Assessing Country Risk: Selected Approaches[1]

B. Real Risks

I. Growth Crises in Low-income Countries (LICs)

This methodology is documented in an IMF Board paper (IMF 2011a) and Working Paper (Dabla Norris and Bal Gunduz, 2012).

Growth Decline Vulnerability Index (GDVI)[2] [3]

Motivation

The GDVI provides early warning signals of a growth crisis in the event of large external shocks in LICs. This tool relates the likelihood of a sharp growth decline occurring in the event of a large exogenous shock to various economic and structural variables. The resources, instruments and policy buffers needed to absorb or mitigate shocks are often unavailable in LICs or difficult to implement in weak institutional and policy environments. In this regard, the GDVI helps to ascertain the potential sources of vulnerabilities (institutional, fiscal and external) and constitutes a useful tool for pre-emptive policy action.

Methodology

Dependent variable: real output drops following shocks

Large negative shocks events in LICs are identified if the annual percentage change of the relevant variables falls below the 10th percentile in the left tail of the country-specific distribution.[4] In particular, shock episodes include one or more of the following five shocks occurring over the post-1990 period: (i) external demand; (ii) terms of trade; (iii) FDI; (iv) aid; and (v) remittances.[5] Within the sample of identified shock episodes, a growth crisis is defined as a large

[1] This document provides technical background and extended descriptions of the cross-country risk assessment tools discussed in the IMF reference note "Assessing Country Risk: Selected Approaches." It should not be reported as representing the views of the IMF. The views expressed are those of the authors and do not necessarily represent those of the IMF or IMF policy. The document describes research in progress as of June 2017, and is intended to elicit comments and to further debate.

[2] See Dabla-Norris and Gündüz (2012).

[3] Contributing authors: Irineu de Carvalho Filho and Corinne Stephenson.

[4] Defining large negative shocks over country-specific distributions better captures cross-country heterogeneity among LICs, particularly with respect to other economic structure and vulnerability to external shocks. It means that each country experiences the same frequency of shocks, so that the focus is on the reaction to the shock.

[5] FDI, aid, and remittances are measured as ratios to GDP.

real output drop when the following two conditions hold; (i) the post-shock two-year average (t and t+1) level of real output per capita falls below the pre-shock three-year average; and (ii) output per capita growth is negative at time t.

Selection of vulnerability indicators

Several indicators were considered, based on empirical studies of growth declines and protracted growth slowdowns in the event of exogenous shocks. Those that were retained can be constructed for a majority of LICs and capture the flow and stock vulnerabilities in the external and public sectors as well as institutional weaknesses:

Overall economy and institutions: real GDP growth; the World Bank's Country Policy and Institutional Assessment Index; the Gini coefficient, natural disasters (proxied by number of people affected by natural disasters in percent of population) and the country-specific average of real GDP per capita growth over the sample period. The latter captures cross-country differences in underlying structural and institutional conditions. The long-run historical performance of income per capita can capture shock amplifiers that are not already in the index, such as relative diversification of trade and production, a broader measure of inequality, and the broader impact of weaker institutions.

External sector: exchange market pressure index (a composite index, comprising depreciation of the exchange rate and change in the stock of international reserves (in months of imports of goods and services)); reserve coverage (gross international reserves in months of imports); real growth of exports of goods and services; growth in trading partners weighted by lagged exports to GDP; and change in export prices weighted by the ratio of lagged exports to GDP. The last two variables capture exposure to trade-related shocks, as countries experiencing larger shocks are more likely to suffer severe growth declines when shocks materialize.

Fiscal sector: overall fiscal balance in percent of GDP; public debt in percent of GDP; and real government revenue growth.

Most explanatory variables are lagged by one year, except for the variables capturing exogenous shock size, and are thus predetermined with respect to the crisis event.

Estimation of thresholds

The estimation of thresholds for growth crises for each indicator is based on a "signaling approach (see Box 1 in the reference note)**.**[6] This entails examining a range of individual indicators to identify variables and thresholds that separate crisis from non-crisis cases. For each of the individual indicators, the approach involves searching for a split that minimizes the combined percentages of missed crises and false alarms. Thresholds that yield the best split are used to map

[6] International Monetary Fund (2007) and (2011a).

indicator values into zero–one scores. These indicators are then aggregated into sectoral indices using weights that depend on the individual indicator's ability to discriminate between crisis and non-crisis cases. The overall index, which ranges from zero (low risk) to one (high risk), is a summary measure of underlying vulnerabilities to a growth decline.

Data sources

WEO, IFS, IMF staff reports, World Bank, and EM-DAT.

References

Dabla-Norris, E. and Y. Bal Gündüz, 2012, Exogenous Shocks and Growth Crises in Low- Income Countries: A Vulnerability Index, IMF Working Paper 12/264.

International Monetary Fund, 2007, "Assessing Underlying Vulnerabilities and Crisis Risks in Emerging Market Countries—A New Approach," (SM/07/328).

International Monetary Fund, 2011a, "Managing Volatility: A Vulnerability Exercise for Low-Income Countries" (Washington).

II. Growth Tracker[7]

Motivation

This tool assesses growth risks. It reflects quarterly changes in underlying growth, where underlying growth is estimated using a dynamic factor model (DFM) and a wide variety of monthly indicators for each country. The methodology is the same as that used for the growth tracker, which appears in Chapter 1 of the October 2010 WEO and Matheson (2014).[8]

Methodology

The DFM assumes that real GDP growth y_t can be decomposed into a common component χ_t and an idiosyncratic component ε_t. The common component captures the bulk of the covariation between growth and a wide range of economic indicators, while the idiosyncratic component is assumed to mainly only affect growth:

$$y_t = \mu + \chi_t + \varepsilon_t, \quad \text{where } \varepsilon_t \sim N(0, \psi)$$

[7] Contributing authors: Kadir Tanyeri and Troy Matheson.

[8] See Appendix 1.2, October 2010, WEO for a description. A more detailed description can be found in Matheson 2014.

where μ is a constant and $\chi_t = \Lambda F_t$, with $F_t = (F_{1t}, \ldots, F_{rt})'$ and $\Lambda = (\lambda_1 \ldots, \lambda_r)$. The common component is thus related to growth through a linear combination of a small handful of r common factors F_t. The common factors themselves are, in turn, estimated using information from a potentially large set of economic indicators. For each country, it is the common component of growth that is used as the growth indicator.

The dynamics of the common factors are captured by the following vector autoregressive process:

$$F_t = \sum_{i=1}^{\rho} \beta_i F_{t-i} + B\nu_t, \quad \text{where } \nu_t \sim N(0, I_q)$$

where the $\beta_i s$ are $r \times r$ matrices, ρ is the lag length of the process, B is an $r \times q$ matrix, and q is the number of underlying common shocks driving the economy. The number of static factors r is generally assumed to be large relative to the number of common shocks in order to capture the dynamic relationships in the economy.[9]

The growth tracker is a centered 7-month-moving average of the estimated common component of growth for each country. Quarterly changes in the growth tracker are used to determine whether underlying growth is rising and falling. Risk assessments are based on whether underlying growth is increasing, decreasing by less than the sample median, or decreasing by more than the sample median.

Data sources

For each country, close attention has been paid to choosing data from a broad cross section of the economy. Given inadequate data quality, for some countries, a multi-step procedure for cleaning the data of outliers and missing observations has been employed. The vast majority of the series are measured at the monthly frequency, with the remaining series measured at the daily and quarterly frequency. All series are converted to the monthly frequency and, where required, they have been transformed to be devoid of long-run trends (non-stationarity) prior to estimation of the DFM.[10] The number of series used also varies across countries depending on available data, ranging from 97 series for Kazakhstan to 290 for Sweden All data are sourced from Haver. See Matheson (2014) for more details.

Broadly speaking, the data were chosen to cover the following categories:

[9] The lag length ρ and the number of static factors r are determined using the Schwarz's Bayesian information criterion and the number of underlying factors is determined by information criteria proposed by Bai, J. and S. Ng 2007

[10] The quarterly series are interpolated, while the daily series are converted to monthly averages. Natural logarithms are taken of the series that cannot take negative values or are measured in percentages, and quarterly differences are taken of the non-stationary series. The remaining data are not transformed.

- Activity (surveys) – includes PMIs, consumer and business confidence etc.
- Activity (hard data) – includes retail sales, industrial production etc.
- Trade – includes exports, imports, exchange rates etc.
- Financial Conditions – includes interest rates, equity prices, credit conditions etc.
- Employment and Income – includes employment, wages etc.
- Prices and Costs – includes PPIs, CPIs, inflation expectations etc.

References

Bai, J. and S. Ng (2007), "Determining the number of primitive shocks in factor models", *Journal of Business and Economic Statistics* 25 (1), 52-60.

International Monetary Fund (IMF). 2014b. World Economic Outlook. Washington, October

Matheson, T.D (2014). "New Indicators for Tracking Growth in Real Time", *Journal of Business Cycle Measurement and Analysis*, 7(2), 51-71.

III. Short Term Inflation Model[11]

Motivation

This tool generates inflation and deflation risk indicators, based on the one-year-ahead inflation forecast density from a Bayesian vector autoregression (BVAR) model.

Methodology

The short-term inflation forecasts (STIF) module is based on a five variable BVAR model estimated separately for each country. The set of variables are common across all countries: the quarterly WTI oil price growth, real GDP growth, CPI inflation, the short-term policy rate, and the 10-year interest rate spread. The priors are chosen to maximize the model's out-of-sample forecast accuracy. The model is estimated using the dummy observations approach described in Banbura and others (2010), and the forecast density is computed based on the stationary posterior distribution of the model's parameters.

[11] Contributing author: Kevin Wiseman. Model development by Philip Liu, Tola Oni, and Sergejs Saksonovs.

The STIF generally outperforms other standard forecast models. STIF module forecasts were compared with 3 other standard forecasts on a sample of ten countries with a reasonably long time series over the period 2000Q1–2010Q1.[12] For all ten countries, the STIF outperforms the random walk and standard VAR model. The STIF also generally outperforms an AR(p) model.

Inflation and deflation risk assessments are based on the model's predictive posterior distribution. To do this, the model calculates the posterior probabilities that one-year-ahead inflation will exceed or fall below the authorities stated inflation target band, and the probability of outright deflation**.**[13]

Data Sources

All the data are collected from the Haver and International Financial Statistics databases. The sample size varies across countries depending on availability, and the earliest sample period begins in 1975Q1.

References

Bańbura, Marta and Modugno, Michele, 2010, "Maximum likelihood estimation of factor models on data sets with arbitrary pattern of missing data" Working Paper Series 1189, European Central Bank.

IV. Monetary Conditions Gap[14]

Motivation

This tool generates output growth and inflation risk indicators, on the basis of the deviation of monetary policy from the policy norm implied by a simple Taylor rule. Countries may be considered vulnerable to growth declines or overheating if monetary policy is excessively tight (e.g. if constrained by the zero lower bound) or loose (e.g. in the case of fiscal dominance).

Methodology

The monetary conditions gap is estimated as the deviation of the actual monetary policy rate from the Taylor-Rule implied rate, which is a function of the neutral interest rate, output gap, and inflation

[12] The forecast evaluation is done using the latest vintage of data and therefore does not capture the real-time nature of data releases.

[13] The inflation target bands are taken from the countries' central bank websites. For the Euro zone, a target band of 1–3 percent is assumed for all Euro countries. For countries that maintain a fixed exchange rate regime rather than targeting inflation as its primary monetary policy objective, e.g., Hong Kong SAR, the target is assumed to be tied with the target of the pegged currency.

[14] Contributing author: Sophia Zhang.

gap defined as deviation of actual inflation rate from inflation target. Positive gaps represent tighter monetary conditions than the policy-implied optimal monetary condition. Tight (loose) monetary conditions predict the accumulation of excess supply (demand) pressure. Additionally, the estimated output gap based on staff's latest WEO forecasts is used as a supplementary indication of inflation risks, where large positive gaps signal future risks of inflation while negative gaps indicate a risk of deflation.

Data sources

Data are collected from the Haver, WEO database and International Financial Statistics databases.