

# Interaction of Monetary and Fiscal Policies through the lens of a semi – structural model: the case for Central America and the Dominican Republic

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# Introduction

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In the Dominican Republic, as well as other economies from Central America, the Central Bank follows an inflation target strategy, where the interest rate is the policy instrument.

In this sense, the CB uses its policy interest rate to influence the market rates relevant for the consumption and investment decisions of agents in the economy.

We study the link between fiscal and monetary policy, highlighting the interest rate channel of fiscal shocks.

If this is important then the monetary policy transmission mechanism is going to be affected by active fiscal policy.

# The fiscal policy on structural and semi-structural models

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Botman et al (2006): A NKM where the structure imposed in the model allows for non-Ricardian individuals, hence capturing the effects of the fiscal policy on different macroeconomic variables.

Blanchard & Perotti (1999): Propose a strategy for the identification of fiscal shocks in a structural VAR model.

# Fiscal and monetary policy

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Canova & Pappa (2011): Empirical study analyzing the conditions in which the fiscal multiplier is greater than 1, including the case where the monetary policy is accommodative.

Duport & Li (2014): Testing the hypothesis that an increase in government spending will increase GDP if the central bank does not react strongly to inflation.

Dai & Phillippon (2005): They study the relationship between the fiscal policy and the term structure of market interest rates.

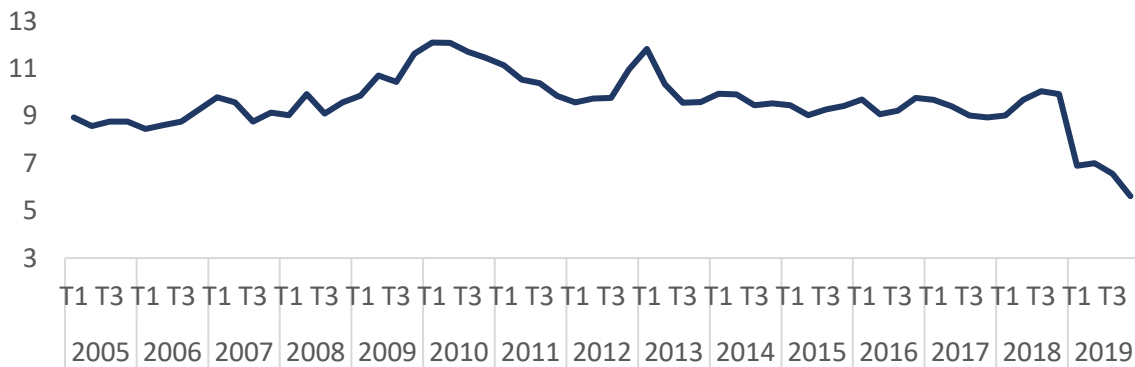
Bredemeier et al (2015): In a traditional structural model, they introduce a spread between the monetary policy rate and the market relevant rate, finding that this spread reacts to government spending.

# The spread between policy and market rate is not constant overtime

Dominican Republic



Costa Rica

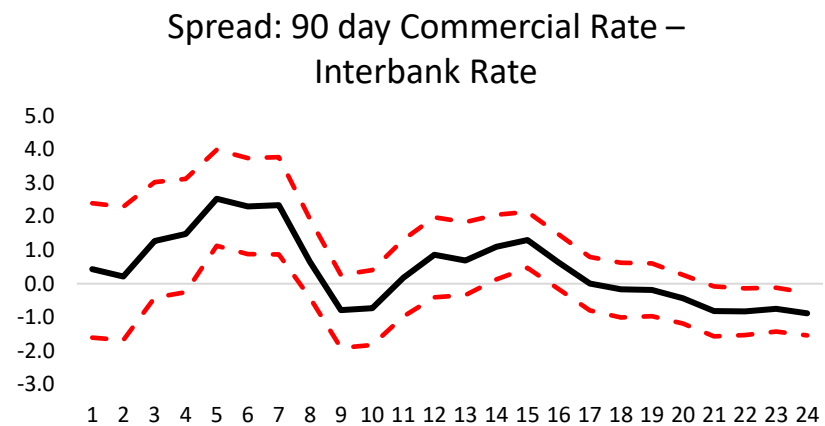
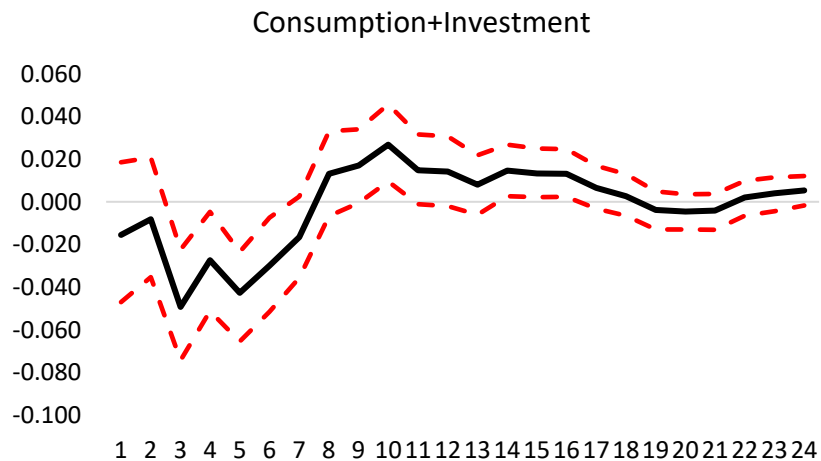
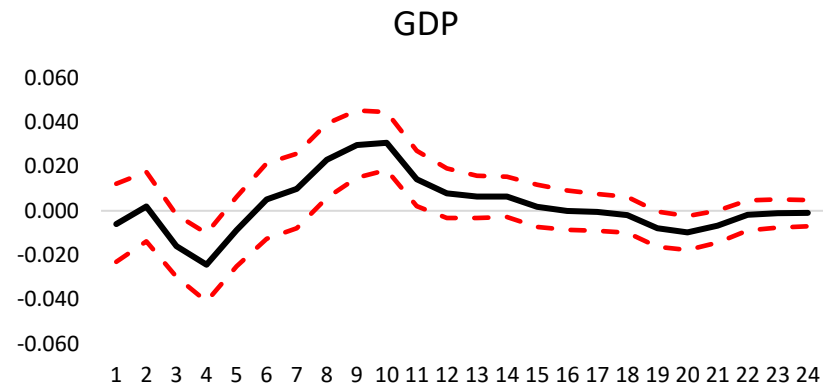
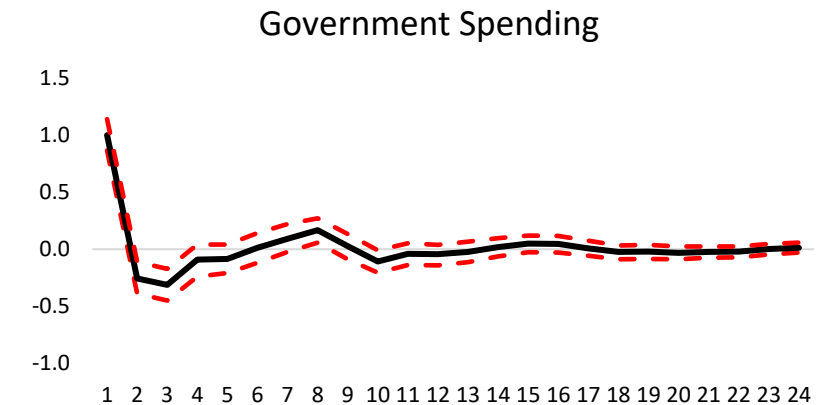


Guatemala



# VAR evidence on the fiscal impact over interest rate spread

IRF: response to a government spending shock



# Empirical strategy

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The interaction between monetary and fiscal policy is evaluated through the lens of a semi – structural model for a small open economy.

The transmission mechanism emphasizes the link between market interest rates and public spending. Therefore, in this model there are two mechanism through which fiscal policy affect the economy and interacts with monetary policy:

- 1) A “direct” channel through which fiscal shocks affects aggregate demand, pushing interest rates up, as central bank stabilizes output gap and inflation.
- 2) An “indirect” channel through which the higher spending is financed using domestic credit, rising interest rate and crowding out the effects of expansive monetary policy.

Despite we specify both channels in the model, we have interest in the estimation of the parameters that characterizes the sensitivity of market rates to fiscal shocks.

# Determination of market interest rates:

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$$i_t^m = i_t^{tpm} + \phi_t$$

$$\phi_t = \phi_g(\text{fiscal}_t) + X\beta + \varepsilon_t^\phi$$

$$i_t^{tpm} = \theta_i i_{t-1}^{tpm} + (1 - \theta_i)(\bar{i} + \theta_\pi(E_t \pi_{t+1} - \bar{\pi}) + \theta_{\hat{y}} \hat{y}_t) + \eta_t^{tpm}$$

$$r_t = i_t^m - E_t \pi_{t+1}$$

$$\hat{r}_t = r_t - \bar{r}$$

where:

$i_t^m$ : market interest rate (comercial banks)

$\phi_t$ : spread

$X$ : macro and financial controls

Note:  $\widehat{\text{var}}_t = \text{var}_t - \text{var}_{ss}$

$i_t^{tpm}$ : monetary policy rate

$\text{fiscal}_t$ : public spending, domestic debt or fiscal deficit



# Determination of market interest rates:

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We consider 2 specifications for  $\phi(\hat{g}_t)$ :

- 1) Lineal (one regime)

$$\phi(\hat{g}_t) = \phi \hat{g}_t$$

- 2) Markov switching (two regimes)

$$\phi(\hat{g}_t) = \begin{cases} \phi_1 \hat{g}_t & S_t = 1 \\ \phi_2 \hat{g}_t & S_t = 2 \end{cases}$$

and the transition matrix:

$$\Pi = \begin{bmatrix} p_{11} & 1 - p_{11} \\ 1 - p_{22} & p_{22} \end{bmatrix}$$

with  $P[S_t = j | S_{t-1} = i] = p_{ij}$ , for  $i, j = 1, 2$ .

# Rest of the model

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Aggregate demand

$$\hat{y}_t = \beta_1 \hat{y}_{t-1} + \beta_2 E_t \hat{y}_{t+1} - \beta_3 \hat{r}_t + \beta_4 \hat{z}_t + \beta_5 \hat{y}_t^* + \beta_6 \hat{g}_t + \eta_t^{\hat{y}}$$

where:

$\hat{y}$ : output gap

$\hat{r}$ : real interest rate gap

$\hat{z}$ : real exchange rate gap

$\hat{y}^*$ : foreign demand gap

$\hat{g}$ : public spending gap

$\eta^{\hat{y}}$ : demand shock

# Rest of the model

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Phillips curve:

$$\pi_t = \alpha_1 \pi_{t-1} + \alpha_2 E_t \pi_{t+1} + \alpha_3 \hat{y}_t + \alpha_4 \hat{z}_t + \eta_t^\pi$$

where:

$\pi_t$ : CPI inflation

$\hat{y}$ : output gap

$\hat{z}$ : real exchange rate gap

$\eta^\pi$ : cost-push shock

# Rest of the model: Fiscal policy

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$$\hat{g}_t = \beta_1^g \hat{g}_{t-1} + \varepsilon_t^g$$

$$\hat{t}_t = \beta_1^t \hat{t}_{t-1} + (1 - \beta_1^t)(\widehat{d^T}_t) + \varepsilon_t^{tt}$$

$$\hat{b}_t = \frac{g_{ss}}{b_{ss}} \hat{g}_t - \frac{t_{ss}}{b_{ss}} \hat{t}_t$$

$$\hat{d}_t = \left( \frac{1+r_{ss}}{1+g_{ss}^y} \right) (\hat{d}_{t-1} + \hat{i}_t^{TPM} - \hat{g}_t^y - \hat{\pi}_t) + \left( \frac{g_{ss}^y+r_{ss}}{1+g_{ss}^y} \right) \hat{b}_t$$

$$\hat{d}_t^* = \left( \frac{(1+r_{ss}^*)+(1+\rho_{ss})+(1+\Delta z_{ss})}{1+g_{ss}^y} \right) (\hat{d}_{t-1}^* + \hat{i}_t^* + \Delta s_t + \rho_t - \hat{g}_t^y - \hat{\pi}_t) + \left( 1 - \frac{(1+r_{ss}^*)+(1+\rho_{ss})+(1+\Delta z_{ss})}{1+g_{ss}^y} \right) \hat{b}_t$$

$$\widehat{d^T}_t = \phi \hat{d}_t + (1 - \phi) \hat{d}_t^*$$

Where:  $\hat{d}_t$ ,  $\hat{d}_t^*$  and  $\widehat{d^T}_t$  represent domestic debt, external debt and total debt;

$\hat{g}_t$ ,  $\hat{t}_t$  and  $\hat{b}_t$  represent public expenditure, tax rate and primary government balance.

# Rest of the model

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UIP condition:

$$i_t^m = i_t^* + \Delta E_t S_{t+1} + \rho_t + \eta_t^i$$

Risk premium:

$$\rho_t = (1 - \theta_\rho)\bar{\rho} + \theta_\rho\rho_{t-1} + \eta_t^\rho$$

Real exchange rate:

$$z_t = s_t + p_t^* - p_t$$

Real exchange rate gap:

$$\hat{z}_t = z_t - \bar{z}$$

Foreign inflation:

$$\pi_t^* = (1 - \phi_{\pi^*})\bar{\pi}^* + \phi_{\pi^*}\pi_t^* + \eta_t^{\pi^*}$$

Foreign interest rate:

$$i_t^* = (1 - \phi_{i^*})\bar{i}^* + \phi_{i^*}i_t^* + \eta_t^{i^*}$$

# Estimation

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- Model is estimated using bayesian methods for the Dominican Republic, Costa Rica and Guatemala.
- Different fiscal indicators are considered in the equation for interest rate spread.
- Observable variables included are: GDP, CPI, NER, MPR, commercial bank interest rate, primary deficit, public domestic debt, public expenditure and commercial banks' non performing loans and solvency ratio.
- Observable foreign variables considered in the estimation are: CPI, GDP, interest rate and EMBI.

# Estimation results: Dominican Republic

Country: Dominican Republic

Dependent variable: Interest rate spread

	Prior			Especifications								
				(1)			(2)			(3)		
Fiscal Indicators	Distribution	Mean	S.D.	Mode	90% HPD interval		Mode	90% HPD interval		Mode	90% HPD interval	
Public Expenditure	Gamma	0.1	0.05	0.0885	0.0235	0.1519						
Primary Deficit	Gamma	0.1	0.05				<b>0.0526</b>	0.0148	0.0853			
Domestic Debt	Gamma	0.1	0.05							<b>0.0118</b>	0.0035	0.0195
<b>Controls</b>												
<b>Financial Conditions</b>												
Solvency ratio	Gamma	0.1	0.05	0.097	0.0219	0.1608	0.0964	0.0245	0.1746	0.0968	0.0248	0.1637
Non Performing Loans	Gamma	0.1	0.05	0.108	0.0255	0.1704	0.1111	0.0255	0.1909	0.0958	0.0251	0.1635
$\Delta$ Output gap	Gamma	0.1	0.05	0.1053	0.0281	0.1748	0.1047	0.0206	0.1757	0.1025	0.0336	0.1739
$\Delta$ Inflation	Gamma	0.1	0.05	0.0586	0.0165	0.1011	0.0702	0.0161	0.1178	0.0639	0.0130	0.1129
$\Delta$ NER depreciation	Gamma	0.1	0.05	0.0478	0.0152	0.0786	0.0457	0.0138	0.0739	0.0450	0.0152	0.0776

# Estimation results: Costa Rica

Country: Costa Rica

Dependent variable: Interest rate spread

	Prior			Especifications								
	Distribution	Mean	S.D.	(1)			(2)			(3)		
Fiscal Indicators				Mode	90% HPD interval		Mode	90% HPD interval		Mode	90% HPD interval	
Public Expenditure	Gamma	0.1	0.05	0.0838	0.0217	0.1446						
Primary Deficit	Gamma	0.1	0.05				<b>0.0479</b>	0.0145	0.0775			
Domestic Debt	Gamma	0.1	0.05							<b>0.008</b>	0.0031	0.0125
<b>Controls</b>												
<b>Financial Condiitions</b>												
Solvency ratio	Gamma	0.1	0.05	0.0866	0.0167	0.1458	0.108	0.0198	0.1824	0.1115	0.0206	0.1886
$\Delta$ Output gap	Gamma	0.1	0.05	0.0890	0.0247	0.1536	0.0835	0.0280	0.1409	0.0863	0.0243	0.1493
$\Delta$ Inflation	Gamma	0.1	0.05	0.0687	0.0175	0.1228	0.0684	0.0169	0.1192	0.063	0.0161	0.1012
$\Delta$ NER depreciation	Gamma	0.1	0.05	0.0600	0.0211	0.0958	0.0619	0.0180	0.0968	0.0638	0.0163	0.1107



# Estimation results: Guatemala

Country: Guatemala

Dependent variable: Interest rate spread

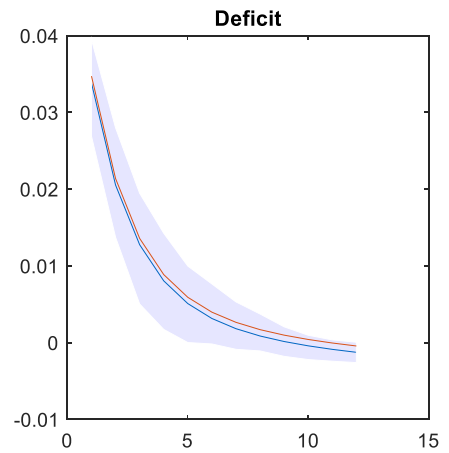
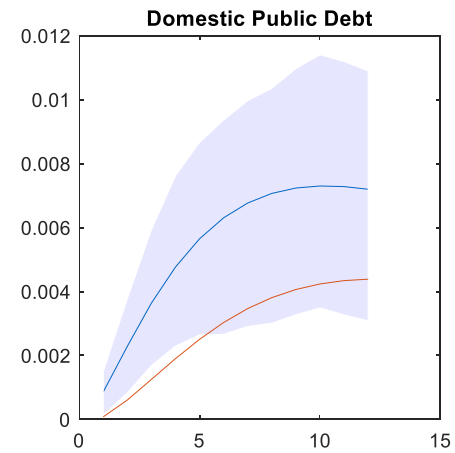
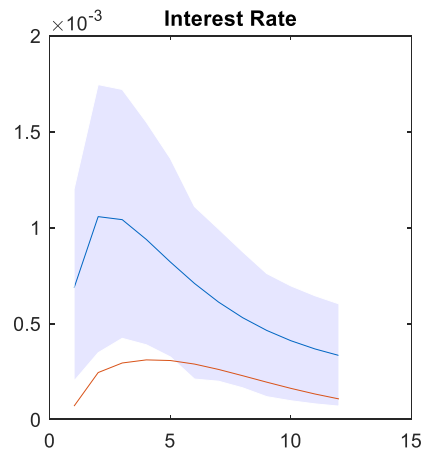
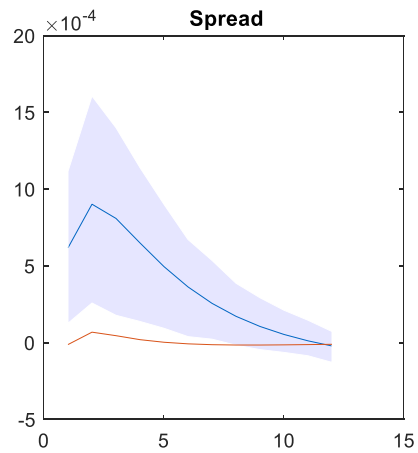
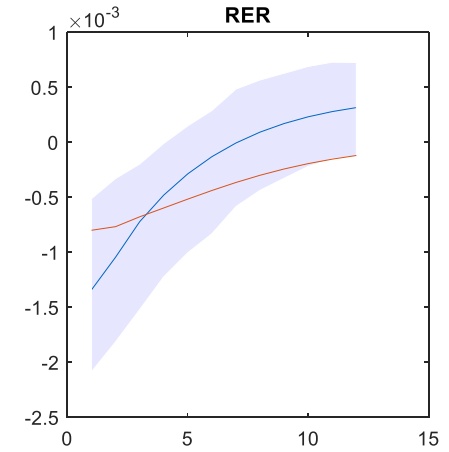
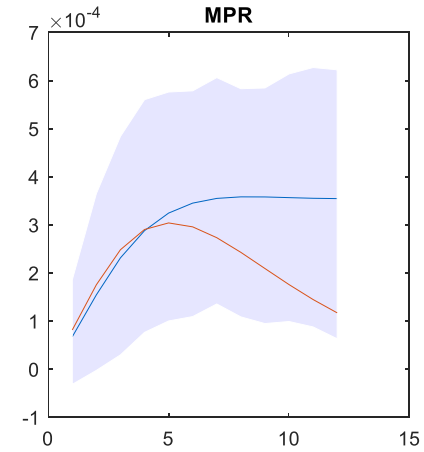
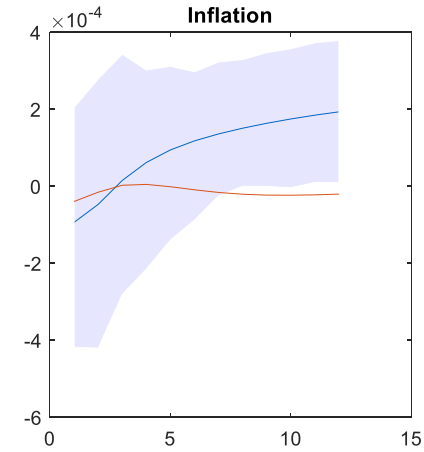
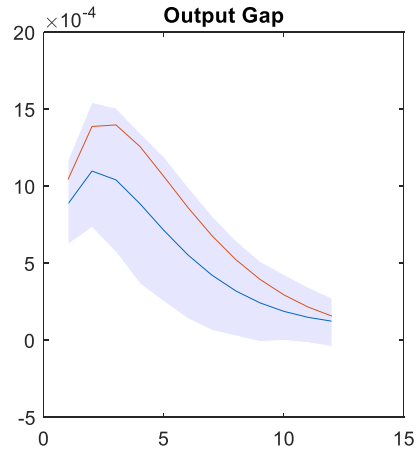
	Prior			Especifications								
				(1)			(2)			(3)		
	Distribution	Mean	S.D.	Mode	90% HPD interval		Mode	90% HPD interval		Mode	90% HPD interval	
<b>Fiscal Indicators</b>												
Public Expenditure	Gamma	0.1	0.05	0.1013	0.0301	0.1681						
Primary Deficit	Gamma	0.1	0.05				<b>0.0768</b>	0.0295	0.1259			
Domestic Debt	Gamma	0.1	0.05							<b>0.0098</b>	0.0032	0.0170
<b>Controls</b>												
<b>Financial Conditions</b>												
Solvency ratio	Gamma	0.1	0.05	0.0994	0.0282	0.1810	0.1006	0.0249	0.1618	0.099	0.0245	0.1697
Non Performing Loans	Gamma	0.1	0.05	0.0947	0.0248	0.1630	0.1106	0.0297	0.1891	0.1009	0.0248	0.1657
$\Delta$ Output gap	Gamma	0.1	0.05	0.0899	0.0229	0.1449	0.0904	0.0232	0.1460	0.0927	0.0240	0.1514
$\Delta$ Inflation	Gamma	0.1	0.05	0.0559	0.0152	0.0911	0.0607	0.0182	0.1055	0.0639	0.0120	0.1094
$\Delta$ NER depreciation	Gamma	0.1	0.05	0.0641	0.0197	0.1046	0.0570	0.0211	0.0995	0.0672	0.0222	0.1143

# Contrafactual simulations

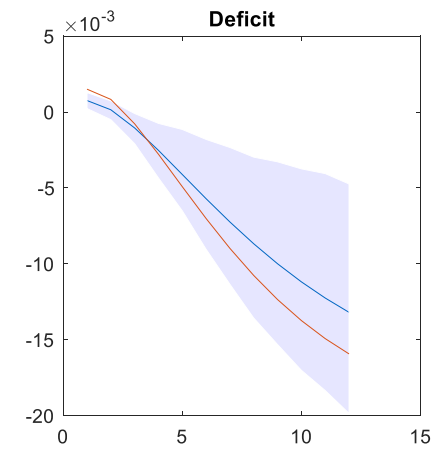
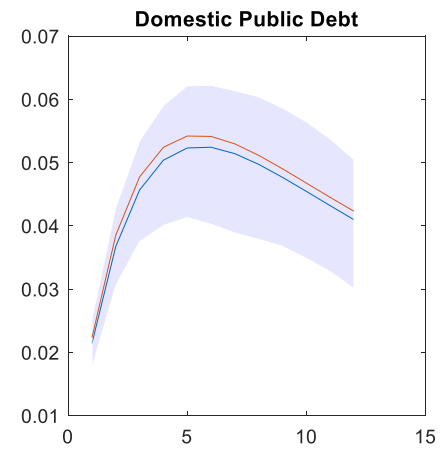
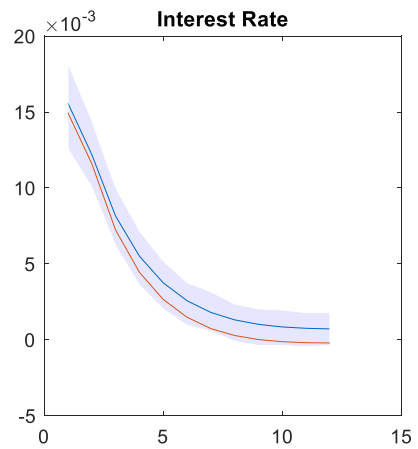
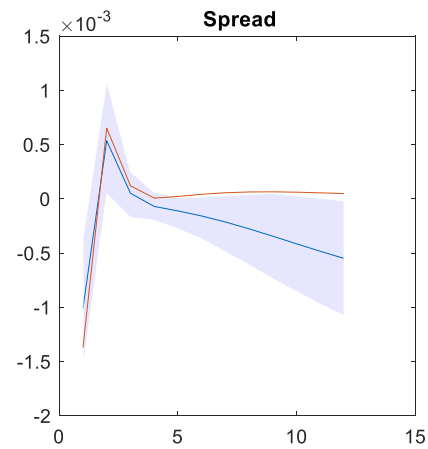
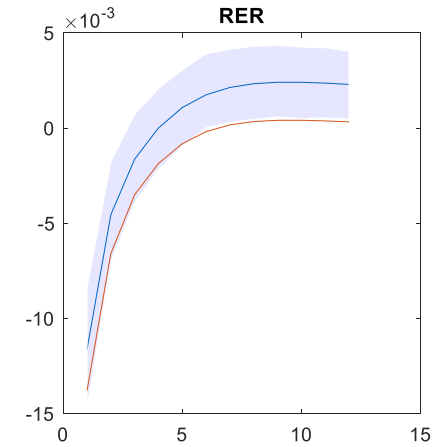
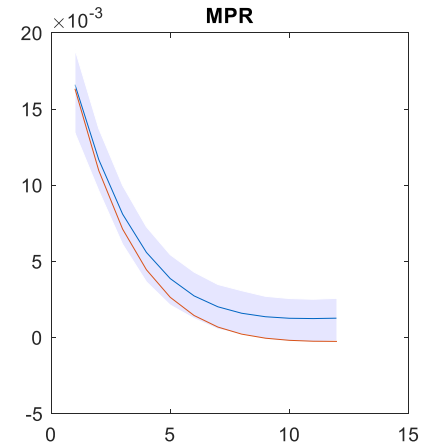
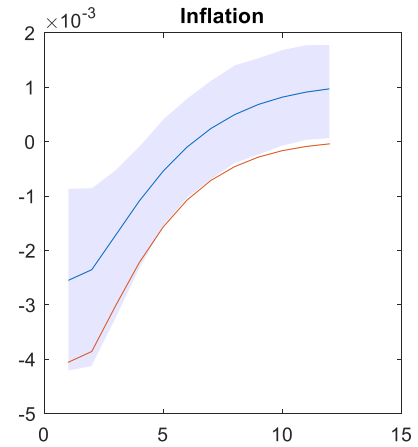
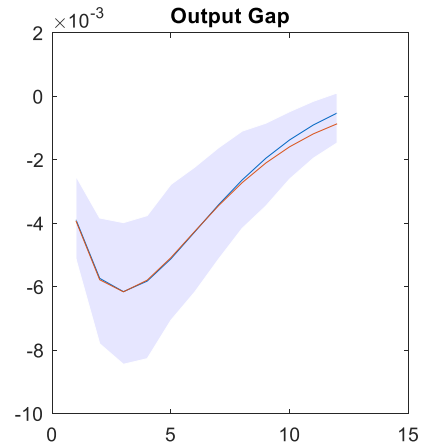
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- Considering the model structure and parameters' estimation, we present a counterfactual simulating the response of domestic variables to a fiscal shock and monetary, in a scenario where there is interaction among the policies and another one where there's no interaction.

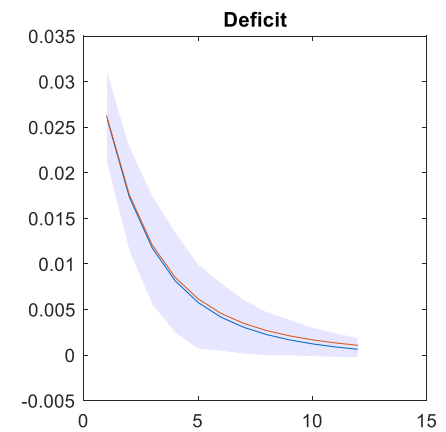
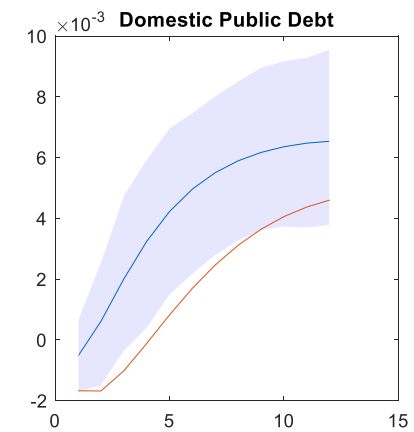
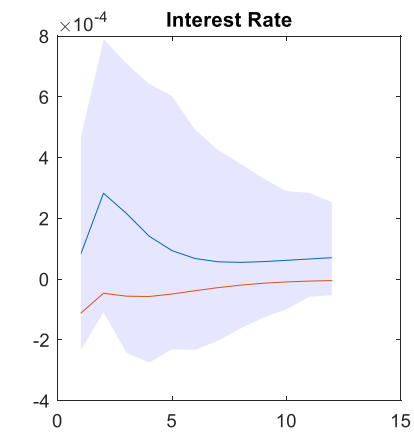
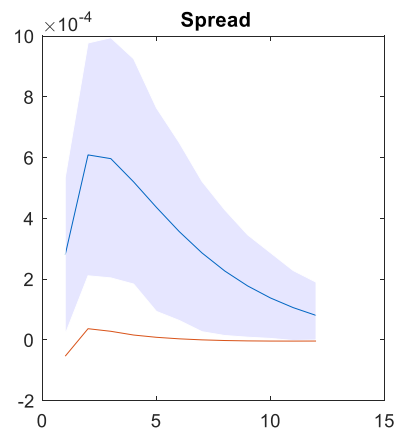
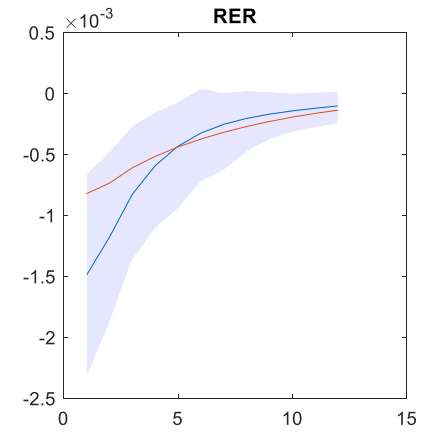
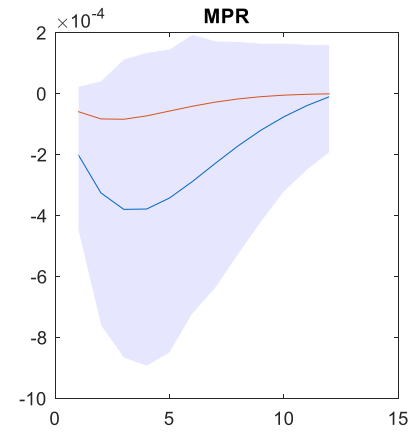
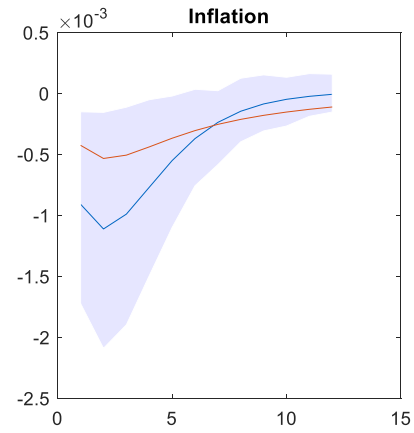
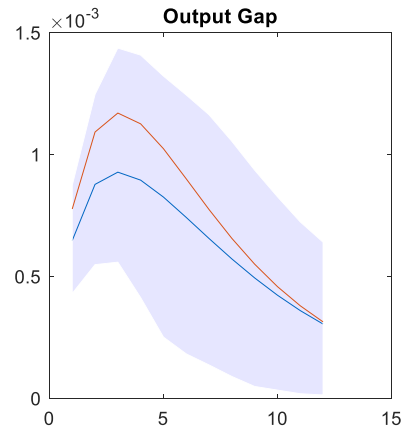
# Dominican Republic: Responses to a Fiscal Expenditure Shock (With interaction)



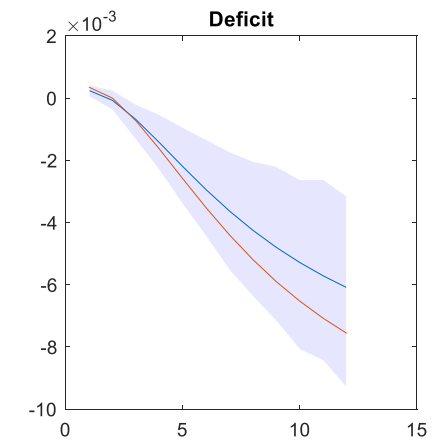
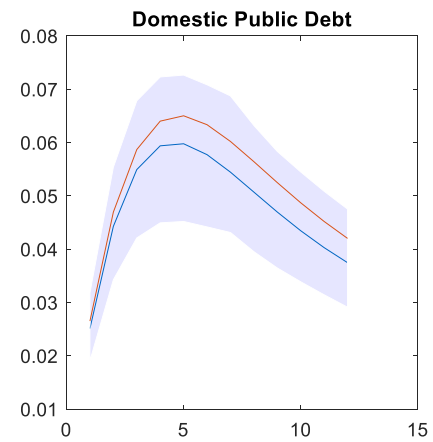
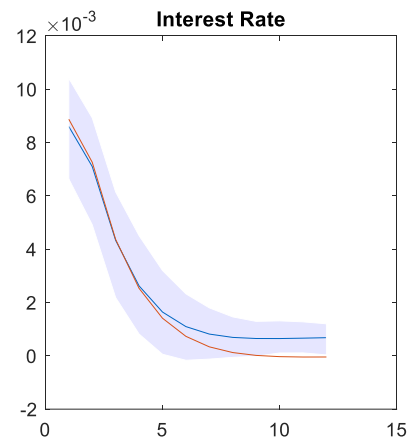
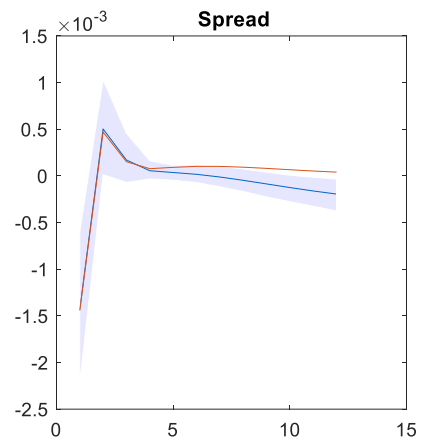
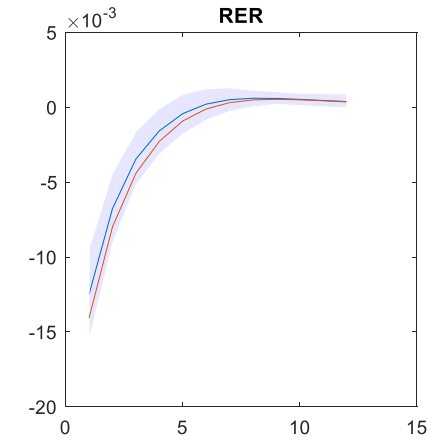
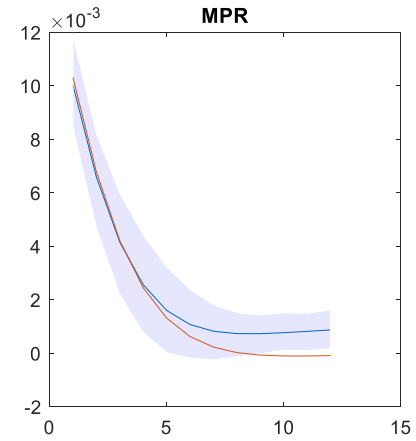
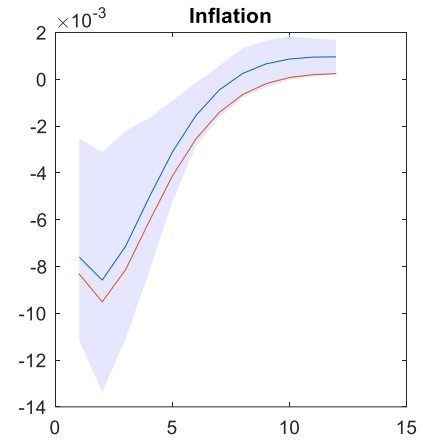
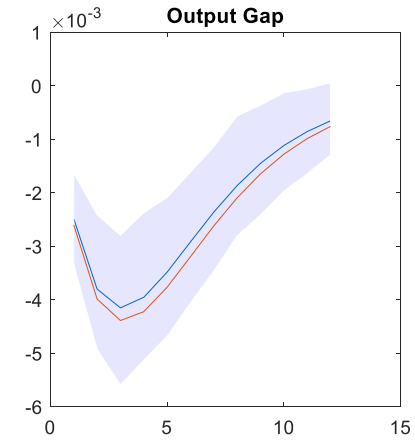
# Dominican Republic: Responses to a MPR Shock (With interaction)



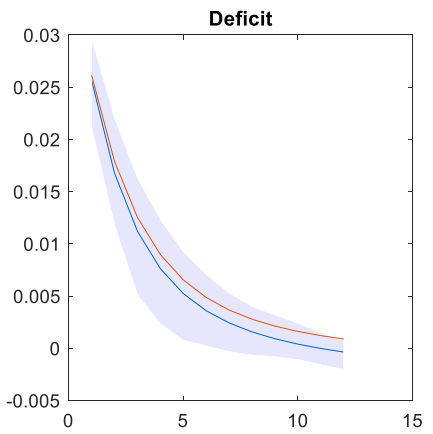
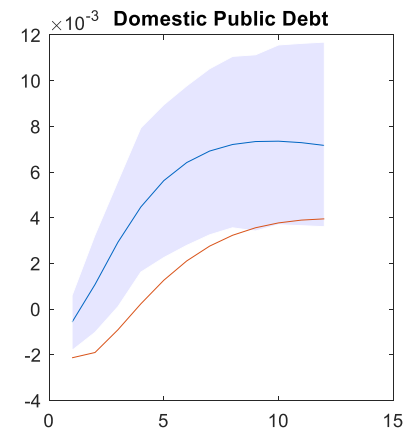
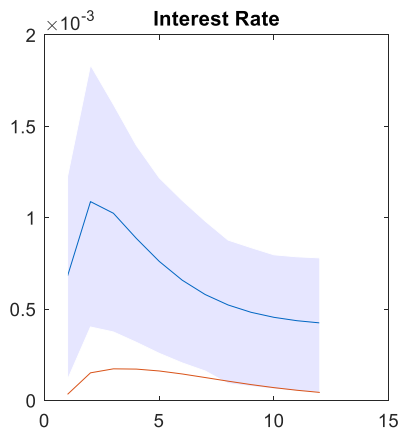
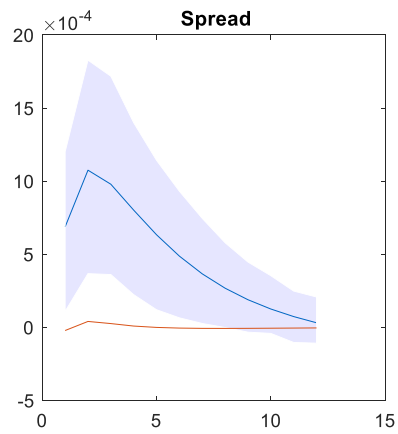
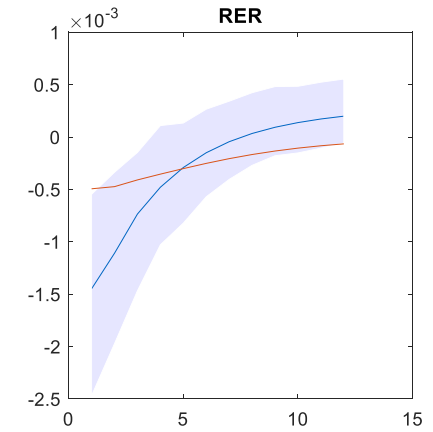
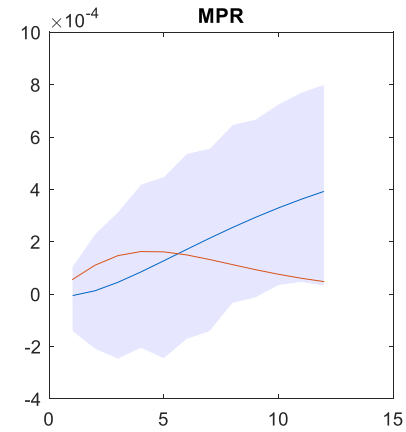
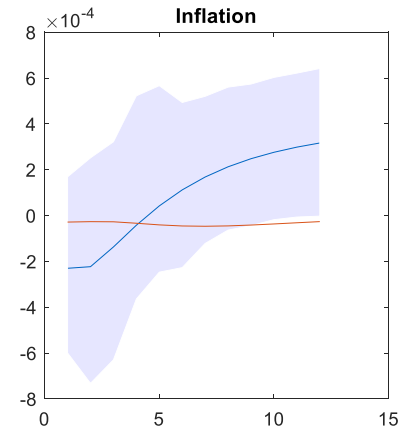
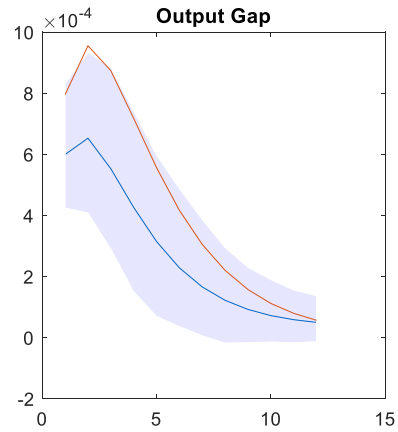
# Costa Rica: Responses to a Fiscal Expenditure Shock (With interaction)



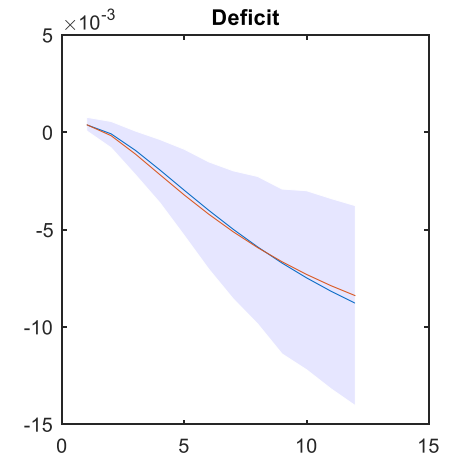
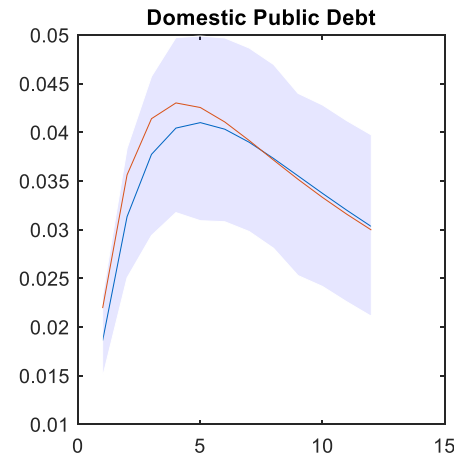
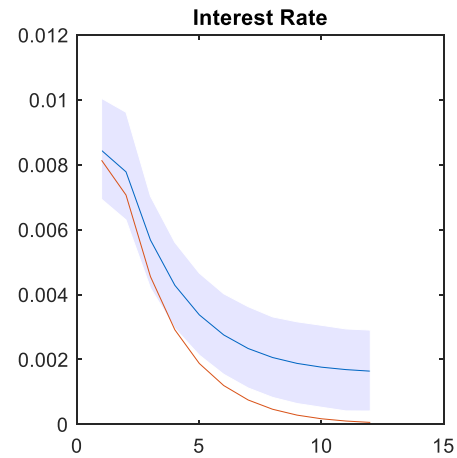
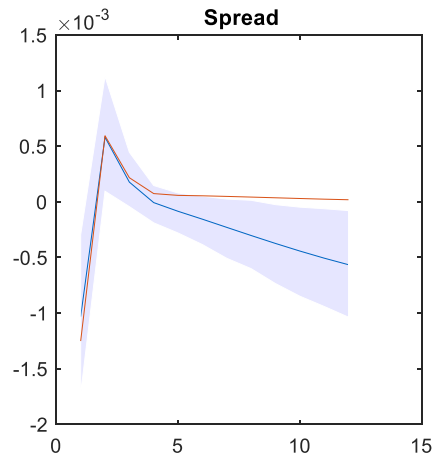
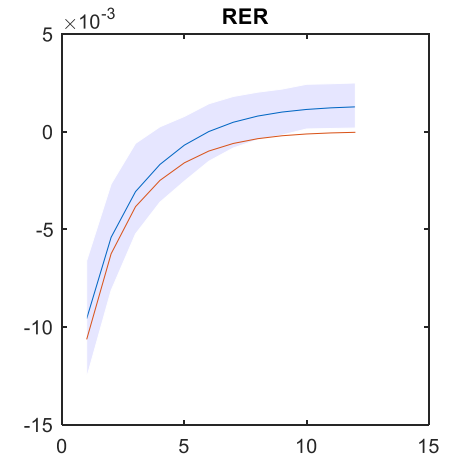
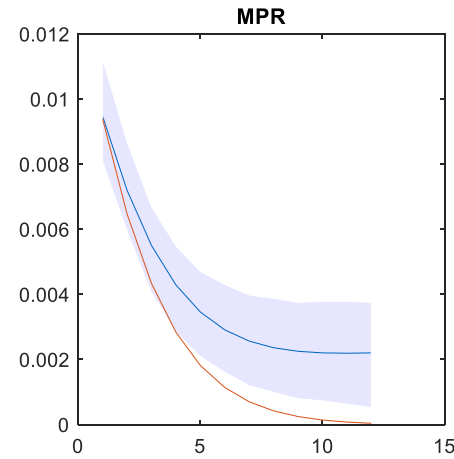
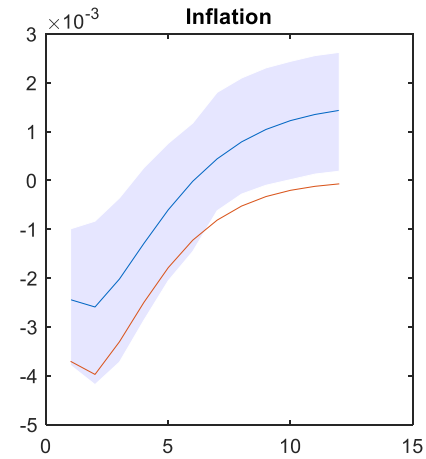
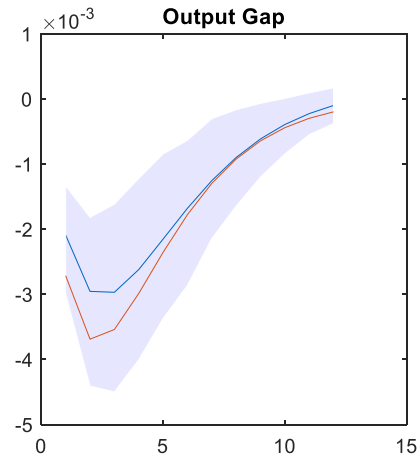
# Costa Rica: Responses to a MPR Shock (With interaction)



# Guatemala: Responses to a Fiscal Expenditure Shock (With interaction)



# Guatemala: Responses to a MPR Shock (With interaction)





# Concluding remarks and next steps

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- The interaction between fiscal and monetary policy is key to understanding the transmission mechanism of the policy taken.
- Our estimation's show that fiscal variables play a role in determining the market interest rates in the selected countries, hence affecting the transmission mechanism of monetary policy.
- Our next step is to verify if this relationship is constant over different fiscal regimes.

# Interaction of Monetary and Fiscal Policies through the lens of a semi – structural model: the case for Central America and the Dominican Republic

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