Measuring the Effects of the 'Normalization' of US Monetary Policy on Central America and the Dominican Republic[1]

Authors[2]

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Abstract

Since the beginning of the international financial crisis in major developed economies, central banks of these countries implemented several monetary policy (MP) measures, oriented to stabilize the financial system and mitigate the effects on the real side of the economy. As more data on the recovery of US economy becomes available, the speech of FED authorities is turning to consider the rising of the FED fund rates (FFR), defined as "normalization". The effects of the US MP normalization are unclear – mainly for economies with low degrees of financial development – since the reversion of a monetary policy to a pre-crisis stance would take place under a US growth scenario. We estimate the impact of the normalization on Central America and the Dominican economies, summarizing the information of nearly 80 variables in a few common factors and considering both effects through real and financial channels. We estimate a factor augmented VAR, to measure the impact of US MP shocks to these economies, using a sign restriction approach in the identification process of such shocks. Then we use measured shocks to map the effects on domestic variables. Our results indicate that this eventuality will affect these economies mostly through its effects on the real side of the economy due to its impact on external demand and the reduced role of exchange rate as a shock absorber, where countries with less flexible exchange rate regimes being more affected. On the financial side, domestic interest rate will rise and net international reserves will fall, as central banks limit volatility in exchange rates.

JEL Classification: E50, E58, C55

Keywords: Transmission of Monetary Policy, Normalization, Interest Rates, Central America

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I. Introduction

In October 2014, the Federal Reserve (FED) decided to end six years of unconventional monetary policy, based on the US economic recovery and the stability of its financial markets. Throughout this period, the federal funds rate (FFR) – conventional monetary policy instrument – has stayed in historical low levels. The improvements in the labor market, as well as in real activity growth forecasts, have brought into the FED policy makers' discussion the possibility of a period of interest rates hikes, to offset potential inflationary pressures in the policy horizon.

This phenomenon, known as *monetary policy normalization*, is considered an important topic among policy makers, given that a sharp increase could raise financial market volatility. This reopens the question of how US monetary policy shocks spillover to rest of the world, currently in a context of historically low interest rates levels.

The main objective of this paper is to quantify the effects of foreign interest rate shocks, measured through the US FFR, to the Central American and Dominican (CADR) economies. This is a relevant subject for policy makers in these economies, because of the important commercial linkage of CARD countries with the US economy, despite the low degree of financial development relative to other Emerging Market Economies in Latin America (LA).

The empirical strategy to study this phenomenon intends to measure the country-specific effects of US monetary policy shocks. The measurement of the impact induced by US monetary shocks in other countries is subject to the problem of identification of such shocks (Canova and De Nicoló (2000), Kim (2001) and Canova (2005)). We address this problem using sign restrictions to identify the effects of a US MP shock by a rise of the FFR. While the FFR has remained unchanged for the last seven years, the FED has employed nonconventional instruments, such as quantitative easing (QE), which have led to a more expansive monetary policy than what can be accounted by the effective FFR. Therefore, in order to address this issue, we use the Shadow Federal Funds Rate (Wu-Xia, 2014) as our measure of monetary policy instrument.

We estimate a Factor Augmented Autorregresive model (FAVAR) with a foreign variables block, where the US is the relevant foreign country for these economies. Common factors are extracted

from a country data set of nearly 80 macroeconomic variables of CARD[3] countries, for the period 2003 - 2014.

Other papers have used the FAVAR methodology to study the international transmission of monetary policy shocks. Mumtaz and Surico (2007) extend the model of Bernanke, Boivin and Eliasz (2004) to the open economy case, analyzing the transmission to seventeen industrial countries. Meanwhile, Zuniga (2011) studies the effects of a change in the US monetary policy for the Mexican and Brazilian case. To date, this is one of the first works that addresses the US monetary policy effects for Central American and Dominican economies.

Summarizing the main findings, US monetary shocks have contractive effects on these economies. The relative importance of exchange rate stability minimizes the response of this variable, hence raising interest rates and falling net international reserves do most of the adjustment. On the real side, exports fall due to the dominance of the income absorption effect over the expenditure switching effect, backed on the limited fluctuation in exchange rates. However, a recover in trade balance is observed, as imports decrease more than exports. Finally, remittances, which are an important source of non-labor income in these economies, respond negatively.

The paper is organized as follows: Section 2 presents the literature review. Section 3 describes the empirical strategies. Section 4 describes the data used. Section 5 compares the results for a positive interest rate shock to main Central American and Dominican indicators. Section 6 concludes.

II. Literature Review

Literature related to conventional monetary shocks, measured through interest rate changes, although extensive, focuses in "normal times", i.e. periods that do not include hyperinflation episodes, currency crises, or massive recessions (Canova, 2005). When studying monetary shocks and its international transmission, two empirical strategies can be distinguished: those based on theoretical models with imposed restrictions, and those which are data oriented, based on empirical relations.

In theoretical models, such as the Mundell-Fleming model and the Obstfeld-Rogoff extension (1996), the transmission of monetary shocks to other economies occurs through two main channels: current account and exchange rate.

[3] Nicaragua is excluded from the sample, due to lack of data prior to 2007.

A tightening shock in the country of origin is associated with a fall in output and an appreciation of the currency of that country. However, the impact of that shock to other countries is ambiguous, since two offsetting mechanisms work simultaneously, with no clear evidence of which one would dominate: on one side, the exchange rate in the foreign country depreciates, having a positive effects on economic activity (expenditure switching effect); meanwhile, the interest rate hike shrinks domestic output in the country of origin, leading to a fall in the demand for exports of foreign countries (income absorption effect)(Kawai, 2015). Likewise, inter-temporal models also show ambiguous results, even after including future expectations from economic agents as an additional mechanism (Kim, 2000).

Empirical models (Lastrapes (1992), Eichenbaum and Evans (1995), Grilli and Roubini (1995), Kim and Roubini (2000), and Clarida and Gali (1994)) employ strategies that minimize restrictions, using data to identify transmission mechanisms for the exchange rate case. Kim (2000) compares the empirical results with different theoretical models, finding that an expansive monetary shock in US, measured by a drop in the world interest rate, has a positive effect on growth for G-6 economies, which matches with the results suggested by inter-temporal models (Svensson and Van Wijnbergen (1989), Obstfeld and Rogoff (1995)). Also, the trade link is not significant, which is not consistent with the "beggar-thy-neighbor" theory of the MFD basic model. The paper concludes that the exchange rate response does not depend on whether the identifying strategies are recursive or not, as prompted by Kim and Roubini (2000) and Cushman and Zha (1997). Other findings of Kim (2000) include the exogeneity of US to non-US monetary policy.

The international transmission of monetary shocks to industrial countries has been recently addressed by Vespignani (2014). Mumtaz and Surico (2007) explore the effects of a decrease in the international short term interest rates on the United Kingdom, finding a positive impact on GDP, investment and consumption after a year. Likewise, the study of Jannsen and Klein (1991) finds that an increase in a foreign interest rate (Euro Zone, in this case) has a positive impact on domestic interest rates for a set of countries that have not adopted the euro[4]. The increase in the interest rates translates into a contraction in GDP, through a reduction in imports. Meanwhile, exports decline, exposing the importance of the income absorption effect in these economies. Since both exports and imports decline, no significant changes are observed in the trade balance. The response of these variables, as well as the negligible role observed in the exchange rate, is similar to the

[4] The set of countries include the United Kingdom, Denmark, Sweden, Norway, and Switzerland.

reaction of countries with a fixed exchange rate regime, revealing the importance of exchange rate stabilization for these small open economies.

For developing economies, the degree of transmission of international monetary shocks varies according to the currency regime, macroeconomic fundamentals and country-specific structural characteristics (Borda and Montauban (1999), Arora and Cerisola (2001), Mackowiack (2001) and Canova (2005), and Zuniga (2011)[5]). These authors identify, through different VAR specifications, two key transmission channels: trade balance and interest rates.

The research of Borda et al. (2000), related to the contribution of US monetary policy to Caribbean business cycles, concludes that for countries with a flexible exchange rate regime, a world interest rate shock has a negative effect on output due to an increase in the real exchange rate that augments the cost of inputs. However, it indicates that GDP for Caribbean countries is not mainly driven by the world interest rate, but rather by the exchange rate, highlighted as an important transmission mechanism. This result is consistent with the conclusions of Mackowiak (2001), where the typical response of an emerging market economy to a tightening of the US monetary policy is exchange rate depreciation, inflation and a fall in economic activity.[6] Meanwhile, the results provided by Canova (2005) suggest that the interest rate channel serves as an amplifier of US monetary changes, conferring the trade channel an insignificant role in the transmission of monetary shocks from US to LA.

The normalization of monetary policy focusing on the impact of unconventional instruments adopted by industrial countries after the 2007 international crisis has been approached by different authors. Hausman and Wongswan (2006), Ehrmann and Fratzscher (2006), Neely (2013), Londono (2014) and Chen, Mancini-Griffoli & Sahay (2014) analyze its spillover effects to emerging economies. Overall, their results confer a more important role to financial linkages and trade channel.

Hausman and Wongswan (2006) explore the channels of US monetary policy transmission through the Federal Open Market Committee announcements, noting that a country with a higher degree of real and financial integration with the US has a greater interest-rate response, as well as those with less flexible exchange rates. In summary, unlike Ehrmann and Fratzscher (2006), they suggest that real and financial linkages with the US are more important than real and financial linkages with the

[5] Zuniga (2011) employs a FAVAR.
[6] Countries under analysis are Korea, Thailand, Malaysia, Philippines, Singapore, Hong Kong, Mexico, and Chile.

rest of the world. Likewise, Neely (2013) distinguishes the relative importance of the signaling and portfolio balance channels to explain the contribution of unconventional policy to the reduction of bond yields in most countries after the international crisis of 2007. [7] Through a dynamic term structure model, they conclude that both channels are important. [8] Nonetheless, Chen et al. (2014) indicate that the spillovers to asset prices and capital markets are larger if they come from signal surprises. They highlight that even if unconventional monetary policies have a greater impact than conventional ones, characteristics such as better fundamentals and a more liquid market structure help to mitigate the effects. Londono (2014) also demonstrates that although fluctuations of asset prices in emerging markets – after a US monetary shock – are bigger than fluctuations in the country of origin (US), weaker fundamentals explains, in part, this overreaction. Among other studies that focus on the effects of unconventional monetary policy to other countries are Craine & Martin (2008) and Hausman & Wongswan (2011).

III. Empirical Strategy

In this section we describe the empirical strategy used to pin down the potential effects of US monetary policy shocks on CARD economies and the underlying transmission mechanisms. For this aim, we utilize a multi-sectorial dataset of about 80 variables, which sum up the macroeconomic information of CARD countries, to estimate common factors through Principal Components. The common factors are used as indicators of the state of the economy for CARD economies. For a proper identification of US monetary shocks, we employ sign restrictions for the US variables.

Hence, our empirical strategy consists of a FAVAR approach with a sign-restriction identification of US monetary policy shock, where factors included are principal components. This methodology – introduced to forecasters by Stock and Watson (2002) and to macroeconomics by Bernanke, Boivin and Eliasz (2004) – extracts from a large set of data a smaller group of factors that drive the dynamics of the whole sample. This mechanism allows the researcher to summarize "big data" neatly, avoiding the "curse of dimensionality", while at the same time accounting for the crucial information.

[7] Australia, Germany, US, Canada and Japan

[8] The signal channel is more important for countries with strong response to conventional monetary policy surprises in the US; and the portfolio balance is consistent with the degree of substitution of international bonds between countries.

The Principal Components Analysis extracts a series of factors from N number of variables, which are linear combination of this data set and attempts to: a) minimizes noise, since the extracted factors contain the most important information, leaving aside noisy deviations and b) minimizes redundancy: two factors should not contain the same "information" from the dataset, but should express different dimensions along which the data varies. After these factors have been estimated, we perform a VAR analysis. We use Bayesian methods to estimate VAR coefficients and impose sign-restriction on the impulse response functions for the identification of US MP shocks.

Suppose we have M number of series spanning T periods, collected in Mx1 vectors X_t , from which we extract N factors spanning the same T periods in an Nx1 vector F_t. Our model is divided in two parts. First, the measurement equation is:

$$X_t = \Lambda F_t$$

where the matrix Λ is MxN. Its elements are called factor loadings; these associate the value of the factors to the measured variables of the model. ε_t is the error term with mean zero and covariance matrix Q.

The second part of the model is the state equation, which is simply a VAR with sign restrictions containing one block for the exogenous external variables (Y_t), the Volatility Index (VIX) to capture financial conditions in these economies and one for the estimated domestic factors (P_t), which Bernanke, Boivin and Eliasz (2004) named Factor Augmented VAR:

$$\begin{bmatrix} Y_t \\ VIX_t \\ P_t \end{bmatrix} = \begin{bmatrix} \mathrm{A}_{10} & 0 & \tilde{\mathbf{0}} \\ \mathrm{a}_{20} & \mathrm{a}_{21} & \tilde{\mathbf{0}} \\ \mathrm{A}_{30} & \mathrm{A}_{31} & \mathrm{A}_{32} \end{bmatrix} \begin{bmatrix} Y_{t-p} \\ VIX_{t-p} \\ P_{t-p} \end{bmatrix} + \nu_t$$

Here, $\mathrm{Y_t}$ includes the FFR and a set of foreign variables such as US output growth, US inflation rate, and US Real Balances growth. It is important to note that we restrict the foreign variables as exogenous, imposing zero coefficients restrictions ($\tilde{\mathbf{0}}$). ν_t is the error term with mean zero and covariance matrix Σ.

The estimation procedure for the factors is non-parametric, as it is done through a matrix decomposition of the data called singular value decomposition (SVD) of the data matrix, from which we obtain the coefficients of the linear combination of the data that composes our factors. Thus we obtain the N series of factors.

Therefore, to assess the dynamic responses of the measurement variables to foreign interest shocks we can simply compute the VAR in the state equation, and induce a shock to the Y_t variable, to obtain vectors of responses of each of the variables of the VAR into the simulated response. Then, with the factor loadings from the measurement equation we can associate these responses of the factors and the monetary policy variable to the responses of each of the measured variables in X_t. Clearly, if the response of a variable h periods in the future to a shock of Y in period t is denoted as $\widehat{W}_{t+h}$, where $\widehat{W}_{t+h}$could be a vector (for the factors) or a scalar (for the monetary policy variable), then we would compute the responses of the measurement variables with:

$$\hat{X}_{t+h} = \Lambda \hat{F}_{t+h}$$

Now, regarding the transmission of monetary shocks, the literature has employed sign-restrictions as an identifying strategy, imposing restrictions that agree with a priori theory. Hence, a contractionary interest rate shock leads to a fall in output[9], diminishing inflation pressures, whereas exchange rate appreciates, as expected from theoretical models.

We rely on this strategy[10] popularized by Canova and De Nicoló (2002), Uhlig (2005) and Gertler and Karadi (2014) for our identification strategy. Our goal is to estimate shocks of models that produce the expected response of US variables to exogenous monetary policy movements. In particular, we impose the following sign restrictions in the spirit of Canova and De Nicoló (2002), where prices are sluggish and output has a lagged response to monetary innovations. As in Uhlig (2005), we limit sign restrictions on the impulse responses to provide a "minimalistic identification". We impose restrictions only on impact, where the horizon for the sign restriction to hold is one period, thus:

FFR >0, t=1

IP growth<0, t=2

CPI inflation <0, t=2

Real balance growth<0, t=2

where t denotes the period in months where the sign restriction is imposed.

[9] Uhlig (2005) employs an agnostic identification procedure to study the effects of monetary policy on output. He finds no clear effect of interest rate hikes on real GDP.

[10] However, as emphasized by Fry and Pagan (2011), we recognize the multiple model issue arising from the transformations of the new set of structural shocks.

IV. Data Description

In this section we describe the statistical data used in the estimation, where all the information is monthly frequency. We take a broad sample of data, consisting of the main macroeconomic indicators for a set of small open economies: Costa Rica (CR), El Salvador (ES), Honduras (HN), Guatemala (GT), Nicaragua (NI) and the Dominican Republic (DR). The complete set of variables and the transformations performed are shown in Appendix A. All variables are expressed in twelve month variation, and standardized subtracting the sample mean and divided by the sample standard deviation.

We divide the dataset into three main groups:

a. Real Indicators

This group contains variables from the real sector of the economy, i.e. real activity indicators[11], exports, imports, trade balance and remittances; all in real terms. From the fiscal sector, we incorporate total fiscal revenue and expenditure. By including this group, we aim to capture the varying responses across sectors and periods to economic cycles, and how they might respond differently to a foreign interest shocks.

b. Prices and relative prices

This group consists of real exchange rates, consumer price indexes (CPI) and food and beverage CPI components. This last variable is included due to its relative importance in explaining domestic inflation. Finally, nominal exchange rates (local currency price of US dollar) are included.

c. Financial and monetary sector indicators

This set is composed of several measures of interest rates, including lending and deposit rates – in nominal and real terms –estimated using observed inflation. We also include credit growth to the private sector in real terms, as an indicator of the business cycle. Finally, to capture the overall evolution of money supply, we include traditional monetary aggregates.

In order to properly measure the impact of foreign interest rates on these economies, we must first identify the US MP shocks. For this purpose, we consider the US CPI, US Industrial Production Index (IPI), and Real Balances (M1), which are the typical set of variables used to analyze the impact of

[11] We utilize a monthly indicator of economic activity called IMAE, for its acronym in Spanish.

MP shock in the US (Sims (1992)). As for the measure of US monetary policy instrument, the effective FFR has remained unchanged for the last seven years. Nonetheless, the FED has employed nonconventional instruments, such as quantitative easing (QE), which have led to a more expansive monetary policy than what can be accounted by the effective FFR. Therefore, in order to address this issue, we consider the Wu-Xia Shadow Federal Funds Rate as our measure of monetary policy instrument (Wu and Xia, 2014).

We also consider the Volatility Index (VIX), as a measure of regional risk premium.

V. Results

In this section we discuss the response of domestic variables to a foreign interest rate innovation, measured by a one-time 25 basis point unexpected increase to the shadow FFR, our proxy of monetary policy rate in the US. Table 1 summarizes the qualitative response of macroeconomic variables for each economy. Complete results in terms of impulse response function are shown in Appendix B[12].

Table 1. Results Overview

Variables	Costa Rica	El Salvador	Guatemala	Honduras	Dominican Republic
Output	↓	↓	↓	↓	↓
Exports	↓	↓	↓	↓	↓
Imports	↓	↓	↓	↓	↓
Trade Balance	↑	-	↑	↑	↑
Remittances	↓	↓	-	↓	↓
CPI Inflation	↓	-	-	↓	↑
Real Exchange Rate	-	-	-	-	-
Nominal Exchange Rate	-		-	-	-
Net International Reserves	↓	-	↑	↓	↓
M1	↓	↓	-	↓	↓
Private Credit	↓	-	-	↓	↓
Interest Rate	↑	-	↑	↑	↑
EMBI		↑			↑

[12] In Appendix B we also include impulse responses assuming a recursive identification strategy using Cholesky decomposition. The problems to identify monetary policy shocks arise when such approach is used.

According to the estimated impulse response functions, a positive shock to the FFR has a negative impact on main real domestic variables. For all countries under analysis, output, export and import growth rates fall. In addition, financial sector variables such as interest rates and risk premium increase, also money and credit demand decrease. There is no evidence of significant nominal and real exchange rates adjustment to the shock, while we find a decrease in international reserves for three of these economies.

The empirical literature of transmission mechanisms of US monetary policy shocks (see Canova, 2000) emphasizes the role of exchange rate regime and the degree of financial integration on the magnitude of the pass-through to domestic macroeconomic variables (real and nominal) of these type of innovations. Therefore, countries with flexible (less-flexible) exchange rates regimes and relative high (low) integrated financial markets show less (more) volatility in domestic variables such as output and interest rates.

One of the peculiarities of these economies is the importance of exchange rate stability as a policy objective. Despite that impulse response results suggest depreciation pressures after foreign interest shock in CR, GT, and HN, they are statistically not significant. Instead, data suggest Central Banks react to the external shock by increasing interest rates across all countries and reducing net foreign reserves in CR, HN and the DR. Risk premium raises in ES and the DR[13]. Likewise, positive inflation pressures are not observed due to interest rate reaction and thus a limited pass-through effect.

On the real side, our results show a negative effect on output growth. Similarly, export and import growth falls in all countries. These results are in line with Jannsen and Klein (2011) which emphasize the importance of income absorption effect over the expenditure switching effect in countries with active exchange rate policies oriented to stabilize this variable. Nevertheless, the fall in import growth exceeds the fall in exports; as a result trade balance improves for most countries considered, excluding ES. This finding is opposite to the prediction from theoretical open economy DSGE literature, such as Gali and Monacelli (2005) where the real depreciation induced by a foreign interest rate shock, trigger an export increase. Behind this theoretical transmission mechanism is the assumption of relative flexibility in exchange rate markets.

[13] Data for the sample period are only available for these two countries

Finally, the flow of remittances is negatively affected in all countries (excluding GT where the response is negative, but insignificant). Remittances are an important source of non-labor income in countries like ES, HN, NI and in less degree in the DR. Therefore, it becomes a relevant transmission channel of foreign shock transmission.

VI. Conclusion

In this document we analyzed the impact of an eventual normalization of US monetary policy on the developing economies of Central America and the Dominican Republic. As we mentioned, these economies differentiate from other emerging economies in their lower financial deepening and their less exposure to capital flows.

Using a panel of macroeconomic variables which includes real sector and monetary indicators, we identify the transmission mechanism of foreign (US) interest rate shocks to the domestic economy. Impulse response analysis suggests that this type of shock pushes down real output, exports and imports. In addition, a US monetary policy shock will have low impact on nominal exchange rates, at the cost of increasing interest rates, falling net international reserves and rising risk premium.

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Appendix A – Data Description

All series were directly taken from *Consejo Monetario Centroamericano/Secretaría Ejecutiva* Database, except for the Miscellaneous series (sources at the end of the Appendix). Format is presented as follows: series name; data span and series description as appears in the database. Nominal variables, except NER and Interest Rates, were CPI deflated. As for the transformation, the interest rates are presented as year-over-year first-difference values. The rest were one year logged-differentiated. All transformed variables are mean-de-trended and expressed in terms of their standard deviation.

Real Sector

1. IMAE_CR	2003M01: 2014M12	MONTHLY INDICATOR OF ECONOMIC ACTIVITY (IMAE): TREND-CYCLE, INDEX - COSTA RICA
2. IMAE_SV	2003M01: 2014M12	MONTHLY INDICATOR OF ECONOMIC ACTIVITY (IMAE) : TREND-CYCLE, INDEX - EL SALVADOR
3. IMAE_G	2003M01: 2014M12	MONTHLY INDICATOR OF ECONOMIC ACTIVITY (IMAE) : TREND-CYCLE, INDEX - GUATEMALA
4. IMAE_H	2003M01: 2014M12	MONTHLY INDICATOR OF ECONOMIC ACTIVITY (IMAE) : TREND-CYCLE, INDEX - HONDURAS
5. IMAE_N	2009M01: 2014M12	MONTHLY INDICATOR OF ECONOMIC ACTIVITY (IMAE) : TREND-CYCLE, INDEX - NICARAGUA
6. IMAE_RD	2003M01: 2014M12	MONTHLY INDICATOR OF ECONOMIC ACTIVITY (IMAE) : TREND-CYCLE, INDEX - DR
7.EXPORTS_CR	2003M01: 2014M12	EXPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - COSTA RICA
8.EXPORTS_SV	2003M01: 2014M12	EXPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - EL SALVADOR
9.EXPORTS_G	2003M01: 2014M12	EXPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - GUATEMALA
10.EXPORTS_H	2003M01: 2014M12	EXPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - HONDURAS
11.EXPORTS_N	2009M01: 2014M12	EXPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - NICARAGUA
12.EXPORTS_RD	2003M01: 2014M12	EXPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - DR
13.IMPORTS_CR	2003M01: 2014M12	IMPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - COSTA RICA
14.IMPORTS_SV	2003M01: 2014M12	IMPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - EL SALVADOR
15.IMPORTS_G	2003M01: 2014M12	IMPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - GUATEMALA
16.IMPORTS_H	2003M01: 2014M12	IMPORTS OF GOODS: MILLIONS OF $US,TOTAL MAQUILA WITHOUT MAQUILA ,FOB - HONDURAS
17.IMPORTS_N	2009M01: 2014M12	IMPORTS OF GOODS: MILLIONS OF $US,TOTAL MAQUILA WITHOUT MAQUILA ,FOB - NICARAGUA
18.IMPORTS_RD	2003M01: 2014M12	IMPORTS OF GOODS: MILLIONS OF $US, TOTAL MAQUILA WITHOUT MAQUILA ,FOB - DR
19.REMESAS_CR	2003M01: 2014M12	REMITTANCES INCOME: MILLIONS OF $US- COSTA RICA
20.REMESAS_SV	2003M01: 2014M12	REMITTANCES INCOME: MILLIONS OF $US- EL SALVADOR
21.REMESAS_G	2003M01: 2014M12	REMITTANCES INCOME: MILLIONS OF $US - GUATEMALA
22.REMESAS_H	2003M01: 2014M12	REMITTANCES INCOME: MILLIONS OF $US- HONDURAS
23.REMESAS_N	2009M01: 2014M12	REMITTANCES INCOME: MILLIONS OF $US- NICARAGUA
24.REMESAS_RD	2003M01: 2014M12	REMITTANCES INCOME: MILLIONS OF $US- DR
25.CCO_CR	2003M01: 2014M12	TRADE BALANCE: MILLIONS OF $US- COSTA RICA
26.CCO_SV	2003M01: 2014M12	TRADE BALANCE: MILLIONS OF $US- EL SALVADOR
27.CCO_G	2003M01: 2014M12	TRADE BALANCE: MILLIONS OF $US - GUATEMALA
28.CCO_H	2003M01: 2014M12	TRADE BALANCE: MILLIONS OF $US- HONDURAS
29.CCO_N	2009M01: 2014M12	TRADE BALANCE: MILLIONS OF $US- NICARAGUA
30.CCO_RD	2003M01: 2014M12	TRADE BALANCE: MILLIONS OF $US- DR

Exchange Rate

31.TCR_CR	2003M01: 2014M12	REAL EXCHANGE RATE- COSTA RICA
32.TCR_SV	2003M01: 2014M12	REAL EXCHANGE RATE- EL SALVADOR
33.TCR_G	2003M01: 2014M12	REAL EXCHANGE RATE - GUATEMALA
34.TCR_H	2003M01: 2014M12	REAL EXCHANGE RATE- HONDURAS
36.TCR_RD	2003M01: 2014M12	REAL EXCHANGE RATE- DR
37.TCN_CR	2003M01: 2014M12	NOMINAL EXCHANGE RATE: LOCAL CURRENCY PER $US- COSTA RICA
38.TCN_SV	2003M01: 2014M12	NOMINAL EXCHANGE RATE: LOCAL CURRENCY PER $US- EL SALVADOR
39.TCN_G	2003M01: 2014M12	NOMINAL EXCHANGE RATE: LOCAL CURRENCY PER $US - GUATEMALA
40.TCN_H	2003M01: 2014M12	NOMINAL EXCHANGE RATE: LOCAL CURRENCY PER $US- HONDURAS
41.TCN_N	2009M01: 2014M12	NOMINAL EXCHANGE RATE: LOCAL CURRENCY PER $US- NICARAGUA
42.TCN_RD	2003M01: 2014M12	NOMINAL EXCHANGE RATE: LOCAL CURRENCY PER $US- DR

Money and credit quantity aggregates

43.BMA_CR	2003M01: 2014M12	BROAD MONETARY BASE: MILLIONS OF LOCAL CURRENCY- COSTA RICA
44.BMA_SV	2003M01: 2014M12	BROAD MONETARY BASE: MILLIONS OF LOCAL CURRENCY- EL SALVADOR
45.BMA_G	2003M01: 2014M12	BROAD MONETARY BASE: MILLIONS OF LOCAL CURRENCY - GUATEMALA
46.BMA_H	2003M01: 2014M12	BROAD MONETARY BASE: MILLIONS OF LOCAL CURRENCY- HONDURAS
47.BMA_N	2009M01: 2014M12	BROAD MONETARY BASE: MILLIONS OF LOCAL CURRENCY- NICARAGUA
48.BMA_RD	2003M01: 2014M12	BROAD MONETARY BASE: MILLIONS OF LOCAL CURRENCY- DR
49.BMR_CR	2003M01: 2014M12	NARROW MONETARY BASE: MILLIONS OF LOCAL CURRENCY- COSTA RICA
50.BMR_SV	2003M01: 2014M12	NARROW MONETARY BASE: MILLIONS OF LOCAL CURRENCY- EL SALVADOR
51.BMR_G	2003M01: 2014M12	NARROW MONETARY BASE: MILLIONS OF LOCAL CURRENCY - GUATEMALA
52.BMR_H	2003M01: 2014M12	NARROW MONETARY BASE: MILLIONS OF LOCAL CURRENCY- HONDURAS
53.BMR_N	2009M01: 2014M12	NARROW MONETARY BASE: MILLIONS OF LOCAL CURRENCY- NICARAGUA
54.BMR_RD	2003M01: 2014M12	NARROW MONETARY BASE: MILLIONS OF LOCAL CURRENCY- DR
55.M1_CR	2003M01: 2014M12	MONETARY AGGREGATE M1: MILLIONS OF LOCAL CURRENCY- COSTA RICA
56.M1_SV	2003M01: 2014M12	MONETARY AGGREGATE M1: MILLIONS OF LOCAL CURRENCY- EL SALVADOR
57.M1_G	2003M01: 2014M12	MONETARY AGGREGATE M1: MILLIONS OF LOCAL CURRENCY - GUATEMALA
58.M1_H	2003M01: 2014M12	MONETARY AGGREGATE M1: MILLIONS OF LOCAL CURRENCY- HONDURAS
59.M1_N	2009M01: 2014M12	MONETARY AGGREGATE M1: MILLIONS OF LOCAL CURRENCY- NICARAGUA
60.M1_RD	2003M01: 2014M12	MONETARY AGGREGATE M1: MILLIONS OF LOCAL CURRENCY- DR
61.DEPOS_TRANSF_CR	2003M01: 2014M12	DEPOSITS IN NATIONAL CURRENCY: MILLIONS OF LOCAL CURRENCY- COSTA RICA
62.DEPOS_TRANSF_SV	2003M01: 2014M12	DEPOSITS IN NATIONAL CURRENCY: MILLIONS OF LOCAL CURRENCY- EL SALVADOR
63.DEPOS_TRANSF_G	2003M01: 2014M12	DEPOSITS IN NATIONAL CURRENCY: MILLIONS OF LOCAL CURRENCY - GUATEMALA
64.DEPOS_TRANSF_H	2003M01: 2014M12	DEPOSITS IN NATIONAL CURRENCY: MILLIONS OF LOCAL CURRENCY- HONDURAS
65.DEPOS_TRANSF_N	2009M01: 2014M12	DEPOSITS IN NATIONAL CURRENCY: MILLIONS OF LOCAL CURRENCY- NICARAGUA
66.DEPOS_TRANSF_RD	2003M01: 2014M12	DEPOSITS IN NATIONAL CURRENCY: MILLIONS OF LOCAL CURRENCY- DR
67.BILLETES_CR	2003M01: 2014M12	CURRENCY IN CIRCULATION: MILLIONS OF LOCAL CURRENCY- COSTA RICA
68.BILLETES_SV	2003M01: 2014M12	CURRENCY IN CIRCULATION: MILLIONS OF LOCAL CURRENCY- EL SALVADOR
69.BILLETES_G	2003M01: 2014M12	CURRENCY IN CIRCULATION: MILLIONS OF LOCAL CURRENCY - GUATEMALA
70.BILLETES_H	2003M01: 2014M12	CURRENCY IN CIRCULATION: MILLIONS OF LOCAL CURRENCY- HONDURAS
71.BILLETES_N	2009M01: 2014M12	CURRENCY IN CIRCULATION: MILLIONS OF LOCAL CURRENCY- NICARAGUA
72.BILLETES_RD	2003M01: 2014M12	CURRENCY IN CIRCULATION: MILLIONS OF LOCAL CURRENCY- DR
73.RIN_CR	2003M01: 2014M12	NET INTERNATIONAL RESERVES: MILLIONS OF $US- COSTA RICA
74.RIN_SV	2003M01: 2014M12	NET INTERNATIONAL RESERVES: MILLIONS OF $US- EL SALVADOR
75.RIN_G	2003M01: 2014M12	NET INTERNATIONAL RESERVES: MILLIONS OF $US - GUATEMALA
76.RIN_H	2003M01: 2014M12	NET INTERNATIONAL RESERVES: MILLIONS OF $US- HONDURAS
77.RIN_N	2009M01: 2014M12	NET INTERNATIONAL RESERVES: MILLIONS OF $US- NICARAGUA
78.RIN_RD	2003M01: 2014M12	NET INTERNATIONAL RESERVES: MILLIONS OF $US- DR
79.CREDITO_CR	2003M01: 2014M12	CREDIT: TOTAL, MILLIONS OF LOCAL CURRENCY- COSTA RICA
80.CREDITO_SV	2003M01: 2014M12	CREDIT: TOTAL, MILLIONS OF LOCAL CURRENCY- EL SALVADOR
81.CREDITO_G	2003M01: 2014M12	CREDIT: TOTAL, MILLIONS OF LOCAL CURRENCY - GUATEMALA
82.CREDITO_H	2003M01: 2014M12	CREDIT: TOTAL, MILLIONS OF LOCAL CURRENCY- HONDURAS
83.CREDITO_N	2009M01: 2014M12	CREDIT: TOTAL, MILLIONS OF LOCAL CURRENCY- NICARAGUA
84.CREDITO_RD	2003M01: 2014M12	CREDIT: TOTAL, MILLIONS OF LOCAL CURRENCY- DR
85.CREDITOPUB_CR	2003M01: 2014M12	CREDIT: PUBLIC SECTOR, MILLIONS OF LOCAL CURRENCY- COSTA RICA
86.CREDITOPUB_SV	2003M01: 2014M12	CREDIT: PUBLIC SECTOR, MILLIONS OF LOCAL CURRENCY- EL SALVADOR
87.CREDITOPUB_G	2003M01: 2014M12	CREDIT: PUBLIC SECTOR, MILLIONS OF LOCAL CURRENCY - GUATEMALA
88.CREDITOPUB_H	2003M01: 2014M12	CREDIT: PUBLIC SECTOR, MILLIONS OF LOCAL CURRENCY- HONDURAS
89.CREDITOPUB_N	2009M01: 2014M12	CREDIT: PUBLIC SECTOR, MILLIONS OF LOCAL CURRENCY- NICARAGUA
90.CREDITOPUB_RD	2003M01: 2014M12	CREDIT: PUBLIC SECTOR, MILLIONS OF LOCAL CURRENCY- DR
91.CREDITOPRIV_CR	2003M01: 2014M12	CREDIT: PRIVATE SECTOR, MILLIONS OF LOCAL CURRENCY- COSTA RICA
92.CREDITOPRIV_SV	2003M01: 2014M12	CREDIT: PRIVATE SECTOR, MILLIONS OF LOCAL CURRENCY- EL SALVADOR
93.CREDITOPRIV_G	2003M01: 2014M12	CREDIT: PRIVATE SECTOR, MILLIONS OF LOCAL CURRENCY - GUATEMALA
94.CREDITOPRIV_H	2003M01: 2014M12	CREDIT: PRIVATE SECTOR, MILLIONS OF LOCAL CURRENCY- HONDURAS
95.CREDITOPRIV_N	2009M01: 2014M12	CREDIT: PRIVATE SECTOR, MILLIONS OF LOCAL CURRENCY- NICARAGUA
96.CREDITOPRIV_RD	2003M01: 2014M12	CREDIT: PRIVATE SECTOR, MILLIONS OF LOCAL CURRENCY- DR
97.CREDITOEXT_CR	2003M01: 2014M12	TOTAL CREDIT TO NON-RESIDENTS AND OTHER: MILLIONS OF LOCAL CURRENCY- COSTA RICA
98.CREDITOEXT_SV	2003M01: 2014M12	TOTAL CREDIT TO NON-RESIDENTS AND OTHER: MILLIONS OF LOCAL CURRENCY- EL SALVADOR
99.CREDITOEXT_G	2003M01: 2014M12	TOTAL CREDIT TO NON-RESIDENTS AND OTHER: MILLIONS OF LOCAL CURRENCY - GUATEMALA
100.CREDITOEXT_H	2003M01: 2014M12	TOTAL CREDIT TO NON-RESIDENTS AND OTHER: MILLIONS OF LOCAL CURRENCY- HONDURAS
101.CREDITOEXT_N	2009M01: 2014M12	TOTAL CREDIT TO NON-RESIDENTS AND OTHER: MILLIONS OF LOCAL CURRENCY- NICARAGUA
102.CREDITOEXT_RD	2003M01: 2014M12	TOTAL CREDIT TO NON-RESIDENTS AND OTHER: MILLIONS OF LOCAL CURRENCY- DR

Interest Rates

103.TASA_ACTIVA_CR	2003M01: 2014M12	INTEREST RATE: NOMINAL, LENDING (PER ANNUM)- COSTA RICA
104.TASA_ACTIVA_SV	2003M01: 2014M12	INTEREST RATE: NOMINAL, LENDING (PER ANNUM)- EL SALVADOR
105.TASA_ACTIVA_G	2003M01: 2014M12	INTEREST RATE: NOMINAL, LENDING (PER ANNUM) - GUATEMALA
106.TASA_ACTIVA_H	2003M01: 2014M12	INTEREST RATE: NOMINAL, LENDING (PER ANNUM)- HONDURAS
107.TASA_ACTIVA_N	2009M01: 2014M12	INTEREST RATE: NOMINAL, LENDING (PER ANNUM)- NICARAGUA

108.TASA_ACTIVA_RD	2003M01: 2014M12	INTEREST RATE: NOMINAL, LENDING (PER ANNUM)- DR
109.TASA_PASIVA_CR	2003M01: 2014M12	INTEREST RATE: NOMINAL, DEPOSIT (PER ANNUM)- COSTA RICA
110.TASA_PASIVA_SV	2003M01: 2014M12	INTEREST RATE: NOMINAL, DEPOSIT(PER ANNUM)- EL SALVADOR
111.TASA_PASIVA_G	2003M01: 2014M12	INTEREST RATE: NOMINAL, DEPOSIT (PER ANNUM) - GUATEMALA
112.TASA_PASIVA_H	2003M01: 2014M12	INTEREST RATE: NOMINAL, DEPOSIT (PER ANNUM)- HONDURAS
113.TASA_PASIVA_N	2009M01: 2014M12	INTEREST RATE: NOMINAL, DEPOSIT (PER ANNUM)- NICARAGUA
114.TASA_PASIVA_RD	2003M01: 2014M12	INTEREST RATE: NOMINAL, DEPOSIT (PER ANNUM)- DR
115.TASA_RACTIVA_CR	2003M01: 2014M12	INTEREST RATE: REAL LENDING (PER ANNUM)- COSTA RICA
116.TASA_RACTIVA_SV	2003M01: 2014M12	INTEREST RATE: REAL LENDING (PER ANNUM)- EL SALVADOR
117.TASA_RACTIVA_G	2003M01: 2014M12	INTEREST RATE: REAL LENDING (PER ANNUM) - GUATEMALA
118.TASA_RACTIVA_H	2003M01: 2014M12	INTEREST RATE: REAL LENDING (PER ANNUM)- HONDURAS
119.TASA_RACTIVA_N	2009M01: 2014M12	INTEREST RATE: REAL LENDING (PER ANNUM)- NICARAGUA
120.TASA_RACTIVA_RD	2003M01: 2014M12	INTEREST RATE: REAL LENDING (PER ANNUM)- DR
121.TASA_RPASIVA_CR	2003M01: 2014M12	INTEREST RATE: REAL LENDING (PER ANNUM)- COSTA RICA
122.TASA_RPASIVA_SV	2003M01: 2014M12	INTEREST RATE: REAL DEPOSIT (PER ANNUM)- EL SALVADOR
123.TASA_RPASIVA_G	2003M01: 2014M12	INTEREST RATE: REAL DEPOSIT (PER ANNUM) - GUATEMALA
124.TASA_RPASIVA_H	2003M01: 2014M12	INTEREST RATE: REAL DEPOSIT (PER ANNUM)- HONDURAS
125.TASA_RPASIVA_N	2009M01: 2014M12	INTEREST RATE: REAL DEPOSIT (PER ANNUM)- NICARAGUA
126.TASA_RPASIVA_RD	2003M01: 2014M12	INTEREST RATE: REAL DEPOSIT (PER ANNUM)- DR

Fiscal Balance

127.ING_FISCALES_CR	2003M01: 2014M12	GOVERNMENT INCOME: TOTAL, MILLIONS OF LOCAL CURRENCY- COSTA RICA
128.ING_FISCALES_SV	2003M01: 2014M12	GOVERNMENT INCOME: TOTAL, MILLIONS OF LOCAL CURRENCY- EL SALVADOR
129.ING_FISCALES_G	2003M01: 2014M12	GOVERNMENT INCOME: TOTAL, MILLIONS OF LOCAL CURRENCY - GUATEMALA
130.ING_FISCALES_H	2003M01: 2014M12	GOVERNMENT INCOME: TOTAL, MILLIONS OF LOCAL CURRENCY- HONDURAS
131.ING_FISCALES_N	2009M01: 2014M12	GOVERNMENT INCOME: TOTAL, MILLIONS OF LOCAL CURRENCY- NICARAGUA
132.ING_FISCALES_RD	2003M01: 2014M12	GOVERNMENT INCOME: TOTAL, MILLIONS OF LOCAL CURRENCY- DR
133.GASTOS_FISCALES_CR	2003M01: 2014M12	GOVERNMENT EXPENDITURE: TOTAL, MILLIONS OF LOCAL CURRENCY- COSTA RICA
134.GASTOS_FISCALES_SV	2003M01: 2014M12	GOVERNMENT EXPENDITURE: TOTAL, MILLIONS OF LOCAL CURRENCY- EL SALVADOR
135.GASTOS_FISCALES_G	2003M01: 2014M12	GOVERNMENT EXPENDITURE: TOTAL, MILLIONS OF LOCAL CURRENCY - GUATEMALA
136.GASTOS_FISCALES_H	2003M01: 2014M12	GOVERNMENT EXPENDITURE: TOTAL, MILLIONS OF LOCAL CURRENCY- HONDURAS
137.GASTOS_FISCALES_N	2009M01: 2014M12	GOVERNMENT EXPENDITURE: TOTAL, MILLIONS OF LOCAL CURRENCY- NICARAGUA
138.GASTOS_FISCALES_RD	2003M01: 2014M12	GOVERNMENT EXPENDITURE: TOTAL, MILLIONS OF LOCAL CURRENCY- DR

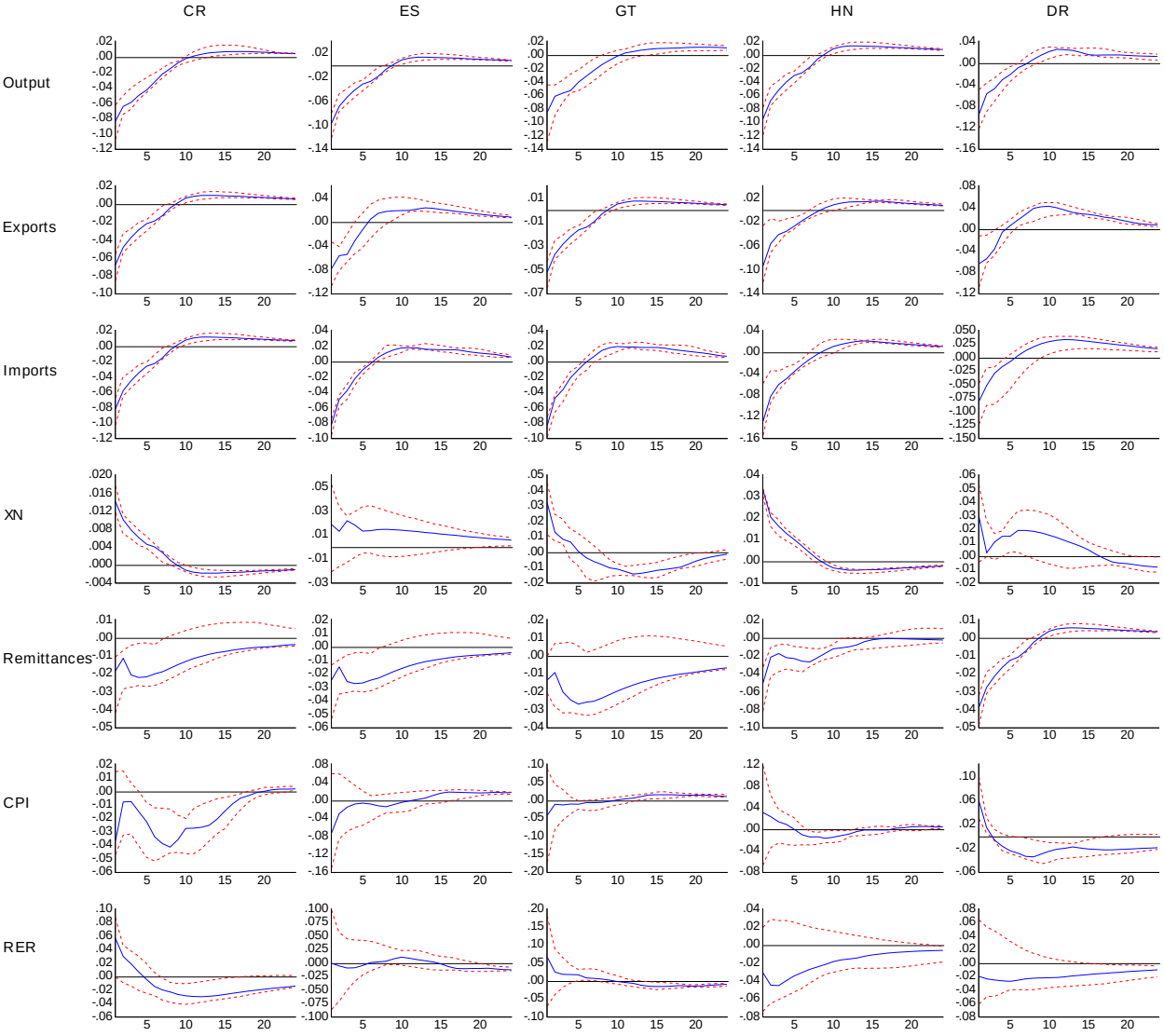
Miscellaneous

139.EMBI_SV*	2003M01: 2014M12	EMERGING MARKET BOND INDEX (JP MORGAN CHASE)- EL SALVADOR
140.EMBI_RD*	2003M01: 2014M12	EMERGING MARKET BOND INDEX (JP MORGAN CHASE)- DR
141.EMBI_LATINO*	1980M01: 2014M12	EMERGING MARKET BOND INDEX (JP MORGAN CHASE) - LATIN
142.PETR_FMI**	2003M01: 2014M12	CRUDE OIL (PETROLEUM), PRICE INDEX, 2005 = 100, SIMPLE AVERAGE OF THREE SPOT PRICES; DATED BRENT, WEST TEXAS INTERMEDIATE, AND THE DUBAI FATEH
143.PETR**	2003M01: 2014M12	PETROLEUM PRICE: END OF PERIOD, US$ PER BARREL
144.US_CPI_SA***	1980M01: 2014M12	CONSUMER PRICE INDEX FOR ALL URBAN CONSUMERS: ALL ITEMS - USA
145.FFR****	1980M01: 2014M12	EFFECTIVE FEDERAL FUNDS RATE (NOT SEASONALLY ADJUSTED) - USA
146.US_IP_SA****	1980M01: 2014M12	INDUSTRIAL PRODUCTION INDEX(2007=100) - USA
147. US_M1****	1980M01: 2014M12	M1 MONEY STOCK, BILLIONS OF DOLLARS, SEASONALLY ADJUSTED - USA

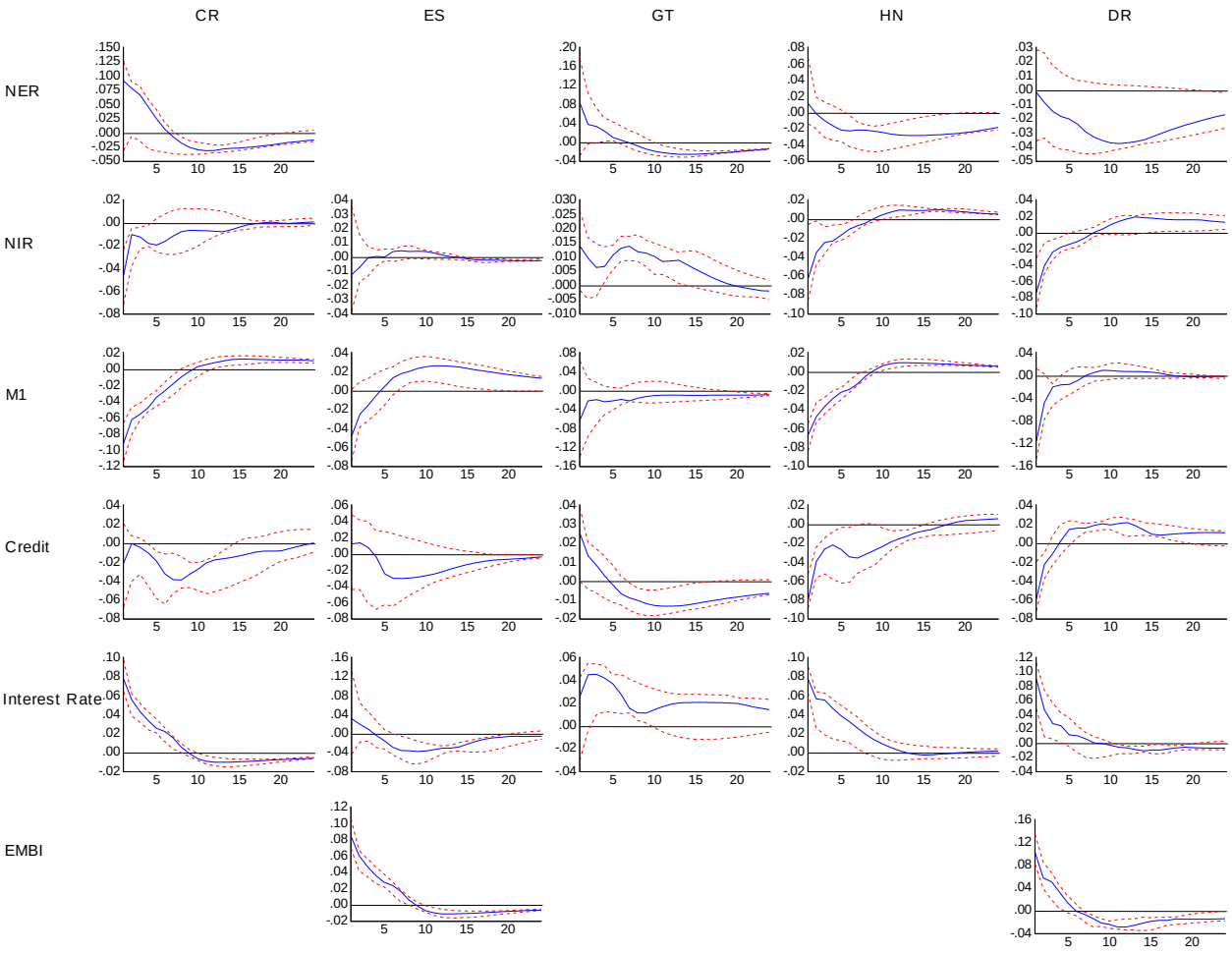
*Sources: * JP Morgan Chase; ** International Monetary Fund; *** Bureau of Labor Statistics; **** FRED*

Appendix B – Impulse Response Functions Figures

1.a FAVAR with Sign Restrictions

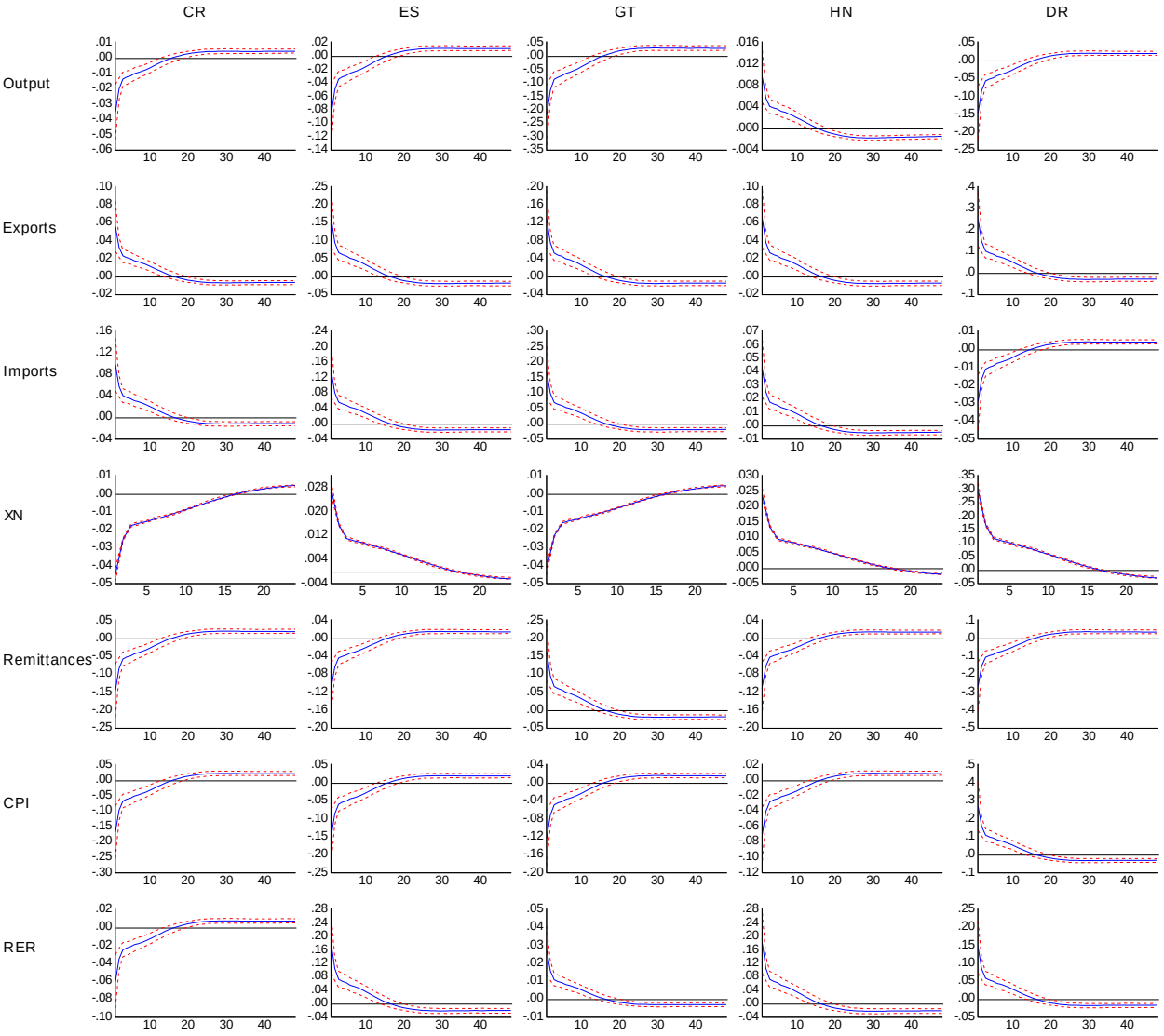


** All results are expressed in terms of a 25-basis points shock to the Wu-Xia Shadow FFR.*

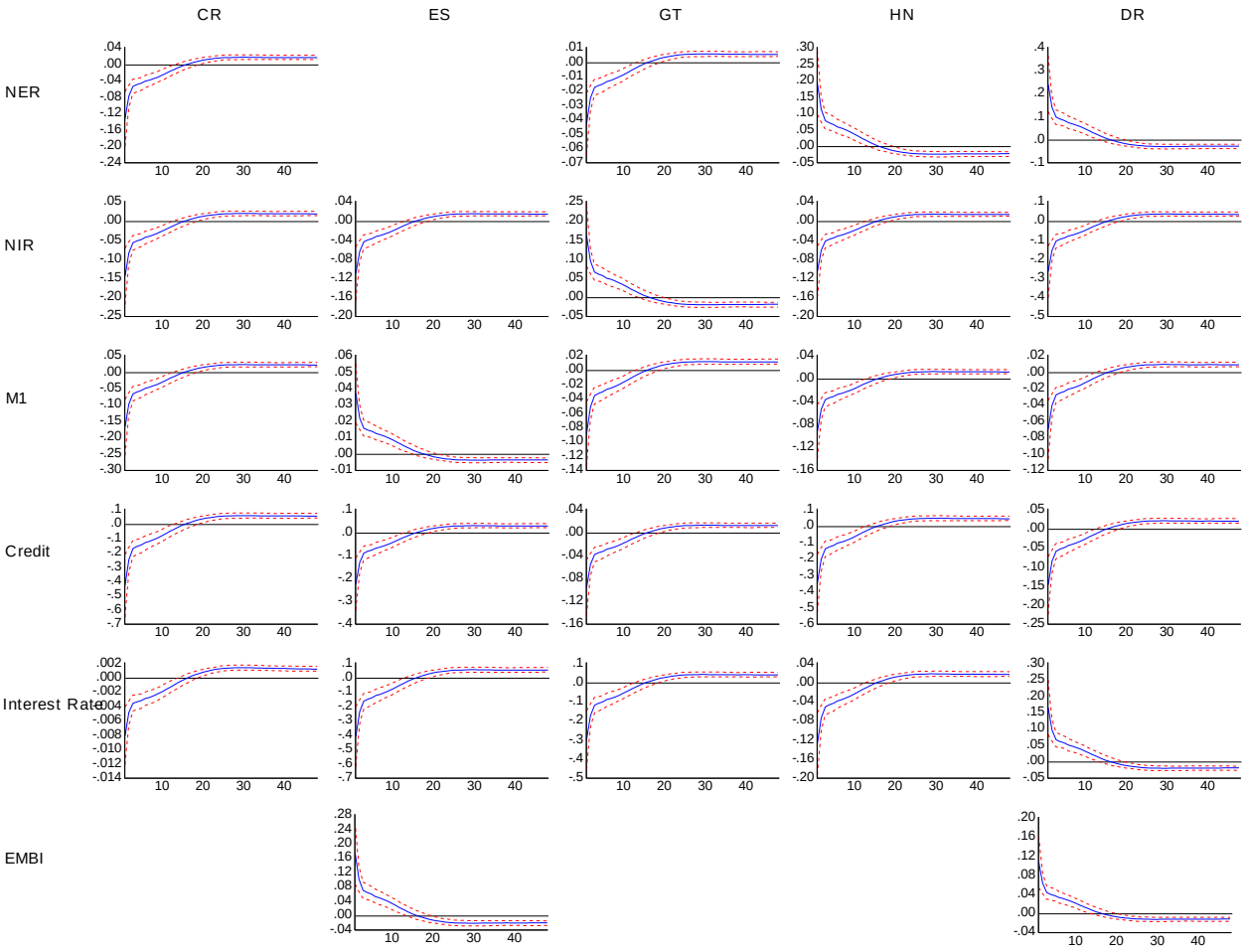


** All results are expressed in terms of a 25-basis points shock to the Wu-Xia Shadow FFR.*

Figure 1.b Cholesky Decomposition



** All results are expressed in terms of a 25-basis points shock to the Wu-Xia Shadow FFR.*



** All results are expressed in terms of a 25-basis points shock to the Wu-Xia Shadow FFR.*