Are Business Cycles Alike in Emerging Market Economies?*

Bira Zhahadai†

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Abstract

This paper explores the predictions of real business cycle theory on the roles of total factor productivity (TFP) and financial shocks to explain aggregate fluctuations in emerging market economies (EMEs). I obtain evidence about TFP and financial shocks by estimating structural vector autoregressions (SVARs) on quarterly samples of real GDP, a country-specific world real interest rate, Tobin's Q, and the trade balance-output ratio in recent twenty years for Brazil and Mexico. On each sample, two SVARs are estimated. One SVAR is identified on short-run restrictions, and the other is grounded on a long-run identification. Estimates of the SVARs show the Brazilian and Mexican business cycles are markedly different, as the contributions of TFP and financial shocks to aggregate fluctuations vary across the two countries. Next, TFP shocks are the main driver of business cycle movements in Brazil and Mexico conditional on the long-run identification. However, which shocks matter most for explaining business cycle dynamics in Brazil and Mexico is sensitive to identifying a SVAR on the short- or long-run restrictions. The short-run restrictions render little information to understand better business cycles in Brazil and Mexico. Hence, the findings of this paper suggest although not all business cycles are alike in EMEs, TFP shocks remain the primary driving force of aggregate fluctuations in EMEs.

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†Department of Economics, North Carolina State University, Campus Box 8110, Raleigh, NC 27695-8110. e-mail: bila@ncsu.edu.

1. Introduction

Business cycles in emerging market economies (EMEs) are distinguished from business cycles in developed economies. The key features are (a) larger volatility of consumption than output (see Aguiar and Gopinath 2007; Boz, Daude, and Durdu 2011; García-Cicco, Pancrazi and Uribe 2010), (b) countercyclical trade balances and world real interest rates (see Akinci 2013; Neumeyer and Perri 2005; Uribe and Yue 2006), and (c) infrequent periods of large contractions in output and investment accompanied by a spike in the trade balance. The latter are often referred as "sudden stop events" (see Calvo, Izquierdo, and Talvi 2006; Mendoza 2010).

There are two lines of research that seek to explain business cycles in EMEs. One line, started by Aguiar and Gopinath (2007), argues that permanent shocks to total factor productivity (TFP) are the primary driving force of business cycles in EMEs. They show that a small open economy (SOE) real business cycle (RBC) model driven primarily by a permanent TFP shock is successful at matching the key features of business cycles in EMEs. The other strand of studies states that EMEs face frictions in financial markets; this assigns financial shocks the responsibility for generating business cycle fluctuations. For example, Neumeyer and Perri (2005) incorporate a working capital constraint into a SOE-RBC model.[1] They report that a country-specific financial risk shock explains a quarter of the variation

[1]The working capital constraint forces firms to borrow internationally to pay for labor in order to produce. As a result, the working capital constraint creates a transmission mechanism in that shocks to international financial markets affect output in EMEs.

in output of their model, which is calibrated to the Argentine business cycle. Uribe and Yue (2006) find that shocks to the international bond market account for one-third of the business cycle movements in EMEs. They build a SOE-RBC model, including a working capital constraint, to replicate this empirical finding. Mendoza (2010) utilizes a SOE-RBC model, which includes an occasionally binding Kiyotaki and Moore (1997) type collateral constraint and is driven by TFP and financial shocks, to study the connection between sudden stop events and financial market turmoils in EMEs. In spite of RBC theory's considerable success on explaining business cycles in EMEs, it remains under debate whether permanent TFP shocks dominate, or whether financial shocks contribute largely to business cycle movements in EMEs.

This paper contributes to this debate by employing structural vector autoregressions (SVARs) estimated on the data from EMEs to explore the predictions of RBC theory on business cycles in EMEs. I estimate SVARs on the Brazilian and Mexican samples of real GDP, a country-specific world real interest rate, Tobin's Q, and the trade balance-output ratio from last twenty years. The choice of these variables rests on two elements. First, dynamics of business cycles in EMEs are captured reasonably well by these variables, as documented in Mendoza (2010), Neumeyer and Perri (2005), and Uribe and Yue (2006). Second, they aid in identifying TFP and financial shocks. Movements in real GDP, the world real interest rate, Tobin's Q, and the trade balance-output ratio respond to shocks to TFP, the risk premium of the world real interest rate, the price of capital, and Kiyotaki-Moore (KM) collateral constraint on international debt, respectively.

I estimate two SVARs on each sample of Brazil and Mexico. The first SVAR is identified on recursive short-run restrictions. A Blanchard and Quah (1989) style recursive long-run restrictions are imposed to estimate the second SVAR. This identification strategy is motivated by the long-run properties of the data. Unit root tests cannot reject that real GDP, the world real interest rate, and Tobin's Q are integrated of order one but do reject the unit root null in the trade balance-output ratio for both samples. The presence of unit roots in the data suggest that TFP, risk premium, and price of capital shocks have permanent effects on real GDP, the world real interest rate, and Tobin's Q. However, the stationarity of the trade balance-output ratio implies the collateral constraint shock is transitory.

The recursive structure of the short- and long-run restrictions follows the order of real GDP, the world real interest rate, Tobin's Q, and the trade balance-output ratio. I gather an assembly of restrictions from the EME literature and neoclassical investment theory to guide the short- and long-run identifications. For example, ordering real GDP first is consistent with the SOE-RBC models in which TFP shock drives output. Studies on default in EMEs and Tobin's Q offer short- and long-run restrictions for identifying the risk premium and price of capital shocks. Theories on financial frictions in small open economies provide insight on the identification of the collateral constraint shock.

The SVAR estimates reveal distinct views of the business cycles in Brazil and Mexico. Forecast error variance decompositions (FEVDs) computed by the SVARs show that shocks to financial markets have different roles in driving the Brazilian and Mexican business cycles across the short- and long-run identifications. About one-fourth of the movements in Brazilian real GDP are attributed to the collateral constraint shock after the four-year horizon under the short-run restrictions. The price of capital and collateral constraint shocks identified on the short-run restrictions explain about half of the variation in Mexican real GDP at the one- to five-year horizon. The long-run identification uncovers that the price of capital shock explains about one-third to one-fourth of the variation in Brazilian real GDP at the one- to four-quarter horizon. Moreover, this shock drives about one-fourth of the fluctuations in the trade balance throughout the business cycle horizons in Brazil. In contrast, the financial shocks hardly contribute at all to the variation in Mexican real GDP under the long-run restrictions.

The Brazilian and Mexican samples also produce SVAR estimates that are in line with the explanation of business cycles in EMEs from Aguiar and Gopinath (2007). However, this result depends on the identification of SVAR. The short-run restrictions render limited knowledge on the business cycles in Brazil and Mexico. SVARs estimated with these restrictions result in real GDP, the world real interest rate, Tobin's Q, and the trade balance respond mostly to their own shocks. The long-run restrictions yield FEVDs that assess the contribution of permanent TFP shocks to business cycles in Brazil and Mexico. In this case, the permanent TFP shock explains about three-fourth of the variation in Brazilian real GDP after the one year horizon while also being responsible for about half of the fluctuations in the Brazilian trade balance from impact to the five-year horizon. The permanent TFP shock is the dominant shock in the SVAR identified on the long-run restrictions and estimated on the Mexican sample. The results are the permanent TFP shock accounts for more than three-fourth of the movements in Mexican real GDP, about one-third of the variation in Tobin's Q, and nearly half of the fluctuations in the trade balance throughout the five-year horizon. These evidence supports the argument that permanent TFP shocks are the main source of business cycle fluctuations in EMEs.

In summary, this paper finds that business cycles in Brazil and Mexico are dissimilar with respect to the contributions of TFP and financial shocks to aggregate fluctuations. Furthermore, the SVAR evidence about prior theorizing on business cycles in EMEs are sensitive to the identification of the shocks generating the business cycle dynamics. The short-run identification provides too little information to conclude if TFP or financial shocks are the primary driving force of the Brazilian and Mexican business cycles. The SVARs estimated on the long-run restrictions produce FEVDs that indicate permanent TFP shocks dominate business cycle fluctuations in Brazil and Mexico. These results agree with the permanent TFP shock view on business cycles in EMEs.

The next section describes the Brazilian and Mexican samples. Section 3 discusses the short- and long-run SVAR identification schemes. Estimates of the SVARs are presented in section 4. Section 5 concludes.

2. Data and Long-Run Properties

This section describes the data and discusses their long-run properties. I conduct augmented Dickey-Fuller tests to obtain evidence of whether unit roots exist in the Brazilian and Mexican variables.

2.1. Data

The Brazilian and Mexican samples include real GDP, a country-specific world real interest rate, Tobin's Q, and the trade balance-output ratio. The world real interest rate measures the interest rate at which the countries borrow in international bonds market. Tobin's Q is a ratio of the equity price index to the producer price index. Movements in Tobin's Q reflect the responses of domestic financial markets to external disturbances. The trade balance-output ratio embodies the international borrowing and lending activities in Brazil and Mexico.

The data are drawn from International Financial Statistics (IFS), Global Economic Monitor (GEM), Brazilian Institute of Geography and Statistics (IBGE), and Federal Reserve Economic Data (FRED) databases. The sample data are seasonally adjusted, quarterly, real, and measured in local currency units.[2] The Brazilian sample runs from 1999Q1 to 2018Q4. The Mexican sample begins two years earlier in 1997Q1, and also ends with 2018Q4.[3]

[2]See the appendix for details about the sources and construction of the data.

[3]Longer Brazilian and Mexican samples are available. However, the SVARs estimated on the longer samples produce badly behaved impulse response functions (IRFs) and FEVDs due to non-stationary endogenous

Figures 1 and 2 display plots of the Brazilian and Mexican samples, respectively. The log levels of real GDP, the world real interest rate, and Tobin's Q appear non-stationary in both samples. It is difficult to tell whether the trade balance-output ratios are stationary. The first differences of log real GDP, the log world real interest rate, log Tobin's Q, and the trade balance-output ratio seem stationary in both samples. Nonetheless, visual inspections offer limited information on the degree of integration of the data. I gather evidence of unit roots by running augmented Dickey-Fuller tests on the Brazilian and Mexican data.

2.2. Unit Root Tests

Dickey and Pantula (1987) point out the need to start unit root tests at a high degree of differencing because multiple unit roots may exist in a time series. In the absence of evidence of a unit root, unit root test should be conducted on one fewer difference of the data. This process continues until either the unit root null is rejected or the unit root test is applied to the series level of the data. As a result, I start augmented Dickey-Fuller tests on the first differences of the data.

The augmented Dickey-Fuller regression includes an intercept, a linear time trend, and lag differences of the variable. The length of lag differences is chosen according to Ng and Perron (1995). They contend the augmented Dickey-Fuller regression should begin with eight lag differences. If the absolute value of the t-statistic for the eighth lag difference is greater than 1.6, the lag length is set at eight. If not, one lag is deleted and the process is

variables. Discussions about the sample size are included in the appendix.

repeated until the t-statistic for the last lag difference is greater than 1.6 or the lag length reaches zero.

Table 1 reports the results of augmented Dickey-Fuller tests. For the Brazilian sample, the tests reject the null of a unit root in the first differences of log real GDP, the log world real interest rate, log Tobin's Q, and the trade balance-output ratio at the 5% significance level. Next, I apply augmented Dickey-Fuller tests to log real GDP, the log world real interest rate, log Tobin's Q, and the trade balance-output ratio of the Brazilian sample. There is no evidence to reject the null of a unit root in these variables at the 5% significance level. However, the test rejects the null of a unit root in the Brazilian trade balance-output ratio at the 10% significance level.[4]

Similarly, for the Mexican sample, the augmented Dickey-Fuller tests are applied to the first difference levels. Next, I estimate the augmented Dickey-Fuller regression on the levels of the variables. The tests show one unit root in log real GDP, the log world real interest rate, and log Tobin's Q but the trade balance-output ratio is stationary at the 5% significance level.

I conclude from the unit root tests that the first differences of log real GDP, the log world real interest rate, and log Tobin's Q plus the level of the trade balance-output ratio from the Brazilian and Mexican samples are stationary.

[4]The small sample critical value for the Brazilian trade balance-output ratio equals -3.160 at the 10% significance level.

3. SVARs

This section presents reduced-form and structural VARs. Next, the short- and long-run identifications are discussed. Estimation of the SVARs is also reviewed.

3.1. Reduced-Form and Structural VARs

The covariance-stationary vector of endogenous variables is

$$\boldsymbol{y_t} = \left[\Delta lnGDP_t \quad \Delta lnR_t \quad \Delta lnQ_t \quad \frac{TB_t}{GDP_t}\right]',$$

where $\Delta lnGDP_t$ is real GDP growth, ΔlnR_t is the first difference of the log world real interest rate, ΔlnQ_t is the first difference of log Tobin's Q, and $\frac{TB_t}{GDP_t}$ is the trade balance-output ratio. Consider a reduced-form VAR to be estimated on $\boldsymbol{y_t}$,

$$\boldsymbol{y_t} = v + C(L)\boldsymbol{y_{t-1}} + \boldsymbol{u_t},\ \boldsymbol{u_t} \sim N(0, \Sigma_u), \tag{1}$$

where v is a 4×1 vector of intercepts, L is the lag operator defined such that $L\boldsymbol{y_t} = \boldsymbol{y_{t-1}}$, $C(L) = \sum_{i=1}^{p} C_i L^{i-1}$ are the 4×4 slope coefficient matrices associated with lags of the reduced-form VAR, p is the lag length, and Σ_u is the covariance matrix of the reduced-form errors, $\boldsymbol{u_t}$.

Build on the reduced-form VAR in equation (1) to construct a SVAR as

$$A_0 \boldsymbol{y_t} = A_0 v + A_0 C(L) \boldsymbol{y_{t-1}} + \boldsymbol{\epsilon_t},\ \boldsymbol{\epsilon_t} \sim N(0, I), \tag{2}$$

by mapping the reduced-form errors into the structural shocks with

$$\boldsymbol{u_t} = A_0^{-1} \boldsymbol{\epsilon_t},$$

where A_0 is the 4×4 nonsingular short-run structural impact matrix, and $\boldsymbol{\epsilon_t} = [\epsilon_{y,t}, \epsilon_{r,t}, \epsilon_{p,t}, \epsilon_{d,t}]'$ is the vector of orthogonalized unit variance structural shocks.

The short- and long-run identification of structural shocks rests on imposing restrictions on the short-run structural impact matrix, A_0, and the long-run structural impact matrix, $\Gamma(1)$, respectively. The long-run structural impact matrix, $\Gamma(1)$, is also mapped from the short-run structural impact matrix as $\Gamma(1) = [I_{4\times4} - C(1)]^{-1} A_0^{-1}$.

3.2. Short-Run Identification

Recursive short-run zero restrictions are imposed on the short-run structural impact matrix, A_0, to identify TFP, risk premium, price of capital, and collateral constraint shocks by the ordering of $\boldsymbol{y_t}$ shown above.

This ordering is consistent with RBC theory as it is applied to EMEs. Real GDP growth is ordered first in $\boldsymbol{y_t}$ because SOE-RBC models often assume only a TFP shock drives output at impact.

The EME literature posits that the risk premium component of the world real interest rate hinges upon the probability of default.[5] The argument is that an EME is likely to default when output is low and the EME has a large net foreign debt position.[6] The TFP shock, which as already noted drives output, influences the probability of default. As a result, the world real interest rate responds to the TFP shock at impact. The literature is silent on the role of Tobin's Q in EME defaults. I assume the price of capital shock does not affect the world real interest rate at impact because there is no compelling evidence to suggest otherwise. The collateral constraint shock alters the value of collateral that foreign investors demand to hold in exchange for loans, and collateral is essentially comprised of capital.[7] Therefore the collateral constraint shock shares the same assumption on the price of capital shock in that it has no contemporaneous effect on the world real interest rate. These arguments explain placing the first difference of the log world real interest rate second in $\boldsymbol{y_t}$.

The first difference of log Tobin's Q is placed third in $\boldsymbol{y_t}$. Hayashi (1982) theorizes that the market value of capital, which is the numerator of Tobin's Q, is the present discounted value of future profits generated by an additional unit of investment. Computing that value involves the stochastic discount rate. Assuming that the stochastic discount rate and the

[5]For reference, see Akinci (2013), Neumeyer and Perri (2005), and Uribe and Yue (2006).

[6]See, among others, Aguiar and Gopinath (2006), Arellano (2008), and Eaton and Gersovitz (1981).

[7]Mendoza (2010) and Schmitt-Grohé and Uribe (2016) are examples of studying the KM collateral constraint in a SOE-RBC model.

world real interest rate are related gives the latter a channel for the risk premium shock to affect Tobin's Q at impact. Since the value of an extra unit of investment responds to TFP shocks, it also moves Tobin's Q at impact. The collateral constraint shock does not influence Tobin's Q at impact for the same reason that disturbances to the value of collateral take one quarter to affect EMEs.

The trade balance-output ratio is ordered last in $\boldsymbol{y_t}$. The TFP shock affects this ratio at impact, as real GDP is the denominator of that ratio. Disturbances to the value of collateral and the world real interest rate elicit changes to the size of foreign loans (import) and interest payments to foreign investors (export), respectively. Therefore the collateral constraint and risk premium shocks alter the trade balance-output ratio contemporaneously. The trade balance-output ratio also responds to the price of capital shock at impact. The reason is EMEs often borrow internationally to fund investment. These investment decisions are reflected in the movements of trade balance.

3.3. Long-Run Identification

In terms of the long-run identification, I impose recursive zero restrictions on the long-run structural impact matrix, $\Gamma(1)$, and use the same ordering of $\boldsymbol{y_t}$ discussed in the previous section. Note that the TFP, risk premium, and price of capital shocks identified on the long-run restrictions are permanent shocks, while the collateral constraint shock is a transitory shock.

Discussion on the long-run identification centers around the six long-run zero restrictions. The long-run neutrality of real GDP yields three long-run zero restrictions because only the TFP shock has a permanent effect on real GDP. According to the assumption that the stochastic discount rate and the world real interest rate are connected, it is the world real interest rate that moves Tobin's Q, not the converse. This gives one long-run zero restriction, meaning that the price of capital shock does not drive the world real interest rate in the long run. The other two long-run zero restrictions are the collateral constraint shock does not affect the world real interest rate nor Tobin's Q in the long run. The collateral constraint shock can only temporarily affect the risk premium component of the world real interest rate at most, due to its transitory effect on the trade balance-output ratio. Therefore it is reasonable to assume that the collateral constraint shock does not drive the world real interest rate in the long run. Moreover, the collateral constraint shock has no influence over the stochastic discount rate that there is zero channel for it to generate any impact on Tobin's Q during long run.

3.4. Estimation of the SVARs

Estimation of the SVAR under the short-run restrictions relies on ordinary least squares (OLS) and specification of the short-run structural impact matrix, A_0. The slope coefficient matrices, $C(1)$, and the covariance matrix, Σ_u, are estimated using OLS. Since the short-run restrictions are recursive, A_0^{-1} is a lower triangular matrix computed by taking Cholesky decomposition of the covariance matrix, $A_0^{-1} = \Sigma_u^{0.5}$.

The long-run identification slightly complicates the SVAR estimation. Construct the structural infinite-order vector moving average (VMA) representation of the SVAR from equation (2) as

$$\boldsymbol{y_t} = \mu + \sum_{j=0}^{\infty} \Gamma_j \boldsymbol{\epsilon_{t-j}}, \tag{3}$$

where Γ_j are the 4×4 structural moving average coefficient matrices that follow

$$\Gamma_0 = A_0^{-1}, \;\; \boldsymbol{u_t} = \Gamma_0 \boldsymbol{\epsilon_t}, \;\; \Gamma(L) = \sum_{j=0}^{\infty} \Gamma_j L^j, \;\; \Gamma(L)\boldsymbol{\epsilon_t} = [I_{4\times4} - C(L)]^{-1}\boldsymbol{u_t}.$$

I apply the Blanchard and Quah (1989) decomposition to specify the long-run structural impact matrix as a lower triangular matrix. The goal is to compute the structural matrix, Γ_0, given the lower triangular long-run structural impact matrix, $\tilde{\Gamma}(1)$. This process starts with multiplying $\Gamma(1)\boldsymbol{\epsilon_t}$ by $[\Gamma(1)\boldsymbol{\epsilon_t}]'$ to obtain

$$\Gamma(1)\boldsymbol{\epsilon_t}\boldsymbol{\epsilon_t}'\Gamma(1)' = [I_{4\times4} - C(1)]^{-1}\boldsymbol{u_t}\boldsymbol{u_t}'\Big([I_{4\times4} - C(1)]^{-1}\Big)'.$$

Since $\boldsymbol{\epsilon_t}\boldsymbol{\epsilon_t}' = I_{4\times4}$ and $\boldsymbol{u_t}\boldsymbol{u_t}' = \Sigma_u$, rewrite the above equation as

$$\Gamma(1)\Gamma(1)' = [I_{4\times4} - C(1)]^{-1}\Sigma_u\Big([I_{4\times4} - C(1)]^{-1}\Big)'.$$

The long-run structural impact matrix, $\tilde{\Gamma}(1)$, is found by taking the Cholesky decomposition of $\Gamma(1)\Gamma(1)'$, $\tilde{\Gamma}(1) = \Big[\Gamma(1)\Gamma(1)'\Big]^{0.5}$. Because of $\Sigma_u = \Gamma_0\Gamma_0'$, the Cholesky decomposition of

$\Gamma(1)\Gamma(1)'$ also yields

$$\Big[\Gamma(1)\Gamma(1)'\Big]^{0.5} = \Big\{[I_{4\times4} - C(1)]^{-1}\Gamma_0\Gamma_0'\Big([I_{4\times4} - C(1)]^{-1}\Big)'\Big\}^{0.5} \Rightarrow \tilde{\Gamma}(1) = [I_{4\times4} - C(1)]^{-1}\Gamma_0.$$

Finally, the structural matrix, Γ_0, is recovered from the long-run structural impact matrix, $\tilde{\Gamma}(1)$, by computing $\Gamma_0 = [I_{4\times4} - C(1)]\tilde{\Gamma}(1)$.

The impulse response functions (IRFs) and FEVDs are computed similarly under the short- and long-run restrictions. The estimates of the short-run structural impact matrix, $\hat{A}_0$, and the reduced-form slope coefficient matrices, $\hat{C}(1)$, pin down the IRFs and FEVDs identified on the short-run restrictions. Under the long-run restrictions, estimates of the structural matrix, $\hat{\Gamma}_0$, and $\hat{C}(1)$ are enough to calculate the IRFs and FEVDs.

4. Results

This section discusses the IRFs and FEVDs computed by the SVARs. I estimate two SVARs grounded in short- and long-run restrictions for each sample. The SVARs are estimated on the first differences of log real GDP, the log world real interest rate, and log Tobin's Q plus the trade balance-output ratio from 1999Q1 to 2018Q4 for Brazil and 1997Q1 to 2018Q4 for Mexico. The lag length of the SVARs equals two, $p = 2$, for both samples.[8]

The IRFs display the dynamic responses of real GDP, the world real interest rate, Tobin's

[8] I follow the common practice in the EME empirical literature of estimating SVARs with two lags. See, for example, Akinci (2013), Bruno and Shin (2015), and Kim, Lim, and Sohn (2020).

Q, and the trade balance to shocks to TFP, risk premium, price of capital, and collateral constraint.[9] The FEVDs address the importance of shocks for explaining the variations in these four variables. Confidence bands of the IRFs and FEVDs are calculated using the bootstrap sup-t confidence bands proposed by Olea and Plagborg-Møller (2019).

4.1. IRFs

Figure 3 depicts the IRFs of real GDP estimated on the Brazilian sample from impact to a twelve-quarter horizon. Real GDP increases permanently in response to a positive TFP shock under the short- and long-run restrictions. The IRFs of real GDP with respect to the risk premium, price of capital, and collateral constraint shocks identified on both restrictions display considerable uncertainty because the confidence bands are wide and cover zero at most horizons.

Figure 4 displays a selection of IRFs of the world real interest rate, Tobin's Q, and the trade balance estimated on the Brazilian sample. Seven out of twelve IRFs in figure 4 have broad confidence bands. The remaining five IRFs exhibit narrower confidence bands but are identified on own shocks. As a result, other than the importance of own shocks, there is little information to assess RBC theory on the Brazilian business cycle from the IRFs estimated under the short- or long-run restrictions.

[9] The appendix details the transformation from real GDP growth, the first difference of the log world real interest rate, the first difference of log Tobin's Q, and the trade balance-output ratio to real GDP, the world interest rate, Tobin's Q, and the trade balance.

The Mexican sample produces several more economically interesting IRFs compared with the Brazilian sample. Figure 5 shows that the price of capital and collateral constraint shocks identified on the short-run restrictions produce positive hump-shaped responses in Mexican real GDP. The long-run restrictions, by contrast, generate negative IRFs of real GDP with respect to the price of capital and collateral constraint shocks with confidence bands mostly covering the zero axis horizon from impact to twelve quarters.

Figure 6 presents the selected IRFs of the world real interest rate, Tobin's Q, and the trade balance estimated on the Mexican sample.[10] The IRF of Tobin's Q with respect to a TFP shock under the long-run restrictions matches a prediction from Schmitt-Grohé and Uribe (2016). Their SOE-RBC model, which is built with an occasionally binding KM collateral constraint, predicts that Tobin's Q rises in response to a positive TFP shock in an EME.[11] Other notable findings from figure 6 are the IRFs of the world real interest rate and trade balance. In response to a TFP shock, the world real interest rate and trade balance rises under both identifications. This shows the Mexican world real interest rate and trade balance are procyclical, which questions the stylized fact that they are countercyclical in EMEs from the literature.

In sum, the IRFs offer only incomplete evidence to evaluate competing business cycle theories for Brazil and Mexico. The evidence for both economies is limited by substantial uncertainty surrounding many of the IRFs. Moreover, the IRFs of real GDP with respect

[10]The remaining IRFs are available in the appendix.

[11]In their SOE-RBC model, a positive TFP shock relaxes the KM collateral constraint that enables a small open economy to borrow more foreign debt. As a result, the demand for capital increases its price.

to the risk premium and collateral constraint shocks, and the IRFs of the world real interest rate and trade balance with respect to TFP shocks are inconsistent evidence on which to assess which RBC theory might best describe the Mexican economy.

4.2. FEVDs

The FEVDs present more economically interesting results than the IRFs for learning about business cycles in Brazil and Mexico.[12] Table 2 contains the FEVDs estimated on the Brazilian sample from impact to a five-year horizon under the short-run restrictions. These FEVDs show that fluctuations in real GDP, the world real interest rate, Tobin's Q, and the trade balance are attributed most often to their own shocks throughout the five-year horizon. The exceptions are that the collateral constraint shock explains between 1% and 74%, with a median estimate of about a quarter of the variation in real GDP, and also explains between 2% and 75%, with a median estimate of about one-third of the variation in Tobin's Q at the four- to five-year horizon. There are substantial uncertainties in these FEVDs, as the width of the confidence bands surrounding the point estimates of FEVDs often exceed 40%.

The FEVDs indicate the TFP shock identified using the long-run restrictions is the main source of business cycle fluctuations in Brazil. Table 3 displays these FEVDs. The TFP shock explains 60% to 87% of the variation in real GDP at the one- to five-year horizon. In addition, from 60% to 44% of the movements in the trade balance are generated by the

[12] I interpret point estimates of FEVDs greater than 20% as economically important and confidence bands surrounding the median estimate of a FEVD greater than 40% interval as large uncertainty.

TFP shock from impact to the five-year horizon. The long-run identification also reveals the price of capital shock is important to the Brazilian business cycle. The price of capital shock drives 33% to 23% of the fluctuations in real GDP at the one- to four-quarter horizon and about 25% of the fluctuations in the trade balance throughout the five-year horizon. The width of the confidence bands covering the median estimates of TFP and price of capital shocks for explaining the variation in real GDP and the trade balance are greater than 40% across the business cycle horizons.

The FEVDs estimated on the Mexican sample are markedly different. As reported in table 4, movements in the world real interest rate, Tobin's Q, and the trade balance often depend on own shocks under the short-run restrictions for Mexico. The only anomaly is almost half of the variation in Mexican real GDP is explained by the price of capital and collateral constraint shocks at the one- to five-year horizon. The associated confidence bands are relatively narrow from impact to the five-year horizon. This suggests that the Mexican price of capital and collateral constraint shocks matter for explaining the variation in real GDP under the short-run restrictions.

Table 5 presents the FEVDs estimated on the Mexican sample under the long-run restrictions. These FEVDs show the TFP shock dominates the Mexican business cycle. This shock is responsible for producing about 75% to nearly 100% of the variation in real GDP, anywhere between 34% to 24% of the movements in Tobin's Q, and more than one-third of the fluctuations in the trade balance throughout the five-year horizon. The tight confidence bands surrounding the median estimates of the FEVD of real GDP with respect to the TFP shock is evidence it makes economically important contributions to the aggregate fluctuations in Mexico.

In summary, business cycles in Brazil and Mexico have distinct features as the contributions of TFP and financial shocks to business cycle fluctuations differ in both economies across the identification schemes. Moreover, TFP shock remain dominant to aggregate fluctuations in both countries conditional on the long-run identification. This finding agrees with the permanent TFP shock explanation of business cycles in EMEs from Aguiar and Gopinath (2007) as the TFP shock identified on the long-run restrictions is a permanent shock. However, this evidence is sensitive to the SVAR identification. The FEVDs under the short-run restrictions yield business cycles in both countries in which the TFP shock has a limited role for generating fluctuations in asset prices and returns and the converse is true for the risk premium, price of capital, and collateral constraint shocks.

5. Conclusion

This paper presents estimates of SVARs using the Brazilian and Mexican samples of real GDP, the world real interest rate, Tobin's Q, and the trade balance-output ratio in recent twenty years. Short- and long-run restrictions are applied to identify shocks to TFP, risk premium, price of capital, and collateral constraint for the SVARs. I report IRFs and FEVDs computed by the SVARs to learn whether the Brazilian and Mexican business cycles are best explained by the permanent TFP shock, or whether financial shocks are the main source of aggregate fluctuations in both countries.

The IRFs computed under the short- and long-run restrictions produce few economically interesting results about the business cycle dynamics in Brazil and Mexico. This is because substantial uncertainties pervade nearly half of the Brazilian and Mexican IRFs. For the few IRFs that display statistical significant movements, they often conflict with RBC theory as it relates to EMEs.

The FEVDs offer useful information about the sources of business cycle movements in Brazil and Mexico. I draw two conclusions from the FEVDs. First, the Brazilian and Mexican business cycles have more differences than similarities. For example, the TFP shock is important for driving fluctuations in the Mexican Tobin's Q, but that is not the case for the Brazil under the long-run restrictions. The price of capital shock identified on the short-run restrictions contributes more to the variation in Mexican than Brazilian real GDP. But when the price of capital shock is pinned down by the long-run restrictions, it accounts for about a quarter of the variations in real GDP and trade balance in Brazil, but is negligible to the business cycle in Mexico.

Second, the Brazilian and Mexican FEVDs under the long-run restrictions show that permanent TFP shocks dominate business cycles in EMEs. The caveat is SVAR estimates are sensitive to the identification of the structural shocks. The FEVDs conditional on the short-run restrictions do not yield sufficient information to decide whether business cycles in

Brazil and Mexico are best explained by permanent TFP or financial shocks. The long-run identification serves to produce FEVDs from the Brazilian and Mexican samples that agree with the permanent TFP shock explanation of business cycles in EMEs.

The findings of this paper should server as a reminder that there is rich heterogeneity in business cycles across EMEs. Future research should aim to build dynamic stochastic general equilibrium models with rich structures that can reproduce this heterogeneity. More importantly, these models should give a central place to permanent TFP shock and also include financial shocks for studying business cycles in EMEs.

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Table 1: Augmented Dickey-Fuller Tests for Unit Roots in the Brazilian and Mexican Samples

	Brazilian Sample	1999Q1 to 2018Q4	**Mexican Sample**	1997Q1 to 2018Q4
Variable	Length of Lag Differences	t-statistic	Length of Lag Differences	t-statistic
ΔlnY_t	1	-5.509 (-3.468)	1	-6.546 (-3.462)
ΔlnR_t	1	-7.841 (-3.468)	1	-7.441 (-3.462)
ΔlnQ_t	4	-4.671 (-3.468)	6	-4.876 (-3.462)
$\Delta\frac{TB_t}{Y_t}$	2	-4.975 (-3.468)	1	-7.699 (-3.462)
lnY_t	1	-0.487 (-3.467)	2	-2.939 (-3.461)
lnR_t	3	-0.999 (-3.468)	3	-1.026 (-3.462)
lnQ_t	5	-1.721 (-3.468)	7	-0.382 (-3.462)
$\frac{TB_t}{Y_t}$	8	-3.263 (-3.467)	6	-4.087 (-3.461)

Notes: Real GDP, the world real interest rate, Tobin's Q, and the trade balance-output ratio are Y_t, R_t, Q_t, and $\frac{TB_t}{Y_t}$, respectively. Except for the trade balance-output ratio, augmented Dickey-Fuller tests are run on first differences of the log levels and log levels of the data. For the trade balance-output ratio, the augmented Dickey-Fuller tests are run on the series level and the first difference of it. The first difference of the trade balance-output ratio is computed as 100*($\frac{TB_t}{Y_t}$-$\frac{TB_{t-1}}{Y_{t-1}}$)/$\frac{TB_{t-1}}{Y_{t-1}}$. The numbers in parentheses are small sample critical values at the 5% significance level.

Table 2: FEVDs Estimated on the Brazilian Sample from 1999Q1 to 2018Q4 Under Short-Run Restrictions

Variable	Shocks \ Horizons	Q1	Q2	Q4	Q8	Q16	Q20
	TFP	0.95 (0.87, 0.99)	0.90 (0.77, 0.97)	0.86 (0.66, 0.95)	0.79 (0.50, 0.93)	0.67 (0.26, 0.91)	0.64 (0.21, 0.91)
Y_t	Risk Premium	0.02 (0.00, 0.09)	0.05 (0.01, 0.15)	0.05 (0.01, 0.18)	0.04 (0.01, 0.17)	0.02 (0.01, 0.16)	0.02 (0.01, 0.15)
	Price of Capital	0.02 (0.00, 0.06)	0.04 (0.01, 0.13)	0.07 (0.01, 0.21)	0.07 (0.01, 0.23)	0.07 (0.01, 0.23)	0.07 (0.01, 0.23)
	Collateral Constraint	0.01 (0.00, 0.03)	0.01 (0.00, 0.06)	0.02 (0.00, 0.15)	0.10 (0.01, 0.39)	0.24 (0.01, 0.67)	0.27 (0.01, 0.74)
	TFP	0.01 (0.00, 0.07)	0.03 (0.00, 0.14)	0.02 (0.00, 0.14)	0.01 (0.00, 0.15)	0.01 (0.00, 0.17)	0.01 (0.00, 0.18)
R_t	Risk Premium	0.87 (0.76, 0.94)	0.83 (0.67, 0.93)	0.83 (0.63, 0.93)	0.80 (0.50, 0.93)	0.73 (0.29, 0.93)	0.72 (0.24, 0.93)
	Price of Capital	0.11 (0.05, 0.20)	0.13 (0.05, 0.26)	0.14 (0.04, 0.29)	0.14 (0.03, 0.30)	0.13 (0.02, 0.29)	0.12 (0.02, 0.29)
	Collateral Constraint	0.01 (0.00, 0.04)	0.01 (0.00, 0.06)	0.01 (0.00, 0.13)	0.05 (0.00, 0.32)	0.13 (0.00, 0.58)	0.15 (0.00, 0.64)
	TFP	0.02 (0.00, 0.09)	0.03 (0.00, 0.10)	0.08 (0.01, 0.25)	0.12 (0.01, 0.36)	0.13 (0.01, 0.41)	0.13 (0.01, 0.42)
Q_t	Risk Premium	0.05 (0.03, 0.13)	0.04 (0.02, 0.12)	0.03 (0.02, 0.12)	0.03 (0.01, 0.16)	0.04 (0.00, 0.20)	0.04 (0.00, 0.21)
	Price of Capital	0.92 (0.81, 0.96)	0.92 (0.79, 0.95)	0.83 (0.60, 0.93)	0.67 (0.36, 0.89)	0.49 (0.15, 0.83)	0.45 (0.12, 0.82)
	Collateral Constraint	0.01 (0.00, 0.05)	0.01 (0.00, 0.06)	0.06 (0.01, 0.20)	0.18 (0.01, 0.46)	0.34 (0.02, 0.70)	0.38 (0.03, 0.75)
	TFP	0.01 (0.00, 0.03)	0.01 (0.00, 0.06)	0.01 (0.00, 0.12)	0.02 (0.00, 0.19)	0.03 (0.00, 0.25)	0.03 (0.00, 0.26)
TB_t	Risk Premium	0.03 (0.00, 0.09)	0.04 (0.00, 0.13)	0.04 (0.00, 0.17)	0.05 (0.00, 0.21)	0.05 (0.00, 0.24)	0.05 (0.00, 0.25)
	Price of Capital	0.01 (0.00, 0.03)	0.01 (0.00, 0.04)	0.01 (0.00, 0.06)	0.01 (0.00, 0.08)	0.01 (0.00, 0.09)	0.01 (0.00, 0.10)
	Collateral Constraint	0.95 (0.90, 0.99)	0.94 (0.85, 0.99)	0.94 (0.77, 0.99)	0.92 (0.67, 0.99)	0.91 (0.61, 0.99)	0.91 (0.60, 0.99)

Notes: The table summarizes the contributions of TFP, risk premium, price of capital, and collateral constraint shocks to the fluctuations of real GDP, Y_t, the world real interest rate, R_t, Tobin's Q, Q_t, and the trade balance, TB_t. The parentheses contain 90% bootstrap sup-t confidence bands.

Table 3: FEVDs Estimated on the Brazilian Sample from 1999Q1 to 2018Q4 Under Long-Run Restrictions

Variable	Shocks \ Horizons	Q1	Q2	Q4	Q8	Q16	Q20
Y_t	TFP	0.48 (0.01, 0.92)	0.52 (0.01, 0.94)	0.60 (0.03, 0.96)	0.72 (0.11, 0.98)	0.85 (0.35, 0.99)	0.87 (0.42, 0.99)
	Risk Premium	0.09 (0.00, 0.53)	0.05 (0.00, 0.47)	0.02 (0.00, 0.43)	0.02 (0.00, 0.37)	0.01 (0.00, 0.26)	0.01 (0.00, 0.23)
	Price of Capital	0.33 (0.02, 0.74)	0.29 (0.01, 0.70)	0.23 (0.01, 0.65)	0.15 (0.01, 0.55)	0.09 (0.00, 0.37)	0.07 (0.00, 0.32)
	Collateral Constraint	0.10 (0.00, 0.46)	0.14 (0.01, 0.50)	0.15 (0.01, 0.49)	0.11 (0.01, 0.36)	0.05 (0.01, 0.20)	0.05 (0.01, 0.16)
R_t	TFP	0.03 (0.00, 0.26)	0.04 (0.00, 0.33)	0.05 (0.00, 0.35)	0.08 (0.01, 0.41)	0.12 (0.01, 0.56)	0.13 (0.01, 0.60)
	Risk Premium	0.71 (0.12, 0.92)	0.68 (0.10, 0.92)	0.73 (0.14, 0.93)	0.77 (0.21, 0.95)	0.79 (0.24, 0.97)	0.79 (0.23, 0.97)
	Price of Capital	0.16 (0.01, 0.61)	0.16 (0.01, 0.59)	0.13 (0.01, 0.55)	0.09 (0.01, 0.46)	0.05 (0.00, 0.31)	0.05 (0.00, 0.26)
	Collateral Constraint	0.10 (0.02, 0.41)	0.12 (0.02, 0.43)	0.09 (0.01, 0.39)	0.06 (0.01, 0.29)	0.04 (0.00, 0.16)	0.03 (0.00, 0.13)
Q_t	TFP	0.07 (0.00, 0.33)	0.06 (0.00, 0.29)	0.05 (0.01, 0.29)	0.08 (0.01, 0.49)	0.13 (0.01, 0.73)	0.14 (0.01, 0.78)
	Risk Premium	0.13 (0.01, 0.41)	0.14 (0.01, 0.39)	0.13 (0.02, 0.37)	0.13 (0.01, 0.42)	0.12 (0.01, 0.50)	0.12 (0.01, 0.52)
	Price of Capital	0.06 (0.00, 0.43)	0.15 (0.01, 0.52)	0.34 (0.05, 0.67)	0.51 (0.06, 0.79)	0.62 (0.05, 0.88)	0.64 (0.05, 0.90)
	Collateral Constraint	0.74 (0.26, 0.94)	0.65 (0.23, 0.89)	0.48 (0.15, 0.76)	0.28 (0.09, 0.53)	0.13 (0.04, 0.26)	0.10 (0.04, 0.21)
TB_t	TFP	0.60 (0.01, 0.97)	0.56 (0.01, 0.97)	0.51 (0.01, 0.98)	0.47 (0.01, 0.98)	0.45 (0.00, 0.98)	0.44 (0.00, 0.98)
	Risk Premium	0.01 (0.00, 0.43)	0.01 (0.00, 0.43)	0.01 (0.00, 0.45)	0.01 (0.00, 0.47)	0.01 (0.00, 0.48)	0.01 (0.00, 0.48)
	Price of Capital	0.21 (0.00, 0.67)	0.23 (0.01, 0.68)	0.26 (0.01, 0.69)	0.28 (0.01, 0.70)	0.29 (0.01, 0.71)	0.29 (0.01, 0.71)
	Collateral Constraint	0.18 (0.00, 0.54)	0.20 (0.00, 0.55)	0.22 (0.00, 0.58)	0.24 (0.01, 0.60)	0.25 (0.01, 0.62)	0.26 (0.01, 0.62)

Notes: The table summarizes the contributions of TFP, risk premium, price of capital, and collateral constraint shocks to the fluctuations of real GDP, Y_t, the world real interest rate, R_t, Tobin's Q, Q_t, and the trade balance, TB_t. The parentheses contain 90% bootstrap sup-t confidence bands.

Table 4: FEVDs Estimated on the Mexican Sample from 1997Q1 to 2018Q4 Under Short-Run Restrictions

Variable	Horizons / Shocks	Q1	Q2	Q4	Q8	Q16	Q20
Y_t	TFP	0.87 (0.78, 0.93)	0.71 (0.57, 0.83)	0.54 (0.37, 0.74)	0.51 (0.29, 0.73)	0.49 (0.25, 0.73)	0.48 (0.25, 0.73)
	Risk Premium	0.01 (0.00, 0.03)	0.01 (0.00, 0.04)	0.01 (0.00, 0.09)	0.02 (0.00, 0.14)	0.02 (0.00, 0.16)	0.02 (0.00, 0.16)
	Price of Capital	0.05 (0.01, 0.11)	0.12 (0.03, 0.24)	0.20 (0.05, 0.36)	0.21 (0.05, 0.41)	0.22 (0.05, 0.44)	0.23 (0.05, 0.44)
	Collateral Constraint	0.07 (0.03, 0.15)	0.16 (0.07, 0.29)	0.25 (0.09, 0.41)	0.26 (0.08, 0.46)	0.27 (0.08, 0.48)	0.27 (0.08, 0.48)
R_t	TFP	0.02 (0.00, 0.07)	0.05 (0.00, 0.16)	0.09 (0.01, 0.26)	0.11 (0.01, 0.28)	0.12 (0.01, 0.31)	0.12 (0.01, 0.31)
	Risk Premium	0.89 (0.77, 0.96)	0.83 (0.66, 0.93)	0.80 (0.58, 0.92)	0.81 (0.57, 0.93)	0.82 (0.55, 0.94)	0.82 (0.55, 0.94)
	Price of Capital	0.08 (0.01, 0.18)	0.09 (0.01, 0.23)	0.08 (0.01, 0.25)	0.06 (0.01, 0.25)	0.05 (0.01, 0.25)	0.05 (0.00, 0.25)
	Collateral Constraint	0.01 (0.00, 0.06)	0.03 (0.00, 0.12)	0.03 (0.00, 0.13)	0.02 (0.00, 0.13)	0.01 (0.00, 0.14)	0.01 (0.00, 0.14)
Q_t	TFP	0.01 (0.00, 0.03)	0.01 (0.00, 0.07)	0.01 (0.00, 0.13)	0.01 (0.00, 0.14)	0.01 (0.00, 0.15)	0.01 (0.00, 0.15)
	Risk Premium	0.02 (0.00, 0.07)	0.04 (0.00, 0.13)	0.06 (0.00, 0.20)	0.07 (0.00, 0.22)	0.07 (0.00, 0.24)	0.07 (0.00, 0.24)
	Price of Capital	0.94 (0.85, 0.98)	0.91 (0.77, 0.97)	0.89 (0.71, 0.97)	0.90 (0.69, 0.97)	0.90 (0.66, 0.97)	0.90 (0.66, 0.97)
	Collateral Constraint	0.03 (0.00, 0.10)	0.04 (0.00, 0.14)	0.04 (0.01, 0.13)	0.02 (0.00, 0.13)	0.02 (0.00, 0.14)	0.02 (0.00, 0.14)
TB_t	TFP	0.01 (0.00, 0.03)	0.01 (0.00, 0.05)	0.01 (0.00, 0.07)	0.01 (0.00, 0.09)	0.01 (0.00, 0.10)	0.01 (0.00, 0.11)
	Risk Premium	0.01 (0.00, 0.04)	0.01 (0.00, 0.05)	0.01 (0.00, 0.11)	0.02 (0.00, 0.15)	0.02 (0.00, 0.17)	0.02 (0.00, 0.17)
	Price of Capital	0.02 (0.00, 0.08)	0.05 (0.00, 0.16)	0.07 (0.00, 0.23)	0.08 (0.00, 0.27)	0.08 (0.00, 0.28)	0.08 (0.00, 0.29)
	Collateral Constraint	0.96 (0.90, 0.99)	0.93 (0.81, 0.98)	0.91 (0.72, 0.98)	0.89 (0.65, 0.98)	0.89 (0.62, 0.98)	0.89 (0.61, 0.98)

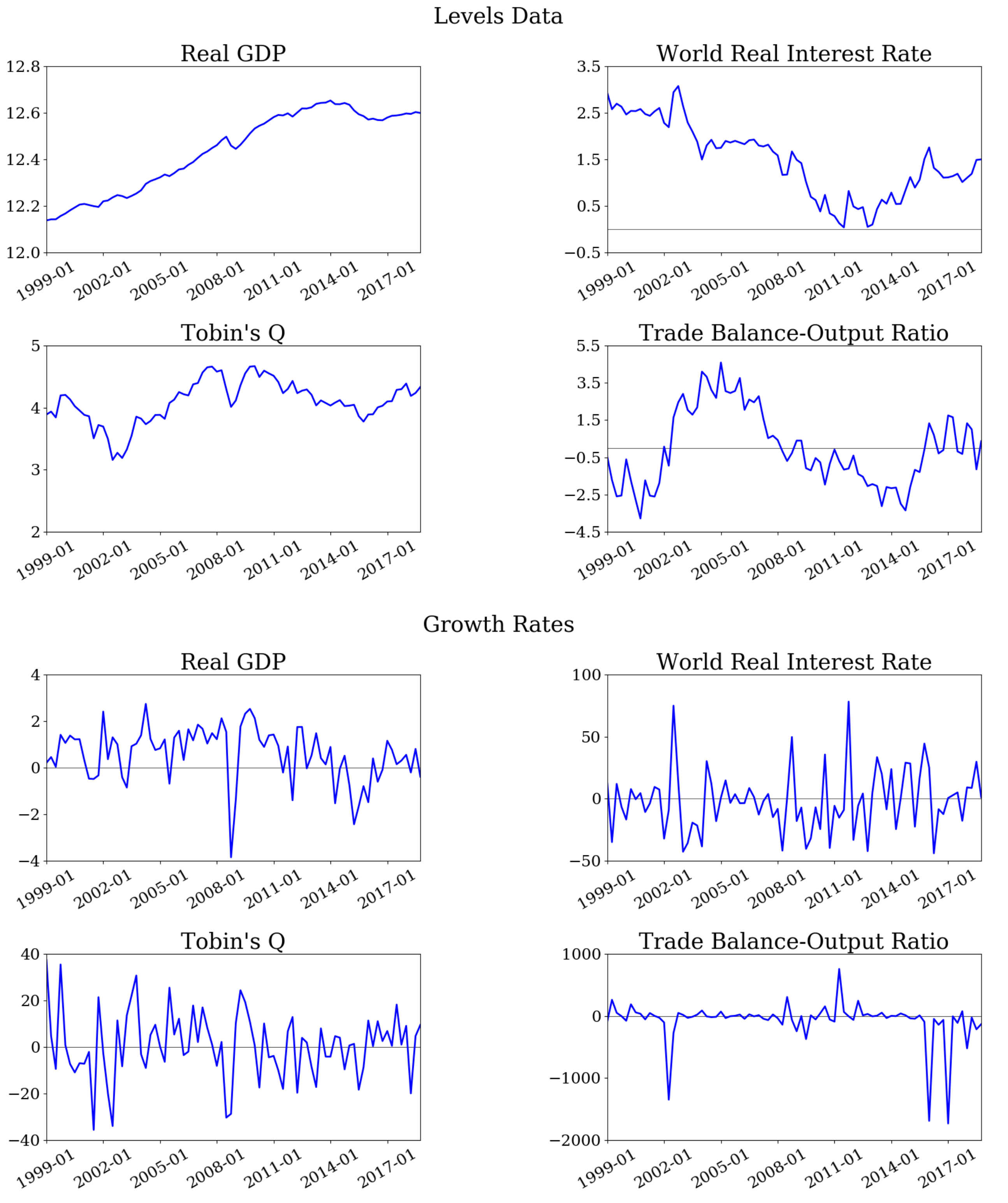
Notes: The table summarizes the contributions of TFP, risk premium, price of capital, and collateral constraint shocks to the fluctuations of real GDP, Y_t, the world real interest rate, R_t, Tobin's Q, Q_t, and the trade balance, TB_t. The parentheses contain 90% bootstrap sup-t confidence bands.

Table 5: FEVDs Estimated on the Mexican Sample from 1997Q1 to 2018Q4 Under Long-Run Restrictions

Variable	Shocks \ Horizons	Q1	Q2	Q4	Q8	Q16	Q20
Y_t	TFP	0.73 (0.48, 0.87)	0.85 (0.67, 0.93)	0.92 (0.83, 0.96)	0.96 (0.90, 0.98)	0.97 (0.95, 0.99)	0.97 (0.95, 0.99)
	Risk Premium	0.01 (0.00, 0.08)	0.01 (0.00, 0.07)	0.01 (0.00, 0.04)	0.01 (0.00, 0.02)	0.01 (0.00, 0.01)	0.01 (0.00, 0.01)
	Price of Capital	0.14 (0.03, 0.32)	0.07 (0.02, 0.19)	0.04 (0.01, 0.10)	0.02 (0.00, 0.06)	0.01 (0.00, 0.03)	0.01 (0.00, 0.03)
	Collateral Constraint	0.12 (0.03, 0.29)	0.07 (0.02, 0.17)	0.03 (0.01, 0.09)	0.01 (0.01, 0.05)	0.01 (0.00, 0.03)	0.01 (0.00, 0.02)
R_t	TFP	0.01 (0.00, 0.14)	0.01 (0.00, 0.15)	0.03 (0.01, 0.24)	0.04 (0.00, 0.31)	0.05 (0.00, 0.35)	0.05 (0.00, 0.35)
	Risk Premium	0.93 (0.73, 0.96)	0.93 (0.72, 0.96)	0.92 (0.65, 0.96)	0.92 (0.62, 0.97)	0.92 (0.59, 0.98)	0.92 (0.59, 0.98)
	Price of Capital	0.03 (0.00, 0.14)	0.04 (0.01, 0.19)	0.04 (0.01, 0.22)	0.03 (0.01, 0.22)	0.02 (0.00, 0.22)	0.02 (0.00, 0.23)
	Collateral Constraint	0.03 (0.00, 0.13)	0.02 (0.00, 0.09)	0.01 (0.00, 0.06)	0.01 (0.00, 0.04)	0.01 (0.00, 0.02)	0.01 (0.00, 0.02)
Q_t	TFP	0.34 (0.12, 0.58)	0.32 (0.10, 0.57)	0.28 (0.07, 0.55)	0.26 (0.05, 0.55)	0.25 (0.04, 0.56)	0.24 (0.03, 0.56)
	Risk Premium	0.03 (0.00, 0.13)	0.02 (0.00, 0.08)	0.01 (0.00, 0.05)	0.01 (0.00, 0.03)	0.01 (0.00, 0.02)	0.01 (0.00, 0.01)
	Price of Capital	0.61 (0.35, 0.82)	0.64 (0.38, 0.85)	0.70 (0.42, 0.89)	0.72 (0.43, 0.93)	0.73 (0.43, 0.95)	0.74 (0.43, 0.96)
	Collateral Constraint	0.02 (0.00, 0.11)	0.02 (0.01, 0.07)	0.01 (0.01, 0.05)	0.01 (0.00, 0.03)	0.01 (0.00, 0.02)	0.01 (0.00, 0.01)
TB_t	TFP	0.36 (0.12, 0.60)	0.41 (0.15, 0.63)	0.43 (0.15, 0.67)	0.45 (0.15, 0.70)	0.46 (0.15, 0.72)	0.46 (0.14, 0.72)
	Risk Premium	0.10 (0.01, 0.29)	0.08 (0.01, 0.25)	0.05 (0.00, 0.21)	0.04 (0.00, 0.19)	0.03 (0.00, 0.18)	0.03 (0.00, 0.18)
	Price of Capital	0.01 (0.00, 0.13)	0.01 (0.00, 0.11)	0.01 (0.00, 0.13)	0.01 (0.00, 0.14)	0.01 (0.00, 0.15)	0.01 (0.00, 0.16)
	Collateral Constraint	0.53 (0.28, 0.74)	0.50 (0.27, 0.73)	0.51 (0.27, 0.74)	0.50 (0.25, 0.75)	0.50 (0.24, 0.76)	0.50 (0.24, 0.76)

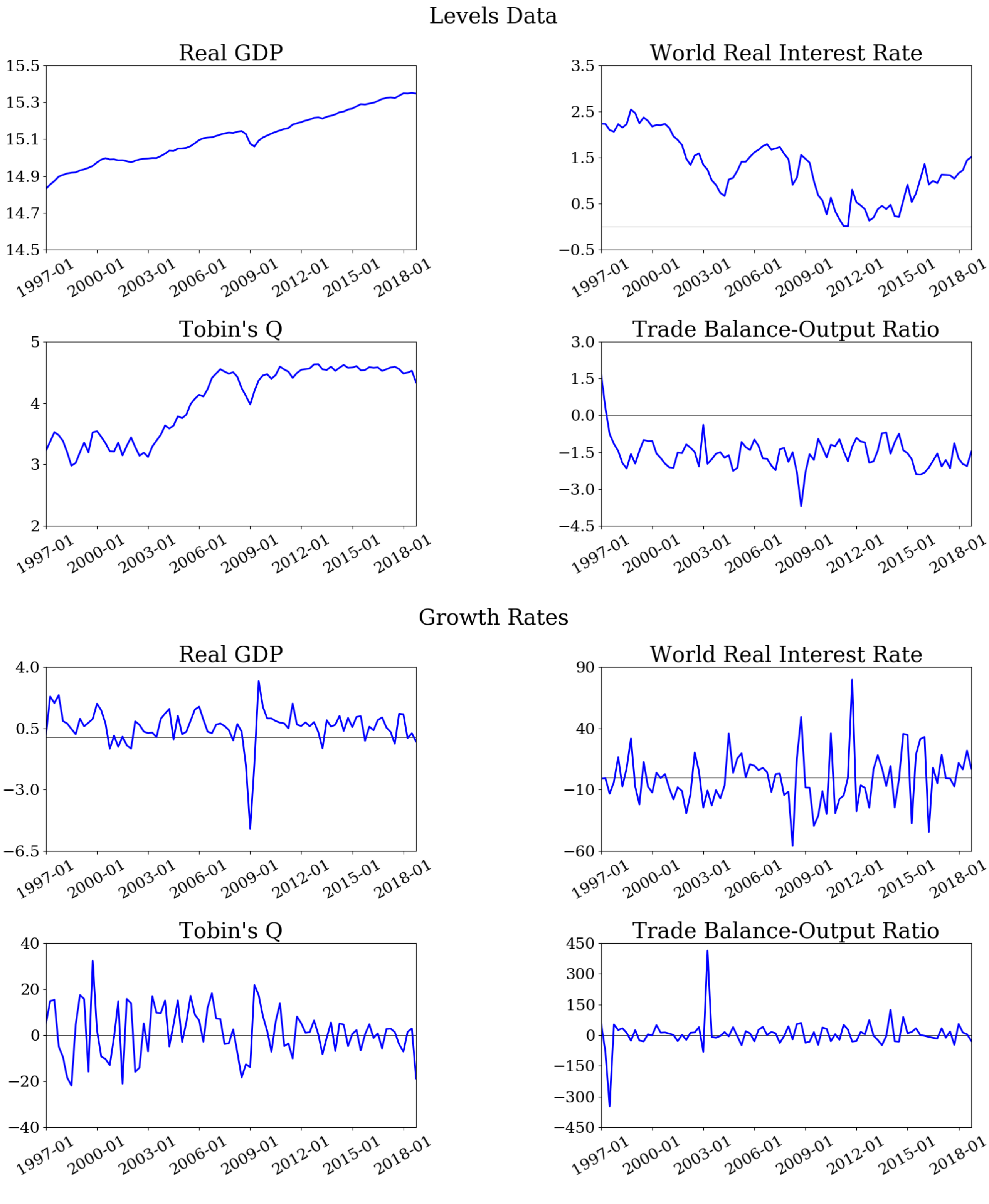
Notes: The table summarizes the contributions of TFP, risk premium, price of capital, and collateral constraint shocks to the fluctuations of real GDP, Y_t, the world real interest rate, R_t, Tobin's Q, Q_t, and the trade balance, TB_t. The parentheses contain 90% bootstrap sup-t confidence bands.

Figure 1: Brazilian Sample from 1999Q1 to 2018Q4



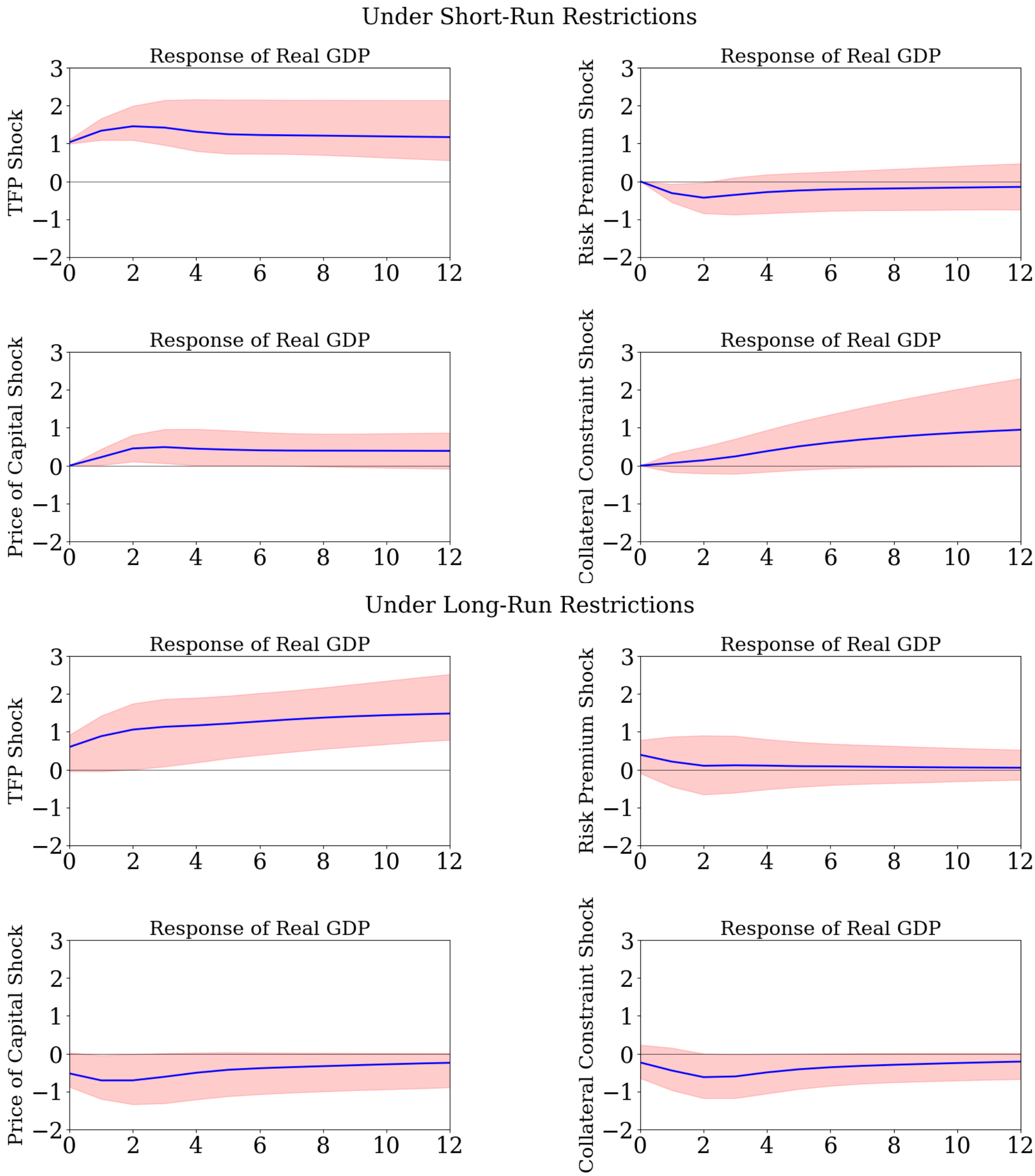
Notes: The top four graphs present log real GDP, the log world real interest rate, log Tobin's Q, and the trade balance-output ratio. Growth rates are the first differences of the log levels. The first difference of the trade balance-output ratio is computed as $100{*}(\frac{TB_t}{Y_t}\text{-}\frac{TB_{t-1}}{Y_{t-1}})/\frac{TB_{t-1}}{Y_{t-1}}$.

Figure 2: Mexican Sample from 1997Q1 to 2018Q4



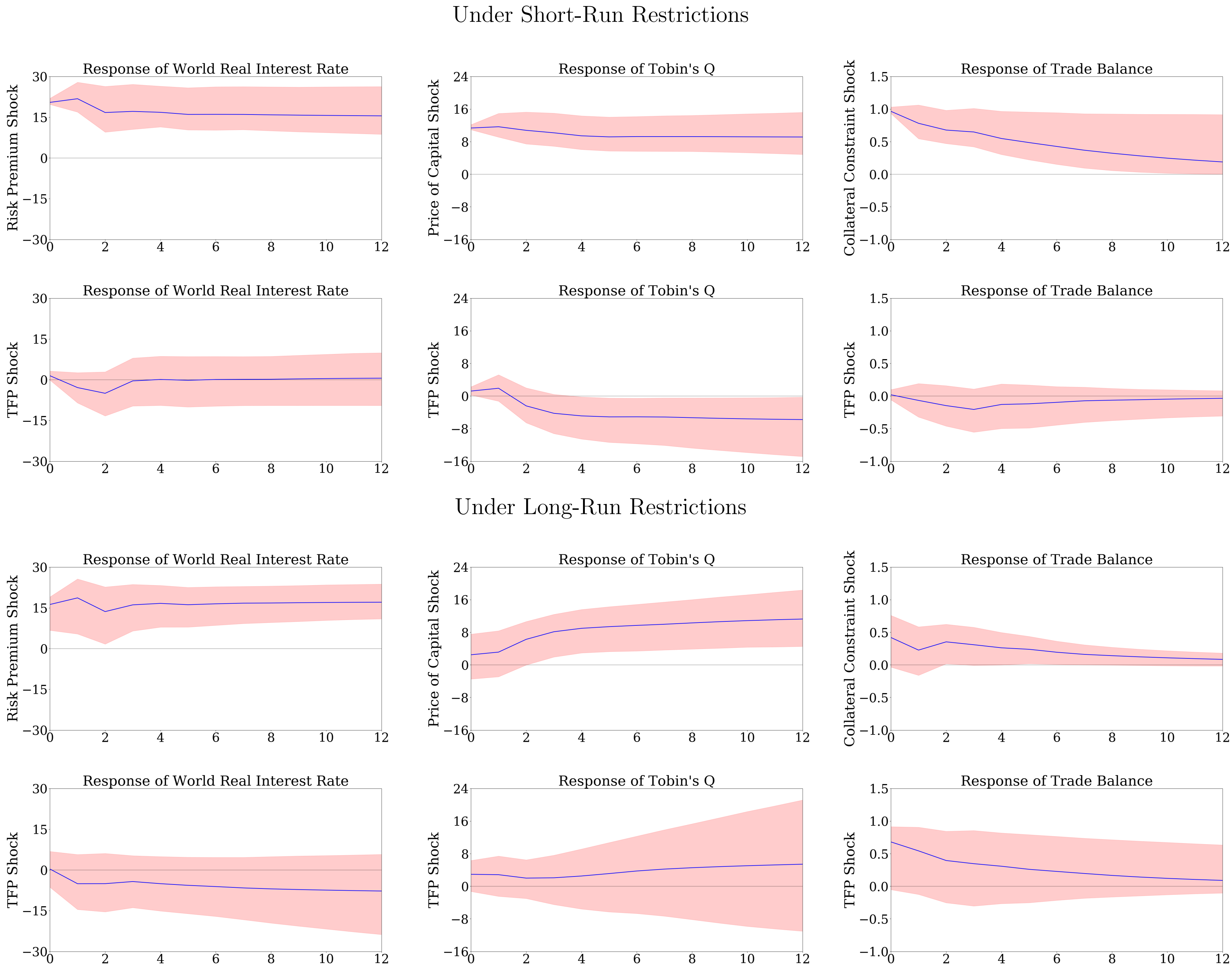
Notes: The top four graphs present log real GDP, the log world real interest rate, log Tobin's Q, and the trade balance-output ratio. Growth rates are the first differences of the log levels. The first difference of the trade balance-output ratio is computed as $100{*}(\frac{TB_t}{Y_t}\text{-}\frac{TB_{t-1}}{Y_{t-1}})/\frac{TB_{t-1}}{Y_{t-1}}$.

Figure 3: IRFs of Real GDP Estimated on the Brazilian Sample from 1999Q1 to 2018Q4



Notes: The blue solid lines trace the IRFs. The red shadings trace the 90% bootstrap sup-t confidence bands. The units of real GDP are in log levels.

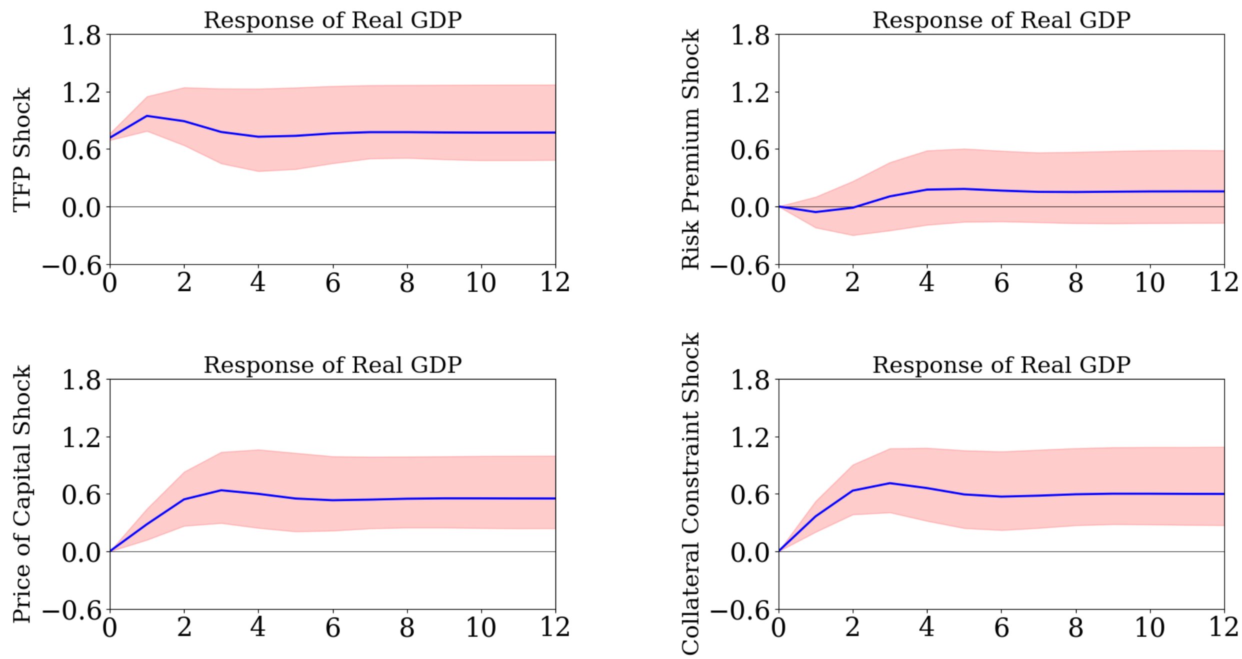
Figure 4: Selected IRFs Estimated on the Brazilian Sample from 1999Q1 to 2018Q4



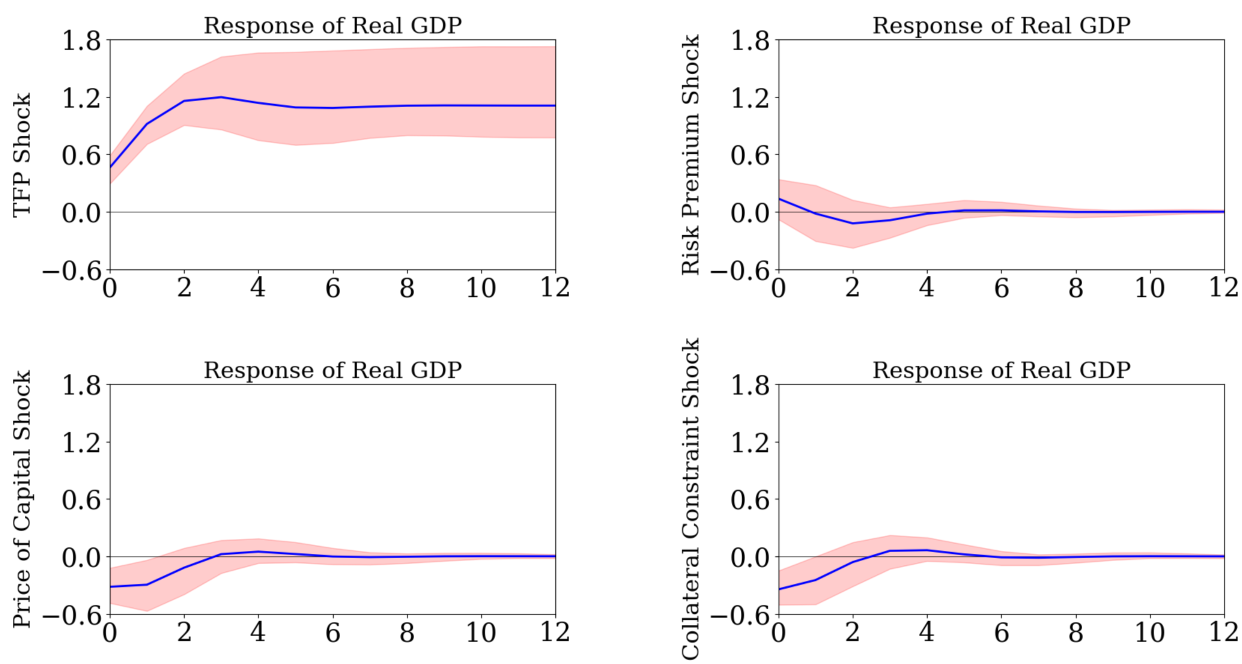
Notes: The blue solid lines trace the IRFs. The red shadings trace 90% bootstrap sup-t confidence bands. The units of the trade balance are in millions of local currency units; the world real interest rate and Tobin's Q are in percentages.

Figure 5: IRFs of Real GDP Estimated on the Mexican Sample from 1997Q1 to 2018Q4

Under Short-Run Restrictions



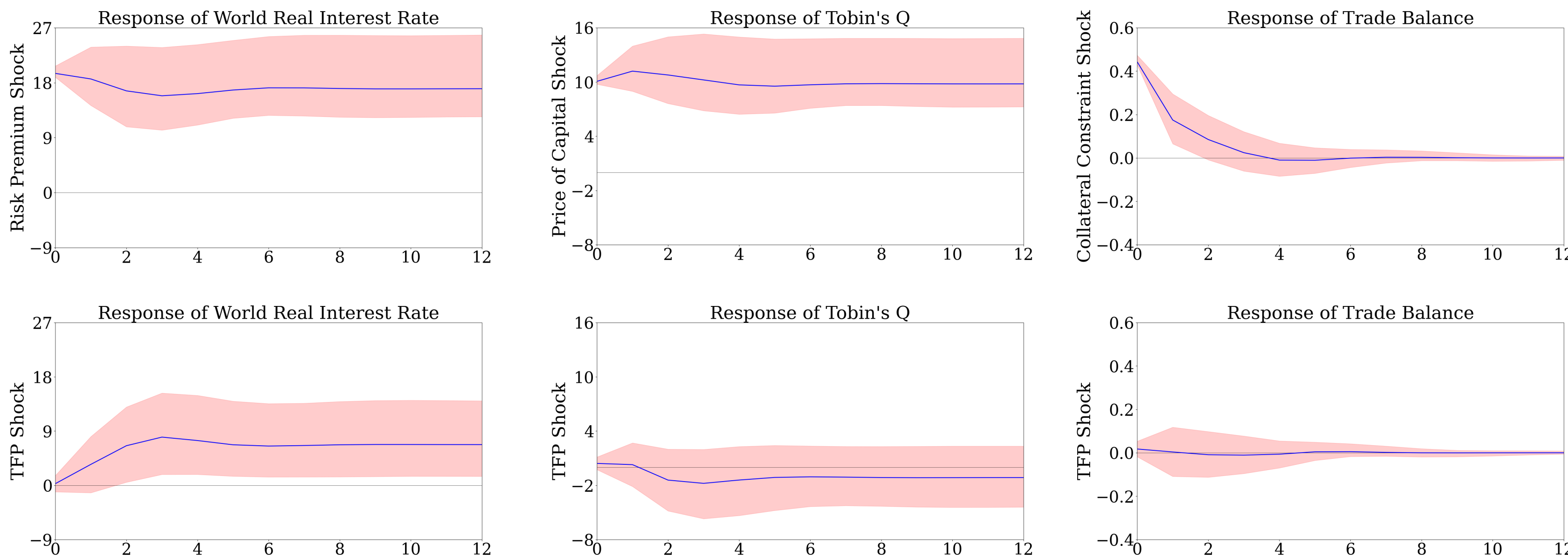
Under Long-Run Restrictions



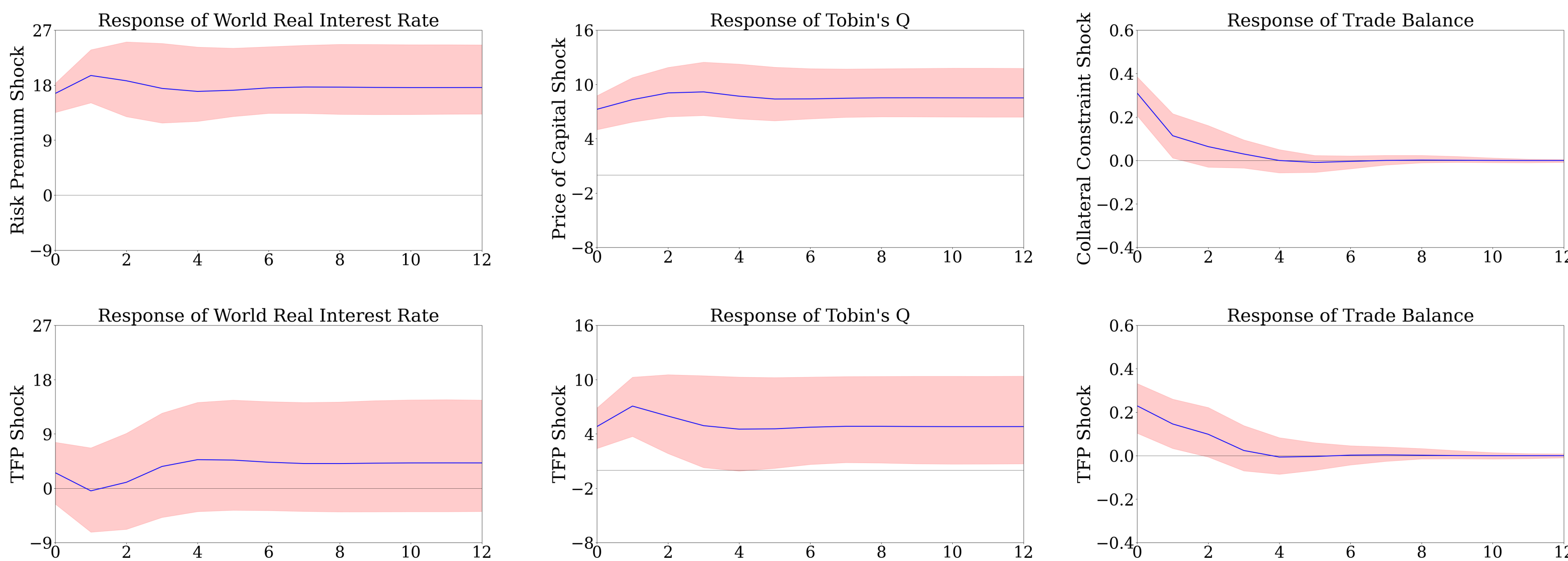
Notes: The blue solid lines trace the IRFs. The red shadings trace the 90% bootstrap sup-t confidence bands. The units of real GDP are in log levels.

Figure 6: Selected IRFs Estimated on the Mexican Sample from 1997Q1 to 2018Q4

Under Short-Run Restrictions



Under Long-Run Restrictions



Notes: The blue solid lines trace the IRFs. The red shadings trace 90% bootstrap sup-t confidence bands. The units of the trade balance are in millions of local currency units; the world real interest rate and Tobin's Q are in percentages.