Session: B2
Cyclical Indicators for Macroeconomic Analysis - Trends, Cycles and Turning Points

A System of Leading Indicators for Russia

Construction and Two-Years Experience of Usage

Serguei V. Smirnov *

Abstract

A system of leading indicators was never compiled for post-Soviet Russia. The article describes the construction and two-years experience of usage of the first version of such a system.

For dating turning points we used a seasonally adjusted industrial production index as a reference series. Then forty indicators were examined, in order to decide whether they are or are not the leading ones. After testing them against turning points of industrial production, we included seven series in our system of leading indicators for Russia:

[1] Effective demand (assessments), diffusion index (IET Surveys); [2] Stocks of finished goods (assessments), diffusion index (IET Surveys); [3] Crude oil price (Urals CIF Med); [4] Real exchange rate of the ruble; [5] Growth of internal financial resources (assessments), diffusion index (CEA Surveys); [6] Stock price index ("Moscow Times" dollar index); [7] Real interest rate (MIACR-overnight).

Finally we calculated a composite leading index and a diffusion leading index. Two years experience showed that their behaviour as leading indicators is quite satisfactory since January 1994 (the moment when the slump, which had been related to the transformation from a planned to a market-oriented economy, was over).

The ways for further refining the procedure are quite obvious, too. They are [1] construction of coincident and lagging composite indices and using the coincident index as a reference series; [2] addition some new components (may be with more publishing lag) to the composite leading index.

Key Words: Cyclical Indicators, Composite and Leading Indicators, Russia

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*   Development Center, Moscow, Russia

1 Introduction

For years, no system of leading indicators was compiled for post-Soviet Russia. 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 have been odd to look for cyclical 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.

After 1998 financial crisis and the following economic expansion, the situation had changed. In the beginning of 2000, it became quite obvious that the transformation had been completed in general, and a structural "break-up" was no longer a major factor in determining economic dynamics. Long-term trends became visible, and a cyclical reiteration of contractions and expansions became visible, too. Therefore, we faced a set of new and interrelated tasks, which had been impossible to solve before: 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).

This article describes in some details the procedure of construction of the first system of leading indicators for Russia and sums up the experience of its two-year regular practical usage.[1]

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[1] Since September 2000, we have prepared and published via Internet (see Smirnov (2000)) a monthly newsletter on the dynamics of the Composite Leading Index for Russia and all its components. Moscow Narodny Bank (London) began to publish its purchasing managers' index (PMI) for Russian manufacturing three years before (see MNB (1997)), but this index is not a leading one in the sense that it doesn't get to its *turning points* earlier than the economy in general does. Like all PM-indexes, the index for Russia provides a single-figure snapshot of business conditions in manufacturing two or three weeks earlier than official data on industrial output for the month appear. For those who keep in mind business cycles but not dates of publishing, the PMI is a coincident (not a leading) index. In April 2002, the IMF published an issue, which applies some leading indicators for Russia (Stavrev (2002)). In the meanwhile, these calculations have been rather occasional.

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).

The American experience of the Great Depression is, of course, closer to the Russian economy in its present state. 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 nosedive 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]

2.2. 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 "a period of significant decline in total output, income, employment, and trade, usually lasting from six months to a year, and marked by widespread contractions in many sectors of the economy". The Committee sessions decide on precise dating of a regular peak or trough in overall activity, upon a qualitative analysis of all available

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[2] 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.

information.[3] 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".[4]

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.[5]

Neither the American NBER approach in its pure form (for it is hardly possible to establish a council of authoritative and 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.*

Since the weight of industry in Russian GDP is quite high (about 25-30%), it is natural to use a seasonally adjusted industrial production index as a reference series.[6] 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

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[3]   For the latest example see: NBER (2001).

[4]   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? The beginning of last recession in US was dated by NBER as March 2001. In the meanwhile, real GDP increased not only in the first but also in the second quarter of 2001.

[5]   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".

[6]   Some restrictions on this approach for Russia have been revealed from two-years experience. For details, see Section 4.

troughs.[7] 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, an indicator can become a *leading* one in a case if,

- it changes the aggregate economy dynamics by shifting the demand-supply balance;

- 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;

- 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 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 situation 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

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[7]   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.

established businesses, etc. The complete list of series we have tried is given in Appendix A1.[8]

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 calculation procedure of the composite leading index in Appendix A3.

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 for the Tuning Period
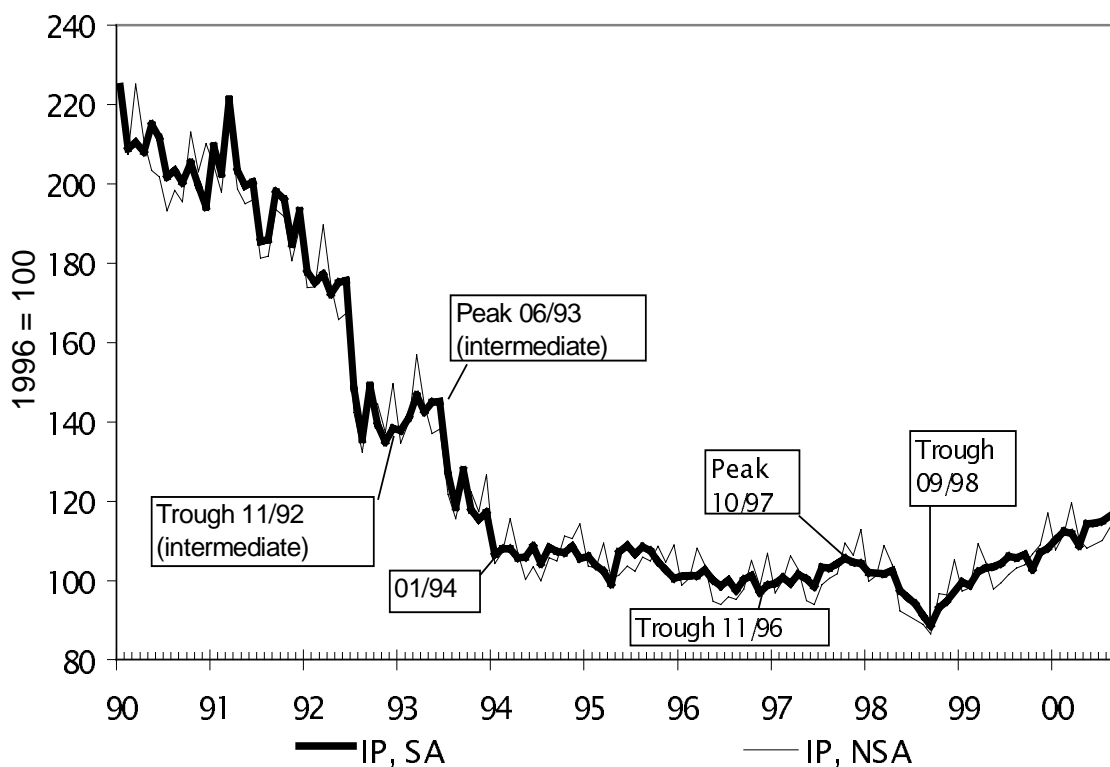
3.1. Turning points in the Russian economic dynamics

Figure 1 gives two series: a) the initial basic industrial production index (IP, NSA) calculated from monthly chain indexes by the Federal Goskomstat[9]; b) the seasonally adjusted industrial production index (IP, SA). The latter indicator is

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[8]   Our paper, from the outset, has been centered on construction of a single (composite) indicator that should *anticipate* the changes in direction of the economy. For this reason, we did not deal with any particular indicator that is coincident or lagging *a priori*.

[9]   The 1990 monthly data are extrapolated with the index of intensity of industrial production, which is calculated by the Centre of Economic Analyses (CEA) of the Russian Government.

used further as a *reference series.*[10] Both time-series are given for the tuning period (January 1990 – August 2000).

Figure 1:   Turning points for Russian industry (the tuning period)

Source: Goskomstat of Russia; Development Center

Figure 1 also 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 economic dynamics in the past ten and over years (or more precisely, during the tuning period) can be divided into the following periods:[11]

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[10]   We have used the simplest method of adjustment: 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. 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.

[11]   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.

Table 1:   **Business cycle reference dates for Russia (the tuning period)**

Cycle phase	Beginning	End (turning point)	Duration in months	Industrial production, average monthly % change
Contraction	February[1] 1990	November 1996	82	-0.9
Slump	*February 1990*	*January 1994*	*48*	*-1.5*
Stagnation	*February 1994*	*November 1996*	*34*	*-0.1*
Expansion	December 1996	October 1997	11	+0.2
Contraction	November 1997	September 1998	11	-1.6
Expansion	October 1998	-	23[2]	+0.8

1.The beginning of this contraction is not known exactly. It may have happened as early as in the first months of 1989. 2.Until August 2000

Source: Development Center

During January 1999 – August 2000, there were two *troughs* (November 1996 and September 1998) and one *peak* (October 1997). These turning points correspond to two periods of contraction and two periods of expansion. Total duration of contractions is 93 months; total duration of expansions is 34 months.[12]

Time span of the first Russian recession (at least 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 a quarter longer than the absolute American record in the 1870s (64 months). The maximum contraction of industrial output in Russia during this recession was 54% (exactly the same as during the Great Depression in US). The main cause of this contraction was transition from a planned to a market economy.

The second Russian contraction was already "market" by its nature. It was triggered by the world ("Asian") crisis and ended in a financial collapse in August-September 1998. The level of industrial production in September 1998 was only 39% of January 1990.

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*[13]. Out of them, we had to reject seven for the reason that there was no information on them except for

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[12]   These figures refer to *the tuning period* (January 1990 – August 2000).

[13]   See Appendix A1.

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 Appendix A2, we present differentials (in months) between turning points of the industrial output 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, in Russia 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 and stock exchange index) have proved their validity as leading indicators in actual practice.

A more careful examination of the chosen series shows that dynamics of assessments of effective demand (IET surveys) and order books (IMEMO surveys) 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, there is a little 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.

3.3. The System of Leading Indicators for Russia

Finally, we included seven series in our system of leading indicators for Russia (see Table 2). 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.

Table 2:   The System of Leading Indicators for Russia

	Initial point	Publi-cation lag (days) [1]	«Extra» turning points (number) [2]	«Lacking» turning points (number) [2]	Average leading time (months) [2,3]	«Weight» of 1% symmetric increment in CLI [4]
Assessments of effective demand (% of normal level), diffusion index (IET) [5]	09/92	0-7	T-1 P-1	T-0 P-0	3	0,040
Assessments of stocks of finished goods (% of normal level), diffusion index (IET) [5,6]	01/93	0-7	T-1 P-2	T-0 P-0	5	-0,213 [8]
Crude oil price (Urals brand, CIF (Mediterranean), $/barrel	05/90	0	T-0 P-0	T-0 P-0	15	0,102
Real exchange rate of the ruble (1996 ruble/$)	01/92	5-7 [7]	T-0 P-1	T-1 P-1	1	0,158
Assessments of growth in internal financial resources of industrial enterprises, diffusion index (CEA)	05/95	0	T-0 P-0	T-0 P-0	4	0,258
Stock price index («Moscow Times» dollar index)	09/94	0	T-0 P-1	T-0 P-0	4	0,045
Real interest rate (MIACR-overnight), % per annum [6,9]	10/94	5-7 [7]	T-0 P-1	T-0 P-0	5	-0,031 [8]
Composite leading index (CLI)	*10/94*	*5-7 [7]*	*T-0 P-0*	*T-0 P-0*	*4*	-

«T» - trough, «P» - peak.
1. Number of days from the end of a calendar month to a publication of data. The publication lag of the industrial production index is 15-17 days. 2. At the January 1994 – August 2000 period or since the start of publications. 3. Calculated from Appendix A2. At the specified average, lags of some indicators are widely dispersed. 4. For definition see Appendix A3. "Weight" of each indicator in the composite index was calculated as inverse value of the standard deviation of symmetric increments (for stocks of finished goods and the real interest rate, with negative sign). The standard deviation was evaluated at the January 1995 – December 1999 interval. 5. The IET data are recalculated into diffusion indices, 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 CPI. 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.
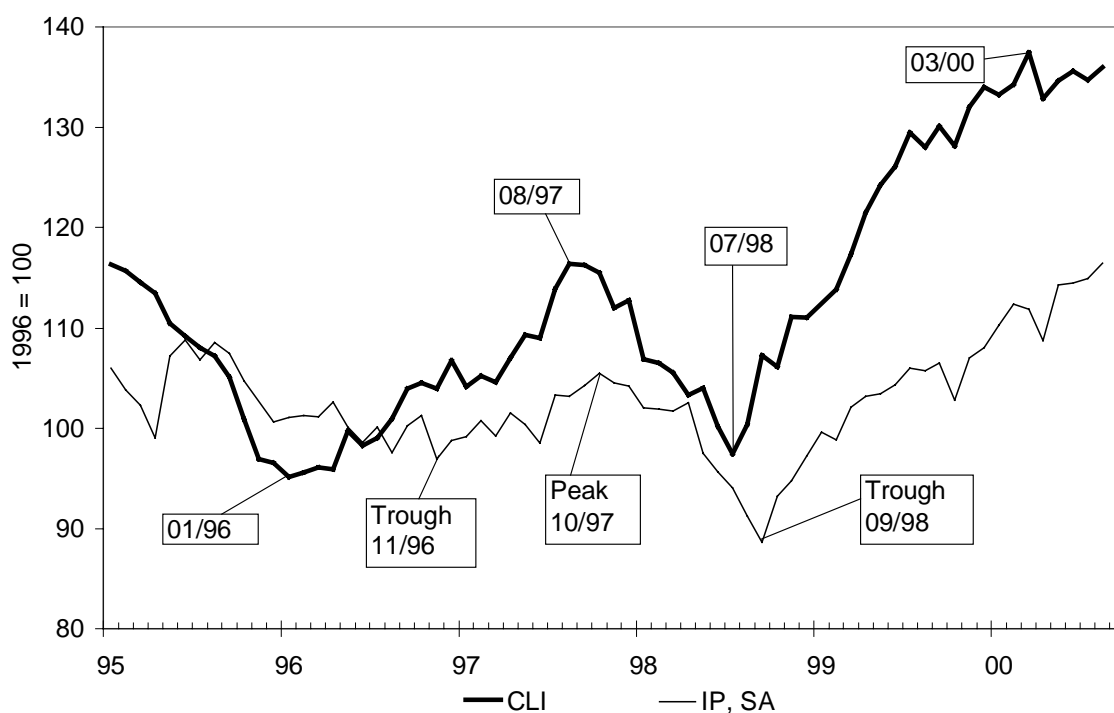Source: Development Center

"Effective demand, % of normal level" (IET Surveys) 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 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 prices were going up, while industrial output was going down, and in 1997, the opposite was true. On the other hand, it's a common view that the level of oil prices has it 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 *the tuning period* are outlined in Figure 2.

Figure 2: **Index of Industrial Production (IP) and Composite Leading Index (CLI), January 1995 – August 2000**

Source: Development Center

The major result is that the composite leading index, which we have offered, in fact goes ahead of the business cycle.[14] The value of the lead (sometimes only two months) is not so great. However shortened time horizons are very much typical of the present-day Russian economy.[15] And more, 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 two months. Without a doubt, at that time, in the fall of 1997, it was hardly possible to precisely date 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 10.6%. In other words, dynamics of industrial production gave no definite 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.

Since spring 2000, continued growth in the CLI has stalled, suggesting that high-growth phase in industrial production may soon come to an end. Until autumn 2000, the dynamics of industrial production by itself gave no grounds for such pessimism.

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 "improved" every month. 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.

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[14]   Till May 1995, the composite leading index was constructed from six series only (CEA surveys didn't exist).

[15]   In the international practice, a three-month interval is considered a *short* term, while in Russia, it is rather a *long* term.

Figure 3:   Diffusion Leading Index (DLI), January 1995 – August 2000
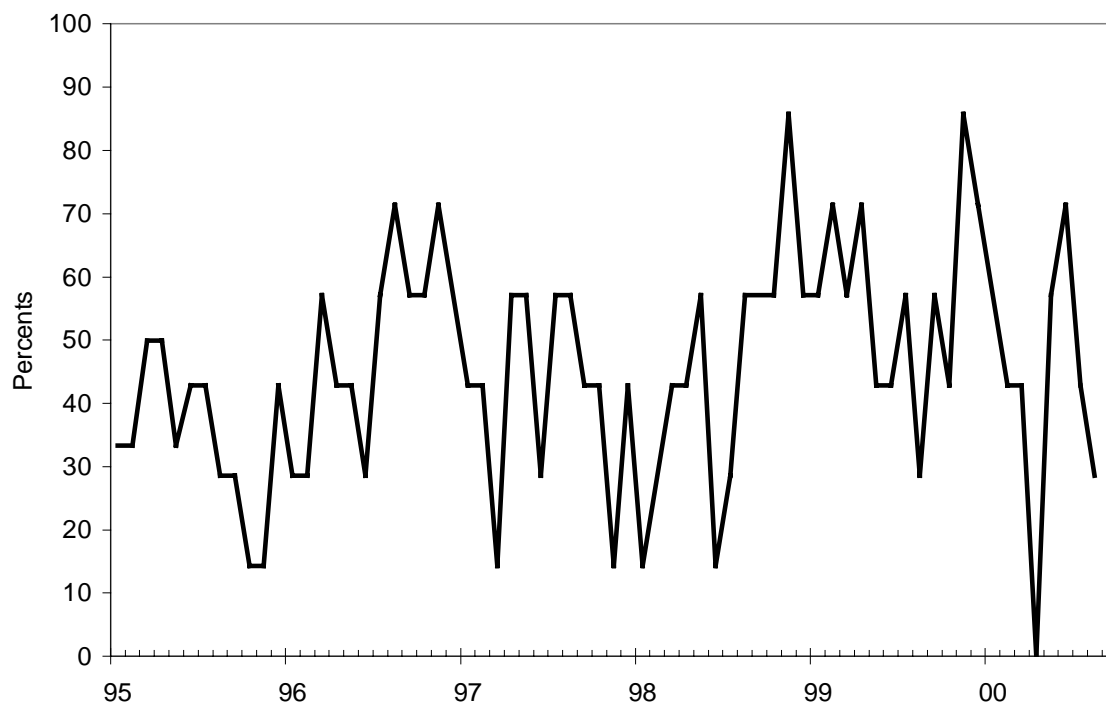
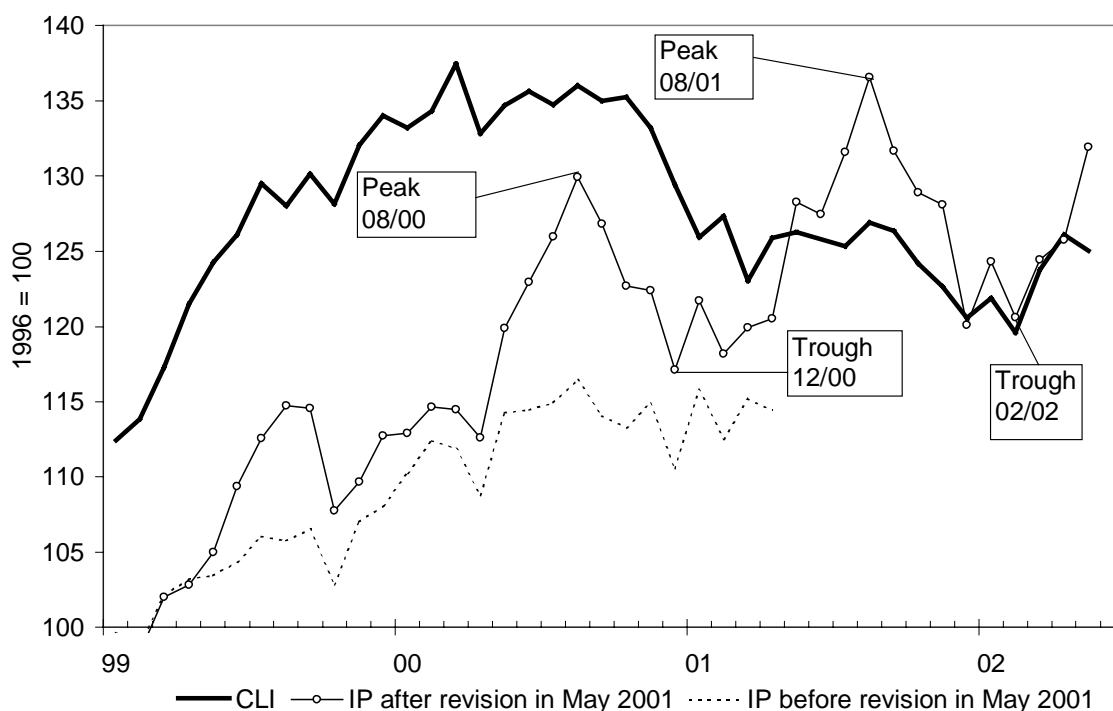Source: Development Center

4   Two-years Experience of Practical Usage

Almost two years have passed since August 2000, and we have accumulated sufficient empirical data to assess the practical applicability of our composite leading index for forecasting turning points for the Russian economy. Moreover, certain conclusions can be drawn about the difficulties encountered in the on-line application of this instrument.

Among undeniable merits of the composite leading index, we shall mention that it has clearly designated two rather short contractions in the Russian industrial production in August 2000 – December 2000 and in August 2001 – February 2002. The first was never detected even by preliminary *direct* data on industrial production compiled by Goskomstat. This contraction became *visible* only upon the annual revision of the Goskomstat data in May 2001, five months after it had been over. The second contraction that started in the second half of 2001 was also practically invisible *by itself* until December 2001. At that time, a decline in the composite leading index put emphasis on the downward trend in industrial output.

Among the demerits of the composite leading index, we shall refer to its failure to catch a period of industrial expansion in January – August 2001. The value of the composite leading index kept actually unchanged, while the volume of industrial production expanded by 16.7% in this period.

Figure 4:   Revisions of Industrial Production Index and Dating of Turning Points, January 1999 – May 2002

Source: Development Center

On the other hand, there is no reason at all in attempts to make the composite leading index as close as possible to the dynamics of industrial production. Practical experience has already shown that a reasonable on-line dating of *turning points* on a sole base of index of industrial production (which is our *reference indicator*) is a very difficult task, because Goskomstat tends to make large-scale a posteriori revisions of the data.

As seen from Figure 4, annual revisions change the characteristics of industrial output time-series quite substantially, affecting even the presence or absence of turning points. The way out of this dead end can be found in compilation of a system of *coincident indicators* and in application of the composite coincident index as a *reference indicator.*

As for components of the composite leading index, none of them has proved to be unnecessary but some of them may be reasonably corrected. For example, in a case we rely on an index "Share of companies having stocks *above normal level*" instead of the diffusion index "Stocks, *% of normal level*", we could better interpret the correlation between changes in inventories and in volumes of industrial production. A seasonal adjustment of indicator "Growth in internal financial resources of industrial enterprises" could allow us to assess current financial condition of enterprises with higher degree of certainty.

We also believe there is a need to expand the number of components in the composite leading index. Generally speaking, seven components are not so few, but in recent years, two of them (the real exchange rate of the ruble and the real interest rate) were making a next to zero contribution to the composite leading index. This is a reflection of economic reality (the rate of real appreciation of the ruble is actually quite low, and interest rate fluctuations are negligible by historical measure); but this makes the variability of the diffusion leading index too low. As a result, practice of application of our diffusion leading index for exploration of turning points in economic activity is problematical.

5   Conclusions

In its present form, the composite leading index for Russia allows to foresee changes in the economic activity, though in a very general shape. However, its ability to forecast is far from being accurate enough not to call for improvements in the technique of its calculation. Main directions for further development of the system of leading indicators are also quite clear.

In the first place, a system of *leading* indicators should be supplemented with a system of *coincident* and *lagging* indicators. In future, a *composite coincident index* will be a better option as a reference indicator that the index of industrial production. The index of industrial production, as Goskomstat calculates it, is prone to substantial revisions that sometimes may even change the qualitative picture of ongoing changes (to say nothing of such "details" as accurate dating of turning points).

In the second place, along with the development of coincident and lagging indexes there is good reason to upgrade the composite leading index, mostly with inclusion of some new components and with a certain refining in the old set of leading indicators. In choosing the array of indicators, more accuracy in the forecasting of turning points may be a better criterion than less publishing lag. It would be worthwhile to use the experience of Japan where timely provisional estimation of a composite leading index is based on a part of its components and then is updated as soon as the data for other components arrive.

Finally, all the time-series with a seasonal component should be adjusted for seasonal fluctuations with a standard and use-proved technique (such as American X-12-ARIMA or European Tramo/Seats).

We can hope that upon this rearrangement, our composite leading index for Russia will become a still more valuable tool for foreseeing the coming turns in economic activity.

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Appendices

A1   Reference Series and Potential Leading Indicators

Indicator (source)[1]	Possible reasons for moving ahead of the overall economic cycle
REFERENCE SERIES	
Industrial production: Industrial production index (seasonally adjusted), 1996 = 100 (GKS)	Reference series, presumably synchronized with the overall economic cycle.
DEMAND AND SUPLY: direct estimates and indicators	
Measurement of product demand: A) Growth in effective demand (IET)[2,3] B) Growth in demand (CEA)[2] C) Effective demand (assessments), % of normal level (IET)[2,3] D) Demand, % of normal level (CEA)[2]	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)
Consumer demand: A) Index of current conditions (CSI Fund)[4] B) Number of new passenger cars registered in Moscow ("Segodnya" daily newspaper)	Revival of demand for consumer durables, for cars in particular, leads to growth in supply of consumer goods, and later, on all technological feedbacks, to a overall economic revival.
Orders for industrial products: A) REB-7: Industry order-book level, % rising over 1-month span (IMEMO)[2] B) REB-17: Industry order-book level, % of normal 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
Stocks of finished products: A) REB-8: Stocks of industrial products, % rising over 1-month span (IMEMO)[2] B) REB-16: Stocks of industrial products, % of normal level (IMEMO) C) Stocks, % of normal level (IET)[2,3] D) Stocks, % of normal level (CEA)[2] E) Stocks of finished goods, % of commodity resources (GKS)	Growing stocks of producers' goods show that sales are difficult. In this situation, producers should adjust their output downward. Hence, there is an inverse relation with output: *growing* stocks of finished goods precede a *decline* in output.

DEMAND AND SUPPLY: indirect estimates and indicators	
Crude oil prices: Urals brand (CIF, Mediterranean), $/barrel (Reuters)	Large-scale inflow of oil dollars leads to higher effective demand of government, producers and consumers (along with rising wages). On the contrary, declining earnings from exports leads to lower effective demand.
Real exchange rate of the ruble: Official exchange rate of the ruble in 1996 prices (1996 ruble/$). (CBR, GKS)[5]	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.
Money supply: A) Money stock M_2, billion rubles at 1996 prices (CBR)[5] B) Reserve money, billion rubles at 1996 prices (CBR)[5]	Increased (to a certain extent) supply of money encourages producer and consumer demand.
Current financial condition: A) REB-19: Share of enterprises in "good" or "normal" financial condition, % (IMEMO) B) Profits growth (CEA)[2] C) Growth in internal financial resources of enterprises (CEA)[2] D) Monetary resources of industrial enterprises, billion rubles at 1996 prices (GKS)[6] E) Deposits of enterprises (nominated in rubles), billion rubles at 1996 prices (CBR)[6] F) Non-cash money (M_2-M_0), billion rubles at 1996 prices (CBR)[6] G) Profits, % of output (industry), (GKS) H) General assessment of economic situation (CEA)[2]	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).

EXPECTATIONS: direct estimates and indicators	
Consumers' expectations: Index of consumers' expectations (CSI Fund)[4]	Displays consumers' expectations. If they are followed with actual changes in consumer demand, further adjustment of output is inevitable.
Expected production growth: A) REB-26: Anticipated growth in output (over 3-months spans), (IMEMO)[2] B) Anticipated growth (over 2-3-months spans) (IET)[2,3] C) Anticipated growth (CEA)[2]	Displays producers' expectations. This indicator, so to say, must lead actual changes in output volume by definition.
Expected change in financial condition: A) REB-28: Anticipated improvement in financial situation (over 3 months spans), industry (IMEMO)[2] B) Anticipated increase in profits (CEA)[2] C) Anticipated growth in internal financial resources (CEA)[2]	Displays producers' expectations for macroeconomic changes.
Estimate of anticipated demand: A) Anticipated change in demand (over 2-3-months spans) (IET)[2,3] B) Anticipated growth in demand (CEA)[2]	Displays producers' expectations for potential sales.
EXPECTAIONS: indirect estimates and indicators	
Stock price index: «Moscow Times» dollar index (Reuters)[7]	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.
Foreign exchange reserves: Foreign exchange reserves at the Bank of Russia (gold excluded), $ billion (CBR)	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.

Bank lending to the real sector: Claims of credit institutions on enterprises and individuals, billion rubles at 1996 prices (CBR)[6]	Volume of lending to the real sector and households displays expectations of commercial banks for macroeconomic changes. Moreover, banks lending for investment programs leads to output growth.
New start-ups: Newly established enterprises registered, by 1000 at the Unified Public Enterprise Register (GKS)	Increase in the number of start-ups for covering future demand display anticipations of entrepreneurs.
Level of real interest rates: MIACR-overnight real rate, % per annum (CBR) [8]	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 banks lending back, also hampering expansion of output. Hence, there is an inverse relation with output: *rising* real interest rates lead to *decline* in output.

1. Full names of sources: CBR – 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, Russian Academy of Sciences (the "Russian Economic Barometer" Bulletin); IET – Institute for the Economy in Transition (the Russian Bulletin of Conjuncture Surveys. Industry); CSI Fund – Consumer Sentiment Index Fund. 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 (D, a sum of "positive" and a half of "neutral" responds, in % of the total number of respondents) by $D = 0.5(100+B)$ 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 conditions 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). 6. 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.

A2 Leading over (+) or lagging behind (-) the index of industrial production (January 1990 – August 2000)

Indicators and sources[2]	Initial point[3]	T[4] 11/92	P[4] 06/93	T[5] -	P[5] -	T 11/96	P 10/97	T 09/98
Growth in effective demand (IET)	06/95	n.a.	n.a.	n.a.	X	9	2	0
Effective demand (assessments), diffusion index (IET)	09/92	-	6	X	X	7	2	0
Demand, % of normal level (CEA)	05/95	n.a.	n.a.	n.a.	X	3	0	2
Consumer sentiment index, current conditions (CSI Fund)	01/93	n.a.	-	-	X	20	1	-2
REB-7: Industry order-book level (percent rising over 1-month spans), diffusion index (IMEMO)	01/92	6	4	X	X	8	7	2
REB-17: Industry order-book level, % of normal level (IMEMO)	01/93	n.a.	4	X	X	-3	-1	4
REB-8: Stocks of finished industrial products (percent rising over 1-month spans), diffusion index (IMEMO)[6]	01/92	9	6	X	X	11	3	6
REB-16: Stocks of finished industrial products, % of normal level (IMEMO)[6]	01/93	n.a.	-	X	X	7	0	5
Stocks of finished goods (assessments), diffusion index (IET)[6]	09/92	n.a.	2	X	X	10	1	5
Stocks, % of normal level (CEA)[6]	05/95	n.a.	n.a.	n.a.	n.a.	9	-3	1
Crude oil price, Urals brand (CIF, Mediterranean), $/barrel	05/90	-	32	-	-	36	12	-3
Real exchange rate of the ruble (1996 ruble/$)	01/92	5	8	-	-	-	-	4
Money stock M_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 industrial enterprises in "good" or "normal" financial condition (IMEMO)	01/93	n.a.	3	X	X	10	0	1
Growth in internal financial resources of enterprises	05/95	n.a.	n.a.	n.a.	-	10	3	0

(assessments), diffusion index (CEA)

Monetary resources of industrial 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 ($M_2 - M_0$), 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
Consumer sentiment index, expectations (CSI Fund)	01/93	n.a.	-6	-	-	20	1	-2
REB-26: Anticipated industrial output (percent rising over 3-months spans) (IMEMO), diffusion index	04/92	2	0	X	X	2	-3	1
Anticipated growth (in a 2-3 months span) (IET)	09/92	n.a.	5	X	X	1	-4	0
REB-28: Anticipated improvement in financial situation, industry (percent improving over 3-months spans), diffusion index (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
Stock price index («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
Real interest rate (MIACR-overnight), % per annum[6]	10/94	n.a.	n.a.	n.a.	-	5	9	2

«T» - trough, «P» – peak of the industrial production index; n.a. – non-available; X – «false» or «extra» peak or trough; «-» - a turning point missing.

1. Against peaks and troughs of industrial production index. 2. Whole names of series and sources are given in the notes to the Appendix A1. 3. The moment when regular monthly data became available. 4."Intermediate" turning points of industrial production index for which some other indicators have corresponding turning points. 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.

Source: Development Center

A3   Calculation of the Composite Leading Index

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

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

Symmetrical increments (as distinct from regular increments) have a characteristic quality that equal percent changes in opposite directions, observed in two consequent instants of time, in sum, bring about the initial level of the indicator X^i.

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

$$x_{av}^i = \frac{\sum x_t^i}{n}$$

$$s^i = \sqrt{\frac{\sum (x_t^i - x_{av}^i)}{(n-1)}}$$

3. For each t, the "averaged increment" g_t is calculated, as well as it average and standard deviation (m - the number of initial indicators) [16:]

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

$$g_{av} = \frac{\sum g_t}{n}$$

$$s^g = \sqrt{\frac{\sum (g_t - g_{av})}{n-1}}$$

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

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[16] In combining standardised series, differences in their lag structure are not taken into account.

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

$$G_t = g_t \frac{s^y}{s^g}$$

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

$$Z_1 = \frac{(200 + G_1)}{(200 - G_1)}$$

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

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.