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# INDICES OF REGIONAL ECONOMIC ACTIVITY FOR RUSSIA

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Regional statistics published by the Russian Federal State Statistics Service (Rosstat) are reviewed in terms of quality, and radical disagreement between "month-on-month" and "year-on-year" monthly statistics is identified. In view of this, an original method is proposed for estimating the level of Regional Economic Activity (REA), based on monthly official regional statistics in five key sectors of the Russian economy: industry, construction, retail trade, wholesale trade, and paid services for the population. This method transforms current "year-on-year" growth rates into specially constructed dichotomous variables, which eliminate the excessive volatility and inaccuracy of the initial time series.

On these grounds, REA indices are estimated for all Russian constituent entities for the period from January 2005 to May 2017. Composite REA indices for all five economic sectors, eight federal districts, and Russia as a whole are then calculated. Methods for visualising multidimensional regional data are also proposed. They allow us to track the regional peculiarities of the Russian economy and to discern the current phase of the business cycle more accurately and without any additional lag. Several illustrative examples for the possible application of these indices in real time monitoring and analyses are provided.

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# 1    Introduction

In large countries, the development of national macroeconomic business cycles clearly involves regional nuances that, as a rule, fall outside scholars' fields of vision, especially when monitoring the current economic situation. As far as we are aware, only Brazil and the United States regularly publish up-to-date statistics reflecting the current levels of economic activity in individual states and sub-national regions.[4] There are no such indicators for Russia, although for a country of its size – with its diverse climate conditions, differing volumes of natural and labour resources, and particular distribution of production capacity – it is vital that regional differences are taken into account in order to achieve a sound understanding of the processes that are unfolding.

Since April 2009, Rosstat (the Russian Federal State Statistics Service) has published a monthly electronic bulletin titled Information for Monitoring Socio-Economic Conditions in the Constituent Entities of the Russian Federation,[5] which offers a regional breakdown of key socio-economic indicators. A significant volume of monthly regional information can also be found in the Unified Interagency Statistical Information System.[6] However, none of the aggregate indicators that best characterise the *current* level of regional economic activity are being estimated in Russia. Therefore, the real time regional data amassed remains, essentially, immense and virtually useless.

In section 2 we analyse the quality of official regional statistics and propose a new method for processing and aggregating data that will make it possible to easily estimate the current level of Regional Economic Activity (REA) in every constituent entity of the Russian Federation ('oblasts'), eight federal districts, five main sectors of the economy, and Russia as a whole.

In section 3 we calculate composite indices of economic activity for the period from January 2005 to May 2017, and demonstrate how they can be used to compare regional trends, and to receive additional information regarding the current phase of the business cycle across the entire Russian economy.

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[4]  See: Banco Central do Brasil. Boletim Regional. http://www.bcb.gov.br/?BOLREGIONAL; The Federal Reserve Bank of Philadelphia. State Coincident Indexes. https://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/. For the methodologies on which these indicators are based, see: Banco Central do Brasil (2009); Crone and Clayton-Matthews (2005). Of course, regional GDPs are not a rare thing for national statistical systems but in the context of monitoring the current situation, this information is unlikely to be of much use. For example, Rosstat only publishes data showing annual (not quarterly) changes in Gross Regional Product (GRP) and with a lag of over a year. Other countries are not much better.

[5] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1246601078438

[6] Its Russian acronym is 'EMISS'. See: https://www.fedstat.ru/

In conclusion, we review the experimental calculations made and outline the possible future uses of these REA indices.

## 2  Indices of Regional Economic Activity (REA): Data and Calculation

In Russia, one of the following two indicators is usually used to monitor the aggregate economic activity at the national level in real time:

a)   Index of production for the basic economic branches; calculated by Rosstat using data for agriculture, mining, manufacturing, production and distribution of electricity, gas, and water, construction, transportation, retail and wholesale trade;[7]

b)   Index of intensity of production for the basic economic branches; calculated by the Higher School of Economics (HSE).[8] This differs from the Rosstat index as it does not include passenger transportation, and also in several important methodological aspects.

The 'popularity' of these two indicators is due to the fact that, for the medium term, their quarterly dynamics are close to the quarterly dynamics of GDP. Since GDP is usually considered an almost ideal indicator of national economic activity, albeit one that is published rarely (once every three months), and with a significant delay (up to two months), for real time monitoring of economic activity experts tend to use monthly indices for the basic economic branches which are supposedly close to the unobservable monthly GDP.

It would be natural to assume that assessments of regional economic activity should be based on similar indices calculated for distinct regions, but regional data on agricultural production and freight transportation is only available each quarter, not monthly. Hence, agriculture and transportation had to be excluded from further calculations and any full analogy between national and regional aggregate indicators was impossible. Instead, we included information on paid services for the population.

Finally, for calculating REA indices, we selected Rosstat's monthly information for regional dynamics in the five key sectors of the economy: industry (the sum of mining, manufacturing, and production and distribution of electricity, gas, and water), construction, retail trade, wholesale trade, and paid services for the population. At this stage, it seemed natural to take the following four steps:

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[7] http://www.gks.ru/free_doc/new_site/vvp/tab45.htm
[8]  See Baranov et al. (2011).

–	For each region, using monthly month-on-month (m-o-m) growth rates to calculate the chain indices for all five sectors;

–	For all these indices, to make seasonal adjustments using a procedure selected (e.g. ARIMA X-12, or Tramo/Seats, implemented as part of the 'Demetra' package);

–	For each region, to calculate a REA index as a weighted average of five seasonally adjusted chain indices (e.g., using each sector's share of GRP as weights);

–	At last, to calculate composite REA indices for Russia as a whole, for federal districts, etc.

However it has not been possible to implement this obvious approach in practice, because using month-on-month data for assessing chain indices often leads to results that cannot be interpreted.

To back this up, we include a graph showing the chain index for industrial production in Moscow calculated by taking December 2008 as 100% and multiplying all the subsequent month-on-month growth rates (see Figure 1). At first glance, it looks more or less acceptable (unlike, for example, the index for Magadan Oblast, which over several years supposedly grew by 20 times and more). Stagnation in Moscow's industry over the period 2009-2013 and the sharp fall in production in 2014-2016 do not explicitly contradict common sense. However, if you look more closely, then you will notice that Figure 1 indicates a 42% fall in the industrial index from December 2008 to December 2016. Meanwhile, according to Rosstat this fall was only 13% when calculated using "December-on-December" indices. Of course, this is also a significant amount, but it indicates a qualitatively different picture: a serious fall, but no disaster. Intuitively, the second figure, 13%, seems more plausible than the first, 42%, and it better matches with annual statistics, which are viewed as the most accurate.
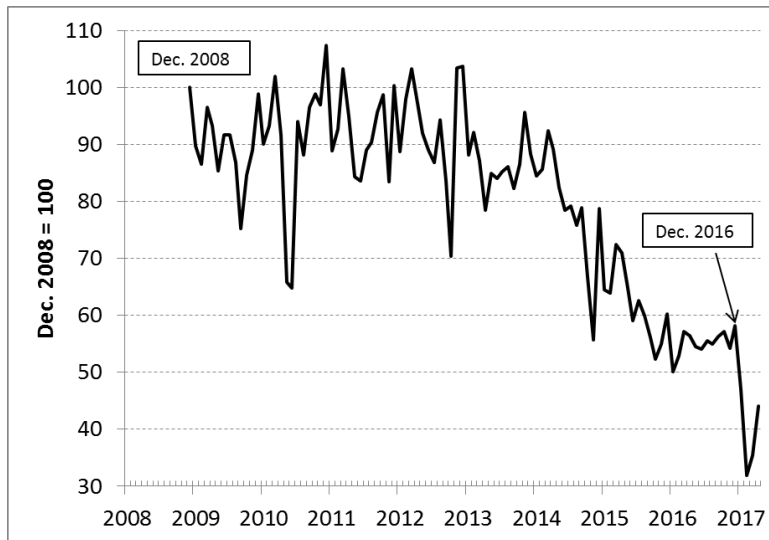
Figure 1. Moscow, Chain Industrial Production Index (IPI)

For many other regions the difference between indices calculated using "month-on-month" and "year-on-year" time-series is even larger.[9] Figure 2 compares regional industrial production growth rates calculated from the multiplication of 12 "month-on-month" indices from January to December 2015 (the abscissa axis), and those published by Rosstat for December 2015 on "year-on-year" basis (the ordinate axis).
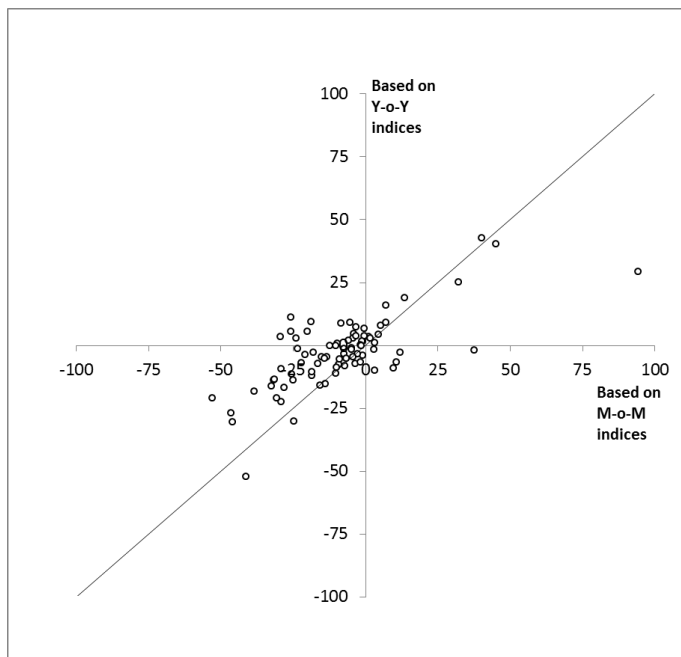


Figure 2. Regional Industrial Production: growth rates, Dec. 2015/ Dec. 2014, calculated by various methods, p.p.

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[9] At the Russian Federal level, they coincide. How that can be when it is not the case for individual regions is a question for Rosstat.

Of course, there is clear correlation between these two indicators (pair correlation coefficient equals 0.74), but this is not enough to build accurate time-series at regional level for at least a five to seven-year period. In 2015 alone, this difference exceeds 10 p.p. in either direction for 34 regions (over 40% of the total number), with the following among the leaders: Republic of Ingushetia (+65 p.p.), Chechen Republic (+39 p.p.), Bryansk Oblast (-37 p.p.), Pskov Oblast (-33 p.p), Republic of Dagestan (-32 p.p), Krasnodar Oblast (-31 p.p). In a longer perspective, the entire trajectory calculated on the basis of highly erratic "month-on-month" growth rates will be unreliable and probably misleading.

Unfortunately, "year-on-year" figures are not much better. For example, according to Rosstat, Dagestan's Industrial Production Index (IPI) rose in November 2013 by 7.4 times compared to November 2012; Chukotka Autonomous District's IPI was 4.8 times higher in October 2008 than in October 2007; Rostov District's IPI was 3.2 times higher in November 2015 than in November 2014. Can all this really be true? And is it worth making any kind of substantive conclusions based on these figures?

A similar situation can be found not only in industry but also in other sectors of the economy where, if anything, it might be worse. For example, according to Rosstat, the 2016 annual growth rate in wholesale trade was 1.4%, while the weighted average growth rate of wholesale trade in all eight federal districts was 8.7% - quite a substantial difference.

Overall, various blunders by Russian regional statistical committees combined with the inadequacy of the methodology applied by Rosstat, means that the published regional data – as it is – simply cannot be used in the analysis of medium and long-term trends.

We therefore find ourselves with the following alternatives:

–   Stop using Rosstat real-time regional data, in which case, since there is no replacement, we would have to stop making any indicators for regional economic activity (REA);

–   Transform published Rosstat data so that it retains some useful information while the 'white noise' is at least partly cancelled out.

We decided to take a risk and selected the second course of action.

Our first step was to create the variables $D_{sr}^t$, equal to 100, if at moment $t$ production output (work done, trade turnover, etc.) in sector $s$ in region $r$ is higher than 100% compared to the same month the previous year, and zero otherwise. In other words, if a particular sector in a particular region sees growth on the previous year, then the variable is assumed to be equal to

100, and if there was no growth, to zero. By taking the average of these dichotomous variables by region, we get nationwide indices for each of the five economic sectors ($n$ – the total number of constituent entities of the Russian Federation, equal to 80 before 2015, and 82 from 2016):

$$S_s^t = 1/n \sum_{r=1}^{n} D_{sr}^t. \tag{1}$$

The trajectories of these indices can be easily compared with those for regular aggregate sectoral indices produced by Rosstat. If the dynamics of these indices are similar, then this would support the proposed approach as rational and effective.

In advance, we may note that the evidence cited in the next section confirms this and there would therefore be confidence in our indices of Regional Economic Activity (REA), which can be calculated by averaging the variables $D_{sr}^t$ for each moment $t$ by the five key sectors in any one region:

$$R_r^t = 1/5 \sum_{s=1}^{5} D_{sr}^t. \tag{2}$$

If, in region $r$ at moment $t$ we see "year-on-year" growth in all five sectors, the REA index for this constituent entity of the Russian Federation will be equal to 100%; if in none of these five areas – zero; if in one of them – 20% and so on.[10] On the basis of $R_r^t$ it is easy to calculate the composite indices for REA by federal districts ($m$ – number of regions included in a Federal District)

$$R_{FO}^t = 1/m \sum_{r \in FO}^{m} R_r^t \tag{3}$$

as well as for the whole of Russia ($n$ – the total number of Constituent Entities of the Russian Federation):

$$R^t = 1/n \sum_{r=1}^{n} R_r^t. \tag{4}$$

It is also possible to note that:

$$R^t = 1/5 \sum_{s=1}^{5} S_s^t. \tag{5}$$

In other words, the Russian national Composite Index of REA $R^t$ can be calculated not only as an average of regional indices $R_r^t$, but also as an average of sectoral indices $S_s^t$, meaning that it can be considered an equivalent to the regular index of production for the basic economic

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[10] It seems that, at this stage, knowing the structure of GRP, it would have been possible to weight sectoral indices to receive more accurate indicators. However, we felt that there was no point trying to refine an inherently approximate methodology, especially since using simple arithmetic means simplifies economic interpretation.

branches. It also turns out that a composite REA index of less than 50% means that growth is seen in less than half of the Constituent Entities of the Russian Federation if we understand it as "average by sector", or in less than half sectors if we understand it as "average by region" (all – in relation to the corresponding month of the previous year).

At the end of this section we offer a more formal outline of the statistical indicators that we use and their sources (see Table 1):

**Table 1. Statistical indicators used in calculating REA indices, January 2005 – May 2017**

| *Indicators* | Sources* | |
|---|---|---|
| (in comparable prices, in % to the corresponding period the previous year) | 01/2005 – 12/2008 | 01/2009 and on |
| Industrial Production Index (IPI) | (1) | (2) |
| Construction, volume of work done | (3) | (2) |
| Retail trade turnover | (1) | (2) |
| Wholesale trade turnover (entities classified to a branch with code 51) | (1) | (4),(1) |
| Volume of paid services for the population | (1) | (2) |

 * Sources
 (1) – Monthly bulletin "Socio-economic Conditions in Russia", Appendix "Particular statistical indicators of socio-economic conditions in Constituent Entities of the Russian Federation"
 (2) – "Information for monitoring socio-economic conditions in Constituent Entities of the Russian Federation"
 (3) – unpublished Rosstat data, provided on our request
 (4) – EMISS (Unified Interagency Statistical Information System), section 1.22.1

# 3    REA Indices and Monitoring the Current Economic Situation

As was noted in the previous section, it is crucially important to establish the reliability of the composite indices calculated from specially constructed dichotomous variables. We do this by comparing the trends for the regular Rosstat indices of production (as % against the corresponding month of the previous year) and our REA composite indices for all five key sectors of the Russian economy. One can see the results of this comparison in Figure 3, which also shows the coefficients of correlation between both time series. The results are clear: the

dynamics of REA composite indices are close to those shown by "year-on-year" growth rates of regular Rosstat indices for all key sectors apart from wholesale trade.[11]
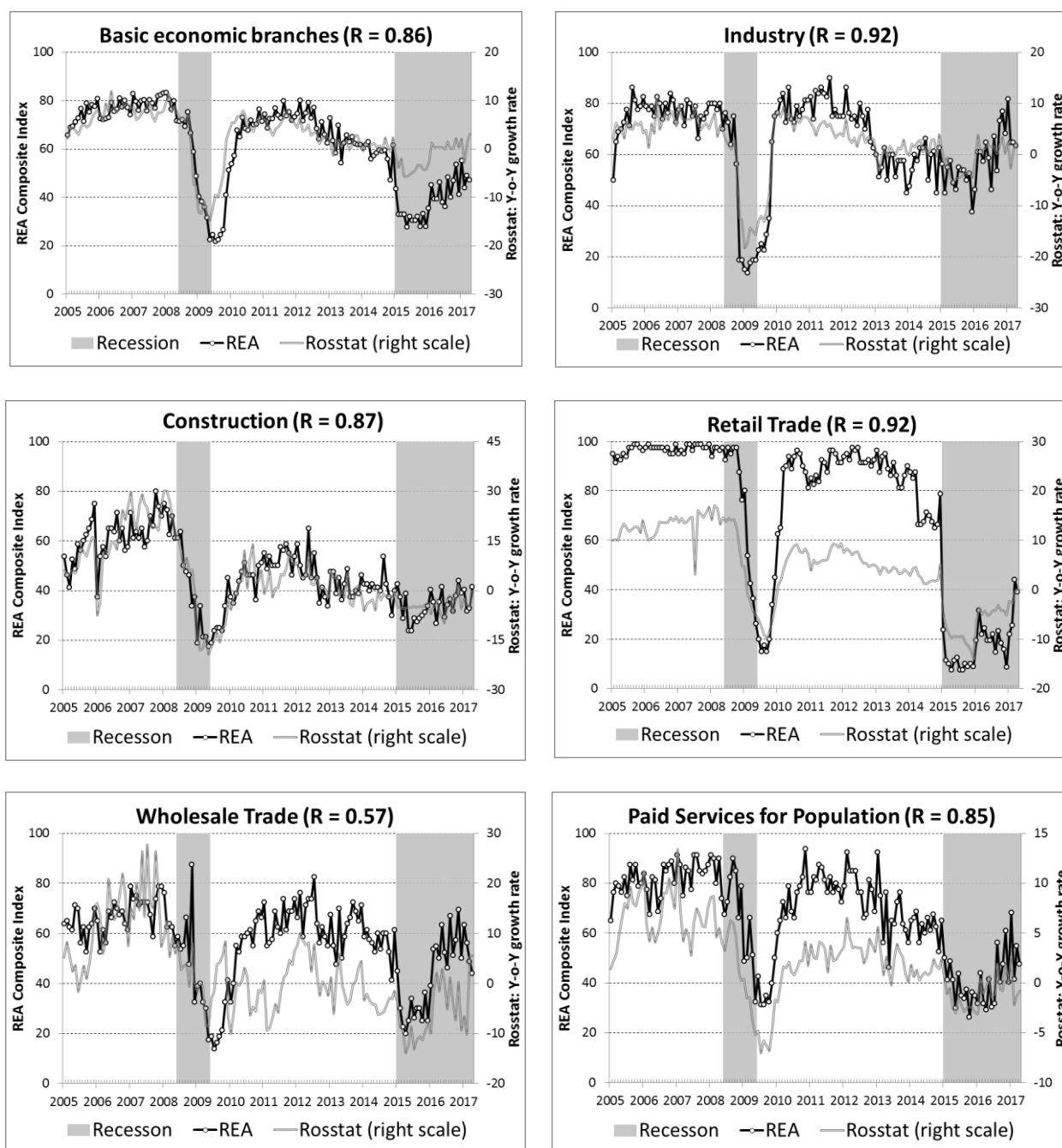


Figure 3. Composite REA indices and Rosstat's y-o-y growth rates, by economic sector, January 2005 – April 2017

The second important result, which is completely clear from Figure 3, is the noticeable fall in REA indices over the two most recent recessions.[12] This means that REA indices can

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[11] As for wholesale trade, the question remains as to which of these two indicators better reflects reality. For critics of regular Rosstat's data on wholesale trade see: Development Centre. Comments on the State and Business. 2016 No. 117. P. 6. https://dcenter.hse.ru/data/2016/08/03/1119859024/KGB_117.pdf?draft=1

definitely be used to analyse economic conditions in the regions (recall that Rosstat calculates and publishes no aggregate indicators for regions in real time).

It is also possible to identify two areas for further analysis. The first is related to assessing the level and changes in economic activity of particular regions; the second, with the use of a set of regional indices to outline the broader economic conditions. We will now give examples of both of these.

Regarding the first area, related to research into cyclical features of particular regions, we offer a graph of REA index for Moscow (Figure 4). We can conclude that:

- Before the 2008-9 crisis Moscow saw rapid economic growth (REA index usually amounted higher than 60%);

- Since the global economic crisis of 2008-9, Moscow saw its economy shrink: first slowly and then radically from November 2008 (REA index fell to 0% or 20%);
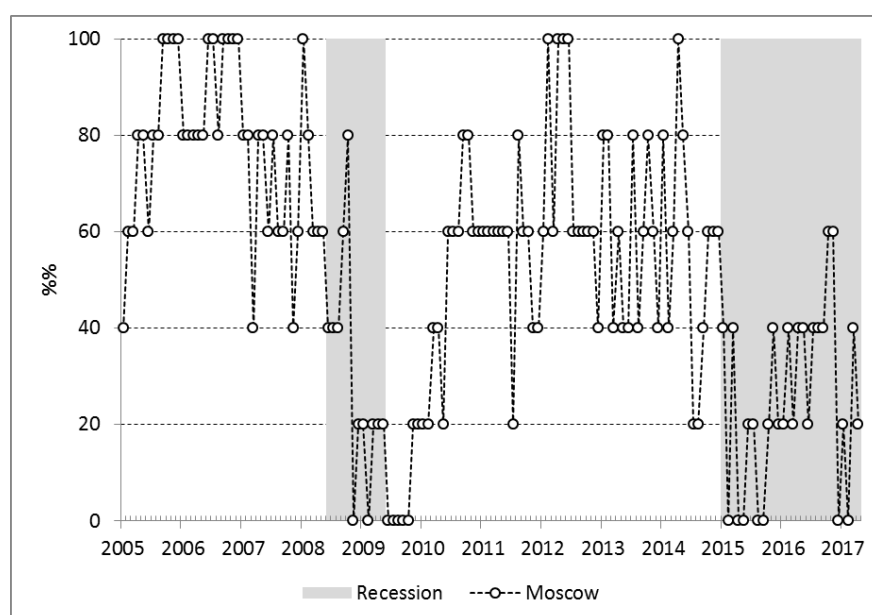


Figure 4. REA index for Moscow, January 2005 – April 2017

- Moscow's post-crisis recovery took place more slowly than in the country as a whole (REA index for Moscow reached the 60% mark only in June 2010, three-four months later than the average for Russia as a whole);

- In 2011-2014, Moscow saw steady growth which, but for the exception of several months in 1H 2012, failed to reach pre-crisis levels of intensity;

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[12] We dated peaks for the economy in May 2008 and December 2014, and contractions in May 2009. (For more detail on this see Smirnov et al, 'We have not yet reached the bottom of the current crisis'.

–   For most of 2015, Moscow's economy contracted sharply (REA index 0% or 20%). In 2016-2017 this fall was no longer so intense, but it is still too early to conclude that the downturn in Moscow is over and the recovery has begun.

On the basis of this kind of analysis of REA indices for different constituent entities of the Russian Federation, it is possible to identify groups of regions that demonstrate similar economic trends, and going forward, to identify the processes of contagion with cyclical falls and rises across Russia. Analysing individual regions, it is possible to identify those regions that have been most successful or most depressed. For example, over the most recent three month period (February-April 2017), the leaders in economic activity level include: Kemerovo Region (on average for this period its REA index was 80%), and six regions with REA indices equal to 73 (the Lipetsk, Tyumen, and Irkutsk Regions, the Stavropol Territory, the Republics of Ingushetia and Tyva).[13] The outliers for this period include: the Saratov and Novgorod Regions (7%). The situation was a bit brighter in the Volgograd and Perm Regions, and the Republic of Buryatia (13%).

It is also possible to trace the trajectories of all 82 regions of Russia and to analyse all the figures as in Figure 4. But here we will instead move to the second area in which REA indices can be used – describing the general economic situation in Russia using regional data. In this context there are several tools that can be used.

First, composite indices can be compiled on five sectors of the economy and 8 federal districts, which makes it easy to create a radar chart from which sectors and regions of growth or decline and stagnation can easily be localised. Figure 5 describes how, in April 2017, there was a particularly clear fall in retail and wholesale trade, and in construction (58 - 60% of regions demonstrated declines in these sectors). This indicates a spatial weakness of consumer and investment demand. Industry was the most successful sector (growth in 63% of regions). In any case, the overall situation is far from favourable.

Similarly, one may observe that four federal districts (the Ural, South, North Caucasus, and Siberia districts) demonstrated growth in April 2017 (REA indices of over 50%), and that the other four (the Central, North-West, Far East, and Volga districts) were contracting.

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[13] In line with our methodology, in each region we identify the changes in economic activity as measured by "year-on-year" growth rate in five economic sectors over three recent months. The maximum number of points a region can get is 15 (all five economic sectors in growth during all three months). If we take this for 100, then a region with only one sector without growth during one month will get 93% (14/15 =0.93). If the average quarterly REA index is equal to 80 then in three of 15 cases there was no growth (this could be one sector for the whole quarter or three sectors in one month, etc.). Similarly, if the average quarterly REA index equals 20%, then in only three out of 15 cases there was a growth; with two cases of growth the average quarterly REA index is equal to 13%, with one case of growth – to 7% (all numbers are rounded).
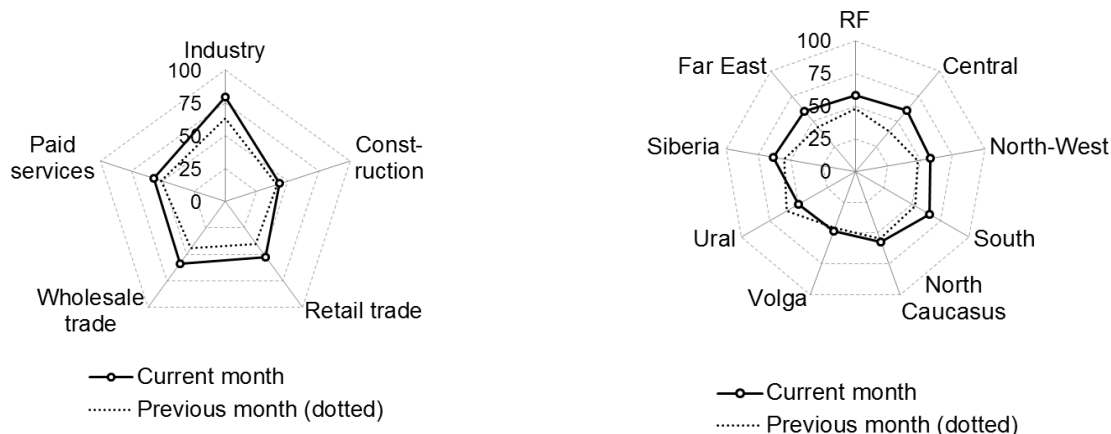
Figure 5. Composite Indices of Regional Economic Activity, by economic sector and Federal District, April 2017

Second, in order to evaluate the current level of economic activity in the Russian economy as a whole, it would be reasonable to consider a map of the country that shows the regions with the same level of economic activity in the same colour.14 This would give a snapshot view of the level of economic activity in the country (in terms of its colour), and would also immediately draw attention to the most and least dynamic areas.

Third, one can create a histogram that shows the distribution of regions by their REA level. Aside from the fact that Federal constituent entities differ significantly from each other in terms of their territory, this kind of chart presents the same information as the geographical map does but in a more aggregated manner (all REA indices are sorted to several intervals). On the other hand, it is easy to compare histograms for two to three sequential months and trace the changes in total economic activity (this is completely impossible with a map). For example, from Figure 6, it is clear that in April 2017 there was roughly the same number of regions that had low and very low levels of economic activity (REA Indices equal to 20% and 0%) as a month before. This is an argument to support the view that Russian growth is still sluggish.

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14 For similar maps for the United States see https://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/maps.
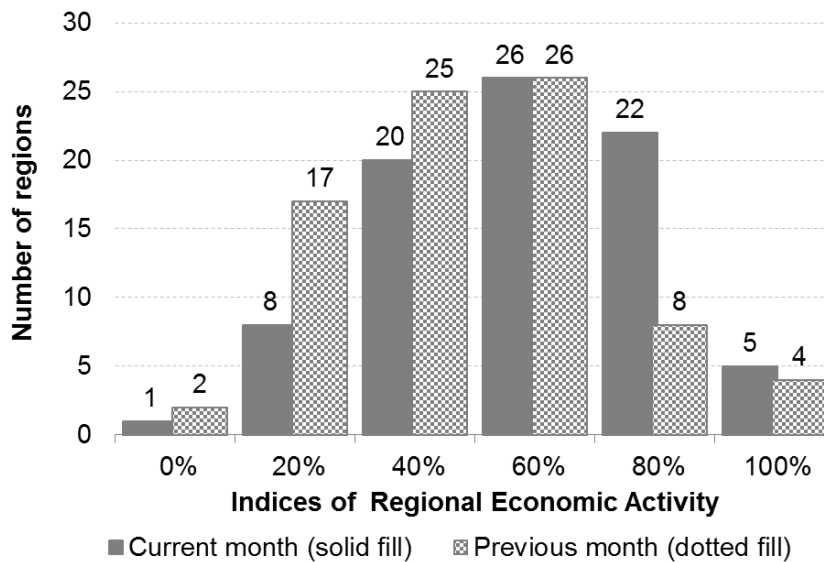
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Figure 6. Distribution of Russian regions by REA index (April 2017)

Fourth, interest could be sparked by how the distribution of regions by economic activity level (REA indices) changes over longer periods. In particular, looking solely at the histogram, it is difficult to get a sense of what the 'norm' is for the Russian economy in each phase of the business cycle. To answer that question, it would be advisable to use a heat-map (see Figure 7), in which each column corresponds to a histogram similar to the one above. From Figure 7, it is clear that in April 2017 the proportion of regions that saw contraction in all five economic sectors or which saw expansion in only one of them (indicated by the two darkest shades) remained very high. The number of regions in which all five economic sectors saw expansion (or at least four of them) was very low (indicated by the two lightest shades). Hence, the current condition of the Russian economy can be described as being just between continuing recession and the start of stagnation. Recovery (if any) is definitely not so strong as it was after the 2008-2009 recession.
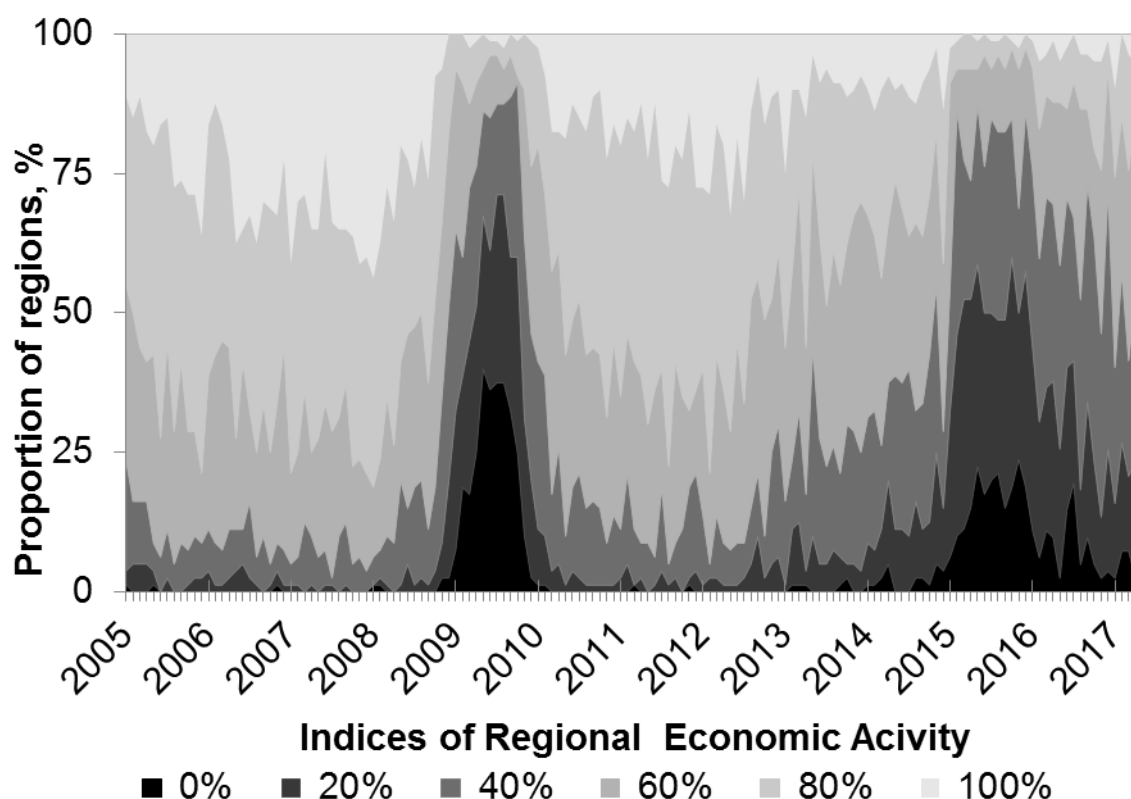
Figure 7. Heat-map: Proportion of regions with different levels of economic activity (REA index), Jan. 2005 – April 2017

# 4    Conclusion

In conclusion, we can state that the methodology we propose for handling real-time regional data from Rosstat and constructing Regional Economic Activity (REA) indices makes it possible to use this mass of official statistical data in the macro-economic monitoring of the Russian economy, and in particular, to identify regions that have greater and lower levels of economic activity (leaders and outliers in terms of growth dynamics), to describe the current phase of the economic cycle, and to refine estimations of Russia's cyclical turning points.[15] In their published form, Rosstat's regional statistics are virtually useless in any attempt of this kind, due to the numerous erratic fluctuations and radical mismatch between "month-on-month" and "year-on-year" time series.

The regional aspect of economic monitoring acquired through REA indices makes it possible to draw a more accurate and multi-dimensional view of ongoing developments in the Russian economy. It is particularly important that this takes place in real time – without any significant lag regarding data for Russia as a whole.

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[15] See Smirnov et al. (2017) for different approaches to this problem.

In addition, studying the synchronisation of medium-term change in different regions of the Russian Federation, identifying regions where trends do not match those of the country as a whole, could become a new area of research into Russian economic cycles. This area of research will help in the development of a more well-founded macro-economic and anti-crisis policy, which takes into account the regional nuances and territorial mechanisms by which economic "shocks" are transmitted.

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