

Forecasting ECB's interest rate decisions: A background note

A good measure of the business cycle is essential to predict the ECB's interest rate decisions. Survey measures are more suitable for this purpose than estimates of the output gap since they are published more rapidly. The PMI seems particularly useful since it leads the Eurostat's Economic Sentiment Index and is significant in estimated reaction functions for the ECB.

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Short-term interest rates set by central banks have a large impact on the pricing of financial assets and on the broader economy, which in turn affect prices of shares and corporate debt securities. Understanding what factors central banks respond to in setting monetary policy is therefore an important task for financial market participants.

What does the ECB respond to?

While central banks react to a myriad of factors and staff assess literally hundreds of time series of data in preparing the background material for policy meetings, empirically it looks like only a few data series are needed to understand a central bank's policy decisions. In particular, empirical research suggests that the ECB increases interest rates in response to:

1. Business cycle upswings, which raise future price pressures. Mitigating the business cycle may also be an independent objective of policy.
2. Faster money growth, which is seen by the ECB as an indicator that inflation pressures are rising.
3. Exchange rate depreciations, which raise inflation directly through import prices and indirectly by affecting competitiveness of the euro area and the demand for euro area goods.
4. Current inflation, which raises the likelihood that future inflation also will be high.

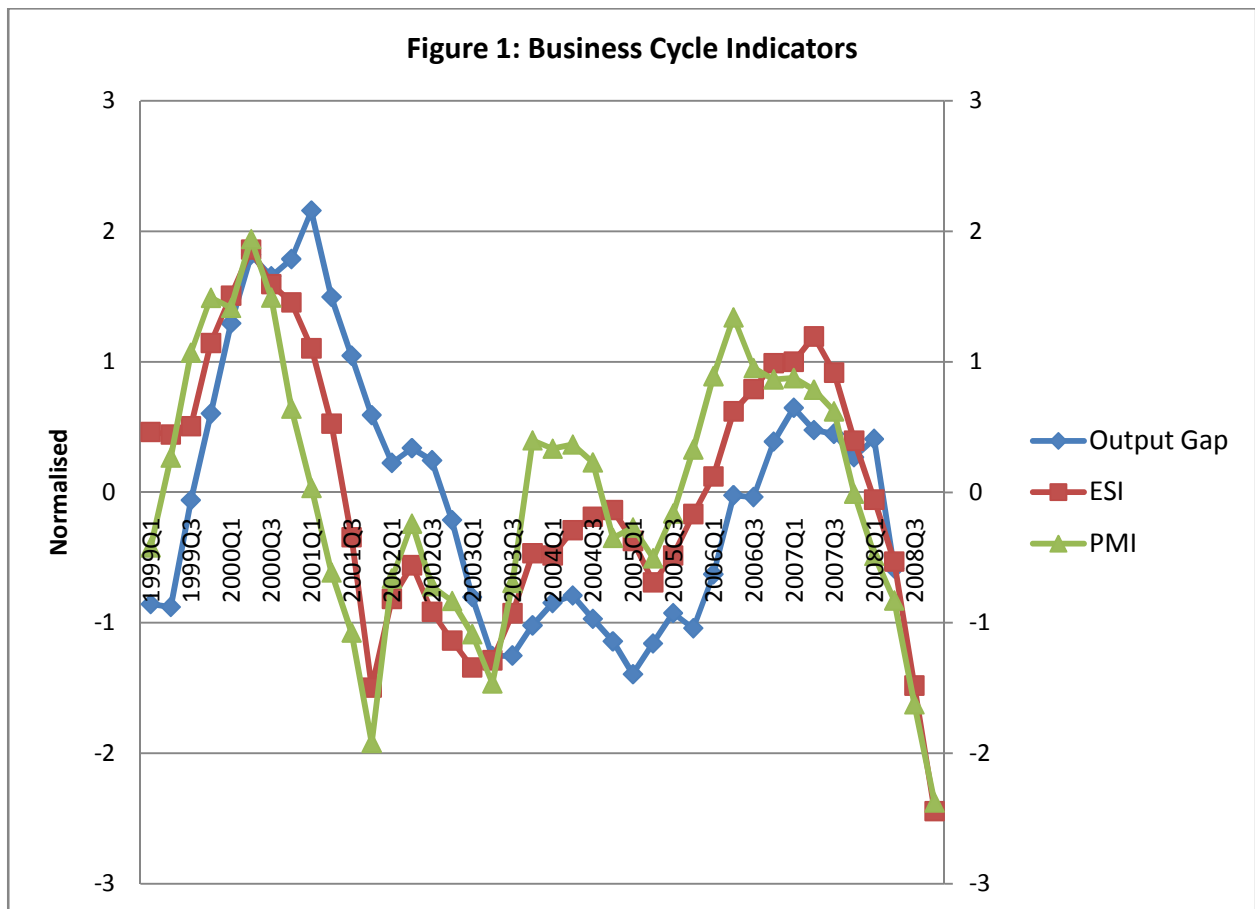
Assessing money growth, exchange rates and inflation is relatively straightforward since the relevant data is available from the ECB's website with little delay (except the monetary data which is about two months old). In contrast, assessing the state of the business cycle is much harder, since GDP data are published with a lag of several quarters and since they are typically revised several times, occasionally by large amounts.

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Survey data

To understand why survey data may be helpful for understanding business conditions, note that when economic conditions change, this is immediately noticed by households and firms: a friend or relative may suddenly be laid off or perhaps find a job surprisingly quickly, or the firm's sales are unexpectedly strong or weak. If one samples a very large number of households from different regions and/or firms in different sectors, it seems likely that their aggregate view will be strongly influenced by the current state of the economy.

This is clear from Figure 1 which uses quarterly euro area data and which shows the output gap – the difference between real GDP and a smooth trend – together with two survey measures of real economic activity in the euro area: the Purchasing Managers Index constructed by Markit (www.markit.com) and the Economic Sentiment Index published on a monthly basis by Eurostat.² To compare the series, the mean has been subtracted so that the series have a zero mean and they have been divided by their standard deviation so that they all have the same amplitude.



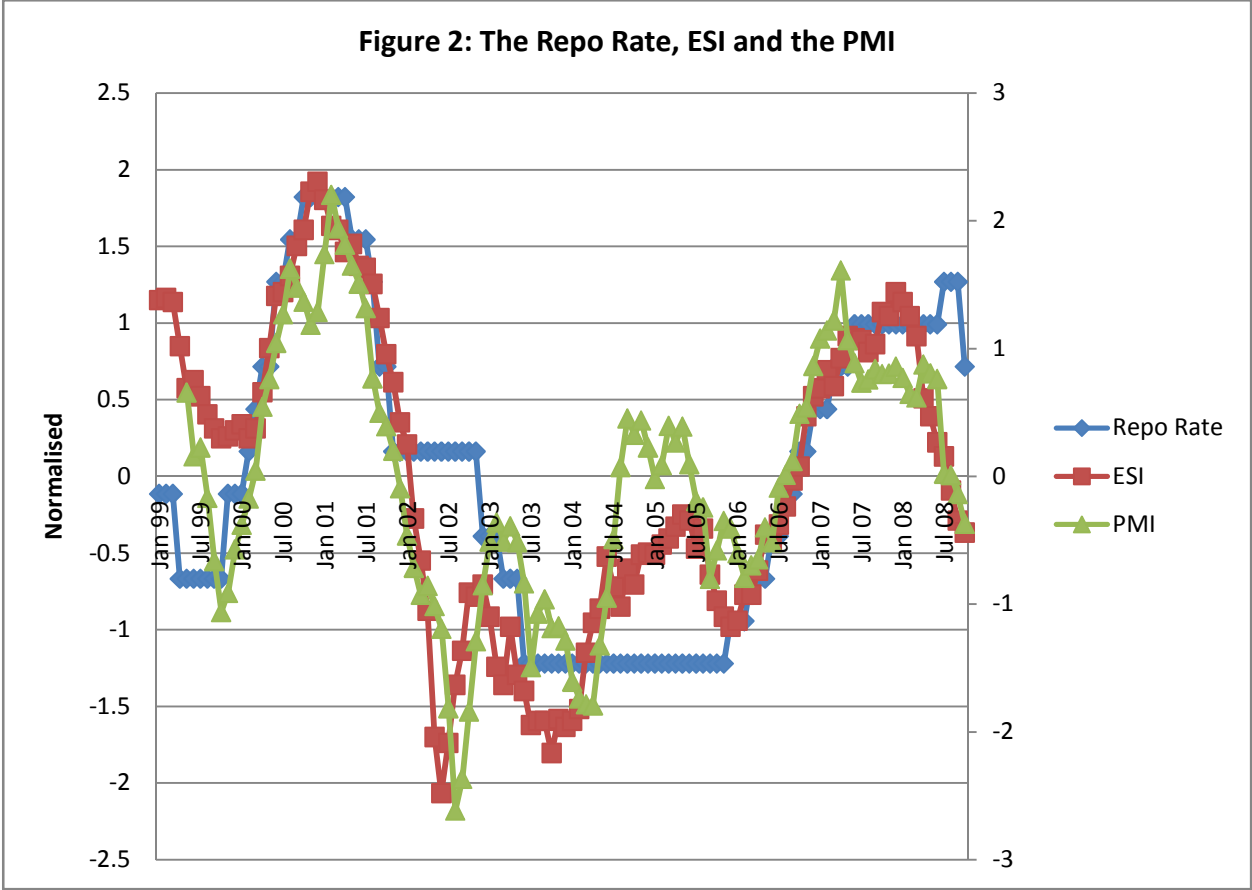
² The output gap is computed using the Hodrick-Prescott filter. The sentiment index is available at: http://ec.europa.eu/economy_finance/db_indicators/surveys9185_en.htm.

The graph shows that these time series move together and that the two survey series capture the state of the business cycle. However, the survey measures have three advantages over the output gap that are important when trying to understand the ECB’s policy decisions:

1. They are available monthly instead of quarterly as is the case for real GDP.
2. They are available much faster than the GDP data. For instance, the survey data in the figure ends in October 2008 while the real GDP data used to compute the output gap ends in 2008Q2.
3. The two series of survey data move in advance of the output gap. Furthermore, PMI seems to move before the ESI.³ This suggests that it picks up business cycle turning points more rapidly than the ESI and that it may be faster in providing information about future ECB policy decisions.

The ESI, PMI and the ECB’s repo rate

Figure 1 establishes that the PMI and the ESI lead movements in the output gap, but provides no information about how much information they contain about the ECB’s interest rate decisions. Nor does it show by how much the PMI and the ESI lead the ECB’s interest rate decisions. Figure 2 addresses both questions.



³ This hypothesis is confirmed by cross-correlation analysis which indicates that the correlation between the ESI this month and the PMI last month is higher than the contemporaneous correlation between the variables.

The figure contains a plot of the repo rate, the ESI and the PMI, and shows that all three series move together. However, to constructing the graph the ESI has been lagged 7 months and the PMI 10 months. This indicates that while both series move before changes in the ECB's monetary policy stance, the PMI seems to lead the ESI, suggesting that it is an earlier indicator of the developments in the state of the real economy that the ECB reacts to in setting monetary policy.

Reaction functions

While suggestive, the Figure 2 disregards the fact that the two survey measures of the state of the business cycle are not the only variables that contain information useful for understanding the ECB's policy decisions. To explore more formally the information content of various macroeconomic data series, it is necessary to run some regressions.⁴ To do so, the interest rate in a given month is allowed to depend on the following variables, with the following expected signs:

- The interest rate last month; with a positive parameter.
- The change in the interest rate last month; with a positive parameter if months of interest rate increases (or decreases) follow each other, or a negative parameter, if an interest rate increase last month "clears the air" and reduces the likelihood of an increase this month.
- The ESI or the PMI last month; with a positive parameter
- The rate of HICP inflation last month; with a positive parameter.
- The rate of depreciation over twelve months of the nominal trade-weighted exchange rate (against 42 countries) last month; with a positive parameter.
- The three-month moving average of the rate of M3 growth three months ago (because of data availability); with a positive parameter.

The results are provided in Table 1. The first column contains the parameter estimates in the case in which both the ESI and the PMI are included. The associated p-values in column 2 indicate how significant the parameters are: if this value is 5% then the parameter is significant at the 5% level, which implies that the interest rate very likely reacts to the variable in question.

The table shows that the ESI is significant at the 20% level and the PMI at the 11% level. Although these variables move together, suggesting that the regression model will have problems determining their relative importance, the results indicate that the PMI is more informative than the ESI about the ECB's policy decisions. Furthermore, while the change of the exchange rate and money growth are both significant at the 5% level, inflation is not ($p = 9\%$).

Since the PMI and the ESI are both intended to measure the state of the real economy in the euro area, we delete the ESI from the regression since it is less significant. Doing so leads inflation to become insignificant too, so it is also dropped from the equation. This should not be surprising: central banks

⁴ Since the ECB sets interest rates in "steps" of 25 or 50 basis points, the correct way to estimate the reaction function for the euro area is to estimate an ordered probit model (see Gerlach, Stefan, "Interest rate setting by the ECB, 1999-2006: Words and deeds," *International Journal of Central Banking*, 2007, available for free at www.ijcb.org). Here standard regressions are used since these are easier to interpret. The results do not depend on this simplification.

control inflation so that if policy is conducted well, inflation will be close to the targeted level and not contain much information about future monetary policy decisions.

Re-estimate the equation it yields the results in column 3. All variables are highly significant and have the expected signs. Interestingly, if the ESI is added to model in column 3, it is insignificant while the PMI remains significant, again implying that the PMI is more informative about future ECB interest rate decisions than the ESI.

<i>Variable</i>	<i>Column</i>	<i>Coefficient p-val.</i>		<i>Coefficient p-val.</i>	
		<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Constant		-1.52	0.00	-1.20	0.00
Repo rate		0.95	0.00	0.98	0.00
Change in repo rate		-0.31	0.00	-0.30	0.00
ESI		0.01	0.20		
PMI		0.01	0.11	0.02	0.00
Inflation		0.05	0.09		
Change in exchange rate		-0.01	0.05	-0.01	0.01
Money growth (M3)		0.02	0.01	0.02	0.00
R-squared		0.98		0.98	
Adjusted R-squared		0.98		0.98	
DW		1.99		1.99	

Conclusions

Overall, the results show that survey measures such as the ESI or the PMI can be thought of as real-time measures of the state of the business cycle and that they move well in advance of estimates of the output gap. Interestingly, movements in the PMI lead systematically movements in the ESI, suggesting that the former contains more rapidly informative useful for predicting future policy decisions by the ECB. This conclusion is supported by the econometric estimates that show that the PMI is more significant than the ESI in estimated reaction functions for the ECB.