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Nowcasting Quarterly GDP Dynamics In The Euro Area – The Role Of Sentiment Indicators

Abstract

The paper compares the most closely watched sentiment indicators with respect to their ability to nowcast quarterly GDP dynamics in the Euro Area and its biggest economies. We analyse cross-correlations and out-of-sample forecast errors generated from equations estimated by rolling regressions in fixed-length window. The results show that models employing PMI Composite perform best in the cases of the Euro Area, Germany, France and Italy, whilst Spanish GDP dynamics is best nowcasted using ESI-based models. PMI-based models generate the most accurate nowcasts at the beginning of the quarter, as well as during periods of high volatility of GDP growth rates.

Keywords: *nowcasting, sentiment indicators*

1. Introduction

Prompt and accurate data on GDP dynamics are crucial not only for investors and financial markets, but also from an economic policy viewpoint. They can, at least to some extent, reduce the problem of lags associated with monetary and discretionary fiscal policy. No single variable available on a monthly

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basis can be considered a satisfactory substitute for GDP. Data on industrial production is perhaps the best candidate, but it is subject to substantially higher volatility and it is also released with a considerable delay.

The first official GDP quarterly data in the Euro Area are released with a two-month delay, and a flash estimate is published approximately two weeks earlier (see Figure 1). However, making use of the higher-frequency data, including cyclical polls on economic activity, it is possible to nowcast the GDP dynamics before those releases. There are a number of soft (sentiment) indicators available in the market which are designed to mirror GDP dynamics. Some of them are closely watched by investors and policymakers, whilst others do not enjoy much popularity.

The aim of the paper is to test the performance of the most popular sentiment indicators in their ability to provide accurate nowcasts of quarterly GDP dynamics. The test group consists of the Euro Area as an aggregate as well as its four largest member states (Germany, France, Italy and Spain).

At the Euro Area level we have the following three most important indicators to choose from:

Markit PMI *Composite* – Purchasing Managers' index is based on monthly surveys of private sector companies, directed to purchasing managers from the manufacturing and services sectors.

€-coin – an indicator constructed in cooperation between Banca d'Italia and CEPR, based on a large dataset of mixed-frequency economic data, processed by a dynamic factor model.

Economic Sentiment Index (ESI) – a European Commission index based on monthly surveys conducted in companies and households. It consists of a weighted average of four sub-components, describing confidence in three economic sectors (manufacturing, construction, and retail trade) and among consumers.

At the country level, the situation is diversified. The economic situation in the two largest economies (Germany and France) is covered by more indicators than in other countries, which reflects investor interest in them. The release of German GDP data is usually a stronger market mover than that of Italy or Spain. Several indicators are published for more than just one country, which offers the possibility to compare them. Except for PMI and ESI, which are available for all the four biggest countries in the Euro Area, we have:

ZEW (Germany, France, Italy) – an indicator synthesizing surveys conducted among financial analysts regarding subjective assessments of current and future (but short-term) macroeconomic perspectives.

IFO *business situation* (Germany, France) – another indicator based on surveys conducted in enterprises. It is a sub-index of IFO *business climate*, which also incorporates IFO *business expectations*.

Insee (France) – a survey-based indicator, utilizing sentiment of company CEOs from all sectors. The indicator refers to the current situation and short-term expectations.

Figure 1 visualizes the timeline of data releases for the Euro Area as a whole. The paper is structured as follows. Section 2 contains a synthetic review of the research, section 3 presents initial results obtained from the cross-correlation analysis, and section 4 presents econometric results. Section 5 contains conclusions.

2. Literature review

Sentiment indicators in recent years have become widely used for the purpose of forecasting GDP. They found their well-established position in datasets used for building dynamic factor models (DFMs, see: Giannone, et. al., 2009, Bańbura et. al., 2011), bridge models (e.g. French OPTIM, see: Irac and Sédillot, 2002), or DSGE models (see e.g. Červená and Schneider 2010). Červená and Schneider (2010) explicitly test the usability of business indicators for improving the quality of forecasts. Based on Austrian data they find that DSGE-based forecasts can significantly benefit from taking those indicators into account with no loss for the created economic context whatsoever. Giannone et. al. (2009) and Antipa et. al. (2012) confirm the significant role of sentiment indicators for improving the GDP forecast accuracy of factor models, applied to the Euro Area and Germany respectively. The latter study reveals a particularly noticeable benefit from using sentiment indicators at the beginning of the quarter, when the stock of available economic hard data is still modest. A similar conclusion is reached by, *inter alia*, Mitchell et. al. (2010) and Keeney et. al. (2012).

Papers aimed at comparing results obtained while employing different sentiment indicators for short-term GDP forecasting and nowcasting are less frequent. One of them is a study by Camacho and García-Serrador (2011), who present evidence that substituting PMI with ESI in the factor model they used for forecasting quarterly GDP in the Euro Area reduces standard forecast errors. In most other studies PMI is generally found to be well-suited for the purpose analysed and tends to outperform other indicators (Insee 2008, European Commission 2012). The European Commission (2012) admits that the construction of ESI makes this index more useful for predicting annual rates of GDP changes, but that the forecast accuracy of quarterly GDP is inferior compared to models

based on PMI. This explains why the European Commission is currently working on releasing a new sentiment index, based on surveys conducted in firms and households, which could give better results in tracking quarterly GDP dynamics. Other evidence of improvements in forecast accuracy by employing the PMI index can be found in the studies of Liedo and Muñoz (2010), Godbout and Jacob (2010) and Rossiteer (2010). Lombardi and Maier (2011) explicitly show that simple PMI-based models generate surprisingly good results in the case of many Euro Area countries in times of both low and high volatility of GDP growth rates. It is not uncommon for these models to achieve lower forecast errors than those generated from large and sophisticated dynamic factor models. De Bondt (2012) goes one step further by claiming that PMI *Composite* is better at forecasting quarterly GDP dynamics in the Euro Area than the flash estimates released by the European Commission.

To the best of our knowledge, the literature does not offer independent studies comparing a broader spectrum of sentiment indicators in their forecasting or nowcasting the performance of quarterly GDP. This paper aims at filling this gap. It also compares the changing forecast accuracy generated by the described sentiment indicator-based models over time.

3. Correlation analysis

Analysing cross-correlations is a good starting point for evaluating nowcasting performance, as it enables drawing initial conclusions regarding both contemporaneous statistical dependencies and their possible time-shifts. Our exercise is performed for the period 1999Q1 – 2012Q4. Exclusion of the last few quarters eliminates the bulk of GDP measurement error resulting from the (frequent) revisions of GDP data which take place at the end of a sample. Table 1 shows that the highest contemporaneous correlation coefficients with quarterly GDP are achieved for the PMI index. As intuition would suggest, with every monthly inflow of new data and new releases of sentiment indicators, the dependency becomes stronger, although this is more evident in the case of €-Coin and ESI, and less so in the case of PMI. Consequently, in the last month of a quarter both €-Coin and PMI indicators achieve similar contemporaneous correlation coefficients with quarterly GDP dynamics. ESI performs slightly worse here, and it also reveals higher correlation with lagged (by one quarter) GDP growth rate. A common feature, found in all three cases, is a rising correlation with future GDP dynamics. As can be observed from Table 1, none of the indicators can be referred to as a strictly leading indicator; statistical

dependency with lagged and current GDP dynamics was always found to be higher than the correlation with its lead growth rate.

The statistical dependency between GDP dynamics and sentiment indicators is noticeably lower in Germany. But also in this country PMI outperforms other indicators, including the two released by German institutes (ZEW and IFO), which are also inferior to ESI. Both ZEW and IFO indicators reveal a stronger dependency on lagged GDP dynamics. It generally seems that both carry a similar information loading – the contemporaneous correlation coefficients between them is as high as 0.93-0.94.[1]

France confirms the pattern found in both the Euro Area and Germany. The highest contemporaneous correlation coefficient with quarterly GDP growth rates is found for PMI indicator. The remaining indicators show noticeably stronger relationships with lagged GDP dynamics. There is a striking similarity between contemporaneous and cross-correlations of ESI and Insee indicators. Indeed, the relationship between these two is found to be very high, which is reflected by correlation coefficients reaching 0.98-0.99.

Contemporaneous correlation coefficients with quarterly growth rates of GDP in the Italian economy are again the highest in the case of PMI. This is especially evident in the second and third month of a quarter. Similarly as with France, ESI and ZEW indicators reveal a stronger statistical relationship with lagged growth rates of GDP.

Compared with the cross-correlation analysis results presented above, Spain clearly stands out. While there are only two sentiment indicators available which track economic activity in this country, their relationship with GDP dynamics seems to be very strong. The first finding is that the release of additional monthly PMI indicators does not translate into a rising correlation coefficient, while this is the case with ESI. As a result, ESI was more strongly correlated with quarterly GDP dynamics in the second and third month of a quarter. Interestingly, ESI was also found to reveal a relatively high (higher than PMI) dependency with future GDP growth rates.

Both these specific features can be attributed to one major difference between the design of both sentiment indicators. While ESI is largely influenced by the developments in the construction sector, this sector is absent in PMI.[2] And construction was a particularly important driving force of the Spanish GDP, both before the crisis and even more so after 2008, when the real estate bubble burst in Spain. Nowhere else in the analysed group of countries was construction so important for GDP dynamics.

[1] Correlation coefficients between particular sentiment indicators are not reported to save space.

[2] Polls conducted for the purpose of constructing PMI are not distributed in construction enterprises.

Construction is also known to slightly lead the business cycle, which is reflected in high correlation between ESI and lead GDP growth in Spain. To a lesser extent, this regularity can be observed in other countries too.

4. Performance of sentiment indicator-based models to nowcast quarterly GDP growth rates in the Euro Area

The nowcasting performance of the indicators introduced above will be assessed in a simple empirical framework. The equation considered is of the form:

$$y_t = \alpha + \beta X_t + \varepsilon_t \tag{1}$$

Where y_t is quarterly GDP dynamics in quarter *t*, and X_t is the sentiment indicator value in the same quarter. Because indicators are released at a monthly frequency (which is their biggest advantage), the dependent variable will consist of the value from the first month, and an average from two and three months in subsequent months of a quarter. In this way, the increasing information loading is accounted for as the quarter progresses.

Parameters are then estimated based on the rolling regression with fixed estimation window of 32 quarters between the 1st quarter of 1999 and the 4th quarter of 2012. As was already mentioned, the last quarters available at the moment of performing the exercise are intentionally excluded because they are often subject to revisions and might potentially introduce bias in the results. In the second stage a one quarter out-of-sample forecast is generated from each equation. Forecast errors and root mean square errors are used to compare the nowcast performance of alternative models.

Table. 6 compares root mean squared errors obtained through one period out-of-sample predictions for every quarter in the period 2007Q1 – 2012Q4, based on the estimated value of parameters, in line with the method described above. A reference benchmark is an AR(1) model, as is usual in these types of exercises.

The benchmark AR(1) model is generally outperformed by all indicator-based models for the Euro Area. The main reason is the relatively high errors generated in times of high uncertainty and volatility of GDP in the Euro Area, encompassing the period between 2008Q4 and 2009Q3. Among the sentiment indicator-based models, the PMI model generates the lowest errors. Nevertheless, in times of a relatively stable macroeconomic environment (e.g. years 2007 and 2012), the superiority of PMI model is mitigated.

Figure 1 shows empirical and theoretical GDP dynamics in the Euro Area and Table 7 presents results of the Diebold-Mariano significance tests of differences between nowcast errors generated from sentiment indicator-based models. It turns out that PMI is especially useful for nowcasting GDP in the Euro Area at the beginning of the quarter. Errors are then significantly lower than those generated from ESI-based and €-Coin-based models. Irrespective of time, €-Coin is found to produce significantly lower errors than ESI.

Compared to the Euro Area aggregate, all indicator-based models produce significantly higher errors for the German economy, which can hardly come as a surprise, given the low contemporaneous correlation coefficients which were shown in the previous section (see Table 2). Nevertheless, it is again the PMI index which stands out in terms of nowcast performance. The remaining models generated very high errors in 2008 and (especially) 2009. This picture is somewhat spoilt by the relatively poor performance of the preferred model in 2012, which results from overly pessimistic nowcasts in the first three quarters. As a result, the ESI model outperformed its PMI counterpart in 2012.

A general superiority of PMI models in the case of Germany is confirmed by the Diebold-Mariano test (see Table 9). In the entire period, errors produced by the PMI model were significantly lower than errors obtained from any other model used for comparison, irrespective of the number of months which elapsed since the beginning of the quarter.

Generally, French quarterly GDP dynamics in the analysed period could have been nowcasted with much more accuracy (lower errors) compared to the German GDP. The lowest average errors were produced by the PMI-based model, mostly owing to its high accuracy in the years 2007-2010. In 2011, the nowcasting performance of all compared models was similar (especially in the second and third month of a quarter), while 2012 brought a sharp deterioration of results generated by PMI-based models (as was the case in the Euro Area and Germany). In contrast, the errors in the remaining models declined substantially in 2012 and reached levels lower than in 2007.

The results of the Diebold-Mariano test statistics, lead (contrary to the case of Germany) to softening the conclusions about the superiority of PMI models as far as French GDP is concerned (see Table 11). The errors produced by these models do not appear significantly lower than the errors generated from ZEW, ESI and Insee-based models at reasonable significance levels. Nowcasts for the Italian economy were constructed with the help of three sentiment indicators.[3] A general conclusion, which can be drawn from Table 12, is that

[3] Italian statistical office releases the IESI *Composite*, which could potentially be used for our exercise, but time series are only available for subcomponents of this indicator.

average nowcast errors obtained for Italy are higher compared to Euro Area aggregate and France, but lower than in Germany. Again, taking into account the root mean squared error criterion, the supremacy of PMI-based models is visible. Compared to ESI and ZEW-based models, PMI had better nowcasting results in all years except 2011. Contrary to the countries analysed earlier, this good overall performance did not deteriorate in 2012. Significance tests for differences between various errors confirm the statistically superior performance of PMI-based models over alternative models after one, two and three months of a quarter (Table 13).

Table 14 confirms the earlier findings from the correlation analysis, i.e. that Spain is an exceptional case in the researched group of countries. There ESI-based models generally outperform models based on PMI, the only alternative sentiment indicator available. In 2007, when the Spanish GDP was growing at a stable quarterly rate of 0.7-0.9%, nowcasts generated by ESI-based models only marginally differed from official (and, importantly, final) data. But the advantage of ESI was even more pronounced in 2009, which can be linked to a better utilization of data from the collapsing construction sector, which was pushing GDP down.

The high quality of ESI-based nowcasts is confirmed by the Diebold-Mariano test (see Table 15). Irrespective of the number of monthly indicators available, ESI generates significantly lower errors than does PMI.

5. Summary

This paper attempts to compare popular sentiment indicators' ability to nowcast current GDP growth rates before any official estimates or data are available. There are various indicators constructed with the aim of tracking changes in economic activity. These indicators differ in terms of methodology, economic sectors, as well as the countries covered. This study shows that some of them carry similar information loading, whilst other are more complementary.

Among the available sentiment indicators, PMI is generally found to reveal the strongest statistical relationship with quarterly growth rates of GDP, and also to perform best as a basis for a model for nowcasting purposes. However, several caveats apply. First of all, ESI gains over PMI if construction is known to be an important sector driving GDP changes, as the example of Spain shows. Second, a stable macroeconomic environment also tends to decrease PMI's advantage over alternative indicators.

The results show, that PMI-based models generate the most accurate forecasts at the beginning of the quarter and in times of elevated uncertainty and volatility of GDP growth rates.

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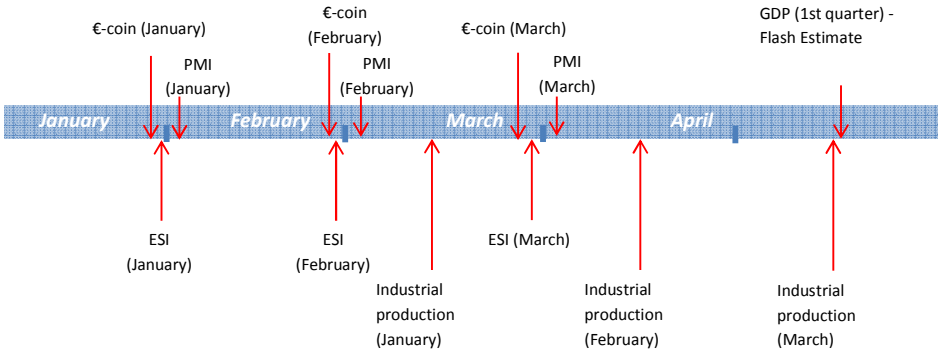
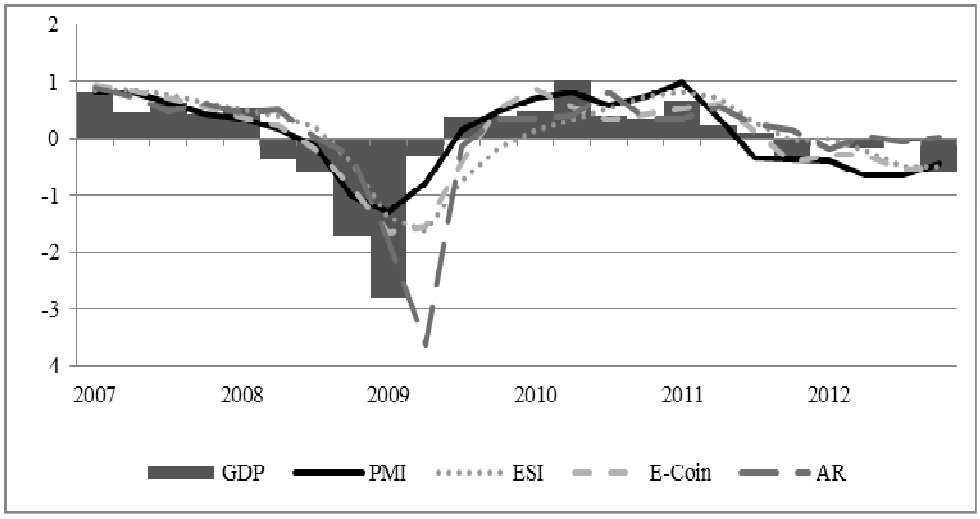
Annex

Figure 1. Publication of sentiment indicators, industrial production and GDP in the first quarter



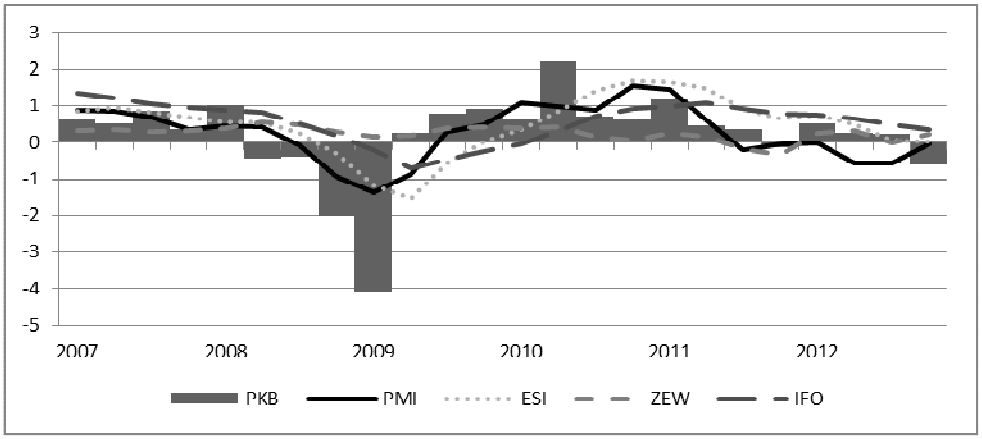
Source: own compilation, based on Eurostat, Markit, CEPR.

Figure 2. Actual and nowcasted quarterly dynamics of GDP in the Euro Area



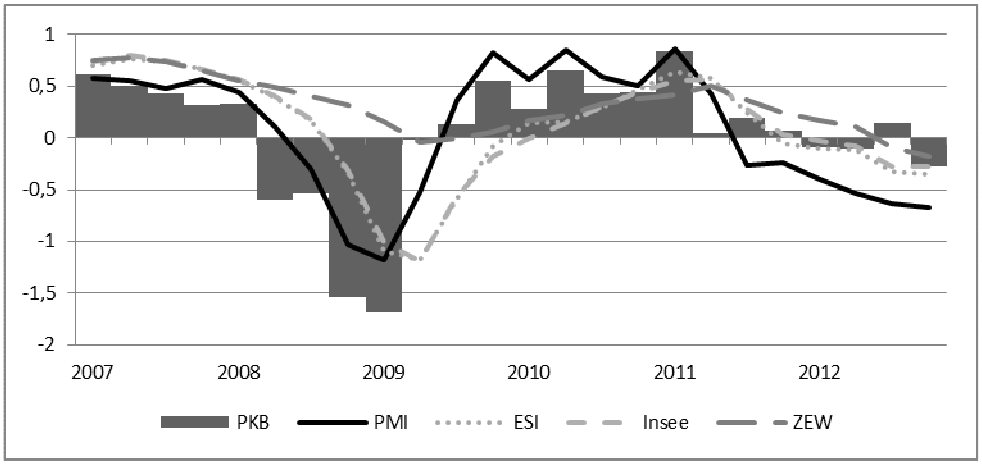
Source: Eurostat, own calculations.

Figure 3. Actual and nowcasted quarterly dynamics of GDP in Germany



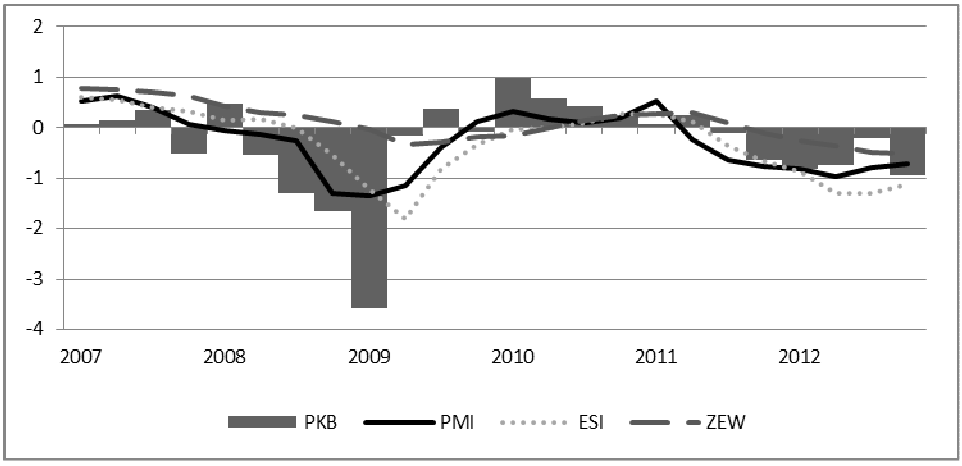
Source: Eurostat, own calculations.

Figure 4. Actual and nowcasted quarterly dynamics of GDP in France



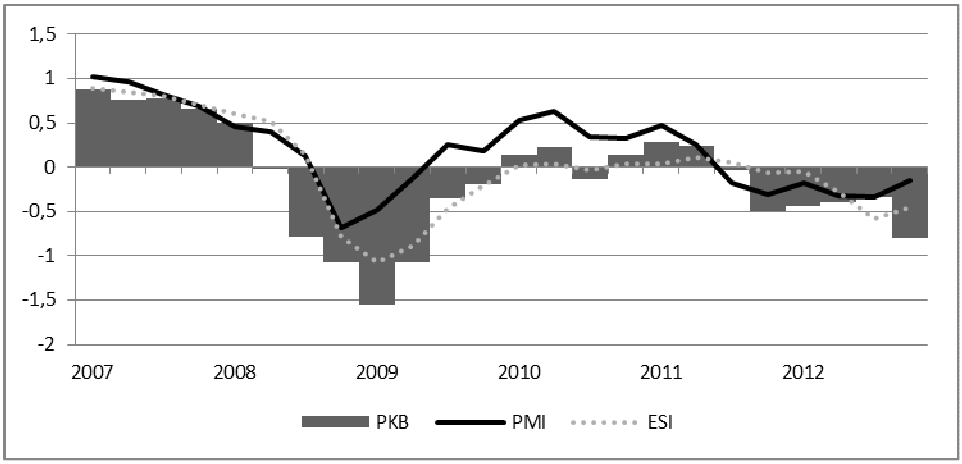
Source: Eurostat, own calculations.

Figure 5. Actual and nowcasted quarterly dynamics of GDP in Italy



Source: Eurostat, own calculations.

Figure 6. Actual and nowcasted quarterly dynamics of GDP in Spain



Source: Eurostat, own calculations.

Table 1. Cross-correlations between quarterly GDP Dynamics and selected sentiment indcators in the Euro Area, 2000Q1 – 2012Q4*

		PMI		ESI		€- Coin	
	quarters	lag	lead	lag	lead	lag	lead
1 month	0	0.87	0.87	0.69	0.69	0.82	0.82
	1	0.64	0.79	0.39	0.82	0.54	0.87
	2	0.33	0.59	0.14	0.80	0.27	0.72
	3	0.11	0.34	-0.05	0.66	0.08	0.42
	4	-0.04	0.14	-0.17	0.48	-0.06	0.13
2 months	0	0.88	0.88	0.73	0.73	0.85	0.85
	1	0.69	0.78	0.44	0.82	0.60	0.86
	2	0.39	0.57	0.17	0.78	0.31	0.68
	3	0.16	0.32	-0.03	0.63	0.11	0.38
	4	0.00	0.11	-0.16	0.45	-0.04	0.11
3 months	0	0.88	0.88	0.76	0.76	0.87	0.87
	1	0.74	0.76	0.50	0.83	0.65	0.84
	2	0.44	0.53	0.20	0.76	0.36	0.64
	3	0.21	0.28	-0.01	0.59	0.14	0.33
	4	0.03	0.07	-0.14	0.42	-0.01	0.07

* In Tables 1-5 the columns *lead/lag* show correlation coefficients between the GDP growth rate and the sentiment indicator led/lagged by the given number of quarters.

Source: own calculations.

Table 2. Cross-correlations between quarterly GDP Dynamics and selected sentiment indcators in Germany, 2000Q1 – 2012Q4

		PMI		ESI		ZEW		IFO	
	quarters	lag	lead	lag	lead	lag	lead	lag	Lead
1 month	0	0.74	0.74	0.52	0.52	0.27	0.27	0.27	0.27
	1	0.49	0.67	0.22	0.66	0.05	0.43	0.01	0.47
	2	0.14	0.40	0.00	0.65	-0.14	0.54	-0.15	0.56
	3	-0.04	0.26	-0.17	0.54	-0.26	0.56	-0.23	0.57
	4	-0.11	0.08	-0.21	0.42	-0.33	0.52	-0.27	0.50
2 months	0	0.74	0.74	0.56	0.56	0.30	0.30	0.31	0.31
	1	0.54	0.66	0.27	0.67	0.09	0.46	0.05	0.50
	2	0.20	0.42	0.02	0.63	-0.10	0.54	-0.14	0.57
	3	0.01	0.25	-0.15	0.51	-0.24	0.55	-0.24	0.56
	4	-0.10	0.05	-0.21	0.40	-0.31	0.52	-0.29	0.49
3 months	0	0.74	0.74	0.59	0.59	0.32	0.32	0.35	0.35
	1	0.59	0.62	0.33	0.68	0.12	0.48	0.10	0.52
	2	0.25	0.41	0.05	0.61	-0.09	0.54	-0.10	0.57
	3	0.03	0.23	-0.13	0.49	-0.23	0.54	-0.23	0.55
	4	-0.08	0.01	-0.21	0.37	-0.30	0.51	-0.28	0.47

Source: own calculations.

Table 3. Cross-correlations between quarterly GDP Dynamics and selected sentiment indcators in France, 2000Q1 – 2012Q4

		PMI		ESI		ZEW		Insee	
	quarters	lag	lead	lag	lead	lag	lead	lag	Lead
1 month	0	0.82	0.82	0.63	0.63	0.34	0.34	0.61	0.61
	1	0.54	0.78	0.31	0.77	0.09	0.52	0.32	0.77
	2	0.39	0.60	0.03	0.81	-0.12	0.66	0.04	0.82
	3	0.10	0.34	-0.13	0.69	-0.26	0.64	-0.12	0.69
	4	-0.04	0.10	-0.22	0.50	-0.35	0.56	-0.23	0.53
2 months	0	0.84	0.84	0.66	0.66	0.38	0.38	0.65	0.65
	1	0.60	0.76	0.35	0.79	0.14	0.56	0.37	0.80
	2	0.40	0.57	0.07	0.79	-0.08	0.66	0.08	0.81
	3	0.16	0.31	-0.11	0.67	-0.24	0.63	-0.10	0.68
	4	-0.02	0.09	-0.21	0.48	-0.34	0.54	-0.21	0.51
3 months	0	0.84	0.84	0.70	0.70	0.41	0.41	0.68	0.68
	1	0.65	0.74	0.39	0.80	0.17	0.58	0.40	0.81
	2	0.44	0.53	0.10	0.78	-0.06	0.66	0.11	0.79
	3	0.23	0.27	-0.09	0.64	-0.22	0.62	-0.08	0.66
	4	0.01	0.05	-0.20	0.45	-0.33	0.53	-0.20	0.49

Source: own calculations.

Table 4. Cross-correlations between quarterly GDP Dynamics and selected sentiment indcators in Italy, 2000Q1 – 2012Q4

		PMI		ESI		ZEW	
	quarters	lag	lead	lag	lead	lag	lead
1 month	0	0.76	0.76	0.63	0.63	0.40	0.40
	1	0.63	0.72	0.39	0.71	0.18	0.49
	2	0.31	0.66	0.18	0.72	-0.01	0.58
	3	0.17	0.39	0.06	0.57	-0.17	0.58
	4	0.01	0.22	-0.11	0.37	-0.32	0.49
2 months	0	0.78	0.78	0.65	0.65	0.43	0.43
	1	0.66	0.73	0.43	0.72	0.23	0.52
	2	0.36	0.63	0.20	0.70	0.02	0.59
	3	0.21	0.34	0.06	0.55	-0.15	0.57
	4	0.05	0.16	-0.09	0.36	-0.30	0.48
3 months	0	0.80	0.80	0.68	0.68	0.44	0.44
	1	0.69	0.72	0.47	0.73	0.26	0.54
	2	0.43	0.59	0.23	0.69	0.04	0.60
	3	0.26	0.32	0.07	0.52	-0.12	0.56
	4	0.07	0.13	-0.07	0.35	-0.28	0.47

Source: own calculations.

Table 5. Cross-correlations between quarterly GDP Dynamics and selected sentiment indcators in Spain, 2000Q1 – 2012Q4

		PMI		ESI	
	quarters	lag	lead	lag	lead
1 month	0	0.90	0.90	0.91	0.91
	1	0.83	0.75	0.85	0.87
	2	0.72	0.61	0.74	0.80
	3	0.57	0.44	0.61	0.68
	4	0.43	0.29	0.52	0.56
2 months	0	0.89	0.89	0.92	0.92
	1	0.86	0.73	0.87	0.87
	2	0.75	0.59	0.75	0.79
	3	0.62	0.42	0.62	0.67
	4	0.47	0.27	0.52	0.55
3 months	0	0.88	0.88	0.93	0.93
	1	0.88	0.72	0.88	0.86
	2	0.78	0.56	0.76	0.77
	3	0.65	0.39	0.64	0.65
	4	0.50	0.25	0.53	0.54

Source: own calculations.

Table 6. Nowcast root mean squared errors (RMSE) of quarterly GDP dynamics in the Euro Area

	PMI			**ESI**			**€-Coin**			**AR**
	1M	2M	3M	1M	2M	3M	1M	2M	3M	
2007-2012	**0.45**	**0.45**	**0.46**	**0.73**	**0.68**	**0.64**	**0.58**	**0.53**	**0.49**	**0.84**
2007	0.17	0.17	0.17	0.22	0.24	0.24	0.23	0.22	0.21	0.19
2008	0.61	0.56	0.50	0.99	0.93	0.84	0.69	0.62	0.55	0.88
2009	0.72	0.76	0.80	1.36	1.25	1.15	1.14	1.03	0.94	1.76
2010	0.27	0.24	0.27	0.40	0.43	0.43	0.25	0.28	0.31	0.37
2011	0.31	0.26	0.28	0.37	0.34	0.31	0.26	0.23	0.20	0.35
2012	0.39	0.40	0.43	0.16	0.20	0.23	0.25	0.28	0.29	0.34

*1M, 2M and 3M in Tables 6 - 15 refer to errors generated from a model based on the indicator value in (respectively) first month of a quarter, average in first and second month of a quarter, and average in all three months of a quarter.

Source: own calculations.

Table 7. Results of the Diebold-Mariano significance test of nowcast error differences in the Euro Area (loss function based on MSE)

	PMI-ESI	PMI- €-Coin	€-Coin - ESI
1M difference	-0.33	-0.13	-0.19
p-value	0.05	0.10	0.02
2M difference	-0.27	-0.08	-0.18
p-value	0.06	0.17	0.02
3M difference	-0.20	-0.03	-0.17
p-value	0.11	0.54	0.02

Source: own calculations.

Table 8. Nowcast root mean squared errors (RMSE) of quarterly GDP dynamics in Germany

	PMI			ESI			ZEW			IFO		
	1M	2M	3M	1M	2M	3M	1M	2M	3M	1M	2M	3M
2007-2012	**0.83**	**0.84**	**0.83**	**1.09**	**1.06**	**1.03**	**1.12**	**1.14**	**1.16**	**1.22**	**1.21**	**1.20**
2007	0.21	0.22	0.23	0.27	0.27	0.28	0.33	0.33	0.33	0.62	0.61	0.59
2008	0.88	0.84	0.77	1.20	1.14	1.07	1.33	1.35	1.38	1.43	1.40	1.35
2009	1.47	1.52	1.51	2.06	1.97	1.88	2.06	2.11	2.13	2.20	2.19	2.16
2010	0.81	0.81	0.80	0.89	0.91	0.95	0.93	0.95	0.99	1.03	1.03	1.02
2011	0.37	0.36	0.32	0.70	0.71	0.73	0.57	0.58	0.58	0.58	0.60	0.64
2012	0.59	0.59	0.70	0.33	0.36	0.36	0.50	0.43	0.44	0.52	0.53	0.53

Source: own calculations.

Table 9. Results of the Diebold-Mariano significance test of nowcast error differences in Germany (loss function based on MSE)

	PMI-ESI	PMI-ZEW	PMI-IFO	ESI-ZEW	ESI-IFO	ZEW-IFO
1M difference	-0.50	-0.58	-0.81	-0.07	-0.31	-0.23
p-value	0.01	0.04	0.02	0.66	0.15	0.00
2M difference	-0.42	-0.60	-0.77	-0.18	-0.35	-0.17
p-value	0.01	0.04	0.02	0.38	0.11	0.00
3M difference	-0.36	-0.65	-0.74	-0.29	-0.37	-0.08
p-value	0.03	0.06	0.02	0.25	0.08	0.00

Source: own calculations.

Table 10. Nowcast root mean squared errors (RMSE) of quarterly GDP dynamics in France

	PMI			ESI			ZEW			Insee		
	1M	2M	3M	1M	2M	3M	1M	2M	3M	1M	2M	3M
2007-2012	**0.38**	**0.36**	**0.37**	**0.59**	**0.56**	**0.53**	**0.67**	**0.66**	**0.66**	**0.60**	**0.57**	**0.55**
2007	0.13	0.14	0.13	0.25	0.27	0.27	0.26	0.27	0.27	0.28	0.29	0.29
2008	0.61	0.51	0.45	0.97	0.93	0.86	1.20	1.19	1.18	0.98	0.92	0.88
2009	0.33	0.34	0.40	0.92	0.88	0.81	0.99	0.97	0.96	0.95	0.90	0.85
2010	0.19	0.19	0.19	0.24	0.26	0.27	0.25	0.24	0.23	0.30	0.29	0.29
2011	0.44	0.35	0.34	0.33	0.30	0.29	0.34	0.34	0.34	0.33	0.31	0.30
2012	0.39	0.47	0.52	0.21	0.21	0.24	0.24	0.22	0.21	0.19	0.20	0.22

Source: own calculations.

Table 11. Results of the Diebold-Mariano significance test of nowcast error differences in France (loss function based on MSE)

	PMI-ESI	PMI-ZEW	PMI-Ins	ESI-ZEW	ESI-Ins	ZEW-Ins
1M difference	-0.20	-0.30	-0.21	-0.11	-0.02	0.09
p-value	0.16	0.13	0.16	0.08	0.14	0.05
2M difference	-0.19	-0.31	-0.20	-0.12	-0.01	0.11
p-value	0.19	0.12	0.18	0.04	0.10	0.03
3M difference	-0.15	-0.30	-0.17	-0.15	-0.02	0.13
p-value	0.26	0.15	0.24	0.04	0.08	0.03

Source: own calculations.

Table 12. Nowcast root mean squared errors (RMSE) of quarterly GDP dynamics in Italy

	PMI			ESI			ZEW		
	1M	2M	3M	1M	2M	3M	1M	2M	3M
2007-2012	**0.72**	**0.70**	**0.67**	**0.92**	**0.89**	**0.85**	**1.02**	**1.01**	**1.01**
2007	0.49	0.46	0.44	0.53	0.53	0.53	0.74	0.75	0.76
2008	0.80	0.73	0.64	1.01	0.98	0.93	1.25	1.24	1.24
2009	1.33	1.31	1.28	1.77	1.66	1.56	1.83	1.82	1.81
2010	0.51	0.44	0.42	0.58	0.62	0.61	0.66	0.66	0.65
2011	0.32	0.37	0.44	0.13	0.15	0.18	0.36	0.33	0.31
2012	0.35	0.35	0.33	0.50	0.60	0.62	0.47	0.43	0.42

Source: own calculations.

Table 13. Results of the Diebold-Mariano significance test of nowcast error differences in Italy (loss function based on MSE)

	PMI-ESI	PMI-ZEW	ESI-ZEW
1M difference	-0.32	-0.52	-0.20
p-value	0.00	0.00	0.08
2M difference	-0.31	-0.54	-0.23
p-value	0.01	0.00	0.14
3M difference	-0.27	-0.56	-0.29
p-value	0.00	0.00	0.14

Source: own calculations.

Table 14. Nowcast root mean squared errors (RMSE) of quarterly GDP dynamics in Spain

	PMI	PMI	PMI	ESI	ESI	ESI
	1M	2M	3M	1M	2M	3M
2007-2012	**0.40**	**0.42**	**0.46**	**0.34**	**0.32**	**0.31**
2007	0.15	0.15	0.13	0.08	0.06	0.06
2008	0.55	0.53	0.54	0.64	0.60	0.56
2009	0.60	0.69	0.81	0.28	0.21	0.27
2010	0.38	0.38	0.38	0.11	0.15	0.13
2011	0.18	0.12	0.15	0.33	0.28	0.26
2012	0.30	0.34	0.35	0.26	0.29	0.30

Source: own calculations.

Table 15. Results of the Diebold-Mariano significance test of nowcast error differences in Spain (loss function based on MSE)

	PMI-ESI
1M difference	0.05
p-value	0.00
2M difference	0.08
p-value	0.01
3M difference	0.11
p-value	0.01

Source: own calculations.

Streszczenie

PROGNOZOWANIE BIEŻĄCE KWARTALNEJ DYNAMIKI PKB W STREFIE EURO – ROLA WSKAŹNIKÓW KONIUNKTURY

W artykule porównane zostały zdolności najpilniej obserwowanych wskaźników obrazujących nastroje gospodarcze do bieżącego prognozowania kwartalnej dynamiki PKB w strefie euro i jej największych państwach członkowskich. Analizowane są korelacje krzyżowe oraz błędy prognoz poza próbę, wygenerowane z równań szacowanych w oparciu o regresję kroczącą w oknie stałej długości. Wyniki wskazują, że modele wykorzystujące wskaźnik PMI Composite dają na ogół najlepsze wyniki w strefie euro, Niemczech, Francji i Włoszech, podczas gdy bieżąca dynamika hiszpańskiego PKB jest najprecyzyjniej prognozowana przez modele oparte na wskaźniku ESI. Modele oparte na PMI generują relatywnie najlepsze prognozy na początku kwartału, a także w okresach wysokiej zmienności stóp wzrostu PKB.

Słowa kluczowe: *prognozowanie bieżące, wskaźniki koniunktury*