GOVERNMENT SPENDING AND REAL EXCHANGE RATE RELATIONSHIP: PANEL EVIDENCE FROM DEVELOPING COUNTRIES

by

Gökçe Çelik

A Thesis Submitted to the Graduate School of Social Sciences and Humanities in Partial Fulfillment of the Requirements for the Degree of

Master of Arts

In

Economics

Koç University

August 2013

ABSTRACT

Findings from recent empirical studies contradict the prediction of the theoretical models regarding the impact of government spending on real exchange rate. Standard macroeconomic framework including both traditional Mundell - Fleming models and international real business cycle models predicts an appreciation of the real exchange rate in response to a positive shock in government spending. However, the results from recent empirical studies report that an increase in government spending is associated with a depreciation of the currency in real terms. In this paper we provide additional empirical evidence on the dynamic relationship between government spending and real exchange rate through a panel-VAR analysis. Unlike former studies, our sample focuses on developing countries and covers 1950 – 2010 period. Our results document real exchange rate depreciation in response to a government spending shock and according to our impulse response analysis the impact does not fade away immediately. In an alternative specification, our impulse response analysis reports similar responses of output, consumption and real exchange rate to the ones in benchmark model, along with a negative response of bond position which is consistent with the prediction of infinite horizon model under the assumption of incomplete international markets.

Key words: government spending, real exchange rate, panel VAR, impulse response analysis

ÖZET

Son dönemde yapılan ampirik çalışmalardaki bulgular kamu harcamalarının reel döviz kuruna etkisine ilişkin olarak iktisat teorisinin tahmin ettiği sonuçlardan ayrışmaktadır. Gerek klasik Mundell-Fleming modellerinde gerekse uluslararası iş çevrimleri modellerinde kamu harcamalarındaki dışsal bir artışın reel döviz kurunda değerlenmeye yol açacağı öngörülmektedir. Ancak ampirik bulgular kamu harcamalarındaki artışın reel döviz kurunda değer kaybına neden olduğuna işaret etmektedir. Bu tezde panel vektör otoregresyon denklem sistemi kullanılarak kamu harcamaları ve reel döviz kuru arasındaki dinamik ilişkiye dair yeni ampirik bulgular sunulmaktadır. Daha önceki ampirik çalışmalardan farklı olarak gelişmekte olan ülkeleri ait veriler kullanılarak yapılan bu çalışma 1950 – 2010 dönemini kapsamaktadır. Bulguları kamu harcamalarındaki artışın sonucunda reel döviz kurunun değer kaybettiğini göstermektedir. Çalışmada yer alan etki – tepki analizi ise reel döviz kurundaki etkinin kısa vadede kaybolmadığına işaret etmektedir. Baz modeldeki değişkenlere ek olarak varlık pozisyonu değişkeninin de yer aldığı alternatif modele ilişkin bulgular da reel döviz kurunun yanı sıra tüketim değişkenine ilişkin olarak önceki çalışmalardaki ampirik bulgularla uyumlu gerçekleşmiştir. Ayrıca eksik piyasalar varsayımı altındaki sonsuz dönemli modelin tahmini ile uyumlu olarak kamu harcamaları ile varlık pozisyonu arasındaki ters yönlü ilişki bulunmuştur.

Anahtar Kelimeler: kamu harcamaları, reel döviz kuru, vektör otoregresyon denklem sistemi, etki-tepki analizi

To my dear family

ACKNOWLEGMENTS

I would like to thank my advisor Prof. Sumru Altuğ who has been a great guide not only during my research but since I started the M.A. in Economics programme at Koç University. She has been very supportive and inspiring since the first day of this process. I would also like to thank her and other members of my thesis committee Prof. Ali Çarkoğlu and Assoc. Prof. Okan Yılankaya for their insightful comments and suggestions.

I am thankful to Asst. Prof. Ceyhun Elgin from Boğaziçi University for providing me with crucial guidance on the empirical methodology that I used in my thesis.

I was lucky enough to find myself in a friendly environment during my time at Koç University. I am grateful to my current flatmate Hayriye Özgül Özkan for her constant support and patience. I would also like to thank Ayşe Damla Üzrek, Mehmet Onur Ezer and Hatice İpek for being such candid friends and encouraging colleagues who created a very productive working environment.

I am also lucky to have a family who has always been there for me and showed me that they never hesitated that I would succeed since the beginning of my education. Their support and love have always been the essential source of my motivation to reach my goals in academic and professional life.

Finally I am thankful to TÜBİTAK for the financial assistance they provided during my graduate studies.

CONTENTS

1. Introduction

Recently, the implications of fiscal policies have been questioned more intensely than ever as most advanced countries, particularly Eurozone economies, are going through a rough time with their large fiscal imbalances and intense austerity measures policymakers have been trying to implement for a while now seemed to fail to restore the competitiveness and growth. Witnessing such a period inspires us to revisit the relationship between government spending and real exchange rate as the latter is one of the primary determinants of a country's competitiveness.

Findings from recent empirical studies contradict the prediction of the theoretical models regarding the impact of government spending on real exchange rate. Standard macroeconomic framework including both traditional Mundell-Fleming models and international real business cycle models predicts an appreciation of the real exchange rate in response to a positive shock in government spending. However, the results from recent empirical studies report that an increase in government spending is associated with a depreciation of the currency in real terms.

The main contribution of this paper is that we provide empirical evidence on the dynamic relationship between government spending and real exchange rate from developing countries. Previous empirical literature generally focused on developed or OECD countries due to the availability of quarterly data which provides the large number of periods that is preferred in VAR procedure. Since quarterly data for developing countries are not available for the variables of interest, at least in a perfectly comparable format, we preferred to use annual data and exhausted different data sources to get sufficiently large number of observations. Moreover, in an alternative specification, we include bond position in the system, in addition to the common variables employed in previous studies.

In this paper we provide evidence from a set of 24 developing countries that real exchange rate depreciates in response to a rise in government spending using panel vector autoregression methodology.

The rest of the paper is organized as follows: Section 2 provides a summary of the related literature on both theoretical and empirical fronts. Section 3 summarizes the main insights from the model presented by Kollmann (2010) which constitutes the theoretical background for the empirical analysis. Section 4 introduces the data and describes the methodology to be followed. Section 5 reports and interprets the results from our empirical analysis. Section 6 provides a brief comparison of Brazil and Turkey on real exchange rate and government spending fronts. Finally, section 7 concludes.

2. Literature Review

Standard open economy macroeconomic models have a common prediction regarding the relationship between government spending and real exchange rate as they foresee an appreciation of real exchange rate in response to an exogenous government spending shock. In traditional Keynesian models, i.e., Mundell-Fleming framework, the mechanism work through interest rate, an increase in government spending raises aggregate demand. Higher aggregate demand imposes upward pressure on domestic interest rates which under perfect capital mobility assumption increases capital inflows and thus leads to an appreciation of nominal exchange rate. Nominal exchange rate appreciation translates into real exchange rate appreciation given the assumption that prices are sticky. Meanwhile, the key motivation that generates real exchange rate appreciation in response to government spending shock in dynamic general equilibrium models is the complete international markets assumption. As the increase in government spending crowds out private consumption, the ratio of marginal utilities from consumption across countries, i.e., home marginal utility of consumption over foreign marginal utility of consumption, rises. Note that complete international financial markets assumption motivates a perfect risk sharing condition that relates the real exchange rate to this ratio of marginal utilities. Therefore, the increase in this ratio implies an appreciation in real exchange rate (Backus, 1994).

In contrast to what theory predicts, a vast number of empirical studies reporting real exchange rate depreciation in response to an expansion in government spending has been accumulating. Not surprisingly, this motivated researchers to come up with modifications to the aforementioned models that would explain this puzzle in the literature.

Kollmann (2010) constructed a micro based model that generates a real exchange rate depreciation in response to an exogenous increase in government spending under incomplete international financial markets assumption. An increase in government spending translates into a negative wealth effect for the households as it crowds out private consumption. In order to compensate this negative wealth effect, households increase their supply of labor and hence, output rises. Under incomplete financial markets assumption, which implies balanced trade, this supply effect is so strong that the country's terms of trade deteriorates and real exchange rate depreciates as the final good production process is biased in favor of the use of the local input. Kollmann also presents that this supply side effect is present when prices or wages are sticky as long as monetary policy is not contractionary enough offset the stimulative effect of higher government purchases on output.

Corsetti, Meier and Müller (2009), on the other hand, showed that new Keynesian model would in fact match the empirical findings once the fiscal policy is modeled more thoroughly. To this end, they constructed a new Keynesian real business cycle model with reversals in government spending. As their model allows for government spending to respond to the level of public debt, an expansion in government spending in current period will be systematically followed by government spending falling below its long run trend. This anticipation of decline in future government spending motivates an expectation of a decline in future short term interest rates which translates into lower long term interest rates currently. As a result of the lower long term interest rates consumption improves and real exchange rate depreciates. Employing a VAR methodology on a data set covering the US time series for the period of 1980:Q1 – 2007:Q4, the empirical dimension of their paper reports evidence supporting

government spending reversals, in addition to an improvement in private consumption and depreciation of real exchange rate in response to a positive government spending shock.

Monacelli and Perotti (2006) analyzes the effects of government spending shocks on real exchange rate and trade balance and tracks their co-movements with output and consumption. Their study employs a structural vector auto regression methodology utilizing quarterly data from four OECD countries, United States, United Kingdom, Canada and Australia, for 1975 – 2001 period. Their empirical analysis yields two main results. First, in response to an increase in government spending, real exchange rate depreciates in all countries but Canada while trade balance deteriorates in all four countries although the magnitude of trade balance impact is relatively small in the US. Note that their finding regarding the response of trade balance is in line with twin deficit hypothesis whereas the response of real exchange rate contradicts with standard macroeconomic models that predict that an increase in government spending leads to real exchange rate appreciation. Second, the rise in government spending is accompanied by a rise in private consumption and a rise in output.

Kim and Roubini (2008) studies the relationship between government spending, current account and real exchange rate during in the US during post Bretton Woods period. Their empirical results through VAR methodology show that, in contrast to what theory suggest, fiscal expansion and fiscal deficit is associated with an improvement in current account balance and a depreciation of real exchange rate. Interestingly, their results remain robust even after they control for the business cycle effects when an economic expansion improves the fiscal budget but deteriorates the current account balance. They nominate the crowding out in investment resulting from fiscal expansion

as an explanation for the unanticipated improvement in current account balance. Meanwhile a possible justification for the response of real exchange rate provided by Kim and Roubini is that the US has been running large current account deficit which leads to an ever increasing ratio of net foreign debt-to-GDP ratio. This implies a higher country risk premium which translates into a weaker currency in nominal terms, as well as under real terms given the sticky prices assumption.

Beetsma, Giuliodori and Klassen (2008) studied the consequences of an increase in public spending for trade balance and budget deficit using a panel VAR approach that employs annual data for 14 European Union countries. Their results report that in response to 1% increase in public spending-to-GDP ratio, output rises by 1.2% on impact while the magnitude of the response peaks at 1.6% after one year. These results are accompanied by a worsening of 0.7% in budget balance on impact and a deterioration of 0.5% in trade deficit-to-GDP ratio on impact on the back higher output which increases imports and decreases exports as output improvement translates into higher wages and hence higher export prices. Impulse response analysis also documents real exchange rate appreciation, albeit with some delay, which is also in line with the rise in wages. In order to address the source of the real exchange rate response, the paper substitutes nominal exchange rate and GDP deflator instead of real exchange rate. The results imply that the appreciation is due to the rise in domestic inflation rather than nominal exchange rate adjustment.

Similar to Beetsma et al., Benetrix and Lane (2009) also employed panel VAR approach in order to study the effects of government spending shocks on real exchange rate in eleven European Monetary Union (EMU) countries. Yet, Benetrix and Lane's study differs from the former as the latter utilizes five different measures of government

spending and reports that the impact of government spending may differ across its components. The main finding is that a shock to total government absorption leads to real exchange rate appreciation. Additionally, their analysis using different components of government spending document that public investment generates a larger and more persistent impact on real exchange rate compared to government consumption and that shocks to wage component of government consumption leads to a larger appreciation than non-wage component does. In addition to EMU countries, Benetrix and Lane also estimate their model using a panel that consists of Australia, Canada, United Kingdom and United States which were also analyzed by Monacelli and Perotti. Interestingly, their results from the second set of countries reported real exchange rate depreciation in response to fiscal shocks, confirming Monacelli and Perotti's results. According to the authors, the explanation for this difference in the results from two different set of countries lies in the exchange rate regimes, i.e., countries with fixed nominal exchange rate regimes experiences real appreciation whereas real depreciation is observed in countries with flexible nominal exchange rate.

Another study that investigates the effects of government spending shocks on real exchange rate, in addition to output, consumption and trade balance, using data from Australia, Canada, United Kingdom and United States is Ravn, Schmitt-Grohe and Uribe (2012). Similar to Monacelli and Perotti (2006), their study also employs a structural vector autoregressive analysis with a sample that is 16 quarters longer for each country compared to the former study. Yet, their empirical strategy differs from those implemented by not only Monacelli and Perotti, but also other related literature e.g., Corsetti and Müller (2006), Kim and Roubini (2008), as they used a pooled data across countries in order to gain higher efficiency. According to their results, a positive

shock to government spending leads to an expansion in output and consumption together with a deterioration of trade balance and a depreciation of real exchange rate. As their findings contradict with the anticipation of neoclassical and Keynesian models, they propose a two country model with deep-habits which generates the observed responses of the variables of interest to an estimated government spending shock. Under deep-habits assumption, firms selling to the domestic market lower their mark-ups when domestic demand increases. This implies that a positive shock to government spending leads to relatively lower domestic mark-ups and hence, domestic prices becomes cheaper relative to foreign economy, i.e., real exchange rate depreciates.

3. Theoretical Background

As stated above, this paper provides an empirical analysis of the dynamic relationship between the government spending and real exchange rate. We will be presenting the details and results of this analysis in the following section. However, at this point, it is plausible to describe the theoretical setting that constitutes a base for our empirical analysis.

Our empirical analysis is based on a micro-based, two country model, presented by Kollmann (2010). In this model, each country produces a tradable intermediate good via a production technology that utilizes labor and imports intermediate goods to produce a non-traded final good. Production is carried out by firms that are owned by the local household and operate in a perfect competition environment. Labor market is also competitive and wages, as well as prices, are flexible.

The household derives utility from consumption and leisure while her budget constraint is characterized by the relationship between the value of her consumption and the value of her after-tax wage income. Note that the lump-sum tax collected from the household is used by the government to finance exogenous public purchases.

Note that since the main focus of our study is on the empirical evidence rather than the theory, we will not go into the details regarding the derivation of the model. Instead we will present some crucial equations that capture the relationship between government spending and real exchange rate.

After following the standard procedures, i.e., taking the first order conditions from household's utility maximization problem, imposing the market clearing conditions and log-linearizing the model around the equilibrium, it yields the following two equations that unveil the relationship among consumption, terms of trade, output and government spending:

$$\hat{c} = -\frac{1}{1-\Gamma}\{2\alpha\phi - 1\}\hat{q} - \frac{1}{1-\Gamma}\ \hat{g} \quad (1)$$

$$\hat{y} = -\{1 + 2\alpha(\phi - 1)\}\hat{q} \quad (2)$$

where the parameter $\phi > 0$ is the substitution elasticity between intermediate goods, $0.5 < \alpha < 1$ implies that production technology is biased in favor of the local intermediate good use in final good production and Γ shows the share of government spending in total domestic absorption in equilibrium. $\hat{c}, \hat{g}, \hat{y}$ and $\hat{q}$ defines consumption, government spending, output and terms of trade, respectively, in terms of their deviation from the point of linearization. Equation (1) implies that an increase in government spending crowds out private consumption, once terms of trade is held constant. Equation (2), which also represents an effective relative demand function for domestically produced intermediate good, implies that an improvement in terms of trade reduces relative output. Intuitively, the two equations above imply that an increase in private consumption or government spending needs to be financed by an increase in output and/or by an improvement in terms of trade.

In a similar manner, once firm's profit maximization problem is solved, we get the following equation:

$$\frac{1}{\eta}\hat{y} = 2(1-\alpha)\hat{q} - \sigma\hat{c} \quad (3)$$

where $\eta > 0$ is the Frisch labor supply elasticity coefficient. Since production technology was defined to be linear in labour, Equation (3) implies that number of hours worked, or equivalently output, is increasing in terms of trade and decreasing in consumption. Nesting the expression for relative consumption specified in Equation (1) into Equation (3), we get the relative supply function for Home intermediate good as follows:

$$\hat{y} = \eta \left\{2\,(1-\alpha) + \sigma\,\frac{2\alpha\phi-1}{1-\Gamma}\right\}\hat{q} + \eta\sigma\frac{\Gamma}{1-\Gamma}\,\hat{g} \tag{4}$$

Equation (4) implies that by crowding out private consumption, an increase in government spending leads to higher labor supply and hence, higher output. This higher output translates into relatively cheaper Home intermediate goods, i.e. a worsening in terms of trade, and consequently, a depreciation in real exchange rate since the link between real exchange rate and terms of trade is specified as $\widehat{rer} = (2\alpha - 1)\,\hat{q}$. Equating relative demand and supply yields the following relationship between government spending and terms of trade:

$$\hat{q} = \Psi_{g}^{BT}\hat{g} \tag{5}$$

where $\Psi_{g}^{BT} \equiv -\sigma\frac{\Gamma}{1-\Gamma}/\left[2(1-\alpha) + \frac{\sigma 2\alpha\phi-1}{1-\Gamma} + \frac{1-2\alpha(1-\phi)}{\eta}\right] < 0$ holds if $\phi > 1/2\alpha$, which would imply that an increase in government spending leads to a deterioration in terms of trade.

Importantly, the supply side effect which calls for real exchange rate depreciation in response to a positive government shock occurs due to limited international risk sharing assumption. This assumption strengthens the negative response of private consumption to higher government spending which then leads to a sufficiently large increase in labour supply and output to worsen the terms of trade and hence, real exchange rate. However, under complete asset markets assumption, i.e., full risk sharing, consumption is determined by solely terms of trade as Equation (6) shows.

$$\hat{c} = -\frac{1}{\alpha}\,\{2\alpha - 1\}\,\hat{q} \tag{6}$$

Following this modification, the relative demand and supply functions for Home intermediate good are now given by Equation (7) and Equation (8), respectively.

$$\hat{y} = -\left[4\alpha(1-\alpha)\phi + \frac{(2\alpha-1)^2(1-\Gamma)}{\sigma}\right]\hat{q} + (2\alpha-1)\Gamma\hat{g} \tag{7}$$

$$\hat{y} = \eta \hat{q} \tag{8}$$

Combining these two equations would yield the following expression for terms of trade:

$$\hat{q} = \Psi_{\mathrm{g}}^{\mathrm{CM}} \hat{g} \tag{9}$$

with $\Psi_{\mathrm{g}}^{\mathrm{CM}} \equiv (2\alpha - 1)\Gamma / \left[4\alpha(1-\alpha)\phi + \frac{(2\alpha-1)^2(1-\Gamma)}{\sigma} + \eta\right] > 0$, implying that an increase in government spending leads to terms of trade improvement.

Once incomplete financial market assumption is introduced into an infinite horizon dynamic setting where only a one-period bond could be traded, the relationship between government spending and terms of trade would be given by the following equation.

$$\hat{q}_t = \Psi_{\mathrm{g}}^{\mathrm{BT}} \widehat{g_t} + \left(\Psi_{\mathrm{g}}^{\mathrm{BT}} - \Psi_{\mathrm{g}}^{\mathrm{CM}}\right) E_t \sum_{s=1}^{\infty} \beta^s \hat{g}_{t+s} + (1-\beta)\frac{1}{b} \tilde{A}_t \frac{1}{\beta} \tag{10}$$

where $\Psi_{\mathrm{g}}^{\mathrm{BT}} < 0$ and $\Psi_{\mathrm{g}}^{\mathrm{BT}} - \Psi_{\mathrm{g}}^{\mathrm{CM}} < 0$, given the assumption that $\phi > 1/2\alpha$. Note that $\tilde{A}_t$ corresponds to the bond position at time t. Equation (10) implies that once all else held constant, an increase in government spending today, and /or an increase in the expected present value of future growth rates leads to a deterioration in terms of trade and therefore, a depreciation in real exchange rate today. Additionally, an increase in bond position is seen to be associated with more appreciated currency in real terms. Intuitively, higher bond holdings indicate a better capability to finance net imports and thus, less depreciation pressure on the currency.

4. Data and Methodology

I. Data

As stated above, this paper investigates the effect of a shock in government spending on real exchange rate. The common conclusion of related empirical literature, in line with the theoretical background, is that the effect works through output and consumption. In this respect, our benchmark empirical analysis will employ four variables: government spending, output, consumption and real exchange rate. Alternatively, as the incomplete international financial market model suggested by Kollmann (2010) presents, bond position also takes part in the system. Therefore, we will also present additional results from an alternative specification that includes bond position in the set of variables, along with government spending, output consumption and real exchange rate.

Government spending variable that will be employed in our analysis corresponds to the share of government expenditure in GDP. We construct this variable using the general government final consumption expenditure and GDP series retrieved from World Bank's World Development Indicators (WDI) database. Similarly, consumption variable also corresponds to the share of household's final consumption expenditure in GDP and it is constructed in an analogous way using the same data source. GDP, measured in constant, US dollars terms, is used as the output variable. To construct the bond position variable, we use the net foreign asset position series measured in local currencies and calculated their share in local currency denominated GDP.

Real exchange rate variable is constructed by adjusting the nominal exchange rate for purchasing power parity following Rodrik (2008). Nominal exchange rate, i.e., the value of each country's currency per 1 US dollar, along with the purchasing power

parity conversion factors, which are used in the construction of the real exchange rate is retrieved from Penn World Tables (PWT 7.1) which provides a longer time frame for this variable compared to other alternatives.

This study employs an unbalanced panel data set that covers the 1950 – 2010 period, on annual frequency, for 24 developing countries. Selection of the countries is based on the availability of the data. The list of the countries used in the analysis is provided in the appendix.

II. Methodology

Previous empirical studies focusing on the relationship between government spending and real exchange rate used VAR methodology. The main motivation for this choice is the existence of a dynamic relationship between the variables as VAR approach treats all the variables in the system as endogenous. Extending the VAR approach to the panel setting allows one to control for the country level heterogeneity. To this end, we will be estimating the following model

$$A\ Y_t = B\ Y_{t-1} + \epsilon_t$$

where Y_t is the vector of variables specified above, i.e., Y_t= [*government expenditure, output, consumption, real exchange rate*]′. A and B are the coefficient matrices. Note that matrix A stores the contemporaneous relationships among the variables in Y_t. Finally, ϵ_t is a serially uncorrelated vector of disturbances with zero mean. Note that in the alternative model we will present the vector of dependent variables will be in the form of Y_t= [*government expenditure, output, consumption, bond position, real exchange rate*]′.

The application of VAR procedure to panel data requires one to impose the restriction that the data generating process is identical for each cross-sectional unit. However, this restriction is unlikely to hold in practice. A common method implemented in the literature to deal with this is to introduce the fixed effects which would allow for country level heterogeneity. Yet, we are to estimate a dynamic model which includes the lags of the dependent variables within the set of regressors, and it is inappropriate to treat fixed effects as constants to be estimated in models with lagged dependent variables (Holtz–Eakin, 1988). One method to overcome this problem is to mean-difference each variable in order to eliminate the fixed effects. However, in the presence of lagged dependent variables, the new regressor, i.e., the difference between y_{it-1} and $\bar{y}_{i,-1}$ would be still correlated with the error term $\epsilon_{it} - \bar{\epsilon}_i$ and thus, would lead to biased estimates.

Instead of using the mean differencing technique due to its drawback explained above, we will use forward mean-differencing technique where we will subtract the mean of all future observations from each observation of each variable, as suggested by Arellano and Bover (1995). This method is known as the "Helmert transformation" and it satisfies the orthogonality assumption between the transformed variables and lagged variables as the lagged variables do not take part in the formulation of transformed variables. Following this transformation, we can use the lagged variables as instruments and estimate the coefficients by system GMM. In this sense, this procedure is equivalent to using 2SLS.

Note that the estimation of the above system requires the assumption that the series are stationary. Therefore, before estimating the GMM coefficients, we will use a second generation panel unit root test proposed by Pesaran (2003). The test is based on

the mean of the individual Augmented Dickey-Fuller (ADF) t-statistics of each unit in the panel. Standard ADF regressions are augmented with the cross section averages of lagged levels and first differences in order to deal with the cross dependence. Note that the null hypothesis of the test suggests the presence of unit root, i.e., all series are non-stationary. Alternatively, we will also report the results of Im-Pesaran-Shin (IPS) test whose null hypothesis also implies that all panels contain unit roots.

In case one fails to reject the presence of unit root, the next step would be checking if those variables with a unit root are cointegrated. Yet, as we will report in the following subsection, the variables in our model are stationary in their levels.

Following the estimation of system GMM, we will present the impulse-response functions which demonstrate how the response of an endogenous variable to a shock in another variable evolves over time when all other shocks are isolated. Note that checking the effect of a shock in a specific variable in the isolation of shocks in other variables requires that variance-covariance matrix of errors is diagonal. However, the variance-covariance matrix of the underlying panel VAR residuals are unlikely to be diagonal and therefore, the residuals should be decomposed in a way that they become orthogonal.

The suggested way in the literature to orthogonalize the residuals is adopting a particular ordering to the endogenous variables and allocating any correlation between any two residuals of any two elements to the variable that comes first in the ordering. This implies that the variables that come earlier in the ordering are more exogenous compared to the ones that come later. This is equivalent to assume that the variable specified at the top in the panel VAR estimation will be affected by only the lagged values of the other values and of its own lag values whereas the variables specified at

the end will be affected contemporaneously by the other variables as well as the lagged values of its own and other variables. In this respect, we ordered the set of variables in our system accordingly while conducting the panel VAR estimation.

Our specification is based on the ordering implemented in previous empirical studies and theoretical guidance (Blanchard and Perotti, 2002). Accordingly, government spending is relatively exogenous implying that it is assumed to be unaffected from the within-year shocks in other variables. This assumption seems plausible as governments generally decide on their expenditure plans while announcing their budget target at the beginning of the fiscal year and major revisions to those plans are rare.

The confidence intervals used while reporting the impulse responses are computed using Monte Carlo simulations with 1000 iterations, following Love and Zicchino (2006). Finally, we will analyze the variance decompositions which report the contribution of each shock to the variance of the each endogenous variable.

5. Estimation Results

I. Pre-estimation Check

As discussed in the previous section, before estimating the panel VAR, we need to ensure that the variables are in the appropriate form to be used in the estimation, i.e., they are non-stationary. To this end, Table 1 presents the results from CADF panel unit root tests which have a null hypothesis that all panels have unit roots. Note that the optimal number of lags to be included in the tests is selected according to the Akaike Information Criteria (AIC) for each variable independently. Both CADF and the alternative IPS test, the results of which is reported in the appendix, are conducted for "Helmert transformed" variables.

Table 1: Panel unit root test statistics

	CADF	
	Test statistic	**p-value**
Output	-15.131	0.0000
Gov. spending	-2.4544	0.0071
Consumption	-3.1570	0.0008
Net for. asset	-2.7200	0.0000
Real exch. rate	-5.2042	0.0000

Checking the p-values of the estimates, we reject the null hypothesis all panels have unit roots for each series at the significance level of 10%. Note that we fail to reject the null hypothesis for output at 5% significance level in the alternative test. Yet, CADF test rejects the presence of unit root for this variable. In this respect, we are confident to conclude that we do not have strong evidence that the set of variables suffer

from unit root and therefore, using the levels of these variables would not violate the non-stationarity assumption for panel VAR analysis.

II. Estimation Results for Benchmark Model

Table 2 reports the results from panel VAR estimation for our benchmark model. Importantly, the real exchange rate responds positively to government spending with 1 year lag[1]. Note that by the construction of the real exchange rate variable positive values correspond to a depreciation of the currency. Hence, our estimate for the impact of government spending on real exchange rate is in line with the vast empirical evidence that government spending causes a depreciation rather than a depreciation in real exchange rate. The coefficient estimate for the impact of output on the government spending in the following period is significantly positive.

Table 2: Panel VAR estimates for benchmark model (1-lag)

	Gov. Spending	**Output**	**Consumption**	**RER**
Gov. Spending (-1)	0.9327*	1.9896	0.0145	3.5381**
	(0.0290)	(12.3076)	(0.0743)	(1.7052)
Output (-1)	0.0001*	0.2919*	0.0002	0.0145
	(3.8E-05)	(0.0942)	(0.0001)	(0.0122)
Consumption (-1)	0.0046	-2.4085	0.9444*	0.0133
	(0.0101)	(6.9617)	(0.0300)	(0.5021)
RER (-1)	0.0005	-0.7917	0.0042**	0.6459*
	(0.0005)	(0.6407)	(0.0020)	(0.1623)

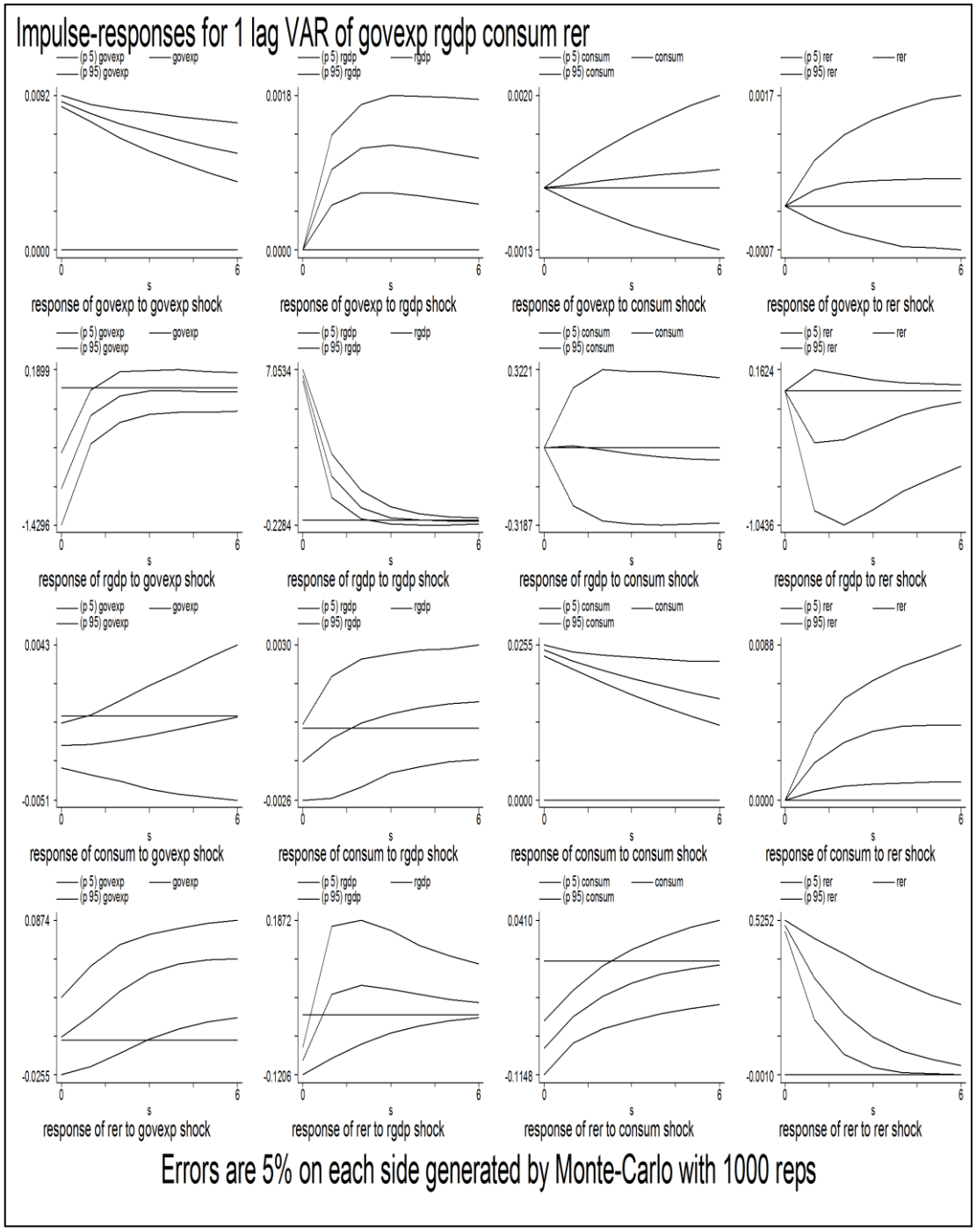
Standart errors are in parantheses. *,**,*** denote 1,5 and 10% confidence levels.

[1] We ran both the benchmark and alternative model with 2 lags, as well. The conclusions regarding the main variables of interest however, remain robust directionally.

Figure 1 demonstrates the impulse responses. According to the results, real exchange rate responds positively, which implies depreciation of the currency as explained above, to a shock in government spending on impact. The magnitude of the impact builds up rapidly through the first three periods and is maintained until the end of 6^{th} period. Hence, in line with the recent empirical evidence, this result shows that real exchange rate depreciates in response to a positive innovation in government spending. Consumption, on the other hand, responds negatively to a government expenditure shock on impact, which is consistent with the prediction of incomplete market model that government consumption would crowd out private consumption. Note that the strength of the response declines over time. Related to this, negative response of output to government spending shock on impact seems to imply that this crowding out impact might outweigh the stimulative effect of higher government spending. Yet, this result contradicts the model as it predicts such decline in consumption would be associated with a rise in output through higher labor supply.

We present the variance decomposition of the benchmark model in table 3 which reports the contribution of each shock to the variance of the each endogenous variable shows how for 10 and 20 periods. Accordingly, government spending shocks explain almost 5% of the variation in the real exchange rate in 10 year horizon while the magnitude of the impact accumulates, albeit at a slower pace beyond 10 years as the share of variation explained by government shock is slightly more than 7% in 20 year horizon. Importantly, it has the largest explanatory power for the variance of real exchange rate, after the variable itself. Output and consumption shocks are responsible for almost 4% and 3%, respectively, of the variation in real exchange rate in during the

Figure 1: Impulse Responses for Benchmark Model



first 10 years. The share of variation in real exchange rate that is attributed to consumption eases by a small amount beyond 10 years.

Table 3: Variance decompositions for benchmark model

	Periods	Gov.spending	Output	Consumption	RER
Gov.Spending	10	97.11%	2.35%	0.23%	0.30%
	20	96.19%	2.62%	0.75%	0.44%
Output	10	2.28%	96.83%	0.03%	0.86%
	20	2.32%	96.76%	0.06%	0.87%
Consumption	10	0.30%	0.19%	95.99%	3.52%
	20	0.83%	0.35%	94.41%	4.42%
RER	10	4.72%	3.97%	2.65%	88.66%
	20	7.61%	3.97%	2.59%	85.83%

The variables in columns explain the variance in the row variables.

III. Results for the Alternative Specification

Following the dynamic model with incomplete markets by Kollmann (2010), we now introduce an additional variable to our specification: bond position. As we stated previously while describing our data set, we will use net foreign asset position series as the bond position variable. Taking the predictions of theoretical and empirical evidence into consideration, we place the bond position variable prior to real exchange rate, in the ordering, implying that the former is relatively exogenous.

Results imply that the lagged values of all the variables except consumption affect real exchange rate such that the impacts are consistent with the common empirical

evidence in terms of directions although the coefficients of government spending and output is not significantly different than zero. Importantly, the additional variable, bond position has a negative coefficient which is different than zero at 1% significance level. This implies that higher levels of bond position is associated with more appreciated currency in real terms which is in line with not only the prediction of infinite horizon model under incomplete markets but also former empirical evidence that reported net foreign asset position as a fundamental driver of real exchange rate (Lane and Milesi-Ferretti, 2002).

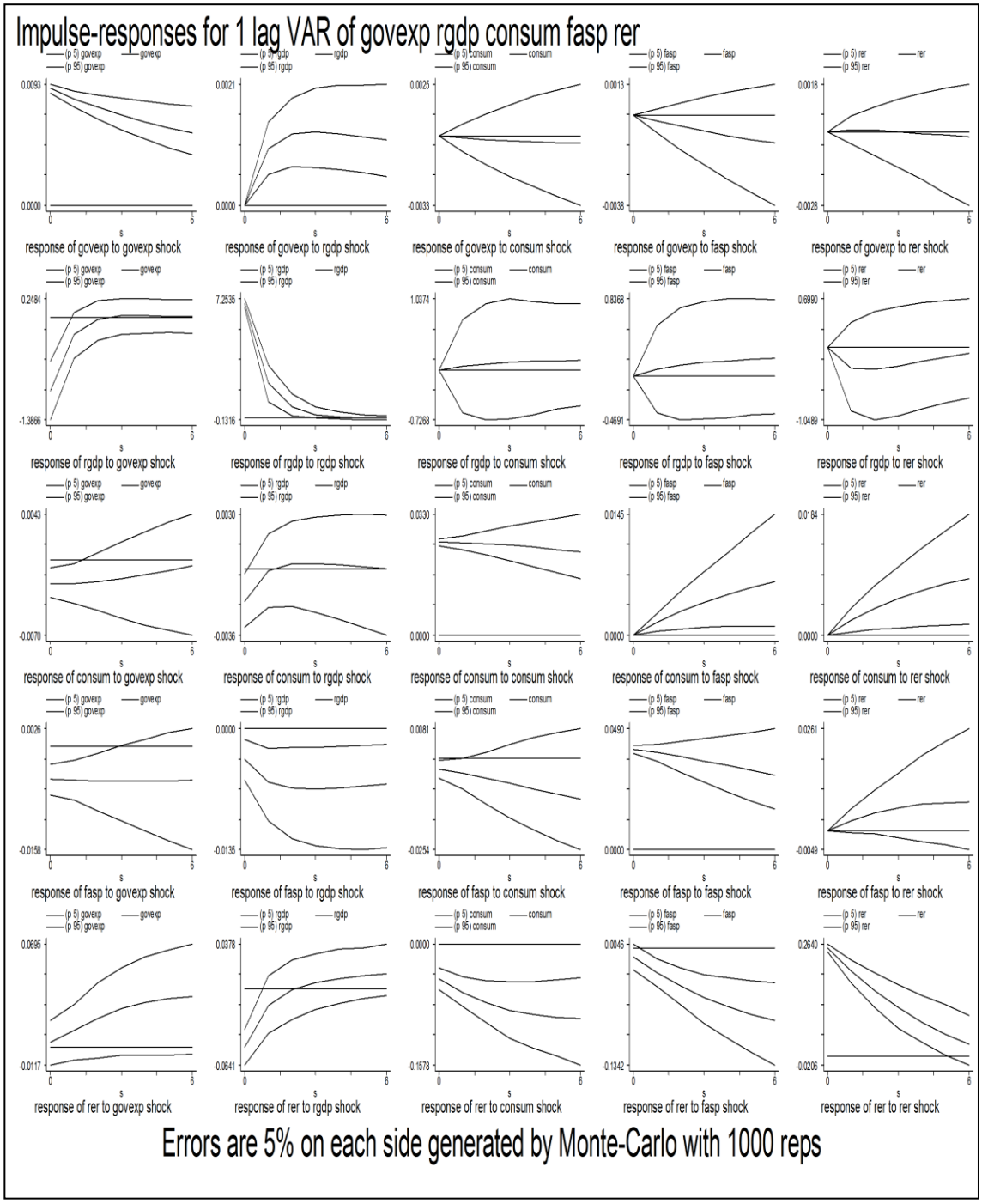
Table 4: Panel VAR estimates for alternative model (1-lag)

	Gov.Spending	**Output**	**Consumption**	**Bond Pos.**	**RER**
Gov.Spending (-1)	0.9192*	8.3366	0.0522	-0.0720	0.7499
	(0.0265)	(12.7271)	(0.0773)	(0.1102)	(0.7958)
Output (-1)	0.0001*	0.2958*	0.0003**	-0.0003	0.0030
	(4.2E-05)	(0.0991)	(0.0001)	(0.0002)	(0.0019)
Consumption (-1)	-0.0042	0.1035	1.0185*	-0.0320	-1.1441**
	(0.0184)	(19.8960)	(0.0445)	(0.0975)	(0.4551)
Bond Pos. (-1)	-0.0064	1.7238	0.0383**	0.9678*	-0.5016*
	(0.0079)	(7.5652)	(0.0172)	(0.0470)	(0.1628)
RER (-1)	0.0003	-1.1854	0.0087**	0.0101	0.7905*
	(0.0012)	(1.5579)	(0.0043)	(0.0070)	(0.0593)

Standart errors are in parantheses. *,**,*** denote 1,5 and 10% confidence levels.

Impulse responses for the alternative specification demonstrated in figure 2 reports that the immediate response of real exchange rate to a government spending

Figure 2: Impulse responses for alternative model



shock is just slightly positive, i.e., the currency depreciates in real terms, although it builds up going forward. On the other hand, a positive shock in bond position leads to real appreciation in the currency with the impact inflating through time.

Finally, the variance decomposition for the alternative model is presented in table 5. Estimates imply that consumption explains almost 26% of the variation in real exchange rate in 10 year horizon while bond position explains 17%. The explanatory powers of bond position increase in longer period while that of consumption is maintained. Government spending and output, on the other hand, explain slightly less than 3% and 1%, respectively, of the variation in real exchange rate during the first 10 years. The explanatory powers of these two variables remain almost unchanged beyond 10 years.

Table 5: Variance decompositions for alternative model

	Period	Gov.Spending	Output	Consumption	Bond Pos.	RER
Gov.Spending	10	94.99%	2.52%	0.16%	2.24%	0.10%
	20	89.91%	3.00%	0.18%	6.29%	0.62%
Output	10	1.90%	96.78%	0.22%	0.48%	0.62%
	20	1.89%	96.00%	0.33%	1.05%	0.72%
Consumption	10	0.31%	0.05%	86.84%	4.51%	8.28%
	20	0.64%	0.04%	75.48%	8.84%	15.00%
Bond Pos.	10	2.06%	2.74%	7.57%	84.96%	2.67%
	20	2.28%	2.68%	24.12%	68.70%	2.22%
RER	10	2.72%	1.25%	25.71%	16.94%	53.37%
	20	2.81%	1.31%	25.74%	29.76%	40.38%

The variables in columns explain the variance in the row variables.

6. Brazil vs. Turkey

Brazil and Turkey are similar in several aspects as both economies have a history of high and volatile inflation rates until recently, have established fiscal discipline after running large levels of budget deficit for a long period in the past. Moreover, both countries have attracted capital inflows, particularly in the form of portfolio investments, i.e., hot money, thanks to this improvement in fiscal conditions along with economic growth performance. Yet, as a noteworthy difference, Brazil has been running trade surplus in recent years while Turkey's trade balance has a consistent record of deficit.

In spite of the directional discrepancy in the trade balance of these countries, we still think that Brazil constitutes a good candidate to compare with Turkey in the context of this paper. In this respect, we spare this section for a closer look at the government spending and real exchange rate developments in both countries through a historical perspective.

I. Fiscal dynamics

As stated above, Brazil and Turkey went through a similar path in terms of fiscal performance. Prior to 2000s both countries ran large fiscal imbalances which also fed the persistently high levels of inflation whereas the fiscal performances have improved considerably through the last decade. The strengthening in the fiscal discipline has become one of the key factors that increased the attraction of foreign investors to both countries.

The adjustment in Brazil's fiscal balances started in 1999 with the introduction of the primary surplus rule which aimed to ensure the sustainability of public debt. Primary

surplus rule was a part of the Fiscal Responsibility Law which imposed a institutional constraint on fiscal policies that would be enforced by all government levels. Prior to 1999, Brazilian fiscal balances deteriorated for four years following the implementation of the Real Plan whose primary aim was to stabilize inflation. The reasons for this deterioration through 1994 – 1998 were the high real interest rates and recognition of previously non-registered debts (Levy, 2013).

Following the introduction of primary surplus rule, Brazil experienced increasing rigidity in fiscal balance and deterioration in public investments which primarily are consisted of discretionary expenditures (Angelo da Silva and Duarte, 2007). We present two sets of statistics that indeed evidence these developments. Figure 3 demonstrates that budget deficit-to-GDP ratio followed a declining trend after 1999 while figure 4 shows that average share of government spending in GDP in 1999 – 2010 period stands almost 2 percentage points below the average registered during the 11 years (1987 - 1998) preceding the primary surplus rule.

Turkey experienced relatively modest public deficits in the first half of 1980s. On the back of the economic program which was implemented in January 1980 and aimed to create a sustainable, export-led growth path and decrease inflation, public sector borrowing requirement (PSBR) declined sharply to 4.5% of GNP in 1981, down from 9% in 1980 and stood around 5% before it started to trend upward again in 1986 (Ertugrul and Selcuk, 2001). Importantly, the share of domestic borrowing increased consistently in this period, which led to higher levels of domestic real interest rates and jeopardized the growth performance due to its crowding out effect on private investment, given the low levels of domestic savings.

Figure 3: Brazil - Budget balance and real exchange rate

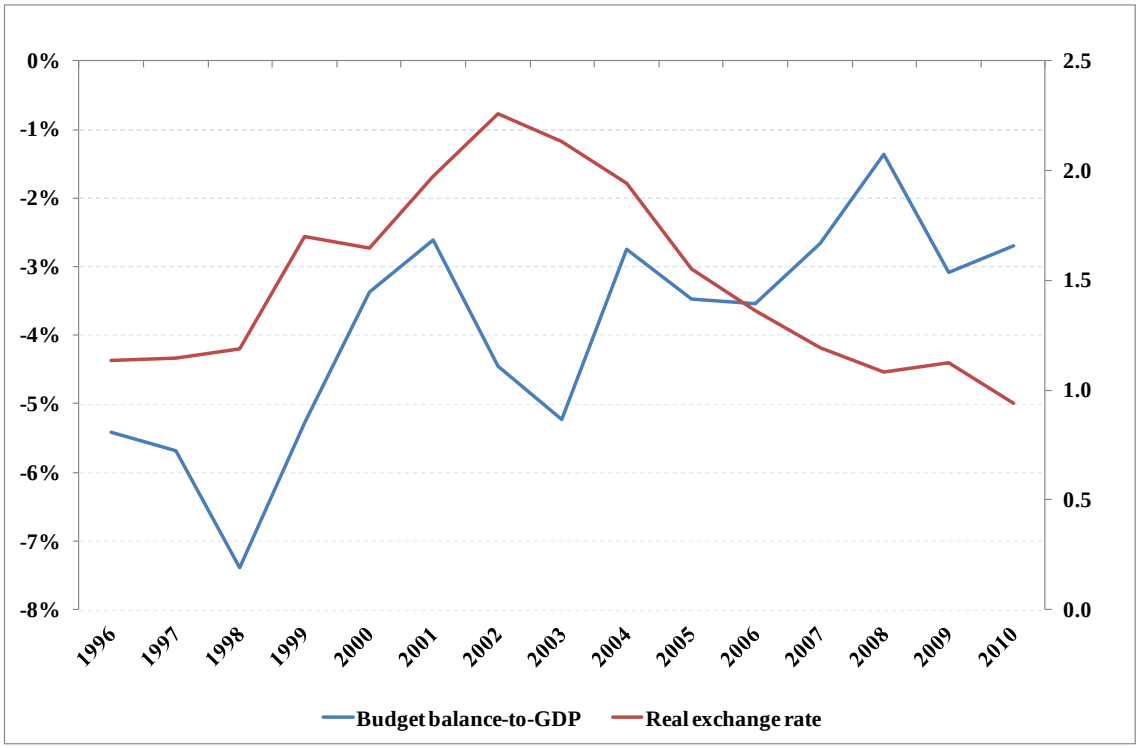
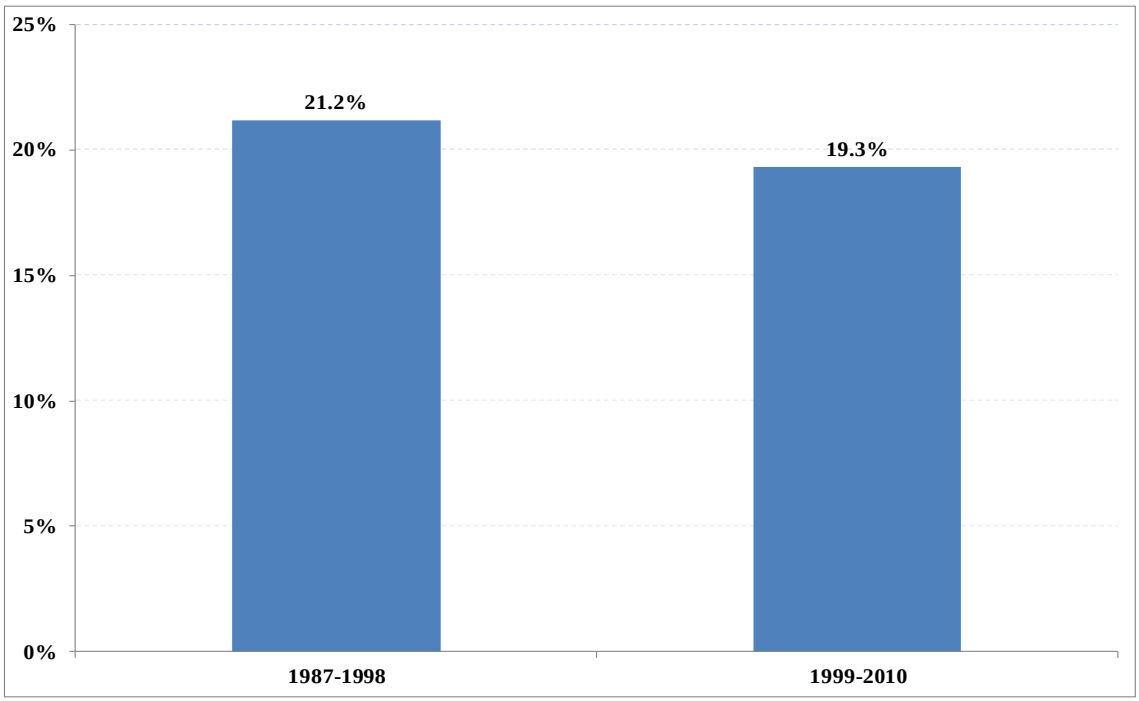


Figure 4: Brazil – Average share of government spending in GDP



The combination of unsustainable fiscal policy path and external imbalances led to a twin deficit crisis in 1994. Although PSBR-to-GNP ratio somewhat eased in the aftermath of 1994 crisis management, the ratio hit 15.5% in 1999 (Pamukcu and Yeldan, 2005). From a broader perspective, in order to achieve high levels of economic growth, the governments applied a loose tax policy and excessive deficit financing, through 1990s which deteriorated the fiscal balances so significantly that the resulting volatility, ironically, hurt growth as Turkey experienced three main crisis during this period.

As the aforementioned fiscal policy framework proved to be unsustainable, the government started an economic programme, i.e., the 17th Stand-by Agreement, one of whose main objectives was to tighten the PSBR and bring public debt to sustainable levels, in collaboration with IMF in 1999. Despite the severe crisis period of 2000 – 2001 which resulted in significant contraction of the economy, the government continued to apply the fiscal consolidation policies including a primary surplus rule, in addition to completing 18th and 19th Stand-by Agreements with IMF. Following the completion of the latter agreement in 2008, the government announced its first Medium Term Programme, which is consisted of official targets for several macroeconomic parameters for the following three years with a primary focus on fiscal front. In this sense, it might be seen as a detailed outline of a legally binding fiscal policy rule. Thanks to the consistently applied fiscal consolidation throughout 2000s, fiscal balances have improved considerably. As shown in figure-5, public debt-to-GDP ratio eased to 36.4% in 2012, down from 77.9% in 2001. In a similar manner, figure-6 demonstrates that budget deficit-to-GDP ratio declined from to 2.3% in 2012, down from 13.9% in 2002.

Figure 5: Turkey – Public debt-to-GDP ratio

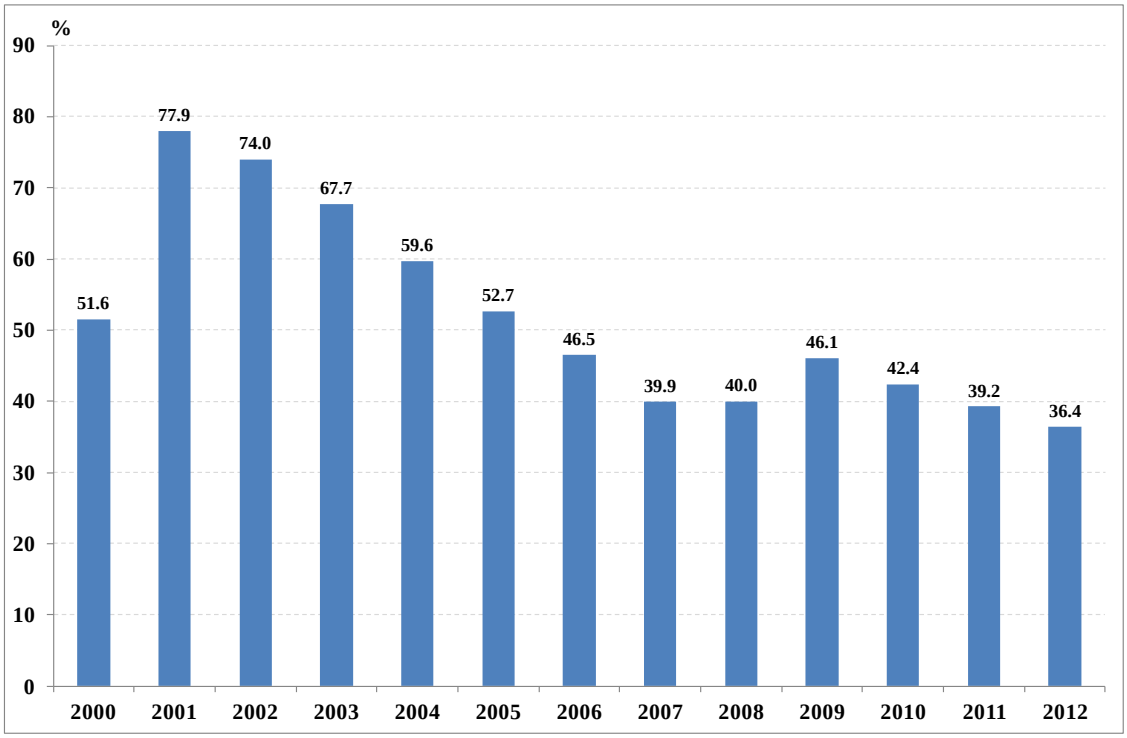
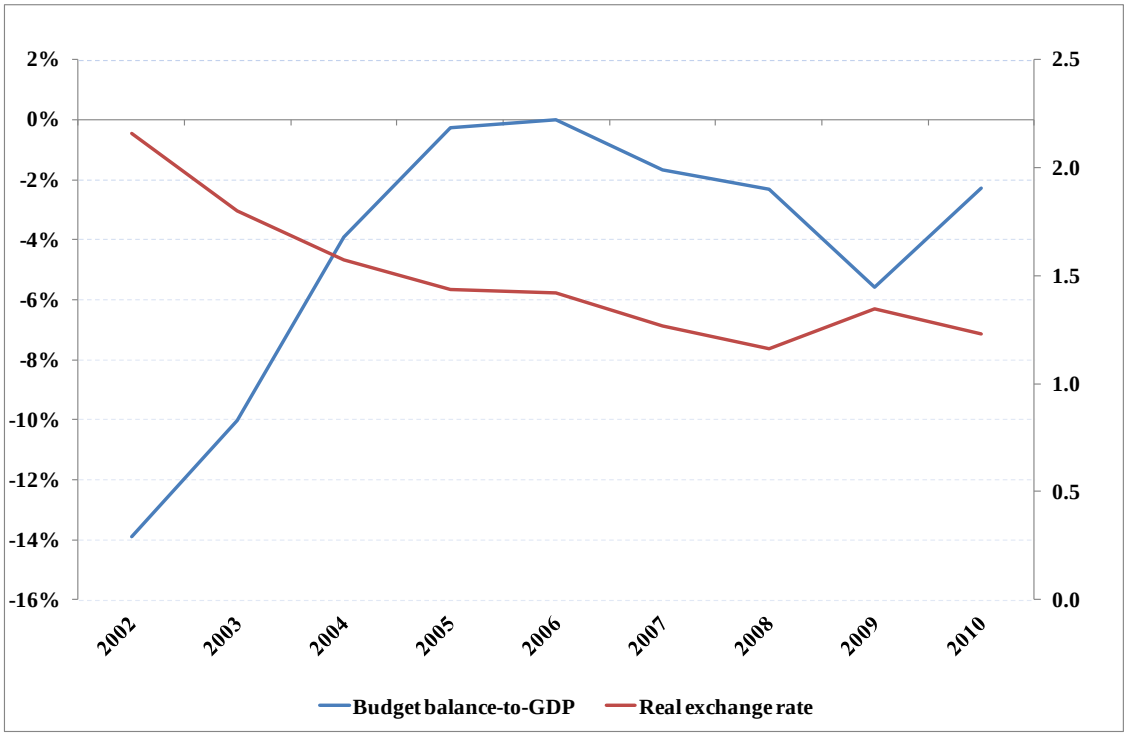


Figure 6: Turkey – Budget balance and real exchange rate



II. Exchange rate developments

Brazil's currency was mainly "crawling pegged" to the U.S. dollar during 1967 – 1990 period (Francisco, 2010). Yet, as an exception, the currency was fixed in terms of the U.S. dollars in 1986 which was short-lived and was followed by a short period when the exchange rate was adjusted by less than the inflation rate as a part of the stabilization programme implemented by the policymakers. This implementation led to an appreciation of the currency. After the devaluation in 1991, policymakers introduced an exchange rate regime that aimed to keep the currency stable in real terms.

In July 1994 the new currency, Real, was introduced with a floating exchange rate subject to a floor of 1 Real per U.S. dollar, which was followed by appreciation in both nominal and real terms. The exchange rate regime was subject to adjustable bands between 1995 and 1999. In the aftermath of the Asian crisis in 1997 and Russian crisis in 1998, Brazil experienced a currency crisis in 1999 and switched to an independently floating exchange rate regime which is still effective.

Turkey ran "adjustable peg" regime until 1980. Pre-1980 period witnessed a number of devaluations of currency on the back of both country specific properties such as the discrepancy between the official and black market exchange rates which was driven by the unsustainable levels of current account deficit the heavy dependence of the economy on imported goods including machinery and oil, and external shocks such as the collapse of Bretton-Woods and oil price shocks (Gormez and Yilmaz, 2007). Exchange rate regime was switched from "adjustable peg" into "crawling peg" in1981. In the aftermath of 1994 economic crisis which was mainly driven by the accumulating fiscal imbalances, along with the usual suspect, unsustainable current account deficit, the Central Bank implemented a policy framework that aims stability in financial

markets. As a part of this framework, the involvement of the Central Bank in the FX market increased and the exchange rate regime evolved into a managed float between 1995 -2000.

Along with the implementation of IMF Stand-by Agreement in 2000, "managed float" regime was replaced by "tablita" where the Central Bank announced the daily exchange rates. This was followed by the introduction of a widening band around exchange rate in July 2001, which might be considered as an intermediate step before implementing the fully flexible exchange rate regime in 2002, as the former regime was hard to maintain in the aftermath of 2001 financial crisis. Flexible exchange rate regime is currently in effect.

Importantly, as the recently increasing level of capital inflows to Turkey has created an appreciation pressure on the Turkish lira and imposed risks on financial stability – one of the two main targets of the Central Bank, along with price stability - the Central Bank announced that an annual appreciation of 2 – 2.5% in real effective exchange rate is desirable and the Bank would be reacting should the appreciation exceed this benchmark. This might be considered as some type of band target for real exchange rate. Moreover, although the Central Bank does not target any level in nominal exchange rate, it intervened into the FX market either directly or via holding FX auctions on several occasions. We have observed a series of these interventions since mid June following the depreciation in the domestic currency which has been mainly driven by the upward adjustment in global interest rates as well as the recent political unrest.

Overall, a closer look at the cases for Brazil and Turkey yield that improvement in fiscal discipline especially in the recent years coincide with more appreciated currency

in real terms, for each country, as documented in figures 3 and 6. In this sense, the experiences of both countries are in line with the evidence from our panel analysis and previous empirical studies. Additionally, the appreciation trend in the currencies, might be further highlighted as stronger fiscal stance translates into lower risk premiums for countries which contributes to the nominal appreciation pressure.

7. Conclusion

Using annual data from a panel of 24 developing countries from 1950 -2010, we identified the effects of government shocks on output, consumption and real exchange rate. According to our results, following a positive shock in government spending, output declines on impact which contradicts with the theory and previous empirical evidence. Consumption also declines which might be due to the fact that the rise in government spending crowds out private consumption. If the magnitude of this crowding out is larger than the stimulative effect of higher government spending, this would explain our contradictory finding regarding the response of output. On the other hand, the response of real exchange rate is in line with the previous empirical findings as it depreciates immediately after the government spending shock and the impact peaks at the end of the third year.

The impulse response analysis for our alternative specification which includes bond position, in addition to the four variables in the benchmark model, yields similar results regarding the response of output, consumption and real exchange rate although the magnitude of the impact on real exchange rate is limited compared to the prior. Moreover, bond position declines in response to an innovation in government spending which is in line with the predictions of the dynamic model proposed by Kollmann (2010). Importantly, we also showed that real exchange rate appreciates in response to positive shock in bond position which is also consistent with the theoretical basis as higher levels of bond holdings, i.e., net foreign assets, indicate a better capability to finance trade deficit and thus less downside pressure on currency.

Overall, our main results are in line with the previous empirical studies. Our main conclusion that a positive (negative) shock to government spending leads to depreciation (appreciation) of the currency in real terms poses emphasis on external

competitiveness implication of the fiscal policy that should be taken into consideration by the policymakers while designing the policy framework. One additional channel that might be added to this framework, in order to deepen the understanding of the relationship between government spending and real exchange rate, might be the interaction between fiscal stance and risk premium which would in turn affect the currency.

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Appendix 1: List of Countries Used in the Analysis

1. Argentina
2. Brazil
3. Chile
4. China
5. Colombia
6. Czech Republic
7. Egypt
8. Ethiopia
9. Hungary
10. India
11. Indonesia
12. South Korea
13. Malaysia
14. Mexico
15. Morocco
16. Phillippines
17. Peru
18. Poland
19. Romania
20. Russian Federation
21. South Africa
22. Sri Lanka
23. Thailand
24. Turkey

Appendix 2: Im-Pesaran-Shin (IPS) Unit Root Test

	IPS	
	Test statistic	**p-value**
Output	-20.512	0.0000
Gov. spending	-1.9660	0.0025
Consumption	-2.3070	0.0000
Net for. asset	-1.4140	0.0787
Real exch. rate	-3.765	0.0000