

A NEW COINCIDENT INDICATOR FOR THE PORTUGUESE ECONOMY*

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1. INTRODUCTION

Within the macroeconomic policy framework, it becomes crucial to track down ongoing economic developments. However, the assessment of the economic situation can be challenging when the policymaker is confronted with data providing mixed signals about the current state of the economy. Although primary focus can be given to Gross Domestic Product (GDP), since it is the most comprehensive measure of economic activity as a whole, GDP *per se* presents several drawbacks. In particular, GDP is affected by measurement errors, it is available only on a quarterly basis and the first estimate, which is typically subject to revisions, is released with a lag of around 70 days in the Portuguese case. Therefore, one has to resort to other available data in order to have a clear and timely economic picture on a higher frequency basis. The need to summarise the information contained in the data leads to the construction of composite indicators. The main aim of this article is to obtain a comprehensive measure of economic activity that reflects the underlying trend of economic developments in Portugal. There is a considerable amount of literature on how to synthesize data, which includes, for example, the well-known Stock and Watson (1989) approach as well as the latest Stock and Watson (1998) and Forni, Hallin, Lippi and Reichlin (2000) methods. More recently, Azevedo, Koopman and Rua (2003) proposed a new approach for the construction of a composite indica-

tor by merging several recent innovations regarding unobserved components time series models.

This article aims to present a new coincident indicator for the Portuguese economic activity using the methodology developed by Azevedo, Koopman and Rua (2003). The resulting indicator is compared with the one proposed by Dias (1993), which is currently published by Banco de Portugal. Moreover, the suggested composite indicator is evaluated in a real-time environment.

The article is organised as follows. In section 2, a brief overview of the model behind the construction of the composite indicator is given. The data used as input is discussed in section 3 and the resulting coincident indicator for economic activity is presented in section 4. In section 5, a real-time evaluation of the proposed composite indicator is performed. Finally, section 6 concludes.

2. THE MODEL

This section briefly presents the intuition of the model underlying the pursued composite indicator (see Azevedo, Koopman and Rua (2003) for a more technical and detailed discussion). The first building block of the model rests on the standard assumption that each series i , possibly after log transformation, can be modelled as the sum of a trend (μ_{it}), cycle (ψ_{it}) and irregular (ε_{it}) components, *i.e.*,

$$y_{it} = \mu_{it} + \psi_{it} + \varepsilon_{it}, \quad i = 1, \dots, N \text{ and } t = 1, \dots, T.$$

In particular, the trend-cycle modelling adopted is the one suggested by Harvey and Trimbur (2003) which allows to obtain a smooth cycle likewise a

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band-pass filter. In the spirit of Burns and Mitchell (1946), if one believes that the business cycle consists of expansions and recessions occurring in several economic activities then one can assume a common cyclical component to all series. Thus, the model becomes

$$y_{it} = \mu_{it} + \delta_i \psi_t + \varepsilon_{it}, \quad i = 1, \dots, N \text{ and } t = 1, \dots, T$$

where the coefficient δ_i measures the contribution of the common cycle ψ_t for each series. However, as it stands it only allows for the simultaneous modelling of coincident variables. One can generalise the model in order to take into account that some variables may be leading while others may be lagging. This can be done by shifting the common cycle for each series according to their lead/lag. Allowing for shifts, the model can now be written as

$$y_{it} = \mu_{it} + \delta_i \psi_{t+\xi_i} + \varepsilon_{it}, \quad i = 1, \dots, N \text{ and } t = 1, \dots, T$$

where ξ_i is the shift for series i . However, each series cycle can only be shifted with respect to another cycle. Therefore, one of the series has to be subject to parameter constraints, namely $\delta_j = 1$ and $\xi_j = 0$, with the model for that particular series given by

$$y_{jt} = \mu_{jt} + \psi_t + \varepsilon_{jt}, \quad t = 1, \dots, T.$$

Thus, the shifts and loads of the other series are all relative to the cycle of series j . *I.e.*, the cycle is common to all series but scaled differently and shifted ξ_i time periods with series j being the reference series for the identification of the cycle. The model can be put in the state-space form and estimated by maximum likelihood. The resulting common cyclical component is the business cycle indicator. The growth indicator can be obtained by trend restoring the common cyclical component and then computing the corresponding growth rate.

3. DATA

As a preliminary step, one has to choose the variables to be included in the coincident indicator. As argued by Stock and Watson (1999), "[...] fluctuations in aggregate output are at the core of the business cycle so the cyclical component of

real GDP is a useful proxy for the overall business cycle [...]". If this is the case, one should not disregard real GDP in the construction of the composite indicator for economic activity⁽¹⁾. In particular, it seems natural to use real GDP for the reference cycle. As mentioned earlier, this can be done by imposing a unit common cycle loading and a zero phase shift for real GDP.

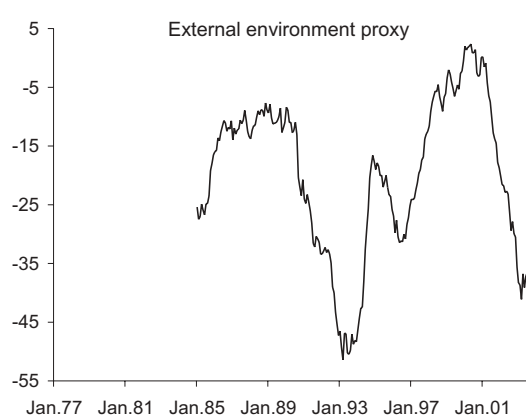
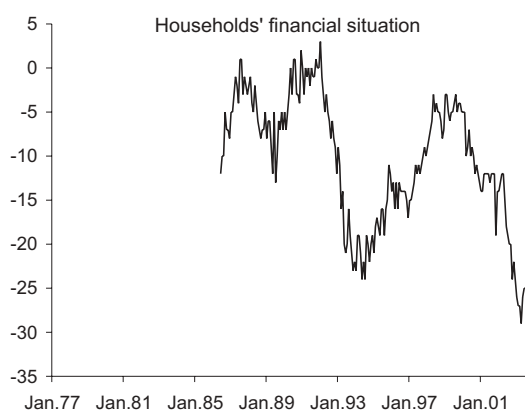
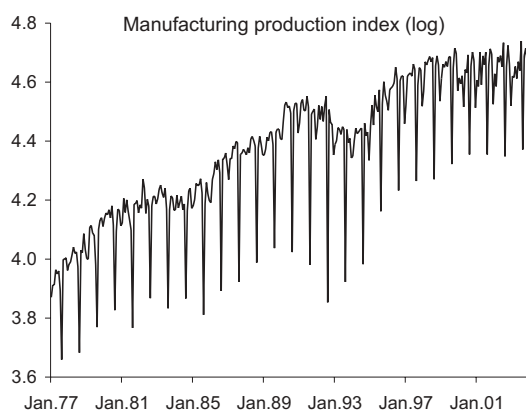
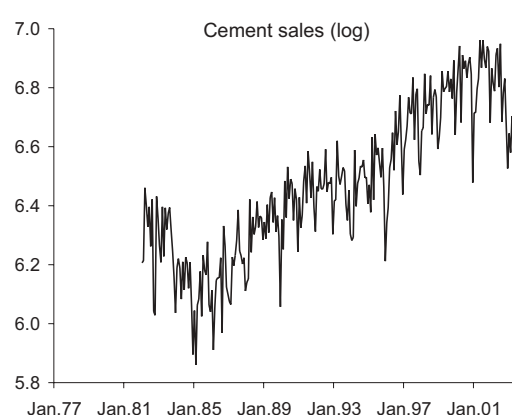
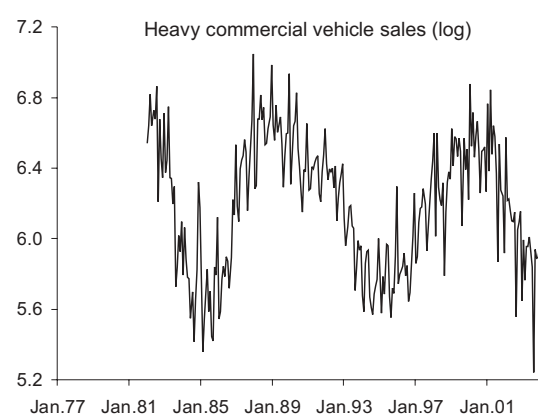
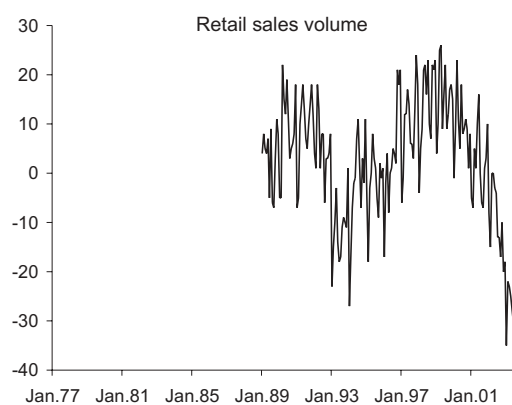
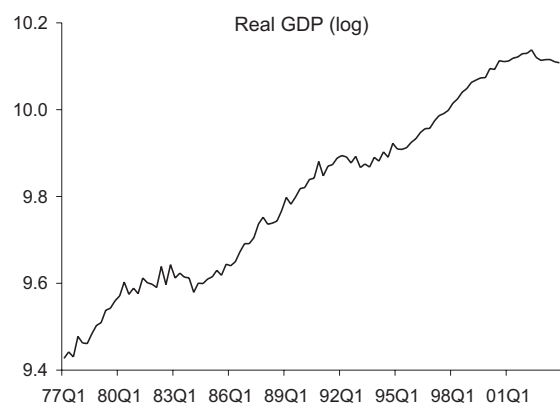
The remaining set of potential series to be included in the composite indicator was constrained to those variables available on a high frequency basis and promptly released and that have a minimal time span for business cycle analysis. The set of series that fulfilled those requirements were then subject to a preliminary analysis in order to assess which series are more informative about the business cycle⁽²⁾. Relying also on economic reasoning and bearing in mind the aim of obtaining a broadly based measure of economic activity one ended up with 8 series. Besides real GDP, the other series are⁽³⁾: retail sales volume (retail trade survey), sales of heavy commercial vehicles, cement sales, manufacturing production index, households' financial situation (consumer survey), new job vacancies and an external environment proxy. Note that 3 of the 8 series are of qualitative nature. The rationale of the chosen series can be put forward as follows. The retail sales volume variable intends to reflect mainly consumption developments while sales of heavy commercial vehicles is linked to investment. Cement sales are also related to investment but in particular, in the construction sector. On the other hand, the manufacturing production index captures the industrial sector behaviour. In order to take into account income and wealth developments, the households' assessment of their current financial situation was included. Concerning the situation in the labour market, the variable considered was new job vacancies. Finally, to reflect external environment, it was included a

(1) For example, Stock and Watson (1989) discarded GDP presumably because it was available only on a quarterly basis. Recently, Mariano and Murasawa (2003) extended Stock and Watson (1989) coincident indicator by including quarterly GDP along with the monthly series.

(2) From a starting set of almost a thousand variables, one only considered slightly more than three hundred series due to time span availability. Then, resorting to a band-pass filter, each series cycle was compared with GDP cycle in terms of comovement through the cross-correlogram.

(3) See Annex for a detailed description of data.

Chart 1
THE INPUT SERIES



weighted average of the current economic situation assessment (consumer survey) of the Portuguese main trade partners, where the weights correspond to the share of each partner country in Portuguese exports. The input series are plotted in Chart 1. Note that real GDP is available only on a quarterly basis whereas all the other series are monthly. Moreover, the series have different sample periods. However, as it is well-known, one can deal with the missing observations problem straightforwardly in the state-space framework (see, for example, Harvey (1989)).

4. THE COINCIDENT INDICATOR

Once chosen the series, the model was estimated by maximum likelihood. Some selected estimation results are now discussed. The estimated common cyclical component is plotted in Chart 2. Note that it is available on a monthly frequency and can be interpreted as a latent monthly measure of GDP cyclical component within a multivariate framework. Additionally, it seems to be in line with common wisdom regarding Portuguese business cycle developments. The corresponding estimated shifts are reported in Table 1. Obviously, real GDP does not present a phase shift as it was used for the reference cycle. Only cement sales present a lag, although negligible. Regarding the other series, notice that both manufacturing production and new job vacancies lead the cycle by around six months while the external environment proxy presents a lead of almost a year. The leading nature of new job vacancies is in line with what

Table 1

PHASE SHIFTS

In months	Phase shifts
Real GDP	0.0
Retail sales volume	4.7
Heavy commercial vehicle sales	1.1
Cement sales	-1.6
Manufacturing production index	6.1
Households' financial situation	2.8
New job vacancies	6.0
External environment proxy	11.4

Note: A positive figure denotes a lead whereas a negative one denotes a lag.

was found elsewhere in the literature and the lead of the other two variables reflect the fact that Portugal is a small open economy. Another interesting estimation result refers to the duration of the cycle. A duration of almost 122 months (around 10 years) was estimated for the Portuguese business cycle.

As mentioned earlier, a growth indicator can be obtained by trend restoring the common cyclical component and then computing the growth rate. In particular, using the estimated GDP trend and calculating the year-on-year growth rate, results in the growth indicator presented in Chart 3⁽⁴⁾. Note that the use of GDP for the reference cycle in a first step and the corresponding trend in a second one is intended to allow one to obtain a coincident indicator with a meaningful scale⁽⁵⁾. One can see that the coincident indicator for economic activity

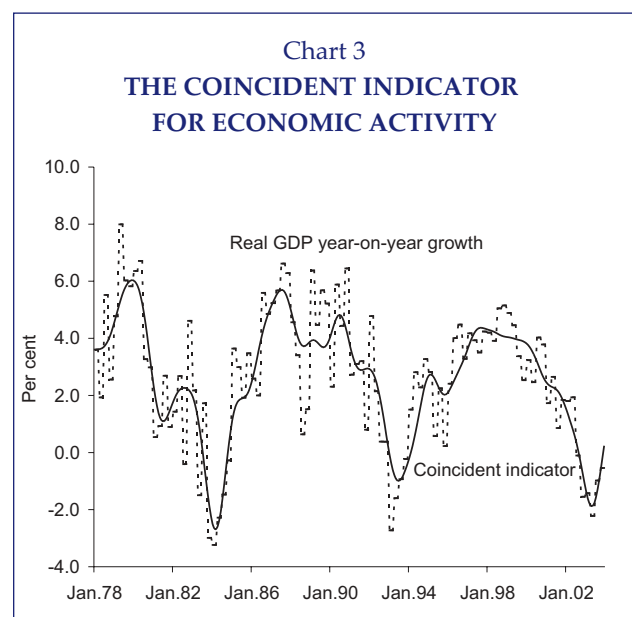
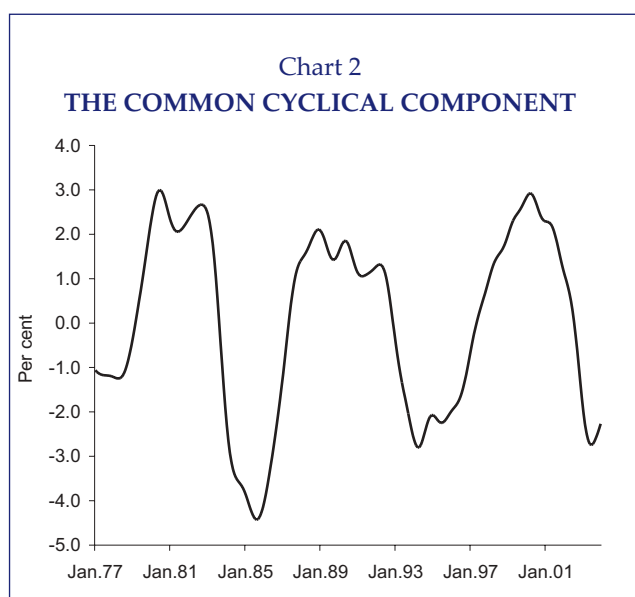
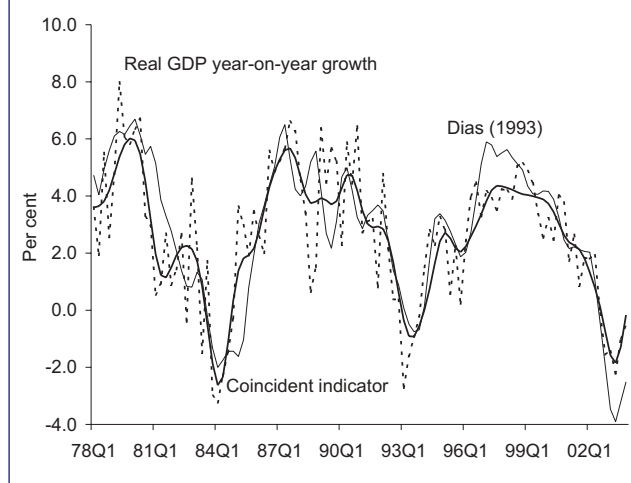


Chart 4
THE COINCIDENT INDICATOR
AND THE ONE PROPOSED BY DIAS (1993)



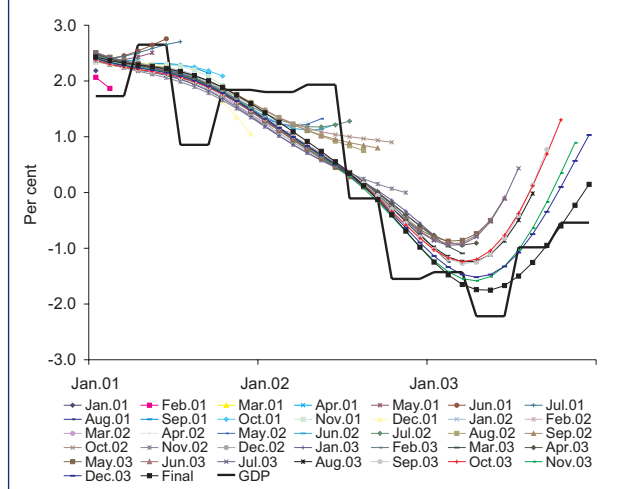
seems to capture quite well the underlying trend of economic developments. It should be stressed, however, that the coincident indicator is not aimed to pinpoint GDP growth. In contrast with GDP, the coincident indicator is available on a monthly basis and it provides a more clear picture regarding the current state of the economy since it avoids the erratic behaviour of GDP growth.

In Chart 4, the coincident indicator is plotted against the one proposed by Dias (1993). The coincident indicator developed by Dias (1993), which is currently released by Banco de Portugal, is based on Stock and Watson (1989) approach. It uses only 4 series, namely: retail sales volume (retail trade survey), wholesale trade volume (wholesale trade survey), manufacturing production (manufacturing survey) and cement sales. Note that 2 of the 4 series are also included in the coincident indicator proposed in this article and that 3 of the 4 series are of a qualitative nature, which over-emphasizes somehow this kind of data. Thus, the suggested coincident indicator seems to cover more aspects of the economy while diversifying further the nature of the data used as input. Although both indicators present, in general, a simi-

(4) In this figure, as in others bellow, due to the monthly nature of the time axis, the same value is given within the quarter for real GDP year-on-year growth.

(5) In Dias (1993) coincident indicator, the rescaling is done through a linear transformation using GDP year-on-year growth rate series.

Chart 5
MONTHLY ESTIMATES
OF THE COINCIDENT INDICATOR



lar pattern over time, the proposed coincident indicator appears to track more closely the underlying trend of overall economic activity. In particular, the coincident indicator developed by Dias (1993) has overstressed considerably the last recession. Moreover, the suggested coincident indicator is available on a monthly basis whereas the former is quarterly.

5. A REAL-TIME EVALUATION

In practice, the coincident indicator is subject to revisions over time due to data revisions and to its re-computation when additional data becomes available. In order to assess the real-time reliability of the coincident indicator the following out-of-sample exercise was performed. First, the model was estimated using the available data up to December 2000⁽⁶⁾. One should note that the estimated values for the parameters of interest are very close to the ones obtained with the whole sample, which provides some evidence of model stability over time. Then, taking into account also data release schedule, the coincident indicator was computed every month until the end of 2003⁽⁷⁾. This mimics a true real-time setting over the last 3 years. The dif-

(6) Since only real GDP and manufacturing production index are subject to revisions, only for these variables were real-time estimates considered.

(7) At each month, the estimate is obtained using the data released up to the end of the following month.

Chart 6A
QUARTERLY ESTIMATES
OF THE COINCIDENT INDICATOR

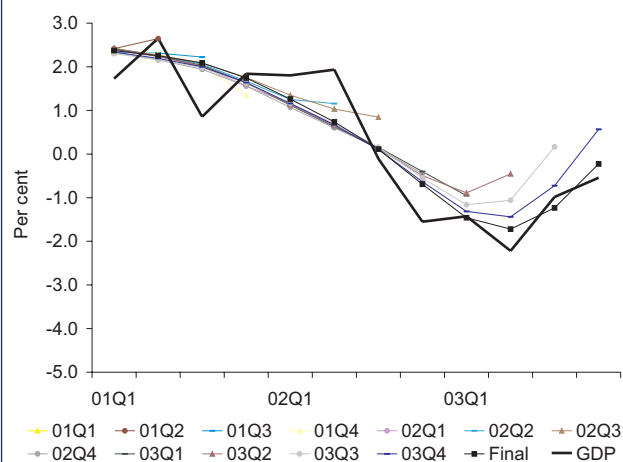
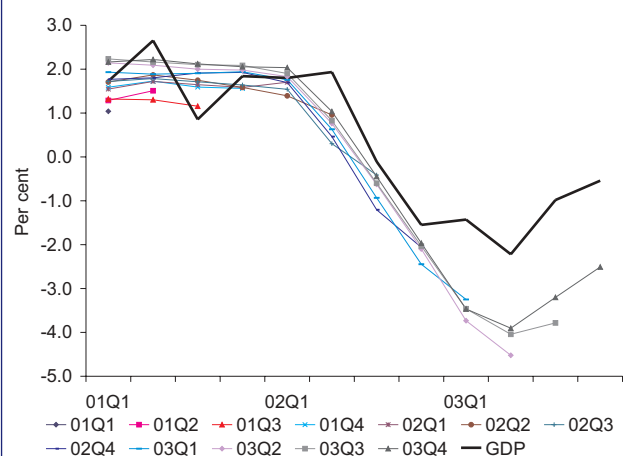


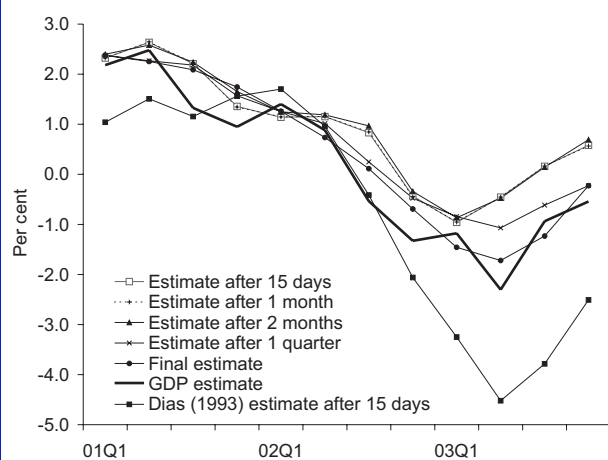
Chart 6B
ESTIMATES OF DIAS (1993)
COINCIDENT INDICATOR



ferent estimates of the monthly coincident indicator at each month are plotted in Chart 5⁽⁸⁾. One should stress that this period is a particularly demanding one for a real-time assessment since it includes an economic activity turning point. As expected, the revisions are slightly more pronounced around the turning point. Nevertheless, these revisions affect mainly the level of the coincident indicator not changing meaningfully the qualitative assessment of economic activity in terms of acceleration/deceleration trend.

(8) In this figure, as in others below, the final estimate refers to the estimate obtained with the whole sample data.

Chart 7
FIRST ESTIMATES OF THE COINCIDENT
INDICATOR, GDP AND DIAS (1993)
COINCIDENT INDICATOR



In order to assess the magnitude of the revisions of the suggested coincident indicator against the revisions of the one developed by Dias (1993), which is available only on a quarterly frequency, the quarterly estimates of the coincident indicator are also plotted in Chart 6. One can see that, on average, the revisions are roughly of similar size.

However, since economic agents tend to focus more on the most recent available estimate for the state of the economy, one should also assess how well first estimates reflect the underlying trend of economic activity. Obviously, the reliability of an estimate depends on the amount of data used to obtain it. Therefore, the first estimate will always be the least reliable and the sooner one wants to obtain it the fewer data is available for its computation. The ability to deal straightforwardly with the missing observations problem in the state-space framework, allows one to compute the coincident indicator even in the presence of unreleased data⁽⁹⁾. Thus, one considered the estimates that could be obtained 15 days⁽¹⁰⁾, one month, two months and one quarter after the reference period. These estimates are plotted in Chart 7 along with the first estimates of real GDP and Dias (1993) co-

(9) In practice, the missing data is extrapolated with the estimated model.

(10) Besides GDP, which is released with a lag of 70 days, this estimate is also obtained without the manufacturing production index, which is released only at the end of the following month.

incident indicator. Although subject to revisions, in particular nearby the turning point, one can see that even the estimate obtained 15 days after the reference period seems to be quite informative about the overall trend of economic developments. Once again, it becomes clear that it is the level that is more affected by revisions not the signal.

6. CONCLUSIONS

In this article, a new coincident indicator for the Portuguese economy was developed using the methodology proposed by Azevedo, Koopman and Rua (2003). The resulting indicator uses as input eight series reflecting both the demand and supply side of the economy, income and wealth developments, the situation in the labour market and external environment. Therefore, the composite indicator turns out to be a very comprehensive measure of the economy. Note that, despite all the noise of the input series, it was possible to obtain a smooth coincident indicator that tracks quite well the underlying trend of economic activity. This feature allows the policymaker to have a clear picture regarding current economic developments. Its usefulness as a tool for short-term analysis is reinforced by the fact of being available on a monthly basis, in contrast with the one proposed by Dias (1993) which is currently published by Banco de Portugal. Moreover, timely estimates can be obtained and it was shown that these estimates, though subject to revisions, seem to be quite informative about the current state of the economy. Thus, the suggested coincident indicator allows for an up to date assessment of economic activity on a high frequency basis.

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ANNEX

Quarterly real GDP (seasonally adjusted) is provided by INE (National Statistics Office), in accordance with the European System of Accounts (ESA) 1995, since 1995. From 1995 backwards the series was growth chained using ESA 1979 quarterly figures. The retail sales volume variable stems from the monthly business survey released by INE. The figures refer to the balance of respondents regarding current volume sales in retail trade and are not seasonally adjusted. The series only start in June 1994. However, using the series previously published by INE, which was based on a different survey sample, it was possible to obtain a series beginning in January 1989. The values prior to June 1994 were adjusted by a constant value, which resulted from the average difference between both series for the common period. The number of new heavy commercial vehicles (above 3.5 ton.) sold is released by ACAP and it is not seasonally adjusted. The volume of cement sold includes the sales of national firms (CIMPOR and SECIL) to the domestic market as well as cement imports and it is not seasonally adjusted. The

manufacturing production index (working days adjusted) is released by INE but due to several basis changes, the most recent series was growth chained with the previous ones. Regarding households' financial situation, it comes from the monthly consumers survey released by the European Commission. It refers to the balance of respondents regarding households' assessment of their current financial situation against 12 months ago and it is seasonally adjusted. New job vacancies are published by IEFP and are not seasonally adjusted. The external environment proxy is calculated as a weighted average of the current general economic situation assessment taken from the consumers survey released by the European Commission in the case of the European Union countries (EU-15) and reported by the Conference Board in the case of the United States (seasonally adjusted). The weights are the share of each country in Portuguese goods exports in the previous year. It was possible to cover almost 90 per cent of the total exports market.