



A Monthly Business Cycle Indicator for Ireland

Thomas Conefrey and Joëlle Liebermann¹

Vol 2013, No.3

Abstract

This *Letter* describes the construction of a new monthly business cycle indicator of the Irish economy. The index of economic activity draws information from a range categories of data covering output, income, employment, external demand and credit. A statistical method is used to extract a single factor from this panel of variables which is common to each of the series and explains most of the variation across all the data. The index captures the steep decline in economic activity at the height of the financial crisis and the recovery which has taken place since 2010. The weak external environment and subdued domestic demand since the beginning of 2013 is reflected in a decline in the index over recent months. The coincident indicator can be updated regularly to provide analysts and policymakers with a timely assessment of the current state of the economy.

1 Introduction

There is a long history of empirical evidence which indicates that economies experience business cycles. Burns and Mitchell (1946) defined these cycles as consisting of expansions occurring at about the same time in many economic activities followed by a contraction and a revival leading into the next phase of the cycle. Hence a characteristic feature in the definition of the business cycle is that macroeconomic data move together during phases of downswings and upswings. As such, a business cycle indicator can be seen as the underlying latent factor driving the comovement, at business cycle frequencies, between numerous macroeconomic variables.

In practise analysts and policy-makers com-

monly face two problems in trying to identify these repetitive sequences of the business cycle. First, movements in macroeconomic indicators such as retail sales or surveys (e.g. the purchasing managers's index (PMI)) capture both underlying changes in their business cycle component as well as short-run fluctuations which are mainly idiosyncratic, i.e. variable specific. The latter are noise and/or measurement errors, which is irrelevant in assessing the underlying state of the economy. Secondly, important macroeconomic variables are available at different frequencies and are published with varying lags. For example, Quarterly National Accounts data on consumption, investment and domestic demand are only released around 90 days after the end of the reference quarter. To have a more timely assessment of the underlying state of the economy, one can look at

¹Corresponding author: joelle.liebermann@centralbank.ie. The views expressed in this letter are those of the authors and do not necessarily reflect those of the Central Bank of Ireland. We would like to thank Reamonn Lydon, Kieran McQuinn and Gerard O'Reilly for comments on an earlier draft.

monthly variables such as house prices, retail sales and PMIs.

An extensive literature has constructed business cycle indicators using the factor model framework (see among others, Mariano and Murasawa, 2003; Stock and Watson, 1991; Altissimo *et al.*, 2010; Brave and Butters, 2011) which decomposes variables in two orthogonal unobserved components: a common component which is driven by unobserved factors which accounts for most of the comovement among the variables and an idiosyncratic component which is driven by variable-specific shocks.

In this Letter we use the factor model framework to construct a monthly business cycle indicator for the Irish economy from a panel of monthly indicators. The panel includes variables relating to internal demand covering the labour, credit and the housing markets among others, as well as external variables. Since in real-time these variables are released in a non-synchronous manner and with varying publication lags, the panel has a ragged-edge structure at the end of the sample. Hence to provide a real-time signal to policy-makers of the state of the economy, i.e. using the latest available information for each variable, we use the Giannone, Reichlin and Small (GRS) (2008) factor model framework that can deal with unbalanced datasets. Furthermore, prior to estimation of the business cycle indicator we apply a three-months moving average filter to the (transformed to stationary) series so as to clean them from the very short run fluctuations.

The construction of a monthly coincident business cycle indicator, although related to, is different from nowcasting GDP.² First, the motivation for constructing such an indicator was described in the seminal paper by Mariano and Murasawa (2003). These authors state that “if we observe real GDP promptly on a monthly basis, then we do not need a monthly coincident index”. This index helps identify at a higher frequency, and hence in a more timely manner, in which direction the economy is headed. Secondly, in nowcasting GDP one aims at tracking the target, i.e. GDP, whereas with a business cycle indicator one aims at summarizing/extracting the overall comovement present in the underlying series, after the removal of measurement errors, seasonal and other short-run fluctuations.

tuations.

2 The econometric methodology

To set notations, let $x_t = (x_{1,t} \dots x_{n,t})'$ denote the $n \times 1$ vector of transformed to stationary variables from the panel of monthly indicators. In a dynamic factor model (DFM), the vector of observables x_t is represented as the sum of two orthogonal unobserved components: a common component which is driven by latent factors and an idiosyncratic component which is driven by variable-specific shocks.

The latent monthly business cycle indicator underlying the comovements between the variables is estimated as the first factor (i.e. the one explaining most of the panel variation) and as such the model reduces to a single factor model.

This model is given by:

$$x_t = \Lambda BC_t + \xi_t \quad (1)$$

where BC_t is the business cycle indicator, Λ is the $n \times 1$ matrix of loadings, and ξ_t is a $n \times 1$ vector of idiosyncratic components. The business cycle indicator dynamics is modeled as an AR(p):

$$BC_t = A_1 BC_{t-1} + \dots + A_p BC_{t-p} + u_t \quad (2)$$

where A_1, \dots, A_p are autoregressive coefficients.

Equation (1) links the unobserved indicator to the observed variables, with the additional assumption that the idiosyncratic components are cross-sectionally orthogonal white noises. The shock, u_t is also a white noise and is orthogonal to the idiosyncratic components.

The estimation method is the two-step estimator of Doz, Giannone and Reichlin (2011a). In a first step the business cycle indicator in equation (1) is extracted using principal components from a balanced panel, i.e truncating the panel at the last month for which all variables are available. This also provides estimates of the loadings and the covariance matrix of the idiosyncratic components. Next the parameters of equation (2) are estimated by running a AR on the estimated business cycle indicator. In a second step the model described by equations (1)-(2) is cast in the state space form,

²A set of modelling tools for nowcasting GDP is used at the CBI to inform its projection exercises (see D'Agostino *et al.*, 2012, and Liebermann, 2012).

and replacing the parameters by their consistent estimates obtained from the first step, the business cycle indicator is re-estimated recursively using the Kalman filter and smoother.

3 The Data

To estimate the latent business cycle indicator for the Irish economy we use a panel of 26 variables. The panel includes hard data such as retail sales, employment, industrial production, prices and credit among others, and soft data which includes surveys such as consumer sentiment and the PMI. Given the openness of the Irish economy, developments in international trade have a key bearing on economic prospects in Ireland. The vast bulk of manufacturing output and a growing share of services output is exported while goods and services exports combined amount to more than 100 per cent of GDP. To capture the importance of foreign demand as a driver of Irish exports, a number of external variables are included in the model. These include a measure of weighted import demand for Irish goods from key trading partners as well as US and euro area industrial production. The extent to which Irish exports are concentrated in particular sectors can alter the impact of changes in external demand on Irish trade. This was apparent in 2009 when Irish exports contracted by less than the decline in world trade due in part to the concentration of Irish exports in sectors such as medical devices and pharmaceuticals.

A notable aspect of Ireland's economic performance since 2009 has been the relatively strong performance of exports in contrast to the weakness of domestic demand (Figure 1). Although world trade volumes collapsed in 2009, Irish exports proved relatively resilient with a decline of less than 4 per cent recorded. Exports recovered strongly over the period 2010-2012 and exceeded their 2007 peak in 2010. In contrast, personal consumption declined by 5.1 per cent in 2009 and has been broadly flat since then while government consumption and investment have registered large declines. As a result, domestic demand has remained subdued and acted as a drag on overall GDP growth. The weakness of the domestic economy reflects a range of factors, in particular reductions in disposable income due to fiscal consolidation and unemployment as well as household deleveraging.

To take account of the dichotomy which has emerged in the economy between domestic demand and the exporting sector, we estimate two versions of the business cycle indicator, one including all 26 series in the panel and a second which includes only variables related to the domestic economy. This allows for an assessment of the current state of the economy if only domestic conditions are considered as well as all relevant variables reflecting domestic and external demand. The model is estimated using data from January 2000 to June 2013.

4 The results

Figure 1: Domestic demand and exports

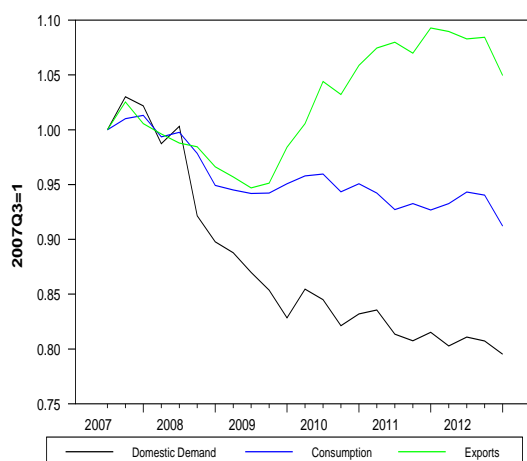
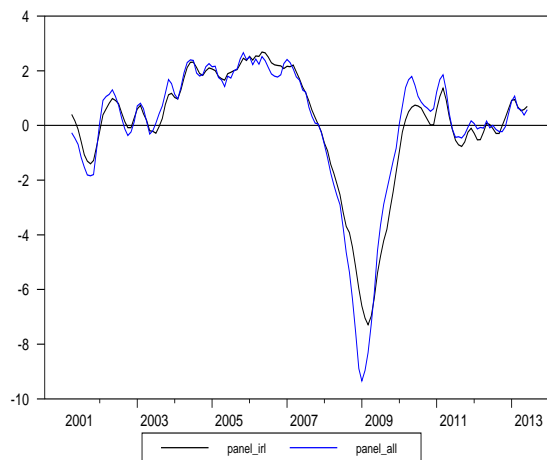


Figure 2 shows our estimates of the two versions of the business cycle indicator described above. The indicator estimated using all data in the panel (panel_all) tracks the version computed using only domestic variables (panel_irl) reasonably closely over the sample period. Both indicators turn negative in 2001 as the economy deteriorated following the global economic slowdown. From 2002 until late 2007, the indicators remained in positive territory suggesting that activity was above its long-run historical trend. A sharp decline in the value of the indices is evident from early 2007 and it falls deep into negative values during 2008 and 2009. The lowest value of the indices is recorded in January 2009 indicating that economic activity was substantially below its historical average. It is no-

table that the index including all variables registers a larger decline than the domestic only version during 2008 and 2009. This likely reflects the sharp reduction in external demand as world trade volumes recorded their sharpest decline since the Great Depression.

Figure 2: Business Cycle Indicator

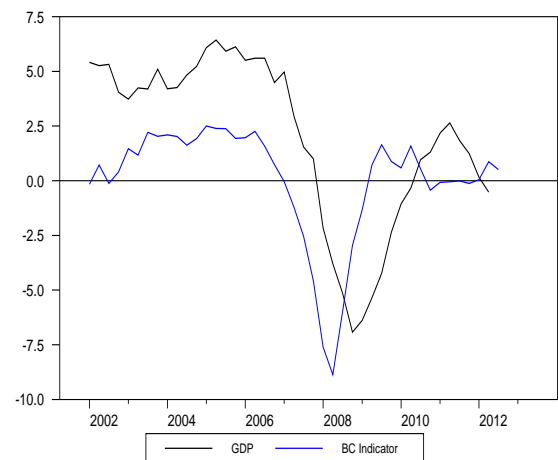


The indicators recover towards positive values during 2010 and 2011, driven by the improvement in the world economy. The index including the external variables rises above the version including only domestic variables during 2010 and 2011. This highlights the boost to Irish economic activity from external demand over this period. The indicator including only domestic variables has been broadly flat since early 2011 reflecting the weakness in domestic demand. A small pick-up is evident in both indicators during mid-2012, however, there is evidence of weaker activity over recent months. This is consistent with the evidence from other macroeconomic data releases which show exports weakening with domestic demand still sluggish. Nonetheless, the indicators remain marginally in positive territory which suggests some underlying strength in economic activity in recent months.

Figure 3 shows a plot of the business cycle indicator (panel_all) along with the annualised percentage change in real GDP. The methodology used to calculate the business cycle indicator is designed to cleanse the underlying economic time series from random fluctuations and noise. As a result, it would not be surprising to find periods

when GDP movements, which have both a long-run cyclical component and a short-run noise element, and changes in the indicator are not closely aligned.

Figure 3: GDP and Business Cycle Indicator



The indicator tracks overall movements in GDP reasonably closely. During the period of strong GDP growth from 2002 to 2007, the values of the index also imply expansion in economic activity. The index tracks the decline and subsequent recovery in GDP growth over the 2008 to 2012 period. As the index is calculated based on a three-month moving average of the underlying data in the panel, in the chart it leads changes in GDP which is shown on an annualised basis.

5 Conclusion

In this letter we describe the construction of a new monthly business cycle indicator for the Irish economy. Using a flexible estimation approach, the index can be estimated from an unbalanced panel of variables covering different time periods. As a result, all of the most recent information across a range of economic indicators can be taken into account to help decipher changes in economic activity. The methodology also differentiates between the noise component of various economic series

and underlying changes which provide useful information on economic developments.

The index captures the steep decline in economic activity at the height of the financial crisis and the recovery which has taken place since 2010.

The weak external environment and subdued domestic demand since the beginning of 2013 is reflected in a decline in the index over recent months. As new data become available, it is intended to update the index regularly and to use it to inform assessments of the current state of the economy.

References

- [1] D'Agostino, A., McQuinn, K., and O'Brien, D. (2012): "Nowcasting Irish GDP", *OECD Journal: Journal of Business Cycle Measurement and Analysis*, OECD Publishing, CIRET, vol. 2012(2), pages 21-31.
- [2] Altissimo, F., Cristadoro, R., Forni, M., Lippi, M. and Giovanni, V. (2010): "New Eurocoin: Tracking economic growth in real time", *The Review of Economics and Statistics*, 92(4), 1024-1034.
- [3] Burns, A. and Mitchell, W. (1946): "Measuring Business Cycles" *National Bureau of Economic Research*.
- [4] Doz, C., Giannone, D. and Reichlin, L. (2011): "A two-step estimator for large approximate dynamic factor models based on Kalman filtering", *Journal of Econometrics*, 164(1), pp.188-205.
- [5] Giannone, D., Reichlin, L. and Small, D. (2008): "Nowcasting: the real-time information content of macroeconomic data releases", *Journal of Monetary Economics*, 55(4), pp.665-676.
- [6] Liebermann, J. (2012): "Short-term forecasting of quarterly gross domestic product growth", *Quarterly Bulletin Articles*, Central Bank of Ireland, pages 74-84, February.
- [7] Mariano, R. and Murasawa, Y. (2003): "A new coincident index of business cycles based on monthly and quarterly series", *Journal of Applied Econometrics*, 18(4), 427-443.
- [8] Stock, D. and Watson, M. (1991): "A probability model of the coincident economic indicators", in *Leading Economic Indicators*, ed. by K. Lahiri and G. Moore. Cambridge University press.