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## **A System of Leading Indicators for Russia**

By Serguei V. Smirnov

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## 1. Introduction

A desire to discover a preview of the future in the present makes people resort to various tricks. Predictions of economic development may be based on simple extrapolation, on sophisticated econometric models, on methods of “technical analysis”, on surveys of consumers and entrepreneurs, on observations that are unfit for formalization, made by experts and analytics, etc. *System of leading indicators* is one of the most widely used methods of anticipation of future economic activity. The idea behind this approach is simple and clear: there should be an “early warning” system to forecast when the economy will shift from expansion to recession (or on the contrary, from recession to expansion). In other words, we have to choose the indicators, which get to their *turning points* earlier than the economy in general. Then, whenever the leading indicator<sup>1</sup> gets to its *peak* or to its *trough*, we are able to predict a forthcoming peak or trough in the business activity in general. This idea was first put unto practice in the United States in the 1930’s. Regular publications of appropriate indicators were launched in the late 1960’s, and they are carried on today (see [5]). In the 1980’s, the OECD Statistics Directorate started construction of leading indicators for its member countries (see [6]). In the 1990’s, leading indicators for Turkey, Korea, Hungary, and Poland were developed under the supervision of the OECD (see [7a], [7c], [7d]). In addition to commonly used “official” indices, some “designers’ indicators” were introduced, with subtle variations in handling the initial statistical data (see, for example, [7b] and [8]).

Such indicators were never compiled for Russia.<sup>2</sup> The single and sufficient reason for this shortcoming was the continuing industrial recession that looked as if would never bottom out. This recession was mainly the result of “transformation”, or the transition from a planned to a market-oriented economy. It would be have been odd to look for turning points against such a background. Moreover, the time span of several years (not decades) was too short to make a distinction between a long-term trend and cyclical or short-term fluctuations.

Now the situation has changed. The transformation is completed in general, and a structural “break-up” is no longer a major factor in determining economic dynamics. The post-Soviet period has exceeded ten years, and long-term trends have become visible. The crisis has obviously bottomed out, and we may speak about a cyclical reiteration of expansion and contraction. Therefore, we now have a set of new and interrelated tasks, which were impossible to solve in the past but have become vital and urgent at this time: to reveal expansion and contraction phases in the Russian economy after the reforms; to precisely date turning points of its cycle; to construct a system of leading indicators; to calculate a *composite leading index* (a certain weighted average of initial series) and a *diffusion leading index* (equal to the weight of the series with positive dynamics).

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<sup>1</sup> It may be better to call it a “warning” indicator.

<sup>2</sup> The paper presented by A. Ivanov [1] discussed the sets of concrete economic indicators that are used in different countries for construction of composite leading indicators. Some papers (for instance, [2] and [4]), gave methods of compilation of composite indicators of business activity, something like “barometers” for the Russian economy. By contrast, this paper, from the outset, has been centered on construction of an integrated [composite] indicator that should *anticipate* the changes in direction of the economy. For this reason, we did not deal with some particular indicators that are coinciding or lagging *a priori*.

## 2. Key Methodological and Statistical Issues

### 2.1 Choice of a Concept of Economic Cycles

Construction of a system of leading indicators may be based on two different concepts of economic cycle that cannot be brought together. The first deals with the direction of economic dynamics (going up or down, expansion or contraction); the other deals with its tempo (going faster or slower, acceleration or deceleration). The first corresponds to the classical conception of *cycles of business activity*; the second is based on the idea of *growth cycles*. In the United States, turning points are evaluated in terms of growth and decline (in a tradition going back to the Great Depression). Contrary to this, the OECD system monitors changes from periods of accelerated growth to periods of slowing down, and vice versa (the basic idea is that a tendency towards more or less steady growth is prevailing in the world, while classical recessions marked with decline in absolute terms are losing their former duration and depth).<sup>3</sup>

The American experience of the Great Depression is, of course, closer to the Russian economy in its present state (to use the conventional OECD ideology, we would have to assume, explicitly or implicitly, that the Russian economy is in a state of constant decline, rather than growth, which is yet a too pessimistic assumption). Indeed, such questions as at what point did the initial, rather modest decline turn into a landslide, or at what time did the economy get out of a nose-dive and turn to stagnation, are matters of interest as such. However, now it is more than ever clear in Russia that all the above stages are just inner phases of the crisis. In Russia, a real (significant by intuition) turning point can be *nothing else but* a shift from contraction to growth (or from growth to decline), not just a slowdown or acceleration of decline.

### 2.2. Dating of Turning Points (Choice of a Reference Indicator)

Both formal and informal methods may be used for dating turning points. An informal method is used in the United States. There is the Business Cycle Dating Committee at the National Bureau of Economic Research, with many leading academic scholars sitting on it. The Committee defines recession as a “period of decline in production, incomes, employment and trade, marked by the spreading of the decline over many industrial sectors”. The Committee sessions decide on precise dating of a regular peak or trough in overall activity, upon a qualitative analysis of all available information.<sup>4</sup> The Committee is never oriented by the dynamics or level of any single indicator. In particular, defining the date of a beginning of recession, the Committee does not use the well-known empirical rule of “two-quarters’ decline in the GDP”.<sup>5</sup>

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<sup>3</sup> Notice that empirical examination of turning points can be done reasonably apart from theoretical and applied models, which describe the cyclical *mechanism* (such as waves of retirement of fixed capital stock, Kondratiev waves, etc.). For this reason, it should be more correct to speak here not about *cycles* that imply certain periodicity, but simply about *turning points* in economic situation.

<sup>4</sup> Extremely seldom are the cases when *formerly defined* turning points are corrected upon revision of initial statistical series.

<sup>5</sup> Indeed, what could a committee of economic gurus deserve if it confined its activity to monitoring the GDP dynamics and to proclaiming that the real GDP was declining for two consequent quarters? However, from a practical point of view, the “rule of two quarters” is probably gives positive results. It is widely used as an indication of a “technical recession” for various rough-and-ready, preliminary and approximate calculations.

On the contrary, the OECD method is based on the idea of a *reference series*, and monthly GDP is valued as the ideal reference series (it is assumed that a business cycle completely reveals itself in the movement of this indicator, and no other information is needed at all to define turning points and phases of the cycle). However, since GDP is not compiled on a monthly basis, there is a need for some other, proxy measure, which is moving close to the GDP. For practical needs, the OECD uses the index of industrial production as a reference series. Peaks and troughs are defined in terms of this particular indicator, and the whole system of leading indicators is constructed in correlation with this reference series.

At the OECD, the procedure of the dating of turning points is rather formal. It is based on comparison of actual values of the industrial production index with its trend values. The point is considered a peak when the relation of actual value to the trends reaches a local maximum, and the point of local minimum relation is considered a trough.<sup>6</sup>

Neither the American NBER approach in its pure form (for it is hardly possible to establish a council of independent experts), nor the OECD Statistics Directorate (because analysis of *growth cycles* is far from being an urgent task) is fit for Russia. A certain compromise is probably the best way out: the NBER concept of a *business cycle* should be applied to the OECD concept of a *reference series*.

It is natural to use a seasonally adjusted industrial production index as a reference series. Local maximum points (against six nearest months on both sides) of this series may be considered peaks, and local minimum points may be treated as troughs.<sup>7</sup> It is also reasonable to assume that there must be a succession of peaks and troughs, and the time span between them must exceed half a year.

### **2.3. Selection of Initial Leading Indicators**

In Russia, one or another indicator can become a *leading* indicator in a case if,

- on shifting the demand-supply balance, it changes the aggregate economy dynamics;
- it displays the expectations of economic agents;
- it responds to changes in business activity earlier than the overall economy;
- it has gained recognition as a leading indicator in other countries.

From a practical standpoint, indicators must meet the following plain requirements:

- their fluctuations must be cyclical (that is, there must be a succession of growth and decline periods); there must be no sharp and incomprehensible jumps;
- the series must be sufficiently reliable and comparable during the whole period in question;

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<sup>6</sup> This calculation seems to be within the powers of any amateur. Well, it is not. At the OECD, they use a special iterative trend separation algorithm, which is designed to handle the series with a trend and a cyclical component. It is impossible to be reconstructed "at home".

<sup>7</sup> Six months is a certain «standard time span», which is required to be sure that the observed recession (from a peak) or growth (from a trough) is "serious" enough to constitute a separate phase of a cycle. There should be confidence that the next growth (decline) is not a continuation of a former trend. Indeed, half of a year is nothing more than an approximate landmark.

- the information must be renewed on time (monthly and with minimum delays against a calendar month).

For each indicator, which more or less meets these requirements, turning points must be found and compared with turning points in the overall cycle of economic activity.

Notice that not only direct but also indirect estimates can be used for assessment of demand-supply balance or of expectations. For example, demand-supply balance is directly presented in polling lists in the data of demand level, order books, and inventories of finished goods, and indirectly, in world oil prices, real exchange rates, current financial indicators of enterprises, and so on. Direct assessments of expectations include various survey data, while indirect assessments are represented in stock indices, interest rates, numbers of newly established businesses, etc. The complete list of series we have tried is given in Supplement 1.

#### **2.4. Calculation of Composite Leading Index and Diffusion Index**

The worldwide experience shows that a system consisting of several leading indicators usually displays quite an irregular picture. For this reason, there is a need to create all-inclusive indicators. Usually, two indicators are made: *a composite leading index* and *a diffusion leading index*.

To unify various leading indicators, series in a mixture of units (billions of rubles, percents, dollars per barrel and so on) must be given on a unified scale. For this purpose, we have used the American NBER procedure with some modifications. The main point of this procedure is to equalize the differences in scale and variability of initial indicators, and to match the variability of *the composite leading index* with the variability of the industrial production index. See a complete description of the measurement procedure of *the composite leading index* in Supplement 2.

Calculation of a diffusion index is simple. Its value in any given moment is equal to a ratio (percent) of the number of the series that have turned for the better in the month in question to the total number of series, which are included into an “early warning system”. A diffusion index shows whether growth or decline is “universal”, whether it covers the “overall economy” or not.

### **3. Main Results**

#### **3.1. Turning points in the Russian economic dynamics (1990-2000)**

Figure 1 gives two series: a) the initial basic industrial production index (1996=100) calculated from monthly chain indexes by the Federal Goskomstat<sup>8</sup>; b) the seasonally adjusted industrial production index (this is the indicator that is used further as a *reference series*). The reason for a seasonal adjustment is that unless it is made, values of the series by month cannot be compared directly, which means that neither the direction of movement at successive moments can be found, nor can the local minimum or maximum be fixed.<sup>9</sup> There are a variety of procedures for seasonal adjustment

<sup>8</sup> The 1990 monthly data are extrapolated with the index of intensity of industrial production, which is calculated by the Economic Conjunction Centre of the Russian Government (CEA).

<sup>9</sup> Let us give an example. In Russia, since the Gosplan era, for some unclear reason, the bulk of dwellings that are built in a year are usually put into service in December. When the January data are published, many factors of ten lower than the December data, it is wrong to decide upon the initial data that there has been a slump in residential construction. The point is that the number of dwellings put into service

(see, for instance, [3], Chapter 5). We have used the simplest one: we divided the initial series values by coefficients, which are equal to the ratio of an average value of a relevant month to the annual average. If seasonal factors are irregular, this method will produce incorrect results.<sup>10</sup> For this reason, we made an evaluation of seasonal factors using the January 1994 – December 1999 data, when seasonal factors exhibited certain regularity, and industrial dynamics didn't display either a clear upward or a clear downward trend.

Figure 1 presents turning points that are found on formal premises, which are given in Section 2.2. As a result, we believe that developments in the Russian aggregate economy in the past ten and over years can be divided into the following periods:<sup>11</sup>

- a continuous recession since February 1990 till November 1996 (82 months), including a “slump” (48 months, since February 1990 till January 1994, when the average rate of decline was 2.5 percentage points a month<sup>12</sup>), and “stagnation” (34 months since February 1994 till November 1996; average monthly rate of decline at 0.3 percentage points);
- a period of “wavering” growth in December 1996 – October 1997 (11 months, average monthly rate of growth at 0.8 percentage points);
- a new recession, which was triggered by the world crisis in capital and primary goods markets, and ended in a “slump” in August-September 1998 (11 months since November 1997 till September 1998, average monthly rate of decline at 1.5 percentage points);
- the after-crisis growth, which is going on at present (23 months since October 1998 till August 2000, average monthly rate of growth at 1.2 percentage points).

The time span of the first recession (82 months since February 1990 till November 1996) is almost twice as long as the Great Depression of 1929-1933 in the United States (42 months), and longer by a quarter than the absolute American record in the 1870s (65 months).

## **Figure 1**

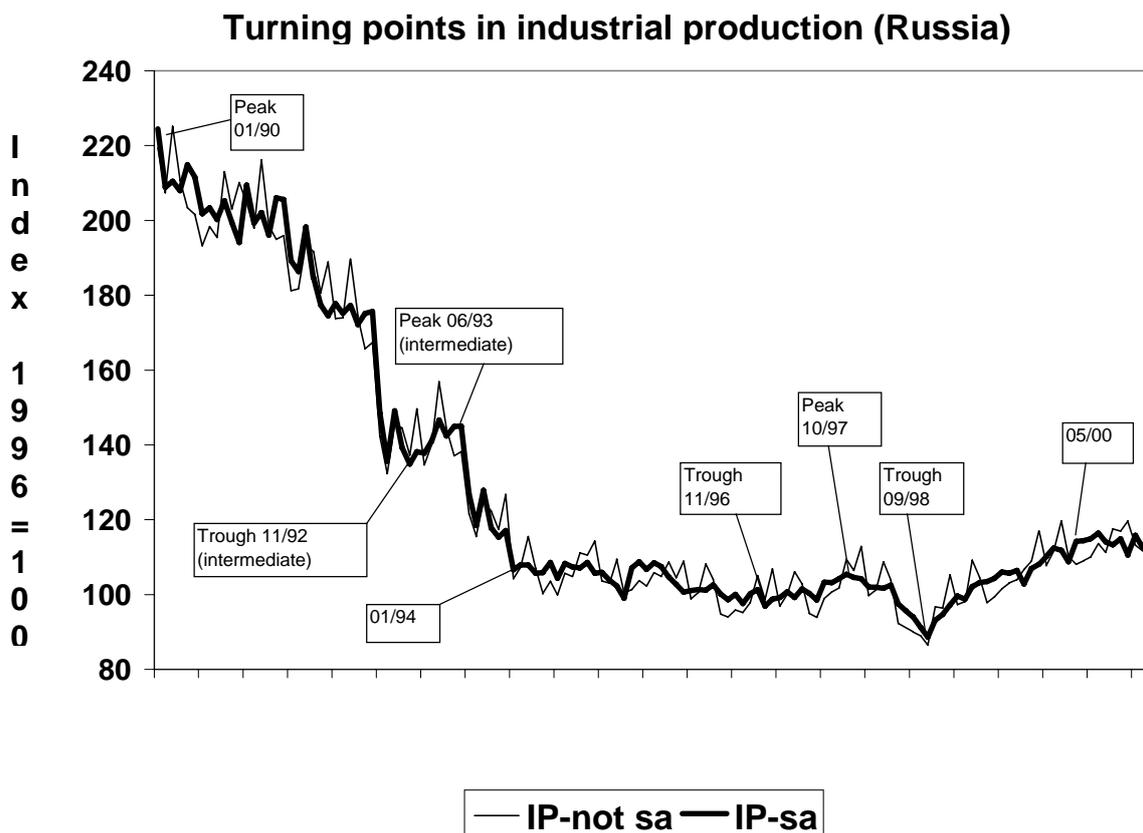
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in January may be higher than their “regular January figure”, while on the contrary, the December number may be lower than their “regular December figure”.

<sup>10</sup> For example, in December 1991, 55% of newly built dwelling were put into service, while in 1999, 37.5%. In this case, which value should be considered a “year-end effect”? And what will be the value of seasonal coefficients for the rest eleven months? Will there be a reason to judge that a comparison of, say, December and January figures are correct? And in general, that the found-out turning points are reliable?

<sup>11</sup> A short-term growth in December 1992 – June 1993 is, most probably, a kind of “technical correction”. Therefore, we suppose that essentially, this period should be treated as a “random fluctuation” against a background of a longer recession.

<sup>12</sup> Average monthly level of production in 1996 is taken as 100.



### 3.2. Selection of Indicators for the System of Leading Indexes

We examined forty indicators divided into 17 categories (groups), in order to decide whether they are or are not the *leading indices*<sup>13</sup>. Out of them, we had to reject seven for the reason that there was no information on them except for during a very short period (since early 1997, or even later), and two others (the expected growth and the expected increase in demand, from the CEA surveys) because they apparently had no cyclical components. For all the rest, we defined turning points, which were compared with *peaks* and *troughs* of the industrial production index. In Table 1, we present differentials (in months) between turning points of the industrial production index that was fixed in the previous section, and turning points of all other indicators. On comparison of turning points within each group, we chose the indicator which was moving ahead of the overall economic cycle in the best possible way (we took into account pair correlations as an additional factor).

First of all, let us note that out of seventeen chosen groups, only eight have the indicators, which can be reasonably used as leading signals. It is remarkable that all direct estimates of any possible expectations (there are many indicators of this kind among survey data) in fact, are leading nowhere. In other words, expectations (as far as they are revealed by surveys), as a rule, do not come true. At the same time, indirect measures of expectations (such as interest rate, stock exchange index) have proved their validity as leading indicators in actual practice.

<sup>13</sup> See Supplement 1.

A more careful examination of the chosen series shows that dynamics of assessments of effective demand (IET surveys) and order books (IMEMO) are quite close to each other (not surprising since orders are one of the ways to develop demand). It should be reasonable to select one of these indicators for our composite leading index. Upon some hesitation, we decided to choose the assessments of effective demand. Firstly, this series has a much closer correlation with the industrial production index. Secondly, it has not given a false signal (as far as it is clear now) of production decline in the late 1999 – early 2000. Finally, there is no publication lag for this indicator, while the results of the IMEMO surveys come into view only 40 days after the end of each calendar month.

The latter is, honestly speaking, a purely technical factor, but it is critically important for our task (which is to warn about a forthcoming turn of trends as early as possible). Finally, well-timed publication of data was our criterion of choice of series on such categories as “stocks of finished goods” and “current financial condition”. In both categories, we preferred the IET and CEA survey series to the indicators of the Russian Economic Barometer, though the former may be no better in other respects than the latter.

**Table 1. Lagging behind (+) or Leading over (-) the index of industrial production**

Indicators and sources <sup>(2)</sup>	Series started <sup>(3)</sup>	T <sup>(4)</sup>	P <sup>(4)</sup>	T <sup>(5)</sup>	P <sup>(5)</sup>	T	P	T
		11/92	06/93	-	-	11/96	10/97	09/98
Growth in effective demand (IET)	06/95	n.a.	n.a.	n.a.	X	9	2	0
Effective demand, % of normal level (IET surveys)	09/92	-	6	?	X	7	2	0
Demand, % of normal level (CEA)	05/95	n.a.	n.a.	n.a.	X	3	0	2
Index of current condition ("IPS" Foundation)	01/93	n.a.	-	-	X	20	1	-2
REB-7: Growth in order book level in a month (IMEMO)	01/92	6	4	x	X	8	7	2
REB-17: Order-book level, % of usual level (IMEMO)	01/93	n.a.	4	x	X	-3	-1	4
REB-8: Growth in stocks in a month (IMEMO) <sup>(6)</sup>	01/92	9	6	x	X	11	3	6
REB-16: Stocks, % of normal level (IMEMO) <sup>(6)</sup>	01/93	n.a.	-	x	X	7	0	5
Stocks, % of normal level (IET) <sup>(6)</sup>	09/92	n.a.	2	x	X	10	1	5
Stocks, % of normal level (CEA) <sup>(6)</sup>	05/95	n.a.	n.a.	n.a.	n.a.	9	-3	1
Price of oil, "Urals" brand (Mediterranean), \$/barrel	05/90	-	32	-	-	36	12	-3
Official exchange rate of the ruble (1996 ruble/\$)	01/92	5	8	-	-	-	-	4
Money stock ?2, at 1996 prices	12/94	n.a.	n.a.	n.a.	-	20	0	-6
Reserve money, at 1996 prices	06/95	n.a.	-38	-	-	-2	3	-5
REB-19: Share of enterprises in "good" financial condition (IMEMO)	01/93	n.a.	3	x	x	10	0	1
Growth in internal financial resources of enterprises (CEA)	05/95	n.a.	n.a.	n.a.	-	10	3	0
Monetary resources of industries enterprises, at 1996 prices	01/92	4	0	-	-	6	-	-
Deposits of enterprises (in rubles), at 1996 prices	12/94	n.a.	n.a.	n.a.	n.a.	-1	-2	1
Non-cash money (?2-?0), at 1996 prices	12/94	n.a.	n.a.	n.a.	n.a.	19	-2	-1
Profits (less: losses), % of output	12/91	7	1	x	x	2	-3	0
General assessment of economic situation (CEA)	05/95	n.a.	n.a.	n.a.	n.a.	1	1	0
Index of consumers' expectations ("IPS" Foundation)	01/93	n.a.	-6	-	-	20	1	-2
REB-26: Growth in output, anticipated (IMEMO)	04/92	2	0	x	x	2	-3	1
Anticipated growth (in a 2-3 months span) (IMEMO)	09/92	n.a.	5	x	x	1	-4	0
REB-28: Anticipated improvement in financial situation (IMEMO)	02/93	n.a.	4	x	x	2	-6	1
Anticipated growth in internal financial resources (CEA)	05/95	n.a.	n.a.	n.a.	n.a.	1	-7	0
Anticipated change in demand (IET)	10/95	n.a.	n.a.	n.a.	n.a.	11	-3	0
«Moscow Times» dollar index	09/94	n.a.	n.a.	x	x	9	3	0
Foreign exchange reserves at the Bank of Russia (gold excluded), \$ billion.	03/96	n.a.	n.a.	n.a.	n.a.	-2	-1	-12
Claims of credit institutions on enterprises and individuals, at 1996 prices	06/95	n.a.	n.a.	n.a.	n.a.	1	-11	-11
MIACR-overnight real rate, % annual <sup>(6)</sup>	10/94	n.a.	n.a.	n.a.	-	5	9	2

Notes: «T» - trough, «P» - peak of the industrial production index;

n.a. - data are non-available; ? - «false» or «extra» peak of trough; «-» - a turning point missing.

1. Against peaks and troughs of each observed indicator. 2. Whole names of series and sources are given in the notes to Supplement 1. 3. The moment when regular monthly data became available. 4. "Intermediate" turning points of industrial production index. However, they have corresponding turning points of some other indicators. 5. In the second half of 1994 - first half of 1995, a range of indicators had "extra" turning points (a trough and a peak), which had no corresponding turning points of the industrial production index. 6. Before dating of turning points, the indicator is taken with a reversed sign.

### 3.3. The System of Leading Indicators for Russia

Finally, we included seven series in our system of leading indicators for Russia. Their behavior as leading indicators is quite satisfactory since January 1994 (or since the moment when the slump, which had been related to the transformation from a planned to a market-oriented economy, was over) (see Table 2).<sup>14</sup>

**Table 2. The System of Leading Indicators for Russia**

	Initial point (date)	Publication lag (days) <sup>(1)</sup>	«Extra» turning points (number) <sup>(2)</sup>	«Lacking» turning points (number) <sup>(2)</sup>	Average leading time (months) <sup>(2,3)</sup>	«Weight» 1% of a symmetric increment in CLI <sup>(4)</sup>
Effective demand, % of normal level (IET), diffusion index <sup>(5)</sup>	09/92	0	T-1 P-1	T-0 P-0	3	0,040
Stocks, % of normal level (IET), diffusion index <sup>(5,6)</sup>	01/93	0	T-1 P-2	T-0 P-0	5	-0,213 <sup>(8)</sup>
Growth in internal financial resources of enterprises (CEA), diffusion index	05/95	0	T-0 P-0	T-0 P-0	4	0,258
Price of oil, «Urals» brand (Mediterranean), \$/barrel	05/90	0	T-0 P-0	T-0 P-0	15	0,102
Official exchange rate of the ruble (1996 ruble/\$) (Bank of Russia)	01/92	5-7 <sup>(7)</sup>	T-0 P-1	T-1 P-1	1	0,158
«Moscow Times» dollar index	09/94	0	T-0 P-1	T-0 P-0	4	0,045
MIACR-overnight real rate, % annual <sup>(6,9)</sup>	10/94	5-7 <sup>(7)</sup>	T-0 P-1	T-0 P-0	5	-0,031 <sup>(8)</sup>
Composite leading index (CLI)	10/94	5-7 <sup>(7)</sup>	T-0 P-0	T-0 P-0	4	-

Notes: «T» - trough, «P» - peak.

1. Number of days from the publication of data and the end of a calendar month. The publication lag of the industrial production index is fifteen days. 2. At the 01/94-08/00 interval (or since the start of publication). 3. Calculated from Table 1. At the specified average lag, some indicators are widely dispersed. 4. The definition of «symmetric increments» is given in Supplement 2. «Weight» of each indicator in the composite index was calculated as inverse value of the standard deviation of symmetric increments (for stocks of goods and the real interest rate, with negative sign). The standard deviation was evaluated at the 01/95-12/99 interval. 5. The initial IET data are presented in a balance form. They are recalculated into a «diffusions index», for the sake of comparability with other survey data, and also in order to avoid negative values. 6. To identify peaks and troughs, the indicator was taken with a reversed sign. 7. Equal to the publication lag of the consumer price index. 8. The «negative» weight corresponds to the fact that growth (decline) in the indicator precedes the decline (growth) in industrial production. 9. To avoid negative numbers, which make the calculation of symmetric increments senseless, we added a constant equal to 350 to the initial data.

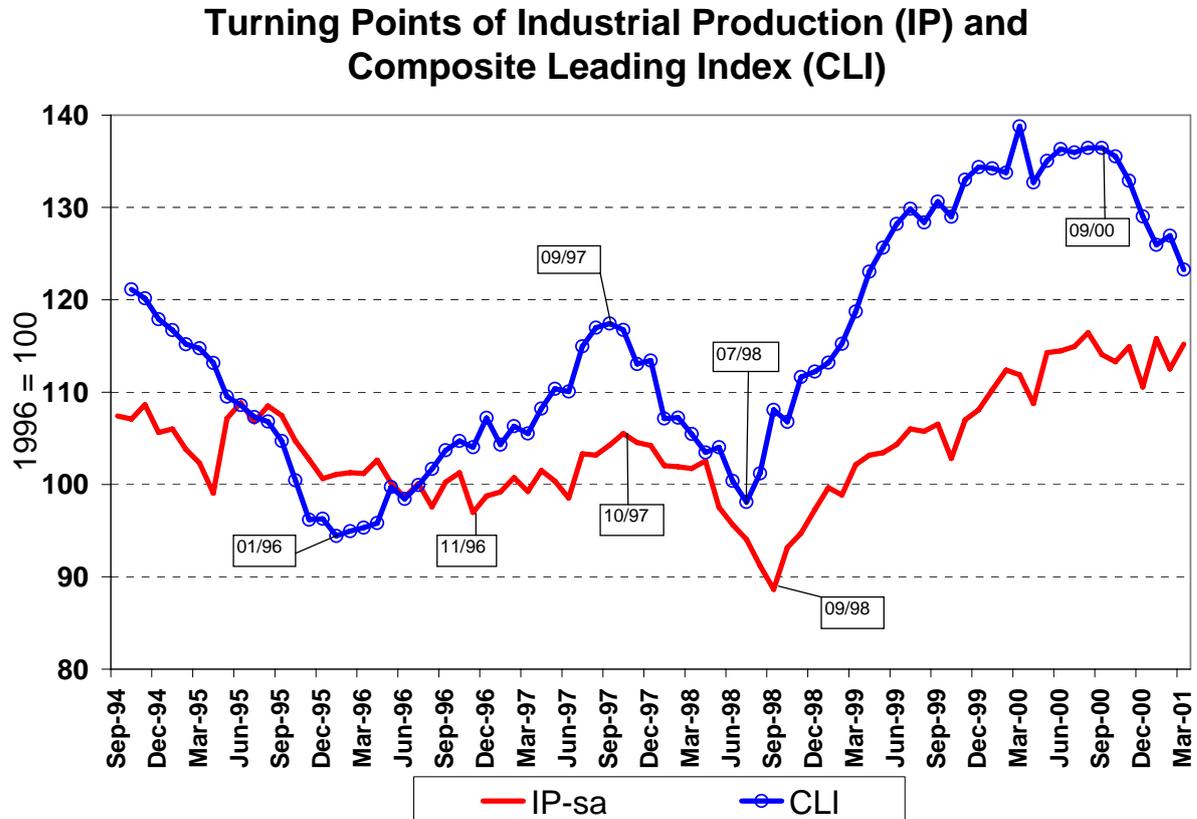
<sup>14</sup> However, some of them gave false signals on a looming new recession at several moments in 1999. Nevertheless, this phenomenon was eliminated as soon as they were combined in *the composite leading index*.

“Demand, % of normal level” is perhaps the best of all indicators to perform the function of a “leading index”. It is moving very closely to the industrial production index, but it goes several months ahead of the latter at turning points. On the contrary, almost no direct correlation of industrial production and world oil prices is actually observed. For example, in 1994-1996, oil was almost continually getting more and more expensive, while output was going down and down with the same steadiness, and in 1997, it was not. On the other hand, the level of oil prices has its effect on the Russian economy in the longer run (with greater lags). For this reason, we did include this indicator into the system of leading indicators.

### 3.4. The Composite Leading Index for Russia

The results of calculation of our *composite leading index* for Russia are outlined in Figure 2. The major result is that the *composite leading index*, which we have offered, in fact goes ahead of the business cycle.<sup>15</sup> Indeed, the value of the lead (sometimes only one or two months) is not so great. However, in the first place, shortened time horizons are very much typical of the present-day Russian economy (for instance, in the international practice, a three-month interval is considered a *short* term, while in Russia, it is rather a *long* term). Secondly, it is not just a lag or a lead at turning points that matters here. For example, the peak of the industrial production index in 1997 lagged behind the peak of the composite leading index by just one month. Without a doubt, at that time, in the fall of 1997, it was hardly possible to precisely date

**Figure 2**



<sup>15</sup> Till 05/95, the composite leading index was constructed from six series only (CEA surveys didn't exist).

the *peak*, or the turning point to the next phase of industrial contraction. But let us look at the situation as it appeared, say, in April 1998. Then, the industrial production index of the last six months went down from its peak by just 2.8%, while the composite leading index declined by 11.8%. In other words, dynamics of industrial production gave no sign of the forthcoming downturn, while dynamics of composite leading index showed that the downturn was inescapable. More or less the same is true about the *trough* of September 1998. At that moment, industrial output went down, and a further contraction could be expected. However, the composite leading index went up (for the second consecutive month, after a lengthy decline), showing that the turn to growth was just around the corner.

The present movement of the composite leading index may be described as a sort of wheel spinning. It reached 133 as early as in November 1999, and since then, it is oscillating in the range of 133 to 138, and the width of this interval is quite comparable with a monthly change in the composite index. Taken alone, this factor is not sufficient to make a conclusion that the next *peak* is coming (in other words, that a shift to a new phase of contraction is near). In certain circumstances, the economy can get a new momentum to grow. And if the observed “hindrance” is caused by weakening of the factors that moved the economy forward at the initial stage of its upswing (first of all, steadily rising oil prices, and next, replacement of imports, which was triggered by devaluation of the ruble), then further evolution will depend on stability and driving force of capital investment under way, and on whether households will or will not expand their demand.

### **3.5. Diffusion Leading Index for Russia**

A chart of our diffusion leading index shows that, since February 2000, as a rule, less than half of the leading indicators “improves” every month. This is more evidence of how uncertain the present situation is. Further events may go both positive (in a case if capital investment grows and domestic demand expands) or negative (if the reverse is true).

A comparison of the diffusion index with the increment in the composite leading index expressed as a percentage, shows that both indicators measure approximately the same things. Indeed, all other factors being equal, the more indicators show that the situation is improving, the faster the composite index grows.

## **4. Conclusions**

After many years of “slump”, which ended in January 1994, the Russian economy has reached a stage of more regular cyclical fluctuations. The “slump” was followed by a fairly long stagnation, with a short-lived revival in late 1996. The revival was interrupted by the worldwide crisis of 1997, and by the following collapse of the Russian financial system. At the same time, the events of the summer of 1998 shored up a foundation of the subsequent revival. It began in October 1998, and it is going on now.

A whole range of indicators (in particular, those showing the level of product demand, the financial situation of enterprises and the attractiveness of Russian corporations to investors, assessed by the capital market) is moving steadily ahead of business activity. Their *peaks* and *troughs* are visible three to five months earlier than *peaks* and *troughs* of the industrial production index.

A *composite leading index* and a *diffusion leading index* can be calculated from these series, combined with several other indicators that are clearly of key importance for the Russian economy. Such indicators are compiled in many countries for decades, but they were absent in Russia until now. This paper covers this gap to a certain extent.

Assessing the immediate future of the Russian economy, it is reasonable to suggest that sources of the recent high growth, coming from devaluation of the ruble and replacement of imports, are practically exhausted. The *composite leading indicator* does not demonstrate any visible tendency to rise, while the *diffusion leading index* is showing that in recent months, the share of indicators foretelling an upswing has usually been below 50%. Since there are no obvious signs of an imminent turn to a downward trend as well, we can suggest that in the nearest future, Russia will come to a “road-fork”. If the situation is favorable, a new growth cycle may begin, based on expansion of domestic demand and massive capital investment. Otherwise, Russia will face another stagnation, and later on, an industrial slowdown (for example, the one related to discharge of obsolete fixed capital).

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### Supplement 1. Reference Series and Potential Leading Indicators

Indicator (source) <sup>(1)</sup>	Possible reasons for moving ahead of the overall economic cycle
<b>REFERENCE SERIES</b>	
<i>Industrial production:</i> Industrial production index (seasonally adjusted), 1996 = 100 (GKS)	Reference series, presumably synchronized with the overall economic cycle.
<b>DEMAND AND SUPPLY: direct measurement and indicators</b>	
<i>Measurement of product demand:</i> A) Growth in effective demand (IET) <sup>(2,3)</sup> B) Growth in demand (CEA) <sup>(2)</sup> C) Effective demand, % of normal level (CEA) <sup>(2,3)</sup> D) Demand, % of normal level (CEA) <sup>(2)</sup>	In the absence of resource constraints, changes in demand lead to growth in supply. However, this does not happen immediately, but with a certain time lag (due to technological inertia in production)
<i>Consumer demand:</i> A) Index of current condition ("IPS" Foundation) <sup>(4)</sup> B) Number of new passenger cars registered in Moscow ("Segodnya" daily newspaper)	Revival of demand for consumer durables, for cars in particular, leads (at all other factors being equal) to growth in supply of consumer goods, and later, on all technological feedbacks, to a overall economic revival.
<i>Orders for industrial products:</i> A) REB-7: Growth in order book level in a month (IMEMO) <sup>(2)</sup> B) REB-17: Order-book level, % of usual level (IMEMO) C) Provision of enterprises with orders, months (GKS)	Extra orders for industrial products show that demand is growing, to be followed with increase in output
<i>Stocks of finished products:</i> A) REB-8: Growth in stocks in a month (IMEMO) <sup>(2)</sup> B) REB-16: Stocks, % of normal level (IMEMO) C) Stocks, % of normal level (IET) <sup>(2,3)</sup> D) Stocks, % of normal level (CEA) <sup>(2)</sup> E) Balance of stock of finished goods, % of commodity resources (GKS)	Growing stocks of producers' goods show that sales are difficult, because of declining demand. In this situation, producers should adjust their output downward. Hence, there is an inverse relation with output: <i>growing</i> stocks of finished goods precede a <i>decline</i> in output.

<b>DEMAND AND SUPPLY: indirect estimates and indicators</b>	
<p><i>World oil prices:</i> Price of oil, "Urals" brand (Mediterranean), \$/barrel (Reuters)</p>	<p>Large-scale inflow of oil dollars leads to higher effective demand of government, producers and consumers (along with rising wages). On the contrary, declining earnings from exports leads to lower effective demand.</p>
<p><i>Real exchange rate of the ruble:</i> Official exchange rate of the ruble (1996 ruble/\$). (The Bank of Russia, GKS)<sup>5</sup></p>	<p>Appreciation of the ruble has an adverse effect on export performance and increases import competition. On the contrary, depreciation of the ruble encourages domestic producers and increases domestic demand for home products.</p>
<p><i>Money supply:</i> A) Money stock ?2, billion rubles at 1996 prices <sup>5</sup> B) Reserve money, billion rubles at 1996 prices <sup>5</sup></p>	<p>Increased (to a certain extent) supply of money encourages producer and consumer demand.</p>
<p><i>Current financial condition:</i> A) REB-19: Share of enterprises in "good" or "normal" financial condition, % (IMEMO) B) Profits growth (CEA) <sup>2</sup> C) Growth in internal financial resources of enterprises (CEA) <sup>2</sup> D) Monetary resources of industries enterprises, billion rubles at 1996 prices. <sup>6</sup> (GKS) E) Deposits of enterprises (nominated in rubles), billion rubles at 1996 prices (CB) <sup>6</sup> F) Non-cash money (?2-?0), billion rubles at 1996 prices <sup>6</sup> G) Profits, % of sales volume (industry), (GKS) H) General assessment of economic situation (CEA) <sup>2</sup></p>	<p>Financial "well-being" leads to extra demand for industrial products. "Improvement" of financial condition can precede the general economic revival (for example, due to increases in creation of money by monetary authorities).</p>
<b>EXPECTATIONS: direct estimates and indicators</b>	
<p><i>Consumers' expectations:</i> Index of consumers' expectations ("IPS" Foundation) <sup>4</sup></p>	<p>Displays consumers' expectations. If they are followed with actual changes in consumer demand, further adjustment of output is inevitable.</p>

<p><i>Expected production growth:</i>  A) REB-26: Growth in output (in a 3 months span), anticipated (IMEMO) <sup>(2)</sup>  B) Anticipated growth (in a 2-3 months span) (IET) <sup>(2,3)</sup>  C) Anticipated growth (CEA) <sup>(2)</sup></p>	<p>Displays producers' expectations. This indicator, so to say, must lead actual changes in output volume by definition.</p>
<p><i>Expected change in financial condition:</i>  A) REB-28: Anticipated improvement in financial situation (in a 3 months span) (IMEMO) <sup>(2)</sup>  B) Anticipated increase in profits (CEA) <sup>(2)</sup>  C) Anticipated growth in internal financial resources (CEA) <sup>(2)</sup></p>	<p>Displays producers' expectations for macroeconomic changes.</p>
<p><i>Estimate of anticipated demand:</i>  A) Anticipated change in demand (in a 2-3 months span) (IET) <sup>(2,3)</sup>  B) Anticipated growth in demand (CEA) <sup>(2)</sup></p>	<p>Displays producers' expectations for potential sales.</p>
<b>EXPECTAIONS: indirect estimates and indicators</b>	
<p><i>Stock price index:</i>  «Moscow Times» dollar index (Reuters) <sup>(7)</sup></p>	<p>Displays investors' (chiefly foreign) expectations of macroeconomic changes. Moreover, leaps in market capitalization of companies may provoke adjustments of investors' decision, which in turn, lead to changes in volumes of output.</p>
<p><i>Foreign exchange reserves:</i>  Foreign exchange reserves at the Bank of Russia (gold excluded), \$ billion (CB)</p>	<p>A sharp decline in foreign exchange reserves, backed by negative expectations of foreign investors, can lead a decline in the real sector, for financial markets have less inertia.</p>
<p><i>Bank lending to the real sector:</i>  Claims of credit institutions on enterprises and individuals, billion rubles at 1996 prices (CB) <sup>(6)</sup></p>	<p>Volume of lending to the real sector and households displays expectations of commercial banks for macroeconomic changes. Moreover, bank lending for funding of investment programs</p>
<p><i>New start-ups:</i>  Newly established enterprises registered, by 1000 at the Unified Public Enterprise Register (GKS)</p>	<p>Increase in the number of start-ups for covering future demand display anticipations of entrepreneurs.</p>

<p><i>Level of real interest rates:</i> MIACR-overnight real rate, % annual (CB) <sup>8</sup></p>	<p>Rising interest rates show that risk levels in the economy are growing, declining rates show that they are stabilizing. Decisions to increase output volumes can be expected in the latter case rather than in the former case. Besides, high interest rates hold bank lending back, also hampering expansion of output. Hence, there is an inverse relation with output: <i>rising</i> real interest rates lead to <i>decline</i> in output.</p>
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*Notes.* 1. Full names of sources: CB – the Central Bank of Russia; GKS – Goskomstat (the Central Statistical Committee of the Russian Federation; CEA - Centre for Economic Analysis under the Russian Government); IMEMO – Institute of World Economy and International Relations, of the Russian Academy of Sciences (the “Russian Economic Barometer” Bulletin); IET – Institute for the Economy in Transition (the Russian Bulletin of Conjuncture Surveys. Industry); “IPS” Foundation – Foundation for Promotion and Construction of the Index of Consumer Sentiment. 2. Diffusion Index. 3. Initial date are given by IET in a format of “balance indicators” (B, a balance of “positive” and “negative” responds, in % of the total number of respondents). We have recalculated them in the format of diffusion indexes (E, a sum of “positive” and a half of “neutral” responds, in % of the total number of respondents) by  $E = 0.5 (100+B)$  formula. This procedure increases comparability with other surveys, but what is more, it allows avoiding negative numbers, which lead to considerable technical difficulties at statistical handling of time series. 4. Since March 1994. Index of consumer sentiment and the two of its components (Index of current condition and Index of consumer expectations) are published bimonthly. For our calculations, we obtained the missing monthly data with linear interpolation. Clearly, definition of turning points requires being especially accurate in this case. 5. Deflated by Consumer price index (1996=100). Deflated by Producer price index (1996=100).7. Recalculated from the ruble index with division by the official exchange rate of the dollar. 8. Nominal rate, less the monthly *increment* in consumer prices, annualized.

## Supplement 2. Evaluation Procedure of the Composite Leading Index

1. Symmetrical monthly increments (t – present instant of time) are calculated for all selected leading indicators  $X^i$  (i is the series number):

$$x_t^i = 200 \cdot (X_t^i - X_{t-1}^i) / (X_t^i + X_{t-1}^i)$$

Symmetrical increments (as distinct from regular increments) have a characteristic quality that changes, which are equal in terms of quality but unlike in direction, observed in two consequent instants of time, in sum, bring about the initial level of the indicator  $X^i$ .

2. Average values of  $x_{av}^i$  and standard deviations  $s^i$  of the obtained *increment* series are calculated (n is the number of months in the basic period):

$$x_{av}^i = \sum(x_t^i) / n$$

$$s^i = (\sum(x_t^i - x_{av}^i) / (n-1))^{**} 1/2$$

3. For each t, the “averaged increment”  $g_t$  is calculated, as well as the average and standard deviation of m series (m is the number of initial indicators) <sup>16</sup>:

$$g_t = \sum(x_t^i / s^i) / m$$

$$g_{av} = \sum(g_t) / n$$

$$s^g = (\sum(g_t - g_{av}) / (n-1))^{**} 1/2$$

4. Steps 1-2 are performed for industrial production indexes Y. The results are the average deviation of  $y_{av}$  and the standard deviation  $s^y$  of the *increment* series.

5. The g indicator is adjusted so that its volatility should be equal to the volatility of *increments* in the industrial production index.

$$G_t = g_t \cdot (s^y / s^g)$$

6. Values of the composite leading index  $Z_t$  are calculated by a recursion formula (going back from increments to the aggregate):

$$Z_1 = (200 + G_1) / (200 - G_1)$$

$$Z_t = Z_{t-1} \cdot (200 + G_t) / (200 - G_t)$$

7. The obtained index Z is adjusted to the base of industrial production index (1996 = 100). To do so, we divide all values of  $Z_t$  by the average monthly level of 1996, and multiplied by 100. As a result, the composite leading index has the common base with the industrial production index, and symmetrical increments of the two indicators have the same volatility.

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<sup>16</sup> In combining standardized series, differences in their lag structure are not taken into account.