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Nowcasting with the help of foreign indicators: The case of Mexico

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ABSTRACT

I propose an econometric model to interpret the flow of macroeconomic data releases that are useful to assess the state of the Mexican economy. I estimate the relevance of both Mexican and US indicators for predicting Mexican GDP, using a nowcasting model that can be continuously updated as new data are released. The model produces forecasts that have better accuracy than Surveys of Professional Forecasters, and shows the high relevance of US data in the real-time process of forecast updating. These results encourage a more frequent use of external indicators in short-term GDP forecasting in small open economies.

1. Introduction

Which are the macroeconomic indicators to look at in order to assess the state of the business cycle? This is a relevant question for policy makers, who make and implement decisions on the basis of the current state on the economy, and for market participants, who take it into account in making their investment decisions. GDP would be the natural indicator to consider. However, since it is published only quarterly and it has a significant publication delay (usually weeks or months after the end of the reference quarter), it is important to extract information from indicators that are available at higher frequency and in a more timely fashion, to have a reliable forecast (or “nowcast”) of the current state of the economy that can be updated whenever a new data release is published. In the case of a small open economy, a related and important question is whether it is important to look at external data as well. The Mexican example could be seen as a case study to analyse the relevance of foreign macroeconomic data in small open economies whose business cycles are highly synchronized with the one of a large trade partner. In the Mexican case, do US indicators help in detecting early signals about business cycle developments and to identify turning points? Are they useful in the process of forecast updating? Which are the relevant domestic and foreign variables to look at? To answer these questions, this paper reconstructs the

macroeconomic information flow from Mexico and from the US, and interprets it through the lens of a nowcasting model for Mexican GDP.

The general framework of the nowcasting approach has been introduced by [Giannone et al. \(2008\)](#), and recent developments have been surveyed by [Banbura et al. \(2011\)](#) and [Banbura et al. \(2013\)](#). The issue is to assess the current state of the economy exploiting the information embedded in many macroeconomic variables which are more timely and at a higher frequency than a target variable usually released with a considerable delay (e.g. GDP), and to be able to update the forecasts in real-time whenever new macroeconomic data is released. Private and institutional sources provide a flow of macroeconomic data almost every day: the challenge is to interpret the new information properly, in a process of signal extraction that copes with its complexity. The complexity lies in dealing with a possibly large number of variables, which can have mixed frequencies, refer to different sectors of the economy, and are released in a non-synchronous way. Using a factor model is a parsimonious way to use a large number of macroeconomic variables exploiting their co-movement, see [Forni et al. \(2000\)](#) and [Stock and Watson \(2002\)](#). The problems of the mixed frequency and of the non-synchronicity of the releases are solved by casting the model in state space form and using Kalman filtering techniques.¹ Following [Doz et al., \(2012\)](#), I estimate the model using Maximum Likelihood in an Expectation-Maximization algorithm in-

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¹ The nowcasting methodology has been proven to be effective in many empirical applications, applied to many countries. Among others see [Rünstler et al. \(2009\)](#) and [Giannone et al. \(2009\)](#) for the Euro Area, [Lahiri and Monokroussos \(2013\)](#), [Higgins \(2014\)](#), and [Grant et al. \(2016\)](#) for the US, [Barhoumi et al. \(2010\)](#) for France, [D'Agostino \(2008\)](#) and [Liebermann \(2012\)](#) for Ireland, [Matheson \(2010\)](#) for New Zealand, [Marcellino and Schumacher \(2010\)](#) for Germany, [de Winter \(2011\)](#) for the Netherlands, [Siliverstovs and Kholodilin \(2012\)](#) for Switzerland, [Arnostova et al. \(2011\)](#) and [Rusnak \(2016\)](#) for the Czech Republic, [Aastveit and Trovik \(2012\)](#) and [Luciani and Ricci \(2014\)](#) for Norway, [Bragoli et al. \(2015\)](#) for Brazil, [Luciani et al. \(2017\)](#) for Indonesia, [Bragoli and Modugno \(2017\)](#) for Canada, [de Antonio Liedo \(2014\)](#) for Belgium, [Bragoli \(2017\)](#) for Japan, [Matheson \(2013\)](#) for 32 economies, [Porshakov et al. \(2016\)](#) for Russia, [Yiu and Chow \(2010\)](#) for China, [Bragoli and Fosten \(2016\)](#) for India, [Modugno et al. \(2016\)](#) for Turkey. Moreover, the nowcasting methodology has also been used to track indicators different from GDP: see for example [Modugno \(2013\)](#) for inflation, [D'Agostino \(2016\)](#) for trade variables, and [Cimadomo et al. \(2015\)](#) for forecasting fiscal variables using a mixed frequency Bayesian VAR.

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itized by principal components.

Some recent papers proposed short-term forecasting models for Mexican GDP, but none of them have analysed in depth the information flow available to the forecasters in real time and the importance of the information carried by US variables. Coutino (2005) presents a model based on several Mexican monthly indicators, but his technique does not allow either a real-time updating or an evaluation of the impact of different indicators. The VAR-based model presented in Guerrero (2013) allows one to make an estimate of GDP that is more timely than the official release, but it can only be estimated at least 15 days after the end of the reference quarter, being a “backcast” rather than a “nowcast”. The use of foreign indicators is a practice rarely found in the nowcasting literature. However, the empirical evidence of spillovers and synchronization between Mexican and US business cycles suggests that a forecasting model of the Mexican economy should take into account the relationship with the US. Among others, Torres and Vela (2003) document the synchronization of the US and Mexican business cycles and the role of trade, while Cuevas et al. (2002), Kose et al. (2004), Chiquiar and Ramos-Francia (2005), Lederman et al. (2005), Bayoumi and Swiston (2008) and Miles and Vijverberg (2011) evaluate the impact of NAFTA agreement on the synchronization, documenting its importance. Herrera Hernández (2004) finds a common trend and a common cycle between Mexican and US GDP and gains in forecasting Mexican GDP using a simple bivariate error correction model with US GDP. Evidence of the correlation between US and Mexican business cycles is confirmed in a later work by Mejía-Reyes and Campos-Chávez (2011). Regarding possible spillovers from the US to the Mexican economy, Sosa (2008) finds a high impact of US shocks on Mexico in the post-NAFTA period, with a major role played by US Industrial Production and by the indicators relating to the automotive sector. Liu et al. (2012) present nowcasting models for the GDP of several Latin American countries, including Mexico, obtaining the result that external indicators (8 US variables plus 11 commodity prices) do not help improve the accuracy of the nowcast for Mexican GDP in the sample 2005–2010. Dahlhaus et al. (2017) make a similar exercise on BRICS countries and Mexico finding a low impact of exogenous variables, but using only two variables about the real side of the US economy. Moreover, the last two works mimic the data available to the econometrician without reconstructing the exact calendar of data releases, they do not explicitly measure the specific weights of US indicators, and they do not compare the performance of their models to other than statistical benchmarks.

The main contributions of the present work can be summarized as follows. First, reconstructing and interpreting the Mexican and US macroeconomic data flow, I evaluate the importance of each data release and the relevance of the information accessible to markets participants and policy makers in order to assess the state of the Mexican economy in real time. Second, I find that the information coming from US indicators has an important role in the updating process of a nowcasting model for Mexican GDP. Finally, I find that a nowcasting model constructed using a medium-scale dataset of real macroeconomic indicators from Mexico and from the US performs well out-of-sample with respect to tough benchmarks like Surveys of Professional Forecasters.

2. The model

The dynamic factor model used in this work can be described as follows. The variables are assumed to have a factor structure:

$$x_t = A f_t + \epsilon_t, \quad (1)$$

where x_t is a vector of standardized stationary monthly variables, f_t are r unobserved common factors with zero mean and unit variance, A are the factor loadings, and ϵ_t is a vector of idiosyncratic components of dimension N which is modelled as an $AR(1)$ process, uncorrelated with f_t at any leads and lags.

The dynamics of the factors are modelled as a stationary Vector Autoregressive process with p lags, in which A_1, \dots, A_p are rxr matrices of autoregressive coefficients:

$$f_t = A_1 f_{t-1} + \dots + A_p f_{t-p} + u_t; \quad u_t \text{ i. i. d. } \sim \mathcal{N}(0, Q). \quad (2)$$

To deal with the mixed frequency of macroeconomic data I follow the approximation of Mariano and Murasawa (2003), including the quarterly variable in the model as a monthly partially-unobserved variable. For any variable y_t , defined at the highest frequency present in the model, define $y_t^{(k)}$ as its “counterpart” which is observed every k periods. That means that the observations of the lower frequency variables are periodically missing. In the case of the present work y_t is the difference of natural logarithms of GDP, and since the highest frequency of the model is monthly we have that its counterpart is $y_t^{(3)}$, which from now on can be defined as $y_t^{(Q)}$. Define as z_t the non-transformed series corresponding to y_t , in our example the level of GDP. The approximation is the following:

$$y_t^{(Q)} = \log(z_t^{(Q)}) - \log(z_{t-3}^{(Q)}) \approx y_t + 2y_{t-1} + 3y_{t-2} + 2y_{t-3} + y_{t-4} \quad (3)$$

with $t = 3, 6, 9, \dots$

I estimate the model using Maximum Likelihood estimation following Doz et al. (2012), who have proven convergence properties in the case of factor models in large dimensions.² The authors also showed that the estimation is robust to different sources of misspecification, for example in the case of weak cross-correlation of the idiosyncratic components, and that Maximum Likelihood is computationally feasible and can be performed within an Expectation-Maximization algorithm initialized with principal components (PC). Precisely, in a first step PC are used for a preliminary extraction of the common factors, in the spirit of Forni et al. (2000) and Stock and Watson (2002), and the parameters are estimated by OLS treating the PC as if they were the true common factors. In a second step, the Kalman smoother is used to extract the common factors conditionally on the parameters estimates. If we stop here we obtain the two-step approach used by Giannone et al. (2008), see Doz et al. (2011) for an asymptotic analysis. The Maximum Likelihood estimation is obtained by iterating the procedure until convergence, and taking into account the uncertainty due to extraction of the factors.³ The number of lags p is set to two. Determining the number of factors is still a debated question in the literature: I fix the number of factors to one, as being the simplest choice, which also permits to interpret the factor as a business cycle indicator.⁴

3. Data

I decide which variables to include in the model following a market-oriented approach. I consider only surveys and real variables, since financial variables have been proven to be not effective in improving the precision of short-term forecasts of GDP in this framework (Banbura et al., 2013). I take into consideration what market operators, statistical agencies, and the specialized press consider to be the key variables for assessing the condition of the Mexican economy. As a starting point I choose the variables reported on Bloomberg, one of the major sources of information for investors, traders and market operators. I also include some variables that were reported on

² Early examples of Maximum Likelihood estimation of small factor models with macroeconomic indicators can be found in Watson and Engle (1983), Stock and Watson (1989), and Mariano and Murasawa (2003); however, these models could handle just a few number of variables. More recent examples of Maximum Likelihood estimation of dynamic factor models in frameworks different from nowcasting can be found in Reis and Watson (2010), Luciani (2015), Delle Chiaie et al. (2015), Coroneo et al. (2016).

³ I use the adaptation of the EM algorithm to the presence of missing data proposed in Banbura and Modugno (2014).

⁴ The forecasting performance is robust to the use of more factors and to a change of the number of lags. Results are available on request.

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