistent with the regression results, the average farm size tended to decreae during the period under investigation (Goscomstat).

Moreover, also with respect to the technological change the two sectors show characteristic differences. In the industry an accelerated increase of the impact of innovation can be observed over the period of investigation leading to notable technological progress, while in agriculture, in general, technical degradation dominated. In fact, only in recent years has the impact of technological change in agriculture tended to be positive.

4.2 Total Factor Productivity Development

This section considers the trajectories of total factor productivity in Russia by analysing whether this refers empirically to changes in the corresponding output or input set.

Russia's industry followed an overall TFP development over the transition process that can be divided in two main periods (see Figure 1). Before the financial crises in 1998, a decrease of outputs as well as inputs was characteristic. However, total factor productivity in total has increased since input reduction was significantly larger than the decline of the monetary aggregated outputs. For the period after the currency crisis an even accelerated TFP growth was measured, triggered particularly by output expansion as an effect of positive TCH. Although this period was also characterized by negative scale effects, Russia's industry experienced a notable upswing and, overall (with

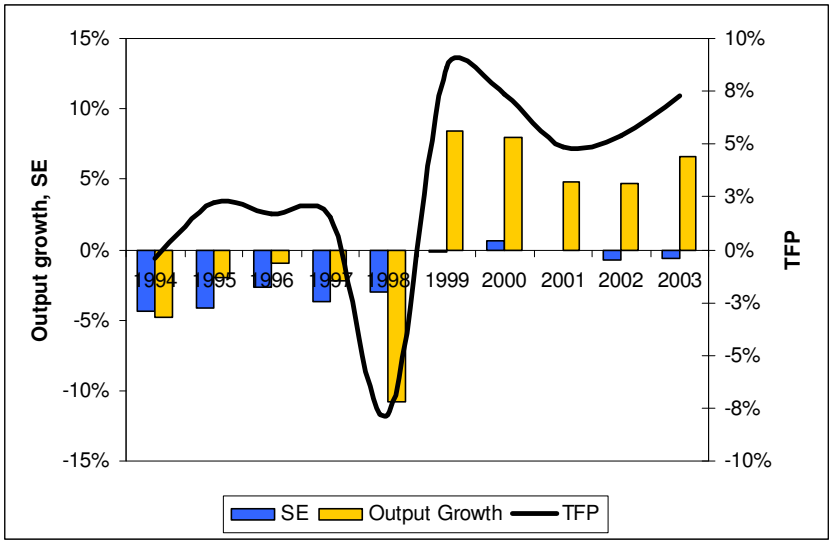
[12] For industry no irregularity concerning neoclassical curvature conditions was found. In case of agriculture, quasi-concavity is violated in case of 5.9% of all observations, and 3% of the elasticities fail the monotony tests. The corresponding observations have not been considered for further interpretations.

[13] With respect to question how labor force in agriculture, in general, has evolved over the transition process see e.g. Swinnen et al (2005).

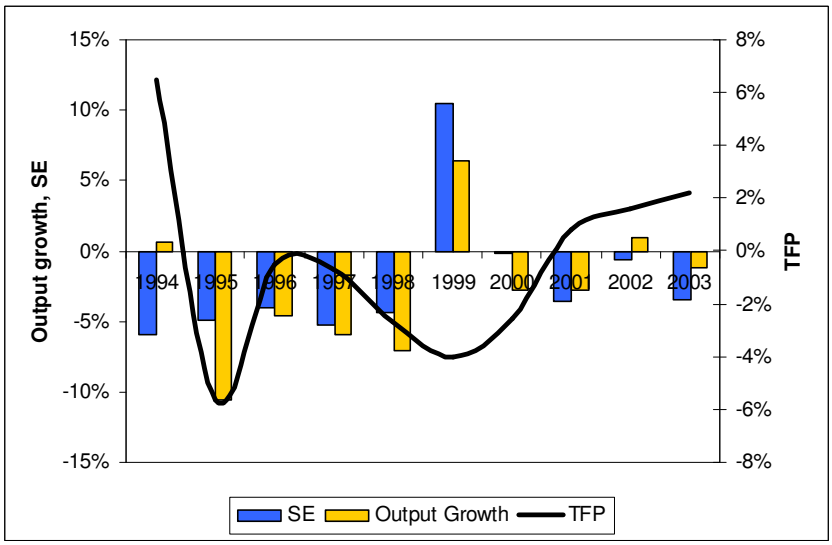
an exception during the currency crisis period), appeared to be on a rather steady growth path. In fact, the considerable reduction of output and inputs in 1998 suggests that the currency crisis might have dramatically changed the existing production structures, forced less productive enterprises to exit the market, and, in turn, provided those who however survived the crisis excellent prospects for a rather sustainable development thereafter.

Figure 1: TFP changes as an effect of input & output growth

Russia's Industry



Russia's Agricolture



Source: Own calculations / own illustrations based on the results of the final restricted frontier model estimates.

In contrast, the developments in agriculture appeared to be quite different compared to those in industry. Before 1998, inputs and outputs decreased, the sector faced negative SE, and, however, TFP changes were mostly negative since the drop in outputs even exceeded the corresponding decrease of the inputs. Moreover, the crisis

also did not have a purification effect like in the industry. TFP change was even negative in the year after the crisis although inputs and outputs both increased. This suggests that the related trends were results of a pure intensification of the agricultural production without any adjustment in terms of the fundamental parameters determining economically the agricultural sector, like structural changes, decision making processes etc. In fact, in this regard agriculture appears to be considerably behind the transition progress realised for example in Russia's industrial sector.

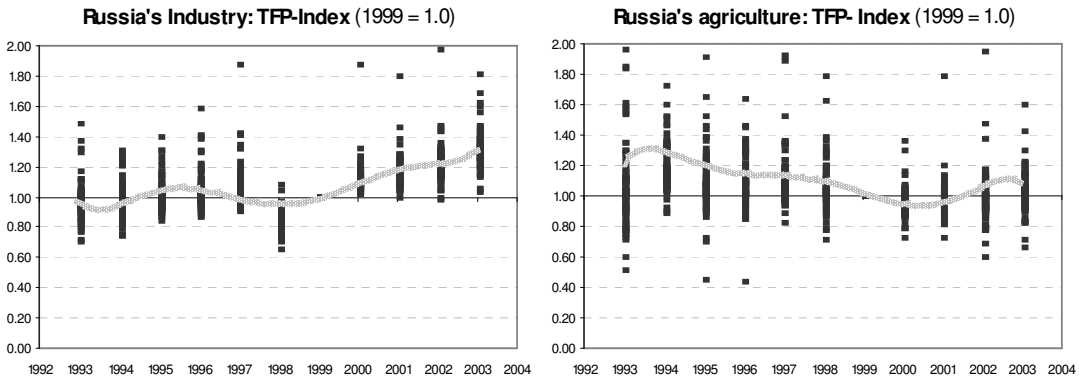
With respect to regional trajectories the following common patterns could be observed:

In Russia's industry, all regions showed decreasing factor inputs during the period 1993 to 2003 accompanied by leveraged output levels in the majority of regions. Only remote areas, like those in the Caucasus region, those close to the Arctic Circle as well as regions in East Siberia experienced a general drop in terms of industrial production. However, TFP grew even in these (marginal) regions since empirically the output decline appeared to be smaller than the decrease of input use.

The developments in agriculture, however, also from a regional disaggregated perspective showed rather different trend patterns. Almost all regions experienced a reduction in terms of aggregated outputs as well as in the input use. In fact, only in a few regions TFP went up at all. The respective regions are those that were also traditionally considered as Russia's main agricultural producers. They are characterized by good natural conditions, like e.g. black soil, predominantly located in the European part of Russia and Southern Siberia.

Figure 2: Indices of Total Factor Productivity per sector among Russia's regions

(each dot = one region + mean trend)



Source: Own calculations / own illustrations based on the results of the final restricted frontier model estimates.

For a more detailed look at regional level an index of TFP changes has been computed for each considered region over the analyzed period 1993 – 2003 (Figure 2).[14] The graph illustrates the general tendency of the regional TFP changes (see trend line) as well as its spread among Russia's regions. Comparing industry and agriculture provides that also in this regard opposite developments among the two the sectors

[14] Based on equation (3) regional TFP changes have been computed. Thus, the index was constructed using the base year 1999 (the year right after the Russian currency crises as this is supposed to have caused substantial restructurings/relative price changes).

occurred. In industry, before the '98 crisis, TFP was slowly increasing, while afterwards the growth appeared even accelerating. In agriculture, TFP was decreasing until 1998 and remained basically at that level or went up marginally after the crisis. In addition, Figure 2 also illustrates that the interregional variance of TFP remained basically constant in Russia's industrial sector, but was found to be decreasing in agriculture. Given the fact that the average TFP in agriculture tends to be diminishing over the period considered (as discussed above), this particular finding suggests not only that less efficient regions were unable to catch up with the more efficient ones. In fact, the superior regions in this regard might have lost this advantage and experienced rather a rapprochement to the marginal conditions prevailing in the less efficient regions. This phenomenon might be called "negative convergence" as it refers exactly to the opposite of what is commonly expected from a catching up process: literally closing an existing gap by enhancement of laggards instead of achieving convergence by a downgrading of the formerly advanced regions.[15]

In the following section we will elaborate more on this assessment by discussing the sources of TFP changes, e.g. the impact of technological change and the development of technical efficiency. As outlined in the introduction, the changes in TE are of particular interest since they provide information about the progresses made in improving the co-ordination mechanism, i.e., the institutional factor affecting production, namely progress in transition.

4.3 Sources of Growth

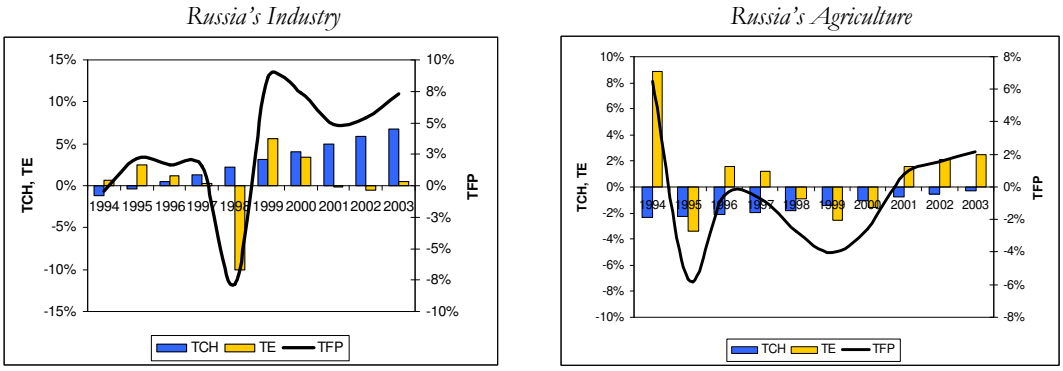
For the following considerations concerning the decomposition of TFP growth into technological change and technical efficiency, we follow the same structure of discussion as applied in the section before. With respect to Russia's industry, Figure 3 illustrates that the mean efficiency and the technological change were increasing in almost all periods and appear to be the sources of TFP growth in this sector as discussed above.

Thus, empirical evidence suggests that Russia's industry reached a relatively high efficiency level already in the 1990s (Figure 4). The graph also shows that the disruption due to the '98 crisis was almost compensated after the two following years (referring to the sample mean), which indeed showed a rather prospering TE development. Moreover, for the subsequent years relative small fluctuations around a comparably high efficiency level were estimated. In addition, as already mentioned in the discussion of the parameter estimates, technological change accelerated in the period under investigation. In fact, analyzing the empirical differences in terms of regional developments it turned out that in all regions, with respect to the industrial sector, technical progress has been realized during the transition process. Moreover, the calculated technical progress does not differ largely among regions, providing that the main differences in TFP change among regions are due to region-specific developments of technical efficiency. In this regard, diminishing TE were reported for about 20% of the regions and these were basically the same which experienced also notable negative scale effect and which also altogether led to a slightly decreasing TFP in those regions.

[15] For Russia's industry no clear tendency with respect to convergence or divergence of regions was found.

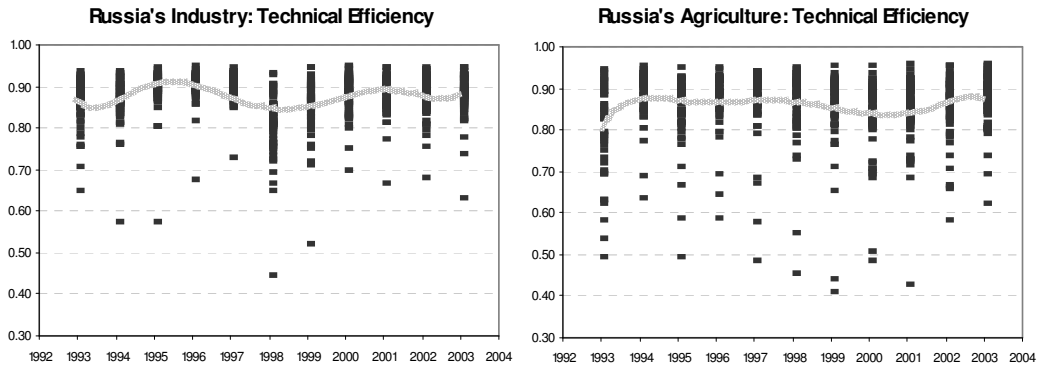
However, with respect to the large majority of Russia's regions, it can be concluded that there is strong evidence indicating that Russia's industry has stepped on a sustainable development path mainly provided by an improvement of the production possibility set through technological progress and at the same time being triggered by improvements in terms of technical efficiency (reduction of wastes/inefficiencies in the production process). Thus, both indicators suggest that in Russia's industry the general challenges of the transition process have been tackled quite satisfactorily.

Figure 3: Decomposition of TFP growth in Russia annual TCH and TE changes per sector, 1993 – 2003



Source: Own calculations / own illustrations based on the results of the final restricted frontier model estimates.

Figure 4: Trajectories of Technical Efficiency (each dot = one region + mean trend)



Source: Own calculations / own illustrations based on the results of the final restricted frontier model estimates.

The agricultural sector, on the contrary, was even at the end of the analyzed period still characterized by a significant degradation of the initial production possibilities. Moreover, at the sample mean this development went hand in hand with decreasing technical efficiency, i.e. empirically the gap to an efficient way of production even increased and regions depart instead of advance to the frontier. The latter stands in sharp contrast to what is supposed to happen on the way from a planned towards a market economy and appears to be another expression of the deep transition crisis in which the sector was trapped. Only at the very end of the observation period there was evidence of a reverse trend and rising efficiency. In fact, in year 2003 the decline of production possibilities finally came almost to an end and efficiency improved significantly (year 2001 ff). But, considering the entire period from 1993 – 2003, it becomes obvious that almost no regions could improve their production possibilities

steadily although more than 50% of the regions were able to increase their efficiency level. But, even this was insufficient to cause substantial increases in terms of TFP.

When taking again a closer look at the regional trajectories of Russia's agriculture notable differences among the individual regions become eminent[16] and these differences appear to be significantly higher as in the case of the industrial sector.[17] In fact, a number of regions apparently still have decreasing trends of their agricultural TFP; others have already initiated a positive trend. Accordingly, it is indeed difficult to observe a common trend pattern for agriculture. Instead, rising divergence among regions has to be noted.

5. Discussion: Divergent transition paths, political needs & addressees

As outlined above, rising TE, positive TCH and, as a result, TFP growth can be expected when a former planned economy is transformed into a market economy. Hence, in order to consider stylized transition paths, a nationwide look at the trajectories of these measures seems to be appropriate. However, no commonly rising TE-trends could be found and the TFP patterns are not clearly positive over the entire transition period, either. Regional TFP-indices seem to be driven in the short run by changes of absolute TE and in the mid-term to be dominated by the question of regionally positive or negative TCH-trends. In fact, the latter refers to regional economic expectations (investment decisions) rather than to transition effects in the sense mentioned above.

Summarizing the empirical evidence as discussed above, it can be stated, referring to the industrial sector that the average regional TFP scores reflect Russia's macro-economic development: Initially it decreased, basically due to adjustment shocks, and then followed by an increasing trend initiated, most likely, due to liberalization effects and the opening of the economy, etc., but hampered by hyperinflation. Then, after 1996, TFP went down again. Apparently this was brought about by the de-monetarization of Russia's economy, which led, consequently, to barter as one of the major modes of exchange. The bottom of TFP temporally coincides with the financial crisis in August 1998. TFP turned upwards thereafter. This commonly is assumed to be caused by the 'window of opportunity' which opened after the financial crises in August 1998. In this context the Rouble was highly devaluated and thus increased the competitiveness of domestic production drastically, and in turn, improved the position of Russian firms on the world market. Thus, the average industrial performance seems to reflect Russia's general macro-economic growth patterns. In parallel, over the analyzed period the external framework conditions for Russia's economy turned to be

[16] See e.g. BEZLEPKINA et al., (2004) concerning the development and performance of Russia's agriculture in transition at enterprise/farm level 1990 – 2001.

[17] Particularly positive trends in terms of agricultural TFP have achieved, for example, Astrakhan, Belgorod, Kirov, Mordovia, Rostov-on-Don (> 20% above Russia's average in terms of TFP change 1993–2003). Noteworthy negative trends were found, for example, in Murmansk, Kamtschatska, Sachalin (> 20% below Russia's average). Some regions, like Moscow, that 1993 already were found to be above the average in terms of TE achieved even further increase of agricultural TFP. Others, like Kamtschatska and Sachalin, kept their levels in TE (around Russia's average), but suffered from substantial negative TCH. For a third group of regions, like Belgorod, increasing TE (catching up) caused the positive TFP change.

favourable due to significantly rising raw material prices at the world markets (which may have indeed superimposed other influences from institutional changes).

The picture that emerges from analyzing agriculture – compared to industry – however is heterogeneous. In fact, the empirical results support the hypothesis of an inter-sectoral co-integration in Russia only to a limited extent. Indeed, in average terms agricultural performance was decreasing until 2001 and has only slightly improved thereafter. That means, in contrast to Russia's industry, the 'window of opportunity' has had little or no direct effect with regard to the performance of the agricultural sector. Taking into account the unclear TFP trend patterns thereafter, it is not even proved whether a general turnaround – like in the rest of Russia's economy – can be recognized so far for agriculture.

As TE has been considered as an approximation of transition progress it seems to be interesting to discuss the corresponding estimates more in detail. In Russia's industry the mean TE followed the general macro-economic developments and has turned up and down accordingly. However, no commonly rising trend is obvious (as expected). That suggests that transition progress cannot be the source of the current industrial growth rates, given the empirical approximation of progress in terms of the transition process. Concerning agriculture a nearly constant TE-average was estimated. Hence, no significant transition progress can be stated for agriculture, either. An interesting aspect in this regard seems to be the notable (and apparently even rising) variance of TE scores, particularly in the agricultural sector. These trends indicate the tendency of growing heterogeneity among regions and, however, divergence in terms of regional TE seems to be another indicator, which suggests that common transition success in Russia cannot be confirmed over the analyzed period. Referring to this divergence, the relation between the regional level of output per capita (normalized by means of Russia's average of output per capita) and the corresponding regional TFP change per year in agriculture and industry was considered. For regions with output per capita above the average no significant relation to the TFP change was obvious. That means that no regional level of absolute productivity (like output per capita) did necessarily come along with a common trend. Apparently, individual circumstances at regional level seem to determine the TFP trajectories, like e.g. regional institutional conditions. On the other hand, marginal regions in terms of output per capita tend to achieve lower (for agriculture even negative) annual TFP changes. Hence, empirical evidence in this respect suggests regional divergence in Russia: Leading regions in terms of output per capita are able to keep or even to improve their TFP and marginal regions tend to fall further behind. Concerning regional integration in Russia this would be alarming. The fact that these regions that were mentioned above exemplary as positive as well as negative regional examples of agricultural TFP trends (see footnote 15) can be found again among the better / lower performing regions in terms of industrial TFP trends underlines the hypothesis of individual circumstances at regional level to be the crucial determinants for any transition trajectory.[18]

[18] Examples of top performing regions in terms of industrial TPF change (1993 – 2003) are: Moscow, Archangelsk, Astrakhan, etc. Particular negative trends achieved: Adygea, Jewish auton. Republic, Kalmykia Chalm, Khakassia, Magadan, Sachalin.

Since substantial progress or even the 'completion of the transition process' (see introduction) apparently are not the driving forces of Russia's recent track record, arises the question: What are the sources of the current growth in Russia's economy?

When reconsidering the differences in regional TFP, TE, and TCH, however, it seems that the driving force of divergence among Russia's regional transition trajectories has a regional origin. The positive examples – those regions that are above the common average (see the graphs in the Appendix) – illustrate the spectrum of possibilities for regional progress. At the federal level, more or less only the administrative boundaries of this spectrum concerning regional differences in institutional settings are defined. With respect to the poor development of Russia's economy during the first decade of transition, one may assume that Moscow has set those boundaries too strictly, which could have hampered the transition process. Even if this might be true and/or may have changed later under Putin, the majority of reasons why many regions were found to be relatively unsuccessful during this period are of a regional character (regionally diverse reform implementations/strictness in reform efforts, availability of raw materials). Hence, it is rather unlikely that the institutional reforms introduced during Vladimir Putin's presidency have solely caused the general upswing of the national economy; first of all because the growth patterns are empirically not homogeneous enough across regions and sectors (as they are supposed to be if triggered by changes of the institutional framework at federal level) and secondly as the identified determinants of progress in transition tend to lie at regional level anyway.

6. Conclusions

In order to understand why Russia's economy is currently growing quite rapidly and whether the foundation of this track record is a self-energizing process or just a flash in the pan, one has to know the impulses which have triggered the growth: (1) success of transition, such as positive "J-curve" effects, as expected theoretically, or (2) favorable external circumstances (rising prices for oil, gas, etc.), or maybe a combination of the two. In fact, it is a challenging task to separate these effects. In order to contribute to this discussion, a comprehensive study of Russia in transition with a particular focus on the individual progress at regional level per sector has been carried out. Thus, progress in transition has been approximated by means of calculated productivity and efficiency measures, which are expected to rise when a formerly planned economy transforms into a market economy.

In general, little evidence of such positive "J-curve" effects was found. Instead of clearly rising trends, a steady up and down of productivity and efficiency had to be observed. Moreover, there is empirical evidence that suggests a divergence among regions and no clearly rising TE trends could be found.

With respect to the empirical approximation of the transition progress – assumed as rising TE – it has to be summarized: Neither for industry nor agriculture notable positive effects can be recognized and, therefore, no general success of transition in the expected sense can be stated for the period of analysis.

Moreover, reflecting the period that remained undiscovered by this analyses due to lack of corresponding empirical data (mainly Mr. Putin's second presidential term), it can be summarized that the general perception of policy in Moscow has changed towards more centralism. Given Russia's regional heterogeneity (which is rather natural),

this has likely been counteracting any individually adjustable process of institution setting in the sense of regional progress in transition, which empirically was identified to be imperative at that level. Furthermore, considering Russia's transition process in general and the corresponding attitudes towards democracy, liberal society, free market economy, etc. in the recent past, evidence suggests that there is indeed little progress. Perhaps even steps backwards compared to the situation during the first presidential term of Mr. Putin might be recognized. Accordingly, the overall conclusion of this analysis – Russia's recent economic growth is not caused by substantial progress in transition – is likely to remain unchanged even if the empirical foundation of this analyses could be further updated and would incorporate also the statistics for the years 2004 – 2007.

This paper should not be seen as an attempt to evaluate the success and the political achievements during the era Putin; it only seeks to put it just into perspective. In fact, Russia today appears to be economically stronger than ever before since the transition process begun and many people will attribute this to Mr. Putin's presidentship, no matter what happens in the raw material markets. Looking at the astonishing growth Russia currently is facing it remains to be stated, Russia does indeed seem to be in the fortunate position of having an incredible amount of raw materials at a time of globally rising prices, which apparently is driving the economy. Any growth potential stemming from the transition process, however, seem to be thus-far under-exploited. Therefore, the present situation should be seen as a call to action for policy makers to push the transition process towards achieving a sustainable growth path. Then, at the time when the expected positive "J-curve"-effects due to transition really come true, Russia could probably even top present growth rates, thereby providing a new 'window of opportunity'.

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Appendix

Table 1: Parameter estimates of the frontier models (FRM per sector)

	Industry				Agriculture			
Variable	**Parameter**	**St-error**	**t-ratio**	**p-value**	**Parameter**	**St-error**	**t-ratio**	**p-value**
β_0 Intercept	0.1107	0.0770	1.437	0.1508	0.1714	0.0307	5.581	0.0000
β_t Time	0.0274	0.0037	7.371	0.0000	-0.0140	0.0029	-4.781	0.0000
β_{tt}	0.0091	0.0025	3.644	0.0003	0.0025	0.0020	1.231	0.2185
β_1 Capital	0.7149	0.0354	20.213	0.0000	0.4179	0.0238	17.565	0.0000
β_2 Labour	0.4253	0.0426	9.982	0.0000	0.3213	0.0342	9.406	0.0000
β_3 Fertilizer	---	---	---	---	0.0986	0.0116	8.516	0.0000
β_4 Land	---	---	---	---	0.1082	0.0166	6.534	0.0000
β_{1t}	-0.0043	0.0095	-0.455	0.6492	-0.0105	0.0057	-1.846	0.0649
β_{2t}	0.0097	0.0123	0.792	0.4285	0.0101	0.0089	1.138	0.2551
β_{3t}	---	---	---	---	0.0030	0.0033	0.887	0.3753
β_{4t}	---	---	---	---	0.0060	0.0045	1.324	0.1855
β_{12}	0.0543	0.1336	0.406	0.6846	-0.0783	0.0731	-1.071	0.2842
β_{13}	---	---	---	---	0.0267	0.0249	1.073	0.2834
β_{14}	---	---	---	---	0.0622	0.0348	1.790	0.0735
β_{23}	---	---	---	---	0.0424	0.0373	1.137	0.2556
β_{24}	---	---	---	---	0.2061	0.0675	3.052	0.0023
β_{34}	---	---	---	---	-0.0631	0.0191	-3.310	0.0009
β_{11}	0.0235	0.1036	0.227	0.8202	0.0330	0.0646	0.511	0.6096
β_{22}	-0.2057	0.1737	-1.184	0.2363	-0.3838	0.1242	-3.089	0.0020
β_{33}	---	---	---	---	0.0146	0.0155	0.941	0.3468
β_{44}	---	---	---	---	-0.1457	0.0336	-4.337	0.0000

Source: Own estimates