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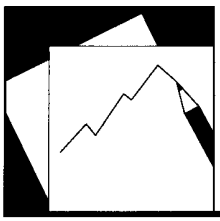

IMF Working Paper

The Economic Effects of Fiscal Consolidation with Debt Feedback

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The Economic Effects of Fiscal Consolidation with Debt Feedback

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Abstract

The past several years of recession and slow recovery have raised much interest on the effect of fiscal stimulus on economic activity, even as high public debts in many countries would call for fiscal consolidation. To evaluate the delicate balance between stimulus and consolidation requires measuring the size of fiscal multipliers, which often depends on having quarterly data so that exogenous fiscal policy shocks can be identified. We estimate fiscal multipliers using a novel methodology for identifying fiscal shocks within a structural vector autoregressive approach using annual data while controling for debt feedback effects. The estimation focuses on regions with scarce quarterly data (mostly low-income countries), and uses results for advanced economies, emerging market countries, and other broad groupings for which alternative estimates are available to validate the methodology. Differently from advanced and emerging market economies, fiscal consolidation in low-income countries has only a small temporary negative effect on growth while raising medium-term output. Shifting the composition of public spending toward capital expenditure further supports long-run growth.

JEL Classification Numbers: E60, E62, H30

Keywords: Central America, Identification, Fiscal mulpiliers, Consolidation, SVECM

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CONTENTS

I. INTRODUCTION[1]

There has been a renewed interest in the macroeconomic effects of fiscal policy since the 2007–08 food and fuel price hikes followed by the global financial crisis. While fiscal stimulus could smooth the negative effects of shocks, many economies were facing hard budget constraints. Several analysts, thus, feared that more debt accumulation would be counterproductive, as negative expectations about fiscal sustainability could raise market interest rates and end up having a contractionary effect on aggregate production. In this context, the adequacy of fiscal stimulus would depend on public debt levels and external financing needs—key determinants of the decision to consolidate fiscal accounts. Adding to the policy challenges, little information about the impact of fiscal stimulus on real activity (the so-called "fiscal multipliers") has hampered the evaluation of trade-offs between stimulus and consolidation in several regions of the world. These issues have been debated publicly. For instance, recent IMF publications (IMF, 2012a and b)[2] have focused on how fiscal policy has influenced the economic outlook during the crisis. In particular, IMF (2012b) finds that fiscal multipliers appear to be higher than what is generally assumed by forecasters, pointing to still-pervasive uncertainty on how to calculate fiscal multipliers in a diverse country setting.

Against this backdrop, this paper develops a methodology to calculate fiscal multipliers using annual data and accounting for feedback effects from debt accumulation to growth. The policy discussion focuses on regions of the world with scant evidence on fiscal multipliers while addressing the following questions: Systematically accounting for the size of the public debt and its dynamic, how can growth-friendly fiscal consolidation be enacted in under-studied regions of the world? Are improvements in tax collection less disruptive to growth than spending cuts? Is curbing current spending less disruptive to growth than curbing capital spending?

To answer these questions, the paper estimates short- and medium-term fiscal multipliers for Central American countries (for the first time in the literature), and a set of advanced, emerging market, oil exporter, low-income, heavily-indebted poor, and Sub-Saharan African countries. It builds on the structural vector autoregressive approach by Blanchard and Perotti (2002) to identify exogenous fiscal policy shocks using quarterly data and on the setup of Giavazzi (2007) to explicitly account for the effect of public debt feedback on fiscal multipliers. Because one important motivation for this paper is to provide estimates for Central American countries and other regions that do not have quarterly fiscal data, we depart

[1] We thank IMF seminar participants, Przemek Gajdeczka, Jesus Gonzalez-Garcia, Miguel Savastano, Gilbert Terrier, Andrew Berg, Susan Yang, Andrew Swiston, Martine Guerguil, Luc Eyraud, Anke Weber, and Christian Johnson for helpful comments and discussions. We also thank Alexander Herman for excellent research assistance. All remaining errors are our own.

[2] Baum et al. (2012) and Blanchard and Leigh (2012) are the respective background studies.

from Blanchard and Perotti (2002) and use cointegrating techniques to identify key terms in the vector autoregression's (VAR) variance-covariance matrix. The proposed modeling approach also assesses the impact of different modalities of fiscal consolidation—current and capital expenditure cuts or tax revenue increases—on economic growth for specific countries and various country grouping.[3] To compare the estimated multipliers across countries, annual data are employed from 1972 to 2010 even for groupings of countries possessing quarterly fiscal data and previous estimates of fiscal multipliers.

The results show that fiscal multipliers are generally significantly different from zero (at least in the first three years following fiscal policy shocks). They imply a *positive* medium-term effect of fiscal consolidation on output in most Central American and low-income countries, more so if this consolidation is based on either increases in tax revenues or cutting government's current spending (while, in general, cuts in capital spending are bad for short- and medium-term output). Advanced and emerging market economies are also shown to post better medium-term output effects when fiscal consolidation focuses on current spending cuts, although the medium-term effects of fiscal consolidation in these countries remain negative—results consistent with evidence in recent papers.

The contributions of the paper to the literature are twofold. First, the estimated fiscal multipliers cover a wide range of countries, from heavily indebted countries and low-income countries to emerging market and advanced countries. Given that many of these countries face the challenges of fiscal consolidation, the analysis takes debt feedback into account when estimating the multipliers. Second, given limited high frequency data across countries, the paper employs annual data and pays greater attention to the identification approach by using structural vector error-correction model, SVECM, techniques.

The rest of the paper is organized as follows. Section II briefly discusses past attempts to address identification issues when estimating fiscal multipliers. Section III presents an econometric model strategy for identifying fiscal shocks with annual data and debt feedback effects. Section IV provides a brief discussion of recent fiscal developments in Central America, Panama and the Dominican Republic (CAPDR), followed by a discussion of the estimated fiscal multipliers for countries in the region, as well as comparator country grouping. These groups include low-income countries (LIC), heavily indebted countries (HIPC), sub-Saharan Africa (SSA), emerging market countries (EME), oil producing countries, and advanced economics (AE). Section V concludes the paper.

[3] The overall approach proposed here is consistent with Ilzetzki, Mendoza, and Vegh (2010), who find that the effects of fiscal shocks on growth depend crucially on key country characteristics (public indebtedness, exchange rate regime, etc).

II. Past Attempts to Identify Discretionary Fiscal Policy Changes

A fiscal multiplier is the ratio between output change and an exogenous variation in the fiscal deficit with respect to their baseline values. Past work has shown that the size of the fiscal multiplier depends on the country, its business cycle stance, time period, special circumstances (including monetary and exchange rate regimes, its degree of financial integration, and the extent of openness, etc), and the methodology used to estimate them.[4] In addition, instantaneous impacts and cumulative effects of fiscal shocks can differ. Multipliers can even be negative—a phenomenon named "contractionary fiscal expansions"—if, for instance, wider interest-rate spreads depress economic activity despite the initial positive impulse from larger net government demand.

Identifying exogenous fiscal policy shocks is an essential step for estimating the output multipliers. In essence, estimating fiscal multipliers requires isolating fiscal policy shocks from the initial influence of economic conditions, due to the bi-directional causality between government spending or tax revenue and growth. The most promising strand of research aiming to isolate discretionary fiscal policy shocks uses vector-autoregression methods (VARs). To date, this strand exhibits five main lines of inquiry for identification of policy shocks.

The first is the recursive approach originally introduced by Sims (1980) and applied by Fatás and Mihov (2001) in the study of fiscal policy, which assumes a causal ordering (from most exogenous to the most endogenous) of variables.

The second is the event-study approach (also called the fiscal-dummy approach) introduced by Ramey and Shapiro (1998). This strategy assumes that the U.S. government spending increases associated with the Korean War, the Vietnam War, and the Reagan military buildup were exogenous to the state of the economy. Thus, in those cases, there is no need to identify the structural form of the VAR model and the analysis can be based on a reduced-form VAR. This line of argumentation was also used more generally to study the effects of large unexpected increases in government defense spending by Edelberg et al. (1999), Eichenbaum and Fisher (2005), Perotti (2007), and Ramey (2007) among others. This approach is now generally called "the narrative" approach as recently developed by Romer and Romer (2010), and Favero and Giavazzi (2012). The framework typically, first attempts to determine the size and the timing of truly exogenous changes in fiscal outcomes (say, "legislated tax") using information from policy documents. Then, the "narrative" shocks are shown (e.g. Favero and Giavazzi, 2011) to be orthogonal to the relevant information in the SVAR model, thus dispensing the inversion of the moving-average representation of a VAR for identification of fiscal shocks.

[4] See for instance Ilzetzki (2011) and Ilzetzki et al. (2010). Caldara and Kamps (2008) show that the lack of robust stylized facts is due to differences in VAR model specification, identification schemes, and fundamentally different fiscal policy experiments across studies.

The third approach is related to the sign-restriction literature, which identify models by imposing restrictions on the acceptable impulse responses to shocks (Faust, 1998, and Canova and de Nicoló, 2002). The application to fiscal policy was introduced by Uhlig (2005) and Mountford and Uhlig (2005). The approach does not impose any zero restrictions on the impulse responses, instead restricting the sign of the impulse responses for a number of quarters after a shock occurred. Mountford and Uhlig (2005) address the problem of the positive correlation of output and revenue residuals by first identifying a business cycle shock and, then, requiring the government revenue shock to be orthogonal to the business cycle shock. An advantage of this approach is that unlike the recursive approach, it does not impose a zero restriction on the initial output response to a revenue shock. Also, unlike several structural VAR approaches, it does not require a two-step estimation procedure. However, a disadvantage of this approach is that by attributing a positive correlation between output and revenue residuals entirely to business cycle shocks, it rules out (by construction) non-Keynesian effects of fiscal policy (see, e.g., Giavazzi et al., 2000).

The fourth approach is the now popular normalization and restrictions on the contemporaneous relationships between variables in a Structural VAR (SVAR). While it has been widely applied to monetary policy (see Bagliano and Favero, 1998, for a review), it was first proposed by Blanchard and Perotti (2002) and extended by Perotti (2005). These authors use (i) institutional information about tax, transfers, and spending programs to construct parameters, and (ii) the reaction timing of policymakers to GDP shocks to identify parts of the variance-covariance matrix. They make the crucial assumption that policymakers and legislatures would take more than a quarter to learn about a GDP shock and decide which fiscal measures to take in response of a shock. This strategy cannot be used with annual data.

The fifth approach takes into consideration the longer-run properties of fiscal variables, economic activity, and other endogenous variables that enter the VAR system, generally in the form of a vector error-correction model (VECM). The VECM captures these long-run properties of the VAR system variables through their cointegrating relationships. Hence, as shown in Pagan and Pesaran (2007), the VECM provides a further identification tool. This approach can be seen as an extension of the Blanchard and Quah (1989) methodology as there is a clear correspondence between SVARs and VECMs.[5,6]

[5] SVECM is a particular case of SVAR. Basically, Pesaran (2007) shows the correspondence between (S)VAR in level (where all endogenous variables are I(1)) and (S)VECM (where all endogenous variables are I(0)). More generally, Pagan and Pesaran (2007) propose an identification strategy for an SVAR in which the endogenous variables are a mix of I(1) and I(0) series.

[6] Dynamic stochastic general equilibrium (DSGE) models are also widely used for estimating fiscal multipliers. However, recent criticisms of this approach pointed to their weak identification schemes. For example, Fève et al. (2012) argue that both short-run and long-run government spending multipliers obtained by this method may be downward biased.

III. IDENTIFIYING FISCAL POLICY SHOCKS WITH DEBT FEEDBACK AND ANNUAL DATA

As discussed in the previous section, there are several ways to undertake identification of fiscal policy shocks in SVARs. However, because many countries do not have high-frequency information as a group, this paper develops a way to identify exogenous fiscal policy shocks using annual data.[7] In particular, we nest the traditional short-run restrictions and take into account the long-run properties of the model through the use of cointegrating relationships (Pagan and Pesaran, 2008; and Dungrey and Fry, 2009) to identify fiscal shocks. Further, we follow Favero and Giavazzi (2007) which extends the Blanchard and Perotti (2002) and Perotti (2005) SVAR to account for a government's budget constraint. We consider the following SVAR model

$$A_0 Y_t = A(L)Y_{t-1} + F(L)d_t + B\varepsilon_t \qquad [1]$$

The evolution of the debt ratio depends on the government budget constraint

$$d_t = \frac{(1+i_t)}{(1+\Delta p_t)(1+\Delta y_t)} d_{t-1} + \frac{Exp(g_t) - Exp(t_t)}{Exp(y_t)} \qquad [2]$$

Where the vector of endogenous variables, $Y_t = \left[g_t, t_t, y_t, reer_t, i_t \right]'$, includes government spending (g_t) defined as the sum of government consumption and investment (excluding interest payment), net revenue excluding interest receipt on government debt (t_t), real output (y_t), real effective exchange rate ($reer_t$), and the yield on government securities ($reer_t$). $\varepsilon_t = \left[\varepsilon_t^g, \varepsilon_t^t, \varepsilon_t^y, \varepsilon_t^{er}, \varepsilon_t^i \right]'$ is the vector of structural shocks to the endogenous variables and $e_t = \left[e_t^g, e_t^t, e_t^y, e_t^{er}, e_t^i \right]$ is the corresponding innovation. A_0 is the matrix of contemporaneous parameters, L is the lag operator, $A(L)$ is the matrix of VAR parameters, and B is the structural matrix associated with innovations.

Identification is achieved with assumptions about policy decision lags and estimated elasticities through cointegrating properties. As defined in Banchard and Perotti (2002) and in Perotti (2005), observed fiscal policy reactions (expenditure and tax):

$$e_t^g = \left(\alpha_{g,y} e_t^y + \alpha_{g,er} e_t^{er} + \alpha_{g,i} e_t^i \right) + \left(\beta_{g,g} \varepsilon_t^g + \beta_{g,t} \varepsilon_t^t \right) \qquad [3]$$

Or

$$e_t^g - \alpha_{g,y} e_t^y - \alpha_{g,y} e_t^y - \alpha_{g,y} e_t^y = (\beta_{g,g} \varepsilon_t^g + \beta_{g,t} \varepsilon_t^t) \sim I(0) \qquad [3']$$

[7] Contrary to a number of studies focusing on clusters, the model proposed in this section is tailored for each country to account for their idiosyncratic factors (on monetary, exchange rate, trade, and fiscal policies) as well as vulnerabilities and structural breaks.

$$e_t^t = \left(\alpha_{t,y} e_t^y + \alpha_{t,er} e_t^{er} + \alpha_{t,i} e_t^i\right) + \left(\beta_{t,g} \varepsilon_t^g + \beta_{t,t} \varepsilon_t^t\right) \quad [4]$$

are functions of (i) automatic responses of spending/ tax to output, exchange rate, and financial shocks; (ii) systematic discretionary responses of fiscal policy to macroeconomic system; and (iii) random discretionary fiscal policy shocks. The relation between the structural shocks and the innovation is thus given by:

$$\begin{bmatrix} 1 & 0 & -\alpha_{g,y} & -\alpha_{g,er} & -\alpha_{g,i} \\ 0 & 1 & -\alpha_{t,y} & -\alpha_{t,er} & -\alpha_{t,i} \\ -\gamma_{y,g} & -\gamma_{y,t} & 1 & 0 & 0 \\ -\gamma_{er,g} & -\gamma_{er,t} & -\gamma_{er,y} & 1 & 0 \\ -\gamma_{i,g} & -\gamma_{i,t} & -\gamma_{i,y} & -\gamma_{i,rer} & 1 \end{bmatrix} \begin{bmatrix} e_t^g \\ e_t^t \\ e_t^y \\ e_t^{er} \\ e_t^i \end{bmatrix} = \begin{bmatrix} \beta_{g,g} & \beta_{g,t} & 0 & 0 & 0 \\ \beta_{t,g} & \beta_{t,t} & 0 & 0 & 0 \\ 0 & 0 & \beta_{y,y} & 0 & 0 \\ 0 & 0 & 0 & \beta_{er,er} & 0 \\ 0 & 0 & 0 & 0 & \beta_{t,t} \end{bmatrix} \begin{bmatrix} \varepsilon_t^g \\ \varepsilon_t^t \\ \varepsilon_t^y \\ \varepsilon_t^{er} \\ \varepsilon_t^i \end{bmatrix} \quad [5]$$

Or in an equation format: $A_0 e_t = B\varepsilon_t$.

[5

A just-identification of [5] would require $\frac{5(5+1)}{2} = 15$ restrictions on the A_0 matrix (left-hand-side of [5]), implying that 5 additional restrictions are needed.

1. $$\alpha_{g,i} = \alpha_{t,i} = 0 \quad [6]$$
   on the grounds that interest payments on government debt are excluded from the definition of expenditures and taxes used in the model. Furthermore, the contemporaneous impact of interest rates on taxes is likely to be small or close to zero in practice.[8]
2. The interest rate on government debt depends on the fiscal stance and the exchange rate, but (contemporaneously) less on output. Thus:
   $$\gamma_{i,y} = 0 \quad [7]$$
3. We now need (at least) 2 restrictions. Most studies using high frequency data have assumed that either expenditures or taxes do not respond to economic activity within a quarter ($\alpha_{g,y} = 0$ and $\alpha_{t,y} = 0$). Such assumption may not hold for annual data and that is why we use cointegration analysis to impose the missing identification assumptions. Suppose that there is at least one cointegrating relationship (which is likely to be the case, given that, by construction, all system variables enter in level and generally follow I(1) processes), then estimates of the automatic response of taxes to changes in the economic environment and the exchange rate or the automatic response of government spending to economic or exchange rate shocks could be obtained.

[8] However, the assumption that tax is inelastic to interest rate change is controversial given that the income tax-base includes interest income as well as dividends, which co-move negatively with interest rate.

More precisely, with one cointegrating vector,[9] the structural VECM counterpart of the baseline model [1] is:

$$A_0\Delta y_t = a\left[\beta' y_{t-1}\right] + A_1\Delta y_{t-1} + F(L)d_t + B\varepsilon_t \qquad [8]$$

where $a = A_0\alpha$ and α is the loading parameter.

With such cointegrating relationship between government spending, output growth, and exchange rate, the remaining two coefficients can be obtained by: [10]

$$y_{g,t-1} - \beta_2 y_{t,\,t-1} - \beta_3 y_{y,t-1} - \beta_4 y_{er,t-1} - \beta_5 y_{i,t-1} = \mathrm{ECM}_{t-1} \qquad [9]$$

Parameters of [3'] can be proxied by estimates from [9]. With this strategy, all fiscal shocks are identified and the matrix A_0 can be fully estimated.

We now extend the previous model to six endogenous variables in which we split total expenditure (excluding interest payment on debt) into capital expenditure (labeled by "ca") and current spending (labeled by "cu"). The expanded equation [5] with 6 endogenous variables is:

$$\begin{bmatrix} 1 & 0 & 0 & -\alpha_{ca,y} & -\alpha_{ca,er} & -\alpha_{ca,i} \\ 0 & 1 & 0 & -\alpha_{cu,y} & -\alpha_{cu,er} & -\alpha_{cu,i} \\ 0 & 0 & 1 & -\alpha_{t,y} & -\alpha_{t,er} & -\alpha_{t,i} \\ -\gamma_{y,ca} & -\gamma_{y,cu} & -\gamma_{y,t} & 1 & 0 & 0 \\ -\gamma_{er,ca} & -\gamma_{er,cu} & -\gamma_{er,t} & -\gamma_{er,y} & 1 & 0 \\ -\gamma_{i,ca} & -\gamma_{i,cu} & -\gamma_{i,t} & -\gamma_{i,y} & -\gamma_{i,er} & 1 \end{bmatrix} \begin{bmatrix} e_t^{ca} \\ e_t^{cu} \\ e_t^{t} \\ e_t^{y} \\ e_t^{er} \\ e_t^{i} \end{bmatrix} = \begin{bmatrix} \beta_{ca,ca} & \beta_{ca,cu} & \beta_{ca,t} & 0 & 0 & 0 \\ \beta_{cu,ca} & \beta_{cu,cu} & \beta_{cu,t} & 0 & 0 & 0 \\ \beta_{t,ca} & \beta_{t,cu} & \beta_{t,t} & 0 & 0 & 0 \\ 0 & 0 & 0 & \beta_{y,y} & 0 & 0 \\ 0 & 0 & 0 & 0 & \beta_{er,er} & 0 \\ 0 & 0 & 0 & 0 & 0 & \beta_{i,i} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{ca} \\ \varepsilon_t^{cu} \\ \varepsilon_t^{t} \\ \varepsilon_t^{y} \\ \varepsilon_t^{er} \\ \varepsilon_t^{i} \end{bmatrix}$$

[12]

Hence, this will require $\frac{6(6+1)}{2} = 21$ restrictions in which 15 are already obtained.

Following [6] and [7], we have $\alpha_{ca,i} = \alpha_{cu,i} = \alpha_{t,i} = 0$ and $\gamma_{i,y} = 0$ respectively. Finally, using co-integration properties, the two remaining coefficient are determined.

[9] The SVECM representation also hold with mix of I(0) and I(1) system variables. We assume shocks are either temporary or persistent.

[10] Typically, this would imply that that $\beta_{g,g}u_t^g + \beta_{g,t}u_t^t$ or $\beta_{t,g}u_t^g + \beta_{t,t}u_t^t \sim$ I(0)

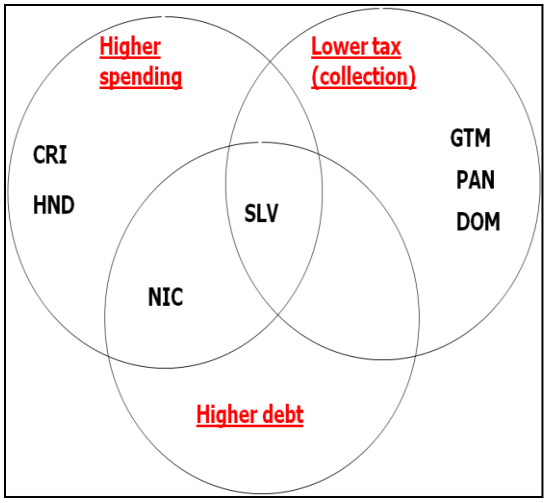
IV. Estimation Results[11]

A. Fiscal Policy in Central America as a case study

Fiscal policy was, in general, procyclical in Central America (including Panama and the Dominican Republic or CAPDR) through the late 1990s. As argued by Talvi and Végh (2000), this stylized fact seems to be valid for most of Latin America and the Caribbean. The authors show that procyclical fiscal policy contributed to deepen business cycles in the region, as governments generally relax their policies during booms and restrict them during busts due to weak institutions, unfavorable political economy, and volatile access to international capital markets.

However, following a decade of adjustment, CAPDR used counter-cyclical fiscal policy to withstand the late 2000s crises. The food and fuel price hikes (2007–08) and the recent global financial crisis hit CAPDR severely. Thanks to strong policy buffers built in the 2000s, appropriate counter-cyclical fiscal policy responses allowed CAPDR withstand the adverse effects of the crises. Lopez-Mejia (2012) argues that most countries accommodated lower import-related tax collections (import duties and indirect taxes levied on imports) and lower domestic-tax receipts during the 2008–09 downturn; and that at the same time, government expenditures increased (except for the Dominican Republic) to support demand.[12]

Despite the general countercyclical response in the region, there are clusters within CAPDR, with additionally important cross-country differences. Indeed, Morra (2011) shows that the size of the fiscal stimulus varied across countries. For instance, in Nicaragua the fiscal stimulus was close to zero and in Panama it was quite large. Moreover, among the countries in the region that have implemented some type of fiscal stimulus during the global financial crisis, the measures did not seem to produce similar outcomes, probably because of differences in the degree of policy credibility, financial integration, and dollarization, among other factors.



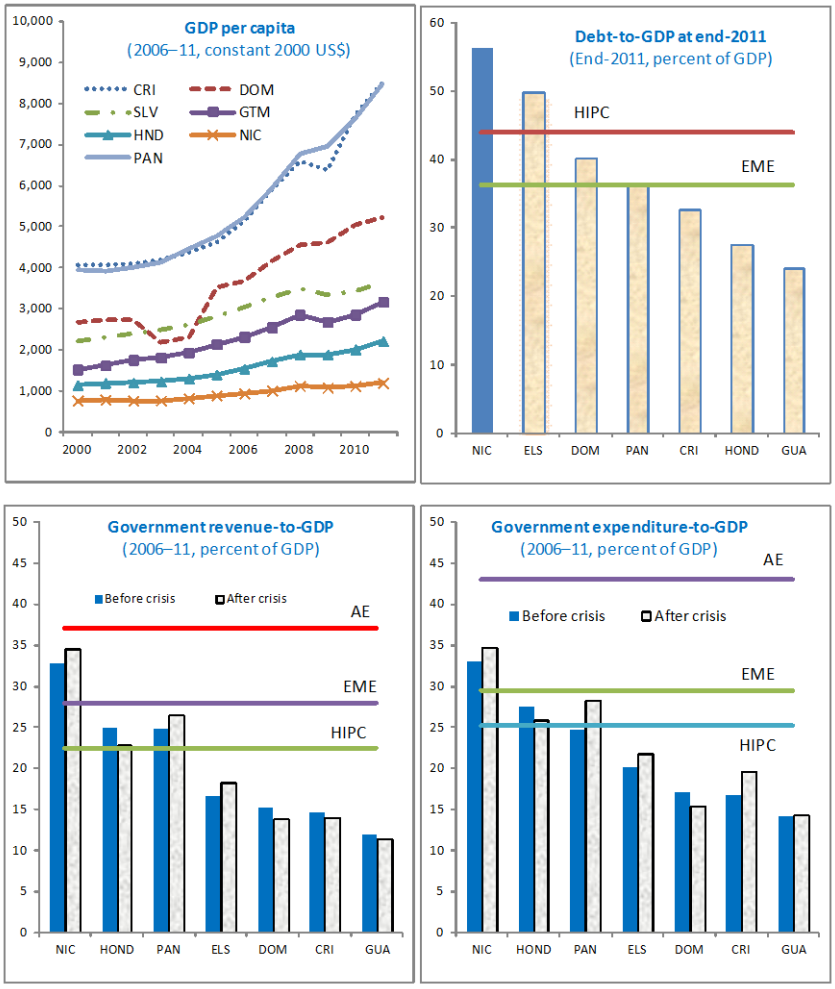
Following a generally countercyclical fiscal policy in CAPDR, public debt could be reduced in some countries, given their high vulnerability to weather and external shocks, which

[11] Detailed estimation results, as well as the raw econometric output, can be obtained from the authors.

[12] Chapter 4 of the upcoming book: "Central America: Challenges Following the 2008–09 Global Crisis."

would require policy buffers.[13] (Figure 1) In addition, while fiscal policy can boost growth through its multiplier, high public debt could dampen its effectiveness. Finally, reducing debt would help to improve the countries' sovereign credit risk rating.[14] While consolidation is a major issue in some of these countries, others may need to raise taxes from very low levels to improve the provision of public services. In this context, knowing how fiscal policy changes would affect economic performance in the region is an important priority.

Figure 1. Central America and Regional Peers: Selected Economic Indicators



Sources: IMF World Economic Outlook; and authors' calculations.

[13] The Center of Research on the Epidemiology of Disasters' estimates that the average cost of natural disasters in CAPDR has been about 2 percent of GDP per year over 1990–2009. Laeven and Valencia (2008) show that the average costs of financial crisis across the world in 1970–2007 has been about 13.3 percent of GDP while that of Nicaragua in 2000 and Dominican Republic in 2003 were 18 percent and 21 percent of GDP respectively.

[14] Bannister and Barrot (Chapter 4 of Piñon at el, 2012) use the approach of debt intolerance to estimate the debt reduction that would support an improvement in the credit risk rating of sovereign debt in the region. Overall, they find that debt-to-GDP ratios would have to be, on average, 16 percentage-points lower than the ones observed at the end of 2009.

B. Empirical Modeling Approach

The analysis uses annual data for 1973–2011 from the IMF International Financial Statistics and IMF World Economic Outlook publications. The econometric modeling requires that we first proceed with various tests prior to estimating fiscal multipliers for Costa Rica (CRI), Dominican Republic (DOM), El Salvador (ELS), Honduras (HON), Guatemala (GUA), Nicaragua (NIC), Panama (PAN), Low-Income Countries (LICs), Heavily Indebted Poor Countries (HIPC), Oil producing countries (OIL), Emerging Market Economies (EMEs), Advanced Economies (AEs), and Sub-Saharan Africa excluding South Africa (SSA).[15] The country-specific SVAR models are derived by following several steps: (i) testing for optimal lag length; (ii) testing for model stability; (iii) analyzing partial autocorrelograms to confirm the absence of serial correlation and heteroscedasticity; (iv) testing for unit roots; (v) performing cointegration analysis and setting up error-correction model (ECM) equations; (vi) transforming the SVAR into SVECM; and (vii) producing the impulse response functions from the SVECM from which both impact and cumulative multipliers are calculated as follow:

$$\text{Impact Multiplier} = \frac{\Delta y_o}{\Delta g_o} = \frac{\text{change in output at t=0}}{\text{exog. and temp. change in fiscal outcome (expenditure or taxes) at t=0}}$$

And $Cumulative\ Multiplier\ (T) = \frac{\sum_{t=0}^{T}(1+i)^{-t}\Delta y_t}{\sum_{t=0}^{T}(1+i)^{-t}\Delta g_t}$

Where, as proposed by Ilzetzki et al. (2010), i is the median interest rate in the sample.[16] Unit-root test results indicate that most of the economic variables are nonstationary. Optimal lag tests using Akaike (AIC), Schwarz (SC), and Hannan-Quinn information criterion suggests that appropriate lags vary between 1 and 2 (see Appendix 3). However, after several attempts and given the limited number of observations, we find it is useful to generalize the model to allow for 2 (when test indicates 1 lag) to 3 (when test indicates 2 lag) lags. The unrestricted VAR(2) or VAR(3) diagnostic test is conducted to ensure that the model is congruent with the data. The tests confirm the absence of serial autocorrelation and heteroscedasticity. Further, we show that the model variables are stable enough at lag 2 or lag 3 to pass the 1-up and N-down Chow tests, indicating that the system is stable. The Johansen's likelihood ratio (LR) trace test is applied to test for the cointegration rank of the five-variable system. Tests generally indicate one cointegrating equation at 5 percent significance.

To ensure (at least just) identification of the system of equations ((1)–(5)), we estimated the error-correction equation for each country or group of countries (Appendix, Table 4). Hence,

[15] Country grouping (LICs, HIPC, OIL, EMEs, AEs, and SSA) are defined according to the *World Economic Outlook*.

[16] They used the median interest rate (rather than the average) to avoid placing excessive weight on extreme events or particular countries.

rather than imposing a particular value for the automatic response of taxes to unexpected changes in GDP, our modeling strategy allows for the direct estimation of automatic stabilizers, as shown in Table 4. The overall estimated output elasticities of net taxes are statistically significant and range from 0.17 (HIPC) to 1.85 (AE) and 1.96 (EME). These results are broadly consistent with Blanchard-Perotti as well as with empirical output elasticity on quarterly data (Appendix, Table 6).[17] However, the relative low tax elasticity for HIPC and LICs (in general) is somewhat puzzling. An explanation could be that while the correlation between automatic stabilizers might be large, they could have been consistently offset by discretionary tax relief (i.e., large tax exception). It could also be that the automatic stabilizer may not be large enough in some of these countries because of lower tax bases and widespread corruption (in tax collection).[18]

C. Overall Results

The results suggest that, in general, fiscal consolidation in less developed countries hurts output only in the short-term. (Figures 2 to 4) The negative short-term effect is largest for advanced economies (AEs), significant for emerging markets (EMEs), and small for less developed economies—a result consistent with the evidence presented in Ilzetzki, Mendoza, and Végh (2010). Fiscal consolidation based on expenditure cuts tends to produce the best medium-term output effects in advanced and emerging economies, but not necessarily in less developed countries. Results for advanced economies (AEs) and emerging markets (EMs) broadly match the evidence in other papers (Appendix, Table 6), which validates the novel method we propose.[19] The cumulative multipliers—the ratios of cumulative increase in the net present value of GDP and the cumulative increase in the net present value of the fiscal variable—are computed from the impulse responses (Figures 5–11). Dashed lines show the boundaries of the 90 percent confidence interval levels (estimated by Monte Carlo simulations with bootstrapped standard errors and 500 repetitions). In general, the impact and cumulative multipliers are statistically significant from zero at the 90 percent confidence level through each horizon—but often not at the 95 percent confidence interval—with wider error bands at longer horizons.

Surprisingly, the positive long-run effect of tax increases on output tend to be higher than the positive effect of cutting spending in heavily indebted poor countries (HIPCs), low-income

[17] Typically, the empirical literature using quarterly data finds output elasticities ranging from 0 to 4 and shows that when the output elasticity of (net) taxes is greater than 2, it translates into a negative impact response of output to revenue shocks.

[18] This could also be associated with poor data quality on LICs/HIPC, a feature bound to be even worse if quarterly data were available.

[19] Recently, Ilzetzki (2011) found that government expenditure has a stronger output effect in high-income countries than in developing countries. He found that the tax multiplier is virtually zero in most countries. However, the exception was developing countries where tax multipliers range from 0.3 on impact to close to 0.8 in the long-run. See also Ilzetzki, Mendoza, and Végh (2010), IMF (2010), and Perotti (2004 and 2011).

countries (LICs), and sub-Saharan Africa (SSA). This result suggests that the stylized fact that fiscal stabilization focused on spending cuts have better growth outcomes may not apply to poorer economies. Such an outcome may be caused by inefficient tax administration in those countries and observed increases in tax revenues may be the result of improved efficiency with little distortive impacts. Most Central American countries appear to have larger tax and spending multipliers in the medium term than other countries in a similar stage of development. Specific estimates for these countries are shown in Table 1 and Figures 5-11 in the appendix. The following sections go over these results in more detail.

D. Spending Multipliers

The impact multipliers for spending cuts in Central America range from -0.01 (Nicaragua, the poorest country in the region) to -0.44 (Panama, the richest country in the region). Across country groupings, the multipliers for spending cuts are found to be between -0.01 (HIPCs) and -0.43 (AEs). In other words, a one percentage-point decline in government spending as a ratio to GDP is associated with an output contraction of 0.01 percent in HIPCs and Nicaragua and a 0.44 and a 0.43 percent output contraction in Panama and AEs in the same year it is implemented. This result is in line with Ilzetzki et al. (2011), who find evidence that the impact response of output to a negative government spending shock is negative in high-income countries and positive in developing countries.

However, the effect of fiscal consolidation provides greater growth benefits over two to four years. Particularly, spending cut multipliers in Central America range from -0.94 (Panama) to 0.43 (Nicaragua) and are positive for poorer economies (for instance, 0.41 for SSA, excluding South Africa) although not in emerging markets (-1.03) and in advanced economies (-0.8).

E. Tax Multipliers

On the tax revenue side, the impact multipliers for increases in tax collection in Central America are small and not statistically different from zero; a result that is shared by some other groups of countries (the short-run output effect of a tax increase is actually positive in HIPCs, zero in advanced economies, SSA, and LICs, and only minus 0.12 and minus 0.10 in oil-producer countries and EMEs, respectively). This is in line with Barro and Redlick (2009) who find that tax changes at a one-year lag are more likely to have an effect on output than contemporaneous tax changes. The positive impact for HIPCs could be explained by the fact that these countries are generally characterized by lower tax collection effort and higher level of debt distress, suggesting that further revenue collection effort could boost growth even in the short-run. This is also consistent with Deak and Lenarcic (2010) who, in the context of a regime switching model, show that in the presence of a debt-to-GDP ratio above 42.6 percent a positive tax revenue shock would raise output.

The cumulative effects on output of increases in tax revenue are positive for Central American countries (ranging from 0.20 in the Dominican Republic to 0.51 in Guatemala),

HIPCs, LICs, and sub-Saharan Africa, but negative for advanced and emerging market economies (as estimated in other papers), and oil producers. These results suggest that improving tax revenue collection in LICs (including HIPCs) could raise medium-term output, which is not true for either AEs or EMEs. The medium-run cumulative multiplier ranges from 0.24 (Nicaragua) and 0.57 (Panama) in Central America and from 0.34 (oil exporter countries) and 0.53 (LIC) across other country groups.

F. Capital and Current Spending Multipliers[20]

Splitting public spending into investment and current expenditure for countries in CAPDR in the SVAR model (equation 12) produces positive impacts of increases in public investment on output (generally higher than that of taxes), while increases in current spending lower output in several countries. (Figure 4) The multipliers for capital expenditures range from 0.21 to 0.70 in the short-run and 0.42 to 0.91 in the medium-run whereas the multipliers for current spending range from -0.24 to 0.19 on impact and -1.00 to -0.41 on cumulative impact. Generally, the point estimates are significantly different from zero in the short-run, while the medium-run estimates are associated with large uncertainties for both current and capital investments.[21] The estimates also show that government current expenditure tends to respond strongly to public investment. This finding is confirmed when we impose a zero restriction on government current spending to isolate the "pure" government investment effects.[22]

Overall, the results point to the importance of moving the composition of public spending toward investment. Fiscal consolidation paths should preserve (or even increase) public investment in CAPDR—an intuitive result given the capital scarcity in the region. The need to control current spending is particularly relevant for Nicaragua, which presents large negative multipliers associated to increases in current spending both in the short- and in the long-run.

More generally, our results are comparable to the existing empirical literature, while confirming that there is no such a thing as a "single multiplier". Multipliers are country (or region) and model-specific. Interestingly, our results show that the size of fiscal multipliers depends crucially on the composition (current expenditure, capital expenditure, or tax) of fiscal consolidation (or expansion), its persistence (short- versus long-run horizons), and on the extent to which monetary policy accommodates fiscal tightening (or expansion). Compared to many available papers, we produce additional results using a common

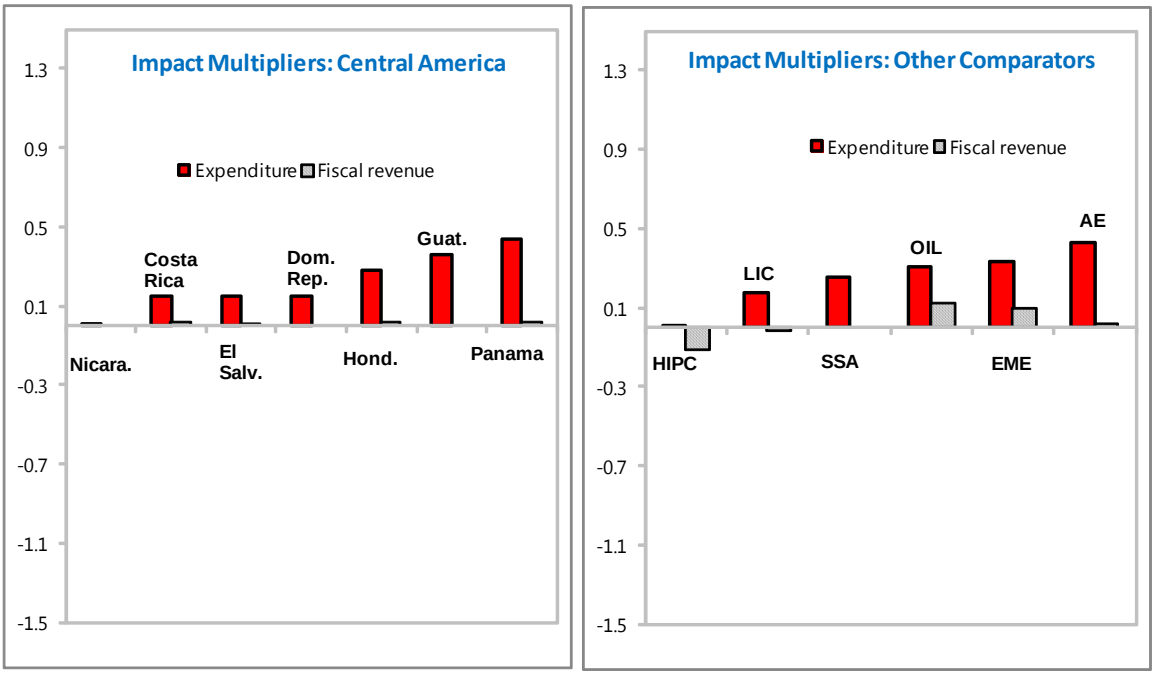
[20] Due to limited availability of data on government capital expenditure, the econometric estimations are not covering other comparators, particularly oil producers, LICs, and SSA.

[21] Nonetheless, we reject at the 95 percent confidence interval the null hypothesis that the effects of government investment are not higher than that current spending in the short-run.

[22] The relative lower share of public investment (compared to current spending) in most Central American countries and the statistical significant and positive response of current spending to public investment shocks may exert some dampening effects on the investment multiplier, hence explaining why it remains below 1.

framework, including evidence that fiscal consolidation multipliers are larger when reducing investment spending as opposed to raising taxes. We also show that fiscal consolidation multipliers tend to be smaller or negative on impact in developing and heavily-indebted countries, suggesting that while fiscal consolidation is in general contractionary in the short run, it can be expansionary in the medium run for these country groupings.

Figure 2. Real GDP Growth Effects of a One-Percentage-Point Increase in Expenditure or Cut in Tax Revenue–A SVECM Approach with Debt Feedback [1/, 2/, 3/]
(Impact)



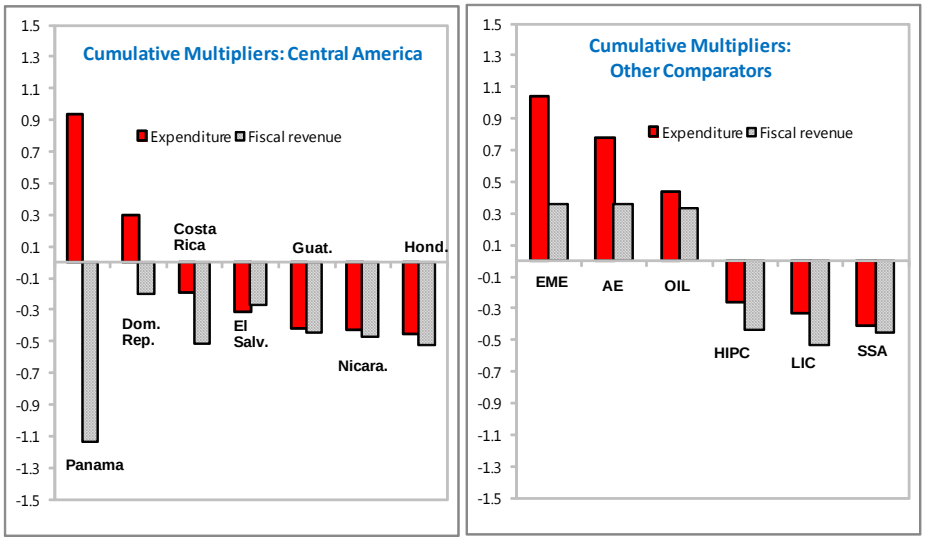
Source: Authors' estimates.

[1/] Response of output growth to a one-standard deviation of expenditure and tax shocks, rescaled to output growth response to a one-percentage-point increase in expenditure and in taxes. The cumulative multipliers are obtained as ratios of net present values as defined in Section IV.B

[2/] The identification scheme utilizes the institutional assumption (Blanchard and Perroti, 2002) and the Long-run employs coefficient from the system long-run cointegration estimates.

[3/] "Tax revenue" referrers to total tax collection and tax base (perhaps at given tax rates).

Figure 3. Real GDP Growth Effects of a One-Percentage-Point Increase in Expenditure or Cut in Tax Revenue–A Structural VAR Approach with Debt Feedback [1/,2/, 3/,] (Cumulative)



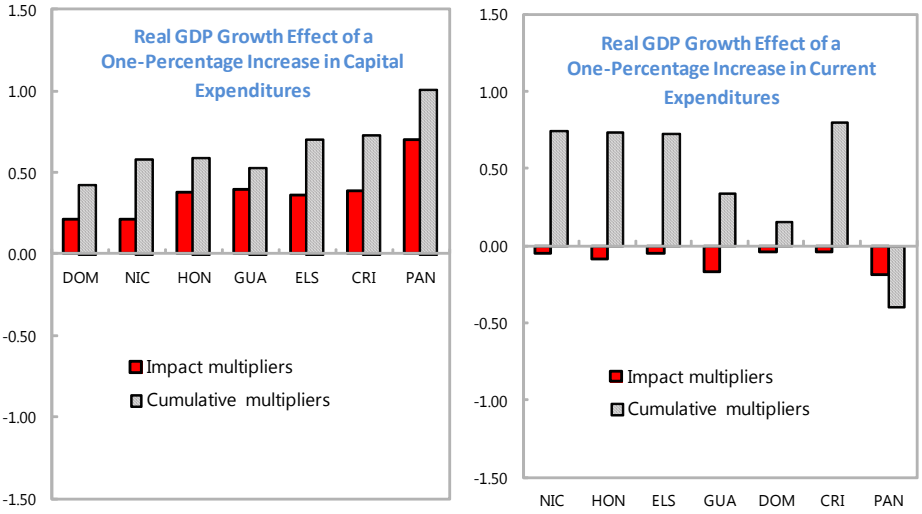
Source: Authors' estimates.

[1/] Response of output growth to a one-standard deviation of expenditure and tax shocks, rescaled to output growth response to a one-percentage-point increase in expenditure and in taxes. The cumulative multipliers are obtained as ratios of net present values as defined in Section IV.B

[2/] The identification scheme utilizes the institutional assumption (Blanchard and Perroti, 2002) and the Long-run employs coefficient from the system long-run cointegration estimates.

[3/] "Tax revenue" referrers to total tax collection and tax base (perhaps at given tax rates).

Figure 4. Impact and Cumulative Output Multipliers of Capital and Current Expenditures – A Structural VAR Approach with Debt Feedback



Source: Authors' estimates.

Note: Reponse of output growth to a one-standard deviation of expenditure and tax shocks, rescaled to output growth response to a one-percentage-point increase in expenditure and in taxesThe identification scheme utilizes the institutional assumption (Blanchard and Perroti, 2002) and the Long-run employs coefficient from the system long-run cointegration estimates. "Tax revenue" referrers to total tax collection and tax base (perhaps at given tax rates). The cumulative multipliers are obtained as ratios of net present values as defined in Section IV.B

Table 1. Cumulative Output Multipliers with Debt Feedback and Financial Constraints: Current and Capital Expenditure

	Current expenditure		Capital expenditure	
	Impact	Cumulative	Impact	Cumulative
Central America-Dominacan Republic and Panama				
Costa Rica	**-0.0436**	**0.7926**	**-0.3835**	**-0.7264**
Lower-band	-0.035	0.951	-0.326	-0.530
Upper-band	-0.0523	0.6341	-0.4410	-0.9225
Dominican Republic	**-0.0392**	**0.1555**	**-0.2161**	**-0.4236**
Lower-band	-0.031	0.187	-0.184	-0.309
Upper-band	-0.0471	0.1244	-0.2485	-0.5380
El Savador	**-0.0453**	**0.7257**	**-0.3604**	**-0.7064**
Lower-band	-0.039	0.871	-0.306	-0.516
Upper-band	-0.0521	0.5805	-0.4145	-0.8972
Guatemala	**-0.1705**	**0.3384**	**-0.3990**	**-0.5267**
Lower-band	-0.145	0.406	-0.339	-0.385
Upper-band	-0.1961	0.2707	-0.4589	-0.6689
Honduras	**-0.0845**	**0.7310**	**-0.3783**	**-0.5925**
Lower-band	-0.072	0.877	-0.322	-0.433
Upper-band	-0.0971	0.5848	-0.4350	-0.7524
Nicaragua	**-0.0486**	**0.7374**	**-0.2117**	**-0.5836**
Lower-band	-0.041	0.885	-0.180	-0.426
Upper-band	-0.0559	0.5899	-0.2435	-0.7411
Panama	**-0.1867**	**-0.3951**	**-0.7006**	**-1.0033**
Lower-band	-0.159	-0.288	-0.595	-0.732
Upper-band	-0.2147	-0.5018	-0.8056	-1.2742

Note: Response of output growth to capital and current expenditure (net of interest) cut (shocks). Upper-band and lower-band are 90th percentile and 10th percentile, respectively. Breakdown of total expenditure between current expenditure (net of interest) and capital expenditure were not available for all country groups from 1970 to 2011.

V. Concluding Remarks

Given the pressing need for fiscal consolidation in many countries in the current global economic environment, this paper estimates the real effect of fiscal consolidation in various country groupings, while offering some more detailed discussion of Central American countries—a region with scant evidence on fiscal multipliers. The estimation procedure modified traditional structural VAR modeling to account for debt feedback effects and to enable the use of annual data. In particular, given that the use of annual data precludes using identification assumptions based on the quarterly timing of fiscal policy reactions to output changes, we use cointegration techniques and error-correction modeling to identify exogenous fiscal shocks and estimate fiscal multipliers. The inclusion of debt as a ratio to GDP in the estimation (as suggested by Favero and Giavazzi, 2007) allows for attenuating effects from changes in the fiscal deficit. For instance, as public debt declines as a result of a smaller fiscal deficit, interest rates would also decline, potentially undoing part of the initial negative impulse. The paper also compares the results from applying the proposed procedure and data frequency to advanced and emerging market economies with estimates from other recent papers, which validates the methodology proposed here.

Our results are comparable to the literature and suggest that fiscal consolidation provides some medium-term growth benefit in many countries and regions. The positive effects of fiscal consolidation tend to be inversely related to a country's stage of development. Fiscal consolidation tends to have a strong positive effect in low income countries (especially HIPCs), although that is also the case in some mid-income countries, as Costa Rica (or Panama and the Dominican Republic if fiscal consolidation is based on improved tax system efficiency). Estimates for advanced and emerging market economies confirm that fiscal consolidation tend to hurt short- and medium-term output.

The composition of the fiscal consolidation effort also matters. For instance, tax revenue increases appear to yield greater medium-term output growth than current spending control in several Central American countries and LICs, including HIPCs. However, the public investment multiplier is found to be larger than tax multipliers. Estimates for CAPDR show that cutting capital spending would hurt short- and medium-term growth significantly, while curbing current spending would *raise* output in Nicaragua, Honduras, El Salvador, and (to a lesser extent and only in the medium term) Guatemala. Nicaragua and Honduras show greater benefits from cutting current spending than raising tax revenues.

APPENDIX

Table 2a. Country Group

	Advanced Economies	Sub-Sahara Africa
1	Australia	Angola
2	Austria	Benin
3	Belgium	Botswana
4	Canada	Burkina Faso
5	Cyprus	Burundi
6	Czech Republic	Cameroon
7	Denmark	Cape Verde
8	Estonia	Central African Republic
9	Finland	Chad
10	France	Comoros
11	Germany	Congo, Democratic Republic of
12	Greece	Congo, Republic of
13	Hong Kong SAR	Côte d'Ivoire
14	Iceland	Equatorial Guinea
15	Ireland	Eritrea
16	Israel	Ethiopia
17	Italy	Gabon
18	Japan	Gambia, The
19	Korea	Ghana
20	Luxembourg	Guinea
21	Malta	Guinea-Bissau
22	Netherlands	Kenya
23	New Zealand	Lesotho
24	Norway	Liberia
25	Portugal	Madagascar
26	Singapore	Malawi
27	Slovak Republic	Mali
28	Slovenia	Mauritius
29	Spain	Mozambique
30	Sweden	Namibia
31	Switzerland	Niger
32	Taiwan Province of China	Nigeria
33	United Kingdom	Rwanda
34	United States	São Tomé and Príncipe
35		Senegal
36		Seychelles
37		Sierra Leone
38		South Africa
39		Swaziland
40		Tanzania
41		Togo
42		Uganda
43		Zambia
44		Zimbabwe

Sources: IMF, and World Economic Outlook.

Table 2b. Country Group

	HIPC	Export Earnings: Fuel
1	Afghanistan	Algeria
2	Benin	Angola
3	Bolivia	Azerbaijan
4	Burkina Faso	Bahrain
5	Burundi	Brunei Darussalam
6	Cameroon	Chad
7	Central African Republic	Congo, Republic of
8	Chad	Ecuador
9	Comoros	Equatorial Guinea
10	Congo, Democratic Republic of	Gabon
11	Congo, Republic of	Iran, Islamic Republic of
12	Côte d'Ivoire	Iraq
13	Eritrea	Kazakhstan
14	Ethiopia	Kuwait
15	Gambia, The	Libya
16	Ghana	Nigeria
17	Guinea	Oman
18	Guinea-Bissau	Qatar
19	Guyana	Russia
20	Haiti	Saudi Arabia
21	Honduras	Sudan
22	Kyrgyz Republic	Timor-Leste, Dem. Rep. of
23	Liberia	Trinidad and Tobago
24	Madagascar	Turkmenistan
25	Malawi	United Arab Emirates
26	Mali	Venezuela
27	Mauritania	Yemen, Republic of
28	Mozambique	
29	Nicaragua	
30	Niger	
31	Rwanda	
32	São Tomé and Príncipe	
33	Senegal	
34	Sierra Leone	
35	Sudan	
36	Tanzania	
37	Togo	
38	Uganda	
39	Zambia	

Sources: IMF, and World Economic Outlook.

Table 2c. Country Group1/

	Country	Credit Rating	Outlook	Date		Country	Credit Rating	Outlook	Date
1	Albania	B+	Stable	2/20/2012	40	Jamaica	B-	Negative	11/29/2011
2	Angola	BB-	Stable	2/20/2012	41	Jordan	BB	Negative	11/29/2011
3	Argentina	B	Negative	4/20/2012	42	Kazakhsta	BBB+	Stable	11/29/2011
4	Azerbaijan	BBB+	Positive	2/20/2012	43	Kenya	B+	Stable	11/29/2011
5	Bahamas	BBB	Stable	2/20/2012	44	Lebanon	B	Stable	11/29/2011
6	Bahrain	BBB	Negative	2/20/2012	45	Lithuania	BBB	Stable	11/29/2011
7	Bangladesh	BB-	Stable	2/20/2012	46	Macedonia	BB	Stable	11/29/2011
8	Barbados	BBB-	Negative	2/20/2012	47	Mexico	BBB+	Stable	11/29/2011
9	Belarus	B-	Stable	6/1/2012	48	Mongolia	BB-	Stable	11/29/2011
10	Belize	CCC+	Negative	2/20/2012	49	Monteneg	BB	Negative	11/29/2011
11	Bolivia	BB-	Positive	2/20/2012	50	Montserra	BBB-	Stable	11/29/2011
12	Bosnia and Herzegovina	B	Negative	2/20/2012	51	Morocco	BBB-	Stable	11/29/2011
13	Brazil	BBB	Stable	2/20/2012	52	Mozambic	B+	Stable	11/29/2011
14	Bulgaria	BBB	Stable	2/20/2012	53	Nigeria	B+	Stable	11/29/2011
15	Cambodia	B	Stable	2/20/2012	54	Pakistan	B-	Stable	11/29/2011
16	Cape Verde	B+	Stable	2/20/2012	55	Panama	BBB	Stable	7/2/2012
17	Colombia	BBB-	Positive	8/15/2012	56	Papua Ne	B+	Stable	11/29/2011
18	Cook Islands	B+	Negative	2/20/2012	57	Paraguay	BB-	Stable	11/29/2011
19	Costa Rica	BB	Stable	2/20/2012	58	Peru	BBB	Stable	11/29/2011
20	Croatia	BBB-	Stable	2/20/2012	59	Philippines	BB+	Stable	7/4/2012
21	Cyprus	BB	Negative	8/2/2012	60	Portugal	BB	Negative	1/13/2012
22	Dominican Republic	B+	Stable	2/20/2012	61	Romania	BB+	Stable	11/29/2011
23	Ecuador	B-	Positive	2/20/2012	62	Russia	BBB	Stable	11/29/2011
24	Egypt	B	Negative	2/20/2012	63	Senegal	B+	Negative	11/29/2011
25	El Salvador	BB-	Stable	2/20/2012	64	Serbia	BB-	Negative	8/7/2012
26	Fiji	B	Stable	2/20/2012	65	South Afri	BBB+	Stable	11/29/2011
27	Gabon	BB-	Stable	2/20/2012	66	Spain	BBB-	Negative	10/10/2012
28	Georgia	BB-	Stable	2/20/2012	67	Sri Lanka	B+	Positive	11/29/2011
29	Ghana	B+	Stable	11/29/2011	68	Suriname	BB-	Stable	11/29/2011
30	Greece	SD		3/13/2012	69	Thailand	BBB+	Stable	11/29/2011
31	Grenada	B-	Stable	11/29/2011	70	Tunisia	BBB-	Negative	11/29/2011
32	Guatemala	BB	Negative	11/29/2011	71	Turkey	BB	Stable	5/1/2012
33	Honduras	B+	Positive	6/8/2012	72	Uganda	B+	Stable	11/29/2011
34	Hungary	BB+	Negative	12/21/2011	73	Ukraine	B+	Negative	7/3/2012
35	Iceland	BBB-	Stable	11/29/2011	74	Uruguay	BBB-	Stable	4/3/2012
36	India	BBB-	Negative	4/25/2012	75	Venezuela	B+	Stable	11/29/2011
37	Indonesia	BBB-	Positive	11/29/2011	76	Vietnam	BB-	Negative	11/29/2011
38	Ireland	BBB+	Negative	1/13/2012	77	Zambia	B+	Stable	11/29/2011
39	Italy	BBB+	Negative	1/13/2012					

1/ Countries considered emerging markets by JP Morgan's EMBI+ index. According to EMBI+, a country is an emerging market if its bonds are rated at BBB+ or below by S&P.

Table 3. Optimal Lag Length

	Costa Rica			Dominican Republic			El Salvador		
Lag	AIC	SC	HQ	AIC	SC	HQ	AIC	SC	HQ
0	-11.69451	-11.02793	-11.46441	-8.050911	-7.384333	-7.82081	-2.851129	-2.184552	-2.62103
1	-16.26567	-14.48813*	-15.65207	-13.29989	-11.52234*	-12.68628*	-8.77203	-6.994490*	-8.158424
2	-17.33726*	-13.66083	-15.66155*	-14.28645*	-9.998849	-11.8902	-9.913667*	-5.67897	-7.57036
3	-16.54933	-13.0427	-15.55222	-12.88735	-9.07555	-11.6944	-8.567473	-4.972588	-7.59144
4	-16.04217	-12.22683	-15.57314	-12.07502	-9.06017	-11.5223	-8.472055	-4.803238	-7.14955

	Guatemala			Honduras			Nicaragua		
Lag	AIC	SC	HQ	AIC	SC	HQ	AIC	SC	HQ
0	-11.20955	-10.54297	-10.97944	-14.09464	-13.42806	-13.8645	-0.64013	0.026448	-0.41003
1	-15.3409	-13.56336*	-14.7273	-19.70754	-17.93000*	-19.0939	-5.339305	-3.561765	-4.7257
2	-17.93149*	-12.82106	-16.16737*	-21.43857*	-16.32814	19.67445*	-8.733228*	-3.622798*	6.969108*
3	-15.92686	-12.03835	-14.92975	-19.59083	-16.70233	-18.5937	-6.104666	-3.216163	-5.10756
4	-15.91124	-11.91178	-14.53063	-19.36103	-15.76157	-18.3804	-5.522008	-2.522542	-4.14139

	Panama			LICs			HIPC		
Lag	AIC	SC	HQ	AIC	SC	HQ	AIC	SC	HQ
0	-6.799652	-6.133075	-6.56955	-10.1817	-9.515123	-9.9516	-9.994566	-9.327989	-9.76446
1	-11.94838	-10.17084*	-11.33477	-16.91688	-15.13934*	-16.3033	-18.11382	-16.33628*	-17.5002
2	-13.38507*	-8.274638	-11.62095*	-18.14351*	-13.43412	-16.43492*	-21.32655*	-16.21613	19.56244*
3	-11.90952	-8.021015	-10.91241	-16.32262	-13.31607	-15.3255	-18.84615	-15.95765	-17.849
4	-11.83548	-7.936015	-10.55487	-15.81554	-13.03308	-14.3794	-18.08989	-15.09042	-17.7093

	Oil producing countries			EMEs			Aes		
Lag	AIC	SC	HQ	AIC	SC	HQ	AIC	SC	HQ
0	-2.31299	-1.646413	-2.082888	2.962607	3.629185	3.19271	-16.81654	-16.14996	-16.5864
1	-10.17056	-8.393022*	-9.556956	-5.952428	-4.174888*	-5.338822*	-22.85808	-21.08054*	-22.24447
2	-11.37950*	-6.269073	-9.615383*	-6.774588*	-3.093925	-4.98532	-23.98371*	-20.1082	-21.9996
3	-10.19488	-6.206379	-9.197772	-5.982429	-2.113101	-4.73195	-22.9967	-19.31047	-21.9293
4	-10.09592	-6.196452	-8.815303	-5.112567	-2.064159	-4.01047	-22.30994	-18.87328	-22.2196

	Sub Saharan Africa		
Lag	AIC	SC	HQ
0	-10.8079	-10.14133	-10.5778
1	-18.29354	-16.51600*	-17.67993*
2	-18.68829*	-15.48385	-17.37524
3	-18.37235	-14.10608	-16.72493
4	-18.10555	-13.57786	-16.52417

Note (for each estimation):
Endogenous variables: EXPD REV GDP INT REER
Exogenous variables: C DEBT Dummy
Sample: 1972 2010
* indicates lag order selected by the criterion
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 4. Cointegration Equations of Revenue

	Costa Rica	Dom. Rep.	El Salv.	Guatem.	Honduras	Nicarag.	Panama	LICs	HIPC	Oil prod	EMEs	AEs	SSA
Revenue	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
GDP growth	-1.54854	-1.87816	1.02823	-1.04062	-1.43806	-1.53674	-1.12153	-1.05964	-0.17408	-1.27207	-1.96125	-1.84752	-1.06495
	[-5.56065]	[-4.69708]	[11.9940]	[-3.23531]	[-13.5476]	[-29.1174]	[-1.37652]	[-3.95461]	[1.22030]	[4.29676]	[-8.61927]	[-2.55546]	[-10.7528]
REER	-0.08086	-0.47605	-1.75950	-0.56948	-0.65978	0.03053	-0.30330	0.90539	0.14682	-0.92755	-0.36388	1.07391	0.65301
	[-0.34563]	[-3.76995]	[-11.0704]	[-0.75931]	[-4.82422]	[1.37869]	[-0.57579]	[0.71575]	[1.42923]	[-2.26405]	[-4.64527]	[3.02634]	[23.2276]
Constant	-2.03434	-2.84200	1.08140	n.a.	-0.43968	n.a.	-0.49154	1.45624	n.a.	-3.47625	1.86639	n.a.	n.a.
	[-2.66045]	[-6.10457]	[8.00970]	n.a.	[-3.22023]	n.a.	-2.399001]	[7.31078]	n.a.	[-3.22023]	[1.990014]	n.a.	n.a.
LR test for binding restrictions (rank = 1):													
Chi-square(2)	17.27829	19.90848	16.53384	33.18406	56.71044	27.99987	26.01798	25.84519	38.22377	9.26141	16.15410	22.39542	29.00369
Probability	0.00018	0.00005	0.00026	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00975	0.00031	0.00001	0.00000

Cointegration Restrictions: B(1,1)=0 [EXPENDITURE], B(1,2)=1 [REVENUE], B(1,4)=0 [INTEREST RATE]

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Table 5. Cumulative Output Multipliers with Debt Feedback and Financial Constraints: Expenditure and Tax Shocks

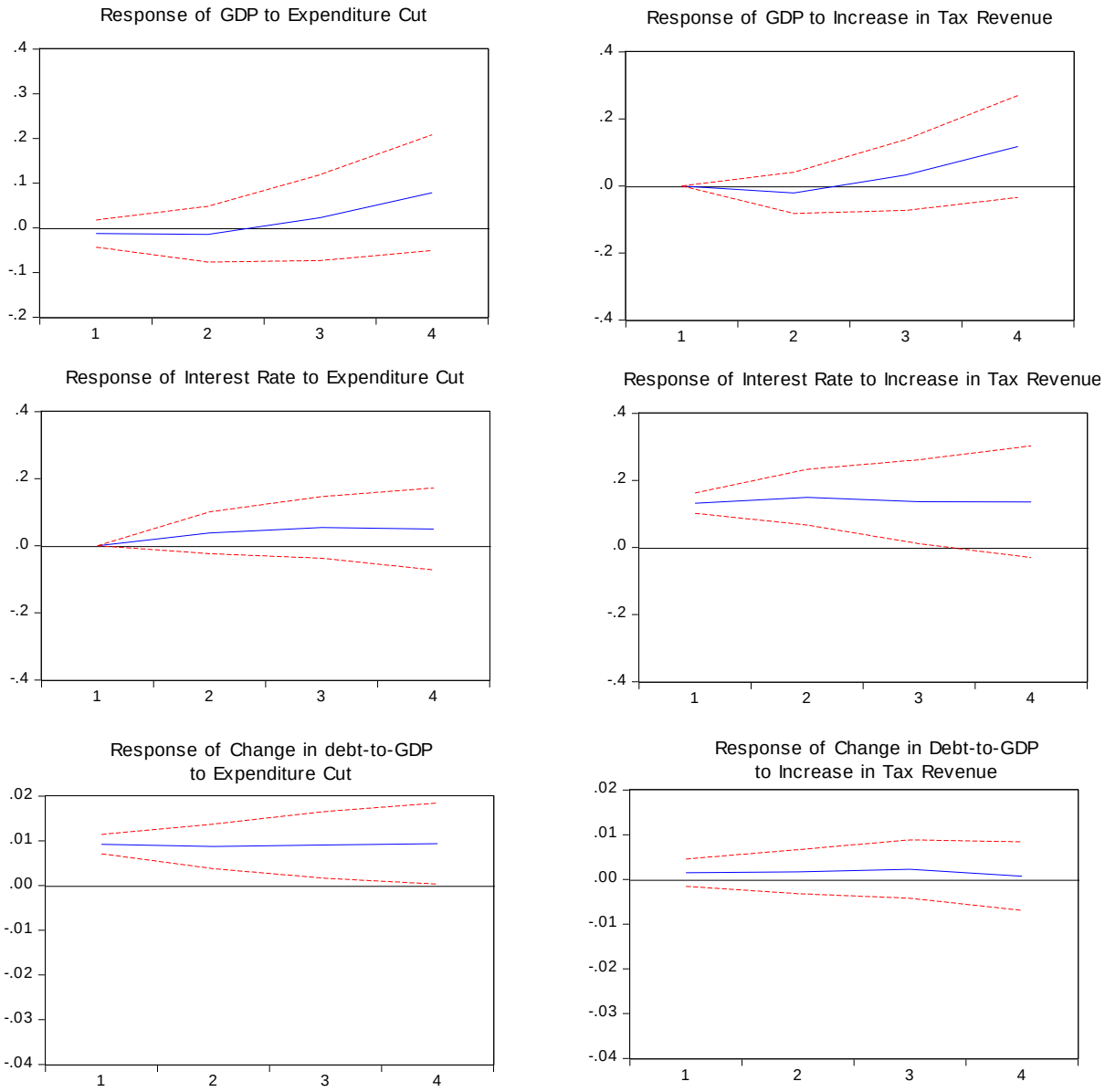
	Expenditure		Tax	
	Impact	Cumulative	Impact	Cumulative
Central America-Dominacan Republic and Panama				
Costa Rica	**0.1466**	**-0.3151**	**0.0200**	**-0.2725**
Lower-band	0.117	-0.394	0.016	-0.327
Upper-band	0.1759	-0.2364	0.0240	-0.2180
Dominican Republic	**0.1531**	**0.2955**	**0.0000**	**-0.2025**
Lower-band	0.130	0.216	0.000	-0.257
Upper-band	0.1760	0.3753	0.0000	-0.1478
El Savador	**0.1502**	**-0.4200**	**0.0100**	**-0.4433**
Lower-band	0.128	-0.525	0.008	-0.532
Upper-band	0.1727	-0.3150	0.0120	-0.3546
Guatemala	**0.3619**	**-0.1886**	**0.0000**	**-0.5114**
Lower-band	0.290	-0.236	0.000	-0.650
Upper-band	0.4343	-0.1415	0.0000	-0.3734
Honduras	**0.2771**	**-0.4496**	**0.0150**	**-0.5214**
Lower-band	0.236	-0.562	0.012	-0.626
Upper-band	0.3187	-0.3372	0.0180	-0.4171
Nicaragua	**0.0106**	**-0.4274**	**0.0000**	**-0.4711**
Lower-band	0.008	-0.534	0.000	-0.598
Upper-band	0.0127	-0.3205	0.0000	-0.3439
Panama	**0.4405**	**0.9387**	**0.0170**	**-1.1330**
Lower-band	0.374	0.685	0.014	-1.190
Upper-band	0.5066	1.1921	0.0204	-1.0764
Other Regional Comparators				
AE	**0.4295**	**0.7782**	**0.0170**	**0.3559**
Lower-band	0.365	0.568	0.014	0.260
Upper-band	0.4940	0.9883	0.0196	0.4520
EME	**0.3355**	**1.0391**	**0.1000**	**0.3590**
Lower-band	0.285	0.759	0.085	0.262
Upper-band	0.3859	1.3197	0.1150	0.4559
HIPC	**0.0122**	**-0.2601**	**-0.1100**	**-0.4371**
Lower-band	0.010	-0.325	-0.127	-0.555
Upper-band	0.0147	-0.1951	-0.0935	-0.3191
LIC	**0.1726**	**-0.3271**	**-0.0150**	**-0.5300**
Lower-band	0.138	-0.409	-0.017	-0.673
Upper-band	0.2071	-0.2453	-0.0128	-0.3869
OIL	**0.3084**	**0.4398**	**0.1200**	**0.3362**
Lower-band	0.262	0.321	0.102	0.245
Upper-band	0.3547	0.5585	0.1380	0.4269
SSA	**0.2520**	**-0.4068**	**0.0000**	**-0.4541**
Lower-band	0.202	-0.509	0.000	-0.577
Upper-band	0.3024	-0.3051	0.0000	-0.3315

Note: Response of output growth to negative spending shock (cut) and positive taxes shock (increase). Upper-band and lower-band are 90th percentile and 10th percentile, respectively. Breakdown of total expenditure between current expenditure (net of interest) and capital expenditure were not available for all country groups from 1970 to 2011.

Table 6. Summary of Selected Results of Fiscal Multipliers from Literature

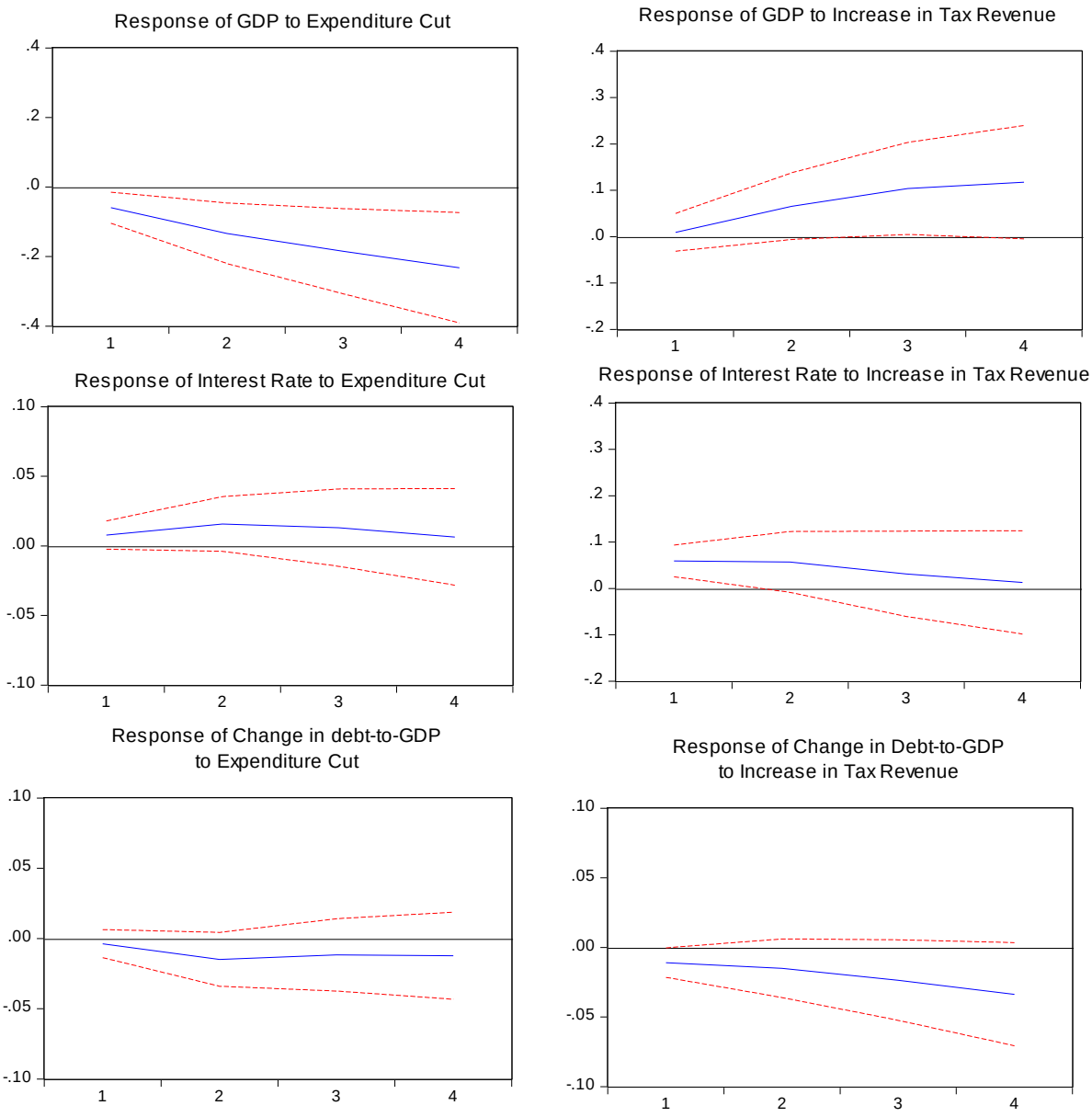
Study	Country/Group	Model	Sample	Fiscal shocks	Multipliers	
					Impact	Cumulative
This paper	Central America (incl., Dom. Rep. and Panama)	SVECM	Annual	Total expenditure	0.01 to 0.44	0.45 to 0.94
				Taxes	0.00 to 0.02	-1.13 to -0.20
				Current expenditure	-0.19 to -0.04	-0.40 to 0.79
				Capital expenditure	0.21 to 0.70	0.42 to 1.00
	AE	SVECM	Annual	Total expenditure	0.43	0.78
				Taxes	0.02	0.36
	EME	SVECM	Annual	Total expenditure	0.34	1.04
				Taxes	0.10	0.36
	Oil prod. Countries	SVECM	Annual	Total expenditure	0.31	0.44
				Taxes	0.12	0.34
	HIPC	SVECM	Annual	Total expenditure	0.01	-0.26
				Taxes	-0.11	-0.44
	LIC	SVECM	Annual	Total expenditure	0.17	-0.33
				Taxes	-0.02	-0.53
	SSA	SVECM	Annual	Total expenditure	0.25	-0.41
				Taxes	0.00	-0.45
Ilzetzti, Mendoza, and Vegh (2010)	44 countries (20 high-income and 24 developing)	SVAR	Quarterly			
	developing			Total expenditure	-0.21	0.18
				Capital expenditure	0.57	0.75
	Highly indebted			Total expenditure	0.06	-2.3
	High-income			Total expenditure	0.37	0.8
				Capital expenditure	0.41	1.15
Ilzetzti (2011)		OLS and GMM	Annual and Quarterly			
	Developing countries			Expenditure	0.14 to 0.25	-0.35 to 0.7
				Tax	0.27 to 0.38	-0.2 to 1.8
	High-income			Expenditure	0.5 to 1.07	0.3 to 1.9
				Tax	0 to 0.2	-0.5 to 0.95
Freedman, Laxton, and Kumhof (2008)	United States			Pub. Investment and transfers	0.5	0.8
				Lump-sum transfer	0.2	0.2
	Euro area			Pub. Investment and transfers	0.5	0.8
				Lump-sum transfer	0.2	0.2
	Emerging Asia			Pub. Investment and transfers	0.7	1.1
				Lump-sum transfer	0.4	0.5
Blamchard and Perotti (2002)	United States	VAR	Quarterly	Spending	0.8 to 0.9	0.7 to 1.0
				Tax	0.7	1.3
Mountford and Uhlig (2002)	United States	VAR	Quarterly	Spending	0.2 to 0.5	
				Tax	0.2 to 0.4	
Perotti (2002)	United States	VAR	Quarterly	Spending	0.1 to 0.4	-1.3 to 1.0
				Tax		0.2 to 0.4

Figure 5. Costa Rica: Estimated Impact of Fiscal Consolidation of 1% of GDP on GDP Growth (Accumulated Responses, 1-Standard Deviation)



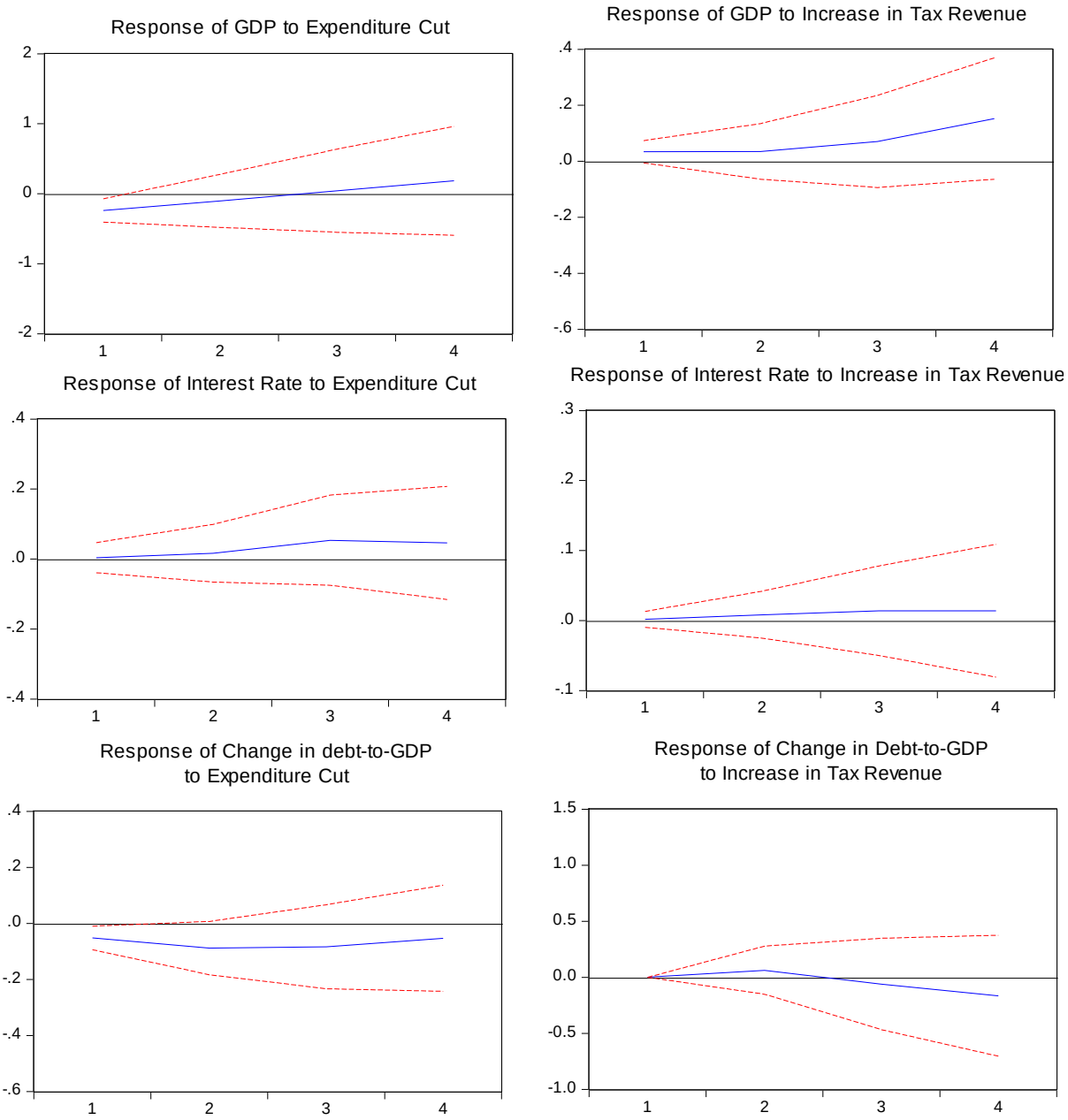
Dashed lines: 90 percent confidence interval levels (estimated with Monte Carlo simulations with bootstrapped standard errors and 500 repetitions).

Figure 6. Dominican Republic: Estimated Impact of Fiscal Consolidation of 1% of GDP on GDP Growth (Accumulated Responses, 1-Standard Deviation)



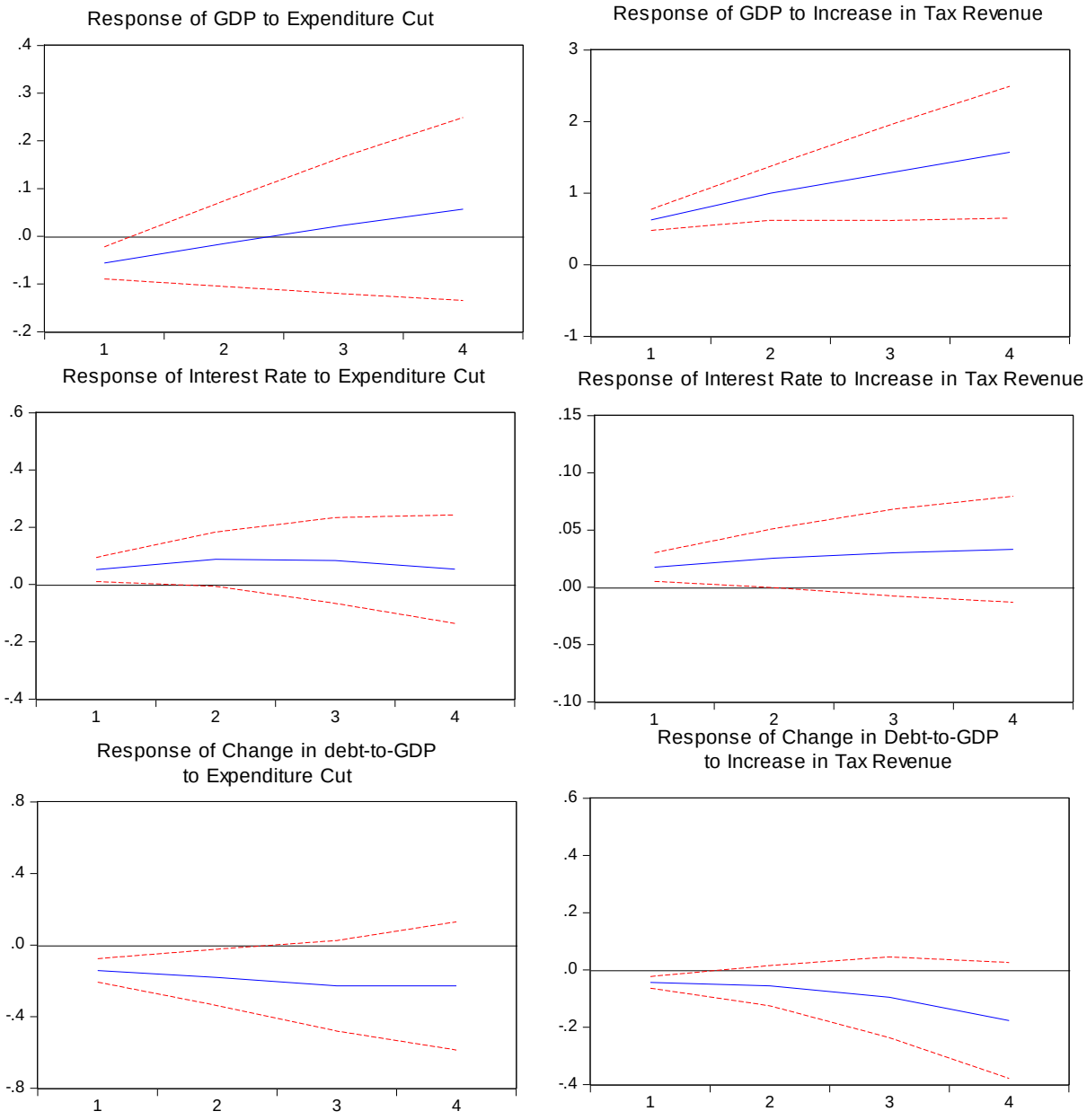
Dashed lines: 90 percent confidence interval levels (estimated with Monte Carlo simulations with bootstrapped standard errors and 500 repetitions).

Figure 7. El Salvador: Estimated Impact of Fiscal Consolidation of 1% of GDP on GDP Growth (Accumulated Responses, 1-Standard Deviation)



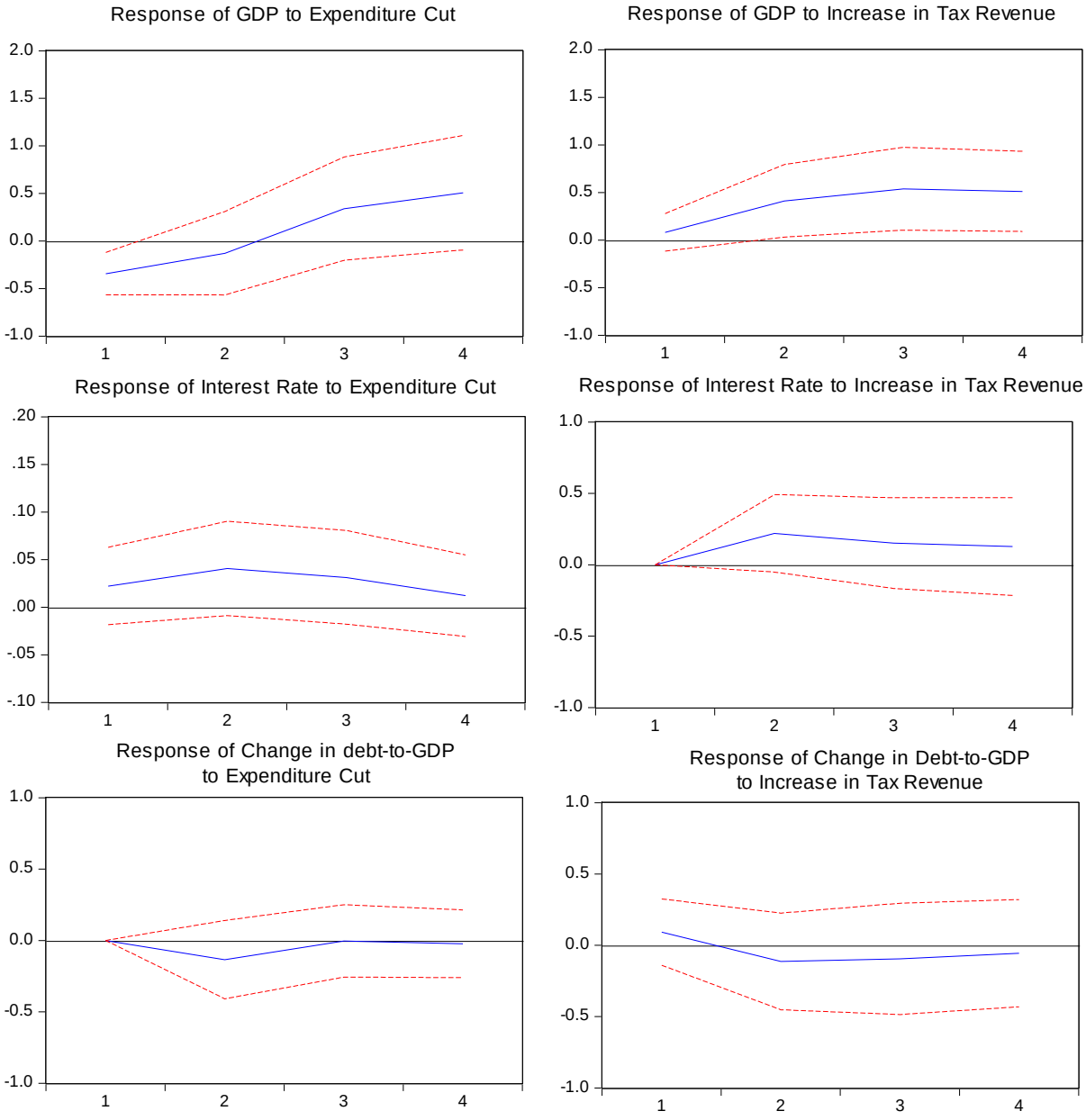
Dashed lines: 90 percent confidence interval levels (estimated with Monte Carlo simulations with bootstrapped standard errors and 500 repetitions).

Figure 8. Guatemala: Estimated Impact of Fiscal Consolidation of 1% of GDP on GDP Growth (Accumulated Responses, 1-Standard Deviation)



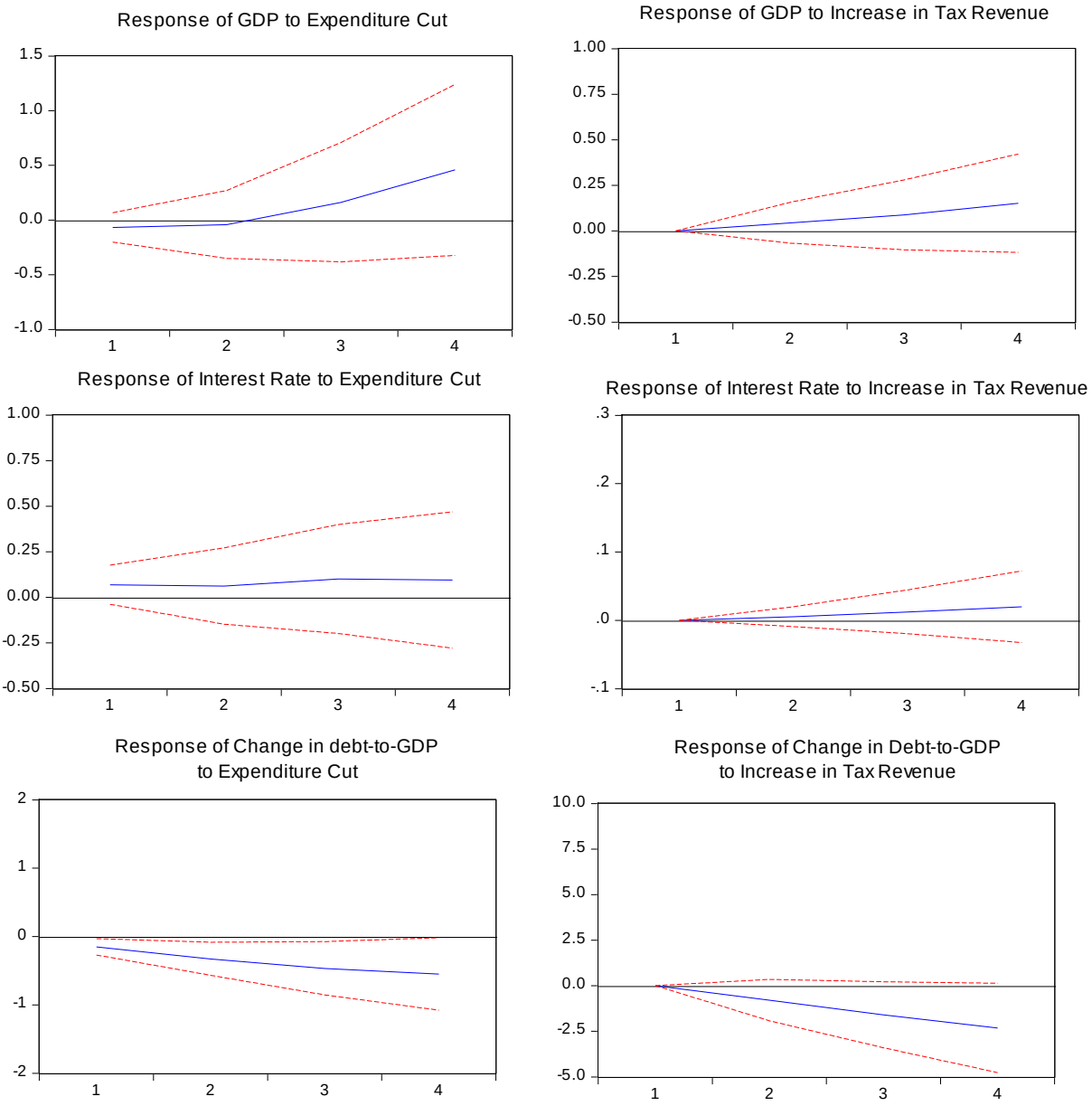
Dashed lines: 90 percent confidence interval levels (estimated with Monte Carlo simulations with bootstrapped standard errors and 500 repetitions).

Figure 9. Honduras: Estimated Impact of Fiscal Consolidation of 1% of GDP on GDP Growth (Accumulated Responses, 1-Standard Deviation)



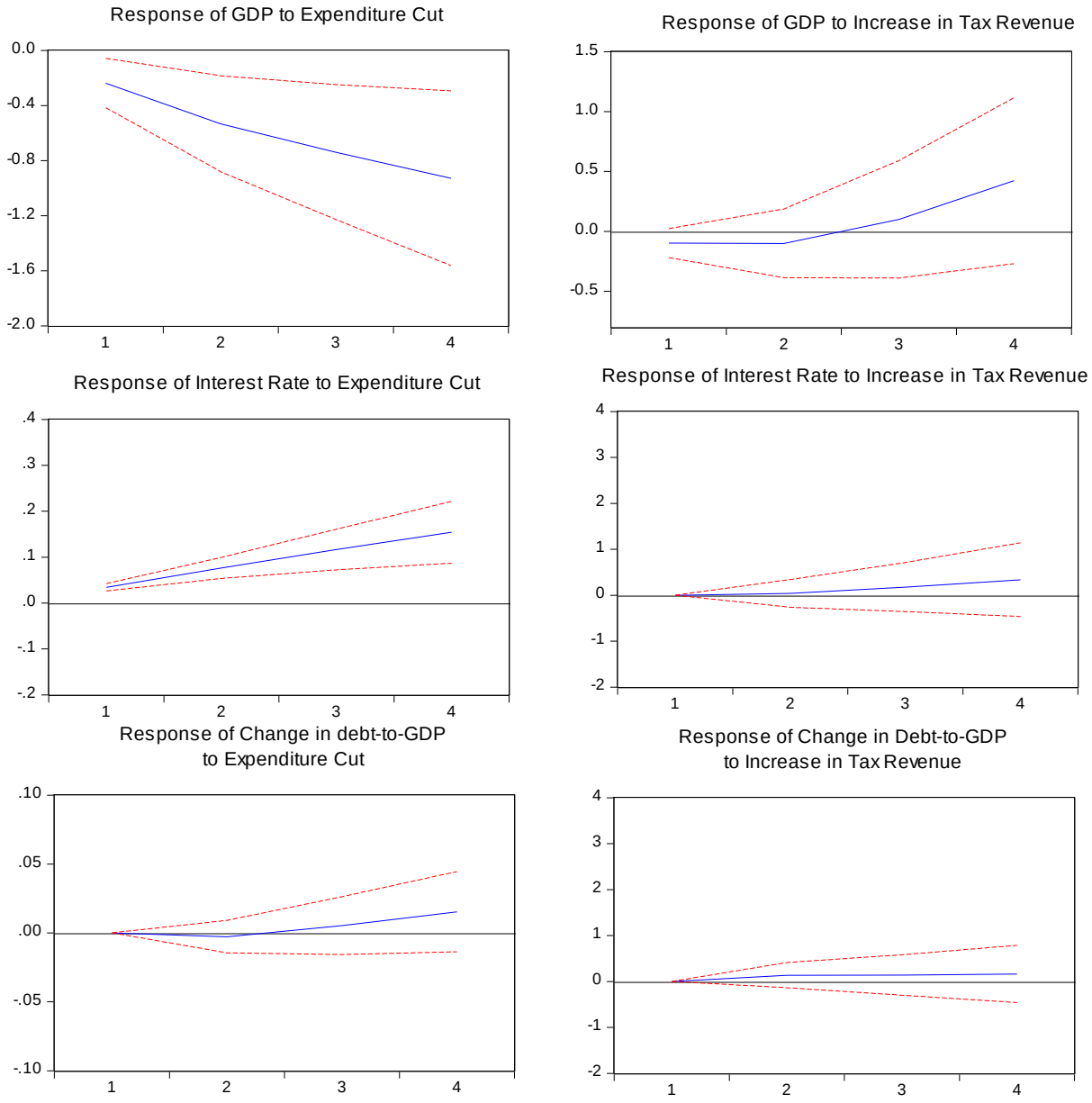
Dashed lines: 90 percent confidence interval levels (estimated with Monte Carlo simulations with bootstrapped standard errors and 500 repetitions).

Figure 10. Nicaragua: Estimated Impact of Fiscal Consolidation of 1% of GDP on GDP Growth (Accumulated Responses, 1-Standard Deviation)



Dashed lines: 90 percent confidence interval levels (estimated with Monte Carlo simulations with bootstrapped standard errors and 500 repetitions).

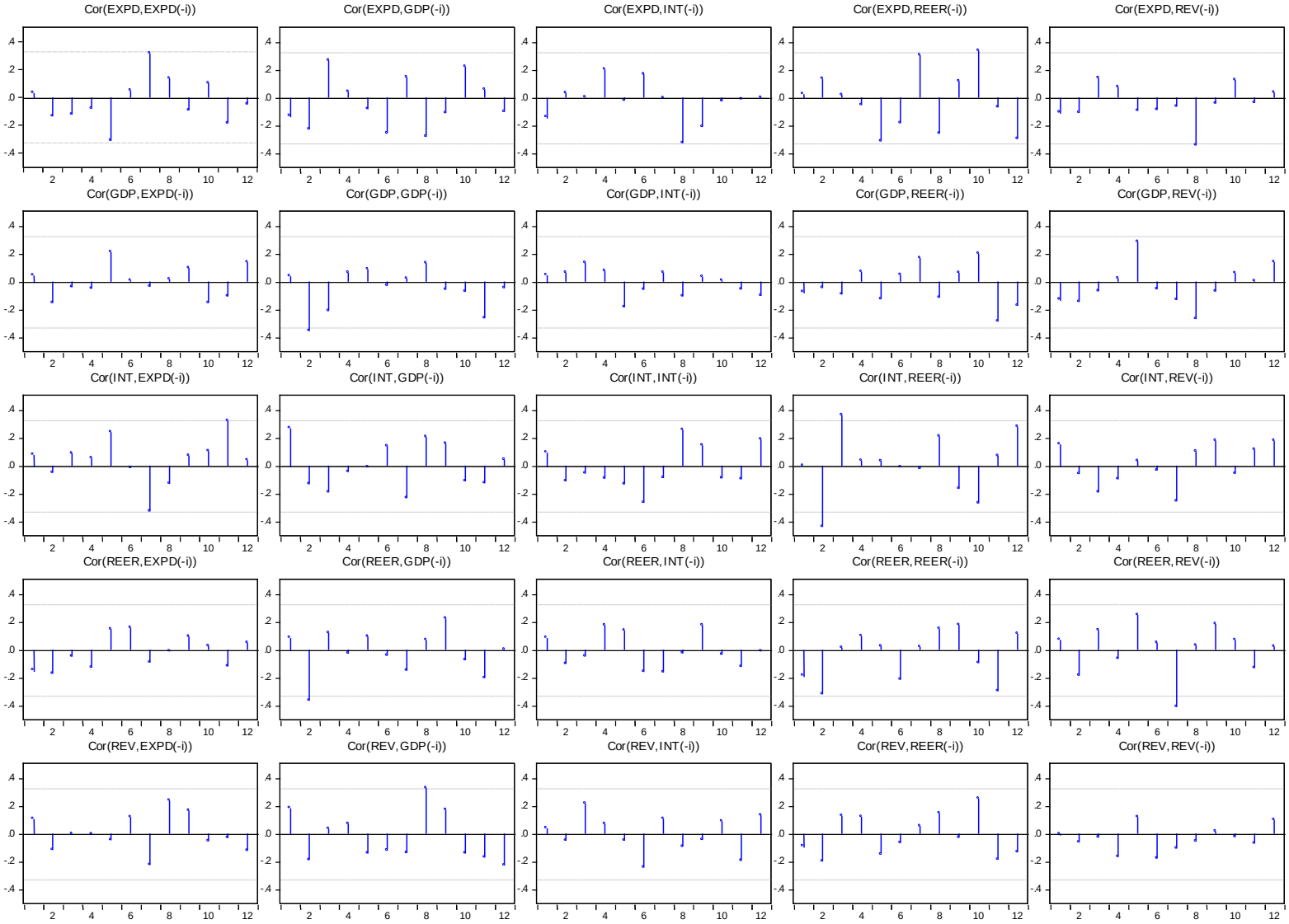
Figure 11. Panama: Estimated Impact of Fiscal Consolidation of 1% of GDP on GDP Growth (Accumulated Responses, 1-Standard Deviation)



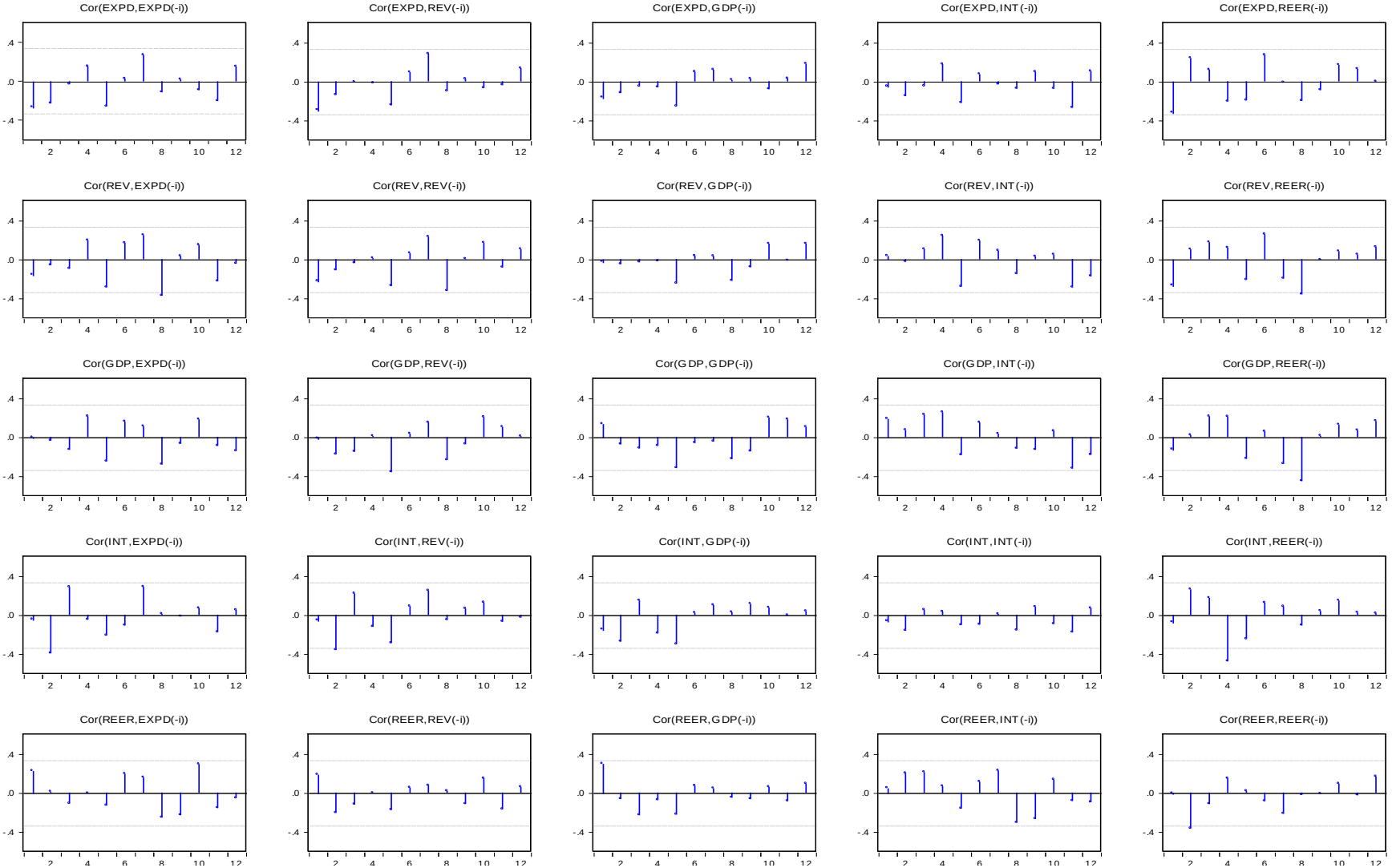
Dashed lines: 90 percent confidence interval levels (estimated with Monte Carlo simulations with bootstrapped standard errors and 500 repetitions).

Figure 12. VAR–Normality test

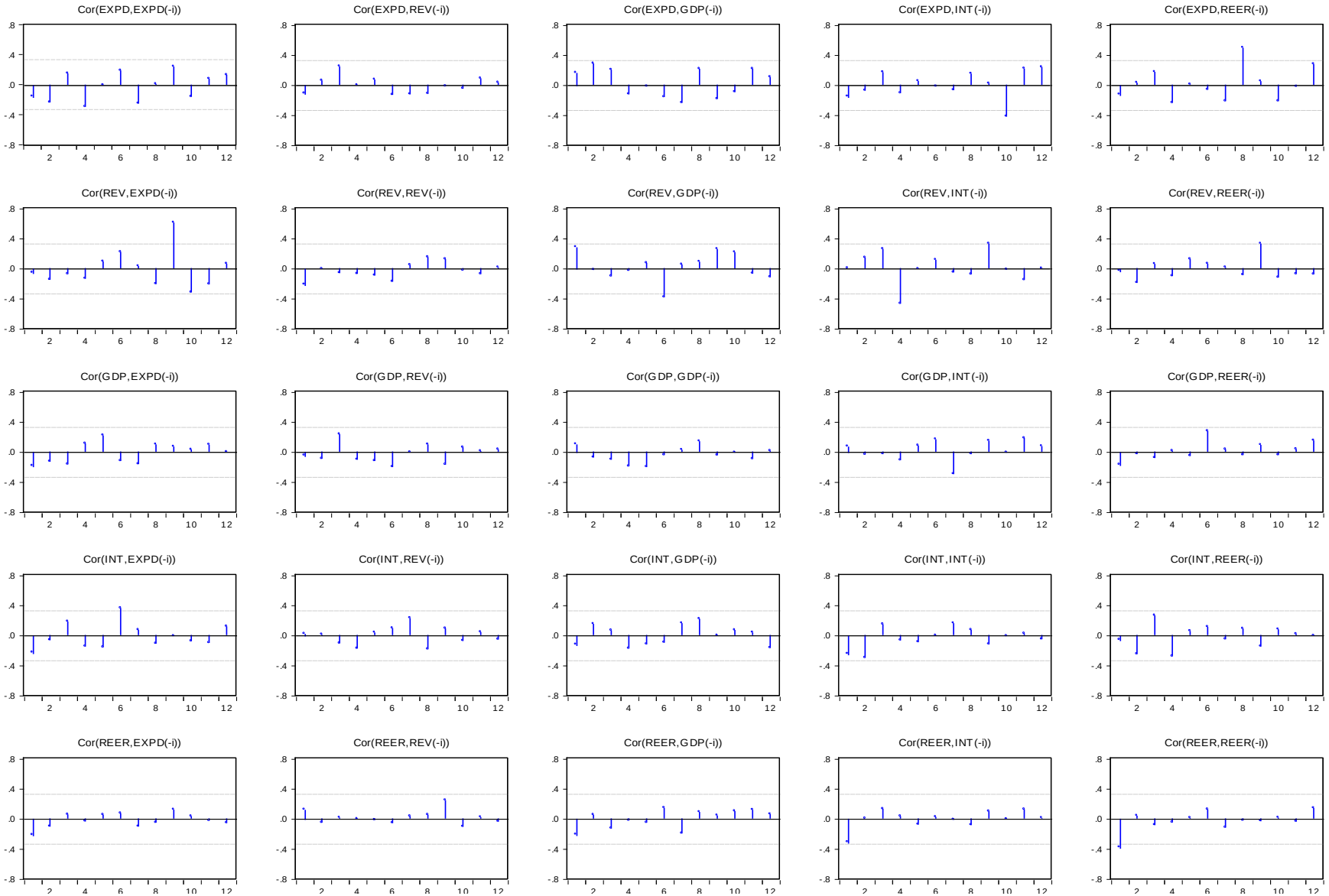
Costa Rica: Residual Test–Autocorrelations with 2 Std.Err. Bounds



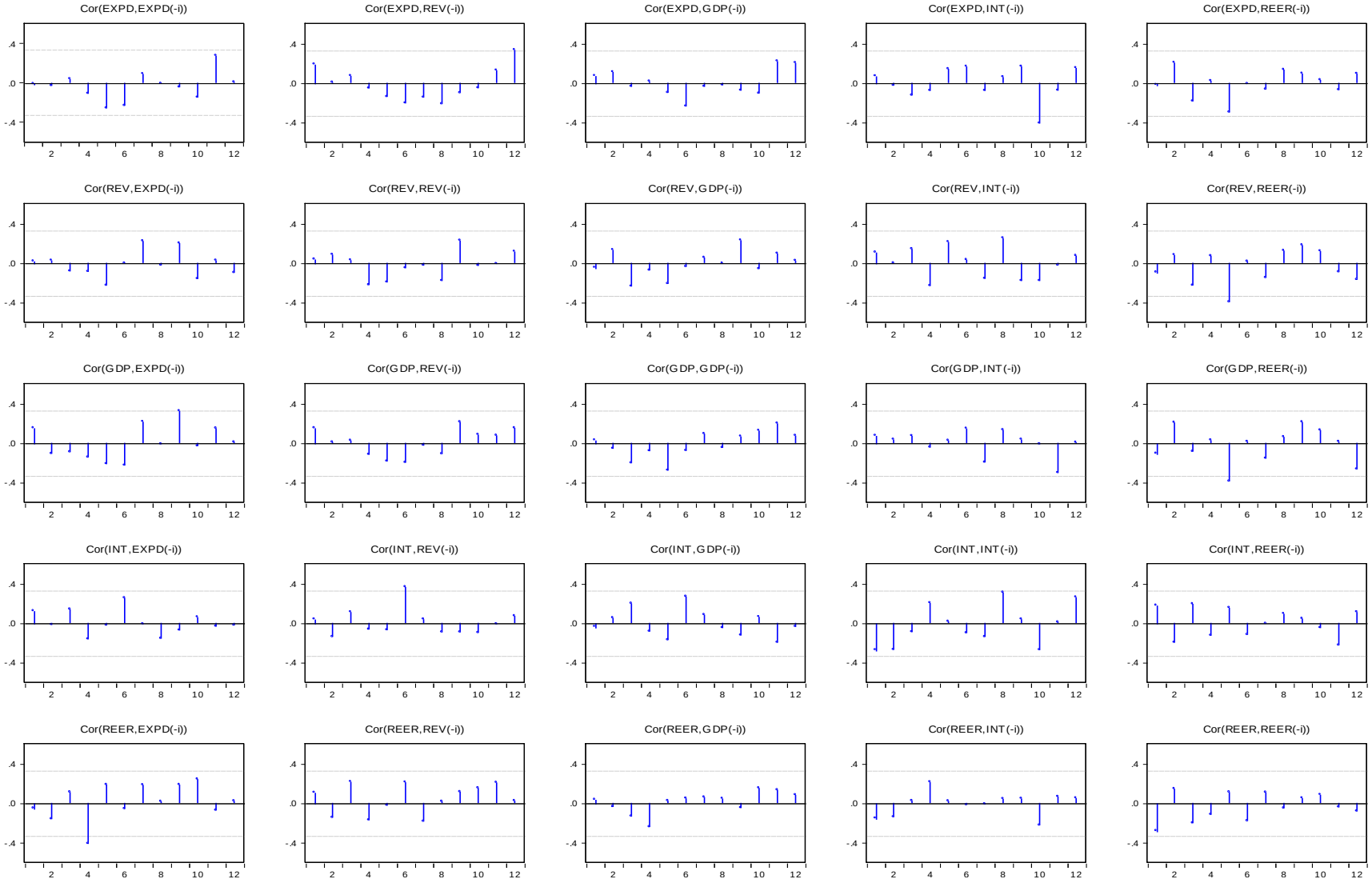
Dominican Republic: Residual Test--Autocorrelations with 2 Std.Err. Bounds



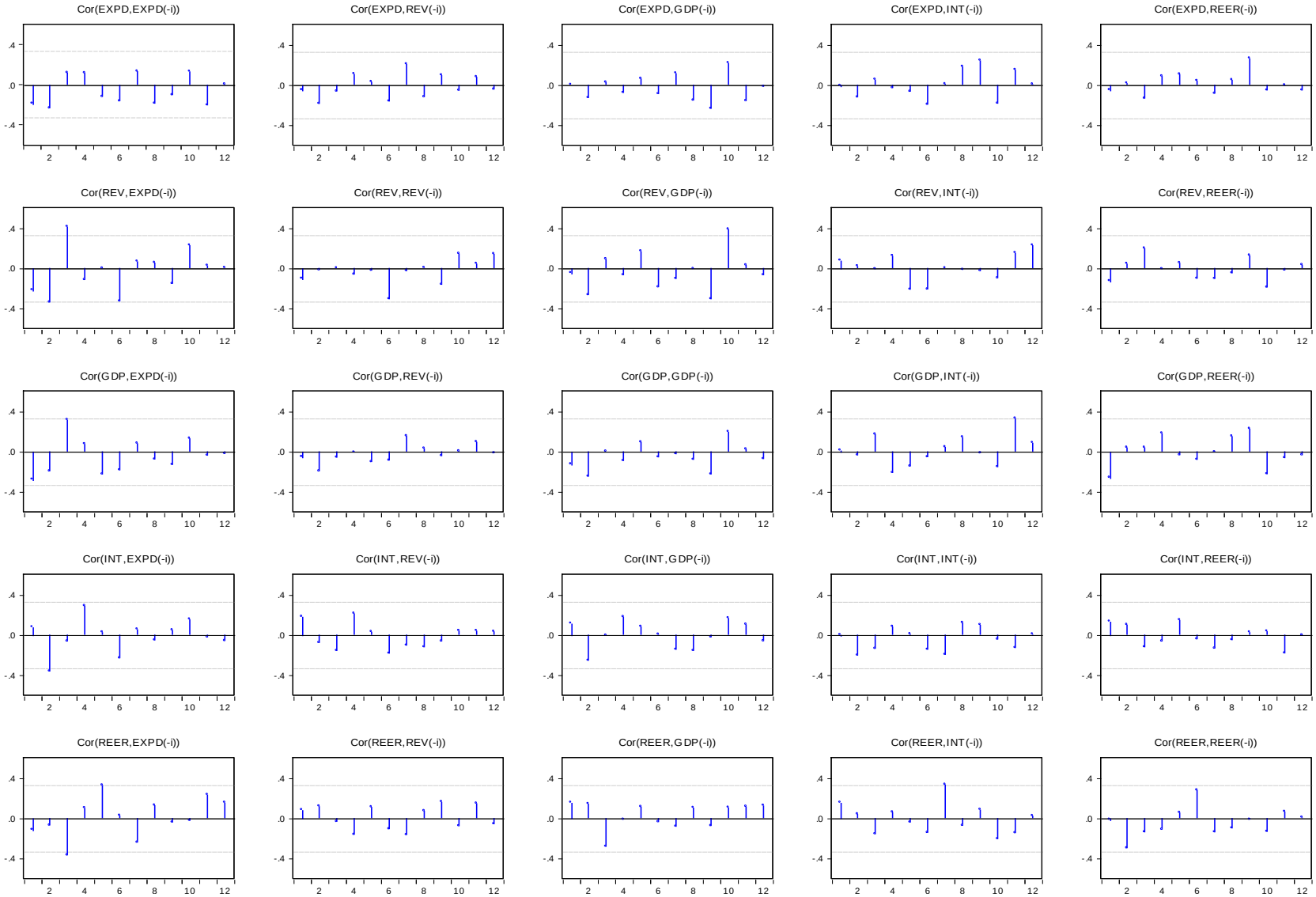
El Salvador: Residual Test–Autocorrelations with 2 Std.Err. Bounds



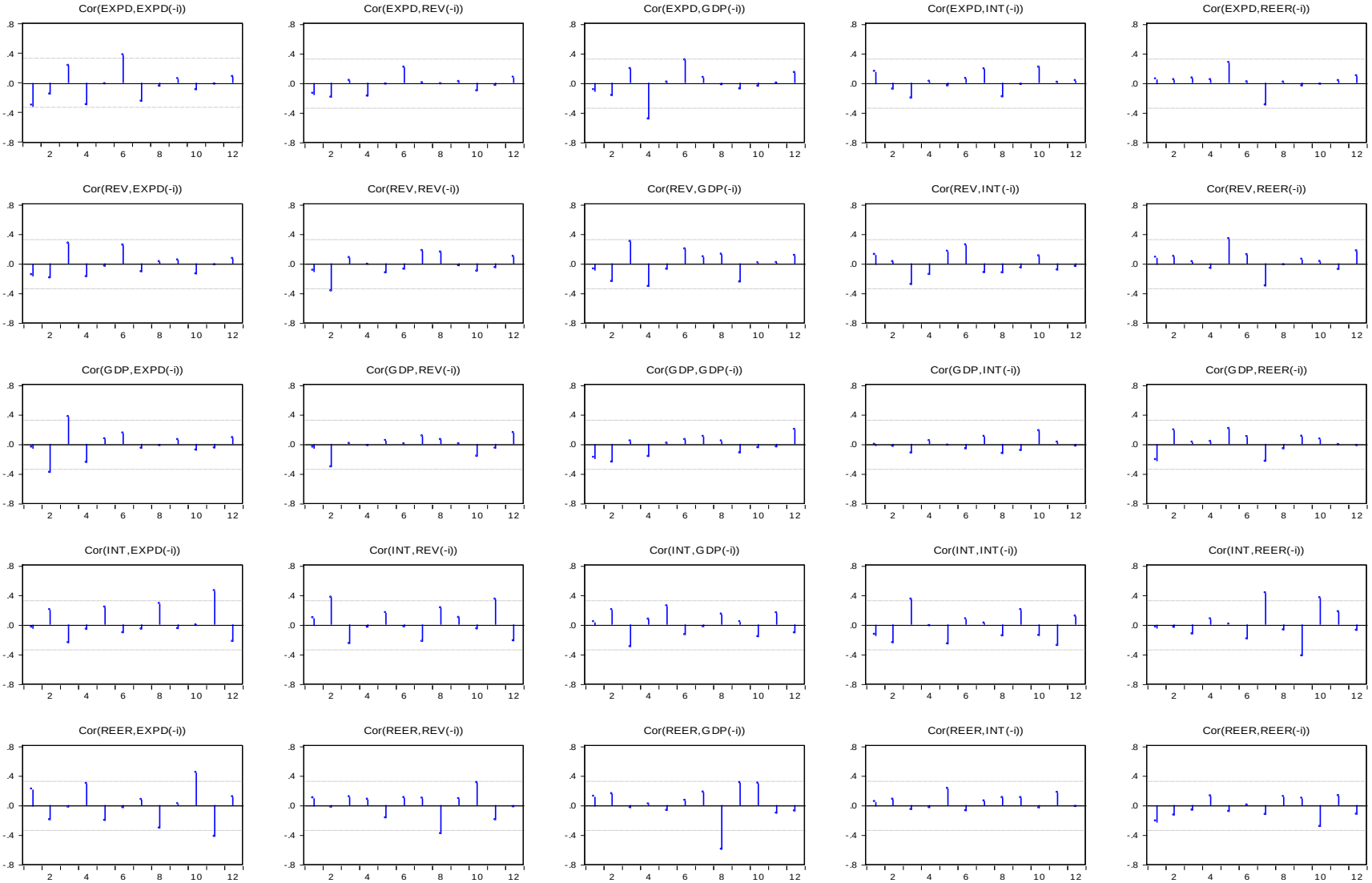
Guatemala: Residual Test--Autocorrelations with 2 Std.Err. Bounds



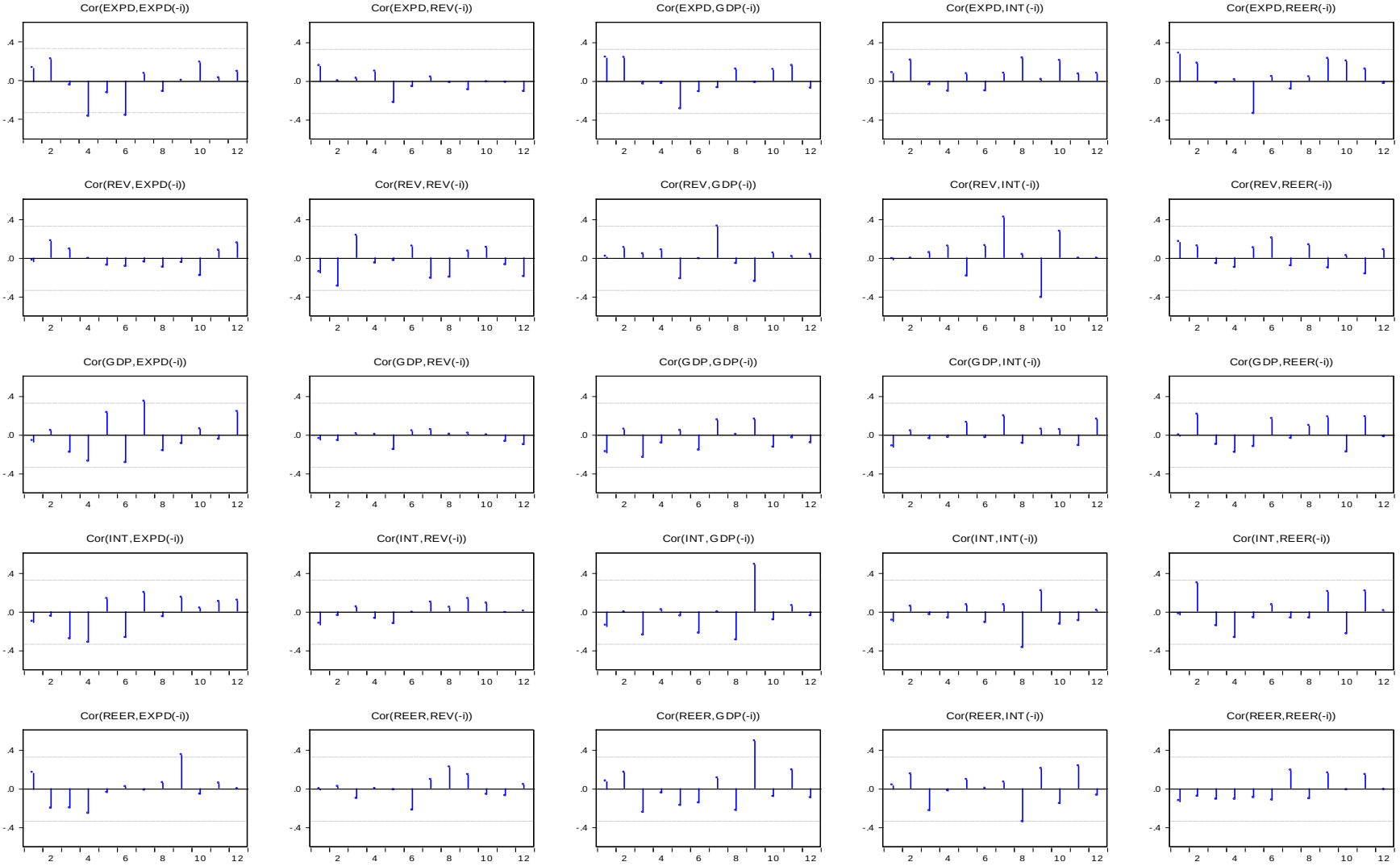
Honduras: Residual Test–Autocorrelations with 2 Std.Err. Bounds



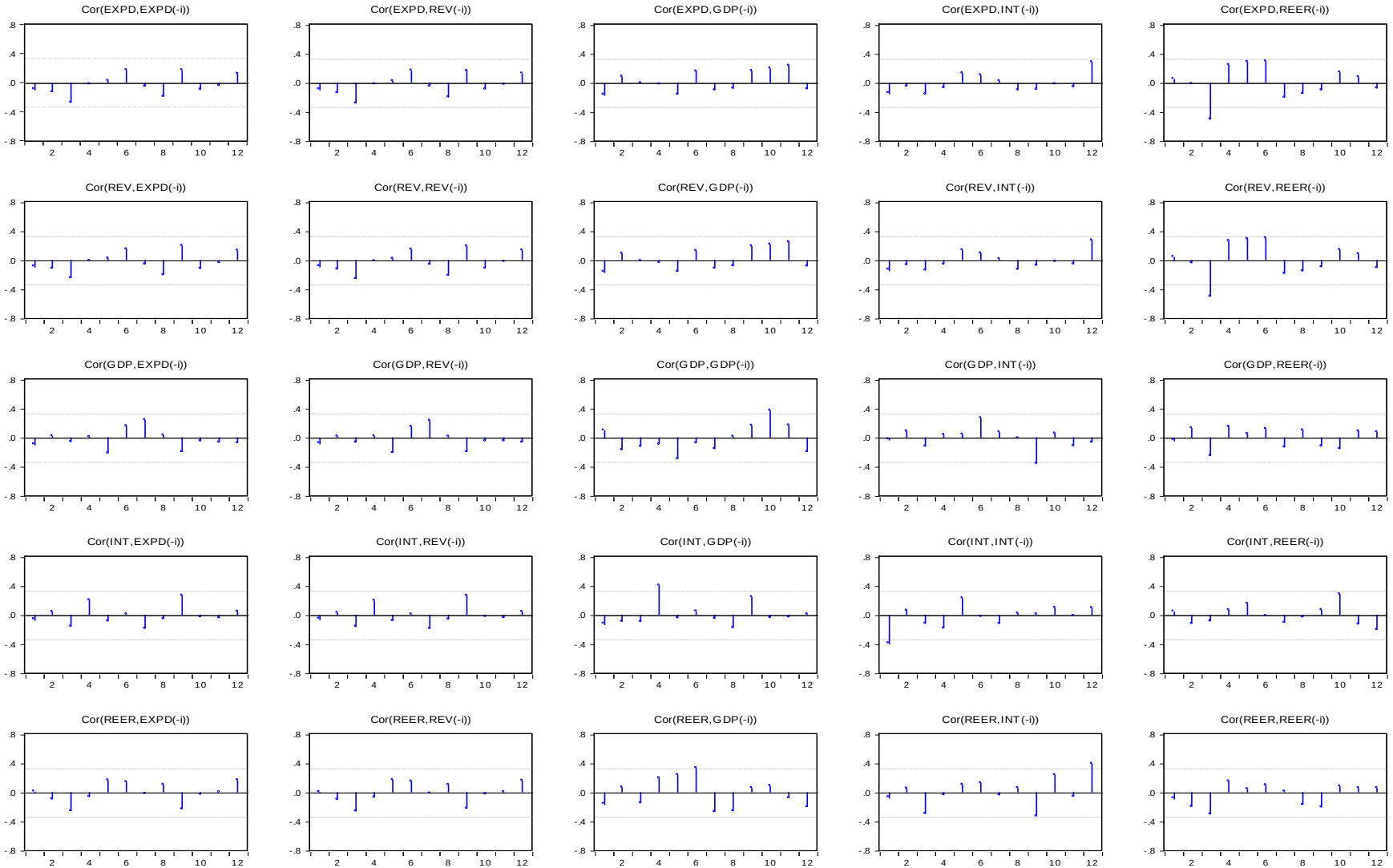
Nicaragua: Residual Test–Autocorrelations with 2 Std.Err. Bounds



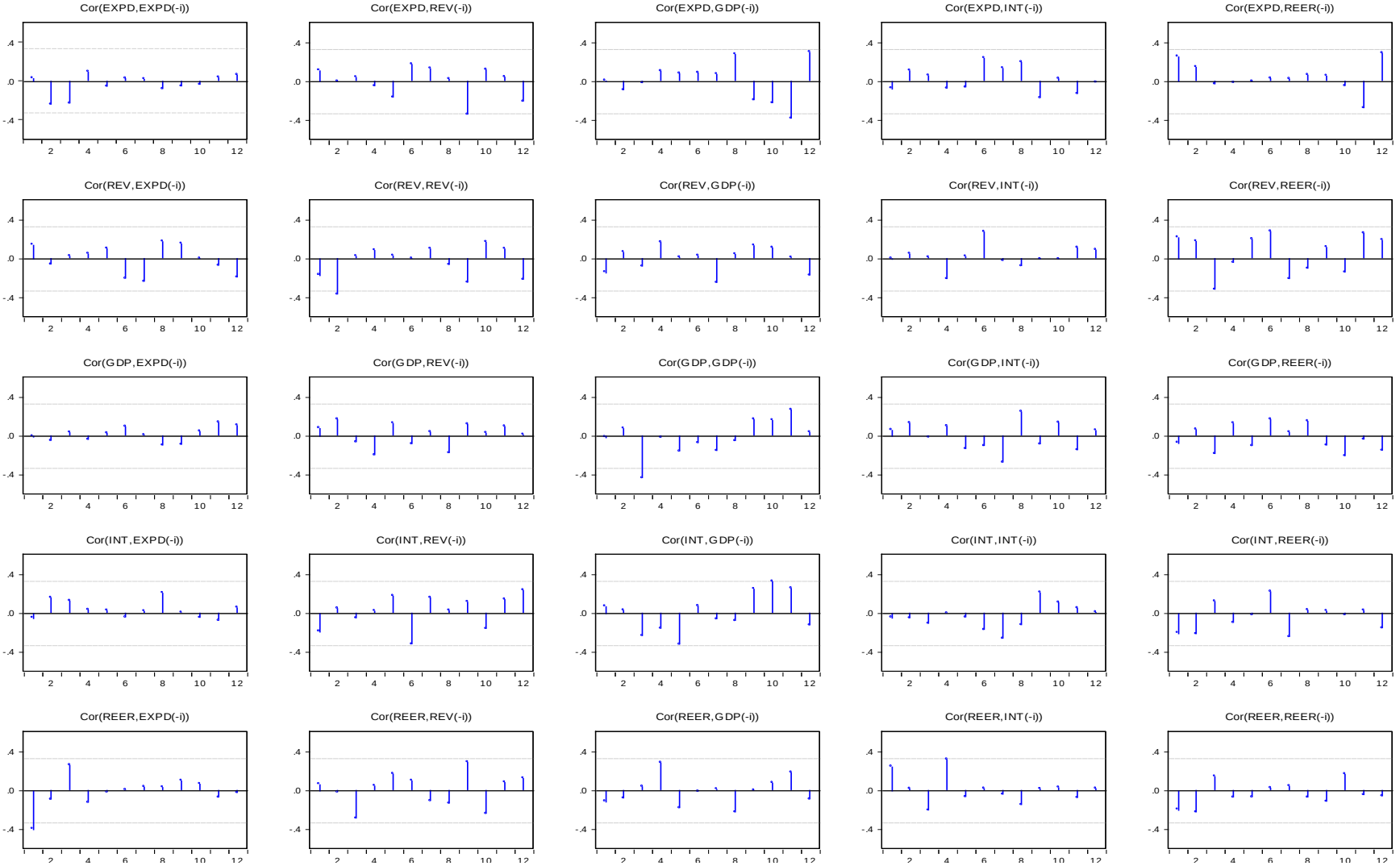
Panama: Residual Test–Autocorrelations with 2 Std.Err. Bounds



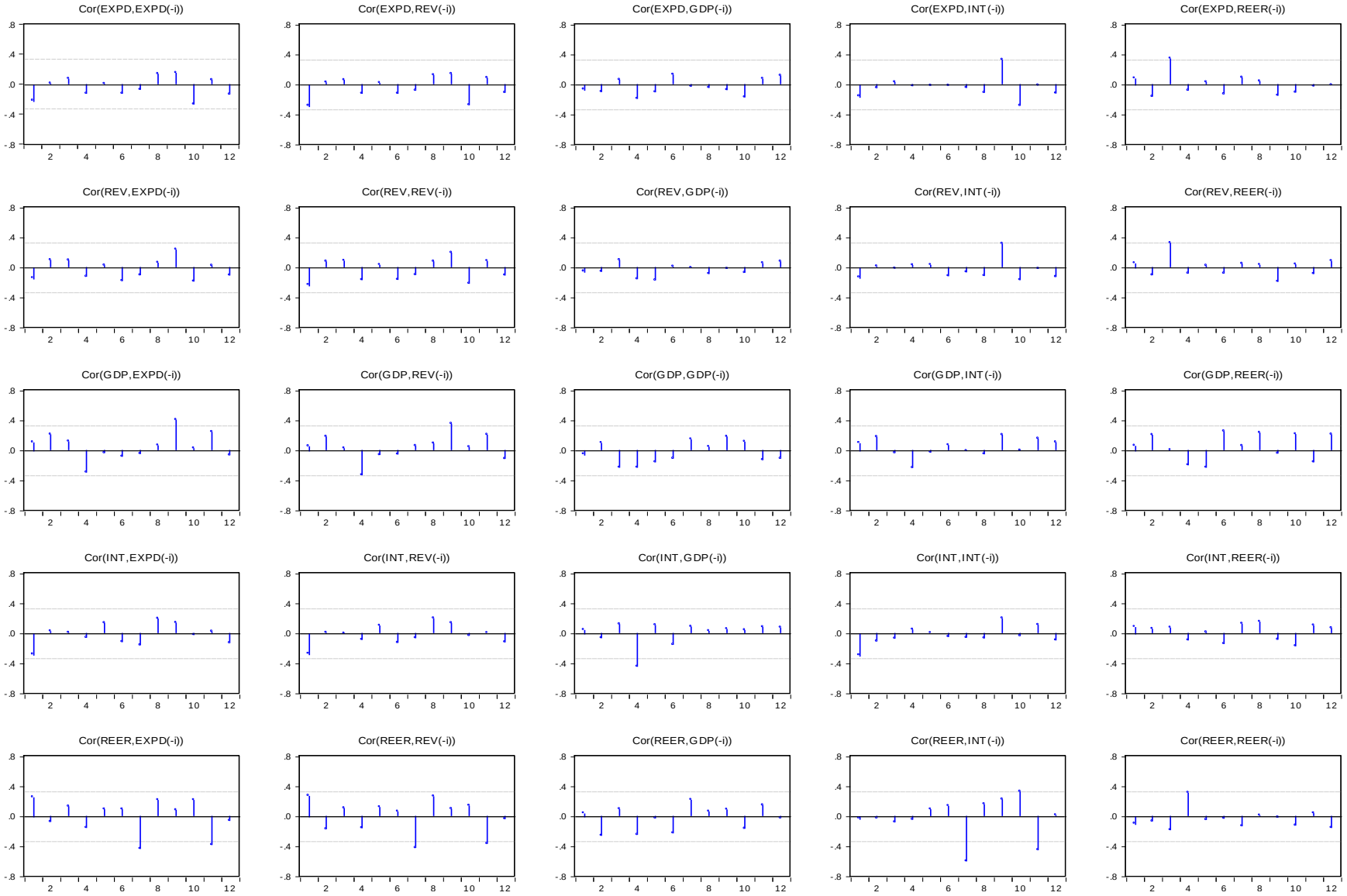
LICs: Residual Test–Autocorrelations with 2 Std.Err. Bounds

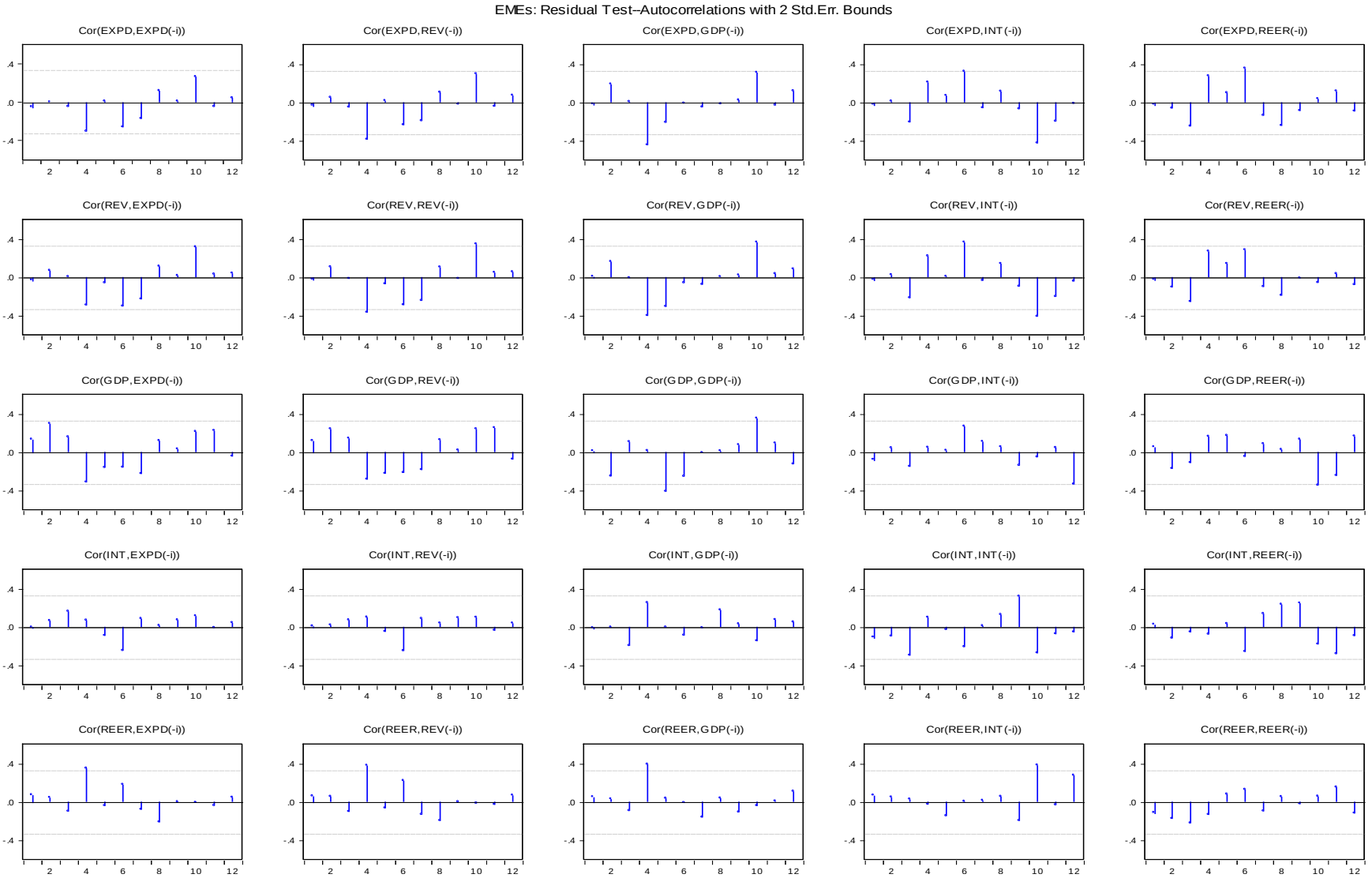


HIPC: Residual Test–Autocorrelations with 2 Std.Err. Bounds

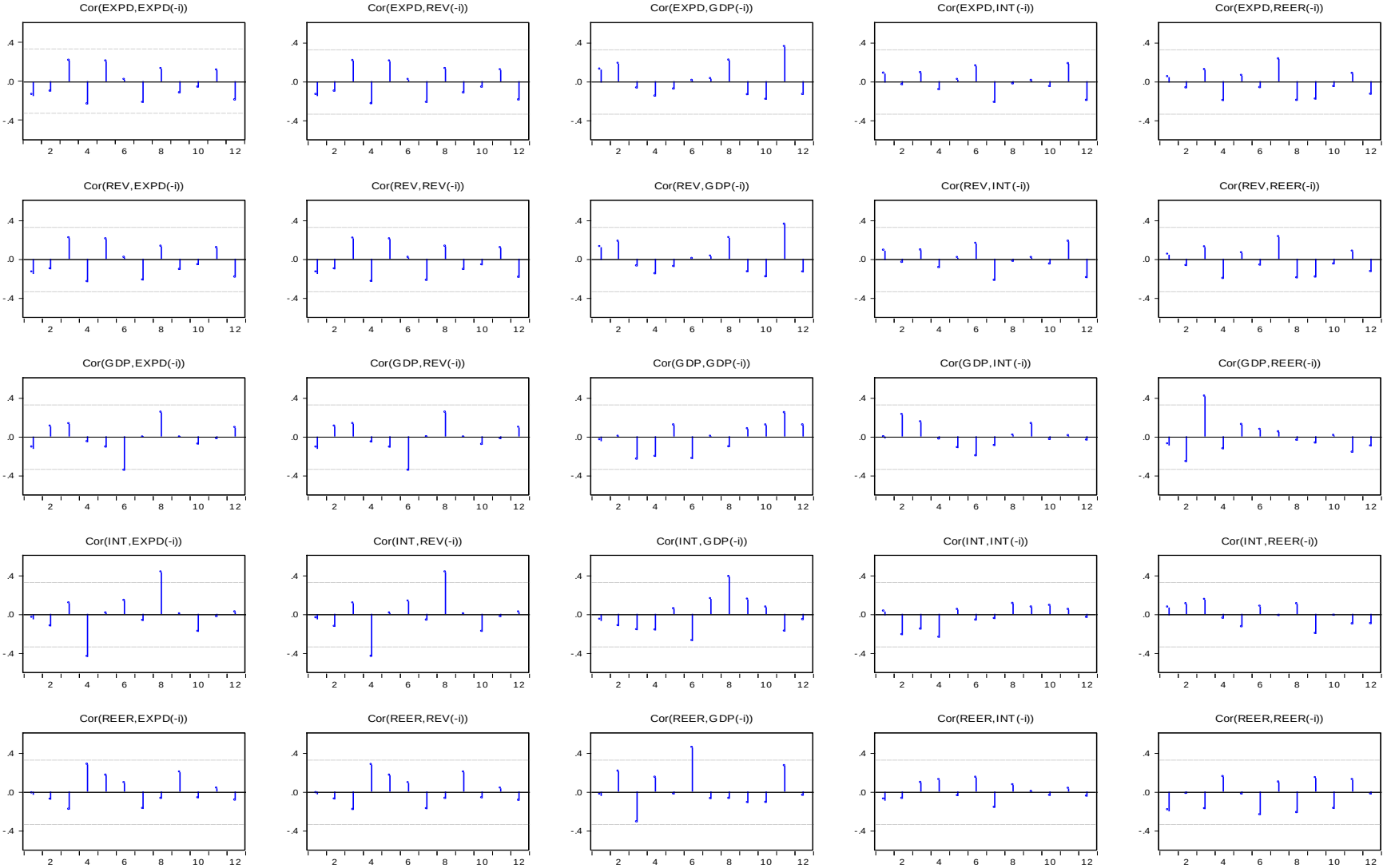


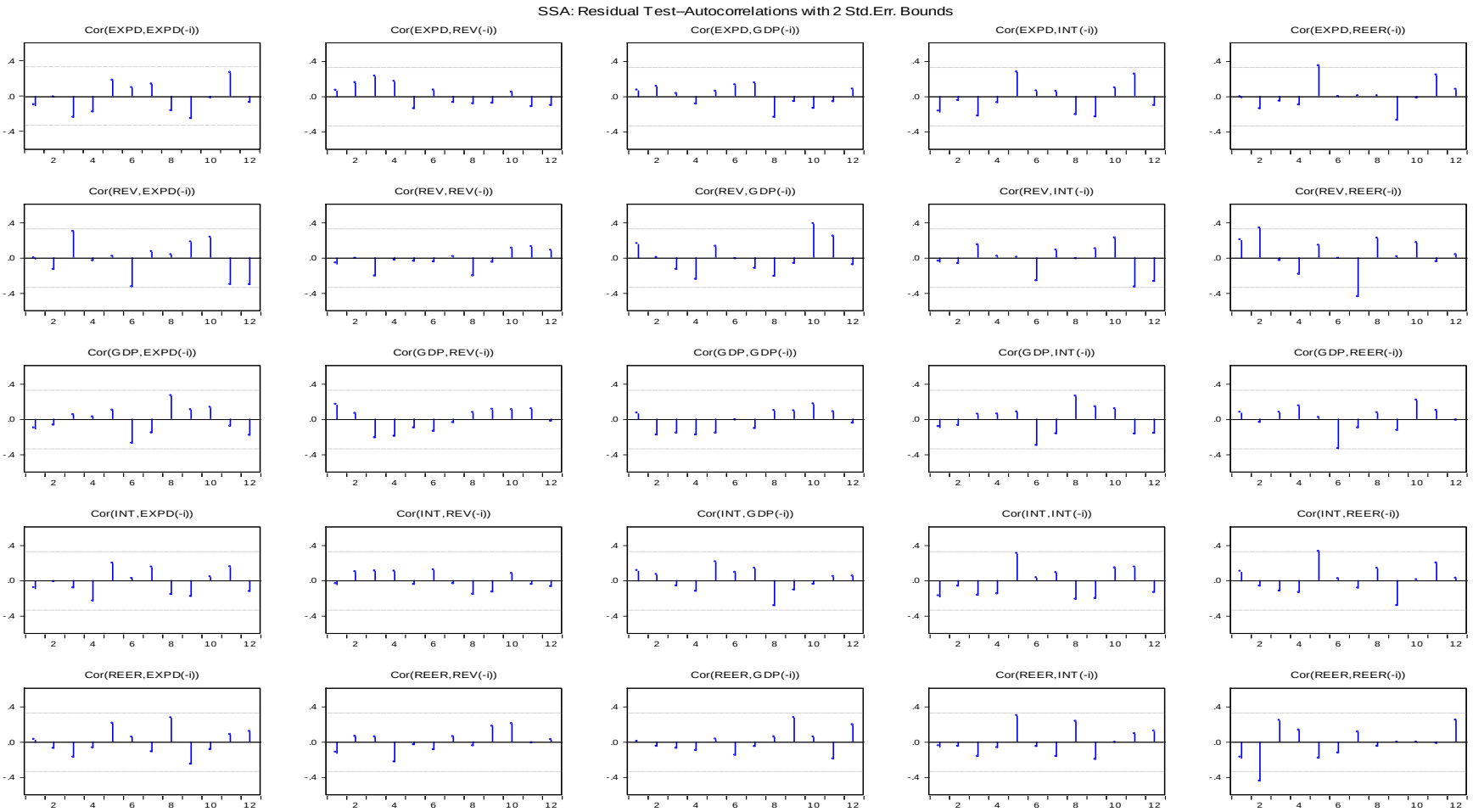
Oil Exporters: Residual Test–Autocorrelations with 2 Std.Err. Bounds




EMEs: Residual Test–Autocorrelations with 2 Std.Err. Bounds
Cor(EXPD,EXPD(-i))
Cor(EXPD,REV(-i))
Cor(EXPD,GDP(-i))
Cor(EXPD,INT(-i))
Cor(EXPD,REER(-i))
Cor(REV,EXPD(-i))
Cor(REV,REV(-i))
Cor(REV,GDP(-i))
Cor(REV,INT(-i))
Cor(REV,REER(-i))
Cor(GDP,EXPD(-i))
Cor(GDP,REV(-i))
Cor(GDP,GDP(-i))
Cor(GDP,INT(-i))
Cor(GDP,REER(-i))
Cor(INT,EXPD(-i))
Cor(INT,REV(-i))
Cor(INT,GDP(-i))
Cor(INT,INT(-i))
Cor(INT,REER(-i))
Cor(REER,EXPD(-i))
Cor(REER,REV(-i))
Cor(REER,GDP(-i))
Cor(REER,INT(-i))
Cor(REER,REER(-i))

AEs: Residual Test--Autocorrelations with 2 Std.Err. Bounds




SSA: Residual Test–Autocorrelations with 2 Std.Err. Bounds
Cor(EXPD,EXPD(-i))
Cor(EXPD,REV(-i))
Cor(EXPD,GDP(-i))
Cor(EXPD,INT(-i))
Cor(EXPD,REER(-i))
Cor(REV,EXPD(-i))
Cor(REV,REV(-i))
Cor(REV,GDP(-i))
Cor(REV,INT(-i))
Cor(REV,REER(-i))
Cor(GDP,EXPD(-i))
Cor(GDP,REV(-i))
Cor(GDP,GDP(-i))
Cor(GDP,INT(-i))
Cor(GDP,REER(-i))
Cor(INT,EXPD(-i))
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Cor(INT,INT(-i))
Cor(INT,REER(-i))
Cor(REER,EXPD(-i))
Cor(REER,REV(-i))
Cor(REER,GDP(-i))
Cor(REER,INT(-i))
Cor(REER,REER(-i))

REFERENCES

Auerbach, Alan, and Yuriy Gorodnichenko, 2012a, "Fiscal Multipliers in Recession and Expansion," in *Fiscal Policy after the Financial Crisis*, edited by Alberto Alesina and Francesco Giavazzi, Chicago: University of Chicago Press.

———, 2012b, "Measuring the Output Responses to Fiscal Policy," *American Economic Journal – Economic Policy*, Vol. 4, pp. 1–27.

———, 2012c, "Output Spillovers from Fiscal Policy," *NBER Working Paper*, No. 18578, Cambridge, Massachusetts: National Bureau of Economic Research.

Batini, Nicoletta, Giovanni Callegari, and Giovanni Melina, 2012, "Successful Austerity in the United States, Europe and Japan," *IMF Working Paper*, No. 12/190, Washington: International Monetary Fund.

Blanchard, Olivier and Roberto Perotti, 2002, "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output," *The Quarterly Journal of Economics*, 117(4), pages 1329-1368.

Blanchard, Olivier ; Leigh, Daniel, 2013, "Growth Forecast Errors and Fiscal Multipliers", *IMF Working Paper*, 13/1, International Monetary Fund, Washington, DC.

Baum, Anja, Marcos Poplawski-Ribeiro, and Anke Weber, 2012, "Fiscal Multipliers and the State of the Economy," *IMF Working Paper*, No. 12/286, Washington: International Monetary Fund.

Baunsgaard, T., A. Mineshima, M. Poplawski-Ribeiro, and A. Weber, 2013, "Fiscal Multipliers", in *Post-crisis Fiscal Policy*, ed. by C. Cottarelli, P. Gerson, and A. Senhadji, forthcoming, Washington: International Monetary Fund.

Caldara, Dario; and Kamps, Christophe, 2008, "What Are The Effects of Fiscal Policy Shocks? A VAR-Based Comparative Analysis" Working Paper Series 877, European Central Bank.

Dungrey, Mardi and Fry, Renée, 2009, "Identification of Fiscal and Monetary Policy in a Structural VAR," *Economic Modeling*, 26 (2009) 1147–1160.

Favero, Carlo and Francesco Giavazzi, 2007, "Debt and the Effects of Fiscal Policy", *NBER Working Paper*, 12822.

———, 2010, "Reconciling VAR-based and Narrative Measures of the Tax-Multiplier," *CEPR Discussion Papers*, 7769.

———, 2012, "Measuring Tax Multipliers: The Narrative Method in Fiscal VARs" American Economic Journal: Economic Policy, 2012, vol. 4, issue 2, pages 69–94.

Fatás, Antonio, and I. Mihov, 2001, "The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence," *CEPR Discussion Paper*, 2760, Center for Economic Policy Research, London.

Feve, Patrick; Matheron, Julien; and Sahuc, Jean-Guillaume, 2012, "A Pitfall with DSGE-Based, Estimated, Government Spending Multipliers," Institut d'Economie Industrielle (IDEI), Working Paper Series No. 708, April.

Hemming, Richard, M. Kell, and Selma Mahfouz, 2002, "The Effectiveness of Fiscal Policy in Stimulating Economic Activity: A Review of the Literature" *IMF Working Paper*, 02/208, International Monetary Fund, Washington, DC.

Ilzetzki, Ethan, Enrique G. Mendoza and Carlos A. Végh, 2010, "How Big (Small?) Are Fiscal Multipliers?" *CEP Discussion Papers*, DP1016, Centre for Economic Performance, LSE.

Ilzetzki, Ethan, 2011, "Fiscal Policy and Debt Dynamics in Developing Countries", London School of Economics, May.

International Monetary Fund, 2010, *World Economic Outlook*, October.

Kaminsky, Graciela, Carmen Reinhart and Carlos A. Végh, 2004, "When It Rains It Pours: Procyclical Capital Flows and Macroeconomic Policies" in *NBER Macroeconomics Annual*, edited by Mark Gertler and Kenneth Rogoff, Cambridge, MA: MIT Press.

Kirchner, Markus, 2011, "Expectations-Based Identification of Government Spending Shocks under Policy Foresight" in Ph.D dissertation: Fiscal policy and the business cycle: the impact of government expenditures, public debt, and sovereign risk on macroeconomic fluctuations, Faculty of Economics and Business, Amsterdam.

Kraay, Aart, 2010, "How Large is the Government Spending Multiplier? Evidence from World Bank Lending",. *World Bank Policy Research Working Paper* No. 5500.

Mountford, A., and Harald Uhlig, 2005, "What Are the Effects of Fiscal Policy Shocks?" SFB 649 Discussion Paper 2005-039, Humboldt University, Berlin.

Perotti, Roberto, 2001, "What Do We Know About the Effects of Fiscal Policy?" in M. Bordignon and D. Da Empoli (eds.), Politica .scale, .essibilità dei mercati e crescita. Milano: Angeli.

———, 2004, "Estimating the effects of fiscal policy in OECD countries," Working Papers 276, IGIER Bocconi University.

———, 2006, "Comparing Alternative Methodologies to Estimate the Effects of Fiscal Policy", IGIER, Università Bocconi, Milan (mimeo).

———, 2011, "The Effects of Tax Shocks on Output: Not So Large, But Not Small Either", *NBER Working Paper*, No. 16786.

Phillips, Peter.C.B.,1998, "Impulse Response and Forecast Error Variance Asymptotics in Nonstationary VARs," *Journal of Econometrics*, 83 (1-2): 21-56.

Piñón, Marco, Alejandro López-Mejía, Mario Garza, and Fernando L. Delgado (eds.), 2012, *Central America, Panama, and the Dominican Republic: Challenges Following the 2008-09 Global Crisis*, IMF, Washington, DC.

Ramey, Valery A., and Mathew D. Shapiro, 1998, "Costly Capital Reallocation and the Effects of Government Spending," *Carnegie-Rochester Conference Series on Public Policy*, 48 (June): 145.194.

Romer, Christina and David H. Romer, 2010, "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks", American Economic Review, 100, 763-801

———, 2007, "The Macroeconomic Effects of Tax Changes: Estimated Based on a New Measure of Fiscal Shocks," *NBER Working Paper*, No.132641, Cambridge, MA.

Reinhart, Carmen M., and Kenneth S. Rogoff, 2010, "Growth in a Time of Debt," *American Economic Review*, 100(2).

Senhadji, Abdelhak S ; Espinoza, Raphael A., 2011, "How Strong are Fiscal Multipliers in the GCC? An Empirical Investigation" *Working Paper* No. 11/61

Sims, Christopher A., 1980, "Macroeconomics and Reality," *Econometrica*, 48 (1): 1.48.

———, James H. Stock, and Mark W. Watson, 1990, "Inference in Linear Time Series Models with Some Unit Roots," *Econometrica*, 58 (1): 113.144.

———, and T. Zha, 1999, "Error Bands for Impulse Responses," *Econometrica*, 67 (5): 1113.1155.

Uhlig, Harald, 2005, "What Are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure," *Journal of Monetary Economics*, 52 (2): 381.419.