Heterogeneous borrowers in quantitative models of sovereign default

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Elections and Sovereign Bond in Brasil

![Interest rate spread graph with labeled key events: Argentinian Default, Elections: first round, Elections: second round.

2002 - 2003

12/3/2001 to 7/2/2003]
Stylized facts

• Declaration of left-wing candidate Luiz Ignacio “Lula” da Silva’s in favour of debt repudiation caused sharp increase in the country spread;
• Pimentel and Murphy (2006) explains a more recent episode: after president of Ecuador declaration regarding country’s debt restructure sovereign bonds’ price declined.

Focus on understanding of how political risk may affect borrowing and default decisions.

Emerging markets feature

• interest rates that are higher, more volatile and countercyclical;
• higher output volatility;
• higher consumption volatility relative to income;
• more countercyclical net exports.
Model in brief

- Assume that two types of policymakers who assign different weights to future utility flows alternate in power.
- The only financial asset is one-period noncontingent bond.
- Risk neutral lenders have perfect information about the economy’s endowment and type of policymaker.
- Every period government makes two decisions: to repay the default on current liabilities or not; and to decide how much to borrow or save.
Results

- Two types of default are observed in equilibrium: political and economic.
- Economic default is triggered by sufficiently low endowment realization.
- Political default occurs when a patient policymaker is replaced by an impatient policymaker, conditionally on enough political stability and sufficiently long period of low endowment realization.

Other results:
- Political default enables the model to partially disentangle default from poor economic conditions. (Tomz and Wright, 2007).
- Post-default levels of debt are lower than the pre-default levels.

Limit sovereign’s ability to choose borrowing level, less suitable to study macroeconomic behavior over the business cycle.

• models of household bankruptcy - Athreya (2002), Chatterjee et al. (2007), Livshits et al. (2007).

Focus on almost myopic behavior of “impatient” type.
The framework is based on Eaton and Gersovitz (1981)

- It’s a small open economy with households, government and foreign investors.
- The government is benevolent and determines the consumption level in the economy.
- Two types of policymakers alternate in power. They assign different weights to future utility flows.
- Government participates in the foreign market and can trade one period non-contingent bond to smooth consumption.
- Government is strategically choosing the period of default by comparing its expected future value in case of default and vv.
- Foreign investors are risk neutral and observe the endowment and types of the government.
Timeline

Issue $b'_{j0} (b_t, y_t, h_t)$

Pay back $b_t$

Type $j$ is replaced

$t + 1$

Type $j$ continues

$t + 1$

$t$

$\beta_j$ is in power

$y_t$ is realized

Default on $b_t$

Type $j$ is replaced

$t + 1$

Type $j$ continues

$t + 1$

Issue $b'_{j1} (y_t, h_t)$

Output loss of $\lambda$
Environment

- There is a single tradable good.
- The economy receives a stochastic endowment stream of $y$

$$\log(y_t) = (1-\rho)\mu + \rho \log(y_{t-1}) - \varepsilon_t, \text{ where } |\rho < 1|, \varepsilon_t \sim N(0, \sigma^2_\varepsilon)$$

- Per-period utility function is given by CRRA

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}$$

- Patient policymakers discount future utility flows at $\beta^h$. Impatient - $\beta^L$, where $\beta^L < \beta^H$
- At the end of every period, the type of policymakers in power changes with probability $\pi$.
- The only financial asset is non-contingent one-period bond, $b$. 
• There is a continuum of risk-neutral lenders, which borrow at risk free rate $r$.

• The equilibrium bond price is determined as follows:
  1. Government announces how many bonds it wants to issue;
  2. Lenders offer a price for the bonds;
  3. Government sells bonds to the lenders who offer the highest price.

• Government’s budget constraint is given by:

\[ c + q_{j,d}(b', y)b' = (1 - h\lambda)y + (1 - d)b \]

• The policymaker in power compares two continuation values, $V_{j,1}(y, h)$ and $V_{j,0}(b, y, h)$. $h$ denotes the credit history.

• The cost of declaring a default is $\lambda$. 
Value Functions in case type $j$ is in power

- $V_j(b, y, h)$ denotes the value function of a policy maker of type $j$ at the beginning of a period when he is in power; and $W_j(b, y, h)$ - when he is not in power.

- The optimal borrowing decision of a government in case it defaults in the current period:

$$V_{j,1}(y, h) = \max_{b'} \left\{ u(y(1 - h\lambda)) - q_{j,1}(b', y)b' + \beta_j \left[ \pi \int W_j(b', y', 1)F(dy'|y) + (1 - \pi) \int V_j(b', y', 1)F(dy'|y) \right] \right\}$$

- Value function in case it pays back:

$$V_{j,0}(b, y, h) = \max_{b'} \left\{ u(y(1 - h\lambda)) + b - q_{j,0}(b', y)b' + \beta_j \left[ \pi \int W_j(b', y', 0)F(dy'|y) + (1 - \pi) \int V_j(b', y', 0)F(dy'|y) \right] \right\}$$
Optimal default decision

- The function $V_j(b, y, h)$ is computed as:

$$V_j(b, y, h) = \max \left\{ V_{j,1}(y, h), V_{j,0}(b, y, h) \right\}.$$  

- The optimal default decision is:

$$d_j(b, y, h) = \begin{cases} 
1 & , V_{j,1}(y, h) > V_{j,0}(b, y, h) \\
0 & , V_{j,1}(y, h) \leq V_{j,0}(b, y, h) 
\end{cases}$$
The value function of a policymaker of type $j$ when he is not in office depends on the optimal behaviour of the other type, denoted by $-j$.

In the set of states when type $-j$ finds it optimal to default, the value function of policy maker of type $j$ is:

$$W_j(b, y, h) = u(y(1 - h\lambda)) - q_{-j,1}(b'_{-j,1}, y)b'_{-j,1} + \beta_j \left[\pi \int V_j(b'_{-j,1}, y', 1)F(dy'|y) + (1 - \pi) \int W_j(b'_{-j,1}, y', 1)F(dy'|y)\right]$$

In the set of states when type $-j$ finds it optimal to pay back, the value function of policy maker of type $j$ is:

$$W_j(b, y, h) = u(y(1 - h\lambda)) + b - q_{-j,0}(b'_{-j,0}, y)b'_{-j,0} + \beta_j \left[\pi \int V_j(b'_{-j,0}, y', 0)F(dy'|y) + (1 - \pi) \int W_j(b'_{-j,0}, y', 0)F(dy'|y)\right]$$
Bond prices satisfy the lender's zero profit condition.

\[ q_{j,d}(b', y) = \frac{1}{1 + r} \left[ 1 - \pi \int d_{-j}(b', y', h') F(dy' | y) - (1 - \pi) \int d_{j}(b', y', h') F(dy' | y) \right] \]
Parameters are set to mimic the behaviour of GDP in Argentina from Q4 1993 to Q3 2001.

- Political stability parameter, $\pi$ is set free.
Results. Political Risk, Default Risk and Political Stability

- In the economy with high political stability ($\pi = 1.5\%$), 96% of the changes from a patient to impatient government triggers default.
- In the economy with low political stability ($\pi = 2.5\%$), only 4% of the changes from a patient to impatient government triggers default.
Results. Value functions in a Stable Economy

![Graph showing value functions for different scenarios and values of beta.](image_url)
Results. Default Regions in a Stable Economy
Results. Bond Price faced by a Patient Policymaker.
Results. Optimal Bond Issuance of a Patient Type

- Choose “low” borrowing level if the current endowment is high
- Choose “intermediate” borrowing level if “intermediate” current endowment takes place

Political default happens when stream of relatively low endowment follows.
Mean Issuance Level before and after Default

Figure 8

Mean issuance level before and after a default episode in the politically stable economy. Nonpolitical defaults are only considered if a patient policymaker is in office. Period 0 is the default period.
Bond Price faced by an Impatient Policymaker

**Figure 9**

Bond price faced by an impatient policymaker in economies with high and low political stability. The graph considers the case in which the endowment realization coincides with the unconditional mean of the distribution and in which the government has defaulted today.
In Argentina, before default (Q4 1993 - Q3 2001), the mean spread was 7.4%. After default (Q3 2005 - Q2 2007) - 3.4%
• It is political turnover that generates higher spreads and not low discount factor.
Conclusion

- Introduces a stylized political process into the framework used in recent quantitative studies of sovereign default.
- Default may be triggered by a political turnover only if there is enough stability in the economy and investor-friendly governments encounter sufficiently poor economic conditions.
- The model is able to generate: a moderate correlation between economic conditions and default decisions, lower borrowing after default episode and higher and more volatile spread.