Imperfect Financial Markets and the Cyclicality of Social Spending

Maren Froemel\textsuperscript{1}  Wojtek Paczos\textsuperscript{2}

\textsuperscript{1}London Business School / Bank of England
\textsuperscript{2}Cardiff University

8.07.2019
8th NBP Summer Workshop
Overview

- Financial markets & fiscal policy over the business cycle
  - Government expenditure
  - Taxes
  - External debt with endogenous risk
  - Inequality

- Why is this interesting?
  - Countercyclical fiscal policies in advanced economies
  - Procyclical fiscal policies in emerging markets
  - Cross-country differences driven by social transfers
Research Question

Can sovereign risk explain the observed cross-country differences in cyclicality of fiscal policy (and its components)?
Contribution

Empirical:
- Cyclicality of fiscal expenditure depends on sovereign risk
- And is most pronounced for social transfers

Theoretical:
- Optimal fiscal policy in endogenous default model
- Framework with two types of expenditure: transfers and public good
- Trade off: taxes (distortionary) vs borrowing (risky)
  - Low risk: countercyclical spending
  - High risk: **optimally** procyclical fiscal spending
  - Cyclicality switch only for transfers
- Role of inequality and risk on optimal default, taxes and spending
Plan

- Literature
- Stylized facts
- Model
- Results from calibrated exercise
Literature

**Empirical Literature: Fiscal Policy differences**


**Default Risk and Fiscal Policy**

Eaton & Gersovitz (1981), Cuadra, Sanchez & Sapriza (RED 2010)

**Political Economy and Fiscal Policy**

Andreasen, Sandleris and van der Ghote (2019), Talvi & Végh (2005), Ilzetzki (2011)

**Redistribution with Uniform Transfers**

Alonso-Ortiz & Rogerson (2010), Bhandari, Evans, Golosov & Sargent (2013)
Stylized facts
Data

- Fiscal expenditure from Michaud & Rothert (2018)
  - Harmonized GFS (IMF)
  - 30 countries between 1990-2015
  - Total expenditure = transfers + goods & services + employment exp. + interest + other
  - Normalized GDP (2005 = 1)
  - Cyclicality: remove linear-quadratic trend and correlate with GDP

- Sovereign debt ratings from S&P, Fitch and Moody’s
  - Encode on 0 to 20 scale
  - Time average (of yearly average) for each country

- Plot cyclicality against sovereign risk
Fiscal Expenditure

On average 40% of GDP, standard deviation 11p.p.
Expenditure Components

Government consumption (left) and transfers (right)

Jointly cover on average 50% of total fiscal expenditures

More Data
Debt and Interest Rates

- **External debt** in EM: on average more than 50% of total government is external (Paczos & Shakhnov, 2016)
- **Interest rates** are countercyclical, drive current account and excess volatility: Neumeyer & Perri (2005)
Environmental: Households

- Time is discrete, $t = 0, 1, 2, \ldots$
- Households differ in labor productivity: $e_i \in [0, 1]$
- Constant population of size 1, share $\sigma^i$ have $e^i$.
- Aggregate, persistent TFP shock $A_t$

$$\max_{c^i_t, h^i_t} \mathbb{E} \sum_{t=0}^{\infty} \beta^t [\kappa u(c^i_t, h^i_t) + (1 - \kappa) \nu(g^P_t)],$$

subject to:

$$ (1 + \tau_t) c^i_t = A_t e^i h^i_t + g^T_t. \quad (1) $$

- Total output: $Y_t = A_t \sum_i \sigma^i e^i h^i_t$
Environment: Government (I)

State of economy is $S = (A, b)$. Every period government decides whether to default:

$$V^0(S) = \max_{d \in \{0,1\}} \left(dV^d(S) + (1 - d)V^{nd}(S)\right),$$

where after repayment it solves:

$$V^{nd}(S) = \max_{\{\tau, g^T, g^P, b'\}} \left[\kappa \sum_i \sigma^i u(c^*_i, h^*_i) + (1 - \kappa)\nu(g^P)\right] + \beta E[V^0(S')|S]$$

where $c^*_i, h^*_i$ solve HHs problem:

$$-\frac{u_n(c^*_i, h^*_i)}{u_c(c^*_i, h^*_i)} = \frac{Ae^i}{(1 + \tau)}, \quad \forall i. \tag{4}$$

$$(1 + \tau)c^i = Ae^i h^i + g^T, \quad \forall i. \tag{5}$$

subject to gov't budget constraint:

$$g^P + g^T + qb' = \tau C^* + b, \quad \text{where } C^* = \sum_i \sigma^i c^*_i. \tag{6}$$

and risk-neutral pricing of debt by foreign investors:

$$q(b', A) = \frac{E(1 - d(b', A))}{1 + r}. \tag{7}$$
Environment: Government (II)

After default gov’t solves:

\[ V^d(S) = \max_{\{\tau_d, g^T_d, g^G_d\}} \left[ \kappa \sum_i \sigma^i u(c^*i, h^*i) + (1 - \kappa)\nu(g^P_d) \right] + \beta \mathbb{E}[\mu V^0(S') + (1 - \mu)V^d(S') | S], \]

(8)

where \( \mu \) is probability of returning to markets, subject to HHs constrains (4)-(5) and gov’t budget constraint:

\[ g^P_d + g^T_d = \tau_d C^*. \]

(9)

After default economy incurs asymmetric proportional productivity loss:

\[ A^d = g(A) = \begin{cases} A & \text{if } A < \theta \mathbb{E}[A] \\ \theta \mathbb{E}[A] & \text{if } A \geq \theta \mathbb{E}[A]. \end{cases} \]

(10)
Optimality Conditions

- Risk sharing condition:
  \[ \kappa \sum_i \sigma^i \sigma^i u^i(c^i_t, h^i_t) = (1 - \kappa) \nu'(G^P_t) = \text{MU of resources} \quad (11) \]

- Distribution of tax distortion:
  \[ \sum_i \left[ \kappa u^i(c^i_t, h^i_t) - (1 - \kappa) \nu'(G^P_t) \right] \sigma^i c^i_t = (1 - \kappa) \nu'(G^P_t) w_t \sum_i \sigma^i \epsilon^i h^i_t \xi_{h, \tau} \quad (12) \]

  \[ \xi_{h, \tau} = \frac{\partial h}{\partial \tau} \frac{\tau}{h} = -\frac{1}{\phi} \frac{\tau}{1 - \tau} \quad (13) \]
A stochastic dynamic recursive equilibrium in this economy is a set of households decisions \( \{ c^i(S), h^i(S), c^i_d(S), h^i_d(S) \} \), government default policy \( d(S) \), government policies \( \{ g^T(S), g^P(S), b'(S), \tau(S), g^T_d(S), g^P_d(S), \tau_d(S) \} \), and a bond price policy function \( q(S) \) such that:

(a) Given bond prices and government policies, the household decisions solve the households’ maximization problem.

(b) Given bond prices and household decisions, the government policies solve the government’s maximization problem.

(c) Lenders’ beliefs are consistent with default probabilities and the resulting bond prices satisfy the zero profit condition.
Calibration

Calibration to Mexican economy

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Target/Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r$</td>
<td>1 %</td>
<td>3 month T-Bill</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>2</td>
<td>Arellano (2008), CSS (2010)</td>
</tr>
<tr>
<td>$\psi$</td>
<td>0.5</td>
<td>CSS (2010), GHH (1988)</td>
</tr>
<tr>
<td>$\mu$</td>
<td>0.16</td>
<td>Literature</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.94</td>
<td>Literature</td>
</tr>
</tbody>
</table>

Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Target/Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi$</td>
<td>0.80</td>
<td>Average Hours worked</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>0.80</td>
<td>Share of social spending</td>
</tr>
<tr>
<td>$\rho_A$</td>
<td>0.8355</td>
<td>Persistence GDP Mexico</td>
</tr>
<tr>
<td>$\sigma_\epsilon$</td>
<td>0.0062</td>
<td>Std GDP Mexico</td>
</tr>
<tr>
<td>$\theta$</td>
<td>0.9907</td>
<td>Debt service/GDP ratio</td>
</tr>
<tr>
<td>$e^i$</td>
<td>[0.393,1]</td>
<td>Gini / Earnings Quintiles</td>
</tr>
</tbody>
</table>

TFP follows AR(1) process:

$$\log(A_t) = \rho \log(A_{t-1}) + \epsilon_t, \quad \epsilon_t \sim N(0, \sigma_\epsilon) \quad (14)$$

Preferences are as in GHH (1988)

$$u(c, h) = \left[ \frac{c - \chi h^{1+\psi}}{1+\psi} \right]^{1-\gamma} \quad (15)$$
Results

Results in 3 steps:

1. Static redistribution

2. Two dynamic polar cases: complete markets and autarky

3. Incomplete markets
   - Policy functions
   - Simulations with two counterfactuals:
     - Lower inequality (distribution features from Canada)
     - No default in equilibrium (no differences in discount factor)
Static Redistribution

**Figure:** Redistribution with constant marginal tax rates and uniform transfers: Ratio of disposable income and earnings.
Two Polar Cases

Regime 1: Autarky
- No access to external credit markets
- Closed economy, cannot smooth income

Regime 2: Complete Markets
- Access to full set of (country-specific) state-contingent assets
- Rest of the world is neutral
- Full insurance against idiosyncratic productivity shocks. ($\lambda$ constant)
Complete Markets vs Autarky

Figure: Optimal taxes (left) and transfers (right) as a function of GDP in complete markets and autarky
Incomplete Markets
Results: Policy Functions (I)

Figure: Bond policy function (high and low productivity) and spread
Results: Policy Functions (II)

Figure: Tax policy (left) and transfer policy (right) functions, high and low productivity

→ tax becomes procyclical when spread is positive, transfers way before.
Results: Spending Composition

Figure: The ratio of transfer spending to public good
Figure: Cyclicality of the ratio of transfers to government consumption vs average rating
Procyclical transfer policy can be rationalized by countercyclical borrowing constraints.

While redistribution still possible, policy achieves opposite of consumption smoothing during periods of distress.

“Procyclical bias”:

- Share of low-productivity types increases in a bust

Role of IMF: Can IFI alleviate procyclicality?
Thank you
## Simulation

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Data</th>
<th>Benchmark Model</th>
<th>Lower Inequality</th>
<th>No Spreads/Low Debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>GINI</td>
<td>0.49</td>
<td>0.49</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>std(Y)</td>
<td>2.37</td>
<td>2.37</td>
<td>2.36</td>
<td>2.08</td>
</tr>
<tr>
<td>std(C)/std(Y)</td>
<td>1.22</td>
<td>1.10</td>
<td>1.10</td>
<td>0.78</td>
</tr>
<tr>
<td>std($g^T$)/std(Y)</td>
<td>2.6</td>
<td>1.97</td>
<td>2.87</td>
<td>0.44</td>
</tr>
<tr>
<td>std($g^{EXP}$)/std(Y)</td>
<td>5.9</td>
<td>1.76</td>
<td>2.04</td>
<td>0.26</td>
</tr>
<tr>
<td>corr($g^T$, Y)</td>
<td>0.41</td>
<td>0.78</td>
<td>0.67</td>
<td>-0.74</td>
</tr>
<tr>
<td>corr($g^{EXP}$, Y)</td>
<td>0.35</td>
<td>0.82</td>
<td>0.77</td>
<td>-0.39</td>
</tr>
<tr>
<td>corr($\tau$, Y)</td>
<td>-0.3</td>
<td>-0.41</td>
<td>-0.40</td>
<td>0.98</td>
</tr>
<tr>
<td>std(TB/Y)/std(Y)</td>
<td>0.85</td>
<td>0.28</td>
<td>0.28</td>
<td>0.30</td>
</tr>
</tbody>
</table>

**Table:** Results from Calibrated Model and Counterfactuals
# Averages

<table>
<thead>
<tr>
<th></th>
<th>GDP</th>
<th>Fiscal Expenditure</th>
<th>Transfers</th>
<th>G.Consumption</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>2.30</td>
<td>21.17</td>
<td>6.13</td>
<td>1.68</td>
<td>4.92</td>
</tr>
<tr>
<td>Austria</td>
<td>1.44</td>
<td>50.72</td>
<td>22.19</td>
<td>5.87</td>
<td>18.94</td>
</tr>
<tr>
<td>Belgium</td>
<td>1.25</td>
<td>51.67</td>
<td>22.39</td>
<td>3.98</td>
<td>18.65</td>
</tr>
<tr>
<td>Bolivia</td>
<td>2.23</td>
<td>21.27</td>
<td>3.74</td>
<td>4.26</td>
<td>6.42</td>
</tr>
<tr>
<td>Brazil</td>
<td>1.65</td>
<td>26.23</td>
<td>8.33</td>
<td>2.44</td>
<td>8.33</td>
</tr>
<tr>
<td>Canada</td>
<td>1.32</td>
<td>42.46</td>
<td>9.56</td>
<td>8.35</td>
<td>19.47</td>
</tr>
<tr>
<td>Chile</td>
<td>3.77</td>
<td>21.11</td>
<td>4.81</td>
<td>2.66</td>
<td>14.53</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>2.40</td>
<td>36.72</td>
<td>16.32</td>
<td>3.59</td>
<td>14.53</td>
</tr>
<tr>
<td>Denmark</td>
<td>1.20</td>
<td>54.60</td>
<td>18.40</td>
<td>8.31</td>
<td>19.52</td>
</tr>
<tr>
<td>Dominican Republ</td>
<td>3.65</td>
<td>12.24</td>
<td>0.74</td>
<td>2.00</td>
<td>6.45</td>
</tr>
<tr>
<td>Finland</td>
<td>1.25</td>
<td>50.51</td>
<td>19.36</td>
<td>8.95</td>
<td>19.38</td>
</tr>
<tr>
<td>France</td>
<td>1.00</td>
<td>51.83</td>
<td>23.32</td>
<td>5.10</td>
<td>19.85</td>
</tr>
<tr>
<td>Germany</td>
<td>1.38</td>
<td>46.81</td>
<td>24.53</td>
<td>3.87</td>
<td>20.00</td>
</tr>
<tr>
<td>Greece</td>
<td>0.63</td>
<td>46.85</td>
<td>17.01</td>
<td>5.64</td>
<td>11.32</td>
</tr>
<tr>
<td>Hungary</td>
<td>2.44</td>
<td>50.80</td>
<td>16.73</td>
<td>7.69</td>
<td>11.91</td>
</tr>
<tr>
<td>Iceland</td>
<td>1.47</td>
<td>40.56</td>
<td>6.25</td>
<td>10.46</td>
<td>14.94</td>
</tr>
<tr>
<td>Ireland</td>
<td>3.47</td>
<td>36.69</td>
<td>12.42</td>
<td>5.07</td>
<td>17.68</td>
</tr>
<tr>
<td>Israel</td>
<td>1.81</td>
<td>43.58</td>
<td>12.26</td>
<td>9.39</td>
<td>14.09</td>
</tr>
<tr>
<td>Italy</td>
<td>0.36</td>
<td>48.72</td>
<td>19.64</td>
<td>4.88</td>
<td>16.79</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>2.02</td>
<td>37.48</td>
<td>19.44</td>
<td>3.38</td>
<td>20.00</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1.47</td>
<td>44.81</td>
<td>19.59</td>
<td>6.18</td>
<td>19.97</td>
</tr>
<tr>
<td>Poland</td>
<td>4.15</td>
<td>43.44</td>
<td>17.30</td>
<td>6.48</td>
<td>13.25</td>
</tr>
<tr>
<td>Portugal</td>
<td>1.06</td>
<td>43.93</td>
<td>15.75</td>
<td>4.74</td>
<td>15.73</td>
</tr>
<tr>
<td>Romania</td>
<td>3.45</td>
<td>33.85</td>
<td>10.83</td>
<td>6.62</td>
<td>9.02</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>3.90</td>
<td>43.20</td>
<td>17.05</td>
<td>6.02</td>
<td>12.96</td>
</tr>
<tr>
<td>Spain</td>
<td>1.13</td>
<td>39.61</td>
<td>15.57</td>
<td>4.57</td>
<td>17.76</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.48</td>
<td>52.08</td>
<td>17.55</td>
<td>7.42</td>
<td>19.27</td>
</tr>
<tr>
<td>Thailand</td>
<td>3.35</td>
<td>17.09</td>
<td>1.74</td>
<td>5.33</td>
<td>12.91</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.48</td>
<td>41.09</td>
<td>13.31</td>
<td>9.77</td>
<td>19.92</td>
</tr>
<tr>
<td>Uruguay</td>
<td>2.92</td>
<td>26.82</td>
<td>12.82</td>
<td>3.72</td>
<td>9.11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1.95</td>
<td>40.17</td>
<td>14.44</td>
<td>5.84</td>
<td>15.45</td>
</tr>
</tbody>
</table>