Central Bank Independence and Sovereign Default

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Motivation

- Following Sargent and Wallace (1981), the traditional view on fiscal and monetary policy interactions suggests that central banks face a trade-off between its control over the price level and its ability to prevent default episodes
  - A central bank willing to maintain fully control over the price level must refuse to its ability of keeping the fiscal authority solvent (Monetary Dominance)
  - A central bank willing to lend to the fiscal authority in insolvency scenarios must let inflation be shaped by fiscal considerations (Fiscal Dominance)
- **This view ignores the role of international reserves on the resolution of this trade-off**

This paper

- Documents that Central Bank Independence (CBI) is associated with:
  1. lower price level
  2. higher accumulation of international reserves
  3. lower default risk
- Provides a sovereign default model with an independent central bank:
  - **money in the utility function + two government entities**
  - an impatient fiscal authority who issues debt to finance public spending
  - a benevolent central bank who chooses foreign assets and the money supply

Findings (Preliminary)

- Today: two-government-entities approach rationalizes $\uparrow$ reserves and $\downarrow$ price level
  - Two Government Entities vs Consolidated Government
- How the trade-off between monetary and fiscal dominance should be resolved?
  - **By accumulating international reserves there is no trade-off!**
  - A central bank should accumulate reserves to lend to the government in insolvency scenarios without loosing control over the price level

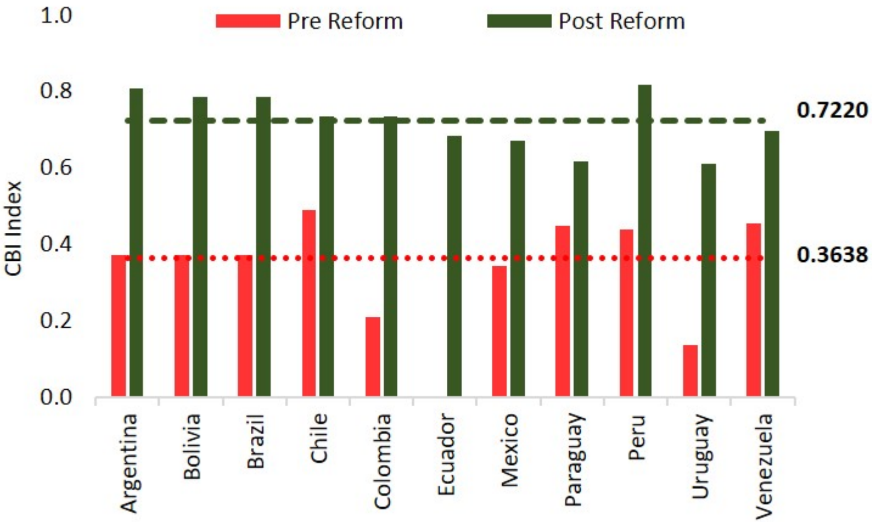
Roadmap

- **Data and Empirical Regularities**
- Model
    - Key Ingredients
    - Environment
    - Recursive Equilibrium
    - Numerical Exercise

Data

- Monetary and Fiscal History of Latin America Project (MAFHOLA)
  - Data from 1960 to 2017 for the eleven largest countries in Latin America
  - For reserves, I add data from the IFS dataset for the period 1980 - 2017
  - For sovereign spreads, I add data from the EMBI+ for the period 1992 - 2017
- I build a CBI index based on CB legislation following Dincer and Eichengreen (2014)
  - The index take into account sixteen aspects of the central bank law that can be classified in operational or financial independence

Fact 1: CBI increased in the early 1990s



Fact 2: CBI is associated with ↓ inflation and ↑ reserves

	Inflation (annual rate, %)		International Reserves (% GDP)	
	Pre Reform	Post Reform	Pre Reform	Post Reform
Argentina	209.7	12.3	2.4	8.2
Bolivia	19.3	4.5	4.0	22.6
Brazil	225.2	7.9	3.5	10.1
Chile	29.1	3.8	11.5	17.5
Colombia	25.5	6.5	6.6	10.1
Ecuador	26.2	5.4	4.3	3.8
Mexico	27.9	5.9	3.0	8.2
Paraguay	18.0	6.2	12.4	12.6
Peru	81.9	3.5	6.4	19.7
Uruguay	58.1	8.2	4.1	18.0
Venezuela	14.2	30.1	10.6	11.0
Average	66.8	8.6	6.2	12.9

Fact 3: CBI is negatively correlated with spreads

Variables		Output and Debt	Reserves	Inflation	**Central Bank Independence**
Dependent	Independent				
Spreads	Output	-2.75*** (0.55)	-2.73*** (0.54)	-2.76*** (0.54)	**-2.15*** (0.51)**
	Debt	0.19*** (0.03)	0.18*** (0.03)	0.18*** (0.03)	**0.28*** (0.03)**
	Reserves		-0.19*** (0.07)	-0.17*** (0.08)	**-0.25*** (0.07)**
	Inflation			-0.05 (0.08)	**-0.01 (0.07)**
	Independence				**-0.18*** (0.04)**
	R2	0.46	0.50	0.51	**0.58**

***: significant at a 1% level

Roadmap

- Data and Empirical Regularities
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  - Key Ingredients
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Key Ingredients

The baseline model follows Alfaro and Kanczuk (2009):

- Canonical sovereign default model + risk-free foreign assets + short-term debt
- I assume a two-government-entities approach + money in the utility function

Main assumptions:

- Government entities have different discount factors
  - Reduced form of potential different incentives driving government entities choices
- Central bank faces a lending constraint
  - Simplest way to introduce a notion of financial independence
    (For now, I only assume lack of fiscal support)

Environment

- Small open economy, where time is discrete and infinite, $t = 1, 2, 3, ...$
- The economy is populated by two government entities and a representative agent:

  1. Fiscal authority finances government spending g by issuing real debt D, collecting taxes τy, and receiving transfers from the monetary authority Ω
  2. Monetary authority chooses nominal balances $\bar{M}$, transfers Ω, and buys foreign assets A in the international financial market at price q^*
  3. Households chooses private consumption c and nominal money holdings M

- I assume risk neutral foreign investors that lend to the fiscal authority as long as the price schedule q is equal to the risk-adjusted opportunity cost,

$$q = \left[\frac{1}{1 + r^*}\right] E\left[1 - \delta\right]$$

where $\delta \in [0, 1]$ is the probability of default

Preferences

- Households have preferences given by

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma} + \gamma_m m_t^{1-\sigma} + \gamma_g \left(g_t - \bar{G} \right)^{1-\sigma}}{1-\sigma} \right] \right\}$$

  where c_t denotes private consumption, $m_t \equiv M_t / P_t$ represents real money holdings, g_t denotes public consumption, $\beta \equiv \frac{1}{1+r^*}$ denotes the households' discount factor, γ_m represents preference for money holdings, γ_g denotes preference for public spending, $\bar{G}$ denotes a minimal level of public spending, and P_t is the domestic price level at period t

- **I assume that government entities discount the future at a different rate**
  - Government entities, $j \in \{M, F\}$, maximize their expected discounted utility

$$E_0 \left\{ \sum_{t=0}^{\infty} \left(\beta^j \right)^t \left[\frac{c_t^{1-\sigma} + \gamma_m m_t^{1-\sigma} + \gamma_g \left(g_t - \bar{G} \right)^{1-\sigma}}{1-\sigma} \right] \right\}$$

    where $\beta^M = \beta$ represents the monetary authority's discount factor and $\beta^F < \beta$ denotes the fiscal authority's discount factor

Budget Constraints

- Households' budget constraint is given by

$$P_t c_t + M_{t+1} = (1-\tau) P_t y_t + M_t$$

$\Leftrightarrow$

$$c_t = (1-\tau) y_t - \mu_{t+1} (M_t / P_t)$$

where $\mu_{t+1} \equiv \left(\bar{M}_{t+1} / \bar{M}_t\right) - 1$ is the money growth rate determined by the central bank

- Central bank's budget constraint is given by

$$\Omega_t + P_t q^* A_{t+1} = \bar{M}_{t+1} - \bar{M}_t + P_t A_t$$

$\Leftrightarrow$

$$\bar{\Omega}_t \left(\bar{M}_t / P_t\right) = \mu_{t+1} \left(\bar{M}_t / P_t\right) + A_t - q^* A_{t+1}$$

where $\bar{\Omega}_t \equiv \Omega_t / \bar{M}_t$ denotes nominal transfers normalized by money supply

- Fiscal authority's budget constraint is given by

$$P_t g_t = \tau P_t y_t + q_t P_t D_t - P_t D_{t-1} + \Omega_t$$

$\Leftrightarrow$

$$g_t = \tau y_t + q_t D_t - D_{t-1} + \bar{\Omega}_t \left(\bar{M}_t / P_t\right)$$

Default

- Debt contracts are not enforceable and fiscal authority can choose to default
- If the fiscal authority defaults, I assume:
  - exclusion from financial markets with reentry probability θ
  - exogenous default cost $\phi(y)$ as in Chatterjee and Eyingungor (2012)
  - zero recovery rate
- Therefore, in default times the government budget constraint is given by

$$g_t = \tau y_t^{def} + A_t - q^* A_{t+1} + \mu_{t+1} \left(\bar{M}_t / P_t \right), \quad \text{where } y_t^{def} \equiv y_t - \phi(y_t)$$

Otherwise,

$$g_t = \tau y_t + q_t D_{t+1} - D_t + A_t - q^* A_{t+1} + \mu_{t+1} \left(\bar{M}_t / P_t \right)$$

Timing

1. The endowment shock is realized, and the aggregate state is $s = (y, D, A)$
2. The fiscal authority chooses whether or not to default
    - If default occurs:

      the fiscal authority is excluded from financial markets, public spending g is financed only by taxes τy and tranfers $\bar{\Omega}$, which are setting by the monetary authority choosing $\{\mu, A'\}$
    - Otherwise:

      the fiscal auhtority issues debt D' to finance public spending g, and the monetary authority chooses $\{\mu, A'\}$
3. Given government policy, households choose $\{c, M'\}$

Households' Recursive Problem

- Let $s = (y, D, A)$ represents the aggregate state of the economy, and let $\Gamma = (d, g, \mu, D', A')$ denotes government policy

- The households' value function is given by

$$V^{HH}(s, \Gamma, M) = \max_{\{c, M'\}} \left\{ u\left(c, M/P, g\right) + \beta E\left[V^{HH}(s', \Gamma', M') \mid y\right] \right\}$$

s.t.

$$c = (1 - \tau)\, y - \mu\, (M/P)$$
$$\Gamma' = \left(d', g', \mu', D'', A''\right)$$

- Solution: policy function for consumption $c(s, \Gamma, M)$ and money $M(s, \Gamma, M)$

Private Equilibrium

Given current and future government policy (Γ, Γ'), a private equilibrium for this economy is a list of value functions $V^{HH}(s, \Gamma, M)$; policy functions for (i) private consumption $c(s, \Gamma, M)$ and (ii) money holdings $M(s, \Gamma, M)$; and a price function $P\left(s, \Gamma, M\right)$ such that:

1. $\{c(s, \Gamma, M), M(s, \Gamma, M)\}$ solve $V^{HH}(s, \Gamma, M)$

2. The market for money balances clears: $M = \bar{M} = 1$

Characterization of the Private Equilibrium

- Define real money balances as $m(s,\Gamma,1) = 1/P(s,\Gamma,1)$ for all $(s,\Gamma,1)$, and let $S = (s,\Gamma,1)$ denotes the individual state faced by households

- Therefore, the private sector equilibrium is characterized by the budget constraint

$$c(S) = (1-\tau)\, y - \mu m(S) \tag{1}$$

and the money demand equation

$$(1+\mu)\, m(S) = \frac{\beta}{u_c(S)} E\left[\left(u_c(S') + u_m(S')\right) m(S')\right] \tag{2}$$

Fiscal Authority's Value Function

$$V^F(s) = \max_{r,d} \left\{ V_r^F(s), V_d^F(s) \right\}$$

where V_r^F is the value associated with repayment,

$$V_r^F(s) = \max_{g,D'} \left\{ u\left(c\left(S\right), m\left(S\right), g\right) + \beta^F E\left[V^F(s') \mid y \right] \right\}$$

s.t.

$$g = \tau y + qD' - D + A - q^* A' + \mu m\left(S\right)$$

$$\mu = \mu_r\left(s\right)$$
$$A' = A_r\left(s\right)$$

and V_d^F is the value associated with default,

$$V_d^F(s) = u\left(c\left(S\right), m\left(S\right), g\right) + \beta^F E\left[\theta V^F(s') + \left(1-\theta\right) V_d^F(s') \mid y \right]$$

s.t.

$$g = \tau y^{def} + A - q^* A' + \mu m\left(S\right)$$

$$\mu = \mu_d\left(s\right)$$
$$A' = A_d\left(s\right)$$

Monetary Authority's Value Function

- The monetary authority's value function in repayment states is given by

$$V_r^M(s) = \max_{\mu, A'} \left\{ u\left(c\left(S\right), m\left(S\right), g\right) + \beta^M E\left[\left(1 - d'\right) V_r^M(s') + d' V_d^M(s') \mid y\right]\right\}$$

s.t.

$$g = \tau y + qD' - D + A - q^* A' + \mu m\left(S\right)$$
$$A - q^* A' + \mu m\left(S\right) \geq 0$$

$$D' = D\left(s\right)$$
$$d' = d\left(s'\right)$$

and V_d^F is the value associated with default,

$$V_d^M(s) = \max_{\mu, A'} \left\{ u\left(c\left(S\right), m\left(S\right), g\right) + \beta^M E\left[\theta V_r^M(s') + \left(1 - \theta\right) V_d^M(s') \mid y\right]\right\}$$

s.t.

$$g = \tau y^{def} + A - q^* A' + \mu m\left(S\right)$$
$$A - q^* A' + \mu m\left(S\right) \geq 0$$

- Solution: policy functions for money growth rate and reserves in both default and repayment states $\left\{\mu_d\left(s\right), A_d\left(s\right), \mu_r\left(s\right), A_r\left(s\right)\right\}$

Parameter Values

Parameter	Description	Value	Source/Target
r^*	Risk-free interest rate	0.04	Related Literature
σ	Risk aversion	2	Related Literature
θ	Reentry probability	0.282	Related Literature
α_0	Default cost	-0.188	Related Literature
α_1	Default cost	0.246	Related Literature
ρ	Autocorrelation of y	0.66	Mexico's GDP
η	Variance of y	0.034	Mexico's GDP
τ	Income tax	0.3	n/a
$\underline{G}$	Public good minimal level	0.2	n/a
γ_m	Money utility constant	0.5	n/a
γ_g	Public good utility constant	1.0	n/a
β^F	Fiscal authority discount factor	0.8	n/a
β^M	Monetary authority discount factor	0.94	n/a

Numerical Exercise

The following table reports long-run moments in the model simulations

	Units	Two-Government-Entities $\beta^M = .81$ and $\beta^F = .80$	Consolidated Government $\beta^M = \beta^F = .80$
mean (c)	% GDP	62.6	59.8
mean (g)	% GDP	37.2	40.0
mean (P)	level	1.4	1.6
mean (μm)	% GDP	7.4	10.2
mean (μ)	%	11.9	16.6
mean (Ω)	% GDP	7.7	10.5
mean (A)	% GDP	8.2	7.3
mean (D)	% GDP	12.9	11.7