# Fiscal Multipliers and Balance Sheet Effects in a Small Open Economy

Martha López

Banco de la República

September 23, 2019

# Outline

# Goals

- We contribute to the empirical studies on the effects of government spending on key macroeconomic variables.
- We develop a dynamic stochastic general equilibrium fiscal model for the Colombian economy.The model has four main components:
  - Entrepreneurs that face external finance premium and nominal contracts (Bernanke et al (1999) and Fernandez-Villaverde (2010)
  - The existence of non-Ricardian households
  - Price and wage rigidities, and
  - A fiscal authority that finances government spending partly with public debt.

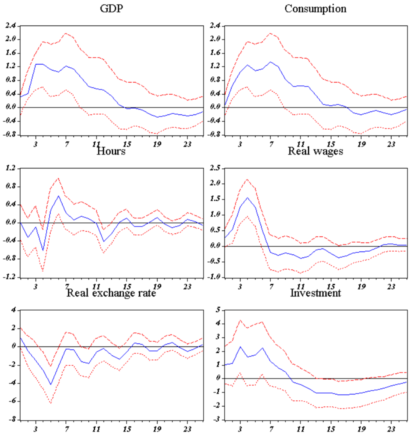
# Empirical Strategy

- Following Vargas, Gonzalez and Lozano (2012) we identify the government spending shock with a method that meets the criteria
  - no anticipation and
  - no contemporaneous correlation with output.
- We define the shock as the difference between the Central Government actual primary expenditures (overall spending without interest payments on public debt) and the forecast made of this variable.
- Next we consider the effect of the shock in a VAR.

# Empirical Strategy

- We use quarterly data for the 1999 to 2017 period.
- We follow Ramey (2011) strategy of using a fixed set of variables and rotating other variables of interest.
    - The fix set of variables consists of the no anticipated spending shock, the log of real per capita government spending, and the log of real per capital GDP.
    - The series of variables that we rotate, one at a time, are investment, private consumer expenditure, total hours, real wage, real exchange rate and net exports as percentage of GDP.

# Effects of government expending shocks



# Model

- Households: Ricardian and non-Ricardian
- Labor Unions
- Labor Agencies
- Firms
    - Entrepreneurs
    - Retailers
    - Capital producers
- Foreign Sector
- Government
    - Monetary Policy
    - Fiscal Policy

# Entrepreneurs

Entrepreneurs purchase capital in each period, $k_t$, and use it in combination with hired labor, $n_t$, to produce the wholesale output good in the economy, $y_t^h$. They use a constant-return-to-scale technology:

$$y_t^h = A_t k_{t-1}^{\alpha} n_t^{1-\alpha} \tag{1}$$

where $A_t$ is an exogenous technology shock.
The entrepreneurs choose $k_t$ and $n_t$ to maximize profits subject to the production technology.
The resulting real marginal cost is:

$$\varphi_t = \frac{1}{A_t} \left( \frac{r_t^k}{\alpha} \right)^{\alpha} \left( \frac{\frac{v_t}{p_t^c}}{1-\alpha} \right)^{(1-\alpha)} \tag{2}$$

Where $r_t^k$ represents the rental rate of capital and $v_t$ nominal wages.

# Entrepreneurs

- The entrepreneur finances their purchases of capital partly with his or her own net worth available at the end of period $t$, $N_t$ and partly by issuing nominal bonds, $B_{t+1}$. The capital financing is divided between net worth and debt as follows:

$$Q_t k_{t+1} = N_{t+1} + B_{t+1} \tag{3}$$

where $Q_t$ corresponds to price of a unit of capital which varies depending of the capital producing technology.

- The entrepreneurs' demand for capital is determined by comparing the expected marginal return to holding capital with its expected marginal financial cost. The expected gross return to holding a unit of capital from $t$ to $t+1$ $E_t f_{t+1}$ is defined as:

$$E_t f_{t+1} = E_t \left[ \frac{(1-\tau_{k,t}) P_t r_t^k + (1-\delta) Q_{t+1}}{Q_t} \right] \tag{4}$$

# Entrepreneurs

- Bernanke et al.(1999), the balance sheets effects that affect investment are given by a financial friction. There is a costly state-verification problem.
- Lenders must pay a fixed "auditing cost" if they wish to observe the borrower's realized returns.
- Additional costs (the premium) over riskless interest rate $r_{t+1}$ are imposed on borrowers if they demand external funds.
- The default risk depends on the degree to which the entrepreneurs depend on external funds, debt.
- Nominal contracts: Fernandez-Villaverde (2010)

$$E_t f_{t+1} = E_t \left[ R_{t+1} \left( \frac{Q_t k_{t+1}}{N_{t+1}} \right)^{\psi} (1+\pi_{t+1})^{\gamma_b} \right] \tag{5}$$

where $(1+\pi_{t+1})^{\gamma_b}$ is a term that adjust nominal deb to inflation at a rate $\gamma^b \in [0,1]$.

- When the ratio of internal funds is low the default risk is high and in this case the cost of borrowing rises.

# Entrepreneurs

- Finally, net worth evolves as following

$$N_{t+1} = \nu \left[ f_{t+1} Q_t k_t - R_t B_t (1 + \pi_{t+1})^{\gamma_b} \right] \tag{6}$$

When deb contracts are denominated in nominal terms, $\gamma^b = 0$, in such a case, an unexpected positive change in inflation improves net worth since the return on capital increases but the nominal debt remains constant.

- This effect is called the debt deflation channel or "Fisher effect".

# Capital producers

- Capital producers purchase consumption goods as material input, $x_t$, and combine it with rented capital, $k_t$, to produce new capital.
- Following Dib and Christensen (2008), we assume that capital producers are subject to quadratic capital adjustment costs. Their optimization problem, in real terms, consist of choosing the quantity of investment to maximize profits:

$$\max_{x_t} \left[ q_t x_t - x_t - \frac{\kappa}{2} \left( \frac{x_t}{k_t} - \delta \right) k_t \right] \tag{7}$$

The first order condition is

$$q_t - \frac{\kappa}{2} \left( \frac{x_t}{k_t} - \delta \right) = 0 \tag{8}$$

The aggregate capital stock evolves according to:

$$k_{t+1} = x_t + (1-\delta) k_t \tag{9}$$

# Model - Households

We assume that there is a fraction $\Gamma$ of Non-Ricardian households in the economy whose variables are denoted by $n$ and a fraction $(1-\Gamma)$ of Ricardian agents whose variables are denoted by $r$.

- Ricardian Households
  Ricardian Household $r \in [\Gamma, 1]$ have preferences of the form

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\sigma_r} \left\{ c_{r,t} - \theta_r \frac{n_{r,t}^{1+\gamma_r}}{1+\gamma_r} \right\}^{1-\sigma_r} - \frac{1}{1-\sigma_r}$$

  where $c_{r,t}$ is a consumption index and $n_{r,t}$ are hours worked. The parameter $\sigma_r$ measures the intertemporal elasticity of substitution, $\theta_r$ is a scale parameter and $\gamma_r$ the inverse of the Frisch elasticity.

- Greenwood-Hercowitz-Huffman (GHH) preferences. GHH preferences and price rigidities allow the increase of consumption as a response to an increase in government spending.

# Households

Budget constraint given by

$$(1+\tau_{c,t})\,c_{r,t}+b_{r,t}+\frac{e_{t-1}p^{\star}_{t-1}}{p^{c}_{t-1}}\,b^{\star}_{r,t-1}\,\frac{(1+i^{\star}_{t-1})}{(1+\pi^{\star}_{t})}=$$

$$(1-\tau_{n,t})\,w_{r,t}n_{r,t}+b_{r,t-1}\left(\frac{1+i_{t-1}}{1+\pi_t}\right)(1+\pi_t)^{\gamma^b\psi}+\frac{e_t p^{\star}_t}{p^c_t}\,b^{\star}_{r,t}+\frac{1}{1-\Gamma}\left[\xi^{\omega_r}_t+\xi^{h}_t+\xi^{e}_t\right]+T_t \qquad (10)$$

where $i^*_t=\bar{i}^*\exp\left(\phi_b\left(\frac{s_t p^*_t}{p^c_t}\frac{b^*_t}{rgdp_t}-\bar{b}\right)\right)$

# Households

- Non-Ricardian Household $n \in [0, \Gamma]$ solves a similar problem but they are assumed to have no access to financial markets. Therefore, they consume period by period all their labor income and the transferss that receive from the government. They seeks to maximize its lifetime utility

$$\mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\sigma_n} \left\{ c_{n,t} - \theta_n \frac{n_{n,t}^{1+\gamma_n}}{1+\gamma_n} \right\}^{1-\sigma_n} - \frac{1}{1-\sigma_n}$$

subject to the budget constraint

$$(1+\tau_{c,t})\, c_{n,t} = (1-\tau_{n,t})\, w_{n,t}^{a} n_{n,t} + \frac{1}{\Gamma} \xi_t^{\omega_n} + T_t$$

# Consumption and investment index

It is assumed that the composition of the consumption bundle is identical for both types of households. The consumption bundle takes the form

$$c_t = \left[(1-\alpha_c)^{\frac{1}{\eta_c}}\left(c_t^h\right)^{\frac{\eta_c-1}{\eta_c}} + \alpha_c^{\frac{1}{\eta}c}\left(c_t^f\right)^{\frac{\eta_c-1}{\eta_c}}\right]^{\frac{\eta_c}{\eta_c-1}} \tag{11}$$

where $c_t^h$ and $c_t^h$ are CES indexes for domestic and foreign goods, with parameter $\alpha_c$determining the degree of openness and $\eta_c$ the elasticity of substitution between domestic and imported goods. The multiplier equal to $p_t^c$ that denotes the consumption price index that normalizes every price index of the economy

$$p_t^{c(1-\eta)} = \left[(1-\alpha_c)\left(p_t^h\right)^{1-\eta_c} + \alpha_c\left(p_t^f\right)^{1-\eta_c}\right]$$

As for consumption, the investment bundle $x_t$ aggregates domestic and foreign investment according to the next function:

$$x_t = \left[(1-\alpha_x)^{\frac{1}{\eta_x}}\left(x_t^h\right)^{\frac{\eta_x-1}{\eta_x}} + \alpha_x^{\frac{1}{\eta_x}}\left(x_t^f\right)^{\frac{\eta_x-1}{\eta_x}}\right]^{\frac{\eta_x}{\eta_x-1}}, \tag{12}$$

# Government

- Monetary Policy
  Monetary policy follows a conventional simple policy rule where interest rate is set by the Central Bank according with

$$i_t = \bar{i} \left( \frac{\pi^c_{t+1}}{\bar{\pi}} \right)^{\rho_\pi} \exp\left\{ z^i_t \right\} \tag{13}$$

  where long-run interest rate is $\bar{i}$, the inflation target is $\bar{\pi}$ and the feed-back parameter is $\rho_\pi$

# Government

- Fiscal policy
  The government purchases both domestic and foreign goods. These purchases are assumed to have null effect on private utility or productivity.

$$G_t = \left[ (1-\alpha_G)^{\frac{1}{\eta_G}} \left( G_t^h \right)^{\frac{\eta_G - 1}{\eta_G}} + \alpha_G^{\frac{1}{\eta_G}} \left( G_t^f \right)^{\frac{\eta_G - 1}{\eta_G}} \right]^{\frac{\eta_G}{\eta_G - 1}}, \tag{14}$$

with the multiplier equal to $p_t^G$. The government goods relative prices are given by:

$$\frac{p_t^G}{p_t^c} = \left[ (1-\alpha_G) \left( \frac{p_t^h}{p_t^c} \right)^{1-\eta_G} + \alpha_G \left( \frac{p_t^f}{p_t^c} \right)^{1-\eta_G} \right]^{\frac{1}{1-\eta_G}}. \tag{15}$$

# Government

- Budget constraint

$$b^{\star}_{g,t} = \left[\left(\frac{1+i^{\star}_{t-1}}{1+\pi^{\star}_{t}}\right)\frac{e_{t-1}p^{\star}_{t-1}}{p^{c}_{t-1}}b^{\star}_{g,t-1} - s_t\right]\left(\frac{e_t p^{\star}_t}{p^{c}_t}\right)^{-1} \quad (16)$$

$$s_t = \tau_t + \omega\frac{p^{m}_t}{p^{c}_t}y^{m}_t - \frac{p^{G}_t}{p^{c}_t}G_t - T_t \quad (17)$$

where $s_t$ is the primary surplus and $\tau_t$ denotes the total tax revenues, the second term in the right hand side is oil revenues from government, $g_t \equiv \frac{p^G_t}{p^c_t}\frac{G_t}{gdp_t}$ is the government spending as a percentage of GDP, and $T_t$ lump-sum net transfers. The international price of oil $p^{m\star}_t$ is assumed to follow an exogenous autorregresive process, implying a domestic oil price $p^m_t = \frac{e_t p^{\star}_t}{p^c_t}p^{m\star}_t$; in the same way, oil production $y^m_t$ is assumed to be exogenous. $\omega$ denotes the share of oil production that the government owns, so that a fraction $\omega$ of oil revenues accrues to the government

# Government

- Government surplus $gs_t$ is defined as:

$$gs_t = -b^{\star}_{g,t}\left(\frac{e_t p^{\star}_t}{p^c_t}\right) + b^{\star}_{g,t-1}\left(\frac{e_{t-1} p^{\star}_{t-1}}{p^c_{t-1}}\right)\left(\frac{1}{1+\pi^{\star}_t}\right), \qquad (18)$$

which equals the primary surplus and net interest payments on government debt.

# Fiscal Policy Rules

- A general form of fiscal policy rule is

$$\frac{gs_t}{gdp_t} = \overline{gs}^{rat} + d_{tax}\left(\frac{\tau_t}{gdp_t} - \frac{\overline{\tau}}{\overline{gdp}}\right) + d_{oil}\left(\omega\left(\frac{p_t^{oil}}{p_t^c}\frac{y_t^{oil}}{gdp_t} - \frac{\overline{p^{oil}}}{\overline{p^c}}\frac{\overline{y^{oil}}}{\overline{gdp}}\right)\right) + d_{debt}\left(\frac{b_t}{gdp_t} - \frac{\overline{b}}{\overline{gdp}}\right)$$

where $\overline{gs}^{rat}$ is the structural surplus target.

- In Colombia in july 2011 was introduced a fiscal rule where the target structural fiscal deficit for the year 2014 is 2.3%.
  - Cyclical adjustments according to excess tax revenue, excess revenue from mining sector and an aditional debt gap variable.
  - This excess revenues are saved in the form of reduced debt or increased assets.

# Fiscal Policy Rules

- Five instruments: three taxes $\tau_{c,t}$, $\tau_{l,t}$ and $\tau_{k,t}$, a subsidy $\tau_{x,t}$ and two spending items $T_t$ and $g_t$. The default instrument for our baseline results is transfers $T_t$:

$$\left(\frac{T_t}{gdp_t}-\frac{\overline{T}}{\overline{gdp}}\right)=(1-d_{tax})\left(\frac{\tau_t}{gdp_t}-\frac{\overline{\tau}}{\overline{gdp}}\right)+(1-d_{oil})\left(\omega\left(\frac{p_t^{oil}}{p_t^c}\frac{y_t^{oil}}{gdp_t}-\frac{\overline{p^{oil}}}{\overline{p^c}}\frac{\overline{y^{oil}}}{\overline{gdp}}\right)\right)-d_{debt}\left(\frac{b_t}{gdp_t}-\frac{\overline{b}}{\overline{gdp}}\right), \quad (19)$$

- $d_{tax}=d_{oil}=d_{debt}=0$: a strict balanced budget rule (BBR) that is highly procyclical because it calls for higer spending in a boom
- $d_{tax}=d_{oil}=1$ and $d_{debt}=0$: a structural surplus rule (SSR) that ties government spending to structural/permanent government revenues
- $d^{tax}>1$ corresponds to a countercyclical rule (CCR) that calls for higher tax rate (or lower spending) in a boom.

# The rest of the Model - Unions and Wage Setting

In order to motivate wage setting and to facilitate aggregation, we expand the unions framework of Kumhof et al. (2010).

- Non-Ricardian Households' Labor Unions
  There is a continuum of unions $j \in [0,1]$ that buy labor from Non-Ricardian Households at $w^a_{n,t}$ and sell it to the Non-Ricardian Labor Agency at $v_{n,j,t}$. They have monopolistic power and can set $v_{n,j,t}$ optimally with probability $\left(1-\varepsilon^{\omega_n}\right)$ each period.
- Ricardian Households' Labor Unions
  There is a continuum of unions $j \in [0,1]$ that buy labor from Ricardian Households at $w^a_{r,t}$ and sell it to the Ricardian Labor Agency at $v_{r,j,t}$. They have monopolistic power and can set $v_{r,j,t}$ optimally with probability $\left(1-\varepsilon^{\omega_r}\right)$ each period. Their problem is similar to the Non-Ricardian Labor Unions.

# Labor Agencies

- There are three types of labor agencies.
  Non-Ricardian Labor Agency: There is a labor Agency that aggregates Non-Ricardian labor products supplied by Non-Ricardian labor Unions. Non-Ricardian labor Agency demands labor from union $j$ given the aggregation function

$$u_{n,t} = \left[ \int_0^1 \left( u_{n,j,t} \right)^{\frac{\theta^{\omega n}-1}{\theta^{\omega n}}} dj \right]^{\frac{\theta^{\omega n}}{\theta^{\omega n}-1}}$$

  thus, the demand from labor from union $j$ is given by

$$u_{n,j,t} = \left( \frac{v_{n,j,t}}{v_{n,t}} \right)^{-\theta^{\omega n}} u_{n,t}$$

  where

$$v_{n,t} = \left[ \int_0^1 \left( v_{n,j,t}^{1-\theta^{\omega n}} \right) dj \right]^{\frac{1}{1-\theta^{\omega n}}}$$

  Respectively, there is a Ricardian labor Agency that solves the corresponding problem with respect to the labor supplied by Ricardian labor Unions.

# Demand of labor from a National Agency

Finally, a National Agency produces an aggregated labor product to be sold to intermediate good firms subject to a CES aggregator: A National Agency produces an aggregated labor product to be sold to intermediate good firms subject to a CES aggregator:

$$\min v_{n,t} u_{n,t} + v_{r,t} u_{r,t}$$

$$n_t = \left[ (1-\alpha_h)^{\frac{1}{\eta_h}} (u_{n,t})^{\frac{\eta_h - 1}{\eta_h}} + \alpha_h^{\frac{1}{\eta_h}} (u_{r,t})^{\frac{\eta_h - 1}{\eta_h}} \right]^{\frac{\eta_h}{\eta_h - 1}} \tag{20}$$

with the multiplier equal to $v_t$ and the First Order Conditions

$$u_{n,t} = (1-\alpha_h) \left( \frac{v_{n,t}}{v_t} \right)^{-\eta_h} n_t \tag{21}$$

$$u_{r,t} = \alpha_h \left( \frac{v_{r,t}}{v_t} \right)^{-\eta_h} n_t \tag{22}$$

agregate wage index is

$$\frac{v_t}{p_t^c} = \left[ (1-\alpha_h) \left( \frac{v_{n,t}}{p_t^c} \right)^{1-\eta_h} + \alpha_h \left( \frac{v_{r,t}}{p_t^c} \right)^{1-\eta_h} \right]^{\frac{1}{1-\eta_h}}$$

# Retailers

Each firm resets its price with probability $1-\varepsilon^h$ each period, independently of the time elapsed since the last adjustment, setting price $p_z^h$. In absence of re-optimization, the firm follows an updating rule

$$p_{z,t+i}^h = p_{z,t+i-1}^h \left(1+\pi_{t-1}^h\right) = p_{z,t}^h \prod_{s=1}^{i} \left(1+\pi_{t+s-1}^h\right) \tag{23}$$

The problem of the firm $z$ is to pick $p_{z,t}^h$ to maximize the discounted sum of expected profits when the firm adjust prices once:

$$maxE \sum (\beta \varepsilon^h)^i \frac{\lambda_{t+i} \xi_{z,t+i}^h}{P_{t+i}^h} \tag{24}$$

subject to the demand function variety $z$

$$y_{z,t}^h = \left(\frac{p_{z,t}^h}{p_t^h}\right)^{-\theta^h} y_t^h \tag{25}$$

where

$$\xi_{z,t+i}^h = \left[p_{z,t}^h \prod_{s=1}^{i} \left(1+\pi_{t+s-1}^h\right) - \varphi_{t+i}\right] y_{z,t+i}^h \tag{26}$$

# Rest of the world

Foreign demand of home produced goods $c_t^{h*}$ is given by

$$c_t^{h*} = \left( \frac{p_t^h}{p_t^c} \left( \frac{s_t p_t^c}{p_t^\star} \right)^{-1} \right)^{-\mu} c_t^* \tag{27}$$

where the parameter $\mu$ represents the price elasticity of exports.

# Equilibrium and Aggregation

Market clearing conditions for domestic inputs are

$$k_t = (1 - \Gamma)\, k_{r,t} \tag{28}$$

Similarly for other asset holdings we have

$$b_t = (1 - \Gamma)\, b_{r,t} \tag{29}$$

$$b_t^* = (1 - \Gamma)\, b_{r,t}^* \tag{30}$$

Agregate consuption and investment are

$$c_t = \Gamma c_{n,t} + (1 - \Gamma)\, c_{r,t} \tag{31}$$

$$x_t = (1 - \Gamma)\, x_{r,t} \tag{32}$$

Domestic uses of product

$$y_t^h = c_t^h + x_t^h + G_t^h + c_t^{h*} \tag{33}$$

Finally real GDP is

$$gdp = \frac{p_t^h}{p_t^c} y_t^h + \frac{p_t^{oil}}{p_t^c} y_t^{oil} \tag{34}$$

# Parameter values

| Parameter | Value | Description |
|---|---|---|
| $\beta$ | 0.99 | Intertemporal discount factor |
| $\Gamma$ | 0.5 | Share of Non-Ricardian on total population |
| $\gamma_j$ | 0.5 | Inverse of Frisch elasticity |
| $\theta_j$ | 4 | Labour supply scale parameter |
| $\sigma_j$ | 1.1 | Intertemporal elasiticity of substitution |
| $\alpha_c$ | 0.13 | Share of imported goods on total consumption |
| $\eta_c$ | 0.9 | Elast. of subst. between domestic and foreign goods |
| $\alpha_x$ | 0.13 | Share of imported goods on total investment |
| $\eta_x$ | 0.5 | Elast. of subst.between domestic and foreign goods |
| $\alpha_G$ | 0.13 | Share of imported goods on total government expenditure |
| $\eta_G$ | 0.5 | Elast. of subst.between domestic and foreign goods |
| $\delta$ | 0.035 | Depreciation rate |
| $\kappa$ | 0.5 | Investment costs |
| $\alpha_h$ | 0.5 | Share of Non-Ricardian labour on total supply |
| $\eta_h$ | 0.99 | Elast. of subst.between Non-Ricardian and Ricardian labour |
| $\omega$ | 0.5 | Government's share on total mining sector benefits |
| $\theta^{\omega_i}$ | 6 | Elast. of subst. between intermediary union labours for intermediary producers |
| $\varepsilon^{\omega_i}$ | 0.01 | Probability of firms not to optimize wage |
| $\alpha$ | 0.3 | Share of capital on total production |
| $\theta^h$ | 0.3 | Elast. of subst. between intermediary goods on final production |
| $\varepsilon^h$ | 0.9 | Probability of firms not to optimize price |
| $\mu$ | 0.4 | Exports elasticity |
| $\phi_b$ | 0.3 | Premium risk elasticity of debt to GDP |
| $\overline{gs}$ | -0.025 | Surplus target |

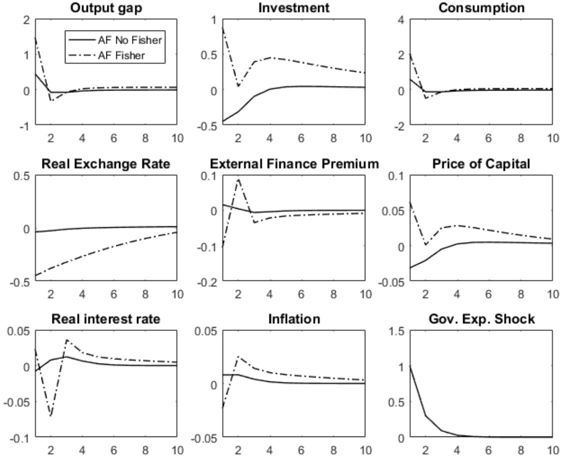
# Parameter values

| Parameter | Value | Description |
|---|---|---|
| $\overline{\pi}$ | 1.03 | Long-run domestic inflation |
| $\overline{\pi}^*$ | 1.03 | Long-run foreign inflation |
| $\overline{b}^*$ | 0.3 | Long-run debt-GDP ratio |
| $\overline{i}^*$ | 1.0176 | Long-run foreign nominal interest rate |
| $\overline{i}$ | 1.0176 | Long-run nominak interest rate |
| $\overline{g}$ | 0.15 | Mean of government expenditure to GDP shock |
| $\tau_c$ | 0.08 | Mean of consumption tax schock |
| $\tau_k$ | 0.1 | Mean of capital tax schock |
| $\tau_w$ | 0.17 | Mean of labor tax schock |
| $\tau_x$ | 0.08 | Mean of investment subsidy schock |

# Model and Data- Steady State values

| Variables | Model values | Economy |
|---|---|---|
| Consumption to GDP ratio | 0.664 | 0.68 |
| Investment to GDP ratio | 0.186 | 0.20 |
| Exports to GDP ratio | 0.164 | 0.16 |
| Imports to GDP ratio | 0.164 | 0.19 |
| Government expenditure to GDP ratio | 0.15 | 0.15 |
| Total hours | 0.369 | 0.33 |
| Debt to GDP ratio | 0.343 | 0.3 |

# Impulse Responses to a government spending shock



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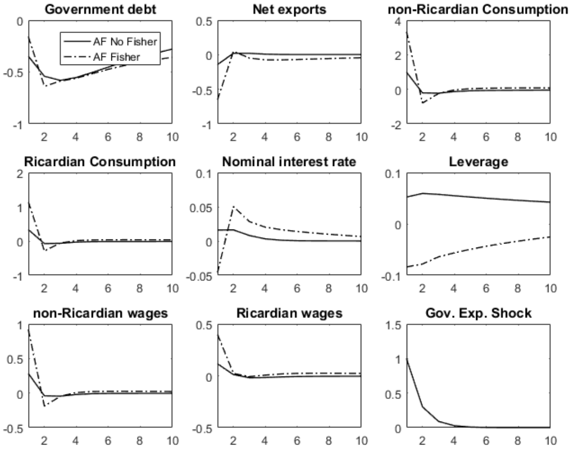
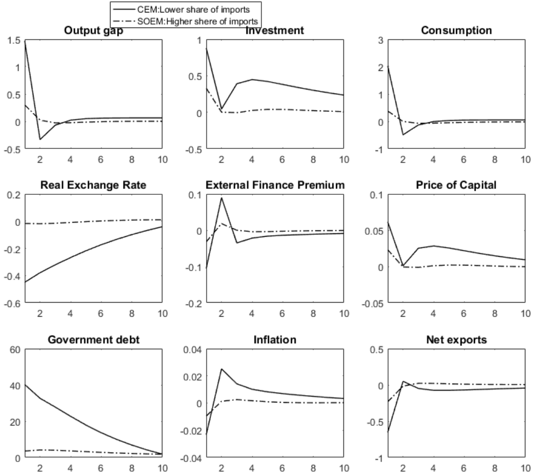


# Impulse Responses CEM vs SOEM (share of imports)

- Import substitution-effect



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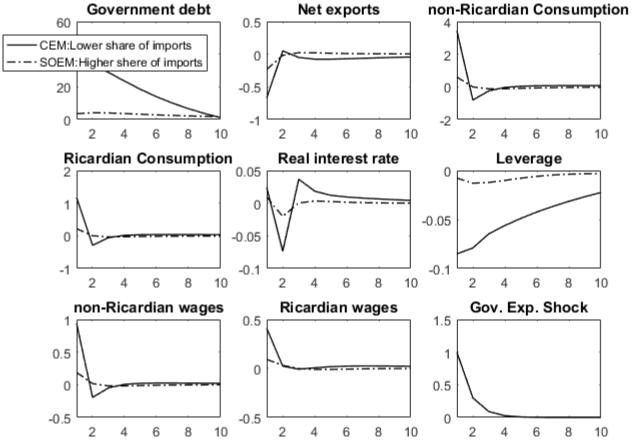
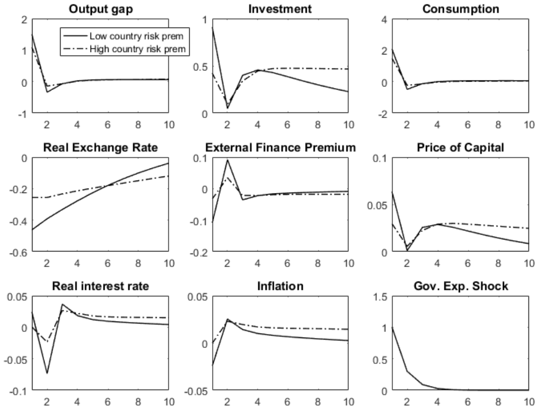


# Impulse Responses CEM vs SOEM (country risk premium)



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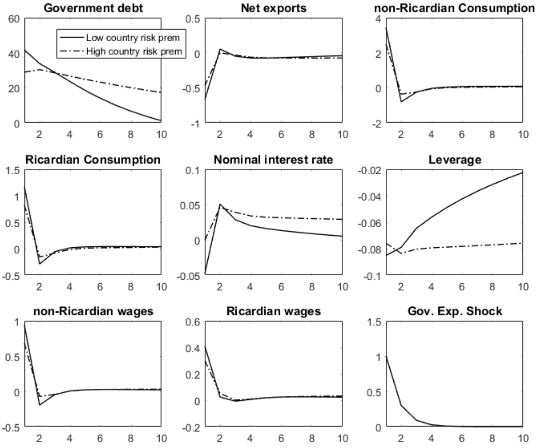
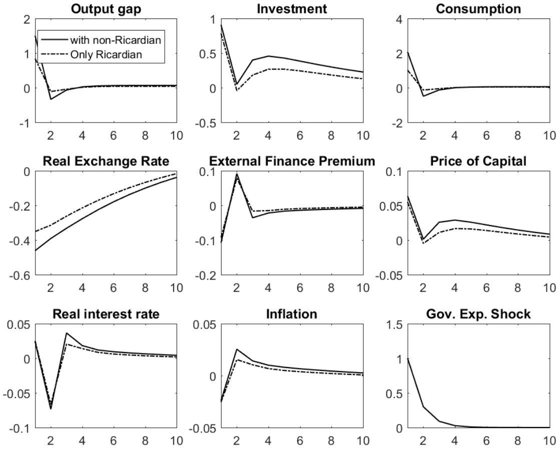
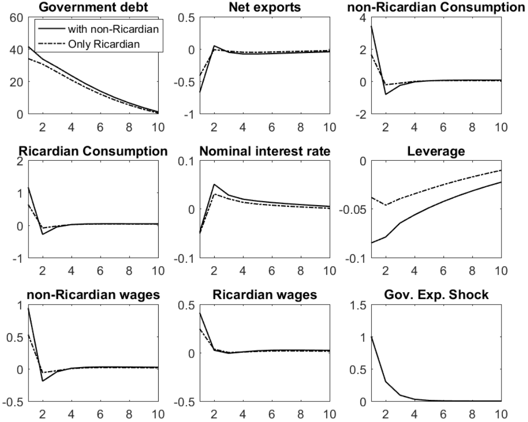


# Impulse Responses Ricardian vs non-Ricardian



# Impulse Responses Ricardian vs non-Ricardian



# Summary

- Our results show that fiscal multipliers in Colombia are positive in a way consistent with the evidence.
- The model with Fisher-effect replicates the response of investment to a shock in govenment spending.
- Nominal contracts play an important role in the results.
- The openness of the economy also play an important role: an economy with low participation of imports has higher fiscal multipliers as well as an economy that faces a low country risk premium
- The non-Ricardian case yields higher consumption multipliers but delivers similar investment multipliers.