UNIVERSITY OF CYPRUS
ECONOMICS RESEARCH CENTRE

Economic Analysis Papers

The role of survey data in the construction of short-term GDP growth forecasts

Christos Papamichael
Economics Research Centre

Nicoletta Pashourtidou
Economics Research Centre

No. 05-16

September 2016

Publication Editor: Christos Koutsampelas

ERC Sponsors (in alphabetical order)

Central Bank of Cyprus

Directorate General for European Programmes, Coordination and Development

Economics Department, University of Cyprus

Ministry of Finance

Ministry of Labour, Welfare and Social Insurance

University of Cyprus

The role of survey data in the construction of short-term GDP growth forecasts*

C. Papamichael and N. Pashourtidou

Executive Summary

The aim of this paper is to investigate the role of Business and Consumer Survey (BCS) data published by the European Commission, in the construction of short-term GDP growth forecasts. A pseudo out-of-sample forecasting exercise is conducted in which the availability of data mimics real-time releases. A sequence of GDP growth estimates is computed starting 5-5.5 months prior to the publication of GDP growth and ending about 10 days before the release of the actual figure. The focus of the analysis is on Cyprus and some of its key trading partners, namely the European Union, the euro area, the United Kingdom and Greece. Due to the openness of the Cypriot economy, timely information on the expected economic performance of Cyprus's main trading partners is crucial to the assessment of domestic prospects and challenges.

The pseudo out-of-sample forecasts are constructed over the period 2006q2-2015q3. Therefore, the evaluation of the BCS data covers a turbulent period for both the domestic and the European economy. The analysis for Cyprus reveals that the use of survey data improves the accuracy of GDP growth estimates, but the forecasting gains are not always statistically significant. The improvements in forecast accuracy from the use of survey data are larger and more significant for the euro area, the European Union and Greece compared to those for Cyprus, while survey predictors were not found to enhance the precision of GDP growth estimates for the United Kingdom. Thus, the BCS indicators for the European Union and the euro area as a whole, as well as for Greece, can be used by practitioners in order to extract reliable signals for the short-term growth prospects of these economies and identify risks to the outlook for the Cypriot economy. The BCS data for Cyprus resulted in large forecasting gains over the benchmark during the international financial crisis and its aftermath and predicted the depth of the recession in 2009 and 2013 fairly accurately. Nevertheless, the relative benefits from the use of survey data began diminishing at the onset of the domestic economic crisis. The analysis also shows that survey information correctly signalled the moderation of the recession in Cyprus in 2013 - 2014.

The BCS data provide early and useful information for monitoring movements in economic activity, enabling policy-makers to react timely. However, additional domestic and foreign leading indicators should also be employed to gain even more reliable and complete insight into the outlook for the Cypriot economy.

* The Economics Research Centre of the University of Cyprus acknowledges funding from the European Commission and the Ministry of Finance for conducting the Business and Consumer Survey Project in Cyprus. This paper reflects only the authors' views and the European Commission is not responsible for any use that may be made of the information it contains.

CONTENTS

Ο ρόλος των στοιχείων Ερευνών Οικονομικής Συγκυρίας στην πρόβλεψη του ρυθμού μεταβολής του ΑΕΠ

ΠΕΡΙΛΗΨΗ

Σκοπός του δοκιμίου είναι η διερεύνηση του ρόλου των στοιχείων από τις Έρευνες Οικονομικής Συγκυρίας (ΕΟΣ), που δημοσιεύονται από την Ευρωπαϊκή Επιτροπή, στην κατασκευή βραχυπρόθεσμων προβλέψεων για τον ρυθμό μεταβολής του ΑΕΠ. Κατά την αξιολόγηση της ικανότητας πρόβλεψης των στοιχείων από τις ΕΟΣ προσομοιώνεται η ροή των δεδομένων, δηλαδή όπως αυτά δημοσιεύονται σε πραγματικό χρόνο. Κατασκευάζεται μια σειρά από προβλέψεις για τον ρυθμό μεταβολής του ΑΕΠ, με την πρώτη εκτίμηση να γίνεται 5-5,5 μήνες πριν από τη δημοσίευση του ρυθμού ανάπτυξης και την τελευταία να υπολογίζεται 10 περίπου ημέρες πριν από τη δημοσίευση των επίσημων στοιχείων. Η ανάλυση επικεντρώνεται στην Κύπρο αλλά και σε ορισμένους βασικούς εμπορικούς εταίρους της όπως η Ευρωπαϊκή Ένωση, η ευρωζώνη, το Ηνωμένο Βασίλειο και η Ελλάδα. Λόγω του μεγάλου βαθμού επηρεασμού της κυπριακής οικονομίας από εξωγενείς παράγοντες, έγκαιρη πληροφόρηση για την πορεία των οικονομιών των εμπορικών της εταίρων είναι εξαιρετικά χρήσιμη στην αξιολόγηση των εγχώριων προοπτικών.

Οι προβλέψεις κατασκευάζονται για την περίοδο 2006 (2ο τρίμηνο) – 2015 (3ο τρίμηνο). Άρα, η αξιολόγηση των στοιχείων από τις ΕΟΣ καλύπτει μια ταραχώδη περίοδο για την εγχώρια και την ευρωπαϊκή οικονομία. Η ανάλυση για την Κύπρο δείχνει ότι η χρήση των στοιχείων από τις Έρευνες βελτιώνει την ακρίβεια των προβλέψεων του ρυθμού ανάπτυξης, αλλά τα οφέλη, σε όρους μειωμένου σφάλματος, δεν είναι πάντα στατιστικά σημαντικά. Η βελτίωση στην ακρίβεια των προβλέψεων από τη χρήση των στοιχείων ΕΟΣ είναι μεγαλύτερη για την ευρωζώνη, την Ευρωπαϊκή Ένωση και την Ελλάδα συγκριτικά με τα αποτελέσματα για την Κύπρο. Αντίθετα, τα στοιχεία των Ερευνών δεν βελτιώνουν την ακρίβεια των προβλέψεων του ρυθμού ανάπτυξης για το Ηνωμένο Βασίλειο. Συνεπώς, οι δείκτες ΕΟΣ για την Ευρωπαϊκή Ένωση, την Ευρωζώνη και την Ελλάδα μπορούν να χρησιμοποιηθούν για την εξαγωγή αξιόπιστων ενδείξεων για τη βραχυπρόθεσμη πορεία αυτών των οικονομιών και για να προσδιοριστούν πιθανοί κίνδυνοι για τις προοπτικές της κυπριακής οικονομίας.

Η χρήση στοιχείων ΕΟΣ της Κύπρου για σκοπούς εκτίμησης του ρυθμού μεταβολής του ΑΕΠ είχε ως αποτέλεσμα (α) ακριβέστερες προβλέψεις, σε σχέση με απλά μοντέλα, κατά τη διάρκεια της διεθνούς χρηματοοικονομικής κρίσης και (β) την πρόβλεψη του βάθους της ύφεσης το 2009 και 2013 με αρκετή ακρίβεια. Παρά ταύτα, τα σχετικά οφέλη από τη χρήση των στοιχείων ΕΟΣ ξεκίνησαν να μειώνονται στην αρχή της εγχώριας οικονομικής κρίσης. Η ανάλυση δείχνει, επίσης, ότι οι δείκτες οικονομικής εμπιστοσύνης διέγραψαν ορθά την απάμβλυνση της ύφεσης στην Κύπρο την περίοδο 2013 - 2014, απέτυχαν όμως να προβλέψουν την επιστροφή του θετικού ρυθμού μεταβολής του ΑΕΠ κατά το πρώτο τρίμηνο του 2015.

Τα στοιχεία των ΕΟΣ παρέχουν νωρίς χρήσιμες πληροφορίες για παρακολούθηση των μεταβολών στην οικονομική δραστηριότητα, βοηθώντας τους φορείς χάραξης πολιτικής να λαμβάνουν μέτρα έγκαιρα. Η παρακολούθηση της οικονομίας όμως θα πρέπει να βασίζεται και σε άλλους εγχώριους και ξένους προπορευόμενους δείκτες, ούτως ώστε να διαμορφώνεται ολοκληρωμένη εικόνα για τις προοπτικές της κυπριακής οικονομίας.

1. Introduction

The construction of GDP growth forecasts for the present and the short run constitutes an essential task for Central Banks, governments and other organisations since the official GDP data are published with a considerable delay. Thus, policy decisions, which rely on assessments of current and future economic conditions, render the publication of timely information regarding the state of the economy a vital tool. Such timely information could be in the form of survey-based economic confidence indicators, which could also be employed in the construction of GDP growth forecasts on a monthly basis. Survey data, which cover different sectors of economic activity are typically released at the end of the reference month and therefore could constitute useful predictors of activity growth.

Because of the importance of survey data in assessing the state of the economy, the European Commission runs harmonised monthly surveys in the member states of the European Union (EU) and in the candidate countries, and publishes the country-specific data as well as the results at the EU and euro area (EA) level. The data include aggregate responses to individual survey questions, composite indicators for industry, construction, services and the retail trade sector, a consumer confidence indicator, and an economic sentiment indicator for the economy as a whole (European Commission, 2014).

Although the release of confidence indicators is widely covered by the media and also the evolution of economic sentiment is closely monitored by practitioners, empirical evidence on the information that survey data convey about future aggregate activity is not clear-cut (see e.g. Batchelor and Dua, 1998 and Ludvigson, 2004 for the United States; Al-eyd et al., 2009 for large EU countries and the United States; Claveria et al., 2007 for the EA; Cotsomitis and Kwan, 2006 for European countries). Batchelor and Dua (1998) conclude that the sharp drop in consumer confidence was helpful in predicting the 1991 recession in the United States, but movements in consumer confidence were not found to improve consensus forecasts for other years. Ludvigson (2004) finds that the Michigan and Conference Board Indices of consumer confidence increase modestly the predictive power for consumption growth beyond baseline indicators, such as income, the interest rate, stock market returns and past consumption growth; moreover, the two indices are associated with higher forecasting power than their expectation components. Using data for large European countries and the United States, Al-Eyd et al. (2009) find that the information content of confidence indicators in explaining consumption growth is limited when other macro series are taken into account. Claveria et al. (2007) augment various time series models for EA macroeconomic variables with information from business and consumer surveys and conclude that the inclusion of survey variables in the models leads to statistically significant forecast gains only in a limited number of cases. Cotsomitis and Kwan (2006) examine the ability of different measures of confidence from EU business and consumer surveys to predict real consumption

expenditure across nine EU countries; they conclude that the out-of-sample predictive power of the measures considered is weak.

More recent research, however, stresses the importance of the timeliness of survey information for real-time forecasting, especially for the construction of short-term forecasts, also known as nowcasts. Giannone et al. (2008) advocate the use of large datasets of monthly economic and financial series for updating nowcasts of GDP growth with newly released monthly data within a quarter. Their application for the United States demonstrates that as from the second month of the quarter new releases, including survey data which are released within the month, increase the precision of the GDP growth nowcast. A large monthly dataset of real activity, survey and financial series is employed by Bańbura and Rünstler (2011) for forecasting EA GDP growth; they find an important role for survey data due to their timely availability, while real activity indicators become less relevant once their publication lags are taken into account. Angelini et al. (2011) and Girardi et al. (2014) exploit the information in large monthly datasets, which also contain survey data, and take into consideration asynchronous data releases in the construction of short-term forecasts for EA GDP growth. The aforementioned works that use extensive datasets attain parsimonious model specifications by using factor models, which summarise the information from a large number of series in a small number of common factors, or by combining forecasts from many small models.

The aim of this paper is to investigate the role of business and consumer survey data published by the European Commission in the construction of short-term GDP growth forecasts. A pseudo out-of-sample forecasting exercise is conducted in which the availability of data mimics real-time releases, and GDP growth forecasts are updated at the beginning of each month, i.e. right after the publication of the European survey data at the end of the previous month. At the beginning of each month two forecasts are computed: one for the previous (backcast) and one for the current (nowcast) quarter or one for the current and one for the next quarter, depending on the month (first, second or third) of the quarter when the forecasts are computed. The focus of the analysis is on Cyprus and some of its key trading partners, namely the EU, the EA, the United Kingdom (UK) and Greece. Due to the openness of the Cypriot economy, timely information on the expected economic performance of Cyprus's trading partners is crucial to the assessment of the domestic economic outlook.

In the case of Cyprus, the idea of updating short-term forecasts for GDP and its demand components on a monthly basis, using a large number of monthly variables, is applied in Papamichael et al. (2014) and in Papamichael and Pashourtidou (2014). No evidence of substantial improvements in forecasting performance with the arrival of new monthly information within the quarter is found; however, forecast combinations based on the models' historical performance improve upon the accuracy of the naïve forecasts.

Furthermore, the inclusion of forecasts from models with business and consumer survey predictors in a large pool of forecasts constructed using macroeconomic and financial predictors is not found to increase the precision of combination forecasts in Papamichael et al. (2014).

The paper is organised as follows. Section 2 describes the data and provides some preliminary results. Section 3 describes the methodology used for constructing forecasts for the previous, current or next quarter by utilising monthly information, prior to the release of the GDP growth flash estimates. Section 4 presents the results of the pseudo out-of-sample forecasting exercise in which the GDP growth forecasts are updated every month with the arrival of new monthly survey data. Section 5 investigates the evolution of the forecasting performance of survey data during the recent crises. Section 6 concludes.

2. Data

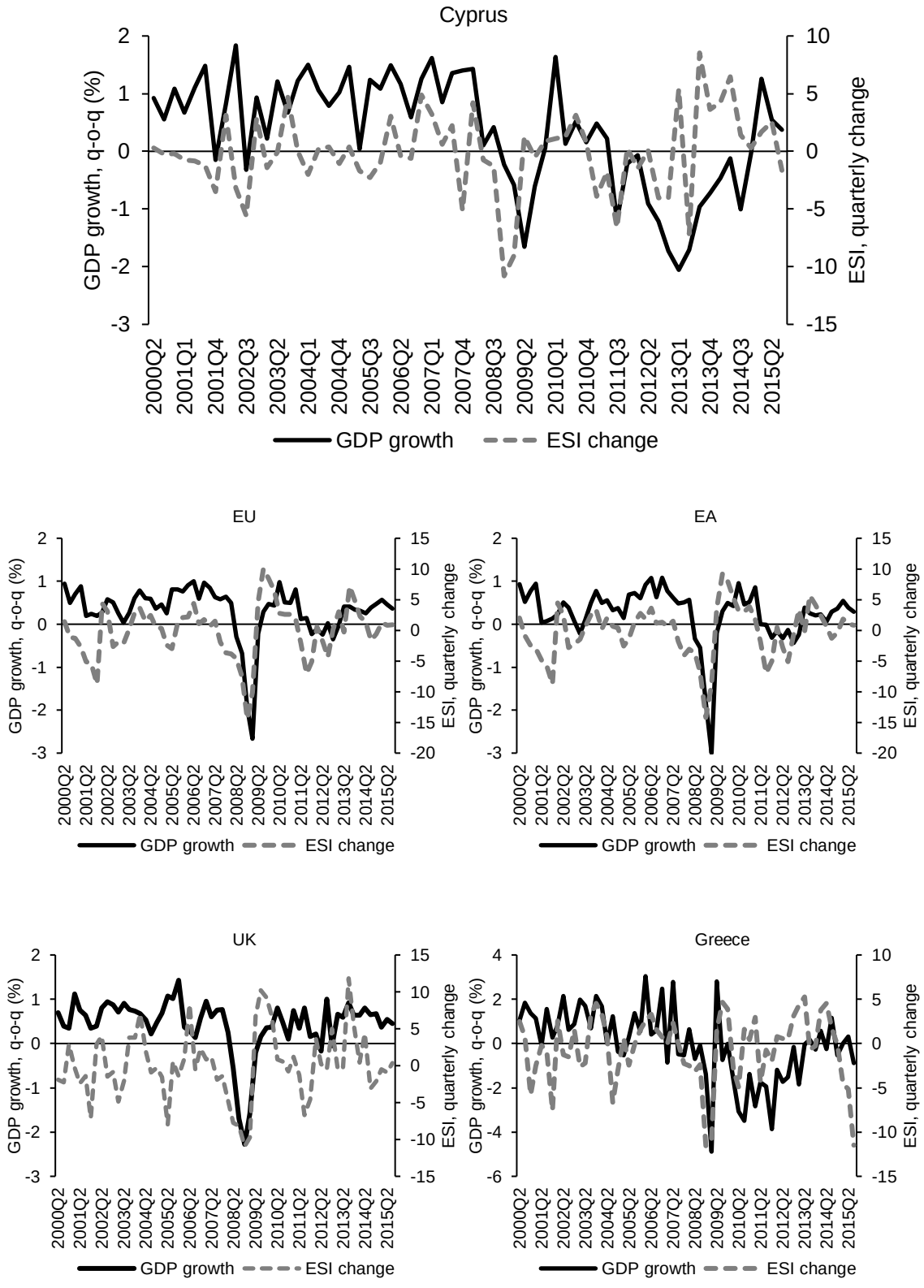
Monthly data from the European Commission's Business and Consumer Surveys (BCS) over the period 2000-2015 and quarterly GDP (constant prices) data over 2000q1-2015q3 for Cyprus, the EU, the EA, the United Kingdom and Greece are used. More specifically, in the analysis we use the Economic Sentiment Indicator (ESI), the composite confidence indicators for industry, construction, services, retail trade and consumers as well as the aggregate responses of firms and consumers to BCS questions. The aggregate responses are in the form of differences between the percentages of optimistic and pessimistic replies.[1]

In the Business Surveys, firms are asked, inter alia, to assess recent trends in the following: production (industry), demand (services), sales (retail trade), building activity (construction), employment (services), order books (industry and construction) and stocks (industry and retail trade). Respondents also state their expectations concerning production (industry), demand (services), sales (retail trade), orders to suppliers (retail trade), selling prices and employment. In the Consumer Survey interviewees are asked, among other things, to state their perceptions and expectations regarding the financial situation of the household, the economic conditions in the country and prices. Consumers also report their expectations concerning unemployment, as well as their intentions to save money and make major purchases in the short term. The business confidence indicators reflect firms' assessments over the past three months and expectations over the next three months; the consumer confidence indicator is based on consumers' expectations over the next 12 months. The overall index, ESI, is composed of all the components of the composite confidence indicators and thus can be viewed as summarising recent and future trends in the economy as a whole.

[1] All variables are seasonally adjusted and transformed into stationary series.

Figure 1 plots the percentage changes of real GDP compared to the previous quarter (q-o-q) together with the quarterly changes of the ESI. For the largest part of the period shown, there is a similarity between fluctuations in economic sentiment and changes in activity.

Figure 1: GDP growth and ESI changes



At the onset of the global financial crisis, economic sentiment declined prior to or at the same time as GDP. The largest drop in the sentiment index was registered in the final quarter of 2008 but the largest quarterly GDP decline over 2008-2009 was experienced first in the UK (2008q4), then in the EU and in the EA including Greece (2009q1) and finally in Cyprus (2009q2). The heightened uncertainty triggered by the financial crisis led to increased variability in GDP growth and economic sentiment. The debt crisis in 2010-2013 that affected the EA, mostly Greece, is well reflected in the movements of the ESI in all cases, although the evolution of real output differs. Real GDP in the EA was contracting (q-o-q) over the period 2011q2-2013q1; the recession in Greece continued after the end of the downturn in the EA, while the recession in Cyprus deepened later. Real output growth in the EU turned negative in 2011q4-2012q2 and again in 2012q4-2013q1, while activity in the UK was expanding albeit rather irregularly. The economic sentiment in Cyprus recovered rather quickly after it had troughed in 2013q2, indicating the easing of the recession. The increase in economic and political uncertainty in Greece at the end of 2014 and in 2015 is depicted by the consecutive declines in the country's economic sentiment. The rise in uncertainty in Greece had a limited effect on economic confidence in Cyprus and no impact on the EA-wide ESI.

Table 1 shows the correlation coefficient between GDP growth (q-o-q) and the quarterly ESI changes at different lags of the ESI changes, for two sub-sample periods, before 2008 and from 2008 onwards, as well as for the full sample period. Prior to 2008 the linear relation between the two indicators was rather weak. The correlation coefficient is significant only for the EU and the EA, with some evidence of sentiment's leading and coinciding properties with respect to GDP growth.

Table 1: Correlation coefficient between GDP growth and ESI changes

	ESI changes lagged by:				
	4 quarters	3 quarters	2 quarters	1 quarter	0 quarters
2000-2007					
Cyprus	0.07	0.20	0.03	0.26	0.28
EU	-0.03	0.06	0.31*	0.46*	0.49*
EA	0.04	0.15	0.40*	0.46*	0.47*
UK	-0.03	-0.08	-0.37*	-0.11	-0.22
Greece	-0.03	-0.21	0.03	0.26	0.19
2008-2015					
Cyprus	0.03	0.25	0.36*	0.15	0.17
EU	0.27	0.37*	0.53*	0.74*	0.69*
EA	0.23	0.32*	0.50*	0.76*	0.68*
UK	0.25	0.39*	0.57*	0.58*	0.54*
Greece	0.04	-0.01	-0.05	0.18	0.30*
2000-2015					
Cyprus	0.03	0.20	0.24*	0.16	0.15
EU	0.21	0.30*	0.46*	0.63*	0.58*
EA	0.18	0.27*	0.45*	0.64*	0.57*
UK	0.18	0.27*	0.36*	0.41*	0.36*
Greece	0.01	-0.06	0.00	0.20	0.27*

Note: The symbol * denotes statistical significance at 10% level.

Over the period 2008-2015, the relation between activity growth and changes in economic sentiment has strengthened and become statistically significant. After 2007, the country blocs (EU and EA) and the UK are associated with the highest correlations between the two series; the corresponding correlation coefficients peak at the first lag, suggesting the ESI changes in the current quarter are strongly linked to the growth rate of GDP in the next quarter. For Cyprus, the correlation is highest at the second lag of the ESI changes, indicating that economic sentiment provides signals for GDP growth as early as two quarters ahead. For Greece, the relation between sentiment movements and GDP growth appears to be contemporaneous. The correlation patterns for the full sample are the same as in the post-2007 period.

Looking at the correlation of sectoral confidence indicators with GDP growth for the full sample period we get an idea of the main drivers of the relation between economic sentiment and growth. For Cyprus, changes in confidence in the sectors of retail trade and industry are more strongly correlated with GDP growth than confidence movements in other sectors; nevertheless after 2007, fluctuations in economic activity have been more closely linked to changes in economic sentiment in services and construction. For the EU and the EA, the confidence indicators for industry and construction are found to track more closely future GDP growth than other confidence indicators. Economic activity movements in the UK are strongly associated with changes in confidence in the construction sector. For Greece, the retail trade and consumer confidence indicators correlate significantly with output growth; the consumer and services confidence indicators have gained further significance after 2007.

Besides the in-sample properties of survey data, it is useful to evaluate their out-of-sample forecasting power for GDP growth, by taking into account the timeliness in their availability.

3. Methodology

The early signs of changes in economic conditions contained in the monthly BCS data can be exploited to construct GDP growth estimates well ahead of the publication of official data. Early GDP growth estimates can be obtained using bridge models that link monthly variables, the publication lag of which is relatively short, with quarterly data, such as GDP growth, which are released much later (e.g. Angelini et al., 2011; Barhoumi et al., 2012).

3.1 Forecasting schedule

The exact form of the forecasting equation and therefore the amount of monthly leading information incorporated in the model depends on the schedule set for the construction of the forecasts. Here, we assume that the computation of early GDP growth estimates is carried out in the first couple of days of each month, i.e. right after the release of monthly BCS data for the previous month. This schedule implies that in each monthly forecast round

in a given quarter Q, the available GDP data that can be used in estimation lag either two quarters or one quarter, with respect to quarter Q. When the forecasts are computed in the first and second month of quarter Q, the available GDP data are two quarters behind quarter Q. When the estimates are computed in the final month of quarter Q, the most recent GDP data cover the previous quarter.[2] Moreover, in each monthly forecast round, the GDP growth estimates are computed for one and two quarters ahead.

Table 2 shows the data availability at the beginning of each month when the growth estimates are constructed, the forecast horizon and the number of months to the official release of the actual GDP growth figure. According to our forecasting schedule, the growth estimates computed in the second month of each quarter and therefore closer to the publication of the actual figure, utilise the greatest amount of BCS information, while the opposite holds for nowcasts and forecasts produced in the final month of the quarter. More specifically, the forecasting schedule has the following features as indicated in Table 2:

(i) In the first couple of days of the *first* month of each quarter we produce GDP growth estimates for the *previous* and the *current* quarter; therefore these estimates are computed at most 1.5 and 4.5 months prior to the publication of GDP growth, respectively.

(ii) The above procedure is repeated in the first couple of days of the *second* month of each quarter when the construction of growth estimates for the *previous* and the *current* quarter precedes the release of GDP growth by at most 0.5 and 3.5 months, respectively.

(iii) Early in the *third* month of the quarter, growth estimates for the *current* and the *next* quarter are computed, thus obtaining nowcasts and forecasts at most 2.5 and 5.5 months prior to the GDP growth announcement, respectively.

This forecasting schedule suggests that we compute six different forecasts (i.e. one in each month) for the growth rate of GDP in a given quarter. The first forecast is produced at most 5.5 months prior to the official release and the last estimate is computed about 10 days before the GDP release. The highlighted rows of Table 2 provide an example of the sequence of the six consecutive forecasts.

[2] This schedule employs the GDP flash estimate published 45 days after the end of the reference quarter as the official release of GDP growth. For the UK, a preliminary flash estimate is available 25 days after the end of the reference quarter; this estimate has been used in the construction of the EU GDP flash estimate published 45 days after the end of the reference quarter (Eurostat, 2003).

Table 2: Forecasting schedule: data availability, forecast horizon and number of months to the release of GDP growth

Quarter i in year Y: Qi(Y)	**Q1(Y)**			**Q2(Y)**			**Q3(Y)**			**Q4(Y)**		
Month j in year Y: Mj(Y)	**M1(Y)**	**M2(Y)**	**M3(Y)**	**M4(Y)**	**M5(Y)**	**M6(Y)**	**M7(Y)**	**M8(Y)**	**M9(Y)**	**M10(Y)**	**M11(Y)**	**M12(Y)**
Data availability when estimates are computed (early in each month)												
GDP, reference quarter i and year Y: Qi(Y)	Q3(Y-1)	Q3(Y-1)	Q4(Y-1)	Q4(Y-1)	Q4(Y-1)	Q1(Y)	Q1(Y)	Q1(Y)	Q2(Y)	Q2(Y)	Q2(Y)	Q3(Y)
BCS data, reference month j and year Y: Mj(Y)	M12(Y-1)	M1(Y)	M2(Y)	M3(Y)	M4(Y)	M5(Y)	M6(Y)	M7(Y)	M8(Y)	M9(Y)	M10(Y)	M11(Y)
GDP growth forecast horizon												
One quarter ahead: quarter forecasted	Previous Q4(Y-1)	Previous Q4(Y-1)	Current Q1(Y)	Previous Q1(Y)	Previous Q1(Y)	Current Q2(Y)	Previous Q2(Y)	Previous Q2(Y)	Current Q3(Y)	Previous Q3(Y)	Previous Q3(Y)	Current Q4(Y)
No. of months to the release of GDP growth (actual figure)[1]	1-1.5	<0.5	2-2.5	1-1.5	<0.5	2-2.5	1-1.5	<0.5	2-2.5	1-1.5	<0.5	2-2.5
Two quarters ahead: quarter forecasted	Current Q1(Y)	Current Q1(Y)	Next Q2(Y)	Current Q2(Y)	Current Q2(Y)	Next Q3(Y)	Current Q3(Y)	Current Q3(Y)	Next Q4(Y)	Current Q4(Y)	Current Q4(Y)	Next Q1(Y+1)
No. of months to the release of GDP growth (actual figure)[1]	4-4.5	3-3.5	5-5.5	4-4.5	3-3.5	5-5.5	4-4.5	3-3.5	5-5.5	4-4.5	3-3.5	5-5.5

Note: [1] The GDP growth release refers to the publication of the flash estimate 45 days after the end of the reference quarter.

3.2 Model

We define $y_{t+h}^{h} = \frac{400}{h}\ln(\frac{Y_{t+h}}{Y_t})$, where Y_t $(t = 1, 2, \dots, T)$ is the quarterly level of real GDP and $h = 1, 2$ shows the forecast horizon in quarters ahead of the latest available GDP data for quarter t; in other words y_{t+h}^{h} gives the annualised growth rate of GDP. Let y_t^Q denote the quarter-on-quarter growth rate of real GDP. Let s_t be a stationary monthly BCS variable such that its quarterly aggregate is denoted by s_t^Q and $s_{t+k}^{M_j}$ represents the monthly values of the indicator observed in the j-th month of quarter $t + k$ $(k > 0)$. The form of the bridge equation depends on the available data during the first couple of days of each month when the forecasts are computed. Thus,

$$y_{t+h}^{h} = a_0 + \sum_{l=0}^{p} \beta_l \, y_{t-l}^{Q} + \sum_{i=0}^{q} \gamma_i \, s_{t+1-i}^{Q} + \mu_1 s_{t+2}^{M_1} + \varepsilon_{t+h}^{Q} \quad (1)$$

$$y_{t+h}^{h} = a_0 + \sum_{l=0}^{p} \beta_l \, y_{t-l}^{Q} + \sum_{i=0}^{q} \gamma_i \, s_{t-i}^{Q} + \mu_1 s_{t+1}^{M_1} + \mu_2 s_{t+1}^{M_2} + \varepsilon_{t+h}^{Q} \quad (2)$$

where ε_{t+h}^{Q} denotes the forecast error.

Equation (1) with the restriction $\mu_1 = 0$ is used when the GDP growth projections are computed in the first month of each quarter (January, April, June and October); these projections cover the previous and the current quarter and are estimated 1-1.5 months and 4-4.5 months prior to the GDP release, respectively. The unrestricted form of equation (1) is employed in the second month of each quarter (February, May, August and November) to update the growth estimates for the previous and the current quarter computed in the previous month by incorporating the maximum possible leading information from survey data. The second forecast round produces GDP growth estimates for the previous quarter some days before the release of the actual figure, as well as nowcasts 3-3.5 months before the flash estimate announcement.

Equation (2) is used for the construction of GDP growth projections for the current and the next quarter in the final month of each quarter (March, June, September and December). The forecast round conducted in the last month of the quarter is associated with the smallest information set since the estimates for the current quarter utilise the most recent survey data within the quarter that cover just the first two months; estimates for the next quarter employ, at best, information on the first two months of the current quarter.

The estimation of the parameters and the selection of the number of lags in (1) and (2) are carried out in a pseudo out-of-sample setup using recursive Ordinary Least Squares and recursive determination of the lag length based on the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). For comparison purposes, we also estimate simple autoregressive models for GDP growth. The forecasts constructed in period t for period $t + h$ are computed using data available up to date t, thus no additional projections for predictors are required; these forecasts are known as 'direct' forecasts (see e.g. Stock and

Watson, 2004, 2008). The choice of the number of lags for predictor s_t^Q is between one and four, whereas for the dependent variable the lag length is between zero and four.

The models are estimated using the first T_0 observations of the sample and the first pseudo out-of-sample forecast is computed in period $t = T_0 + h$. The recursive procedure requires increasing the sample size by one observation, re-estimating the models and computing the forecast in period $t = T_0 + h + 1$. The procedure is repeated up to the end of the sample period T so that the pseudo out-of-sample forecast computed in period $t = T - h$ refers to period T which is the last date for which we have observed data. The h-quarter-ahead forecast for y_{t+h}^h, based on quarterly GDP data up to period t, is given by $\hat{y}_{t+h|t}^h$. Then, the Mean Squared Forecast Error (MSFE) used to evaluate the forecasting performance of each model for horizon h is given by:

$$MSFE = \frac{1}{(T-h)-(T_0+h)+1} \sum_{t=T_{0+h}}^{T-h} (y_{t+h}^h - \hat{y}_{t+h|t}^h)^2 \quad (3)$$

where T here denotes the number of observations in the sample.

Equations (1) and (2) include only one survey indicator (predictor); therefore different bridge equations for y_{t+h}^h can be estimated using alternative survey variables and the resulting forecasts can be combined using some forecast combination method (e.g. Stock and Watson, 2004). Forecast combinations can provide more accurate forecasts by using evidence from all the models considered rather than relying on a specific model (e.g. Stock and Watson, 2004, 2008). Forecast combinations reduce the uncertainty resulting from the specification of individual models due to different sets of predictors, lag structures and modelling approaches.

Given $M > 1$ models and associated forecasts, combination forecasts, denoted by $\hat{F}_{t+h|t}^h$, are weighted averages of individual forecasts where the weights can be fixed or time varying:

$$\hat{F}_{t+h|t}^h = \sum_{i=1}^M w_{i,t}\, \hat{y}_{i,t+h|t}^h \quad (4)$$

where $\hat{y}_{i,t+h|t}^h$ is the $h-$step ahead forecast from model i computed in period t and $w_{i,t}$ is the weight assigned to that forecast. In general the weight $w_{i,t}$ depends on the historical forecasting performance of model i; however, $w_{i,t}$ can be fixed, leading to simple forecast combinations, such as the mean ($w_{i,t} = 1/M$), the median, or some type of trimmed mean. In cases where $w_{i,t}$ depends on the model's past forecasting performance, the resulting combination forecasts are known as discounted MSFE forecasts (Stock and Watson 2004). In particular, the weights can be inversely proportional to the discounted MSFE (or the square of the discounted MSFE) of the individual models, i.e.

$$w_{i,t} = \frac{v_{i,t}}{\sum_{j=1}^M v_{j,t}},$$

or, (5)

$$w_{i,t} = \frac{(v_{i,t})^2}{\sum_{j=1}^{M}(v_{j,t})^2} \quad (6)$$

where $v_{i,t} = [\sum_{s=T_0+h}^{t-h} \delta^{t-h-s}(y_{s+h}^h - \hat{y}_{i,s+h|s}^h)^2]^{-1}$;

δ is the discount factor, so forecast errors made in the distant past are of smaller importance. Thus, larger weights are assigned to forecasts from models with lower MSFE (i.e. better historical forecasting performance).

4. Forecasting performance

We used data for 38 monthly BCS variables, including composite indicators, with the availability pattern shown in Table 2.[3] At the beginning of each monthly forecast round, survey data may capture developments in the economy that have not yet been reflected in the available GDP data. The sample for the forecasting exercise covers the period 2000q1 to 2015q3; monthly BCS data from October to December 2015 are also used. The pseudo out-of-sample forecasts for the growth rate of GDP are constructed over the period 2006q2 – 2015q3.

Table 3 and Table 4 present the results of the forecasting exercise whereby the forecasting performance (forecast error) of models using BCS predictors is compared to that of a simple autoregressive model. According to the forecasting schedule, two GDP growth estimates for a horizon of one quarter and two quarters ahead, are constructed every month, using the latest monthly BCS information. This schedule results in three different sets of forecast errors for each horizon: one for each month of the quarter. The autoregressive model produces one forecast per quarter, thus the error remains unchanged within a quarter.

Table 3 shows the square root of the MSFE (RMSFE) of models that include (one at a time) the key survey confidence indicators, relative to the RMSFE of an autoregressive model. The results for one-quarter-ahead forecasts computed 0.5-2.5 months prior to the GDP release, are presented in the top panel; the lower panel shows the relative errors for two-quarter-ahead forecasts estimated 3-5.5 months before the GDP release. The relative errors are ordered in columns according to the available information set in each monthly forecast round, starting from that with the most information (first column) and moving towards the round with the least information (third column). The results in the first (second, third) column relate to the forecasts computed less than two weeks (1-1.5 months, 2-2.5 months) before the GDP publication date.

[3] We use current GDP data vintages that might differ from the flash estimate releases. For the EA, Diron (2008) finds that the use of revised as opposed to real-time data in forecasting exercises does not seem to bias the reliability of the assessments.

Table 3: Forecasting performance of key survey indicators[1]

Forecasts estimated early in:	Cyprus			EU			EA			UK			Greece		
	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec
							One quarter ahead								
No. of months to the GDP release	<0.5	1-1.5	2-2.5	<0.5	1-1.5	2-2.5	<0.5	1-1.5	2-2.5	<0.5	1-1.5	2-2.5	<0.5	1-1.5	2-2.5
Autoregressive model (benchmark)[2]	0.93	0.93	0.93	0.50	0.50	0.50	0.59	0.59	0.59	0.54	0.54	0.54	1.83	1.83	1.83
BCS predictors, AIC for lag length selection															
Economic Sentiment Indicator	1.09	1.06	1.00	0.94	0.89	1.00	0.91	0.90	0.91	1.37	1.36	1.14	0.90	0.80*	0.83*
Industry Confidence Indicator	1.10	1.10	1.11	1.01	0.97	0.98	0.95	0.93	0.93	1.28	1.30	1.27	0.91	0.85*	0.80*
Construction Confidence Indicator	1.02	1.01	0.92	1.11	0.97	0.98	0.99	0.98	1.02	1.65	1.51	1.77	1.20	1.15	1.17
Services Confidence Indicator	1.09	1.07	1.06	0.97	1.00	1.05	0.90	0.90	0.93	1.31	1.31	1.21	1.02	0.99	0.98
Retail Trade Confidence Indicator	0.92	0.98	0.96	1.06	1.04	1.05	1.08	1.06	1.05	1.27	1.19	1.20	0.95	0.86	0.91
Consumer Confidence Indicator	1.14	1.11	1.17	1.13	1.02	1.03	1.04	1.11	1.13	1.24	0.97	1.00	1.15	1.13	1.17
BCS predictors, BIC for lag length selection															
Economic Sentiment Indicator	1.09	1.09	1.12	0.94	0.85	0.86	0.89	0.87	0.90	1.29	1.29	1.04	0.87*	0.86*	0.89
Industry Confidence Indicator	1.07	1.12	1.28	0.98	0.87	0.97	0.90	0.85*	0.84*	1.22	1.17	1.20	0.86*	0.81*	0.91
Construction Confidence Indicator	1.05	1.06	1.04	0.97	0.98	0.98	0.98	0.97	0.98	1.63	1.45	1.72	1.18	1.14	1.13
Services Confidence Indicator	1.09	1.08	1.07	0.87*	0.86*	1.02	0.87*	0.86*	0.90	1.16	1.17	1.16	1.04	1.00	1.05
Retail Trade Confidence Indicator	1.08	1.04	1.06	1.04	1.03	0.97	0.99	0.98	1.01	1.26	1.14	1.16	0.93	0.88	0.99
Consumer Confidence Indicator	1.15	1.11	1.17	1.04	0.94	0.96	1.04	1.09	1.09	1.02	0.88	0.88	1.16	1.15	1.19
							Two quarters ahead								
No. of months to the GDP release	3-3.5	4-4.5	5-5.5	3-3.5	4-4.5	5-5.5	3-3.5	4-4.5	5-5.5	3-3.5	4-4.5	5-5.5	3-3.5	4-4.5	5-5.5
Autoregressive model (benchmark)[2]	1.91	1.91	1.91	1.24	1.24	1.24	1.29	1.29	1.29	1.43	1.43	1.43	2.94	2.94	2.94
BCS predictors, AIC for lag length selection															
Economic Sentiment Indicator	0.99	0.95	1.00	0.91	0.90	0.94	0.67*	0.76*	0.82	1.72	1.70	1.95	0.92	0.89	0.91
Industry Confidence Indicator	0.93	0.91	0.95	0.94	1.01	0.83	0.70*	0.78	0.73*	1.68	1.62	1.84	0.94	0.89	0.91
Construction Confidence Indicator	0.85*	0.95	0.95	0.74*	0.77*	0.78	0.89	0.89	0.91	1.56	1.64	1.70	1.02	1.01	1.02
Services Confidence Indicator	1.01	1.00	1.00	0.81	0.86	0.98	0.81	0.89	0.93	1.77	1.76	1.70	0.93	0.94	0.95
Retail Trade Confidence Indicator	0.80*	0.87	0.89	0.97	0.98	1.01	0.81	0.80	0.87	1.70	1.66	1.67	0.78	0.80	0.96
Consumer Confidence Indicator	1.04	1.01	1.08	1.03	0.94	0.96	0.95	0.92	0.92	1.29	1.28	1.36	1.04	1.05	1.04
BCS predictors, BIC for lag length selection															
Economic Sentiment Indicator	1.01	1.03	1.05	0.93	0.94	0.93	0.75*	0.74	0.82	1.57	1.35	1.77	0.88	0.90	0.96
Industry Confidence Indicator	0.94	1.17	1.05	0.93	0.97	0.93	0.80	0.81	0.77*	1.34	1.32	1.70	0.85*	0.86*	0.90
Construction Confidence Indicator	0.89	1.00	1.03	0.74*	0.76*	0.78*	0.86	0.85	0.79*	1.43	1.66	1.66	0.96	0.99	1.02
Services Confidence Indicator	1.02	1.03	1.04	0.93	0.93	1.02	0.79	0.82	0.92	1.68	1.66	1.63	1.05	1.06	1.07
Retail Trade Confidence Indicator	0.91	1.07	1.06	0.99	0.98	1.00	0.80*	0.81	0.86	1.59	1.40	1.55	0.74	0.80	0.94
Consumer Confidence Indicator	1.06	1.04	1.06	1.04	0.99	0.98	0.96	0.92	0.97	1.15	1.16	1.08	1.09	1.03	1.05

Notes: [1] The symbol * denotes statistical significance at 10% level of the modified Diebold-Mariano test of equal forecast accuracy (Diebold and Mariano, 1995; Harvey et al., 1997). The tests compare the forecasts errors from the benchmark model to those from the models with survey variables.

[2] An autoregressive model of order four for Cyprus and Greece; a first order autoregressive model for the EU, the EA and the UK.

For one-quarter-ahead growth forecasts for Cyprus, no statistically significant gains are achieved from the use of any of the key domestic BCS indicators; nevertheless the inclusion of the retail trade confidence indicator in the model seems to improve upon the autoregressive benchmark. Models that include the confidence indicators for retail trade and construction outperform the benchmark in the case of two-quarter-ahead forecasts for Cyprus; however the difference in predictive accuracy is statistically significant only when the estimates are computed 3-3.5 months before the GDP growth release.

The use of the EU services confidence indicator significantly enhances the forecast precision of the simple autoregression when the estimates are calculated at most 1.5 months before the GDP release. For longer horizons, i.e. 3-5.5 months before the GDP growth announcement, the use of the construction confidence indicator is associated with the lowest forecast error.

The accuracy of the EA growth estimates is improved when information in the confidence indicator for industry or services is exploited for forecasting, at most 2.5 months before the publication of GDP. Models that include the ESI or the industry confidence indicator are significantly better than the benchmark for EA growth forecasts estimated 3-5.5 months before the release.

Looking at Cyprus's two key European trading partners, we find that survey indicators provide signals for future GDP growth in Greece, but the autoregressive benchmark beats survey-based forecasts almost uniformly in the case of the UK. The Greek industrial confidence indicator improves significantly upon the benchmark for both horizons, while the ESI is associated with significantly smaller forecast errors than the autoregression when the estimates are constructed less than 2.5 months prior to the release of the actual figure.

Table 4 compares the performance of forecast combinations based on models with BCS variables with that of the autoregressive benchmark. The table shows the RMSFE of forecast combinations relative to that of an autoregressive model. Four different combination methods were considered, namely the median and the mean forecast as well as weighted averages of forecasts where the weights are functions of past performance (i.e. MSFEs). The results are ordered according to the time interval between the construction of the estimate and the GDP release, starting from the shortest interval in the first column. We consider combinations of forecasts from models that include the following: (a) the key sectoral confidence indicators, (b) the variables related to all individual BCS questions, (c) the variables related to survey questions on current conditions, and (d) the variables concerning BCS questions on expectations.

In the case of Cyprus, combining forecasts from models with sectoral confidence indicators or variables based on individual BCS questions is not found to lead to more accurate predictions vis-à-vis the autoregressive benchmark, when the estimates are computed at

most 2.5 months before the release of GDP. Forecast combinations that incorporate information from the composite confidence indicators or the individual survey questions concerning expectations generate some gains against the benchmark for forecasts calculated 3-5.5 months prior to the release of GDP. However, only the gains from forecast combinations using the mean and discounted MSFE methods constructed 3-3.5 months before the GDP release are statistically significant.

The accuracy of forecast combinations for EU GDP growth is not found to outperform that of the autoregressive model for one-quarter-ahead forecasts. For two-quarter-ahead EU growth estimates, forecast combinations from models with composite confidence indicators or individual BCS questions are clearly superior to the benchmark. Forecasts from models that include sectoral confidence indicators or survey questions related to expectations are the best performers when combined using the squared discounted MSFE method. For the EA, forecast combinations incorporating information from composite confidence indicators or from individual BCS questions significantly enhance the forecast accuracy of the benchmark for both one- and two-quarter ahead forecasts. The forecast precision is maximised when the growth estimates for the EU and the EA are computed 3-3.5 months prior to the GDP growth publication.

Sectoral confidence indicators or individual survey questions used to estimate the Greek GDP growth through forecast combinations, at most 1.5 months before its official publication, lead to significantly lower forecast error compared to the autoregressive model. When the estimates are computed 3-5.5 months before the GDP release, combinations of forecasts from models with composite confidence indicators are associated with the highest precision. For the UK, survey information does not seem to improve the forecast accuracy of models compared to the benchmark.

Overall, the improvements in the relative forecast accuracy from the use of survey information appear to be smaller for Cyprus compared to those for the EA, the EU and Greece. No model with a composite confidence indicator as a predictor is found to significantly outperform the benchmark in all monthly forecast rounds and over all horizons. The results vary with the economy considered and, to a lesser extent, the time interval between the estimation date and the GDP release date. The inclusion of the consumer confidence indicator in the forecasting models for GDP growth does not yield significant gains over the autoregression. Forecast combinations based on models with individual survey variables uniformly beat the benchmark for EA growth forecasts. Exploiting the information in sectoral composite confidence indicators through forecast combinations appears to be a promising strategy for the computation of GDP growth estimates for the EU, Greece and Cyprus.

Table 4: Forecasting performance of forecast combinations[1]

	Cyprus			EU			EA			UK			Greece		
Forecasts estimated early in:	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec
	One quarter ahead														
No. of months to the GDP release	<0.5	1-1.5	2-2.5	<0.5	1-1.5	2-2.5	<0.5	1-1.5	2-2.5	<0.5	1-1.5	2-2.5	<0.5	1-1.5	2-2.5
Autoregressive model (benchmark)[2]	0.93	0.93	0.93	0.50	0.50	0.50	0.59	0.59	0.59	0.54	0.54	0.54	1.83	1.83	1.83
Forecast combinations															
Confidence indicators															
Median	1.01	1.01	1.01	0.95	0.91	0.97	0.94	0.91	0.90*	1.20	1.16	1.17	0.92	0.89	0.92
Mean	1.01	1.01	0.99	0.95	0.91	0.95	0.91	0.91	0.92*	1.23	1.15	1.18	0.89*	0.87*	0.90
Discounted MSFE[3]	1.01	1.01	0.98	0.96	0.93	0.96	0.93	0.91*	0.92*	1.23	1.11	1.09	0.89*	0.86*	0.90
Squared discounted MSFE[3]	1.01	1.01	0.97	0.97	0.93	0.97	0.95	0.91*	0.93*	1.22	1.06	1.03	0.89*	0.86*	0.90
BCS questions: all															
Median	1.04	1.03	1.04	1.00	0.99	1.00	0.91*	0.92*	0.94*	1.17	1.14	1.13	0.96	0.95	0.95
Mean	1.03	1.03	1.04	0.99	0.97	0.99	0.91	0.92	0.93	1.22	1.16	1.17	0.92*	0.90*	0.93
Discounted MSFE[3]	1.03	1.03	1.04	0.98	0.96	0.98	0.89*	0.91	0.90*	1.21	1.15	1.13	0.92*	0.90*	0.94
Squared discounted MSFE[3]	1.03	1.03	1.05	0.99	0.95	0.98	0.89*	0.90*	0.89*	1.21	1.14	1.08	0.92*	0.90*	0.93
BCS questions: assessments of current conditions															
Median	1.03	1.03	1.04	1.01	1.00	1.03	0.94	0.93*	0.95*	1.19	1.14	1.13	0.99	0.97	0.96
Mean	1.03	1.02	1.05	0.98	0.97	1.01	0.93	0.94	0.96	1.24	1.18	1.17	0.92*	0.91*	0.94
Discounted MSFE[3]	1.03	1.03	1.04	0.97	0.96	1.01	0.92*	0.95	0.95*	1.23	1.17	1.13	0.93*	0.91*	0.94
Squared discounted MSFE[3]	1.04	1.03	1.05	0.97	0.96	1.01	0.92*	0.94*	0.95*	1.22	1.14	1.09	0.92*	0.90*	0.93
BCS questions: expectations															
Median	1.05	1.05	1.04	1.00	1.00	0.99	0.90*	0.91	0.90	1.17	1.14	1.15	0.93	0.94	0.95
Mean	1.04	1.04	1.04	1.00	0.97	0.97	0.91	0.90	0.90	1.21	1.15	1.17	0.92	0.91	0.93
Discounted MSFE[3]	1.03	1.04	1.04	0.99	0.96	0.96	0.88	0.87*	0.88	1.20	1.14	1.14	0.93	0.91*	0.93
Squared discounted MSFE[3]	1.03	1.04	1.05	1.00	0.95	0.95	0.87	0.86*	0.86	1.20	1.12	1.11	0.93	0.91	0.92

Notes: [1] The symbol * denotes statistical significance at 10% level of the modified Diebold-Mariano test of equal forecast accuracy (Diebold and Mariano, 1995; Harvey et al., 1997). The tests compare the forecasts errors from the benchmark model to those from the forecast combinations based on survey variables.

[2] An autoregressive model of order four for Cyprus and Greece; a first order autoregressive model for the EU, EA and UK.

[3] The discount factor, δ, is set equal to 0.95.

Table 4: continued[1]

	Cyprus			EU			EA			UK			Greece		
Forecasts estimated early in:	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec	Feb May Aug Nov	Jan Apr Jul Oct	Mar Jun Sep Dec
	Two quarters ahead														
No. of months to the GDP release	3-3.5	4-4.5	5-5.5	3-3.5	4-4.5	5-5.5	3-3.5	4-4.5	5-5.5	3-3.5	4-4.5	5-5.5	3-3.5	4-4.5	5-5.5
Autoregressive model (benchmark)[2]	1.91	1.91	1.91	1.24	1.24	1.24	1.29	1.29	1.29	1.43	1.43	1.43	2.94	2.94	2.94
Forecast combinations															
Confidence indicators															
Median	0.90	0.94	0.98	0.92	0.90*	0.92	0.76*	0.77*	0.80*	1.54	1.56	1.60	0.86*	0.88*	0.90
Mean	0.87*	0.93	0.94	0.84*	0.85*	0.87*	0.70*	0.74*	0.78*	1.49	1.49	1.55	0.84*	0.85*	0.87*
Discounted MSFE[3]	0.85*	0.91	0.93	0.83*	0.83*	0.86*	0.71*	0.74*	0.77*	1.50	1.52	1.56	0.84*	0.84*	0.89*
Squared discounted MSFE[3]	0.85*	0.91	0.92	0.82*	0.82*	0.85*	0.72*	0.74*	0.77*	1.51	1.54	1.57	0.84*	0.85	0.91*
BCS questions: all															
Median	0.99	1.00	1.00	0.85*	0.92*	0.93*	0.80*	0.85*	0.88*	1.39	1.36	1.44	0.92	0.94	0.93
Mean	0.98	0.98	0.98	0.87*	0.91*	0.93*	0.79*	0.84*	0.87*	1.43	1.40	1.44	0.90*	0.92	0.92*
Discounted MSFE[3]	0.97	0.97	0.97	0.85*	0.90*	0.93*	0.75*	0.83*	0.86*	1.43	1.40	1.44	0.90*	0.92	0.92*
Squared discounted MSFE[3]	0.97	0.97	0.97	0.84*	0.88*	0.92*	0.73*	0.83*	0.85*	1.45	1.41	1.45	0.90*	0.93	0.93*
BCS questions: assessments of current conditions															
Median	1.01	1.01	1.00	0.91*	0.94*	0.95	0.85*	0.89*	0.92*	1.38	1.36	1.37	0.91	0.94	0.92
Mean	1.00	1.00	1.00	0.89*	0.93*	0.94*	0.84*	0.89*	0.90*	1.41	1.39	1.39	0.89*	0.92	0.91
Discounted MSFE[3]	1.00	1.00	1.00	0.89*	0.93*	0.94	0.85*	0.90*	0.90*	1.41	1.39	1.38	0.88*	0.92	0.91
Squared discounted MSFE[3]	1.00	1.00	1.00	0.90*	0.94*	0.95	0.87*	0.92*	0.91*	1.41	1.39	1.37	0.88*	0.92	0.91
BCS questions: expectations															
Median	0.97	0.99	0.98	0.83*	0.87*	0.92*	0.76*	0.81*	0.84*	1.38	1.37	1.50	0.93	0.95	0.94
Mean	0.96	0.97	0.97	0.86*	0.89*	0.92*	0.75*	0.80*	0.84*	1.45	1.41	1.50	0.93	0.93	0.94
Discounted MSFE[3]	0.95	0.95	0.95	0.83*	0.87*	0.91*	0.70*	0.79*	0.82*	1.47	1.42	1.51	0.93	0.93	0.94
Squared discounted MSFE[3]	0.94	0.94	0.94	0.83*	0.85*	0.90*	0.68*	0.80*	0.81*	1.49	1.44	1.53	0.94	0.93	0.94

Notes: [1] The symbol * denotes statistical significance at 10% level of the modified Diebold-Mariano test of equal forecast accuracy (Diebold and Mariano, 1995; Harvey et al., 1997). The tests compare the forecasts errors from the benchmark model to those from the forecast combinations based on survey variables.

[2] An autoregressive model of order four for Cyprus and Greece; a first order autoregressive model for the EU, EA and UK.

[3] The discount factor, δ, is set equal to 0.95.

5. Performance during crises

In this section we consider the forecasting properties over time of some models and forecast combinations that were found to perform well in the previous section, by examining the evolution of their recursive RMSFE relative to that of the benchmark model. Figures 2-4 plot the relative RMSFE for Cyprus, the EA and Greece respectively over the pseudo out-of-sample forecasting period, which includes the dates at the onset of the international financial crisis and during the Eurozone crisis. The evolution of the relative RMSFE for each model or forecast combination is juxtaposed with the actual year-on-year (y-o-y) percentage change in GDP over the same period. The dates on the horizontal axis correspond to the quarter in which the forecast was computed.[4]

For Cyprus, the use of information from sectoral confidence indicators for the computation of GDP growth estimates on a monthly basis resulted in a reduction in the RMSFE during the financial crisis and the 2009 recession that followed in Cyprus. The inclusion of confidence indicators in the forecasting models, particularly of the retail trade confidence indicator, continued to yield gains over the benchmark during the brief upswing in 2010 and at the onset of the economic crisis in 2011-2012. However, forecasts based on confidence indicators failed to generate substantial gains when the Cypriot economy troughed in 2013 as well as during the recovery that followed.

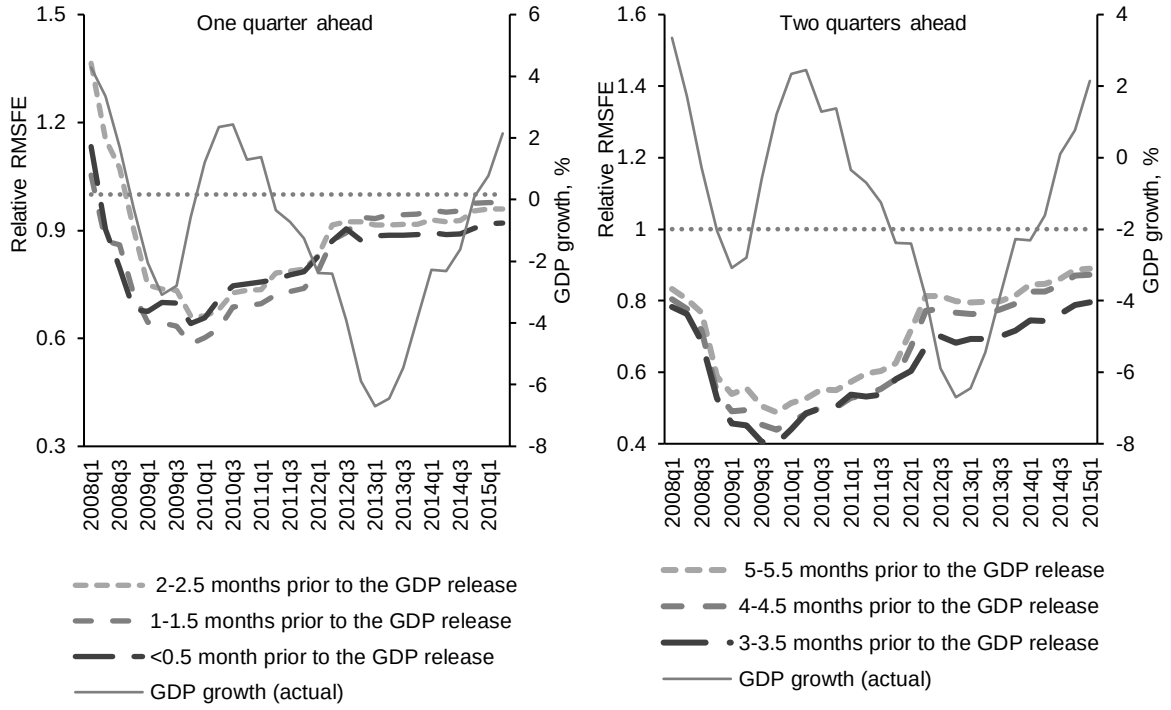
The use of confidence indicators resulted in larger gains for two-quarter-ahead forecasts, especially when growth estimates are computed 3-3.5 months prior to the GDP release. For one-quarter ahead forecasts, exploiting the information in all confidence indicators by combining forecasts resulted in less stable performance compared to solely using the retail trade indicator. After 2012, GDP growth estimates for Cyprus computed via the retail trade indicator and just before the release (<0.5 month) were associated with larger gains relative to the benchmark.

For the EA, the information contained in the ESI as well as in the individual survey variables enhanced considerably the performance of the simple autoregressive benchmark during the international financial crisis and its aftermath. The forecast gains due to the inclusion of survey data in the forecasting models declined at the onset of the EA sovereign debt crisis, but remained quite stable afterwards. The predictive accuracy of the ESI model and the forecast combination based on all BCS variables was higher for two-quarter-ahead forecasts, particularly when the EA GDP growth rate was estimated 3-3.5 months prior to the release. When the EA growth projections are constructed less than 2.5 months before the publication date, no improvements in the predictive accuracy were found through the inclusion of new survey information in each monthly forecast round.

[4] The values of the actual GDP growth rate in the plots are shifted backwards one or two quarters depending on the forecast horizon to correspond to the RMSFE in the quarter in which the forecast was computed.

Figure 2: Relative RMSFE of models with survey predictors and GDP growth, Cyprus

2.1 Predictor: CY Retail trade confidence indicator (AIC)



2.2 Forecast combinations based on all CY confidence indicators (squared discounted MSFE)

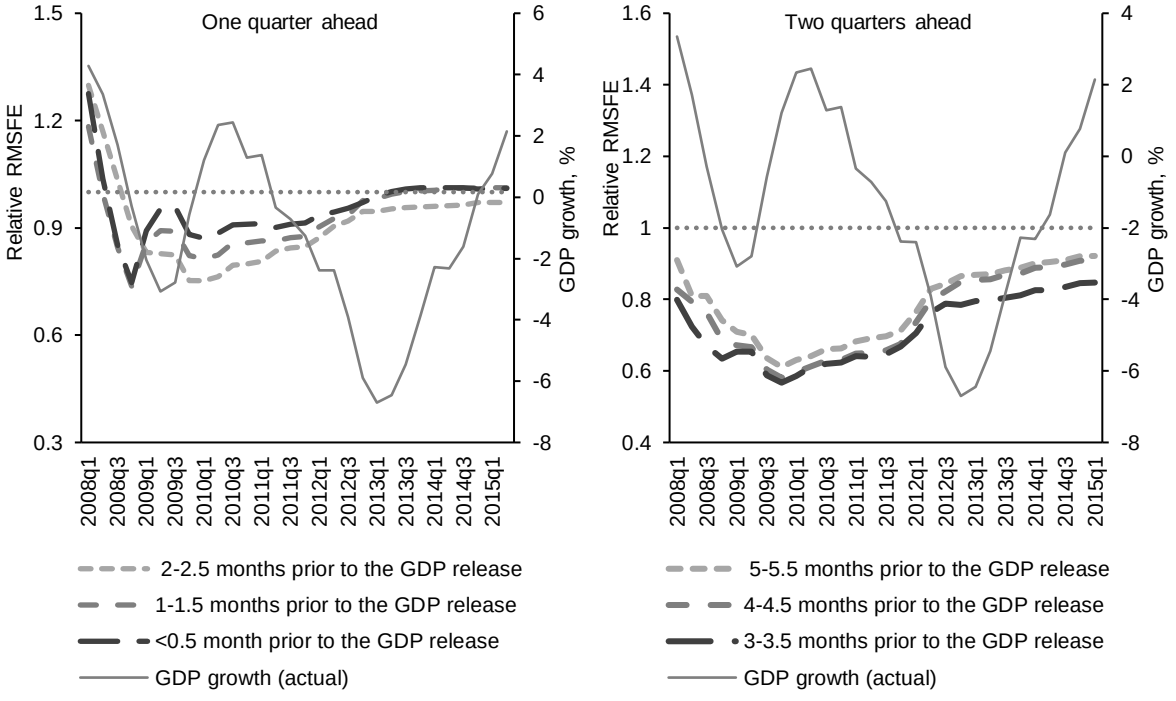
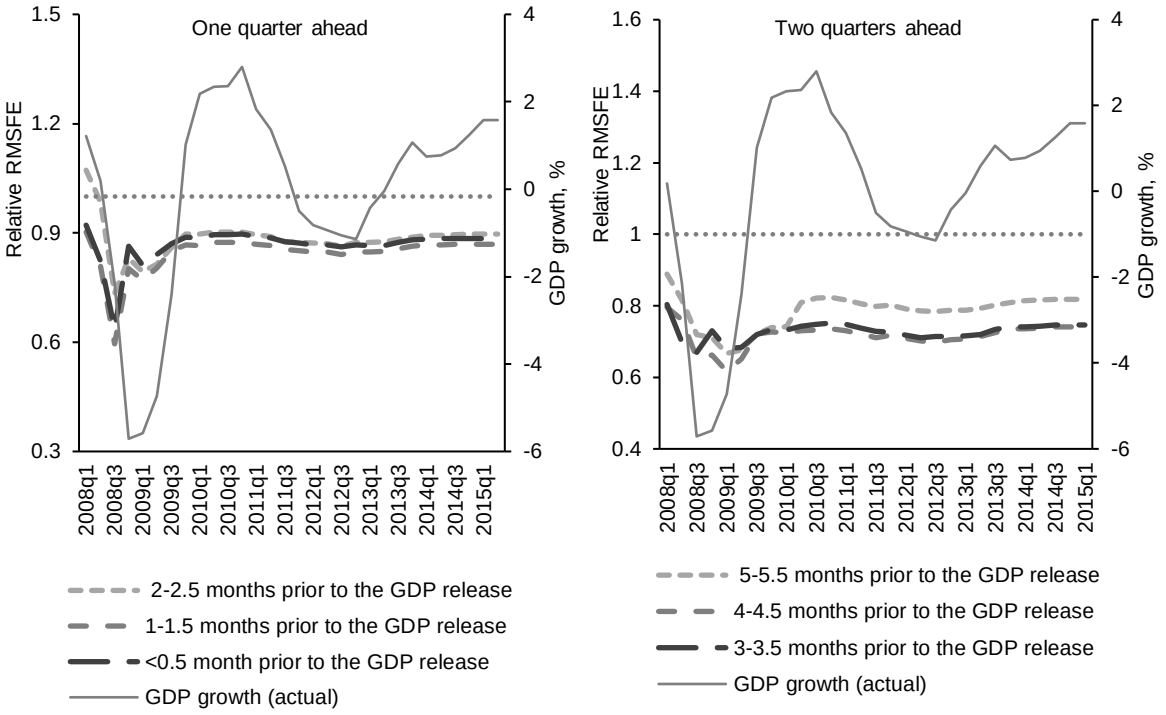


Figure 3: Relative RMSFE of models with survey predictors and GDP growth, EA

3.1 Predictor: EA Economic Sentiment Indicator (BIC)



3.2 Forecast combinations based on all individual EA BCS variables (squared discounted MSFE)

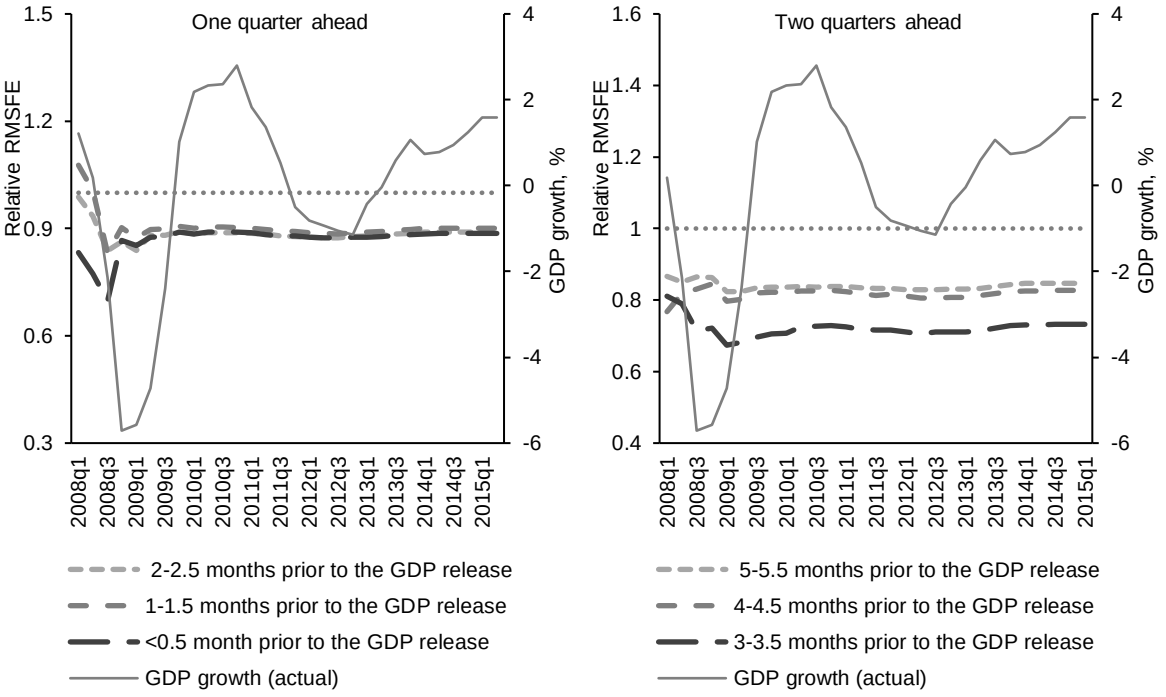
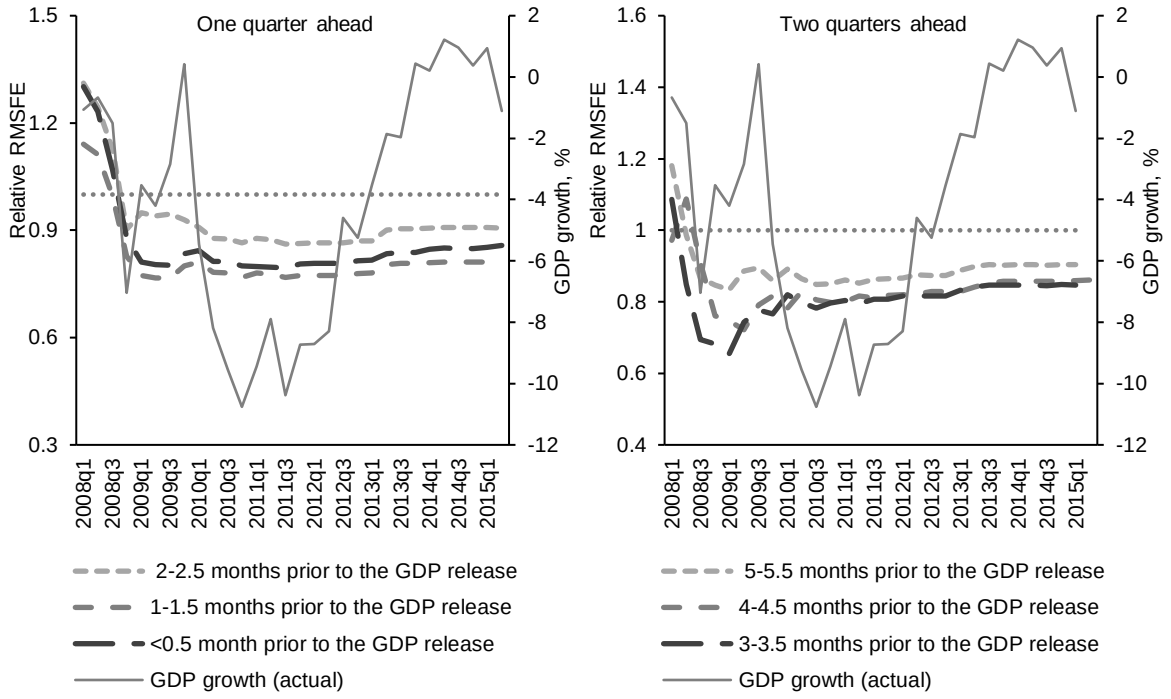
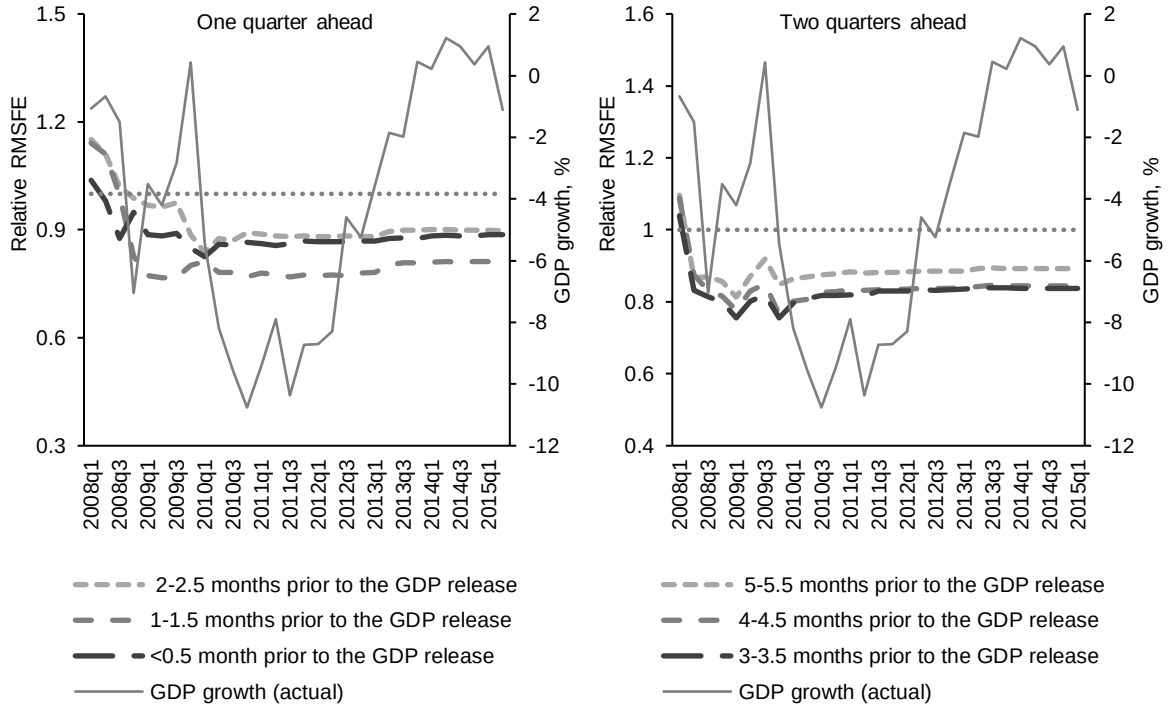


Figure 4: Relative RMSFE of models with survey predictors and GDP growth, Greece

4.1 Predictor: GR Industry Confidence Indicator (AIC)



4.2 Forecast combinations based on all GR confidence indicators (discounted MSFE)



Estimates of GDP growth for Greece, computed from models with confidence indicators were associated with increasing forecast accuracy during the international financial crisis. Despite the turbulent economic conditions that followed due to the sovereign debt crisis, the performance of growth projections based on either the Greek industry confidence indicator or forecast combinations using all confidence indicators remained quite stable, generating gains over the autoregressive benchmark. The forecast gains were similar for one- and two-quarter-ahead forecasts. Moreover, new monthly information incorporated in the growth estimates in the final forecast round before the GDP release was not found to lower the forecast error.

Figure 5 shows the actual rate of GDP growth (y-o-y), together with the six growth forecasts computed in six different monthly rounds starting 5-5.5 months prior to the GDP publication and ending about 10 days prior to the release. For Cyprus, the forecasts shown are obtained from the model that includes the retail trade confidence indicator, which is the best performing survey predictor. For the EA and Greece the growth estimates plotted are obtained from forecast combinations based on all individual survey questions and all composite confidence indicators respectively; these forecast combinations are chosen on the basis of their superior performance in different forecast rounds compared to other combinations or survey predictors.[5]

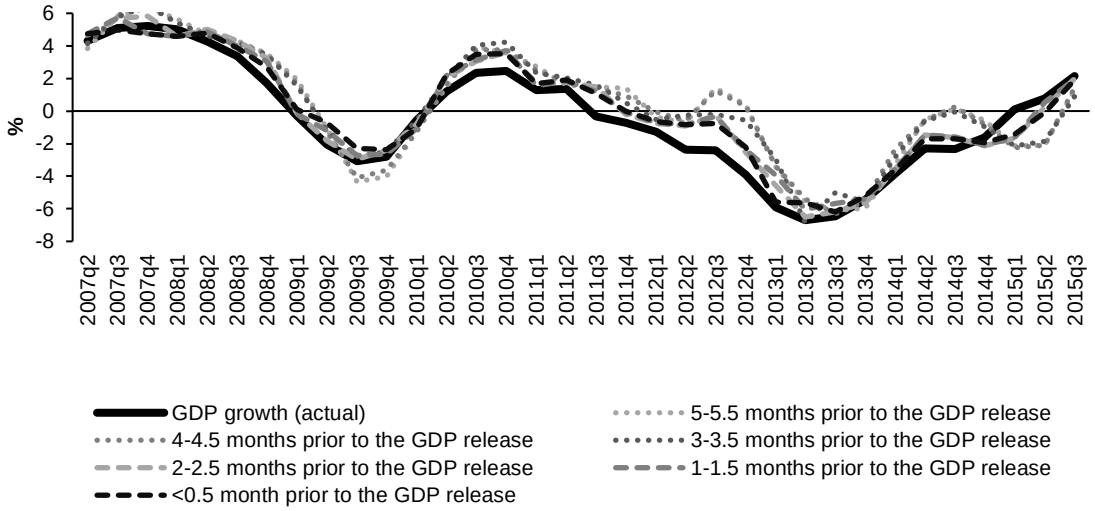
The slowdown preceding the international financial crisis was forecasted quite accurately by survey data particularly for the EA and Cyprus. However, as the economies were slipping into recession the survey predictors were generating more optimistic forecasts compared to the actual growth rates. The information in the EA and Greek BCS failed to forecast the trough quarter correctly. For Cyprus, the initial forecast rounds were also unsuccessful in predicting the trough, but the growth projections computed 2-2.5 months prior to the release estimated the rate of output contraction accurately. The EA-wide survey variables provided quite accurate forecasts for the brief upturn in the bloc's activity that followed in 2010, while the retail trade confidence indicator for Cyprus tended to overestimate the short-lived recovery. The extent of overestimation of the growth rate was even larger for Greece early in 2010.

The debt crisis increased uncertainty not only in Greece but also in Cyprus due to the links between the financial systems of the two countries that existed then, as well as in the EA at large. The deepening of the Greek recession following the sovereign debt crisis was forecasted as less severe by confidence indicators, but the subsequent easing of output contraction was predicted fairly accurately. The actual economic performance in the second half of 2013 was underestimated by the Greek confidence indicators.

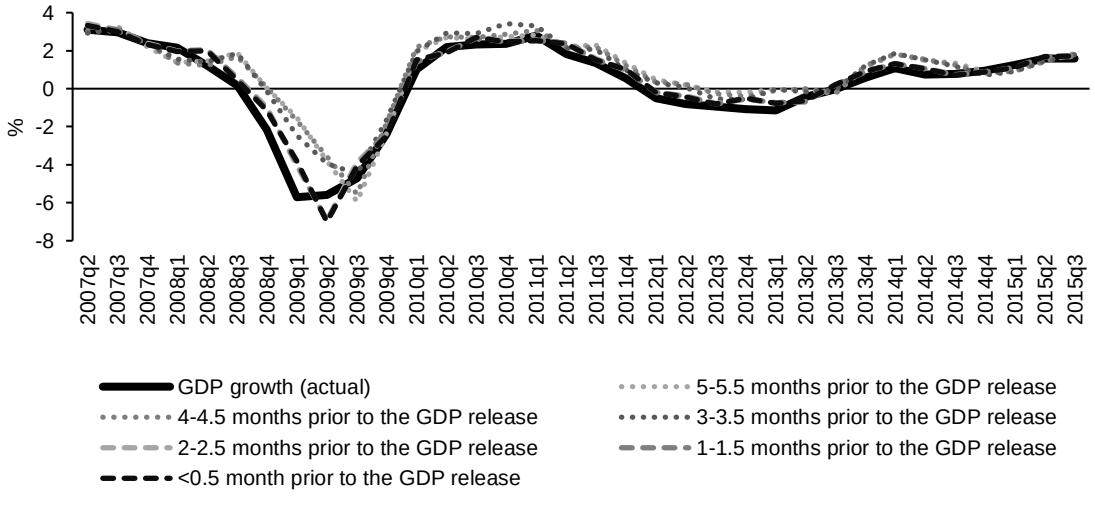
[5] The relative accuracy of these forecasts is shown in Figure 2 (2.1), Figure 3 (3.2) and Figure 4 (4.2) for Cyprus, the EA and Greece, respectively.

Figure 5: GDP growth and forecasts

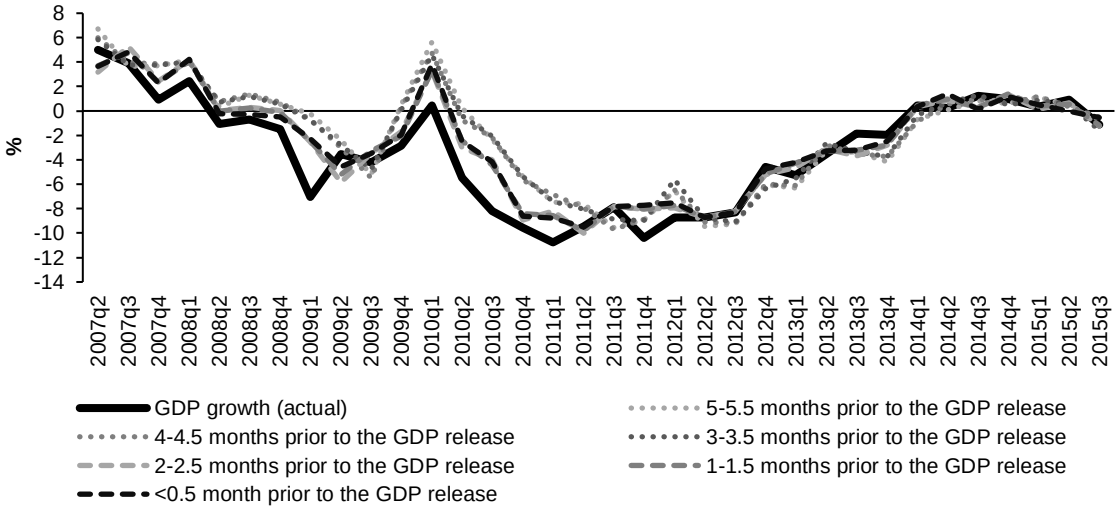
5.1 Cyprus, predictor: CY Retail trade confidence indicator



5.2 EA, forecast combinations based on all EA individual BCS variables



5.3 Greece, forecast combinations based on all GR confidence indicators



For Cyprus, the retail trade confidence indicator traced closely the 2011-2012 downturn, though it produced more optimistic predictions compared to the actual figures. The depth of the 2013 recession in Cyprus was forecasted accurately 2-2.5 months prior to the release of the actual growth rate. The beginning of the recovery of the Cypriot economy was correctly forecasted by the confidence indicator, but survey information failed to predict the first positive growth rate registered after the recession (2015q1).

During the EA crisis and subsequent recovery, forecast combinations that utilise the information from all EA-wide survey variables resulted in revisions to the EA growth projections towards the actual growth rates, indicating the usefulness of the timely available BCS data for forecasting the bloc's short-term economic conditions.

6. Conclusions

This paper aims to evaluate the information content of the BCS data for the computation of a sequence of GDP growth estimates. The first estimate is computed 5½ months prior to the publication of GDP growth and the last forecast is constructed about 10 days before the release of the actual figure. The construction of GDP growth forecasts for the short run constitutes a valuable tool for macroeconomic surveillance and policy making because quarterly National Accounts data are published with a considerable time lag. The BCS data, on the other hand, are available on a monthly basis, typically at the end of the reference month.

The focus of the analysis is on Cyprus and some of its key trading partners, namely the EU, the EA, the UK and Greece. Due to the openness of the Cypriot economy, timely information on the expected economic performance of Cyprus's trading partners is crucial to the assessment of the domestic economic outlook. The forecasting performance of survey-based models over the recent financial and debt crises is also explored.

The evaluation of the predictive ability of the BCS data is carried out via a pseudo out-of-sample forecasting exercise with a data availability pattern that mimics real-time releases. The results in the case of Cyprus show that the use of confidence indicators significantly improves on the accuracy of autoregressive forecasts when the growth estimates are computed 3 to 3½ months prior to the release of GDP growth. Specifically, the relative forecast precision is significantly higher in the case of composite confidence indicators for retail trade and construction as well as forecast combinations utilising information from all sectoral confidence indicators. Some forecast gains over the univariate benchmark are attained in other forecast rounds, but are not found to be statistically significant. Moreover, the improvements in the forecast accuracy due to the use of survey data are larger and more significant for the EA, the EU and Greece compared to those in the case of Cyprus. Interestingly, survey predictors are not found to improve the autoregressive GDP growth

estimates for the UK. Thus, survey information for the EU, the EA and Greece can be used to extract reliable signals concerning the short-term growth prospects of these economies and therefore identify risks to the outlook for the Cypriot economy. Gauging future economic conditions in the UK should be based not only on the BCS data but also on other short-term indicators.

Our results for the EA are along the lines of findings in other studies that simulate the real-time data availability pattern and demonstrate the importance of timely available survey data for short-term GDP growth forecasting (e.g. Angelini et al., 2011; Bańbura and Rünstler, 2011).

The use of survey data for Cyprus resulted in large forecasting gains over the benchmark during the international financial crisis and its aftermath and predicted the depth of the recession in 2009 and 2013 fairly accurately. Also, the BCS indicators had provided early signals when the Cypriot economy was approaching turning points. Nevertheless, the relative benefits from the use of the BCS data began diminishing at the onset of the economic crisis in Cyprus. Moreover, survey information correctly signalled the moderation of the recession in Cyprus in 2013 - 2014, but failed to predict the turnaround in the growth rate in the first quarter of 2015.

The swift release of the BCS data, typically at the end of the reference month, the absence of data revisions and the wide coverage of different sectors of the economy, render survey variables ideal candidate predictors for the short-run forecasting of the growth rate of aggregate and sectoral output. An extension of the current analysis would be the comparison of the forecasting performance of the BCS data with that of other timely available macroeconomic/financial series, such as stock market indices, exchange rates, international commodity prices (e.g. oil), European interest rates, the number of registered unemployed, credit card use, etc. Some of the abovementioned series are found to be useful GDP growth predictors when employed for short-term forecasting (e.g. Bańbura and Rünstler, 2011; Giannone et al., 2008).

The monthly revisions to the growth estimates resulting from the inflow of new BCS data tend to correct forecasts in the right direction, providing more accurate predictions when the estimation date approaches the publication date of GDP growth. Overall, the BCS data provide early and useful information for monitoring movements in economic activity, thus enabling policy-makers to react timely. Additional domestic and foreign leading indicators should also be employed to gain even more reliable and complete insight into the outlook for the Cypriot economy.

References

Al-Eyd, A, Barrell R., Davis E. P. (2009), "Consumer confidence indices and short-term forecasting of consumption" Manchester School 77, 96-111.

Angelini, E., Camba-Mendez G., Giannone D., Reichlin L. and Rünstler G (2011), "Short-term forecasts of euro area GDP growth", Econometrics Journal 14, C25-C44.

Bańbura, M. and Rünstler G. (2011), "A look into the factor model black box: Publication lags and the role of hard and soft data in forecasting GDP", International Journal of Forecasting 27, 333-346.

Barhoumi, K., Darné O, Ferrara L. and Pluyaud B. (2012), "Monthly GDP forecasting using bridge models: Application for the French economy", Bulletin of Economic Research 64, s53-s70.

Batchelor, R. and Dua P. (1998), "Improving macro-economic forecasts: The role of consumer confidence", International Journal of Forecasting 14, 71-81.

Claveria, O., Pons E. and Ramos R. (2007), "Business and consumer expectations and macroeconomic forecasts", International Journal of Forecasting 23, 47-69.

Cotsomitis, J. A. and Kwan A. C. C. (2006), "Can consumer confidence forecast household spending? Evidence from the European Commission Business and Consumer Surveys", Southern Economic Journal 72, 597-610.

Diebold, F. X. and Mariano R. S. (1995), "Comparing predictive accuracy", Journal of Business and Economic Statistics 13, 134-144.

Diron, M. (2008), "Short-term forecasts of euro area real GDP growth: An assessment of real-time performance based on vintage data", Journal of Forecasting 27, 371-390.

European Commission (2014), "The joint harmonised EU programme of Business and Consumer Surveys: User guide", Directorate-General for Economic and Financial Affairs. http://ec.europa.eu/economy_finance/db_indicators/surveys/documents/bcs_user_guide_en.pdf

Eurostat (2003), "Flash estimation of the quarterly gross gomestic product for the euro-zone and the European Union: Eurostat methodology", Methods and Nomenclatures, European Commission, Theme 2 Economy and Finance
http://ec.europa.eu/eurostat/documents/3859598/5875261/KS-BE-03-002-EN.PDF

Giannone, D., Reichlin L. and Small D., (2008), "Nowcasting: The real-time informational content of macroeconomic data", Journal of Monetary Economics 55, 665-676.

Girardi, A., Golinelli R. and Pappalardo C. (2014), "The role of indicator selection in nowcasting euro area GDP in pseudo real time", Working Paper DSE No 919, Department of Economics, Universita di Bologna.

Harvey, D., Leybourne S. and Newbold P. (1997), "Testing the equality of prediction mean squared errors", International Journal of Forecasting 13, 281-291.

Ludvigson, S.C. (2004) "Consumer confidence and consumer spending" Journal of Economic Perspectives 18, 29-50.

Papamichael, C., Pashourtidou N. and Kourtellos A. (2014), "Forecasting Cyprus GDP and its demand components: Single equation models and forecast combinations", Economic Analysis Paper No. 06-14, Economics Research Centre, University of Cyprus.

Papamichael, C., and Pashourtidou N. (2014), "Forecasting Cyprus GDP and its demand components: Applications of dynamic factor models", Economic Analysis Paper No. 11-14, Economics Research Centre, University of Cyprus.

Stock, J. H. and Watson M. W. (2004), "Combination forecasts of output growth in a seven-country dataset", Journal of Forecasting 23, 405-430.

Stock, J. H. and Watson M. W. (2008), "Phillips curve inflation forecasts", NBER Working Paper 14322. Available at: http://www.nber.org/papers/w14322

RECENT ECONOMIC POLICY/ANALYSIS PAPERS

04-16 Karagiannakis, C., P. Pashardes, N. Pashourtidou and S. Andreou "The CypERC property price index: data and estimation methods", May 2016.

03-16 Michail A. M. and M.C. Polemidiotis " Estimates of Public, Housing and Other Private Sectors Net Capital Stocks for the Cyprus Economy: 1995Q1-2015Q4", April 2016.

02-16 Polycarpou, A. "The output gap in Cyprus and EU-28", April 2016,

01-16 Koutsampelas, C. "The Cypriot GMI scheme and comparisons with other European countries", April 2016.

10-15 Polycarpou, A. "Methodologies for estimating the output GAP with an application to Cyprus", December 2015.

09-15 Ketteni, E. and T. Mamuneas "Comparisons of Productivity among European Sectors and Cyprus: The Case of Tourism Sector", December 2015.

08-15 Clerides, S. and C. Karagiannakis " Recent trends in the Cypriot electronic communications sector", December 2015

07-15 Koutsampelas, C., S. Andreou and P. Tsakloglou "The Progressivity of Public Education in Greece in the Era of Depression", December 2015.

06-15 Kourtellos, A, and K. Petrou "Preferences for Redistribution in Cyprus", December 2015.

05-15 Charalambous, A. "The Cyprus Adjustment Programme – Necessity or Wrong Medicine", November 2015.

04-15 Zachariadis, T. "How Can Cyprus Meet Its Energy and Climate Policy Commitments? The Importance of a Carbon Tax", November 2015.

03-15 Karagiannakis, C., Pashardes, P., Pashourtidou, N. and S. Andreou, "The CypERC Property Price Index: Data and Estimation methods", November 2015.