BANCO CENTRAL DE RESERVA DEL PERÚ

A composite leading indicator for the Peruvian economy based on the BCRP's monthly business tendency surveys

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Abstract

This paper documents the construction of a composite leading indicator for the Peruvian economy based on the business tendency surveys (BTS) conducted by the Banco Central de Reserva del Perú (BCRP). We first classify potential composite leading indicators into "semantic" and "sophisticated" types. The former are based on the contents of the underlying indicators, whereas the latter results from statistical analyses relating to pre-determined reference series. We show that the BCRP BTS data provides a suitable basis for the construction of a sophisticated indicator with the Peruvian year-on-year GDP growth rate as a reference series. The indicator selection consists of a number of steps comprising semantic analyses of the questionnaire items, cross-correlation analyses as well as turning point analyses. We argue that based on these analyses, the choice should fall on five indicators, relating to firm-specific questionnaire items as well as to items relating to the sector or economy as a whole. The composite leading indicator is computed as the fist principal component of the selected variables. In-sample, it shows a lead of four months before the reference series, which amounts to about six months before the first official data release dates. Due to the limited number of observations (the BCRP's BTS now covering about eight years), we did not reserve any data points for out-of-sample analyses of the suggested composite leading indicator. Accordingly, the performance of the indicator still has to stand the test of time and its lead should be carefully monitored.

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Overview

In 2009, the authors of this paper were invited to analyse the business tendency surveys (BTS) conducted on a monthly basis by the Banco Central de Reserva del Perú (BCRP) and to assess the potential to develop coincident and/or leading indicators for core economic variables of the Peruvian economy.[1] The analysed BCRP BTS data start in 2002 and end in 2010. They cover manufacturing, construction, commerce, services and total economic activity (GDP).

The time span of eight years and the sectoral coverage allowed us to extend our search to comparably sophisticated indicators. The selection process of indicators comprised semantic analyses, cross-correlation analyses as well as turning point analyses (referring to a quality index suggested by the authors).

As with other BTS data, the BCRP data revealed a trade-off between stability at the margin and the signal-to-noise ratio. Low pass filtering of the indicators increases the signal-to-noise ratio stability, but makes end points - i.e. the most up-to-date observation - of the series prone to filter-induced revisions. Also, we faced the usual choice whether to refer to a smaller bundle of variables (usually on firm-specific items) or to a larger variable set, where over-fitting is less likely.

Altogether, given the reference series considered, we identified a number of leading indicators for the GDP growth rate, but hardly any coincident BTS data. We hence were able to suggest a composite leading indicator for the dynamics of GDP. This indicator is given by the fist principal component of our selection of five leading indicators. In-sample, it shows a lead of four months before the reference series, which amounts to about six months before the first official data release dates.

1. Introduction

In this section, we shall discuss the possibility of referring to the data from the BCRP BTS to construct a comprehensive coincident/leading Business Sentiment Indicator for the Peruvian economy. We shall distinguish a *semantic* and a *sophisticated* approach.

A fundamental issue for policy oriented research is to provide reasonably reliable coincident and – if possible – leading indicators. To this end, government and business bodies worldwide are regularly processing and publishing statistical information and a wide range of institutions are conducting business tendency surveys amongst firms. Importantly, there is a trade-off between early availability and precision of economic indicators. Specifically, business tendency surveys reveal first in-

[1] See Etter and Graff (2009).

formation as early as possible, whereas final official statistics are supposed to come as close as possible to the manifestation of the economic process.[2]

The search for coincident and leading indicators of economic activity has long attracted the attention of applied economists. Traditionally, this line of research concentrates on quantitative statistical indicators, but qualitative indicators, many of them resulting from BTS, have recently been receiving a fair share of attention, too. For the Peruvian economy in particular, we are aware of two studies dealing with leading indicators, Escobal and Torres (2000) as well as Ochoa and Lladó (2003).[3] Escobal and Torres (2000) refer to 243 economic indicator series from Peru and find that 28 of these are significantly correlated with the Peruvian GDP growth rate and suitable to serve as leading indicators. Interestingly, these authors specifically mention that some of these indicator series are derived from BTS, although not from the (only subsequently launched) survey of the BCRP, but from the opinion survey in the industrial sector then conducted by the Instituto Nacional de Estadística e Informática. Ochoa and Lladó submit a set of 519 economic indicator series from Peru to a range of analyses to establish their usefulness as indicators for the evolution of the Peruvian GDP as well as for its turning points. They do indeed identify a number of indicators that prove useful as leading indicators. However, Ochoa and Lladó's as well as Escobal and Torres's conducted their research before the BCRP BTS were launched at all or early enough to provide them with reasonably long time series, so that no qualifications regarding the suitability of the BTS as a source for leading indicators could be made.[4]

The related literature referring to other countries or regions is too vast and diverse to be summarised in a short survey. In particular, there is no generally accepted state of the art of selecting and combining indicators into coincident or leading composite indicators.[5] Nevertheless, a number of steps and practical procedures – involving pre-selection, filtering and aggregation – are widely used and recommended.[6] Another fairly general conclusion is that a considerable number of potential leading indicators perform well on average and over extended time spans *in-sample*, but that their prognostic power is less impressive *out-of-sample* and in the vicinity of turning points, where – from a policy perspective – it is most important to have reliable signals of the state and the development of the economy. Moreover, the problems can usually be traced back to the indicators. Some of the correla-

[2] Of course, since the compilation of statistics is costly, there is an optimum level of ignorance, which implies that even final official statistics do not necessarily come as close to the real world as technically possible. Nonetheless, official statistics most likely rely on a larger set of information than business tendency surveys.

[3] We are indebted to César Carrera for directing our attention to these papers.

[4] To our knowledge, no analyses in this direction have been published so far, so that this paper is filling a gap.

[5] For more details, see e.g. Etter and Graff (2003), Ochoa and Lladó (2003), Graff and Etter (2004) and Graff (2010).

[6] See e.g. OECD (2008)

tions between indicators and reference series tend to break down out-of-sample, which may be due to changing conditions or to the fact that the correlations were spurious in the first place. In other instances, the observed lead in-sample cannot be maintained out-of-sample, as the publication lag increases (or was not properly considered when performing the in-sample indicator selection). Out-of-sample, some lead is also swallowed by the common symmetric filter procedures, whereas the aggregation method is a lesser issue.

Having said this, it is crucial to notice that BTS are specifically designed and conducted to reflect a picture of the current economic situation of a sector, an industry or the entire economy of a country as well as of the participants' outlook for the near future. In particular, the information conveyed by answers to BTS questions that refer to the firms' managers' assessments (judgments) of a particular situation or to the managers' expectations are usually unique. Last but not least, results from BTS are practically available in real time, whereas official statistics are released with considerable lags. Thus, the timeliness and the broad range of the information reflected by BTS that makes them a unique and invaluable source for early or even leading indicators of the state and development of important economic aggregates and prices, and for the cyclical situation of the economy as a whole.

Finally, notice that firms have clear advantage in processing and summarising relevant information on their own business, i.e. the economic activity of the firm, whereas they usually will not have additional or superior knowledge than informed outsiders on economic variables that lie outside the firm. Therefore, BTS clearly focus on questions on the firm.

Turning to possible composite indicators for the Peruvian economy, let $\mathrm{BTS}(t)$ refer to information on present conditions reflected in the BTS conducted by the BCRP, $\mathrm{BTS}(t+w)$ to information from business tendency surveys on conditions with a lead of w, and $\mathrm{OS}(t+v)$ to final official statistics on past conditions with lag v ($v > 0$).

Referring to this notation, we now proceed to analyse whether information from BTS is related to economic variables of interest. Specifically, we outline a procedure to select a limited number of transformed series from survey data to be combined into principal components that qualify as coincident or leading indicators of a given reference series.

1.1. Semantic approach

A number of prominent composite economic indicators (e.g. the ifo Business Climate Index or the ECFIN confidence index) are constructed as coincident indicators that reflect the general sentiment in the economy rather than a precise representation of a particular reference series, i.e. their construction is based on BTS(t) only. Following this international practice, a composite indicator for the Peruvian economy could be constructed along the following lines:

- Referring to a limited number of series that are taken from the BCRP BTS data.
- Referring only to questions that directly relate to the focus of the sentiment indicator.
- Transparent computation and aggregation.

Note that this approach puts more emphasis on simplicity and transparency than on technical and econometric sophistication. Accordingly, this indicator would have to be constructed on the basis of experience with similar instruments elsewhere and *a priori* reasoning rather than on a data driven selection and aggregation algorithm. This has three important implications:

– Since the construction of the indicator is primarily based on the semantic and, presumably, economic content of the underlying survey data, it can go ahead without a quantitative reference series to which it is fitted.
– The indicator is still aiming at giving a real time indication of an economic process. This process may not (yet) have an adequate quantitative representation in the corpus of data on the Peruvian economy.
– Without an explicit reference series, the indicator basically relies on the content of the underlying survey data, along with the experience that is available from similar exercises elsewhere.

Typically, such an economic indicator (sentiment index) is computed as the arithmetic average of two or three series from BTS, which refer to items like

– assessment of present business situation
– expected business situation in the near future
– assessment of present demand
– expected demand in the near future
– assessment of present profit
– expected profit in the near future
– assessment of present employment,
– expected employment in the near future

An inspection of the BCRP BTS shows that there are enough suitable items to embark on such a strategy.

1.2. Sophisticated approach

For the more sophisticated approach, we would systematically analyse how the information reflected in the BCRP BTS_t series relates to official statistics OS_t or other reference series of interest.

In particular, we search for variables and indicators suitable to reflect a particular reference series, such as GDP (Y) or transformations of it. Since in a growing economy, these series are mostly non-stationary, and in addition to this, are affected by seasonal factors, one would usually refer to year-on-year (y-o-y) growth rates (GR_) of the reference series (e.g. Y), where in quarterly notation

$$\text{GR\_}Y = \ln Y_t - \ln Y_{t-4}.$$

With the restriction that data are available for a relative short period only, we didn't want not to sacrifice many observations of the in-sample domain, which ideally should cover at least two cycles, in favour of an out-of-sample domain. Nevertheless, out-of-sample forecast analysis is principally a necessary way to examine whether a comparatively good fit to a reference series in-sample is the result of 'overfitting', which means that the underlying correlations between reference and indicator series do not reflect stable relationships but rather peculiar characteristics in-sample and hence break down out-of-sample.

Last but not least, we have to be aware of potential end point instability of our time series. While this affects neither the reference series – which are growth rates of final official numbers – nor the raw numbers of the indicator series – which are final from the beginning and hence not subject to revisions – most seasonal and low pass filters are asymmetric, so that at the boundary it may take a long time until the latest entries converge to their final values.[7]

We shall then refer to our established methodology for selecting coincident indicators for the selected reference series and combining them into composite indicators that are appropriate specifications of $f\left[\text{BTS}(t)_t\right]$. This helps to equip analysts as well as policy makers with timely information on crucial trends of economic activity.

2. The data

2.1. BTS data

2.1.1. Economic sectors

The BCRP BTS cover all sectors of the economy: agriculture, fishing, mining, electricity, manufacturing, commerce and services. The average sample size (questionnaires sent to firms) varies between 950 and 900. The average return varies between 350 and 300, giving a return rate within a range of 36.8% and 33.3%. The sample includes large and medium-sized companies located all over the country with a higher representation on manufacturing firms located in Lima, the capital.

7 See Graff (2004).

The longest time series start in April 2002. Some time series begin in January 2004 or later. They all end in March 2010, which makes a maximal time span of eight years. Under these circumstances, it was not clear whether it would be possible to construct reliable indicators. The data include the aggregation of firm responses into the following sectors:

- Total economy
- Manufacturing
- Commerce

Time series shorter than three years are not taken into consideration in the search for coincident and/or leading indicator.

The survey questions are qualitative. In particular, there are three possible answers to the qualitative questions. The appraisals may be stated as 'good/too high', 'satisfactory/sufficient' or 'poor/too low' or the like. In order to quantify these data, the responses from the questionnaires generally receive equal weights[8] and are aggregated to form percentages of each response category of the total. Then, the difference between the above and below 'satisfactory/sufficient' or 'the same' shares (commonly called 'balance') is to be calculated, which reduces the information into a single index number that ranges from –1 to +1.[9] The BCRP then rescales the balance into an index ranging from 0 to 100, to avoid negative numbers.

2.1.2. Transformations

BTS data may be affected by seasonality, and like most survey data, they may be expected to be relatively volatile, so they should be sent through a low pass filter to separate the trend/cycle components from season and noise. To analyse the BTS data, we produced deseasonalised data and low pass filtered (smoothed) data. A visible inspection reveals the following findings (the graphs can be obtained upon request from the authors):

- Original data: Some variables have a very strong seasonal pattern (e.g. inventories, orders); others have very little seasonality (e.g. judgments). To filter out the seasonality and thus to help identifying the business cycle movements (still including erratic movements); we eliminate these effects from all original data.
- Deseasonalised data: We applied the CENSUS X12 procedure, based on the additive method using the X11 filter, implemented in EViews. Deseasonalised data will be used in all cross-correlation analyses. The deseasonalised data contain, in some instances, strong erratic

8 However, micro-level weights are applied for *quantitative* questions about specific issues such as the "level of capacity utilization" or the "percentage of wages and salaries increase". Here, the answers are weighted with the firms' income.

9 This method of extracting relevant information is widely used. For a discussion, see Dasgupta/Lahiri (1992).

movements (e.g. inventories, sales). To locate turning points, the noise must be eliminated (smoothed) with a low pass filter.

- Smoothed data: We applied the Henderson trend filter based on X12, implemented in EViews. And indeed, all smoothed variables show strong cyclical movements. These data will be used in the turning point analyses.

2.1.3. Items for analysis

The questionnaires of the BCRP cover a broad range of economic items. There are questions concerning the situation of the firm, the industry and the total economy. In particular, the BTS of the BCRP comprise the following:

- Yearly growth rate on a calendar year basis for two or three years
- Situation in the previous month (without comparison to another period)
- Situation in the previous three months (without comparison to another period)
- Situation in the previous year (without comparison to another period)
- Monthly growth rate compared to the same month a year before
- Present situation compared to a month before
- Present situation compared to three months before
- Situation in the last three months (without comparison to another period)
- Quantitative difference of interest rates

2.2. Reference series

We received eighteen quantitative reference series. They all start in January 1995, end in February 2010, and are disposable on a monthly basis. However, already on the basis of *a priori* assessment, not all of them are found suitable as reference series for the BTS data. We selected the following series as references for the BTS data:

- GDP, y-o-y growth rate
- Value added of all economic sectors except primary goods, y-o-y growth rate
- Internal (i.e. domestic) demand, y-o-y growth rate
- Production in the manufacturing sector, y-o-y growth rate
- Production in the manufacturing sector except primary goods, y-o-y growth rate
- Sales in commerce

Other possible reference series do not cover branches included in the Peruvian surveys.

As we have seen in the last section, the BTS variables exhibit some seasonal movement and significant noise. Therefore, we filter the reference series in analogy to our treatment of the BTS data.

Assuming that the quality of the reference series taken from official Peruvian statistics will reflect a reliable picture of the Peruvian economy, the BCRP BTS series starting in 2002 should contain sufficient information to develop a reasonably reliable *sophisticated* leading composite indicator. If, however, the validity of the reference series had been too questionable to allow identifying stable correlations with the BTS data, we would have resorted to developing a *semantic* composite economic indicator that reflects the general sentiment in the economy rather than a precise representation of a particular reference series, i.e. the construction will be based on $\text{BTS}(t)$ only. The interpretation of such a composite sentiment index is contingent on the BTS questions that it comprises.

3. Cross-correlations

The first step in the process of selecting suitable variables is 'data mining'. To this end, all possible pairwise permutations of cross-correlations are computed to screen the data for highly correlated BCRP BTS data with the reference series. From these, we pick all pairs where the maximum correlation shows up simultaneously or with a lead of the BTS data. Then, a selection threshold is set at

$$|\text{r}| \geq 0.7 \Leftrightarrow \text{r}^2 \geq 0.5\,.$$

Then, the cross-correlograms are listed in descending order by the absolute value of the closest correlation. Hence, after this initial step, we are equipped with a complete map of the coincident and leading indicator series, which would reproduce the largest shares of the reference series' variance in the in-sample domain.

From these, we pick all pairs where the maximum correlation showed up with a lead (λ, where a negative sign denotes a lead) of *on average* $-9 \leq \lambda \leq 1$ of the BTS data before the reference series. Moreover, the correlation coefficient is required to show the economically correct sign.

With short time series, there is always a danger of 'overfitting', which may result in high, but spurious correlations. Accordingly, series with an extension of less than three years are excluded from the analyses. Also, data beginning in 2007.10 or 2008.01 (October 2007 and January 2008) are too short to be transformed into deseasonalised time series and therefore not considered.

The results are shown in Appendix A2. The first column shows the variables analysed. The second column indicates the period of analysis. This period begins for long time series at the left side of the cell, medium length time series start in the middle, and short time series at the and of the cell. Time series with an extension of less than three years are marked in red. The third column shows the maximum correlation coefficient, and the fourth column indicates whether the BTS series have a lead (–) or a lag (+) with respect to their reference series.

To be considered as potential leading indicators, the series are required to show a lead of at least three months in this step of analysis. Below, we deliver some detailed comments of the results reflected in Appendix A2.

3.1. GDP, y-o-y growth rate

It is no surprise that amongst the variables with a correlation coefficient of more than 0.8, we find only the shortest time series. We presently do not select these variables for further analysis. But they should be kept in mind in case of revisions of the synthetic indicator(s) some years ahead from now, when the series will be longer so that spurious correlations are less likely.

We found high correlations of 0.7 to 0.8 in nine cases. Three variables have to be excluded because of the shortness of the available time series, but the other six variables belong to the long time series. They have a lead to the growth rate of GDP of at least three months. These findings are very much inspiring confidence.

3.2. Value added of all economic sectors except primary goods, y-o-y growth rate

Excluding the production of primary goods from GDP, the results are markedly different. No variable has a maximum correlation of at least 0.7. Also, excluding primary goods makes the time series much noisier. On the other hand, the BTS series tend to have a longer lead before this reference series compared to the one before GDP. It is mainly between 6 and 8 months. However, the noisiness will make it difficult to find variables for this reference series based on statistical procedures.

3.3. Domestic demand, y-o-y growth rate

The results of the cross-correlations for domestic demand (y-o-y growth rate) are quite promising. One time series has a correlation coefficient higher than 0.8. Unfortunately, this variable has *on average* a lead of only two months. Given this trade-off, though the series fails to match the lead criterion, we keep it as an option and shall decide whether to go ahead with it after the turning point analysis (see below).

Thirteen variables show up with a maximum leading correlation of 0.7 to 0.8. Three of them are too short to be considered further. Another three variables produce this correlation for the period 2004.01–2010.02, and seven for the period 2002.04–2010.02. Accordingly, the coherence between the quantitative data for domestic demand and the BTS data appears to be stronger than with GDP.

3.4. Production in the manufacturing sector, y-o-y growth rate

During the search for variables with a high coherence with the manufacturing production, we exc1uded data reflecting activity in commerce, as we do not want to compute any spurious correlations. Three variables show a correlation coefficient above 0.8. However, one of these reflects this coherence based on a very short period. We shall leave it aside for the time being. A reassuring finding is that the variable with the highest correlation also covers the longest time span

3.5. Production in the manufacturing sector except primary goods, y-o-y growth rate

The results for manufacturing production excluding primary goods are similar to the results in manufacturing without exclusion of primary goods. There are three variables with a correlation above 0.8. Out of these, one series is too short and another has a lead of only one month – both will hence not be analysed further. We found three variables with correlations between 0.7 and 0.8. Two of them cover a long time span, one a medium time span.

3.6. Sales in commerce

The number of variables to be analysed is limited. To prevent spurious results, we use only BTS results from the survey in commerce. Therefore, only nine variables are disposable. The results of these variables concerning the coherence with the reference series are somewhat poor. There is no variable with a correlation of at least 0.8, and there are only three variables with a correlation of 0.7 to 0.8, of which two have to be excluded because the time series are too short.

3.7. Conclusions from the cross-correlations

Preparing this project we hoped – but were not sure – to find enough variables for the construction of a leading indicator, but we expected to find many more for a coincident indicator. Therefore, our primary aim was – based on statistical criteria – to at least construct reasonably reliable composite coincident indicators. To our surprise, we empirically found quite a few leading, but hardly any coincident variable series. Based on this finding, we are especially well equipped to construct statistically sound leading indicators, which is good news, as policy makers (including monetary authorities) are far more in need of leading than coincident indicators. In what follows, we hence focus exclusively on the former. (Note that any leading indicator can be transformed into a coincident indicator by shifting it forward in time according to its lead.)

Notably, the cross-correlations with the various reference series have shown considerable differences regarding the BTS series. In some cases, there has been hardly any correlation, and in others, strong correlations could be shown. In the following, we hence restrict the analysis to four reference series: ‘GDP, y-o-y growth rate’, ‘Domestic demand, y-o-y growth rate’, ‘Production in the manufacturing sector, y-o-y growth rate’ and ‘Production in the manufacturing sector except primary goods, y-o-y growth rate’. These are the reference series where we found reasonably high and stable correlations to the BTS series set.

4. Turning point analyses

The selection of BTS based series with a lead before the reference series *on average* is an important step in the empirical search for leading indicators. Unfortunately, some variables exhibit a positive average lead, but give either false signals, or they lag at turning points (TP). However, for economic policy, it is crucial to identify as clearly, and as soon as possible, peaks and troughs of the business cycle. We shall therefore now analyse the behaviour of the variables at the points of inflection of their reference series.

In the economic literature, several theoretical concepts of business cycles are elaborated. Depending on the choice of concept, turning points have to be determined differently. We choose to use a commonly accepted business cycle concept: turning points represent the extrema (minima and maxima) of the monthly y-o-y growth rates of aggregate quantitative data for Peru. The turning points of the reference series as well as of the series selected in the cross-correlation analyses are defined by the Bry-Boschan (1971) method on the basis of smoothed time series.

There are two possibilities of false signals emitted by the variables. Either the reference series shows a turning point whereas the variable does not signal it (missing signals), or the variable signals a turning point without incidence of a turning point in the reference series (additional signals).

Our quality index *(QI)* reflects these considerations. It is defined as:

$$QI = \frac{NCS - NFS}{NTP}$$

NCS = Number of correct signals

NFS = Number of additional signals of the variable

NTP = Number of turning points in the reference series

QI equals one if the variable signals the turning points of the reference series correctly and indicates no additional turning points. *NCS* is always equal to or – reduced by missing signals –smaller than *NTP*. Assuming *NTP* is positive, *QI* is zero if the variable signals as many additional as correct turning points. Any variable to be selected should have a significant positive value for *QI*. The selection criterion for the *QI* applied here is a positive coefficient exceeding 0.5.

Our second condition for a variable to be selected is the performance at the TPs it is signalling. For this reason, we calculate the average lead or lag at the upper and lower TPs. To be selected, a significant average lead should be found at TPs.

4.1. GDP, y-o-y growth rate

The six variables selected for this reference series in the cross-correlation analyses, are classified according to the TP criteria elaborated above (see details in Appendix A4).

GDP (var. %)			**QI**	**Lead at TP**
All firms	Situation of the firm	next three months	0.71	0.1
All firms	General economic situation	next three months	0.71	-2.0
All firms	Orders of purchase	last month	0.57	-1.7
All firms	Situation of the sector	next three months	0.86	-0.5
All firms	Sales	last month	0.86	-0.8
Commerce	Orders of purchase	last month	0.57	-5.3

All pre-selected variable series show a quality index *QI* of more than 0.5. Accordingly, they all signal most of the TPs and have only few additional TPs with respect to this reference series.

For five out of the six variables, there is a lead at TPs, though it is in most cases somewhat lower at the TPs than on average across all observations (section 4.1). Given the positive lead at TPs, we still conclude that these five variable series are statistically robust candidates to be combined into a composite leading variable. (This step will be performed and discussed below; see section 6).

4.2. Domestic demand, y-o-y growth rate

Nine variables were selected in the cross-correlation analyses for the reference series 'domestic demand', which is even higher than for GDP. The results of the TP analysis are as follows:

Domestic demand (var. %)			**QI**	**Lead at TP**
All firms	General economic situation	s.a. by Tramo-Seats	0.50	-3.3
All firms	Situation of the firm	next three months	0.67	-1.2
All firms	Situtation of the economy	next three months	0.67	-1.7
All firms	Orders of purchase	last month	0.67	-2.3
All firms	Situation of the sector	next three months	0.67	-1.5
All firms	Sales	last month	0.67	-3.5
Manufacturing	Stocks of finished products	last month	0.00	-0.5
Manufacturing	Orders of purchase	last month	0.00	-2.5
Commerce	Orders of purchase	last month	0.33	1.0

The *QI* reaches the minimal level of 0.5 for selection to form part of a leading composite variable in only six out of nine cases. One variable has no lead at the TPs, but this variable does not meet the *QI* criterion either. Hence, six variables will later be combined into a composite leading variable

4.3. Production in the manufacturing sector, y-o-y growth rate

For this reference series the results of the TP analysis are somewhat poor. The number of variables passing the cross-correlation analysis had only been three.

Manufacturing production (var. %)			**QI**	**Lead at TP**
All firms	General economic situation	s.a. by Tramo-Seats	0.33	-3.5
All firms	Sales	last month	0.00	-2.0
All firms	Situation of the firm	next three months	0.83	0.7

Regarding the values of *QI*, only one variable signals the turning points satisfactorily. Unfortunately, this variable has no lead at TPs. Therefore, no variable is selected, and – at least for the time being – we cannot suggest any composite leading variable for this reference series. ('Empresa dentro 3 meses', however, might qualify as input into a coincident variable.)

4.4. Production in the manufacturing sector except primary goods, y-o-y growth rate

Excluding the production of primary goods delivers a slight improvement to the number of selected time series according to the cross-correlation procedure. But the results of the four selected variables are yet again poor.

Non-primary manufacturing production (var. %)			**QI**	**Lead at TP**
All firms	General economic situation	s.a. by Tramo-Seats	0.33	-4.5
All firms	Sales	last month	0.83	1.8
All firms	Situation of the firm	next three months	0.83	10.5
Manufacturing	Orders of purchase	last month	-0.17	-2.5

Two out of four variables have a *QI* of more the 0.5. At the same time, two out of four variables have no lead at the TPs. Unfortunately, there is no overlap of these criteria. As the intersection of sets is empty, no variable passes all selection criteria.

As a result of this section, only the selected BTS-variables of the reference series 'GDP, y-o-y growth rate' and 'Domestic demand, y-o-y growth rate' enter the next step – the principal component analysis.

5. Principal component analyses

The selection of a single leading or coincident indicator is straightforward for all of our reference series. The variables that show the best in-sample performance and the coefficients of determination that we would get from a bivariate regression of the reference series on any of the tabled variables are already known from the correlation analyses. Hence, referring to these pairs, ex post-estimates of a reference *Y* series are feasible through OLS-regressions on just one coincident or leading BTS series *X*:

$$Y_t = \beta_0 + \beta_1 X_{t-\lambda} + \varepsilon_t$$

To improve the in-sample fit, we can include additional 'second-best' survey based series as regressors, but multicollinearity will soon render the regression parameters too imprecise for sensible out-of-sample estimates, when the pattern of multicollinearity is random and specific to the in-sample domain. In this case, the resulting overfitting to an ultimately meaningless random pattern will impair the accuracy of the fitted values in the forecast period.

On the other hand, for substantial as well as statistical reasons, it is unlikely that a single time-series will bear sufficient information to secure informational efficiency in the process of estimating and forecasting a reference series (see Appendix A1). Moreover, our survey based variables certainly comprise a considerable share of noise, so that at this stage of our analysis, we refer to a statistical method that is designed to identify and combine the common variance of a chosen set of variable series into a new synthetic indicator. The procedure chosen here is principal component (PC) analysis. If the variance of a given set of pre-selected variables, which are closely correlated to a given reference series, can reasonably well be represented by one principal component only,[10] this first component will serve as the basis to derive our final indicator.[11]

Assuming that the quality of the reference series taken from official Peruvian statistics will reflect a reliable picture of the Peruvian economy, the BCRP BTS series starting in 2002 should contain sufficient information to develop a reasonably reliable *sophisticated* leading composite indicator.

Computing principal components (PC) is a linear transformation that transforms a number of correlated variables into an equal number of orthogonal variables called principal components. Principal component analysis (PCA) is frequently used to explore the internal structure of a dataset, reducing

[10] That is, if the correlations between the desired representations are high, but measurement errors and stochastic shocks in the data for the individual variables have little common variance. Technically, we accept this condition as fulfilled, if no eigenvalue, except for the first component, exceeds unity.

[11] Note that this method, which in our set-up amounts to the identification of the co-variance of selected time series, captures some of the spirit of Burns/Mitchell's (1946) notion of the business cycle, which is the co-movement of a number of economic series; see also Stock/Watson (1989) and Forni et al. (2000).

its dimensionality from *n* (the number of variables) to $k < n$ PC explaining a 'sufficient' fraction of the total variance in the data. In particular, the first principal component is determined by OLS to account for as much of the variance in the data as possible, and each subsequent component will account for as much of the remaining variance as possible.

Our aim is to combine a set of variable series to serve as a predictor for a reference series. As all variables have been selected in a multi-step bivariate procedure relating to a given reference series, a PCA should result in a clearly one-dimensional solution, where the fist PC reflects most of the variance in the indicator set (the covariance of all variables). A common criterion to assess whether a PCA yields a one-dimensional solution is to check that only the first PC has an eigenvalue exceeding one. We shall resort to this criterion.

In what follows, we shall submit the sets of potential variables for a given references series that passed the cross-correlation and turning-point criteria to PCA. To purge the results from correlated season and/or noise, the PCA will be conducted with deseasonalised as well as smoothed series. Moreover, we run the PCA in two versions: for all potential variables as well as for the subsets of variables relating to firm-specific items in the BTS, as firms can be assumed to be particularly good in assessing their own business, but not necessarily the general economic situation.

5.1. Results

There is a trade-off between the stability at the margin and the signal-to-noise ratio, and low pass filtering of the indicators increases the latter. It is not *a priori* clear if a low pass filter should be applied or not. Taking this into consideration, we decided to produce a smoothed as well as a non-smoothed variant of the indicators. The latter could consist of original or on deseasonalised data.

5.1.1. Variables selected for GDP, y-o-y growth rate

PCA were performed in two different versions: the first version comprises all selected variables, the second version only firm-specific series. Moreover, the two versions are calculated with deseasonalised data as well as – alternatively – with smoothed data.

All PCA results comprising the variables selected for GDP y-o-y growth rates represent one-dimensional solutions; according to the eigenvalue criterion, there is only one PC to be extracted. The eigenvalues of the first component are in both cases smaller for the deseasonalised (_sa_) than for the smoothed (_tc_) data. This is true for all five variables as well as for the three firm-specific variables only. The elimination of noise obviously improves the eigenvalues.

To compare the PCA results of the two versions, we have to take the number of variables entering the PCA into consideration. The explained variance (eigenvalues/*n*) with deseasonalised data is significantly higher if we refer only to firm-specific variables: 90 % versus 74 %. With smoothed data, the difference between the two versions is somewhat smaller, but again higher for the firm-specific set of variables (97 % versus 90 %). Accordingly, the co-variance within the set of firm-specific variables alone is higher than within the set that adds the pre-selected non-firm-specific variables.

Table 2a: PC eigenvalues

a) Variables selected for GDP, yearly growth rate

GDP - all selected variables			**GDP - firm specific variables**	
gdp_pca1_sa_vec	gdp_pca1_tc_vec		gdp_pca2_sa_vec	gdp_pca2_tc_vec
3.698	4.519		2.701	2.905
0.809	0.352		0.210	0.056
0.348	0.056		0.089	0.039
0.099	0.046			
0.047	0.026			
Explained variance by the first component				
0.740	0.904		0.900	0.968
Correlations GDP and PC-Indicator				
3	4	lead	4	4
0.861	0.878	corr.	0.800	0.834

The cross-correlation between the indicator derived from all selected variables with the reference series y-o-y GDP growth rate is higher then with the firm-specific variables only. This holds for the seasonally adjusted as well as for the smoothed variables. With respect to the lead, there is no significant difference.

5.1.2. Variables selected for domestic demand, y-o-y growth rate

The PCA comprising the variables selected for the reference series 'domestic demand' again results in only one component to be extracted according to the eigenvalue criterion; and this holds for deseasonalised data and for the smoothed series as well a for firm-specific and general items from the BCRP BTS. Also, the eigenvalue of the first component is again somewhat smaller for the deseasonalised than for the smoothed data. This is true referring to the total of five selected variables as well as for only the three firm-specific variables. The elimination of noise by low pass filtering hence improves the eigenvalues in both versions, but the difference is less obvious than with the GDP growth rate as reference series. In other words, the questionnaire items that are good indicators for domestic demand appear to be affected less by noise than those relating to GDP.

Comparing the PCA results regarding the distinction 'firm-specific' versus 'general', contrary to the results for GDP as reference series, we find that the explained variance with deseasonalised data is somewhat lower when we restrict the variables to be firm-specific only; and this holds for the seasonally adjusted series (87 % versus 91 %) as well as for the smoothed data (90 % versus 94 %). Yet, the relative difference between the within-group covariance is less pronounced with domestic demand serving as reference series.

Table 2b: PC eigenvalues

b) Variables selected for Internal demand, yearly growth rate

Internal demand - all selected variables			**Internal demand - firm specific variables**	
demand_pca1_sa_vec	demand_pca1_tc_vec		demand_pca2_sa_vec	demand_pca2_tc_vec
5.435	5.677		2.606	2.691
0.315	0.183		0.293	0.274
0.106	0.095		0.101	0.035
0.100	0.037			
0.031	0.005			
0.013	0.003			
Explained variance by the first component				
0.906	0.946		0.869	0.897
Correlations GDP and PC-Indicator				
4	4	lead	4	5
0.900	0.933	corr.	0.872	0.920

The cross-correlation between the composite indicator derived from all selected variables with the reference series y-o-y demand growth rate is higher then with the firm-specific variables only. This holds for the seasonally adjusted as well as for the smoothed variables. With respect to the lead, there is no difference.

5.2. Principal components and reference series

For the determination of the set of time-series from BTS that are submitted to a PCA, where the first extracted PC delivers a time series to serve as a composite leading indicator, a number of points have to be considered, with some trade-off between each other:

- To produce a composite indicator which is stable at the right margin of the series when new data points are coming in, the simplest way is to use only original data. But the BTS data of Peru contain too much of seasonal patterns to go this way.
- Deseasonalised data are purged of season, and in most seasonal filters, some smoothing (mostly treatment of outliers) is happening at the same time. There are ways to purge the data of seasonal factors only, but the more one goes this way, the more noise remains.

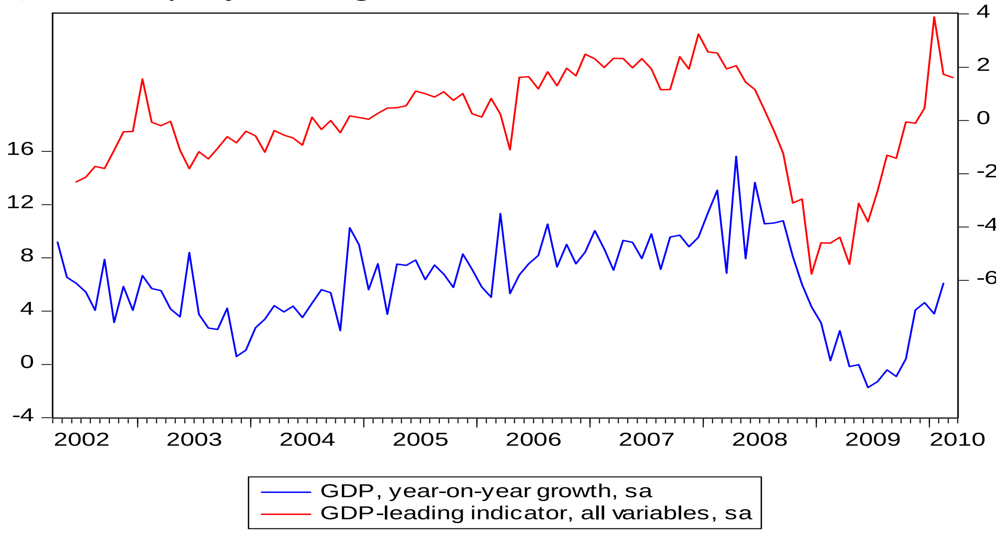
- Smoothed data are much easier to interpret than deseasonalised or even original data, because the elimination of the noise increases the signal-to-noise ratio. The disadvantage is the end point instability of the smoothed time series, which may lead to massive revisions, especially at turning points, when they are least tolerable from a policy perspective. There are low pass filters that are not affected by the end point problem (i.e. so-called ‘direct filters’), but all these approaches lead to a phase shift, which considerably reduces the lead of the indicator series before the reference series.

In the following, we show the first PCs extracted from deseasonalised as well as from smoothed data, along with the respective reference series.

5.2.1. GDP, yearly growth rate

5.2.1.1. All selected variables

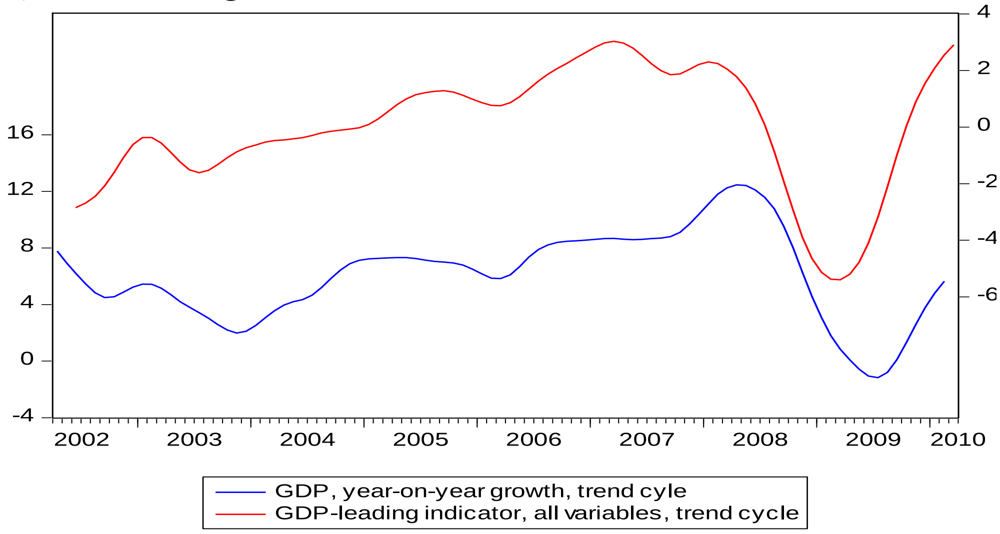
a) Seasonally adjusted, Figure 1



Correlation = 0.80; lead = 4 months

The first PC of all selected seasonally adjusted leading variables for the growth rate of GDP performs fairly well. It catches the general economic tendency, and the correlation of 0.8 is high. But the short term movements – mostly erratic movements – cannot be captured. The noisy elements are somewhat smaller than in the reference series. The lead of four months, which is also achieved at the turning points, is quite impressive.

b) Smoothed, Figure 2

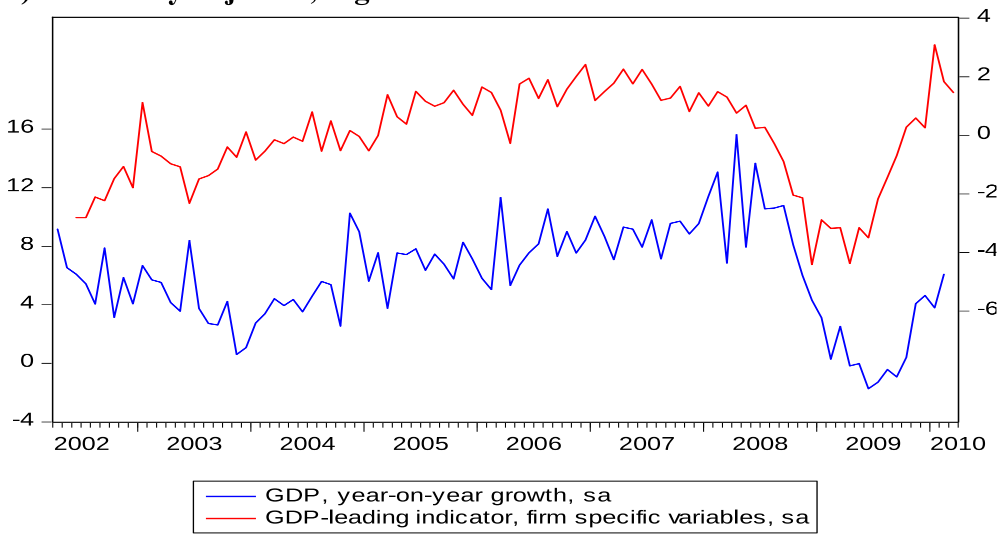


Correlation = 0.88; lead = 4 months

The first PC of all smoothed selected leading variables for the growth rate of GDP performs particularly well for the last recession. The correlation of 0.88 is very high. All in all, it also catches the general economic tendency very well. The lead of four months, which is achieved at most turning points, too, is again quite impressive.

5.2.1.2. Only firm-specific variables

a) Seasonally adjusted, Figure 3

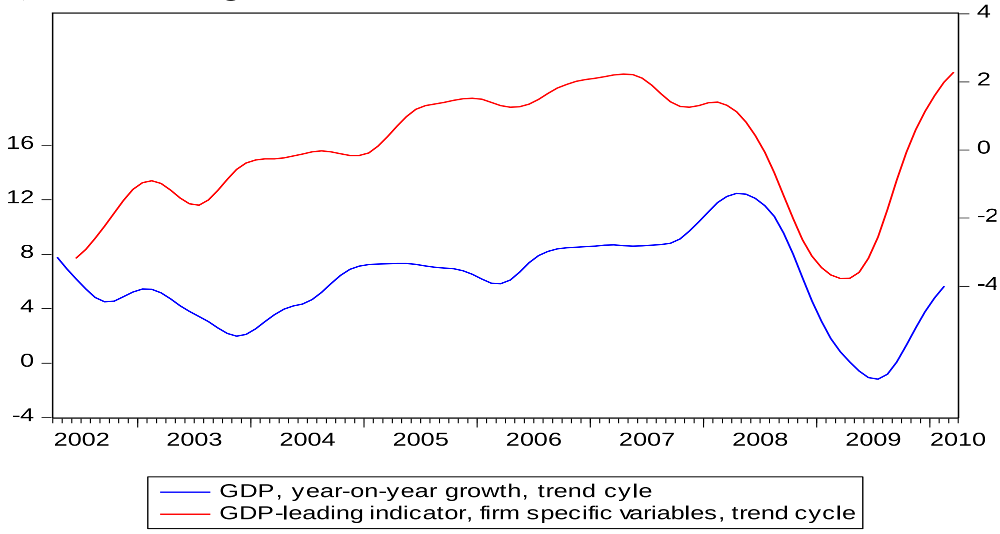


Correlation = 0.75; lead = 5 months

The first PC of the selected firm-specific deseasonalised variables for the growth rate of GDP performs well, too. It catches the general tendency, and the correlation of 0.75 is considerable; nevertheless, it does not reach the level of the PC with all selected variables. The short term movements –

mostly erratic movements – cannot be captured. The noise is somewhat less pronounced than in the reference series. The lead of five months, which is also achieved at the turning points, is impressive.

b) Smoothed, Figure 4



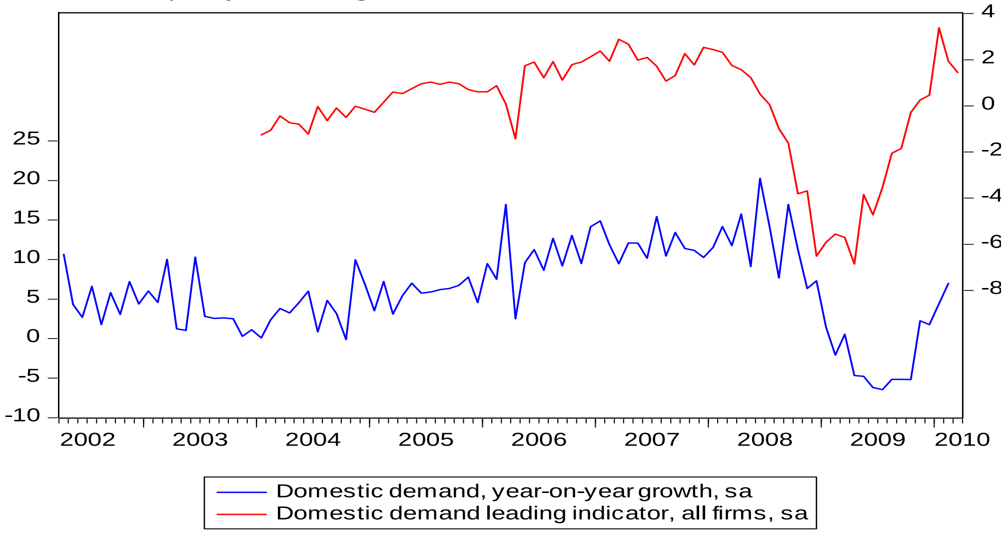
Correlation = 0.83; lead = 4 months

The first component of the selected firm-specific smoothed variables for the growth rate of GDP again performs particularly well during the last recession. All in all, it catches the general economic tendency well, an impression which is supported by a correlation of 0.83. The lead of four months, which holds at most turning points, too, is again quite impressive.

5.2.2. Domestic demand, yearly growth rate

5.2.2.1. All selected variables

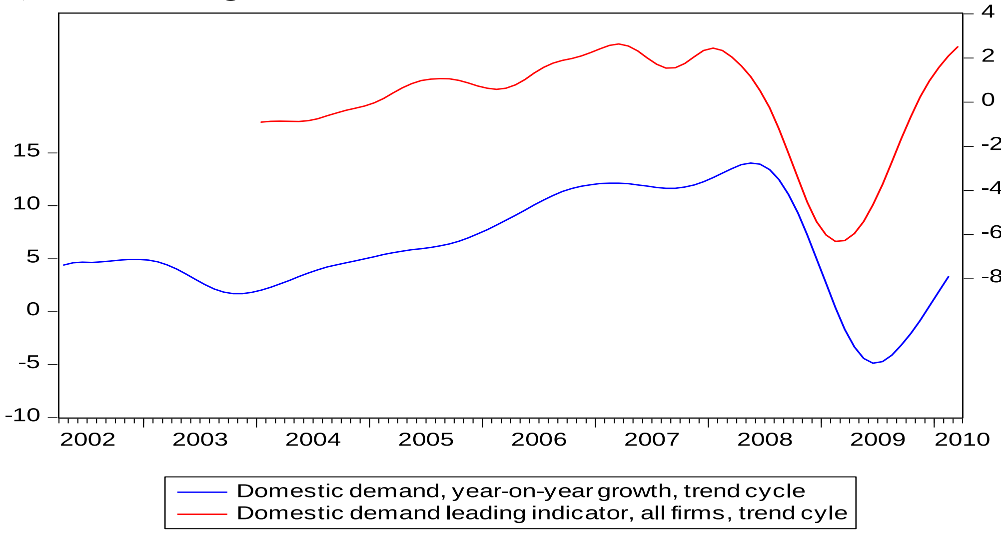
a) Seasonally adjusted, Figure 5



Correlation = 0.84; lead = 4 months

The PC of the selected deseasonalised variables for the growth rate of domestic demand does not start in 2002, but in 2004, because one of the selected time series – actividad_economica – is shorter than the other variables. The first PC performs well as a composite leading indicator. It reflects the general economic tendency, and the correlation of 0.84 is high. But as before, the short term movements – mostly erratic movements – are not be captured. The noisy elements are somewhat smaller than in the reference series. The lead of four months, which is also achieved at the turning points, is quite impressive.

b) Smoothed, Figure 6

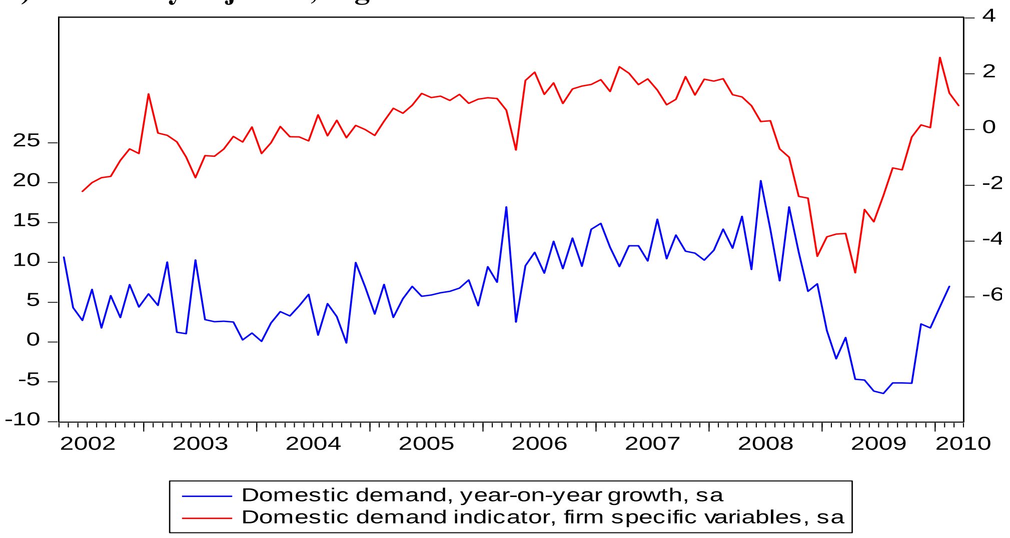


Correlation = 0.93: lead = 4 months

The first component of the smoothed selected variables for the growth rate of domestic demand performs particularly well in the last recession. The correlation of more 0.93 is the highest encountered in our entire analysis, but it has to be kept in mind that the analytical period is two years shorter than for the indicators discussed before. It reflects the general economic tendency well, and the lead of four months is again impressive.

5.2.2.2. Only firm-specific variables

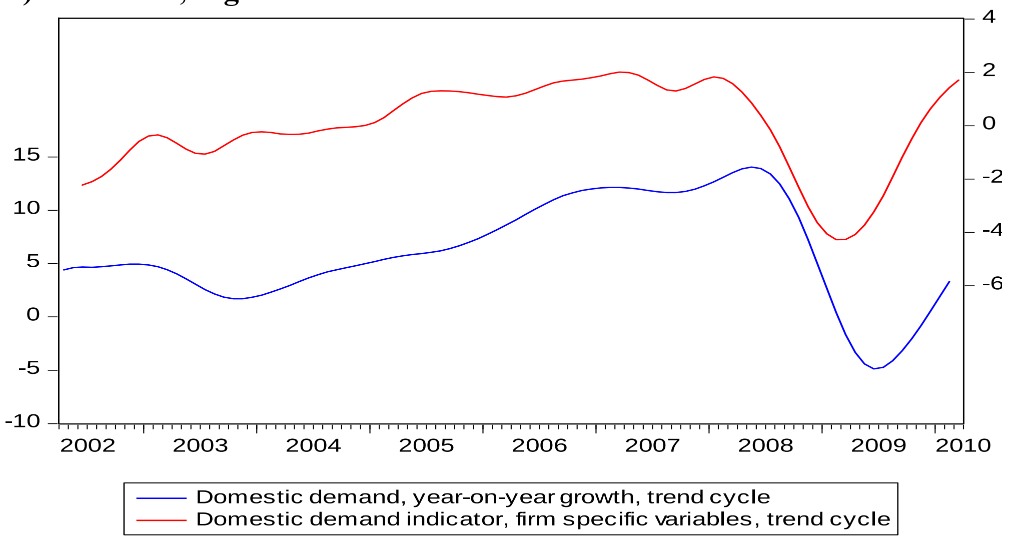
a) Seasonally adjusted, Figure 7



Correlation = 0.87; lead = 4

The first component of the deseasonalised selected firm-specific variables for the growth rate of domestic demand performs well. It catches the general economic tendency, and the correlation of 0.87 is the highest of all coefficients with deseasonalised data. But again, the short term movements – mostly erratic movements – cannot be captured. The noisy elements are somewhat smaller than in the reference series. The lead of four months, which is also achieved at the turning points, is again impressive.

b) Smoothed, Figure 8



Correlation = 0.92; lead = 5

The first component of the selected firm-specific smoothed variables for the growth rate of domestic demand performs well, and again particularly during the last recession. The correlation of 0.91 is very high. The lead of five months is the highest and indeed impressive.

5.3. Conclusions from the PCA

The first principal components of the selected variable sets perform reasonably well as composite leading indicators in *ex post* comparisons with their respective reference series (growth rate of GDP and of domestic demand). They reflect the general trend of the economy and show leads of four to five months, which is as much as one can reasonably hope for. There is a trade-off between the stability at the margin and the signal-to-noise ratio, where low pass filtering of the variables increases the latter. Also, there are choices whether to refer to a smaller bundle of indicators (usually on firm-specific items) or to a larger variable set, where over-fitting is less likely.

6. A leading indicator for the Peruvian economy

The GDP is the core indicator for the economic situation and its development of any country. For a central bank, it is therefore one of the most important variable for the assessment of the economic situation. Taking this into consideration, we decided to select the GDP y-o-y growth[12] rate as reference series for the suggested new – and potentially prominent – leading indicator to be derived from the BTS data collected by the Banco Central de Reserva del Perú.

In particular, the choice falls on the indicator including all five selected variables (low pass filtered before PC extraction). It performs slightly better then that with only firm-specific variables: the correlation of the reference series with the all-variables composite indicator is higher than with the firm-specific-only composite indicator, while they show the same lead of four months. Moreover, by and large, the original non-firm-specific series are smoother and therefore easier to interpret than the firm specific ones and the risk of spurious correlation is smaller.

The final decision relates to the desired smoothness of the composite leading indicator, given the trade-off between end point stability and signal-to-noise ratio. At the right margin, the original data often leave room for interpretation of the underlying business tendency. The smoothed indicator apparently indicates a clear trend, but the signal may be misleading in hindsight, due to filter induced revisions.

As there are pros and cons for smoothing the BTS data and the reference series, we suggest as a pragmatic solution to communicate both only seasonally adjusted and smooth series. The result is

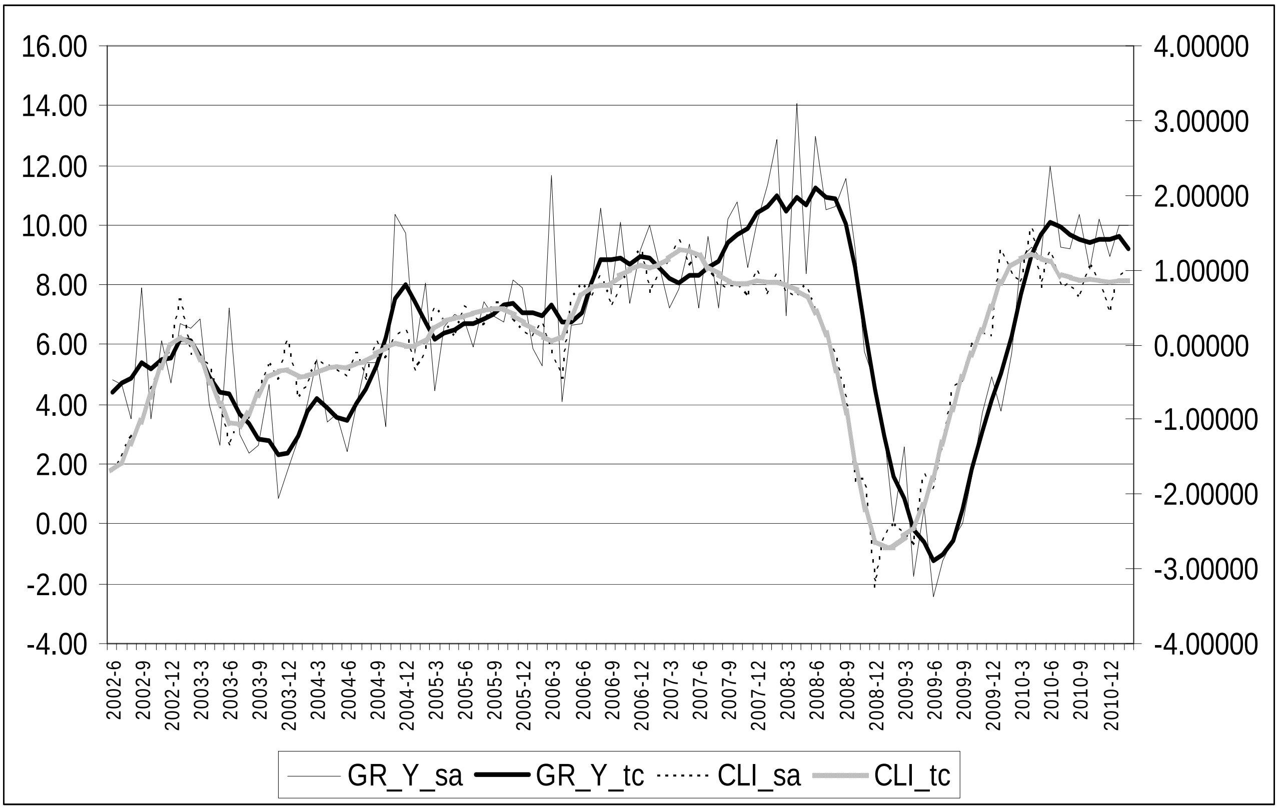
[12] Note that all preparations are made to select a leading indicator for domestic demand, should such a necessity arise.

shown in Figure 9, which reveals a pronounced co-movement and at the same time a substantial lead of the composite leading indicator (CLI) before the reference series (GRY). Moreover, this holds not only on average, but also at turning points. We are pleased with the fact that the deseasonalised data from the BTS is smoother than the analogue data for the GDP.

Apart from this, the visualisation of both reference series and composite leading indicator based on seasonally adjusted as well as smoothed data is transparent as well as easy to interpret. Taken together, the plotted results of our search for a composite leading indicator for the Peruvian economy based on survey data from the BCRP offer a powerful demonstration of the usefulness of qualitative BTS data, provided the information is processed and aggregated accordingly.

Our final remarks relate to the limits of this study. First, we did not perform out-of-sample analyses, as the available BTS time series were too short. As more BTS data points are coming in, careful out-of-sample analyses to control the quality of this proposed indicator are mandatory. Moreover, as additional variables will become available, the indicator selection procedure should be performed again, which may result in an improved composite indicator for the y-o-y growth rate of GDP, or in identification of variable sets that are suitable to be combined into leading or coincident composite indicators for additional reference series of interest to observers of the Peruvian economy.

Reference series and composite leading indicator, figure 9



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Appendix

A1: Composite economic indicators ─ conceptual issues

Assuming that business tendency surveys and official statistics are the only two sources of information on a particular economic process, at any point t in time, an observer can refer to the following set of information:

$$I_t = \{\mathrm{BTS}(t)_t, \mathrm{BTS}(t+w)_t, \mathrm{OS}(t-v)_t\},$$

where $\mathrm{BTS}(t)$ refers to information from business tendency surveys on present conditions, $\mathrm{BTS}(t+w)$ to information from business tendency surveys on conditions with a lead of w, and $\mathrm{OS}(t+v)$ to final official statistics on past conditions with lag v ($v > 0$). The true, but ultimately unknown, manifestation of economic conditions T can be represented by the elements of I as

$$\begin{aligned} T_t &= \mathrm{OS}(t)_{t+z} + \varepsilon_{\mathrm{OS}(t)_{t+z}} \\ &= f\left[\mathrm{BTS}(t)\right]_t + \varepsilon_{\mathrm{BTS}(t)_t} \\ &= g\left[\mathrm{BTS}(t)\right]_{t-w} + \varepsilon_{\mathrm{BTS}(t)_{t-w}}, \end{aligned}$$

where $\varepsilon_{\mathrm{BTS}(t)_t}$ and $\varepsilon_{\mathrm{BTS}(t)_{t-w}}$ are the estimation and forecast errors for T_t from coincident and leading business tendency survey indicators, and $\varepsilon_{\mathrm{OS}(t)_{t+z}}$ denotes the final error in the official data.

Now, if both business tendency surveys and official statistics refer to the same empirical representations, they should be statistically correlated. Given this, since the survey data are available before their corresponding official statistics, to the extent to which the official data are correlated with coincident and/or leading indicators, they can be derived as functions $f\left[\mathrm{BTS}(t)_t\right]$ from coincident survey indicators or $g\left[\mathrm{BTS}(t+w)_{t-w}\right]$ from leading survey indicators, respectively.

A2: Cross correlations

Correlations

Seasonal adjusted BTS data			**Period**	**Corr. Coeff.**	**Lead(-)/Lag** (months)
GDP (var. %)					
All firms	General economic situation	s.a. by Tramo-Seats	2004.01-2010.02	0.7577	4
All firms	Production	last month	2007.01-2010.02	0.8027	-4
Manufacturing	Stocks of finished products	last month	2004.01-2010.02	0.5219	-3
All firms	Situation of the firm	next three months	2002.04-2010.02	0.7184	-5
All firms	Availability of credits	judgement	2007.01-2010.02	0.7835	-1
All firms	Demand	next three months	2007.10-2010.02		
All firms	General economic situation	next three months	2002.04-2010.02	0.7353	-4
All firms	Stocks of finished products	last month	2002.06-2010.02	0.5456	-3
All firms	Production	last month	2007.01-2010.02	0.7699	-4
All firms	Number of employees	next three months	2007.01-2010.02	0.8725	-4
All firms	Orders of purchase	last month	2002.06-2010.02	0.7359	-4
All firms	Price of primary products	next three months	2007.10-2010.02		
All firms	Average sales price	next three months	2007.01-2010.02	-0.6414	-9
All firms	Situation of the sector	next three months	2002.06-2010.02	0.7595	-3
All firms	Financial situation	judgement	2007.01-2010.02	0.8016	-4
All firms	Business situation	judgement	2007.12-2010.02		
All firms	Sales	last month	2002.06-2010.02	0.7032	-4
Manufacturing	Sales	last month	2002.06-2010.02	0.6547	-5
Manufacturing	Stocks of finished products	last month	2002.06-2010.02	0.2921	-3
Manufacturing	Orders of purchase	last month	2002.06-2010.02	0.6839	-4
Manufacturing	Average sales price	next three months	2008.01-2010.02		
Manufacturing	Price of input products	next three months	2008.01-2010.02		
Manufacturing	Demand	next three months	2008.01-2010.02		
Manufacturing	General economic situation	next three months	2008.01-2010.02		
Manufacturing	Situation of the sector	next three months	2008.01-2010.02		
Manufacturing	Business situation	judgement	2008.01-2010.02		
Manufacturing	Number of employees	next three months	2008.01-2010.02		
Commerce	Average sales price	next three months	2007.01-2010.02	0.6732	-2
Commerce	Number of employees	next three months	2007.01-2010.02	0.7905	-4
Commerce	Number of employees	judgement	2007.01-2010.02	0.7939	-2
Commerce	Demand	next three months	2007.01-2010.02	0.8392	-4
Commerce	Business situation	judgement	2007.12-2010.02		
Commerce	Number of employees	last month	2007.01-2010.02	0.779	-6
Commerce	Sales	last month	2002.06-2010.02	0.6495	-5
Commerce	Stocks of products	last month	2002.06-2010.02	-	
Commerce	Orders of purchase	last month	2002.06-2010.02	0.7198	-5
Commerce	General economic situation	next three months	2007.01-2010.02	0.8172	-3
Commerce	Situation of the sector	next three months	2007.01-2010.02	0.8469	-4
Value added of the non-primary sectors (var. %)					
All firms	General economic situation	s.a. by Tramo-Seats	2004.01-2010.02	0.3932	-8
All firms	Production	last month	2007.01-2010.02	-0.5994	7
Manufacturing	Stocks of finished products	last month	2004.01-2010.02	0.3425	-3
All firms	Situation of the firm	next three months	2002.04-2010.02	0.3979	-6
All firms	Availability of credits	judgement	2007.01-2010.02	0.5209	-8
All firms	Demand	next three months	2007.10-2010.02		
All firms	General economic situation	next three months	2002.04-2010.02	0.3605	-6
All firms	Stocks of finished products	last month	2002.06-2010.02	0.342	-4
All firms	Production	last month	2007.01-2010.02	-0.6082	6
All firms	Number of employees	next three months	2007.01-2010.02	0.6117	-8
All firms	Orders of purchase	last month	2002.06-2010.02	0.3299	-6
All firms	Price of primary products	next three months	2007.10-2010.02		
All firms	Average sales price	next three months	2007.01-2010.02	0.343	0
All firms	Situation of the sector	next three months	2002.06-2010.02	0.407	-6
All firms	Financial situation	judgement	2007.01-2010.02	0.5598	-8
All firms	Business situation	judgement	2007.12-2010.02		
All firms	Sales	last month	2002.06-2010.02	0.3558	-8

Manufacturing	Sales	last month	2002.06-2010.02	0.2849	-8
Manufacturing	Stocks of finished products	last month	2002.06-2010.02	0.3677	-3
Manufacturing	Orders of purchase	last month	2002.06-2010.02	0.3321	-6
Manufacturing	Average sales price	next three months	2008.01-2010.02		
Manufacturing	Price of input products	next three months	2008.01-2010.02		
Manufacturing	Demand	next three months	2008.01-2010.02		
Manufacturing	General economic situation	next three months	2008.01-2010.02		
Manufacturing	Situation of the sector	next three months	2008.01-2010.02		
Manufacturing	Business situation	judgement	2008.01-2010.02		
Manufacturing	Number of employees	next three months	2008.01-2010.02		
Commerce	Average sales price	next three months	2007.01-2010.02	0.5899	-8
Commerce	Number of employees	next three months	2007.01-2010.02	0.6179	-9
Commerce	Number of employees	judgement	2007.01-2010.02	0.5899	-8
Commerce	Demand	next three months	2007.01-2010.02	0.5517	-7
Commerce	Business situation	judgement	2007.12-2010.02		
Commerce	Number of employees	last month	2007.01-2010.02	0.5758	-8
Commerce	Sales	last month	2002.06-2010.02	-	
Commerce	Stocks of products	last month	2002.06-2010.02	0.5578	-4
Commerce	Orders of purchase	last month	2002.06-2010.02	-	
Commerce	General economic situation	next three months	2002.04-2010.02	-0.5789	7
Commerce	Situation of the sector	next three months	2005.07-2010.02	0.5895	-8
Domestic demand (var. %)					
All firms	General economic situation	s.a. by Tramo-Seats	2004.01-2010.02	0.7986	-4
All firms	Production	last month	2007.01-2010.02	0.7927	-6
Manufacturing	Stocks of finished products	last month	2004.01-2010.02	0.566	-1
All firms	Situation of the firm	next three months	2002.04-2010.02	0.7506	-5
All firms	Availability of credits	judgement	2007.01-2010.02	0.804	-2
All firms	Demand	next three months	2007.10-2010.02		
All firms	General economic situation	next three months	2002.04-2010.02	0.7498	-4
All firms	Stocks of finished products	last month	2002.06-2010.02	0.5439	-1
All firms	Production	last month	2007.01-2010.02	0.7716	-5
All firms	Number of employees	next three months	2002.06-2010.02	0.7656	-4
All firms	Orders of purchase	last month	2007.01-2010.02	0.8858	-3
All firms	Price of primary products	next three months	2007.10-2010.02		
All firms	Average sales price	next three months	2007.01-2010.02	-0.5545	-9
All firms	Situation of the sector	next three months	2002.06-2010.02	0.7825	-4
All firms	Financial situation	judgement	2007.01-2010.02	0.8151	-3
All firms	Business situation	judgement	2007.12-2010.02		
All firms	Sales	last month	2002.06-2010.02	0.7121	-5
Manufacturing	Sales	last month	2002.06-2010.02	0.6723	-5
Manufacturing	Stocks of finished products	last month	2002.06-2010.02	0.8383	-2
Manufacturing	Orders of purchase	last month	2002.06-2010.02	0.7124	-4
Manufacturing	Average sales price	next three months	2008.01-2010.02		
Manufacturing	Price of input products	next three months	2008.01-2010.02		
Manufacturing	Demand	next three months	2008.01-2010.02		
Manufacturing	General economic situation	next three months	2008.01-2010.02		
Manufacturing	Situation of the sector	next three months	2008.01-2010.02		
Manufacturing	Business situation	judgement	2008.01-2010.02		
Manufacturing	Number of employees	next three months	2008.01-2010.02		
Commerce	Average sales price	next three months	2007.01-2010.02	0.6803	-3
Commerce	Number of employees	next three months	2007.01-2010.02	0.7967	-4
Commerce	Demand	next three months	2007.01-2010.02	0.8588	-4
Commerce	Business situation	judgement	2007.12-2010.02		
Commerce	Sales	last month	2002.06-2010.02	0.6773	-5
Commerce	Stocks of products	last month	2002.06-2010.02	-	
Commerce	Orders of purchase	last month	2002.06-2010.02	0.718	-4
Commerce	General economic situation	next three months	2007.01-2010.02	0.8364	-4
Commerce	Situation of the sector	next three months	2007.01-2010.02	0.8635	-4

Manufacturing production (var. %)					
All firms	General economic situation	s.a. by Tramo-Seats	2004.01-2010.02	0.7726	-4
All firms	Production	last month	2007.01-2010.02	0.8045	-3
All firms	Sales	last month	2002.06-2010.02	0.7484	-4
All firms	Situation of the firm	next three months	2002.04-2010.02	0.8264	-4
Manufacturing	Sales	last month	2002.06-2010.02	0.6563	-4
Manufacturing	Stocks of finished products	last month	2002.06-2010.02	0.3308	-3
Manufacturing	Stocks of finished products	last month	2002.06-2010.02	0.6574	-4
Manufacturing	Orders of purchase	last month	2008.01-2010.02		
Manufacturing	Price of input products	next three months	2008.01-2010.02		
Manufacturing	Demand	next three months	2008.01-2010.02		
Manufacturing	General economic situation	next three months	2008.01-2010.02		
Manufacturing	Situation of the sector	next three months	2008.01-2010.02		
Manufacturing	Business situation	judgement	2008.01-2010.02		
Manufacturing	Number of employees	next three months	2008.01-2010.02		
Non-primary manufacturing production (var. %)					
All firms	General economic situation	s.a. by Tramo-Seats	2004.01-2010.02	0.7911	-3
All firms	Production	last month	2007.01-2010.02	0.8068	-3
All firms	Sales	last month	2002.06-2010.02	0.7016	-4
All firms	Situation of the firm	next three months	2002.04-2010.02	0.8463	-4
Manufacturing	Sales	last month	2002.06-2010.02	0.6683	-4
Manufacturing	Stocks of finished products	last month	2002.06-2010.02	0.3525	-1
Manufacturing	Stocks of finished products	last month	2002.06-2010.02	0.7028	-4
Manufacturing	Orders of purchase	last month	2008.01-2010.02		
Manufacturing	Price of input products	next three months	2008.01-2010.02		
Manufacturing	Demand	next three months	2008.01-2010.02		
Manufacturing	General economic situation	next three months	2008.01-2010.02		
Manufacturing	Situation of the sector	next three months	2008.01-2010.02		
Manufacturing	Business situation	judgement	2008.01-2010.02		
Manufacturing	Number of employees	next three months	2008.01-2010.02		
Commerce (var. %)					
Manufacturing	Business situation	judgement	2007.01-2010.02	0.6997	-2
Manufacturing	Number of employees	next three months	2007.01-2010.02	0.7584	-4
Commerce	Average sales price	next three months	2007.01-2010.02	0.7584	-4
Commerce	Number of employees	next three months	2007.01-2010.02	0.7903	-6
Commerce	Number of employees	judgement	2007.12-2010.02	0.7074	-6
Commerce	Sales	last month	2002.06-2010.02	0.5756	-5
Commerce	Stocks of products	last month	2002.06-2010.02	0.3869	-2
Commerce	Orders of purchase	last month	2002.06-2010.02	0.6511	-5
Commerce	General economic situation	next three months	2002.04-2010.02	0.5486	-4
Commerce	Situation of the sector	next three months	2005.07-2010.02	0.7506	-4

(pink) too short

A3: Variables selected as leading indicators

All firms	General economic situation	s.a. by Tramo-Seats
All firms	Situation of the firm	next three months
All firms	General economic situation	next three months
All firms	Orders of purchase	last month
All firms	Situation of the sector	next three months
All firms	Sales	last month
Manufacturing	Stocks of finished products	last month
Manufacturing	Orders of purchase	last month
Commerce	Orders of purchase	last month

Turning Point Analysis

in months

	Turning Point (- equals lead)							Average			Uncorrect Turning Points			Quality
	down	up	down	up	down	up	down	**all**	Av. Up	Av. Down	Total	additional	missing	**Index**
Reference series														
PBI (var. %)	**02.09**	**03.01**	**03.11**	**05.04**	**06.03**	**08.04**	**09.07**							
Empresa_dentro_3_meses	0	1	3	5	0	-3	-5	**0.1**	1.0	-0.5	2	2		**0.71**
all_Economía dentro de tres meses	-1	0	-3	0	-2	-3	-5	**-2.0**	-1.0	-2.8	2	2		**0.71**
all_ordenes de compra		1	-4			-3	-4	**-1.7**	-1.0	-4.0	3		3	**0.57**
all_Sector dentro de tres meses		0	0	5	-1	-2	-5	**-0.5**	1.0	-2.0	1		1	**0.86**
all_ventas		1	-3	3	2	-3	-5	**-0.8**	0.3	-2.0	1		1	**0.86**
com_Nivel de órdenes de compra, mes anterior		3	-4	-9	-10	-10	-2	**-5.3**	-5.3	-5.3	3	2	1	**0.57**
Reference series														
Demanda interna (var. %)		**02.12**	**03.10**	**07.02**	**07.09**	**08.05**	**09.06**							
actividad economica,sa, Tramo-Seats				-5	-1	-4	-3	**-3.3**	-4.5	-2.0	2	2		**0.50**
Empresa_dentro_3_meses		2	-1	1	-1	-4	-4	**-1.2**	-0.3	-2.0	2	2		**0.67**
all_Economía dentro de tres meses		1	-2	0	-1	-4	-4	**-1.7**	-1.0	-2.3	2	2		**0.67**
all_ordenes de compra		1	-3	1	-1	-4	-3	**-2.3**	-1.0	-3.5	2	2		**0.67**
all_Sector dentro de tres meses		1	1	1	-1	-4	-4	**-1.5**	-1.0	-2.0	2	2		**0.67**
all_ventas		2	-4	-4	0	-4	-4	**-3.5**	-3.0	-4.0	2	2		**0.67**
man_inventarios de bienes finales						1	-2	**-0.5**	1.0	-2.0	4	2	2	**0.00**
man_ordenes de compra		2	-4	1	-1	-4	-4	**-2.5**	-0.5	-4.5	6	6		**0.00**
com_Nivel de órdenes de compra, mes anterior		3	-3	4	3	-2	-1	**1.0**	2.5	-0.5	4	4		**0.33**