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MACROECONOMICS OF DEVELOPMENT

The use of high-frequency indicators in short-term forecasting models

The case of Latin American and Caribbean countries

Sandra Manuelito

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This document has been prepared by Sandra Manuelito, Economic Affairs Officer with the Economic Commission for Latin America and the Caribbean (ECLAC).

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Abstract

The importance of sound and accurate early estimates of economic activity is of utmost importance to national economic authorities at the time of the decision-making process, and to the various agents involved in the economic analysis and follow up of the short-term economic prospects. In this context, the availability of short-term forecasts for quarterly GDP growth rates becomes highly relevant. In Latin America and the Caribbean an increasing amount of countries is producing high frequency economic data, and there has been an increasing interest by national authorities to use this data to improve economic analyses and short-term economic forecasts. This article discusses the use of the nowcasting methodology applied to Latin American and Caribbean countries with the objective of generating more accurate quarterly GDP growth forecasts. The results show that, for the short-term, this methodology produces accurate and reliable estimates although results at the country level depend very much on the amount and quality of the data available, as well as on its timeliness.

Introduction

The topic of short-term economic forecasts is particularly relevant to the analysis of the economic activity in Latin America and the Caribbean. As shown by the performance of forecasting models in the aftermath of the economic and financial crisis of 2008-2009,[1] [2] the importance of sound economic analysis and economic modeling that provides authorities with relevant, accurate and timely information on the evolution of economic activity is of utmost importance in the decision-making process, both at the national and at the regional level.

In the particular case of ECLAC, and in order to be able to do the follow-up of the economic situation and prospects of the world, the regional and the national economies, a thorough knowledge of up-to-date statistical information, both quantitative and qualitative, is required. The economic analyses done within ECLAC are used in the economic publications produced by the institution, in the assessments made of local and regional economic conditions, and also in the design and implementation of technical cooperation activities and the formulation of policy recommendations to national and regional authorities. These analyses, and the economic forecasts elaborated based on them, are used as inputs in a wide range of estimated indicators published by ECLAC such as poverty rates, the current account balance, the fiscal sector, monetary aggregates and unemployment and employment rates, among others.

In Latin America and the Caribbean many countries are publishing an increasing amount of high frequency indicators, by the hand of a growing interest of national authorities to take into account this information to improve the economic analysis on the overall state of the economic activity and the accuracy of growth forecasts. However, the availability of high frequency data is relatively recent, and this is even more so in the case of the Caribbean countries. Only in the last decade several countries in the region started to publish a monthly indicator of economic activity and in some cases the evolution of this indicator cannot be taken as an accurate leading indicator of the quarterly GDP growth rate measured by quarterly national accounts.

[1] For the case of OECD countries see Lewis and Pain (2015).
[2] Gadea and Pérez-Quirós, (2012).

In order to take advantage of the increasing availability of high frequency economic data in the Latin American and Caribbean countries, an initial effort to generate forecasts of quarterly GDP growth rates based on a monthly indicator of economic activity taking this information into account was made by Camacho and Pérez-Quirós (2011).[3] [4]Using a dynamic factor model methodology in the framework of *nowcasting* [5]techniques, indicators of the evolution of aggregated economic activity were produced for Argentina, Brazil, Chile, Colombia, México and Peru. At present, and based on this methodology, the number of countries of the region for which indicators are available expanded to 17, albeit with different results.[6]

This paper intends to document and discuss the application of the methodology initially proposed by Camacho and Pérez-Quirós to Latin American and Caribbean countries, as well as difficulties encountered. Advantages and limitations of this methodology are also discussed. The paper continues as follows. Section I discusses the use of high frequency indicators in short-term economic analysis in the countries of Latin American and Caribbean. Section II presents the empirical application of the methodology, whereas section III discusses the advantages and disadvantages of applying this methodology to countries in the region. Finally, conclusions.

[3] Camacho and Pérez-Quirós, (2011).

[4] For the cases of Euro Zone and Spain see, respectively, Camacho and Pérez-Quirós, (2008) and (2009).

[5] According to Banbura et al., (2010) nowcasting can be defined as the prediction of the present, the very near future and the very near past.

[6] Fernando Cantú and Seung-Jin Baek also worked, at different stages, in applying this methodology to other countries in the region, as well as in tasks related to the regular work concerning the maintenance of the models and forecasting quarterly GDP growth rates.

I. The use of high frequency indicators in short-term economic analysis and forecasting in Latin America and Caribbean countries

In the decision-making process, economic agents have to take decisions in real-time, requiring accurate and timely estimates of the evolution of the state of the economy. In this context, economic authorities regularly have to make choices regarding policy options that will impact the near future, based on the information available today that actually refers to what already happened. In this sense, economic agents and economic authorities do not only have to make assumptions about the evolution of the near future but also on the state of the economy today. Therefore, the availability of accurate and timely estimates of the dynamics and current state of the economy is essential.

The most widely used indicator to measure the economic evolution of a given country in the short-term is the quarterly GDP growth rate. This variable measures economic activity from an aggregated, homogenous and relatively comparable perspective among countries and, in most cases, is the best indicator available. In Latin America and the Caribbean, 19 out of the 33 countries included in ECLAC's regional economic aggregates regularly publish quarterly GDP growth rate figures.

In countries in the region, quarterly GDP national accounts published by National Statistics Offices and Central Banks present certain particularities that condition the economic analyses that can be done solely using GDP growth rates as an indicator to assess the current state, and make forecasts on the near future, of aggregated economic activity. First, with very few exceptions, the length of the homogeneous time-series is short, as countries in the region just started to regularly compile and publish quarterly GDP data from the mid-nineties. Second, the timely availability of quarterly GDP data is limited. Economic institutions have to wait up to three (or more) months before new data is available, making it difficult for economic authorities to react promptly to real time developments and abrupt changes in economic activity. In this context, data available with a significant lag in relation to the reference period looses relevance.[7] In addition, the use of monthly industrial production indicators,

[7] Arouba et al. (2008).

consumer confidence indicators, trade balance, and retail sales, among others, as leading indicators of quarterly GDP growth rates represents a challenge, as in many cases both quarterly GDP data and sectoral indicators are published at the same time.

Finally, there are methodological issues such as changes in the base year of the GDP calculations, and "structural" changes that include modifications in the methodologies used for GDP compilation, coverage of different sectors of the economy and valuation mechanisms. Challenges arise as the scope of the methodological changes introduced is in many cases considerable, generating a lack of comparability between different sub-periods of the time-series. The fact that quarterly GDP data and indicators related to the dynamics of the economic activity are published with long delays creates the need for reliable estimates of these indicators based on timely available information to improve the decision-making process. Hence, the construction of a monthly indicator of the aggregated economic activity and forecasts of quarterly GDP growth rate in order to follow up the evolution of economic activity is important.

In recent years, National Statistical Offices and Central Banks have made an effort to increase the availability, scope and frequency of statistical information concerning the evolution of economic activity. In order to take stock and profit from this data, and deal with the issues arising by relying solely on quarterly GDP growth rates to assess the evolution of the economic activity, this paper builds upon the initial work done by Camacho and Pérez-Quirós (2011) and discusses the results obtained when expanding the application of the nowcasting methodology to other countries in the region.

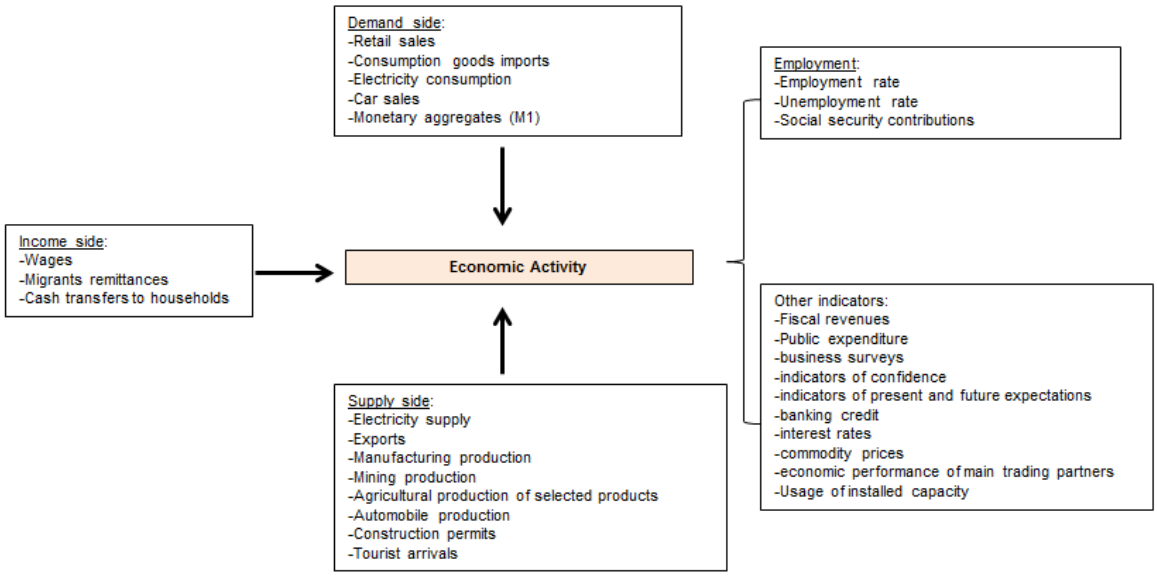
II. The empirical models

Besides GDP and sectoral economic activity indices, there are many other indicators that also measure directly or indirectly the evolution of economic activity. As a first step in the process of determining which indicators to be included in the model, it is necessary to identify high-frequency series, published on a timely basis, that have dynamics that follow closely the dynamics of economic activity, measured by quarterly GDP.

As economic activity can be measured according to different dimensions (demand, supply and income) it is important to take into consideration high-frequency data corresponding to each of them. Indicators relating to each dimension are publically available with different releasing calendars and are published by different agencies. These indicators are relevant for the assessment of the evolution of the activity of a given economy, as they provide information from different perspectives. In addition, there are a group of other indicators that do not relate exclusively to one of these three dimensions but that have a more cross-cutting nature, providing information of the evolution of the economic activity as well (figure 1).

Examples of economic indicators that are available on a timely basis that are could be considered as variables to be included in the model are, among others: (a) data on external trade such as imports, exports, commodity prices, tourist arrivals; (b) indicators of economic activity by type of industry such as manufacturing production, retail sales, mining production, agricultural production of selected products, automobile production, construction permits; (c) financial and monetary indicators such as banking credit, interest rates, monetary aggregates; (d) employment, unemployment, occupation, wages and social security contributions; (e) retail sales and imports of consumption goods; (f) business surveys, indicators of confidence and indicators of present and future expectations; (g) economic performance of main trading partners; (h) fiscal statistics such as fiscal revenues and public expenditure; (i) usage of installed capacity; (j) migrants' remittances; (k) electricity generation and consumption; and (l) cash transfers to households. Since one of the objectives of this methodology is to generate short-term forecasting models that can be easily replicated, data included should be publically available and accessed through documents published by official national authorities or through official databases.

Diagram 1
Dimensions of the economic activity and examples of timely available indicators



Source: Author's elaboration.

The proposed methodology by Camacho y Pérez-Quirós considers a short-term forecasting model that modifies Stock and Watson's (1988) strict dynamic factor model allowing dealing with the specific problems of real-time forecasting. The methodology basically consists of the use of a dynamic factor model comprising a variety of data observed at mixed frequencies (monthly and quarterly) based on the notion that the co-movements in many macroeconomic variables have a common element that can be captured by a single underlying and unobserved variable.[8] In this sense, indicators of aggregated economic activity obtained through the dynamic factor models for each economy are highly correlated with activity indicators available in each country and with quarterly GDP growth rates. Once the indicators to be incorporated in the model are defined, each time forecasts of quarterly GDP growth rates are generated, they take into consideration all new information available.

The specifications of the proposed modified dynamic factor models are based on the assumption that the joint dynamics of GDP growth and the variables included in the estimation of the indicator of aggregate economic activity can be decomposed in two orthogonal components: the first refers to the common dynamics whereas the second refers to its idiosyncratic dynamics.[9] In general terms, the idea behind this type of models is to build an indicator of aggregated economic activity with monthly frequency that synthesizes the information contained in timely available indicators (hard indicators and soft indicators, see examples in figure 1), including the most up-to-date data available for each one. Once this monthly indicator of economic activity is built, it is possible to generate forecasts of quarterly GDP growth rates. In a very simple form, the idea of these models is reflected in (1).

$$\begin{pmatrix} GDP_t \\ Indicators_t \end{pmatrix} = \beta \cdot f_t + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix} \quad (1)$$

[8] Arango and Melo (2006) use the dynamic factor model methodology to estimate the industrial production index as an indicator of the state of the economic activity. For an application of more traditional dynamic factor models with a large number of variables see Aiolfi, Catão y Timmermann (2006).

[9] For a detailed description of the model specifications see Camacho and Perez-Quiroz (2011), Op. Cit.

GDP_t and $Indicators_t$ correspond to the observable data; GDP_t corresponds to the quarterly GDP growth rate and $Indicators_t$ to the vector of the rest of the indicators included in the model. f_t corresponds to the common factor and β corresponds to the values of the loading factors (the available information that is included in the model). Finally, u_{it} corresponds to the vector of the idiosyncratic components. With these small scale models that use a small number of variables covering different dimensions of economic activity it is possible to generate accurate forecasts of quarterly GDP growth rates.

The methodology allows for the model to be able to handle indicators which are available at different frequencies, in particular monthly and quarterly frequencies, and the gaps that characterize the ragged edges behind the asynchronous data publication are also filled in by using the Kalman filter.[10] Additionally, data revisions for GDP growth are modeled assuming that preliminary estimates are equal to true GDP growth plus uncorrelated noise. In this sense, this methodology is able to take into consideration mixed frequencies, missing data and data revisions.

The dynamic factor model can be then written in the space-state form[11] allowing for the use of the Kalman filter, a recursive procedure for computing the optimal estimate of the unobserved state vector based on the appropriate information set, assessing that the information used in the model is known.[12]

The basic filter procedure is based on two steps: prediction and updating. In the prediction step, the state in t is forecast on the basis of information up to t-1. After that the model generates the best possible prediction conditional on the available information. In the updating procedure, as the actual result of the observed variable is already available, it is possible to calculate the prediction error, and therefore to recalculate the estimate of the unobserved state vector in order to have better estimators. Therefore, according to this recursive procedure the model automatically incorporates new information available. As the uncertainty associated with the estimate of the unobserved state vector increases, more weight is given to the new information in the prediction error, and vice-versa.

Although there is some debate in the literature regarding the relevance of using large-scale models instead of small-scale models,[13] one of the advantages of using small scale models is that, given their small dimension, it is relatively easier to check the empirical implications of the violation of the theoretical assumptions. In addition, the asymptotic advantages of large-scale factor models frequently are not present in empirical applications (Boivin and Ng, 2006).[14]

Finally, bearing in mind that the objective of these models is to generate forecasts in real time, it is very important to keep vintage sets of the exact information that was available at each time that forecasts were generated. This allows for comparative analysis of the forecasting accuracy of the models, as the results are highly dependent on the availability and quality of the data incorporated.

[10] According to Camacho and Peréz-Quiróz (2011), the model is able to handle mixed frequencies by incorporating the approximate Kalman filter as in Mariano and Kurasawa (2003), fill in the gaps that characterize ragged ends using the Kalman filter as in Giannone, Reichlin and Small (2006), and as in Evans (2005) data revisions for GDP growth are modeled assuming that preliminary estimates are equal to true GDP growth plus uncorrelated noise.

[11] State-space models were originally developed by control engineers and are useful tools for expressing dynamic systems that involve unobserved state variables. Consists of two equations: a transition equation (also sometimes called the state equation) which describes the dynamics of the state variables that has the form of a first order difference equation in the state vector; and a measurement equation which describes the relation between observed variables (data) and unobserved state variables. To write in the space-state form a transition equation and a measurement equation are required and have the following matrixes: F (the state transition model), H (the observation model), Q (the COV of the process noise), R (the COV of the observation noise) and B (the control input model for each time step k). For a discussion on state-space models and the Kalman filter see Kalman (1960). For a discussion on the use of these models in order to generate short-term economic forecasts see Kim and Nelson (1999).

[12] For a description of the state space representation of the dynamic factor model see the appendix included in Camacho and Pérez-Quirós (2009), Op.Cit.

[13] For a discussion of the pros and cons of large versus small scale models see Camacho and Pérez-Quirós (2009) and Watson (2000).

[14] Boivina and Ng (2006).

III. Usefulness, scope and challenges in the use of these models in the Latin American and Caribbean context

As mentioned, one of the objectives of this exercise is to generate quarterly GDP growth rate forecasts that can be easily replicated. Therefore, data needs to be publically available (both hard and soft indicators) in order to be included in the forecasting models. However, the inclusion of specific indicators depends on their availability in each country.

In addition, in the selection of the indicators to be included in the models, all relevant statistical information publically available and accessed through documents published by official national authorities or through official databases needs to be taken into consideration. This last point is not an easy task, as in many countries each organization produces its own statistical information and there are limitations for the general public to access the data. As a consequence, in some cases the public availability of statistical information may be much lower than what is actually produced by public organizations and at the disposal of national authorities.[15]

Timeliness of the data is also an issue. In the majority of the countries this data is published with a delay that ranges from six weeks to three months and the methodology, publication criteria set out by national authorities, coverage, and publication calendar are all different depending on the country we are analyzing. In this sense, the possibility to expand this methodology to all countries in the region is conditioned by the public availability of timely statistical information.

Another issue was the quality of the available data. Often the starting point for the publication of the data is very recent, which limits its inclusion in the case we would like to have long time-series included in the model. In other cases, the time lag between the data release in relation to the reference period is considerable, which generates inconveniences at the time of making real-time forecasts.

[15] In several countries, as statistical data is not integrated into one National Statistical System, it is even more difficult as sometimes public organizations don't have easy access to statistical information produced by other public organizations.

Finally, since macroeconomic data is very collinear, including additional variables may not result in an improvement in the accuracy of the forecast. Therefore, in some cases it generated better results to focus on a few key variables. For this purpose, having defined the set of core variables (at least one related to the demand, to the supply and to the income sides of the economic activity), a method was used to decide whether new indicators should be added to this set of core variables. Based on the assumption that the primary focus of the model is to provide forecasts of GDP growth, a variable would only be added when it increased the percentage of variance of GDP growth explained by the common factor.[16]

Three criteria were established to include additional indicators:[17] (a) they should have data for at least 25 per cent of the total sample period considered in the model; (b) they should be significant, as measured by the degree of the dynamic correlation between the common component and each economic indicator; and (c) bearing in mind that the objective of the model is to get quarterly GDP growth rate forecasts as accurate as possible, the inclusion of these indicators should not significantly reduce the proportion of the variance of the GDP explained by the common component. According to these criteria, those indicators that showed a significant idiosyncratic component and whose inclusion in the model did not improve the explanatory power of the common component were left outside of the model.

In spite of the difficulties encountered, the use of the described methodology in the context of Latin American and Caribbean countries generates several advantages compared to other methods. First, given the characteristics of the statistical economic data available in the countries in the region, as already discussed, the use of this methodology allows for the generation of short-term forecast based on a small number of indicators whose dynamics are highly correlated with the dynamics of a monthly indicator of economic activity. Second, it does so with a high degree of accuracy of the forecasts three quarters ahead. Third, this method allows dealing with different types of data and frequencies, which are common difficulties that arise when using high frequency data, in particular, the ragged ends problem, missing observations, different frequencies and series that have different samples. Fourth, the methodology used in these models is simple and has low maintenance cost. Fifth, this methodology can be implemented using data that is publically available. The requisite to include additional data is that it shows a strong correlation with the evolution of economic activity indicator. Moreover, this methodology is used by a significant group of institutions, mostly central banks, which generates comparable evidence.

However, this methodology also presents some shortcomings. First, these models don't have economic structure and therefore have limitations in what relates to making interpretations of different scenarios concerning the evolution of economic activity, as well as evaluating the impacts of different policy decisions. It is possible though to make assessments of the impact on forecasts of the realizations of the economic variables included in the model, and how the deviation between expectations and realizations of such variables affects the GDP forecast.

Second, forecasts are sensible to the information that is available in a given point in time, in particular, to the publication calendar of the variables included in the model, as in some cases most of the relevant data is published at the same time. This last issue is of particular importance because it imposes an advantage as well as a limitation. With respect to the advantage, the use of this methodology generates forecasts that incorporate all available information at any given point in time. In this sense, it can produce forecasts taking as inputs limited information and not the complete set of variables. Therefore, the weights of the different variables on the estimation adjust according to whether an update for a given variable is available or not, taking in consideration whether this variable was included or not in the generation of the forecast. These weight adjustments are a desired element because they generate forecasts with a high degree of confidence. But these weight adjustments according to the available updates included in the model also impose a limitation since forecasts may end up being biased depending on the number and dynamics of the updated variables that were available at the time of generating the forecast.

[16] Camacho y Perez-Quiros (2009), Op. Cit.
[17] Camacho y Perez-Quiros (2011), Op. Cit.

During the last years, this methodology has been applied with different results to 17 countries in the region: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Jamaica, Mexico, Nicaragua, Panama, Peru, Dominican Republic, Uruguay and Venezuela. Except for a few countries, the publication calendar of statistical data related to sectoral economic activity is the same as the publication calendar of the monthly indicator of aggregated economic activity, and monthly-desegregated statistical data on production sectors for a given reference period is published at the same time as the synthetic indicator of economic activity. Examples of this are Bolivia, Costa Rica, El Salvador, Guatemala, Nicaragua and Dominican Republic. This represents a challenge at the time of applying the methodology to these countries. As one of the main objectives of the nowcasting methodology is to anticipate the results of a synthetic indicator of economic activity and, on the basis of it, forecast quarterly GDP growth rates, if sectoral data is published at the same time as the monthly indicator of economic activity, the exercise of building this indicator somewhat looses relevance. Furthermore, the majority of the statistical information relating to the evolution of sectoral economic activity is already incorporated in the monthly indicator of economic activity which limits the benefit of incorporating additional variables (there are no intermediate steps: one gets from having very little information to have the information set complete). In these countries, although the forecast for the next quarter is subject to small revisions, forecasts for the second and the third quarter ahead are subject to greater revisions.

In other countries, the public release of statistical data has big lags in relation to the reference period. Examples are Ecuador, Jamaica, Panama and Venezuela. In this case, until all statistical data is included in the model and is incorporated with the same reference period, the forecast is subject to considerable revisions. Finally, in some countries the quality of the statistical data included in the model varies considerably depending on the source of the statistical data. This also poses challenges at the time of generating forecasts, mostly for the second and third quarters ahead. In spite of the above, it is important to bear in mind that these challenges are valid for all forecasting methodologies applied to these countries based on high frequency data and statistical data publically available.

Table 1 and figure 2 show the results obtained for the countries included in this exercise. Table 1 shows the combination of variables included in the model for each country that provided best results, measured by the percentage of quarterly GDP growth rate explained by the dynamics of the "common factor". It is important to highlight that in the case of some Central American countries the value for the percentage of quarterly GDP growth rate explained by the evolution of the "common factor" is very high, which suggests that the forecast for the quarterly GDP growth rate forecast for quarter ahead is relatively accurate. However, as can be seen from the comparison between the evolution of both series in figure 2 (quarterly GDP growth rates and the quarterly year-on-year growth rates of the series corresponding to the common factor), it is difficult to see a high degree of correlation. One possible explanation is that, as the majority of the data available has the same releasing calendar, forecasts are subject to strong revisions. Moreover, historical GDP growth rates are in many of these countries subject to significant revisions, which also have an impact on the estimations of the quarterly year-on-year growth rate of the "common factor".

Graphs in figure 2 show the dynamics over time of the estimated "common factor" and monthly indicators of economic activity. An analysis of these graphs shows that there is a high degree of correlation between both series in the cases of Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Venezuela, whereas there is a low observed correlation for Central American countries and Jamaica. These differences reflect factors such as the availability and timeliness of the statistical data. In many cases, even though there is a large number of high frequency data available, this data relates only to one or two dimensions of the economic activity (for example, many variables relate to the supply side of the economy and there is no data that relates to the income side) which also causes difficulties to capture information on the evolution of other variables relevant to assess the state of the economy.

Table 1
Latin America and the Caribbean (selected countries): selected variables included in quarterly GDP growth rates forecast

A. Argentina

Percentage explained by common factor			88,6
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Unemployment	M	yoy	
Industrial production index	M	yoy	
Electricity generation	M	yoy	
Consumer confidence index	M	yoy	
Exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Capacity utilization	M	yoy	
Industrial production index - Brazil	M	yoy	
Construction activity index	M	yoy	

B. Bolivia

Percentage explained by common factor			94,42
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Monthly indicator of economic activity (IMAE)	M	yoy	
Exports	M	yoy	
Imports	M	yoy	

C. Brazil

Percentage explained by common factor			87,55
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Industrial Production Index	M	yoy	
Retail Sales Index	M	yoy	
Employment	M	yoy	
Consumer confidence index	M	yoy	
Exports	M	yoy	
Imports (excluding oil and derivates)	M	yoy	
Industrial electricity	M	yoy	
Banking credit to households	M	yoy	
Fiscal revenues	M	yoy	

D. Chile

Percentage explained by common factor			88,25
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Industrial Production Index	M	yoy	
Employment	M	yoy	
Retail Sales Index (real)	M	yoy	
Monetary aggregate M1 (contants values)	M	yoy	
Exports	M	yoy	
Consumer confidence index	M	yoy	
Value added tax revenues	M	yoy	

E. Colombia

Percentage explained by common factor			77,53
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Industrial Production Index	M	yoy	
Manufacturing employment	M	yoy	
Manufacturing salaries	M	yoy	
M1 (in constant values)	M	yoy	
Exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Coffee production	M	yoy	

F. Costa Rica

Percentage explained by common factor			98,40
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Manufacturing activity index	M	yoy	
Retail sales activity index	M	yoy	
Employment	M	yoy	
Exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Industrial electricity (sales)	M	yoy	

G. Ecuador

Percentage explained by common factor			44,29
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Economic activity index	M	yoy	
Unemployment	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
VAT revenue	M	yoy	
Fiscal expenditures	M	yoy	

H. El Salvador

Percentage explained by common factor			89,03
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Agricultural sector activity index	M	yoy	
Manufacturing sector activity index	M	yoy	
Retail sales activity indicator	M	yoy	
Electricity generation	M	yoy	
Cement	M	yoy	
Maquila exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Tax revenues	M	yoy	

Table 1 (conclusion)

I. Guatemala

Percentage explained by common factor			99,66
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Economic activity monthly indicator	M	yoy	
Exports	M	yoy	
Imports	M	yoy	
Migrants remittances	M	yoy	
Tourism revenues	M	yoy	
Private capital financial inflows	M	yoy	
Tax revenues	M	yoy	

J. Jamaica

Percentage explained by common factor			92,12
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Exports	M	yoy	
Migrants remittances	M	yoy	
Tourists	M	yoy	
Alumina production	M	yoy	
Industrial electricity sales	M	yoy	

K. Mexico

Percentage explained by common factor			97,46
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Industrial production index	M	yoy	
Retail sales	M	yoy	
Employment	M	yoy	
Maufacturing salaries	M	yoy	
Consumer´s confidence index	M	yoy	
Exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
United States industrial production index	M	yoy	
Credit by commercial banks	M	yoy	

L. Nicaragua

Percentage explained by common factor			64,06
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Industrial production index	M	yoy	
Average salary social security contributions	M	yoy	
Exports	M	yoy	
Migrants remittances	M	yoy	
Electricity consumption	M	yoy	
Domestic consumption of gasoline	M	yoy	

M. Panama

Percentage explained by common factor			87,20
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Enectricity generation	M	yoy	
Panama canal toll revenues	M	yoy	
Colon Free Trade Zone	M	yoy	
Fiscal revenues	M	yoy	
Cement	M	yoy	

N. Peru

Percentage explained by common factor			82,24
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Industrial production index	M	yoy	
Retail sales	M	yoy	
Minimum salary	M	yoy	
Exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Electricity generation	M	yoy	
Tax on production and consumption	M	yoy	
Fiscal capital expenditures	M	yoy	
Public investment	M	yoy	
Construction economic activity indicator	M	yoy	

O. Dominican Republic

Percentage explained by common factor			99,98
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Monthly economic activity index	M	yoy	
Employment	M	yoy	
Free Trade Zone exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Tax on goods and services	M	yoy	
Fiscal capital expenditures	M	yoy	

P. Uruguay

Percentage explained by common factor			78,56
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Industrial production index	M	yoy	
Employment	M	yoy	
Exports	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Bovine production	M	yoy	
Tax revenues	M	yoy	
Banking credit to the private sector	M	yoy	
Industrial production index-Argentina	M	yoy	

Table 1 (conclusion)

Q. Venezuela

Percentage explained by common factor			100,00
Variables	Frequency		
Gross Domestic Product (GDP)	Q	qoq	SA
Employment	M	yoy	
Imports (excluding oil and derivatives)	M	yoy	
Imports	M	yoy	
Oil production	M	yoy	
Banking credit to the productive and sales sectors	M	yoy	

Source: Based on author's calculations.
Notes: Q: quarterly; M: monthly; qoq: quarter on quarter growth rate, yoy: year-on-year growth rate, SA: seasonally adjusted.

Figure 1
Latin America and the Caribbean (selected countries): year-on-year growth rates of the estimated "common factor" and indicators of aggregated economic activity

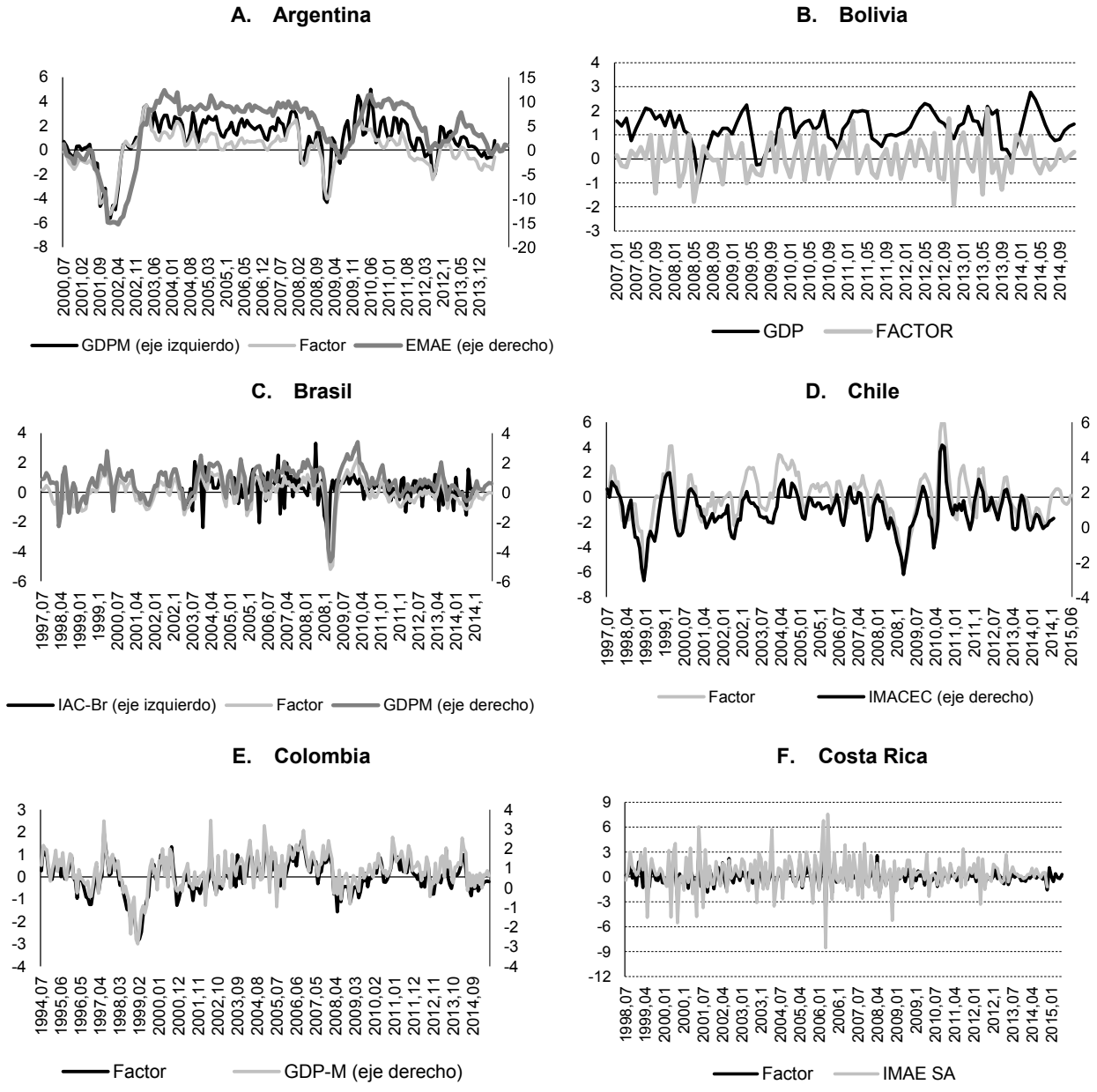
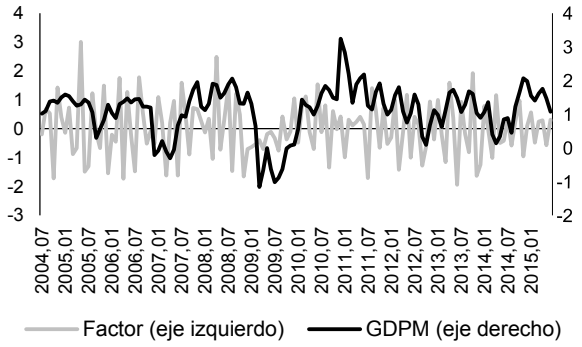
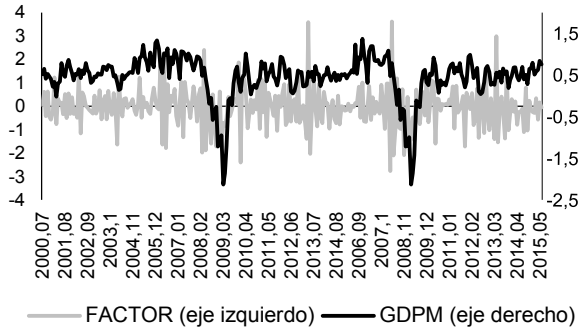


Figure 1 (continues)

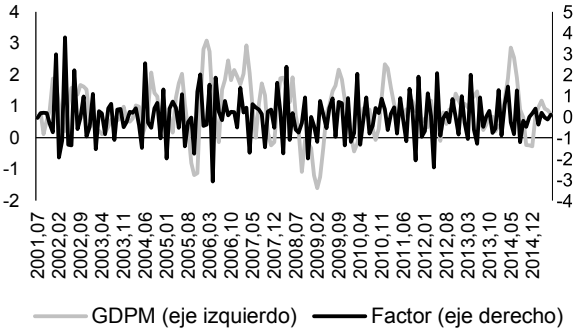
H. Ecuador



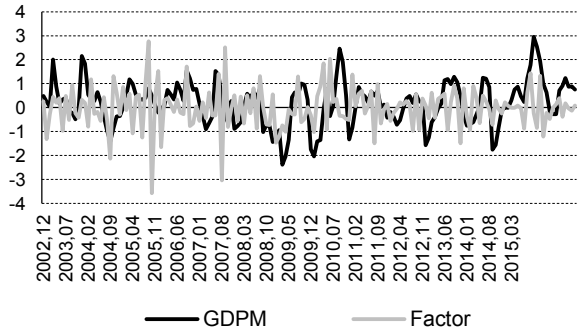
I. El Salvador



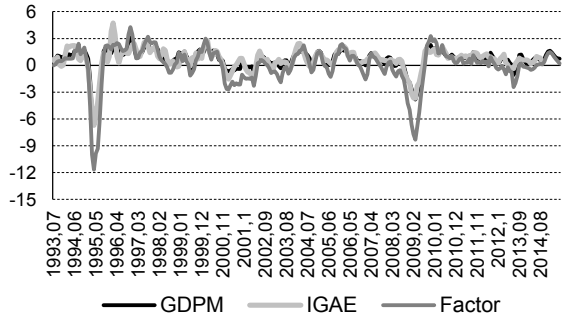
J. Guatemala



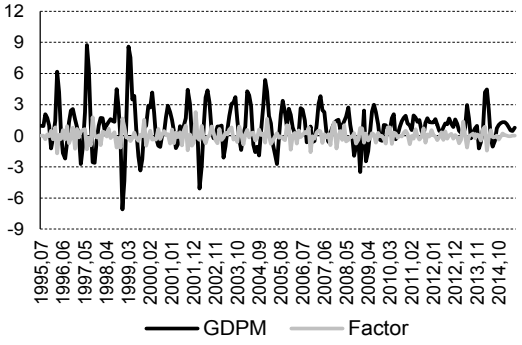
K. Jamaica



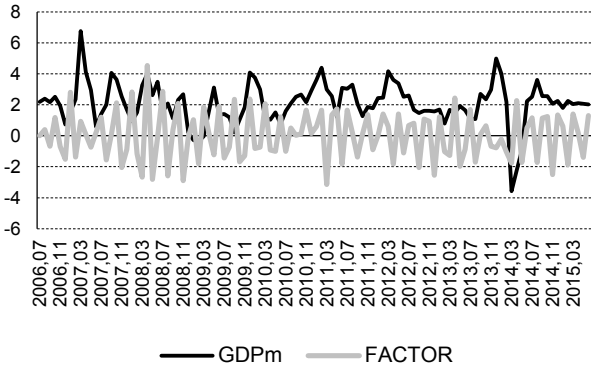
L. Mexico



M. Nicaragua



N. Panama



O. Peru

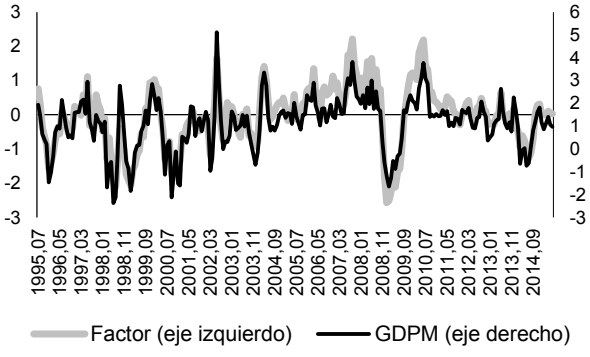
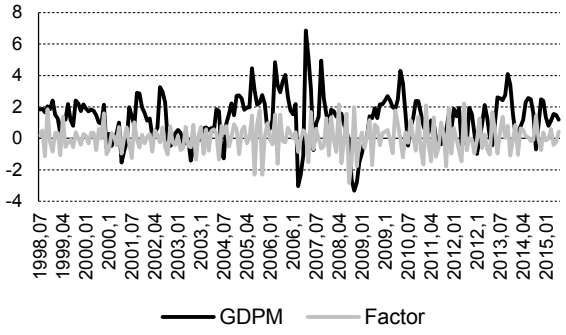
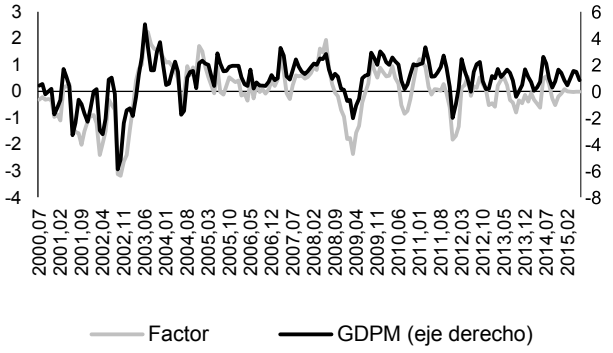


Figure 1 (conclusion)

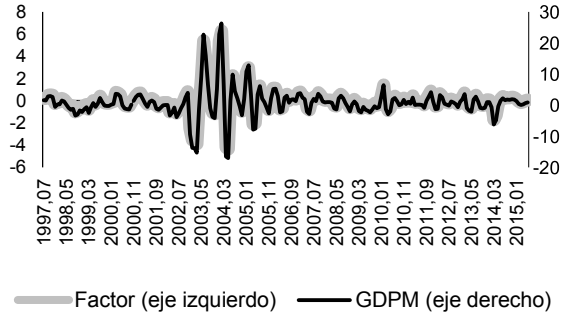
P. Dominican Republic



Q. Uruguay



R. Venezuela



Source: Based on author's calculations.

Conclusions

The methodology described in previous sections allows building a synthetic monthly indicator of economic activity that incorporates information provided by several other indicators, whose dynamics remains very close to that of GDP. As in the Latin American and Caribbean region quarterly GDP growth rates are often published with an important time delay in relation to the reference period, this methodology allows obtaining timely and accurate estimates of economic activity, using the most recent and up to date statistical information that is publically available. Once this synthetic indicator is available, it is possible to generate forecasts for quarterly GDP growth rates.

Through this methodology it is possible to incorporate: (1) a greater number of publically available indicators, (2) additional data related to the evolution of economic activity, including soft and hard indicators, and (3) indicators with different release calendars. In this sense, the methodology described is a useful method to follow-up the evolution of economic activity in the short-term. By dealing with common difficulties that arise when using high frequency data (the ragged ends problem, missing observations, and mixed frequencies), this methodology allows to work with many variables.

This methodology was applied to 17 countries in the Latin American and Caribbean region, with different results. Quarterly GDP growth rates are forecasted three quarters ahead, and although the quality of these forecasts depends on the quality and availability of the statistical data, the accuracy of the forecast is higher for the next immediate quarter; in many cases, the prediction error increases significantly for the other two forecasted quarters. Another important element is the timely availability of data concerning the evolution of economic activity. In spite of the difficulties encountered, the use of the described methodology in the context of Latin American and Caribbean countries generates several advantages compared to other methods, considering the data availability, data quality and its timeliness.

Finally, as these models have no economic structure, with this methodology it is not possible to access/quantify the impact of different variables in the economic activity. It is however possible to make some judgments based on the realizations of economic variables and their incorporation in the models.

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