University of Cyprus
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Economic Policy Papers

Weighting Business Survey Results for Cyprus

Nicoletta Pashourtidou

Economics Research Centre, University of Cyprus

Marianna A. Charalambous

Economics Research Centre, University of Cyprus

No. 03-23

July 2023

Publication Editor: Vasiliki Bozani

ERC Sponsors (in alphabetical order)

Central Bank of Cyprus

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Μέθοδοι Στάθμισης των Αποτελεσμάτων Ερευνών Οικονομικής Συγκυρίας Επιχειρήσεων στην Κύπρο

Νικολέττα Πασιουρτίδου και Μαριάννα Α. Χαραλάμπους

ΠΕΡΙΛΗΨΗ

Τα αποτελέσματα των ερευνών οικονομικής συγκυρίας επιχειρήσεων υπολογίζονται σε επίπεδο τομέων (κατασκευές, μεταποίηση, λιανικό εμπόριο, υπηρεσίες) και υποτομέων (π.χ. κατασκευές κτηρίων, έργα πολιτικού μηχανικού, εξειδικευμένες κατασκευαστικές δραστηριότητες κλπ.). Τα δημοσιευμένα στοιχεία για την Κύπρο βασίζονται σε μια μέθοδο στάθμισης ενός σταδίου όπου: (α) για τον υπολογισμό των αποτελεσμάτων σε επίπεδο υποτομέα, δεν εφαρμόζονται οποιοιδήποτε συντελεστές στάθμισης στις ατομικές απαντήσεις των επιχειρήσεων, και (β) για τον υπολογισμό των συνολικών αποτελεσμάτων του τομέα, χρησιμοποιούνται συντελεστές στάθμισης βασισμένοι σε επίσημα στοιχεία για τον κύκλο εργασιών του κάθε υποτομέα. Έτσι, στον υπολογισμό των αποτελεσμάτων των ερευνών λαμβάνεται υπόψη μόνο το μέγεθος του υποτομέα (σε όρους αξίας κύκλου εργασιών) στον οποίον ανήκει η επιχείρηση, και όχι το μέγεθος της ίδιας της επιχείρησης.

Σε αυτό το άρθρο διερευνάται η εφαρμογή μιας μεθόδου στάθμισης δύο σταδίων για τον υπολογισμό των αποτελεσμάτων από τις έρευνες οικονομικής συγκυρίας επιχειρήσεων στην Κύπρο, αξιοποιώντας δεδομένα για τον αριθμό των εργαζομένων της κάθε επιχείρησης που συλλέγονται μέσω των ερευνών. Με βάση τη μέθοδο δύο σταδίων, τα αποτελέσματα σε επίπεδο υποτομέα υπολογίζονται σταθμίζοντας τις ατομικές απαντήσεις των επιχειρήσεων με τον αριθμό των εργαζομένων· επομένως, δίνεται μεγαλύτερη βαρύτητα στις απαντήσεις επιχειρήσεων με περισσότερο προσωπικό. Σε επίπεδο τομέα, τα αποτελέσματα λαμβάνονται με την εφαρμογή συντελεστών στάθμισης από επίσημες στατιστικές για τον κύκλο εργασιών, όπως και στη μέθοδο στάθμισης ενός σταδίου. Η ανάλυση εντάσσεται στο πλαίσιο αξιολόγησης της ποιότητας των αποτελεσμάτων από τις έρευνες οικονομικής συγκυρίας στην Κύπρο.

Οι δείκτες οικονομικής συγκυρίας που προκύπτουν από τις πιο πάνω μεθόδους στάθμισης, σε επίπεδο τομέα και συνολικής οικονομίας, συγκρίνονται ως προς τη συσχέτισή τους με επίσημους στατιστικούς δείκτες, τη μεταβλητότητα και την ικανότητα πρόβλεψης σειρών που δημοσιεύονται στους εθνικούς λογαριασμούς. Η ικανότητα πρόβλεψης εξετάζεται σε ένα πλαίσιο που προσομοιώνει τη διαθεσιμότητα των στατιστικών στοιχείων σε πραγματικό χρόνο. Η εφαρμογή της μεθόδου στάθμισης δύο

σταδίων δίνει δείκτες που είναι παρόμοιοι με αυτούς που ήδη δημοσιεύονται, σε όρους συσχέτισης με επίσημους δείκτες και ικανότητας πρόβλεψης. Ωστόσο, οι δείκτες επιχειρηματικού κλίματος που λαμβάνονται από τη μέθοδο στάθμισης δύο σταδίων χαρακτηρίζονται από μεγαλύτερη μεταβλητότητα από τους αντίστοιχους που υπολογίζονται με τη μέθοδο ενός σταδίου, κάτι που ευνοεί την τρέχουσα μέθοδο στάθμισης (ενός σταδίου) βάσει της οποίας υπολογίζονται οι δημοσιευμένοι δείκτες οικονομικής συγκυρίας για την Κύπρο. Επιπλέον, ανεξάρτητα από τη μέθοδο στάθμισης που εφαρμόζεται, η ικανότητα πρόβλεψης των μοντέλων που περιλαμβάνουν δείκτες οικονομικού κλίματος τείνει να είναι τουλάχιστον εξίσου καλή με εκείνη των μοντέλων που περιλαμβάνουν επίσημα μηνιαία στατιστικά στοιχεία.

CONTENTS

Weighting Business Survey Results for Cyprus

Nicoletta Pashourtidou[*] and Marianna A. Charalambous

Abstract

The published business survey results for Cyprus are produced using a single-step weighting method where no weights are applied to individual responses to obtain survey results at the subsector level, while weights based on population data for subsector turnover are used to compute sectoral aggregates. Thus, in the calculation of survey results only the size of firms' subsector in terms of turnover matters, while the size of individual firms is not taken into account. In this paper, we investigate the application of a two-step weighting method for computing the business survey results for Cyprus, by using survey-reported data on the number of employees. At the subsector level, the results are obtained by weighting individual responses by the number of employees, thus replies given by firms with more staff members gain greater importance. At the sector level, survey results are computed by applying weights drawn from subsector population data on turnover, as in the single-step weighting method. The sectoral and economy-wide survey indicators from the single-step and two-step weighting methods are compared in terms of in-sample tracking performance, volatility, and out-of-sample forecasting ability examined in a setup that simulates real-time data availability. The application of the two-step weighting method results in survey indicators that are very similar to the currently published indicators in tracking and forecasting relevant hard data. However, the sectoral confidence indicators obtained from the two-step weighting method are noisier than their single-step counterparts, a finding that favours the currently used single-step weighting method. Moreover, regardless of the weighting method applied, the forecasting performance of models that include survey data tends to be at least as good as the performance of models with officially published monthly indicators.

Keywords: business surveys, weighting methods, forecasting, nowcasting.

[*] Corresponding author address: Economics Research Centre, University of Cyprus, P.O. Box 20537, 1678, Nicosia, Cyprus. Email: pashourtidou.nicoletta@ucy.ac.cy.

1. Introduction

Survey indicators are expected to provide information about current business conditions and signals about a country's economic situation in the near future, such as advance warnings of large fluctuations in activity. The majority of business survey questions, particularly those used in the computation of closely watched confidence indicators are qualitative; hence, the qualitative responses provided by a firm do not reflect the size of the reporting firm. Weighting survey responses ensures that the sample is representative of the population and the resulting survey indicators are comparable to relevant official statistics.

More generally, weights are assigned to survey responses to correct for non-response and insufficient coverage of the population by the survey sample, and to improve the accuracy of the survey results so that they match population data (i.e. limit bias). Lavallee and Beaumont (2015) argue for the use of weights not only for producing survey indicators, but also for conducting statistical analysis with survey data, particularly if the data are collected through a complex survey design.[1] The weights are computed from information in auxiliary variables obtained through surveys or official statistics. Nevertheless, the variability in the weights relative to the case of equal weights (i.e. no weighting) lowers the precision of survey results; see, Kalton and Flores-Cervantes (2003) for a review of weighting methods.

The weighting of responses in business tendency surveys has received attention among data practitioners as the application of different weighting schemes may affect the quality of the resulting indicators (see, European Commission, 2022; OECD, 2003). Business survey results are usually computed in the form of balances at the branch, or subsector level, and at the sector level. [2] The balances show the differences between the percentages of positive and negative replies given by firms in the corresponding subsectors and sectors. [3] In practice, the results at lower levels of aggregation (for example at the branch level) are calculated by either a simple counting of replies for the different reply options, or a weighted counting of replies, with weights that reflect the importance of each firm at the aggregation level considered. The significance of each firm is measured through an auxiliary variable such as the number

[1] For an overview of the different stages typically involved in the weighting process, see, for example, Haziza and Beaumont (2017) and Lavallee and Beaumont (2015).
[2] Examples of branches or subsectors in manufacturing include food, apparel and pharmaceuticals; land transport, air transport, water transport, accommodation and telecommunications are examples of subsectors in services. The sectors usually covered by business tendency surveys are manufacturing (industry), construction, retail trade and services.
[3] Business survey responses are typically in the form of a positive (increase), neutral (no change) or negative (decrease) replies.

of employees. At higher levels of aggregation, for example at the sector level, the results are computed by aggregating branch-level results, using weights that reflect the contribution of each branch to the sector. These weights are obtained from official statistics on value added or turnover (see, European Commission, 2022; OECD, 2003). Therefore, at the branch level, we can compute unweighted or weighted results, but at the sector level the results are typically weighted. The applied weighting method is then described as a single-step or two-step, depending on whether the results at the branch level are unweighted or weighted, respectively.

In evaluating the impact of weighting methods on the quality of survey results, a range of statistical measures is employed to determine which method performs the best with respect to aspects that usually involve the volatility of the resulting survey data and the ability of survey indicators to track developments in official statistics. Kershoff (2019) examines the impact of different weighting methods for calculating business survey results on the volatility and tracking performance. For example, his analysis for the building sector shows that the weighted results are associated with higher volatility compared to the unweighted results published under the benchmark method, but the correlations of survey variables with corresponding official data are very close in the case of weighted and unweighted results. Etter and Koberl (2006) examine whether firm-specific and question-specific weights are warranted in business surveys. Because of the importance of inventory changes in business cycle analysis, Etter and Koberl (2006) focus on the effects of alternative weighting methods on the quality of survey results about stocks and order books in the manufacturing sector. The following one-step weighting schemes were applied at the firm level: no weighting, weighting by the number of employees, and a question-specific variable drawn from auxiliary data on the ratio of stocks (or order books) to sales. These schemes are compared to the existing two-step method based on the number of employees at the firm level and value added at the branch level. The method that involves firm-level weights specific to the survey questions gives more volatile survey indicators, while the unweighted results delivered the best tracking performance.

Mitchell, Mouratidis and Weale (2004) argue that the widely-used survey indicators that are based on the aggregation of individual responses may disregard firm-specific information. The authors exploit the fact that survey data are published before official statistics, as well as the panel nature of firm-level data to obtain indications for movements in official statistics. Using data from the Joint Harmonised Programme of EU Programme of Business and Consumer Surveys for four European countries, they propose disaggregate indicators derived by quantifying the expected value for

manufacturing output for each respondent at a given point in time, and then computing the weighted or unweighted averages of the quantitative expectations across respondents. They find that disaggregate indicators computed using equal weights as opposed to varying weights reflecting firm size or empirical weights, tend to be associated with the best performance.

Other aspects of weighting that were investigated by practitioners in relation to business survey results include the effects of weighting schemes on the rationality properties of expectation series and the search for weights that best represent the structure of an economy in developing sentiment indicators (see, Kowalczyk and Tomczyk, 2011; Ptackova, Stepanek and Hanzal, 2019).

Business tendency indicators have been an essential tool for monitoring and forecasting economic developments since survey data are not subject to revisions and are available much earlier than key macroeconomic variables. The role of soft data in forecasting movements in macroeconomic variables has been investigated extensively in the literature by the use of different forecasting models, techniques and datasets (see, for example, Claveria, Monte and Torra, 2020; Garnitz, Lehmann and Wohlrabe, 2019; Girardi, Gayer and Reuter, 2016; Gotz and Knetsch, 2019). The timeliness of survey data has received particular attention in the design of exercises for nowcasting activity growth, by taking account of mixed data frequencies and publication lags in variables. Empirical findings show that the use of survey indicators increases the accuracy of nowcasts because of the early publication of survey vis-à-vis hard indicators (see, Angelini et al., 2011; Giannone, Reichlin and Small, 2008; Giannone, Reichlin and Simonelli, 2009). Moreover, there are studies that highlight other useful properties of survey data for forecasting, in addition to their timeliness; these properties of survey data include: information content beyond that found in monthly activity indicators, broader sectoral coverage compared to monthly hard data on activity, a forward-looking component stemming from expectation questions, and increased predictive ability in times of tranquility (see, Banbura and Runstler, 2011; Girardi, Gayer and Reuter, 2016; Kurz-Kim, 2019).

Currently, business survey results for Cyprus are produced using a single-step weighting scheme. More specifically, the results at the subsector level are obtained from a simple counting of the replies (unweighted), while the results at the sector level are computed using population data on subsector turnover as the weighting variable. The purpose of this paper is to employ survey-reported data on the number of employees to compute the survey results at the sector level, by applying a two-step weighting method described as follows. At the subsector level, the results are obtained

by weighting individual responses by the number of employees and thus replies by firms with more staff members gain greater importance. At the sector level, survey results are computed by applying weights drawn from subsector population data on turnover, as in the single-step weighting method. The indicators from the two-step weighting scheme are compared to the published survey indicators based on the single-step weighting scheme, by evaluating aspects such as volatility, and in-sample and out-of-sample tracking performance with respect to officially published data.

The paper contributes to the discussion among practitioners and producers of business tendency data as to the impact of weighting schemes on the statistical features of the resulting indicators. Moreover, the paper contributes to the empirical literature on the usefulness of survey indicators for forecasting activity and employment growth in the short run. Specifically, it adds to the empirical literature on how soft data compare to officially published short-term indicators when the availability of data in real-time is simulated. The application of a two-step weighting method gives rise to survey indicators that are very similar to the currently published indicators from single-step weighting, in tracking and forecasting relevant hard data. However, the two-step weighting method results in sectoral confidence indicators that are noisier than their single-step counterparts, thus favouring the currently applied method.

The structure of the paper is as follows. Section 2 presents the two-step weighting method applied to the business survey data and compares the resulting indicators with the currently published indicators obtained from the single-step weighting method. Section 3 describes a forecasting exercise for activity and employment that mimics the flow of data observed in real time and discusses the out-of-sample tracking performance of survey indicators from the two weighting methods vis-à-vis official statistics. Section 4 concludes.

2. A two-step weighting method

In this section we describe how a two-step weighting scheme can be applied to the business survey data for Cyprus. The survey results are computed under the two-step weighting method and the resulting indicators are compared to the published indicators based on the single-step weighting method.

2.1 Weighting business survey responses

Firm-level business survey data for Cyprus are available on a monthly basis since May 2008. The firm-level data are aggregated to produce survey results for subsectors of economic activity, which represent the lowest level of aggregation for which survey

results are typically available.[4] The published results for the lowest aggregation level are currently computed in the form of balances as follows:

$$B_{gs} = 100 \sum_{i=1}^{N_g} \frac{x_{igs}}{N_g}, \quad g = 1,2,\dots,G \text{ and } s = 1,2,3,4 \tag{1}$$

where x_{igs} takes the values $1, 0, -1$ representing a positive, neutral or negative reply to a survey question given by firm i, operating in subsector g and sector s (i.e. construction, industry, retail trade and services); G is the number of subsectors in sector s, and N_g denotes the number of firms in subsector g that answered the survey question. Thus, the results at the lowest aggregation level are unweighted, i.e. they are computed as a simple average. The published balances at the sector level are given by:

$$B_s = \sum_{g=1}^{G} w_g B_{gs}, \qquad g = 1,2,\dots,G \text{ and } s = 1,2,3,4 \tag{2}$$

where w_g is the weight assigned to subsector g. The weights, measured by each subsector's share of the sector's total turnover, are computed from published population data on turnover.[5]

The business surveys in Cyprus collect data on the number of firm employees that can be used to construct weights for computing the results at the lowest level of aggregation and therefore assigning a greater importance to the answers of larger firms in terms of employment. This, leads to a two-step weighting method, instead of the currently applied single-step weighting scheme where all replies are treated equally (regardless of the firm's size) in the calculation of the results at the lowest aggregation level. In the two-step weighting scheme, the balances at the lowest aggregation level are computed as weighted averages, i.e.

$$B^*_{gs} = 100 \sum_{i=1}^{N_g} l_{ig}\, x_{igs} \qquad g = 1,2,\dots,G \text{ and } s = 1,2,3,4 \tag{3}$$

where $l_{ig} = L_{ig}/L_g$, L_{ig} denotes the number of employees in firm i, operating in subsector g, and L_g is the total number of employees in subsector g. The sector level

[4] For Cyprus, the lowest aggregation level is represented by two-digit NACE (Rev. 2) codes or groupings of three-digit NACE codes. For details on the different levels of aggregation and classification of sectors (NACE Rev. 2) covered in business surveys, see European Commission (2022). For some two-digit NACE codes in Industry and Services the results for Cyprus are not available because of the very small number of firms in the population.

[5] Population data on turnover are obtained from Eurostat (Structural Business Statistics: Annual enterprise statistics by size class for special aggregates of activities, NACE Rev. 2.) and the weights are revised annually.

balances are calculated using the weighted results from equation (3) and applying the same weights based on population turnover as in equation (2):

$$B_s^* = \sum_{g=1}^{G} w_g B_{gs}^* \; . \qquad g = 1,2,\dots,G \text{ and } s = 1,2,3,4 \tag{4}$$

2.2 Survey indicators from the single-step and two-step weighting methods

The business survey results for all monthly questions, from May 2008 to December 2021 were computed using the two-step weighting method, described by equations (3) and (4). The balances at the sector level were seasonally adjusted by applying the same method as the one employed for producing the published results, i.e. TramoSeats. Subsequently, the seasonally adjusted balances for specific questions from the two-step weighting method were combined to obtain the following aggregates: (i) the Confidence Indicator for each sector, (ii) the Economic Sentiment Indicator (ESI-EC), (iii) the Employment Expectations Indicator (EEI), and (iv) an Economic Sentiment Indicator (ESI-CypERC) constructed using weights that reflect the contribution of each sector to the GDP of Cyprus.[6]

Table 1 presents some descriptive statistics for the main published indicators obtained from the single-step weighting method and for the corresponding survey indicators computed using the two-step weighting method. The values of the sectoral confidence indicators based on two-step weighting are on average larger than the values from the current weighting method, except in the case of industry for which the means are similar. The two-step weighting method results in higher standard deviations and larger mean absolute monthly changes compared to the current method, suggesting that the two-step weighting method increases the volatility of survey results. Both methods deliver indicators that are sufficiently correlated with official statistics, with the resulting correlations from the two methods being of very similar magnitude. Moreover, the indicators from the two-step method are highly correlated with the corresponding indicators from the single-step method.[7] The strong co-movement between the indicators from the two weighting schemes is shown in Figures A1 and A2 in the

[6] For details on the construction of Confidence Indicators, ESI-EC and EEI, see European Commission (2022). The weights employed in the ESI-EC published by the European Commission are the same across all countries; the ESI-CypERC is released by the Economics Research Centre on a monthly basis for monitoring developments in the local economy.

[7] Frame information in the form of size brackets for the number of employees has been included in the raw data since December 2017; the frame information on firm size was used as an alternative weighting variable in the first step of the two-step weighting method for robustness checks. The findings of the descriptive analysis when the weighting variable is based on size brackets are very similar to those reached when the firm-reported number of employees is used. The only exception is the construction confidence indicator when frame information is used for weighting the results, which is found to be less volatile than the currently published indicator; however, this finding might be driven by the short time period over which the frame information is available.

Appendix for the sectoral and overall indicators, respectively. The graphs reveal that survey indicators track relevant hard data well, regardless of the weighting method used, and that the currently published survey indicators exhibit a smoother evolution than those from the two-step weighting method.

TABLE 1
Descriptive statistics

	Mean	Standard deviation	Correl. with official statistics [2]	Absolute monthly changes, mean	Correl.[3]
Single-step weighting method					
Construction confidence indicator	-33.89	18.88	0.38	4.02	0.91
Industry confidence indicator	-8.32	12.44	0.58	3.84	0.95
Retail trade confidence indicator	-12.62	13.98	0.58	3.21	0.87
Services confidence indicator	0.92	26.91	0.46	6.11	0.96
ESI-EC [1]	100.00	10.00	0.54	2.13	0.98
ESI-CypERC [1]	100.00	10.00	0.57	1.86	0.98
EEI [1]	100.00	10.00	-0.53	3.88	0.94
Two-step weighting method					
Construction confidence indicator	-27.28	22.82	0.38	8.17	0.91
Industry confidence indicator	-8.64	14.53	0.60	5.41	0.95
Retail trade confidence indicator	-1.13	15.20	0.54	7.94	0.87
Services confidence indicator	5.20	29.88	0.45	8.59	0.96
ESI-EC [1]	100.00	10.00	0.53	2.51	0.98
ESI-CypERC [1]	100.00	10.00	0.56	2.16	0.98
EEI [1]	100.00	10.00	-0.53	4.20	0.94

Notes: [1] The Indicators are standardised (European Commission, 2022).
[2] The official statistics used in the calculation of correlations with confidence indicators are as follows: (i) number of building permits, (ii) index of industrial production (manufacturing), (iii) volume index of retail trade and (iv) weighted average of deflated turnover value indices in services (transport and storage, hotel and restaurants, information and communication, professional scientific and technical activities, administrative and support service activities). A weighted average of activity indices (in real terms) in manufacturing, retail trade and services obtained from official statistics is used in the calculation of correlations with ESIs. Officially published data on the number of registered unemployed is used in computing the correlation with EEI. All official data were seasonally adjusted and expressed in year-on-year percentage changes. The sample covers the period from May 2008 to December 2021. All correlation coefficients are statistically significant at the 5% significance level.
[3] The entry shows the correlation between the indicator computed using the two-step weighting method and the corresponding indicator from the single-step weighting method. All correlation coefficients are statistically significant at the 5% significance level.

To look further into the volatility of the survey indicators from the two weighting methods, we decompose each indicator into a trend-cycle component and an irregular component, after seasonal variation has been removed. By comparing the changes in the two components, we can gain insights into the short-term fluctuations of the series and disentangle cyclical changes from irregular movements or "noise" in the data. More specifically, a measure known as Months for Cyclical Dominance (MCD) is defined as a noise-to-signal ratio:

$$MCD = \frac{\frac{1}{T}\sum_{t=1}^{T}(I_t - I_{t-m})}{\frac{1}{T}\sum_{t=1}^{T}(C_t - C_{t-m})},\ m = 1,2,\dots,6 \quad (5)$$

where I_t and C_t denote the irregular and trend-cycle components of the monthly series, respectively; the changes in the two components are computed over different time spans, ranging from one to six months. The values for MCD decrease as the time span over which the changes are computed increases. As the time span increases, the magnitude of changes in the trend-cycle component increases, while the size of changes in the irregular component stays about the same. When the value of MCD falls below unity, the average change of the trend-cycle component exceeds (dominates) the average change in the irregular component, and the time span corresponding to this value of MCD shows the number of months over which a change in the series can be attributed to cyclical developments as opposed to erratic fluctuations. Thus, the smoother the series, the lower the MCD values and the shorter the time span over which an observed change can be viewed as cyclical.

Table 2 presents the MCD values for key survey indicators published on a monthly basis and the corresponding indicators computed using the two-step weighting scheme. Compared to the single-step weighting method, the noise-to-signal ratios tend to increase when the two-step weighting scheme is used. For the confidence indicators in construction and retail trade from the two-step weighting method, the irregular component remains dominant over the regular component at six months; hence time spans of over six months would be required before viewing a change in these indicators as cyclical. However, for the published construction and retail trade confidence indicators, the value of MCD falls below unity for time spans of four and two months, respectively, indicating that the current weighting method delivers cyclical signals much earlier than the two-step weighting method. Similarly, for the industry confidence indicator computed with the current and two-stage weighting schemes, the noise-to-signal ratios are less than unity at a time span of three and four months, respectively. For the services confidence indicator and the ESI, both methods result in similar MCD values, while for the EEI, both methods are associated with irregular

fluctuations that remain dominant over cyclical movements at six months. The analysis of MCD values shows that applying a two-stage weighting scheme results in noisier sectoral confidence indicators, particularly for construction and retail trade, extending the time span over which the series must be observed in order to extract cyclical information.

TABLE 2
Noise-to-signal ratio (months for cyclical dominance)

Number of months for computing the changes	1	2	3	4	5	6
Single-step weighting method						
Construction confidence indicator	2.8	1.4	1.0	0.8	0.7	0.6
Industry confidence indicator	2.2	1.2	0.9	0.8	0.8	0.7
Retail trade confidence indicator	1.1	0.6	0.5	0.5	0.4	0.4
Services confidence indicator	1.1	0.5	0.4	0.3	0.3	0.2
ESI-EC	1.7	0.9	0.7	0.5	0.5	0.4
ESI-CypERC	1.0	0.5	0.4	0.3	0.3	0.3
EEI	3.3	1.8	1.5	1.2	1.0	1.1
Two-step weighting method						
Construction confidence indicator	5.2	2.9	1.8	1.5	1.4	1.1
Industry confidence indicator	2.6	1.4	1.1	0.9	0.9	0.8
Retail trade confidence indicator	4.6	2.3	1.7	1.5	1.2	1.1
Services confidence indicator	1.1	0.5	0.3	0.3	0.2	0.3
ESI-EC	1.6	0.8	0.6	0.5	0.5	0.5
ESI-CypERC	0.9	0.5	0.4	0.3	0.3	0.3
EEI	3.4	1.8	1.5	1.2	1.1	1.1

Note: The underlined entries show the ratios corresponding to the shortest time span (number of months) for which cyclical changes dominate over irregular fluctuations.

3. Forecasting performance

This section evaluates the out-of-sample tracking performance of main business survey indicators with respect to activity and employment, published under national accounts. We analyse the performance of published survey indicators obtained using the single-step weighting method and the corresponding indicators computed from the two-step weighting procedure. The out-of-sample performance of survey indicators is compared with that of key monthly statistics published by the Statistical Service of Cyprus.

3.1 Publication lags

Quarterly national accounts data on economic activity and employment are available about 62 and 68 days after the end of the reference quarter, respectively. More specifically, national accounts data are published early in March, June, September and December. Monthly data that provide early signals on economic developments can be used for forecasting the growth rate of activity and employment in the short run. Survey data become available at the end of the reference month, while official monthly indicators on activity and labour market developments are released after the end of each reference month, with publication lags ranging from four to 70 days. We carry out a forecasting exercise in which the forecasts for the quarterly aggregates are computed at the end of each month and the availability of data mimics the publication pattern of monthly indicators and national accounts seen in real time. At the end of each month, two forecasts are computed: one for the current and one for the next quarter, or one for the previous and one for the current quarter, depending on the month in which the forecasts are computed.

Table 3 presents the pattern of data availability at the end of each month when the forecasts are assumed to be computed. Survey indicators are the most timely released, with published information extending within the forecast horizon, while data on building permits exhibit the longest publication delay. The table also shows the quarters for which forecasts are computed: six consecutive forecasts are constructed for each quarterly aggregate, starting about five months before the release of the national accounts and ending a few days prior to the publication of the official data. For example, the first forecast for second-quarter GDP growth is constructed at the end of March, and it is updated every month until the end of August when the last forecast is computed before the official publication of GDP growth at the beginning of September. As shown in Table 3, the amount of available monthly data for forecasting varies over the three months of the quarter. In the third month of each quarter, we forecast the current quarter (i.e. nowcast) and the next quarter, with information from monthly predictors that can extend at most within the current quarter (one, two, or three months), depending on the predictor. In the first and second months of each quarter, we forecast the previous quarter (i.e. backcast) and the current quarter. In the first month of the quarter, the available monthly data can at best cover all the months of the previous quarter and the first month in the current quarter. The forecasts computed in the second month of the quarter incorporate the largest amount of information; monthly data on almost all predictors cover the previous quarter fully and can extend in the first and second months of the current quarter, depending on the predictor.

TABLE 3

Data availability and forecasts computed at the end of each month

Real time:												
Quarter of current year		Q1(Y)			Q2(Y)			Q3(Y)			Q4(Y)	
Month of current year	M1(Y)	M2(Y)	M3(Y)	M4(Y)	M5(Y)	M6(Y)	M7(Y)	M8(Y)	M9(Y)	M10(Y)	M11(Y)	M12(Y)
Available data at the end of each month: latest reference period												
National accounts	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)**
Surveys	M1(Y)	M2(Y)	M3(Y)	M4(Y)	M5(Y)	M6(Y)	M7(Y)	M8(Y)	M9(Y)	M10(Y)	M11(Y)	M12(Y)
Registered unemployed	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)
Registrations of motor vehicles	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)
Tourist arrivals	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)
Volume index of retail trade	M11(Y-1)	M12(Y-1)	M1(Y)	M2(Y)	M3(Y)	M4(Y)	M5(Y)	M6(Y)	M7(Y)	M8(Y)	M9(Y)	M10(Y)
Index of industrial production (manufacturing)	M11(Y-1)	M12(Y-1)	M1(Y)	M2(Y)	M3(Y)	M4(Y)	M5(Y)	M6(Y)	M7(Y)	M8(Y)	M9(Y)	M10(Y)
Building permits	M10(Y-1)	M11(Y-1)	M12(Y-1)	M1(Y)	M2(Y)	M3(Y)	M4(Y)	M5(Y)	M6(Y)	M7(Y)	M8(Y)	M9(Y)
Turnover value indices in services	M9(Y-1)	M12(Y-1)	M12(Y-1)	M12(Y-1)	M3(Y)	M3(Y)	M3(Y)	M6(Y)	M6(Y)	M6(Y)	M9(Y)	M9(Y)
Forecasts computed at the end of each month												
Current or previous quarter (one quarter ahead)	Q4(Y-1)	Q4(Y-1)	Q1(Y)	Q1(Y)	Q1(Y)	**Q2(Y)**	**Q2(Y)**	**Q2(Y)**	**Q3(Y)**	**Q3(Y)**	**Q3(Y)**	Q4(Y)
Next or current quarter (two quarters ahead)	Q1(Y)	Q1(Y)	**Q2(Y)**	**Q2(Y)**	**Q2(Y)**	**Q3(Y)**	**Q3(Y)**	**Q3(Y)**	Q4(Y)	Q4(Y)	Q4(Y)	Q1(Y+1)

Note: The notation Qi(Y+j), i=1, 2, 3, 4 and j=-1, 0, 1 denotes the i-th quarter in the previous (j=-1), current (j=0) or next (j=1) year; Mi(Y+j), i=1, 2, …, 12 and j=-1, 0 denotes the i-th month in the previous (j=-1) or current (j=0) year.

3.2 Forecasting model

In the forecasting exercise, the dependent variables at the economy level are given by GDP and total employment (total number of persons employed). Moreover, production-side components of GDP, as well as sectoral employment are used as dependent variables. More specifically, the dependent variables at the sector level include gross value added and employment in the sectors of construction, manufacturing, trade and services; these variables are chosen to correspond to indicators produced by business surveys.[9] The joint contributions of the sectors considered to GDP and aggregate employment amount to 65% and 68%, respectively.

The dependent variable, $\hat{y}_{t+h}^{h}$ is expressed as the annualised growth rate:

$$\hat{y}_{t+h}^{h} = \frac{400}{h}\ln(\frac{Y_{t+h}}{Y_t}),$$

where Y_t denotes the level of the variable. The forecasts are computed by estimating Autoregressive Distributed Lag (ADL) models which include one predictor at a time. The dependent variables are in quarterly frequency and the predictors are published in monthly frequency and transformed into quarterly prior to estimation; monthly information on the predictors that extends within the forecast horizon is also incorporated in the models. The ADL forecasting equation (estimated by OLS using quarterly observations $t = 1,2, \dots, T$) takes the form,

$$\hat{y}_{T+h}^{h} = \hat{a}_h + \sum_{i=0}^{p} \hat{b}_{ih} X_{T-i} + \sum_{j=0}^{q} \hat{c}_{jh} y_{T-j} + \hat{d}_h X_{T+h}^{m}, \quad h = 1, 2 \qquad (6)$$

where X_t is a predictor based on business surveys or official statistics and X_{t+h}^{m} denotes monthly observations on predictor X_t available within the forecast horizon. The form of X_{t+h}^{m}, which can be a vector or a scalar, depends on the month of the quarter when the forecast is computed ($m = 1, 2, 3$) and the publication lag of the predictor. Let x_t^1, x_t^2, x_t^3 be the series of the monthly values for predictor X_t, relating to the first, second and third month of quarter t, respectively, and $X_t = \frac{1}{3}\sum_{m=1}^{3} x_t^m$. As an example, Table 4 presents various forms of X_{t+h}^{m} in the case of predictors from business surveys, and official statistics such as registered unemployed. Survey data are available at the end of the reference month, while data on registered unemployed are published shortly after the end of the reference month. The forms of X_{t+h}^{m} shown in Table 4 include information in ascending order, starting from the month with less

[9] Services exclude public administration, health and education.

information ($m = 3$, i.e. third month of the quarter, top row) and moving to the month with more information ($m = 2$, i.e. second month of the quarter, bottom row).

TABLE 4
Available information within the forecast horizon: examples

Business surveys		Official statistics: registered unemployed	
$h = 1$	$h = 2$	$h = 1$	$h = 2$
$X^3_{T+1} = X_{T+1}$	$X^3_{T+2} = 0$	$X^3_{T+1} = [x^1_{T+1}\ x^2_{T+1}]'$	$X^3_{T+2} = 0$
$X^1_{T+1} = [X_{T+1}\ x^1_{T+2}]'$	$X^1_{T+2} = x^1_{T+2}$	$X^1_{T+1} = X_{T+1}$	$X^1_{T+2} = 0$
$X^2_{T+1} = [X_{T+1}\ x^1_{T+2}\ x^2_{T+2}]'$	$X^2_{T+2} = [x^1_{T+2}\ x^2_{T+2}]'$	$X^2_{T+1} = [X_{T+1}\ x^1_{T+2}]'$	$X^2_{T+2} = x^1_{T+2}$

The forecasts in (6) are based on the multiperiod regression method (as opposed to the iterated forecast method), thus they are computed using only published data for predictors and lagged dependent variables in both steps. Alternative approaches to address publication lags and the difference in the frequency between dependent variables and predictors include the use of auxiliary models for forecasting monthly predictors, as in Golinelli and Parigi (2007), or mixed data sampling models (see, Ghysels, Santa-Clara and Valkanov, 2004).

The pseudo out-of-sample forecasting exercise uses quarterly and monthly data over the period 2008Q3 – 2021Q4 and July 2008 – March 2022, respectively; the first estimation sample consists of the first 24 observations and the sample is extended by one quarter in each iteration. The lag length selection and estimation of forecasting equations are carried out anew in each iteration. Forecasts are computed for $h = 1, 2$, using a pseudo out-of-sample set-up that mirrors the availability of monthly indicators in real time, as explained in section 3.1. The forecasts are evaluated over the period 2015Q3+ h – 2021Q3- h.

3.3 Results

The results of the forecasting exercise are shown in Table 5 for GDP and production-side components, and Table 6 for total and sectoral employment. The tables present the root mean squared forecast error (RMSFE) of each model relative to that of a benchmark model. As explained in section 3.1, for each quarterly variable of interest, we construct six consecutive forecasts, starting about five months before and ending a few days prior to the first official publication of the national accounts. Thus, we have six series of forecasts: one for the next quarter, three for the current quarter and two for the previous quarter; the corresponding RMSFEs are given in the six successive columns in Table 5 and Table 6. In other words, the six columns of Table 5 and Table 6 correspond to a forecast, three consecutive nowcasts and two backcasts.

TABLE 5
Relative RMSFE, GDP and components

Quarter for which the forecast is computed	Next (Forecast)	Current (1st Nowcast)	Current (2nd Nowcast)	Current (3rd Nowcast)	Previous (1st Backcast)	Previous (2nd Backcast)
GDP						
RMSFE, random walk (benchmark)	4.66	4.66	4.66	3.52	3.52	3.52
SW: ESI-EC	0.99	0.81	0.79	0.75	0.88	0.71
SW: ESI-CypERC	0.95	0.78	0.76	0.68	0.72	0.71
TW: ESI-EC	0.99	0.86	0.88	0.92	0.87	0.87
TW: ESI-CypERC	1.08	0.88	0.85	0.87	0.87	0.87
OS: Registered unemployed	1.06	0.97	0.91	1.13	0.98	0.95
OS: Volume index of retail trade	1.15	0.93	0.95	1.10	1.11	0.98
OS: Index of industrial production (manufacturing)	0.94	0.94	0.82	0.95	0.94	0.82
OS: Activity indices for sectors (weighted average)	1.18	1.18	1.30	1.18	1.18	1.13
Value added: Construction						
RMSFE, random walk (benchmark)	13.97	13.97	13.97	8.16	8.16	8.16
SW: Construction confidence indicator	0.98	0.94	0.98	1.03	0.99	1.02
TW: Construction confidence indicator	0.93	0.91	0.92	1.02	1.04	1.08
OS: Building permits	1.13	1.11	1.08	1.21	1.13	1.12
Value added: Manufacturing						
RMSFE, random walk (benchmark)	8.27	8.27	8.27	5.95	5.95	5.95
SW: Industry confidence indicator	1.01	0.96	0.76	0.96	0.99	0.98
TW: Industry confidence indicator	1.01	0.93	0.90	1.03	0.99	1.00
OS: Index of industrial production (manufacturing)	1.10	1.10	0.85	1.13	1.16	0.77
Value added: Trade, transport, storage, etc.						
RMSFE, random walk (benchmark)	10.69	10.69	10.69	7.83	7.83	7.83
SW: Retail trade confidence indicator	0.98	0.93	0.96	1.03	1.03	1.04
TW: Retail trade confidence indicator	0.99	0.93	0.90	1.02	0.92	0.94
OS: Registrations of motor vehicles	1.08	1.02	1.05	1.06	0.99	1.00
OS: Tourist arrivals	1.13	1.02	1.09	1.04	1.00	0.99
OS: Volume index of retail trade	1.13	1.11	1.03	1.10	1.09	0.99
Value added: services						
RMSFE, random walk (benchmark)	5.09	5.09	5.09	3.96	3.96	3.96
SW: Services confidence indicator	1.01	0.88	0.81	0.83	0.82	0.84
TW: Services confidence indicator	1.06	0.96	0.93	0.95	0.90	0.90
OS: Registrations of motor vehicles	1.18	1.10	1.02	1.20	1.10	1.03
OS: Tourist arrivals	1.59	1.35	1.43	1.21	1.22	1.19
OS: Deflated turnover indices (weighted average)	1.35	1.35	1.36	1.19	1.19	1.25

Notes: The acronyms "SW" and "TW" indicate that the survey predictor is based on single-step and two-step weighting, respectively. The acronym "OS" indicates that the predictor is obtained from official statistics (Statistical Service of Cyprus). The forecasts and therefore the RMSFE from the benchmark model are updated every quarter when new national accounts data become available. The number of lags is selected using the Bayesian Information Criterion. Underlined entries indicate rejection of the null hypothesis of equal MSFE (against the alternative that a model has a smaller MSFE than the benchmark) at the 5% level of significance (Clark and West, 2007).

As can be seen in Table 5, in the case of GDP and large components, such as gross value added in trade and services, the use of survey indicators for forecasting improves significantly on the benchmark's performance. Smaller gains from employing survey indicators for forecasting are found for gross value added in construction and manufacturing. No survey weighting method is found to uniformly outperform the other, and the weighting methods considered result in similar RMSFEs in most cases. For GDP and gross value added in services and manufacturing, indicators from the single-

step weighting method lead to lower RMSFEs than the corresponding indicators based on the two-step weighting method, while the opposite is found for gross value added in construction and trade.

No noticeable improvements in the forecast accuracy are observed from utilising official statistics vis-à-vis employing survey indicators for forecasting. The use of the industrial production index for computing the final backcast for manufacturing value added is an exception. In general, the forecasting performance of models which include officially published indicators tends to be similar or inferior to that of models with survey indicators.

The release of new data every month does not always increase the accuracy of the forecasts for GDP and components. This holds for survey data but most notably for official statistics. The first and second forecasts for the current quarter are associated with lower RMSFEs in most cases, suggesting that new information results in revisions that bring the forecasts closer to the actual value of the aggregate. No improvements in accuracy are found in the case of the final forecast computed for the current quarter and the first forecast for the previous quarter; in many cases forecast errors tend to increase. The final nowcast and the first backcast incorporate information relating to the quarter for which the forecasts are computed. However, new information does not lower RMSFEs relative to the benchmark, because the decrease in the benchmark's RMSFE due to new information on the previous quarter from the dependent variable is larger than the change in the RMSFE of models that use new monthly data releases for the current quarter. The only exception is the GDP growth forecasts which are updated using new information from single-step weighted survey responses incorporated in the ESI. Finally, the last forecast round, just before the first official release of the national accounts data, results in RMSFEs declines which are mainly associated with the use of new monthly official data (for example, index of industrial production) rather than new survey information.

Turning to Table 6 and total employment, forecasting gains from the use of monthly indicators are observed only in the case of the final forecast for the current quarter and the forecasts for the previous quarter. Therefore, monthly predictors are useful for forecasting total employment when the available data on predictors cover at least two out of the three months of the quarter being forecast, and the time lapse before the official publication of the actual employment data is less than three months. Also, using the EEI based on the two-step weighting method does not improve the accuracy of the final nowcast or the two consecutive backcasts, compared to utilising the official

statistics on registered unemployed or the EEI based on the single-step weighting method.

TABLE 6
Relative RMSFE, employment

Quarter for which the forecast is computed	Next (Forecast)	Current (1st Nowcast)	Current (2nd Nowcast)	Current (3rd Nowcast)	Previous (1st Backcast)	Previous (2nd Backcast)
Total employment						
RMSFE, AR(4) (benchmark)	1.74	1.74	1.74	1.75	1.75	1.75
SW: EEI	1.14	1.21	1.27	0.92	0.89	0.91
TW: EEI	1.06	1.05	1.01	0.99	0.97	0.97
OS: Registered unemployed	1.77	1.86	1.90	0.92	0.96	0.88
Employment: Construction						
RMSFE, AR(4) (benchmark)	4.14	4.14	4.14	2.59	2.59	2.59
SW: Employment expectations, construction	0.88	0.86	0.90	1.01	1.03	1.07
TW: Employment expectations, construction	1.11	0.95	0.96	0.91	0.84	0.88
OS: Registered unemployed, construction	1.14	1.11	1.13	1.09	1.01	1.04
Employment: Manufacturing						
RMSFE, AR(4) (benchmark)	1.68	1.68	1.68	1.27	1.27	1.27
SW: Employment expectations, industry	1.03	1.01	1.01	0.82	0.88	0.83
TW: Employment expectations, industry	1.10	1.11	1.14	0.94	0.90	0.82
OS: Registered unemployed, manufacturing	1.26	1.16	1.72	1.25	1.08	1.31
Employment: Trade, transport, storage, etc.						
RMSFE, AR(4) (benchmark)	2.18	2.18	2.18	1.36	1.36	1.36
SW: Employment expectations, retail trade	0.85	0.85	0.84	0.95	0.95	0.95
TW: Employment expectations, retail trade	1.00	0.93	0.92	0.96	0.96	0.94
OS: Registered unemployed, retail trade	1.27	1.28	1.27	1.29	1.28	1.40
Employment: services						
RMSFE, AR(4) (benchmark)	5.33	5.33	5.33	7.38	7.38	7.38
SW: Employment perceptions, services	0.96	1.04	1.05	0.88	0.87	0.82
SW: Employment expectations, services	0.95	0.96	0.94	1.01	0.96	1.00
TW: Employment perceptions, services	0.98	0.96	0.96	0.88	0.90	0.90
TW: Employment expectations, services	0.96	0.93	0.89	0.98	0.99	0.99
OS: Registered unemployed, services	1.12	1.12	1.10	0.99	1.00	0.96

Notes: The acronyms “SW” and “TW” indicate that the survey predictor is based on single-step and two-step weighting, respectively. The acronym “OS” indicates that the predictor is obtained from official statistics (Statistical Service of Cyprus). The forecasts and therefore the RMSFE from the benchmark model are updated every quarter when new national accounts data become available. The number of lags is selected using the Akaike Information Criterion. Underlined entries indicate rejection of the null hypothesis of equal MSFE (against the alternative that a model has a smaller MSFE than the benchmark) at the 5% level of significance (Clark and West, 2007).

At the sector level, the results reveal that the use of survey indicators in employment growth models, reduces the RMSFEs vis-à-vis both the benchmark and models that include the officially published statistics on registered unemployed. Models with employment expectations from the single-step weighting scheme outperform those with two-step weighted employment expectations, for forecasting employment growth in the sectors of manufacturing and trade. The results are mixed for the construction sector, as single-step weighting yields superior performance when the forecast and the first two nowcasts are constructed, while two-step weighting lowers RMSFEs for the last nowcast and the two backcasts. For services, predictors on both employment

perceptions and expectations are available, which are found to lower RMSFEs at different stages of the forecasting cycle. Employment expectations improve forecast accuracy in the early forecast rounds, while perceptions lead to lower RMSFEs for the last three forecast rounds. For services, no weighting method leads to uniformly lower RMSFEs over all forecasts rounds.

The availability of new survey information does not always lower the relative RMSFEs in successive forecast rounds; however, a reduction in the relative RMSFEs is found when the final nowcast is computed in the case of employment in manufacturing and, to a smaller degree, employment in services (when the predictor is given by employment perceptions) and total employment.

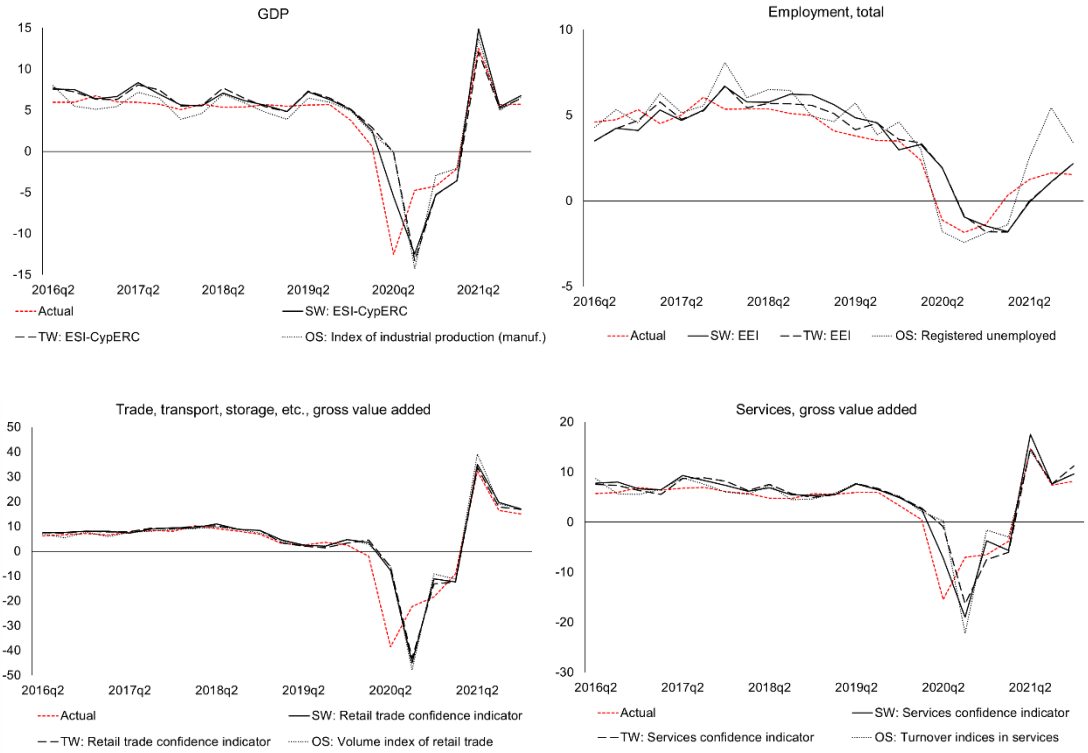
The currently applied single-step weighting scheme fares well in terms of short-term forecasting against the two-step weighting method and official statistics, particularly for GDP and large components, and, to a smaller extent, for employment. Comparing the RMSFEs associated with survey and hard data, we can conclude that survey data yield forecast gains because of their timely availability, but also owing to forward-looking information they incorporate for developments in variables in the national accounts. In most cases, using survey predictors results in lower forecast errors than employing official indicators, especially at the early stages of the forecasting cycle.

A comparison of the pseudo-real time forecasts for the current quarter (nowcasts) with the actual values is shown in Figure 1, for GDP and its largest components, and for total employment. The forecasts plotted refer to the final nowcasts computed less than three months before the official publication of the actual values. Although the available time period is short, the plots provide indications of the predictors' out-of-sample tracking performance. Survey predictors from the two different weighting methods result in very similar or almost identical nowcasts. Also, the differences in the forecasts obtained using survey indicators and official statistics are very small.

In the case of activity aggregates, the forecasts from survey indicators track activity growth closely, but a tendency to overpredict during normal times and in downturn is discernible, especially for GDP and gross value added in services. The magnitude of the abrupt activity contraction caused by the COVID-19 pandemic was missed by both survey and official data; however, survey indicators, particularly those based on the single-step weighting method, provided more useful insights on the COVID-19 downturn than officially published indicators. The peak of activity growth following the COVID-19 downturn was more accurately predicted by survey indicators based on the two-stage weighting scheme.

In the case of employment, forecasts generated using official statistics are more volatile that those obtained from employment expectations. Official statistics on registered unemployed predicted the decline in employment during the COVID-19 pandemic better than survey indicators; however, the former resulted in large overpredictions as the economy retuned to normalcy.

FIGURE 1
Forecasts for the current quarter (nowcasts)



Notes: The acronyms “SW” and “TW” indicate that the survey predictor is based on single-step and two-step weighting, respectively. The acronym “OS” indicates that the predictor is obtained from official statistics (Statistical Service of Cyprus). Forecasts and actuals are in the form of year-on-year percentage changes.

4. Conclusions

The published business survey results for Cyprus are produced using a single-step weighting method. Under the current weighting method, no weights are applied to firm responses to obtain survey results at the subsector level; weights based on turnover population data for subsectors are employed to compute sectoral aggregates. The purpose of this paper is to investigate the application of a two-step weighting method for computing the business survey results for Cyprus, by using survey-reported data on the number of employees. More specifically, at the subsector level, the results are obtained by weighting individual responses by the number of employees and thus replies by firms with more staff members gain greater importance. At the sector level,

survey results are computed by applying weights drawn from subsector population data, as in the single-step weighting method. The sectoral and economy-wide survey indicators from the two weighting methods are compared in terms of in-sample tracking performance, volatility, and forecasting ability examined in a setup that simulates the data availability observed in real time.

Our results show that the survey indicators computed from the two-step weighting method and the corresponding published indicators, obtained from a single-step weighting method, perform similarly in terms of in-sample tracking and out-of-sample forecasting. However, compared to the published sectoral confidence indicators, those computed from the two-step weighting method are more volatile and require a longer time span before reliable cyclical signals can be extracted. The increase in the volatility of business survey variables after the introduction of a second weighting step has also been reported in other studies (see, for example, Kershoff, 2019, and Etter and Koberl, 2006).

The results of the forecasting exercise show that irrespective of the weighting method, models with survey indicators outperform both simple autoregressive models and models with officially published indicators, particularly for GDP and production-side components. Thus, survey data constitute a useful input in models for forecasting macroeconomic variables in the short run, not only because of their shorter publication lags vis-à-vis official statistics, but also because of their forward-looking information content, especially in times of tranquillity or for signalling a recovery.

The results of the analysis are encouraging in relation to the single-step weighting method currently applied to the survey responses to produce sectoral confidence indicators. The forecasting ability of survey data vis-à-vis monthly official statistics and other publicly available indicators could be further explored in future work using mixed data sampling models.

Acknowledgements

The Economics Research Centre of the University of Cyprus acknowledges funding from the European Union, the Ministry of Finance and the University of Cyprus for conducting Business and Consumer Surveys in Cyprus as part of the Joint Harmonised European Union Programme of Business and Consumer Surveys. Special thanks to Efi Kalorkoti who participated in the early stages of this work.

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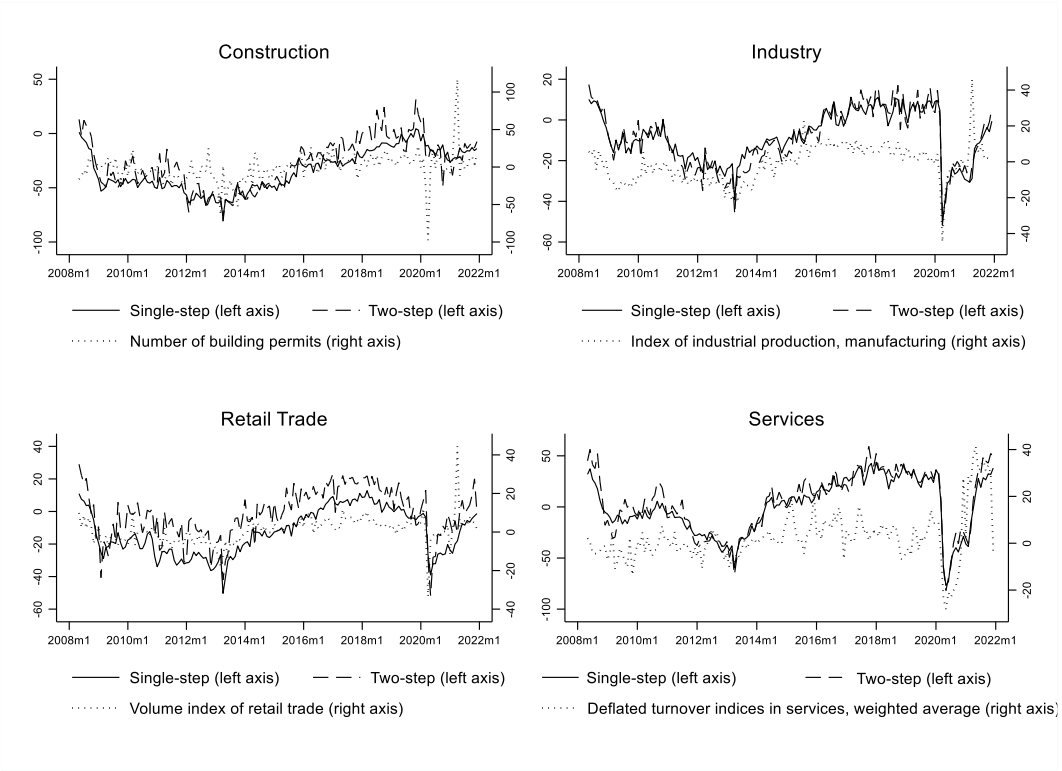
Appendix

FIGURE A1

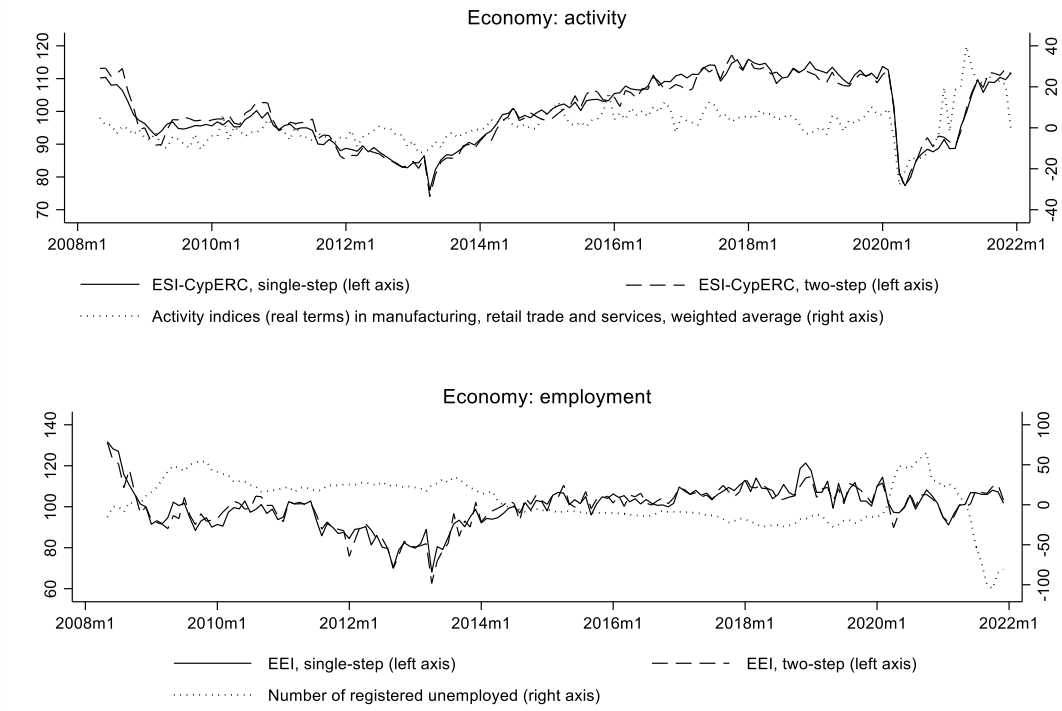
Confidence indicators (left axis) and official statistics (right axis), sectors



Note: All official data were seasonally adjusted and expressed in year-on-year percentage changes.

FIGURE A2

Survey indicators (left axis) and official statistics (right axis), economy



Note: All official data were seasonally adjusted and expressed in year-on-year percentage changes.