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# Economic Sentiment in Europe: Disentangling Private Information from Public Knowledge

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## Abstract

This paper addresses a general problem with surveys asking agents for their assessment of the state of the economy: answers are highly dependent on information that is publicly available, while only information that is not already publicly known has the potential to improve a professional forecast. We propose a simple procedure to disentangle the private information of agents from knowledge that is already publicly known (that is common knowledge) for surveys that are structured like that for the European Commission's consumer sentiment indicator. We show that, empirically, this procedure works quite well for some economies, in particular for Germany.

**Keywords:** private information, public information, consumer confidence, survey data

**JEL:** D12, E32, E37, C83

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# 1 Introduction

Surveys on private agents' economic sentiment (or assessments of economic conditions) are important tools for economic forecasting, aggregating a lot of private information that is otherwise so dispersed that it is not available to forecasters. A major problem with surveys, however, is that the economic assessments of agents are based both on private information (stemming from their own close economic environment) and on information that is, in principle, publicly available. In general, professional forecasters have better access to public information than ordinary agents such as private households. It is reasonable to assume that private agents cannot add anything valuable concerning publicly available information to what is already known by professional forecasters. If this is true, surveys would be a more valuable source of information if the aggregate of private information that affects the survey results could be separated from information agents get from publicly available sources.

We propose a simple procedure to disentangle the two types of information for surveys that are structured like that of the European Commission (EC) on consumer sentiment, briefly described in section 3. The idea is to utilize the fact that this survey asks agents how they assess their own as well as the general economic prospects. We show that, assuming a simple information structure, the weight agents give to their private information is higher for their assessment of their own prospects than for their assessment of the general prospects of the economy, and that disentangling the two sources of information is straightforward: the indicator representing private information is a linear function of the difference between the assessment of the general prospects and the assessment of the private household's own economic prospects (section 2). Private information extracted from the consumer survey in this way can be used as input for forecasts that, in the simple informational setting we assume, perform better than forecasts that use the survey differently. Sections 4 and 5 show that this method works quite well in practice for several large euro area economies. Section 6 concludes.

This paper is inspired by the theoretical literature, following the seminal paper of Morris and Shin (1998), on the interplay between private and public information in coordinating economic activity. An important result of this literature is that public information about the economy can be detrimental if private agents have an incentive not only to react to economic developments, but also to align their activities to each other. In this case, as Morris and Shin (2002) show, agents use public information as a coordination device and, therefore, put too little weight on their private knowledge. Lindner (2009), however, shows that private information becomes more valuable for agents if public information gets more detailed. A particular application of the interplay between public and private information is the analysis of strategic behaviour of professional forecasters, pioneered by Trueman (1994). Ottaviani and Sorensen (2006) show that, from a theoretical perspective, professional forecasts are imprecise in equilibrium if forecasters have the objective is their reputation for competence. This is so because a precise forecast will not be regarded as honest, since these forecasters always have the incentive to give the impression that their best forecast equals their own private information – while actually it is a combination

of their private and the publicly available information. In the following we will not focus on such strategic issues, but on how forecasters can get most from surveys when participants form their expectations on the basis of both public and private information.

## 2 Optimal forecasting with survey data: a simple theoretical approach

In this section we show that, for a highly stylized information structure, the weight rational agents give to their private information is higher for their assessment of their own economic prospects than for their assessment of the general economic prospects of the economy, and that the two sources of information can simply be disentangled by calculating the difference between the two assessments. Consider an economy that consists of a large number of private agents receiving public as well as private signals about the future state of the economy. Public information about the economy, measured by income per capita,  $y$ , is noisy:<sup>1</sup>

$$\tilde{y} = y + \eta \tag{1}$$

with the variance of this signal equal to that of the noise term  $\eta$ ,  $\sigma_\eta^2$ . This public information might, for example, be about policy measures that will influence the state of the economy next year. We define the precision of this signal as the inverse of its variance  $p_{\tilde{y}}(y) = 1/\sigma_\eta^2$ .

Expected personal income of the representative agent  $i$ ,  $y_i$ , equals economic output per capita  $y$  plus an idiosyncratic shock to her own income  $\rho_i$  that is a normally distributed random variable with zero mean and variance  $\sigma_\rho^2$  (because all the idiosyncratic income shocks have the same variance,  $\sigma_{\rho_i}^2 = \sigma_\rho^2$ ):  $y_i = y + \rho_i$ . The agent does not observe  $\rho_i$ . Instead she gets a noisy private signal about her future personal income. The noise term  $\epsilon$  (with variance  $\sigma_\epsilon^2$ ) is the same for all agents, blurring economic prospects for everyone in the same way. Thus, the private signal  $\tilde{y}_i$  the agent gets concerning her own economic state is:

$$\tilde{y}_i = y + \rho_i + \epsilon = y_i + \epsilon \tag{2}$$

The precision of this signal  $p_{\tilde{y}_i}(y_i)$  is again defined as the inverse of its variance  $p_{\tilde{y}_i}(y_i) = 1/\sigma_\epsilon^2$ .

Moreover agents can utilize this private signal on their own future income for an assessment of the overall economic state, as they can use the public signal on the latter for their assessment on their own economic prospects. Given only  $\tilde{y}$ , this would also be agent  $i$ 's best estimate for  $y_i$ , with the precision of this signal being  $p_{\tilde{y}}(y_i) = 1/(\sigma_\eta^2 + \sigma_\rho^2)$ , and given only  $\tilde{y}_i$ , this would be her best estimate for  $y$ , with the precision of this signal being  $p_{\tilde{y}_i}(y) = 1/(\sigma_\epsilon^2 + \sigma_\rho^2)$ . Thus

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<sup>1</sup> In the following, variables with a  $\tilde{}$  are signals; random variables (in Greek letters) are normally distributed with an expected value of 0. The covariances between these random variables are also assumed to be 0.

it is assumed that the precision of the private information  $\tilde{y}_i$  for forecasting the average future income is lower than if used for forecasting the own future income of agent  $i$ .

The optimal forecasts of agent  $i$  for the general as well as for her individual income are the weighted sums of her private signal on her own income and of the public signal about the overall state of the economy; the weighting factors are, according to Bayes' rule, the fractions between the precision of the respective signal and the precision of the optimal forecast, with the latter precision being simply equal to the sum of the two single precisions<sup>2</sup>. Thus agent  $i$ 's forecast for the overall state of the economy is:

$$\mathbf{E}_i[y] = \frac{p_{\tilde{y}}(y)\tilde{y} + p_{\tilde{y}_i}(y)\tilde{y}_i}{p_{\tilde{y}}(y) + p_{\tilde{y}_i}(y)} = \frac{\frac{1}{\sigma_\eta^2}\tilde{y} + \frac{1}{\sigma_\epsilon^2 + \sigma_\rho^2}\tilde{y}_i}{\frac{1}{\sigma_\eta^2} + \frac{1}{\sigma_\epsilon^2 + \sigma_\rho^2}} \quad (3)$$

Agent  $i$ 's forecast for her own income is:

$$\mathbf{E}_i[y_i] = \frac{p_{\tilde{y}_i}(y_i)\tilde{y}_i + p_{\tilde{y}}(y_i)\tilde{y}}{p_{\tilde{y}_i}(y_i) + p_{\tilde{y}}(y_i)} = \frac{\frac{1}{\sigma_\epsilon^2}\tilde{y}_i + \frac{1}{\sigma_\eta^2 + \sigma_\rho^2}\tilde{y}}{\frac{1}{\sigma_\epsilon^2} + \frac{1}{\sigma_\eta^2 + \sigma_\rho^2}} \quad (4)$$

Using basic transformations it is easy to show that the difference between agent  $i$ 's forecast of her own income and her forecast of the average income per capita in the economy is a simple linear function of her private and of the public signal,  $\mathbf{E}_i[y_i] - \mathbf{E}_i[y] = A(\tilde{y}_i - \tilde{y})$ , with  $A = \sigma_\rho^2/(\sigma_\epsilon^2 + \sigma_\eta^2 + \sigma_\rho^2)$  and  $0 < A < 1$ . Intuitively, the larger the variance of the unobserved idiosyncratic shock  $\rho_i$  to the agent's economic prospects compared to the noise terms  $\epsilon$  and  $\eta$ , the larger is the difference between the expected own income and the expected general income for any difference between the two signals the agent observes. Because  $\rho_i$  is unobserved, it makes private information less useful for assessing the general situation and public information less useful for assessing the private prospects.

Put differently, the private signal agent  $i$  receives is a linearly increasing function of the difference between her assessment of her own economic prospects and her assessment of the general economic prospects:

$$\tilde{y}_i = (\mathbf{E}_i[y_i] - \mathbf{E}_i[y])/A + \tilde{y} \quad (5)$$

Now we assume that a forecaster does a survey asking each agent for her expectations about her own and about the general average income,  $\mathbf{E}_i[y_i]$  and  $\mathbf{E}_i[y]$ , and that each agent reveals her expectations correctly. The forecaster is able to calculate the private signal  $\tilde{y}_i$  from eq. 5 if, as it is assumed here, the properties of the distribution functions of  $\rho$ ,  $\epsilon$ , and  $\eta$  are known. Furthermore, if the forecaster takes the average of all the single private signals  $\tilde{y}_i$ ,  $\bar{y}$ , the idiosyncratic shocks

<sup>2</sup> This result, shown by eq. 3 and 4, comes from the fact that the vectors  $(y, \tilde{y}_i)$  and  $(y_i, \tilde{y})$  have a multivariate normal distribution. The vector of the corresponding means and the variance-covariance matrix of such a vector are given, for example, by Lütkepohl 2006, p. 677/678.

$\rho$  disappear:  $\bar{y} = y + \epsilon$ . The best forecast for the future average income  $E_f[y]$  is then a weighted average of the signal extracted from the survey and the public signal:<sup>3</sup>

$$E_f[y] = \frac{\frac{1}{\sigma_\epsilon^2} \bar{y} + \frac{1}{\sigma_\eta^2} \tilde{y}}{\frac{1}{\sigma_\epsilon^2} + \frac{1}{\sigma_\eta^2}} \quad (6)$$

Broadly speaking, the central result of this section is that, in the simple theoretical setting presented here, the best way of utilizing a survey described above for forecasting the economy is to look at the differences between the agents' expectations concerning their private prospects and concerning the general economic prospects. If the forecast were based, for example, on some convex combination of the averages of  $E_i[y_i]$  and  $E_i[y]$  and of  $\tilde{y}$ , private information  $\tilde{y}_i$  would get too low a weight since agents, in forming their expectations, take not only private, but public information as well into account, and thus the signal the forecaster gets from the survey is unnecessarily blurred.

Under the assumptions outlined above, these results also hold if agents are not asked to give cardinal numbers as indicators for their expectations, but are asked if their own and the general average income will exceed certain thresholds  $y_0$  and  $y_{i0}$ . As section 3 will discuss in more detail, this is close to the way the consumer survey of the European Commission works, with the current economic states as the relevant thresholds. In such a case the forecaster can infer the agents' average cardinal expectations from the balance between positive and negative answers. Because many agents are being asked, the share of agents that report that their expectation for  $y$  is lower than  $y_0$  equals the probability that a single agent gets a private signal low enough that  $E_i[y] \leq y_0$  holds. From eq.3 we see that this is the case if the following holds:

$$\tilde{y}_i \leq \frac{\frac{1}{\sigma_\eta^2} + \frac{1}{\sigma_\epsilon^2 + \sigma_\rho^2}}{\frac{1}{\sigma_\epsilon^2 + \sigma_\rho^2}} y_0 - \frac{\sigma_\epsilon^2 + \sigma_\rho^2}{\sigma_\eta^2} \tilde{y} \quad (7)$$

The forecaster knows that  $\tilde{y}_i$  is normally distributed with mean  $\bar{y}$  and variance  $\sigma_\rho^2$ . Thus, the share of agents reporting that in their opinion the threshold will not be reached equals the probability:

$$P[E_i[y] \leq y_0] = N\left(\tilde{y}_i = \frac{\frac{1}{\sigma_\eta^2} + \frac{1}{\sigma_\epsilon^2 + \sigma_\rho^2}}{\frac{1}{\sigma_\epsilon^2 + \sigma_\rho^2}} y_0 - \frac{\sigma_\epsilon^2 + \sigma_\rho^2}{\sigma_\eta^2} \tilde{y}; \mu = \bar{y}; \sigma^2 = \sigma_\rho^2\right) \quad (8)$$

With this equation the forecaster can infer the average private information  $\bar{y}$  from the share of negative answers to the survey. The following sections will, for the example of the assessments of private households according to the Economic Sentiment survey by the European Commission, test whether empirical findings support the simple theoretical approach presented in this section.

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<sup>3</sup> For simplicity we assume that the forecaster does not have private information.

### 3 The European Commission’s Economic Sentiment Indicator

The Directorate General for Economic and Financial Affairs of the European Commission has been conducting for many years harmonised surveys in all member states of the European Union (EU) and in the applicant countries.<sup>4</sup> These surveys are frequently used as sources for nowcasting and short-term forecasting, since they provide information on very recent developments, as their frequency is monthly with the results being published as early as at the end of the month the surveys are conducted in. The number of participants is large enough to provide significant results.<sup>5</sup> Representatives of the so-called “sectors” industry (this is manufacturing), services, financial services, retail trade, construction and consumers are requested to answer mainly qualitative questions. The number of questions varies between 6 (for construction and for retail trade firms) and 12 (for consumers). The Commission calculates the balance between positive and negative answers in percentage of the total number of answers. Consumers, for example, are asked: “how do you expect the general economic situation in this country to develop over the next 12 months? It will.. a) get a lot better b) get a little better c) stay the same d) get a little worse e) get a lot worse f) don’t know.” In our example, where respondents can choose between different intensities, the following simple weighting scheme is applied:  $B = (\text{Number}(a) + \text{Number}(b)/2 - \text{Number}(d)/2 + \text{Number}(e))/\text{Total Number}$ . The resulting time series are seasonally adjusted and then aggregated to composite indicators of confidence in each of the single “sectors”. The aggregation scheme is simply the arithmetic average of the balances of answers to specific questions chosen from the full set of questions in each individual survey. The selection of questions is guided by the aim to maximize the coincident correlation of the confidence indicator with a reference series, in the case of consumers with the real expenditure of private households. The composite indicator of consumer confidence is constructed with four out of twelve questions of the EC consumer survey

q2 How do you expect the financial position of your household to change over the next 12 months?

q4 How do you expect the general economic situation in this country to develop over the next 12 months?

q7 How do you expect the number of people unemployed in this country to change over the next 12 months? (The balance on this question enters the composite indicator with inverted sign.)

q11 Over the next 12 months, how likely is it that you save any money?

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<sup>4</sup> For the following and for more details on the Economic Sentiment Indicator see European Commission (2006) and European Commission (2017).

<sup>5</sup> For instance in Germany, the survey comprises about 3800 firms in industry, 3900 in services, 1000 in retail trade and construction, respectively. In the consumer survey 2000 people were asked.

The Commission calculates an overall Economic Sentiment Indicator (ESI) that consists of the 15 individual components of the single confidence indicators (with 20% weight for the consumer components and 40% weight for industry components).

The suitability of the Commission's Economic Sentiment Indicator for monitoring the economy has frequently been tested. A general result is that it is useful for nowcasting (Mourougane and Roma, 2003; Gayer, 2005; Drechsel and Scheufele, 2012), but less so for forecasting economic activity (or consumption spending) in future quarters (Gelper and Croux (2010); for Germany see Hüfner and Schröder (2002)). Moreover, the performance in nowcasting can be improved by applying more sophisticated methods for the selection or weighting of indicators (Gelper and Croux, 2010; Dreger and Kholodinin, 2010). The use of data driven procedures, however, risks losing sight of economic relations that a forecaster might be able to exploit. Such a relation can be found between the question concerning the expectations regarding the consumer's own financial situation (q2) and concerning the general economic situation (q4): if answers differ markedly, the reason might be found in differences between information stemming from private sources and publicly available information. As was shown in section 2, utilizing this difference might make the survey more valuable for forecasting purposes.

## 4 Empirical analysis

This section shows how we test whether a forecast that includes private information inferred from the sentiment survey of the European Commission can outperform alternative specifications. Of course, the assumptions of our stylized model do not perfectly hold in real world economies. In particular, consumers do not represent the whole economy, and there is a lot of heterogeneity among them. Furthermore, consumers are probably not capable to utilize all the information they have access to efficiently. Thus, while the highly stylized model presented above has served as a theoretical motivation, it does not appear suitable for empirical estimation. Instead of trying to estimate the variances of the noise terms  $\eta$ ,  $\rho$  and  $\epsilon$  and, based on these estimates, calculating the non-linear relation between survey results and private information deriving from eq.(8), we utilize the general result of section 2: the weight of private information relative to public knowledge is higher if agents form expectations about their private prospects rather than for the general prospects; therefore a more positive result of the survey concerning prospects for the agents' own economic situation than those concerning the general situation means that private information points to more favourable general prospects than public information does. We test whether forecasts can be improved by using the difference between the two results as an additional explanatory variable. The analysis is based on quarterly seasonally adjusted GDP data of EU member states for which the Commission's survey has been well established for many years.<sup>6</sup> As a benchmark serves a forecast from a quarterly AR-equation.

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<sup>6</sup> Silgoner (2008) pointed out that survey data for new EU members are not as valuable for nowcasting as those for old member states, maybe because of structural breaks or data quality. Therefore, we exclude the Central and Eastern European countries as well as Malta and Cyprus from our analysis.



The AR process in general exhibits positive autocorrelation and therefore can be used to capture public information about the prospect of the economy: good (bad) current conditions are to a certain extent good (bad) news for economic conditions in the near future. While public knowledge about the economy is surely much larger, it is less clear whether additional knowledge is of much use for forecasting. Furthermore, it is difficult to identify indicators that capture this knowledge for all the different economies examined in a non-arbitrary manner. For Germany, however, the ifo index on business expectations is an indicator that is observed by a broader public and that is known to have some forecasting ability (Drechsel and Scheufele, 2012). The ifo institute asks firms whether their business expectations for the next six months are “more favourable”, “unchanged” or “more unfavourable”.<sup>7</sup> The balance of answers to this question is used as an additional bit of public knowledge on the German economy. For the other economies, we add the results of a similar question that the Commission asks in its survey on sentiment in the industrial sector all over the EU. In particular, we consider question q5 of the EC industry survey where firms are asked “How do you expect your production to develop over the next 3 months?”.

For the analysis of the consumer data survey, we consider the balanced answers to survey questions q2 and q4 of the consumer survey during the period 1995 – 2018. Since the survey of the Commission asks consumers for their expectations regarding economic developments during the next 12 months, the target of our forecast analysis is the GDP growth rate 12 months ahead.<sup>8</sup> Taken different volatilities of the time series stemming from different survey questions into account, we standardize the original answers by mean and variance. Furthermore, monthly indicators have to be converted to the quarterly frequency of GDP. In this paper, we use the average monthly value to represent the quarterly value.<sup>9</sup> Given question 2 and question 4 of the EC consumer survey, we calculate the additional information of private information by the diff-measure:

$$\text{diff} = q2 - q4. \tag{9}$$

#### 4.1 Descriptive Statistics

In a first step we analyse the normalized answers of consumer survey questions on expectations regarding the own economic status and on the general economy. As an example, the data for Germany and the Euro Area are shown in Figure 1. Expectations on the own economic status are less cyclical than on the general economic development.

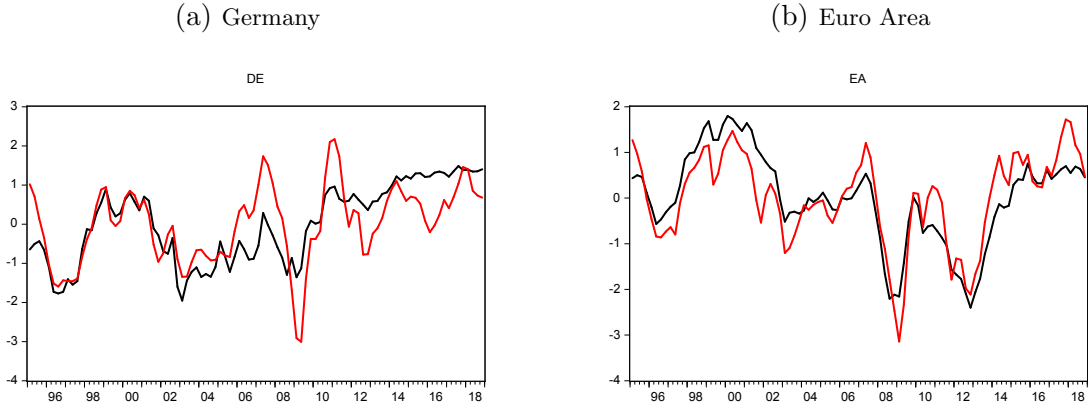
Comparing these survey answers with GDP growth for Germany (Figure 2), we find a clear contemporaneous relationship for both survey questions – although weaker for q2. GDP growth

<sup>7</sup> There is no parallel question on the general economic prospects in the ifo survey.

<sup>8</sup> When participants were asked in e.g. in January, we might assume that they consider the change until December, hence their target quarter is Q4. For answers in March, the target quarter should be Q1 of the next year. Given that we conduct the forecast analysis at the end of the quarter, we assume that if the consumers are asked in quarter  $t$  they refer to  $t + 4$ .

<sup>9</sup> As an alternative to this approach, monthly survey information can be directly employed to forecast GDP growth using a MIDAS approach (Ghysels, Sinko, and Valkanov, 2007).

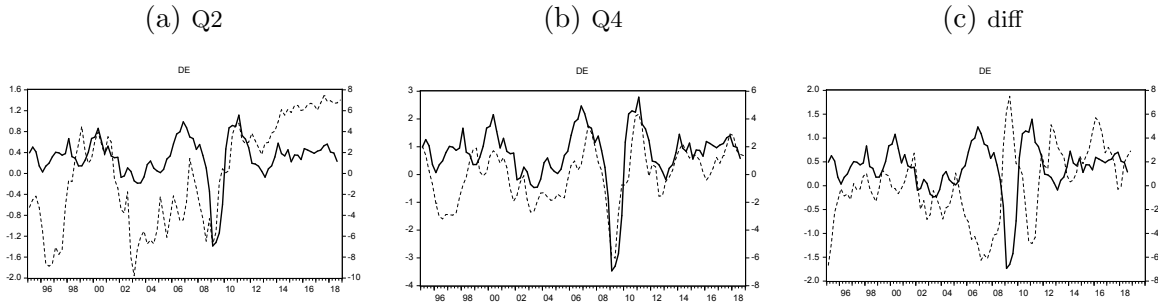
**Figure 1: Expectations regarding own and general economic situation**



*Note:* The black line refers to expectations regarding own economic status, red line to expectations regarding general economy.

is negatively correlated with the contemporaneous diff-measure, but positively correlated with the diff-measure lagged by a few quarters.

**Figure 2: Survey data and GDP**



*Note:* The dotted line refers to the standardised survey questions or the difference between private and public information, left axis; and the solid line to GDP growth (yoy), right axis.

The pattern of the consumer survey indicators is similar for many European countries (see Figure 3 in the Appendix). However, the linkage between GDP and the diff-measure is different (Figure 5). To investigate the relationship between survey data and GDP growth we calculate contemporaneous correlation in various sectors of the economy (Table 3 in the Appendix). Similar to previous finding in the literature (e.g. Gayer, 2005), for the countries under consideration the average correlation between the total ESI and GDP growth is above 0.8.<sup>10</sup> The highest correlation is given for almost all countries between the confidence indicator in the industry sector and GDP – only UK has a substantial different pattern. Correlation between GDP growth and confidence in services or consumer confidence differs across countries. For instance, for Germany the correlation is higher with consumer confidence (0.7) compared to confidence in services (0.5). This finding is not surprising given that the sectoral structures differ from country to country.

<sup>10</sup> Correlation in Denmark and Luxembourg is much weaker.

This paper focuses on the the leading properties of selected consumer survey questions and the proposed diff-measure (Table 4). For Sweden and the UK private information (q2) has a negative relationship with GDP growth and hence probably does not contain useful information for GDP forecasts. The diff-measure has a negative correlation with future GDP growth for Denmark, Greece, Netherlands, Portugal and Finland. In line with our theoretical concept are positive correlations between the diff-measure and future GDP growth. These can be found for the Euro Area aggregate, Belgium, Germany, Spain, France, Italy, Luxembourg and Austria. Apparently these are either countries that are relatively large or economies (Belgium, Luxembourg, Austria) that are very closely linked to large neighbouring countries. It seems plausible that for these cases the business cycle is formed to a larger degree by domestic factors (as opposed to external ones), and that the private information agents get from their close environment is more important than it is the case for economies that are more open to external shocks. Hence, there is some evidence that the diff-measure might indeed help predicting GDP growth in these countries.

## 4.2 Forecasting Analysis

Section 2 argued from a theoretical viewpoint that the diff-measure might improve a forecast that already includes public information. A straightforward way to model public information is to use an AR equation, the usual benchmark in forecasting. Given the fact that the survey questions reach 12 months into the future the natural target is year-on-year GDP growth ( $y_t$ ),<sup>11</sup> with the number of optimal lags  $p$  determined by AIC criteria:

$$y_t^{yoy} = \alpha + \sum_{i=1}^p \beta_i y_{t-i}^{yoy} + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon), \quad (10)$$

For instance, in 2017Q1 we would like to forecast one year ahead, hence GDP growth for 2018Q1 compared to 2017Q1.<sup>12</sup> Because forecasts for quarter-to-quarter growth tend to be more precise than direct year-on-year forecasts, we forecast in a first step quarter-on-quarter  $\hat{y}_{t+k}^{qoq}$  similar to eq.(10) until  $t+4$  and in a second step calculate the corresponding forecast value for year-on-year growth for  $\hat{y}_{t+4}^{yoy}$ . This provides us our benchmark forecast.

Next we assess the forecast for individual indicators  $x^j$ , i.e. the diff-measure and the two individual survey answers (q2 and q4), taken into account the expectations character of the survey by 12 months.

$$y_t = \alpha + \sum_{i=4}^q \gamma_i x_{t-i}^j + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon), \quad (11)$$

<sup>11</sup> Note that the labels do not coincide with the labels in the previous section.

<sup>12</sup> Given that survey data is only slightly revised (due to seasonal adjustment procedures), we refer to a pseudo real-time environment. We assume that the forecaster knows the value of the previous quarter – in this example 2016Q4. This means the analysis is executed by the end of the quarter.

Similarly, we analyse business survey indicators, such as answers to ifo survey in Germany or the EC industry survey. Finally, we merge eq.(10) and eq.(11) to

$$y_t = \alpha + \sum_{i=1}^p \beta_i y_{t-i} + \sum_{i=4}^q \gamma_i x_{t-i}^j + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon), \quad (12)$$

and consider indicators and the forecast based on quarter-on-quarter estimates jointly. As an alternative, single indicator-based forecasts can be combined by several weighting criteria to a pooled forecast.

Given that the financial crisis has heavily affected economic growth – with quarterly growth rates in the euro area compared to the previous quarter in 2008q4 and 2009q1 of -1.7% and -3.0%, respectively – and has huge impact on estimation parameters, we set a dummy variable for both quarters.

Based on an in-sample forecast evaluation, the estimation sample covers the period 1995q1 – 2018q3. For our analysis, the one-year ahead forecast is the relevant target. Given that the lags of the estimation parameters are optimized we start our assessment in the period 1997q1. To analyse the forecast performance of our models, we examine the forecast errors for the specified period and measure the forecast quality by means of standard mean squared loss functions. We judge our survey-based forecast  $\hat{y}_{i,t+h|t}$  relative to the corresponding AR forecast  $\hat{y}_{AR,t+h|t}$  over the  $k$  evaluation periods, calculating the relative loss

$$relative\ RMSFE = \frac{\sqrt{\sum_{t=1}^k (y_{t+h} - \hat{y}_{i,t+h|t})^2}}{\sqrt{\sum_{t=1}^k (y_{t+h} - \hat{y}_{AR,t+h|t})^2}} = \frac{\sqrt{\sum_{t=1}^k (\hat{\varepsilon}_{i,t+h})^2}}{\sqrt{\sum_{t=1}^k (\hat{\varepsilon}_{AR,t+h})^2}}, \quad (13)$$

and test whether the forecast differences are significant. Given the squared loss function, the corresponding null hypothesis of each model can be expressed as

$$H_0 : E[L_t] = E[(y_t - \hat{y}_t)^2 - (y_t - \hat{y}_t^{AR})^2] = 0, \quad (14)$$

where  $L_t$  is the loss differential of the time series. To test this hypothesis we follow the modification of the Diebold-Mariano test of equal predictive ability (Diebold and Mariano, 1995) proposed by Harvey, Leybourne, and Newbold (1997) based on small-sample bias corrected variance calculations.

## 5 Results

The forecasting experiment shows that our approach as it is formalized in eq.(12) works well for Germany, Belgium, and Luxembourg, and quite satisfactory for the Euro Area, France and Austria. Results are mixed for Spain and Italy, and, as was already suggested by the correlation matrix, negative for the UK, the Netherlands, Denmark, Portugal, and Greece. This assessment is based on the following criteria: has the estimated coefficient for the diff-variable the correct sign, and is it significant? Does the forecast perform significantly better than the AR-benchmark? Finally, does it perform better than alternative equations that include the balances of q2 and q4? The answers to these questions are all yes for Germany, Belgium and Luxembourg.

**Table 1: Estimation Results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Diff (-4)	0.391013	0.203308	1.923251	0.0577
business expectations (-4)	0.247576	0.159909	1.548226	0.1252
GDP qoq forecast	1.047061	0.074154	14.12005	0.0000
R-squared	0.599105	Mean dependent var		1.466663
Adjusted R-squared	0.589993	S.D. dependent var		2.096865
S.E. of regression	1.342660	Akaike info criterion		3.459593
Sum squared resid	158.6407	Schwarz criterion		3.542369
Log likelihood	-154.4115	Hannan-Quinn criter.		3.492988
Durbin-Watson stat	0.347799	observations		91

*Note:* Dependent variable: German GDP growth (yoy), least squares estimation for sample 1996–2018.

Focusing on Germany, Table 1 indicates a positive and significant coefficient for the diff-measure. Furthermore, the forecast performance of the survey-based models compared to the benchmark model is provided in Table 2. The lagged ifo business expectations improve the forecast performance to the standard model; but only if we take into account the information from the diff-measure in addition to the public knowledge the performance can be significantly improved. The performance using individual consumer questions q2 and q4 are also better than using the industry survey alone, however, they cannot beat the results of the suggested diff-measure. Interestingly, all the models analysed are more optimistic than the benchmark forecast.

Results for Belgium and Luxembourg are similar. For the Euro Area, France, and Austria, our criteria are fulfilled as well, with the exception of the last one: the equation with q2 renders an even lower RMSFE than that with diff. This holds also true for Spain and Italy. In these two cases, the coefficient of diff-measure is insignificant, but the performance is significantly improved if various lag lengths (larger than 4) are taken into account. This is shown in Table 5 in the Appendix, where the forecast evaluation results for all European economies examined are provided. This table also shows that, with the exception of Greece, the benchmark model is superior to an AR-model with year-on-year (instead of quarterly) growth rates.

**Table 2: Forecast Evaluation Germany**

Forecast model	MFE	MAFE	RMSFE	relative RMSFE	obs
Benchmark	-0.06	1.087	1.393		87
AR yoy forecast	0.012	1.297	1.837	1.318	87
ind.survey + GDP qoq forecast	0.054	1.082	1.375	0.987	87
ind.survey + GDP qoq forecast + Diff	0.017	1.071	1.347	0.967**	87
ind.survey + GDP qoq forecast + Q2	0.052	1.081	1.375	0.987	87
ind.survey + GDP qoq forecast + Q4	0.044	1.081	1.355	0.973	87

*Note:* Evaluation period 1997–2018 for quarterly German GDP compared to same quarter of the previous year. Relative RMSFEs are compared to the benchmark model in the first row. For Germany ifo business expectations 6 month ahead are used as industry survey.

## 6 Conclusion

We argued that surveys would be a more valuable source of information if the aggregate of private information that affects the survey results could be separated from information agents get from publicly available sources. We proposed a simple procedure to disentangle private information from public knowledge for surveys that are structured like that of the European Commission’s (EC) on consumer sentiment. Utilizing the fact that this survey asks agents how they assess their own as well as the general economic prospects we showed that the weight rational agents give to their private information is higher for their assessment of their own prospects than for their assessment of the general economic prospects of the economy. In this case, the indicator representing private information is simply a linear function of the difference between the assessment of the general prospects and the assessment of the private household’s own economic prospects. Private information extracted from the consumer survey in this way can be used as input for forecasts.

We showed that this method works quite well in practice for some EU economies such as Germany. For others, however, it works less well or not at all. This might be due to quite different reasons: Information agents get from their close environment might be of limited value for economies whose business cycle is largely driven by external shocks. In addition, public information about economic prospects might be less accessible in some countries than in others. If consumers (contrary to our model) do not use public information efficiently, assessments of their own economic prospects might be more informative than those of the general prospects and also more so than the difference between the two assessments. We found that this appears to be the case for quite a few countries. Another potential problem with our approach is that the survey might not be representative for all the private information dispersed in the economy. For example, all consumers have equal weight in the survey, but income shares differ widely.<sup>13</sup>

<sup>13</sup> Das, Kuhnen, and Nagel (2017) show the importance of income levels, socioeconomic status and education for expectations of macroeconomic developments.

Probably even more important is that firms and the public sector are missing in the survey.<sup>14</sup> Mortgage rates, for example, are of high importance for private households, but a bit less so for the rest of the economy. Profits might rise early in an upswing, and only later might employment and wages do so. Thus, if the method of disentangling private information from public knowledge proposed here appears promising, it might be worth asking twin questions for agent specific as well as for general prospects not only to consumers, but to managers as well.

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<sup>14</sup> The reader might recall that the Commission’s survey on firms does not contain the questions appropriate for our approach.

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## Appendix



**Table 3: Contemporaneous correlation with GDP growth**

	EA	BE	DK	DE	EL	ES	FR	IT	LU	NL	AT	PT	FI	SE	UK
Economic sentiment indicator (ESI)	0.877	0.821	0.499	0.796	0.873	0.892	0.838	0.856	0.525	0.911	0.879	0.892	0.743	0.7	0.673
Consumer confidence indicator	0.808	0.595	0.419	0.682	0.781	0.788	0.702	0.547	0.419	0.84	0.662	0.782	0.642	0.539	0.609
Construction confidence indicator	0.544	0.445	0.647	0.233	0.742	0.731	0.436	0.422	0.231	0.725	0.188	0.788	0.718	0.23	0.632
Industry confidence indicator	0.786	0.758	0.449	0.798	0.86	0.854	0.867	0.896	0.517	0.866	0.834	0.844	0.755	0.68	0.42
Retail trade confidence indicator	0.569	0.666	0.266	0.526	0.802	0.642	0.546	0.21	NA	0.802	0.37	0.92	0.344	0.676	0.487
Services confidence indicator	0.818	0.776	0.437	0.473	0.773	0.889	0.828	0.776	NA	0.83	0.894	0.868	0.749	0.687	0.728

*Note:* Correlation coefficients for the sample 1995–2018 for quarterly GDP compared to same quarter of the previous year.

**Table 4: Cross correlation with GDP growth**

	EA	BE	DK	DE	EL	ES	FR	IT	LU	NL	AT	PT	FI	SE	UK
<b>Question 2</b>															
0	0.71	0.39	0.21	0.34	0.76	0.78	0.59	0.53	0.21	0.72	0.28	0.78	0.50	0.14	-0.03
1	0.76	0.36	0.17	0.34	0.73	0.85	0.59	0.56	0.22	0.68	0.44	0.78	0.55	0.17	-0.06
2	0.75	0.30	0.17	0.32	0.67	0.87	0.56	0.58	0.15	0.61	0.53	0.75	0.52	0.14	-0.11
3	0.68	0.21	0.12	0.25	0.61	0.85	0.49	0.57	0.07	0.50	0.54	0.68	0.43	0.02	-0.17
4	0.56	0.12	0.07	0.16	0.54	0.78	0.40	0.53	0.08	0.40	0.47	0.58	0.27	-0.09	-0.24
5	0.43	0.06	-0.01	0.08	0.49	0.69	0.30	0.48	0.04	0.27	0.33	0.47	0.12	-0.21	-0.32
6	0.29	0.00	-0.13	-0.01	0.46	0.61	0.19	0.41	0.03	0.15	0.16	0.37	-0.02	-0.32	-0.35
7	0.17	-0.03	-0.18	-0.09	0.43	0.53	0.09	0.33	0.04	0.04	-0.04	0.27	-0.13	-0.35	-0.37
8	0.09	-0.07	-0.21	-0.12	0.41	0.48	0.03	0.23	0.02	-0.03	-0.20	0.19	-0.19	-0.36	-0.38
<b>Question 4</b>															
0	0.74	0.27	-0.07	0.71	0.75	0.70	0.66	0.37	0.50	0.55	0.65	0.79	0.41	0.36	0.12
1	0.80	0.30	0.06	0.66	0.73	0.77	0.66	0.44	0.46	0.65	0.70	0.80	0.59	0.54	0.25
2	0.74	0.24	0.19	0.47	0.68	0.80	0.57	0.47	0.26	0.68	0.62	0.77	0.68	0.57	0.30
3	0.59	0.14	0.24	0.21	0.61	0.78	0.44	0.49	0.02	0.65	0.44	0.72	0.67	0.49	0.29
4	0.42	0.01	0.25	-0.03	0.56	0.73	0.30	0.49	-0.17	0.57	0.24	0.63	0.61	0.33	0.22
5	0.25	-0.08	0.19	-0.22	0.52	0.66	0.16	0.46	-0.33	0.44	0.03	0.54	0.49	0.11	0.12
6	0.10	-0.15	0.09	-0.35	0.50	0.59	0.03	0.43	-0.38	0.30	-0.16	0.47	0.36	-0.10	0.02
7	-0.03	-0.19	0.01	-0.43	0.48	0.54	-0.05	0.35	-0.33	0.16	-0.32	0.39	0.24	-0.24	-0.07
8	-0.10	-0.23	-0.04	-0.43	0.47	0.50	-0.09	0.25	-0.23	0.03	-0.42	0.33	0.16	-0.34	-0.13
<b>diff-measure</b>															
0	-0.02	0.15	0.20	-0.48	0.05	0.27	-0.10	0.26	-0.35	0.17	-0.47	-0.02	0.07	-0.20	-0.14
1	-0.03	0.09	0.07	-0.42	0.03	0.24	-0.09	0.20	-0.29	0.03	-0.38	-0.04	-0.05	-0.32	-0.27
2	0.05	0.07	-0.03	-0.20	-0.02	0.23	-0.02	0.19	-0.14	-0.07	-0.20	-0.06	-0.14	-0.38	-0.36
3	0.17	0.09	-0.11	0.06	-0.02	0.21	0.08	0.15	0.06	-0.14	0.03	-0.09	-0.22	-0.42	-0.40
4	0.27	0.13	-0.16	0.26	-0.06	0.18	0.16	0.09	0.29	-0.17	0.19	-0.13	-0.30	-0.36	-0.40
5	0.33	0.16	-0.17	0.39	-0.12	0.12	0.21	0.05	0.44	-0.17	0.29	-0.19	-0.32	-0.28	-0.38
6	0.35	0.18	-0.16	0.45	-0.15	0.05	0.23	0.00	0.49	-0.15	0.35	-0.26	-0.33	-0.20	-0.32
7	0.37	0.19	-0.14	0.44	-0.21	-0.01	0.21	-0.01	0.44	-0.12	0.33	-0.32	-0.33	-0.09	-0.26
8	0.35	0.19	-0.11	0.41	-0.26	-0.06	0.18	-0.02	0.30	-0.06	0.28	-0.37	-0.30	-0.02	-0.21

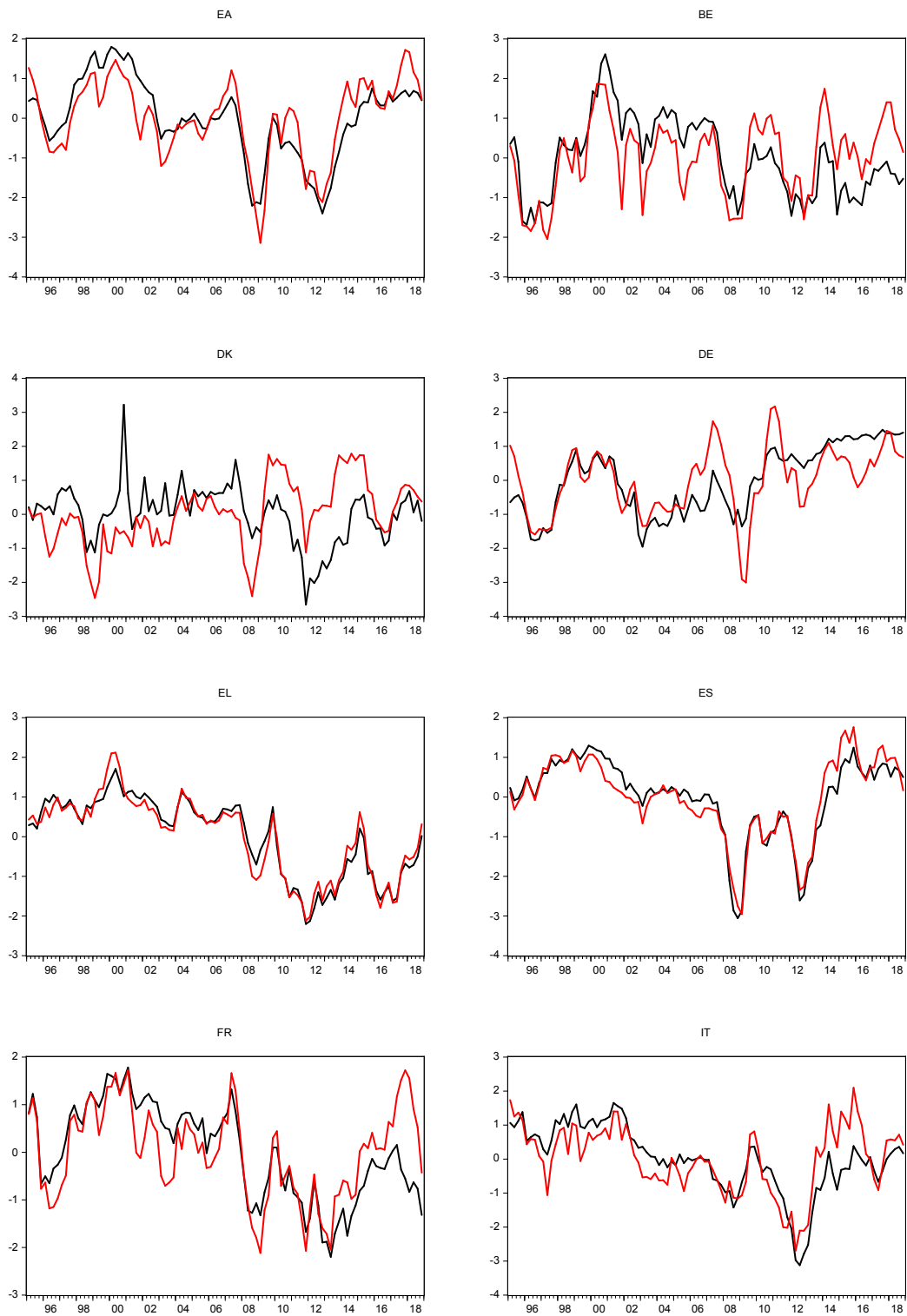
*Note:* Correlation coefficients for the sample 1995–2018 for quarterly GDP compared to same quarter of the previous year at various lags with questions and diff-measure.

Table 5: Forecast Evaluation

Forecast model	EA	BE	DK	DE	EL	ES	FR	IT	LU	NL	AT	PT	FI	SE	UK
Benchmark	1.384	1.245	1.480	1.393	3.253	1.592	1.103	1.653	2.891	1.367	1.327	1.890	1.653	1.653	1.388
AR yoy forecast	1.231	1.217	1.382	1.318	0.942	1.215	1.256	1.243	1.222	1.355	1.252	1.125	NA	NA	1.302
ind.survey (Q5)	0.97	0.998	0.985	0.987	0.894*	0.997	0.963*	0.943*	0.992	0.999	1.005	0.985	NA*	NA*	0.984
Diff (various lags)	0.922**	0.944**	0.986	0.946*	0.962	0.963*	0.926**	0.936*	0.752***	0.977*	0.974*	0.91**	NA*	NA*	0.913**
Q2 (various lags)	0.804***	0.982	0.98	0.96*	0.956*	0.906*	0.93**	0.817***	0.899	0.965**	0.914**	0.884**	NA***	NA***	0.903***
Q4 (various lags)	0.893***	0.982	0.981	0.931*	0.938*	0.943	0.971	0.833***	0.812**	0.937**	0.943**	0.879**	NA***	NA***	0.962
Diff + ind.survey(Q5)	0.903**	0.951**	0.985	0.967**	0.893*	0.989	0.929**	0.942*	0.875*	0.979*	0.975*	0.964*	NA*	NA*	0.911**
Q2 + ind.survey(Q5)	0.838***	0.983	0.983	0.987	0.889*	0.941	0.892**	0.78***	0.906	0.993	0.951*	0.932*	NA***	NA***	0.928***
Q4 + ind.survey(Q5)	0.884**	0.994	0.983	0.973	0.89*	0.966	0.932**	0.827***	0.889*	0.906***	0.992	0.86**	NA***	NA***	0.98

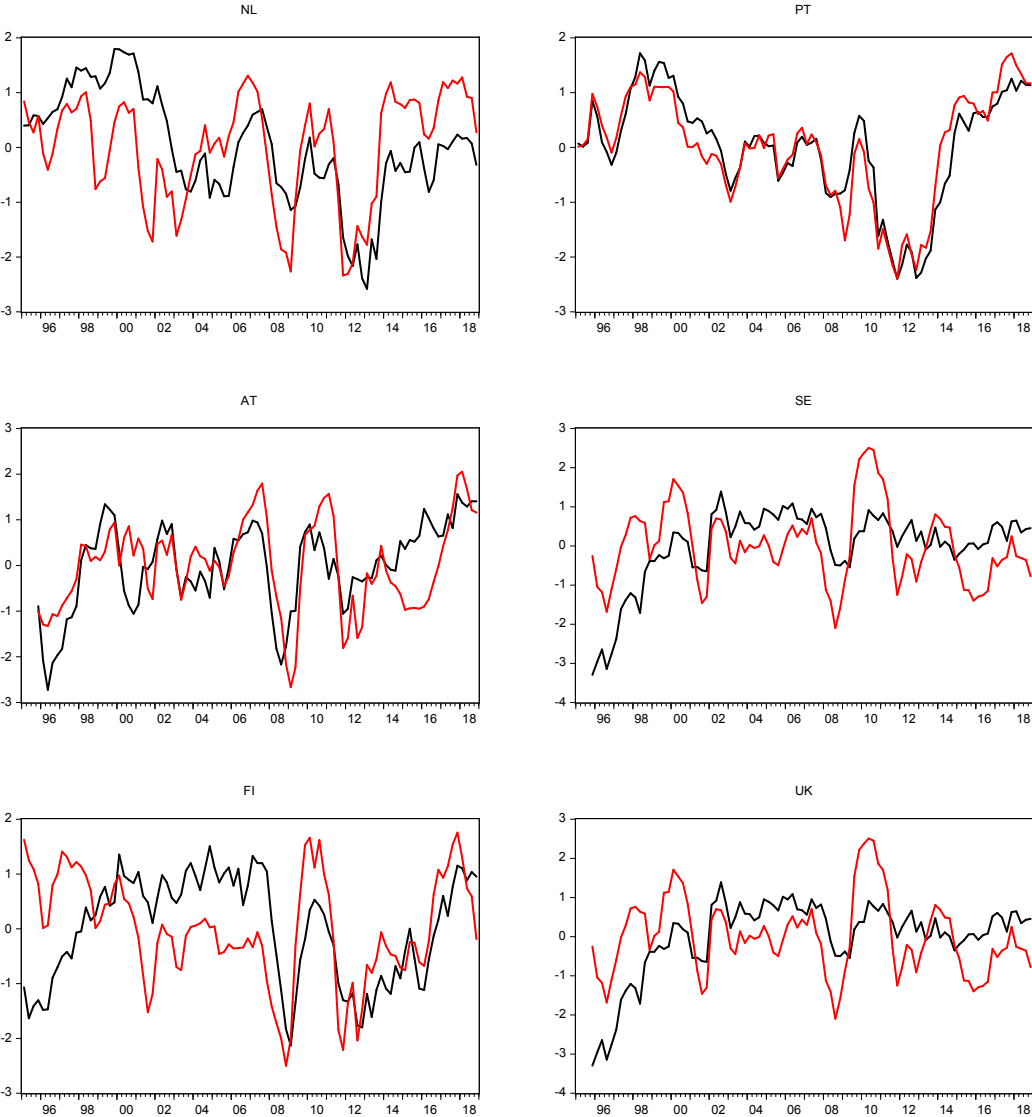
Note: Evaluation period 1997–2018 for quarterly GDP compared to same quarter of the previous year. Relative RMSEs are compared to the benchmark model in the first row. For Germany ifo business expectations 6 month ahead are used as industry survey, otherwise EC industry survey, q5.

**Figure 3: Expectations regarding own and general economic situation**



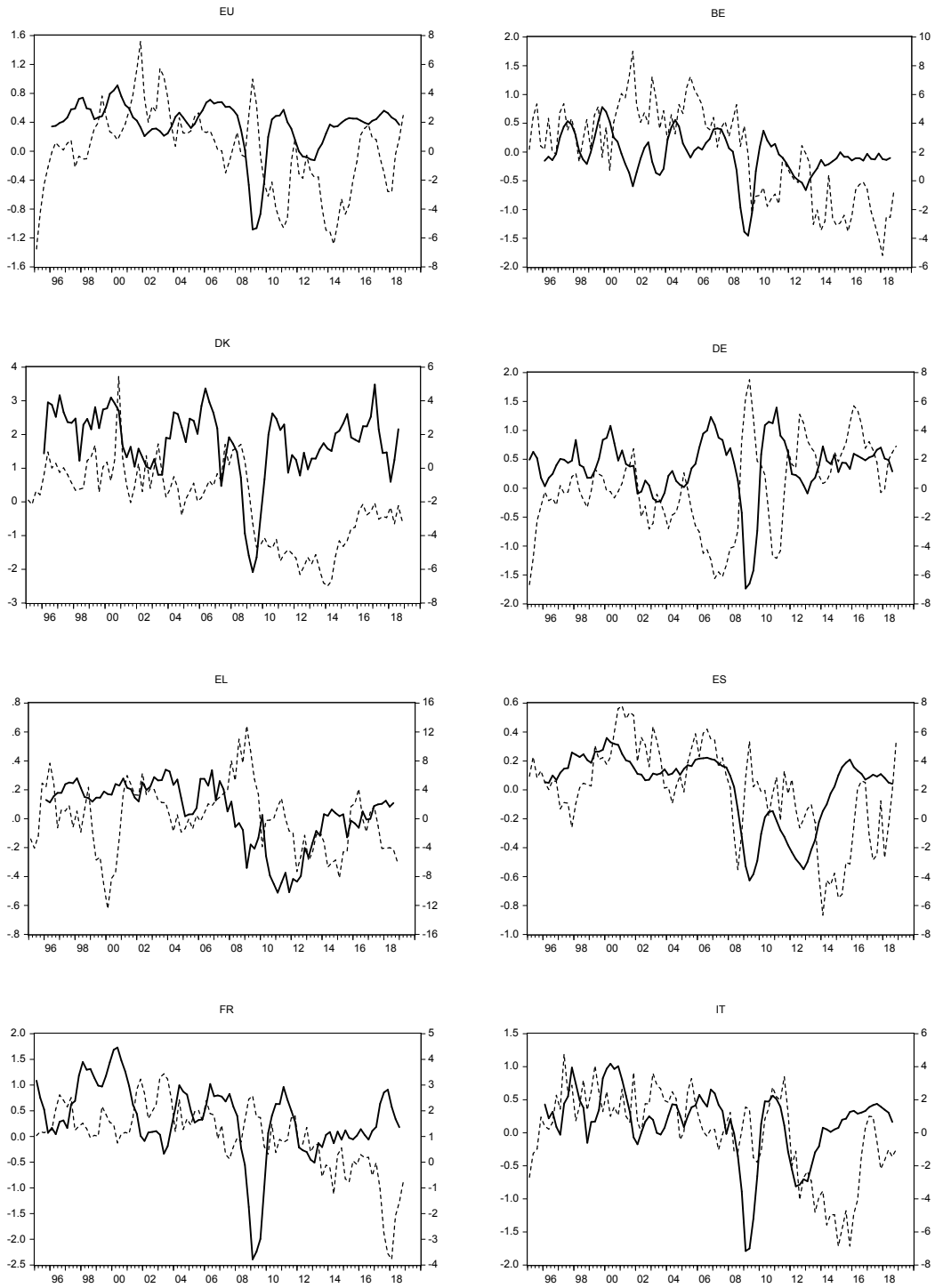
*Note:* Black line – expectations regarding own financial status; red line – expectations regarding general economy. Both indicators are normalized.

**Figure 4: Expectations regarding own and general economic situation (cont.)**



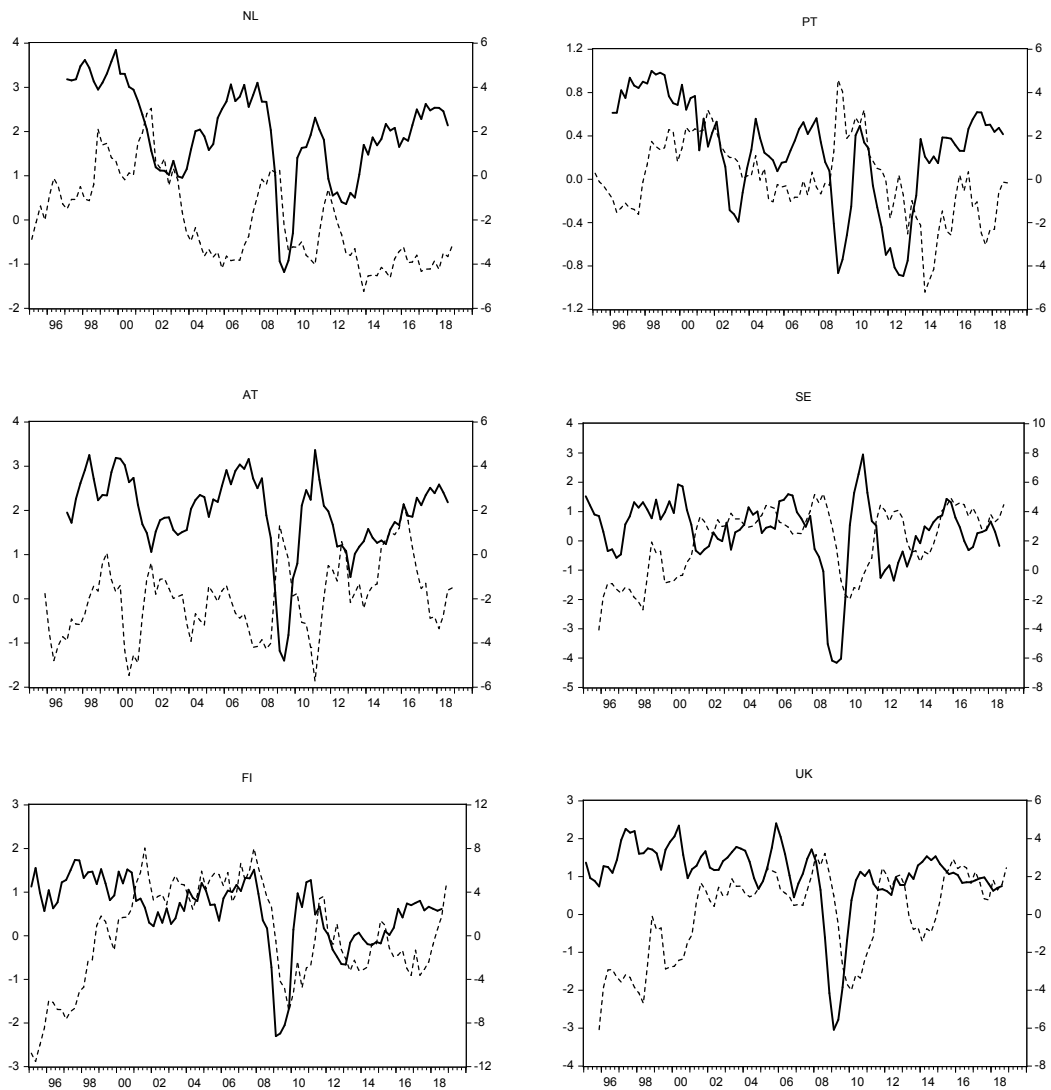
*Note:* Black line – expectations regarding own financial status; red line – expectations regarding general economy. Both indicators are normalized.

Figure 5: Differences and GDP



Note: Dotted line – Difference between balance of answers to question on own economic state and answers to question on general economic state (lagged by 4 quarters), left axis; Solid line – GDP growth yoy, right axis.

Figure 6: Differences and GDP (cont.)



*Note:* Dotted line – Difference between balance of answers to question on own economic state and answers to question on general economic state (lagged by 4 quarters), left axis; Solid line – GDP growth yoy, right axis.