Growth Regimes, Endogenous Elections, and Sovereign Default Risk

Satyajit Chatterjee and Burcu Eyigungor

Federal Reserve Bank of Philadelphia

February 15, 2016

Abstract

A model in which the sovereign derives private benefits from public office and contests elections to stay in power is developed. The possibility of turnover (and loss of private benefits) makes the sovereign behave myopically. Consistent with evidence, the sovereign is reelected if economic growth is strong. Combined with an estimated Markov switching growth process, the model explains the average debt-to-GDP ratio, the average sovereign spreads and a large fraction of the standard deviation of spreads for three emerging economies. Existing explanations of these facts rely on very low discount factors and default costs that are asymmetric with respect to output, assumptions not made in this study.

Keywords: Regime Switches, Elections, Sovereign Default

JEL Codes:
1 Introduction

Quantitative-theoretic models of sovereign debt and default based on the Eaton and Gersovitz (1981) framework — and extended to include long-term debt — has been shown to be capable of accounting for the average sovereign spreads and average sovereign debt levels typically observed for emerging market economies (Hatchondo and Martinez (2009), Chatterjee and Eyigungor (2012), Aguiar, Chatterjee, Cole, and Stangebye (2016))). This success, however, comes at the expense of parameter restrictions that would seem to require some micro foundations. Two such restrictions stand out. First, the discount factor needed to rationalize the observed level of sovereign borrowing at the high spreads demanded by foreign investors, is very low: The quarterly discount factor needed to match these facts ranges between 0.75 – 0.95. It is implausible to ascribe such low discount factors to people living in emerging economies.\(^1\) Second, the structure of default costs needed to account for debt and spread facts requires that default costs fall sharply with a fall in GDP. For instance, Arellano (2008) assumed default costs go to zero below some (low) level of output. While such asymmetry in default costs may seem plausible, it is not clear what mechanisms (or set of mechanisms) would give rise to it.\(^2\)

In this paper we propose modifications of the Eaton-Gersovitz framework that makes progress along both these dimensions. Our point of departure is to drop the assumption that the sovereign is benevolent. Instead, we model the sovereign as a leader whose decisions to borrow and default are guided, in part, by his prospects for re-election and who derives private benefits from public office (see, for instance, Barro (1973) and Ferejohn (1986) and the many papers that have followed their lead). The presence of these private benefits means that their loss loom large in the decision-making of the sovereign: If tenure as a leader is expected to be short, the relevant discount factor will be much lower than the true intertemporal rate of time preference. Thus, the extreme impatience required to account for

\(^1\)For instance, compare these values to the typical value of 0.99 or less in quantitative macro models calibrated to developed country facts.

\(^2\)Some mechanisms have been proposed. Mendoza and Yue (2012) suggest the default costs decline with TFP because the value of foreign intermediate inputs – access to which is assumed lost during default – falls with TFP and hence output. Perez (2015) argues that the financial disruption caused by the loss in collateral due to sovereign default is worse when output is high. In a different vein, Grossman and Huyck (1988) argue that debt is partially forgiven if output declines due verifiable bad events.
sovereign debt and spread facts can be the result of politics.\(^3\)

Our second modification is to endogenize the expected duration of political tenure via a model of elections. We base this modification on empirical evidence reported in Brender and Drazen (2008) who show that for developing countries that there is a strong positive link between economic growth and the likelihood of reelection. We incorporate this link by assuming that citizens base their votes in an election primarily (but not entirely) on the perceived success of the incumbent’s economic policies. This modification makes the sovereign’s effective discount factor positively related to the country’s economic performance. When economic growth is strong, the leader’s chances of reelection are high which extends his economic horizon and makes him act patiently. In contrast, when economic growth is weak, his reelection probability falls which shrinks his planning horizon and makes him act myopically. This growth-linked movement in the effective discount factor leads to behavior that resembles those generated by the assumption of asymmetric default costs. Thus our model does not rely on asymmetric default costs to account for sovereign debt and spread facts.

The final modification is to model the growth rate of real GDP as draws from an AR1 process whose parameters shift according to a two-state Markov process as in Hamilton (1989). We show that such a Markov switching model gives a good description of the real GDP growth process for emerging market economies — including Mexico, Peru and Turkey, the countries studied in this paper. All three countries seem to shift between two growth regimes with large differences in the volatility of shocks and modest differences in average growth rates. Importantly, the estimated likelihood of the high volatility regime shows a higher correlation with the country’s sovereign spreads than the growth rate of GDP itself. Evidently, estimated regime shifts matter for sovereign spreads.

To understand the effects of shifts in the growth regime and the influence of economic growth on political turnover, we perform three experiments in our quantitative analysis. In each case, we calibrate our model economy so as to match the average spreads and average

---

\(^3\)This point is made in Cuadra and Sapriza (2008) who use the model of political disagreement and (exogenous) political turnover a la Alesina and Tabellini (1990) and Persson and Svensson (1989) to micro-found low discount factors. Our approach emphasizes private benefits of political office rather than political disagreement over the size and/or types of public expenditures.
debt levels in each country. In the first experiment, we estimate a single AR1 growth process (no regime-switching) and impose a constant reelection probability. In the second, we estimate a two-state Markovian switching process but assume a constant reelection probability. In the third exercise, we incorporate both Markov regime switches and endogenous reelection probabilities.

For the first set of experiments, we find the implied volatility of sovereign spreads are very low relative to the data. This confirms the common finding that in the standard Eaton-Gersovitz setup, the volatility of spreads is very low with proportional default costs. With both mechanisms incorporated—the third set of experiments—we find that the model can fully account for the volatility of spreads in Peru, about 75 percent of it for Mexico, and 65 percent for Turkey. About half of the spread volatility for Peru and around a third of it for Turkey and Mexico come from the Markov switching regime for growth. In addition, in the full model (as in the data) the correlation of model spread is higher with the regime probability than with growth rate of output itself.

2 Environment

Time is discrete and denoted by \( t = 1, 2, 3, \ldots \). We consider a small economy that takes world prices as given. The economy is populated by a representative individual and two politicians who circulate in power.

2.1 Preferences

The representative individual derives utility from the consumption of a public good (for simplicity we ignore consumption of private goods), \( x_t \). The utility flow to the individual from a sequence \( \{x_t\} \) of the public goods is:

\[
\sum_{t=0}^{\infty} \beta^t U(x_t) \quad 0 < \beta < 1,
\]

where

\[
U(g) = \frac{g^{1-\gamma}}{1 - \gamma}, \quad 0 < \gamma < 1.
\]
The public good is produced by the politician elected to public office. The politician derives utility from the public good just as ordinary citizens do, but, in addition, he also derives a monetary benefit equal to a proportion $\tau$ of the public good. Specifically, the lifetime utility of a politician from the sequence \( \{x_t\} \) if he is permanently in power is:

\[
\sum_{t=0}^{\infty} \beta^t \left[ \zeta U(x_t + m) + U(\tau(x_t + m)) \right] \quad 0 < \beta < 1, \tag{3}
\]

where $m$ is an i.i.d. shock to the marginal utility from public and private consumption and $U$ is given as in (2).\(^4\) The monetary benefit could represent a salary but it is perhaps better thought of as a stand-in for the range of private benefits politicians obtain from political office. The parameter $\zeta$ controls the scale of the benefit from the consumption of the public good to those obtained from the private good (conditional on $\tau > 0$). Since the size of national-level public projects is generally huge relative the resources of ordinary individuals, even a small (proportional) diversion of public funds into personal consumption would amount to a very large private gain. It is mathematically convenient to capture this difference in scale by making $\zeta$ a small number.\(^5\)

The preference of politician who is not in power, conditional on being out of power forever is

\[
\sum_{t=0}^{\infty} \beta^t \zeta U(x_t). \tag{4}
\]

### 2.2 Endowments

The level of revenues in period $t$ is given by $Y_t$, so $Y_t = \exp(g_t) \cdot Y_{t-1}$, where $g_t$ is the growth rate of revenues. The growth rate $g_t$ is random and follows the AR1 process

\[
g_{t+1} = \mu_i + \rho g_t + \varepsilon_{it}, \quad \varepsilon_{it} \sim N(0, \sigma_i^2), \quad |\rho| < 1, \tag{5}
\]

where $i$ indexes the growth regime in place in period $t$. We assume that there are two regimes – bad and good – labeled \{B,G\}. These regimes differ in terms of their mean growth rate and

\(^4\)The shock to marginal utility is needed for computation of the model and is not important otherwise.

\(^5\)In particular, by setting $\zeta = 0$, we can capture the case where the private benefits of political office is the only meaningful source of utility for politicians.
volatility. For the three countries studied in this paper, the bad growth regime is estimated to have a lower mean growth rate and a higher volatility.

2.3 Politicians, Growth Regimes and Elections

A newly elected politician chooses economic policies for the rest of his political tenure. This choice determines whether the good or the bad growth regime is chosen. The probability that his policy choices lead to the good growth regime is \( \theta > 0 \). Once a growth regime \( i \) is in place, the economy continues on in that regime next period with probability \( \alpha_i \in (0, 1) \).

We assume that the growth regime in place is not directly observable to citizens, politicians or foreigners. But everyone observes the history of growth rates under a particular political leader and can make inferences about which growth regime the economy is in. Of course, with the election of a new politician (and a new economic regime), history ceases to be relevant and the probability that the economy is in the good regime resets to \( \theta \).

To stay in power, the leader must periodically contest elections with the politician who is currently out of power. The probability that an election is called in any period is \( \pi \in (0, 1) \). As is realistic, we assume that the outcome of an election (if one is called) is intrinsically random but the incumbent is more (less) likely to be re-elected the higher (lower) is the perceived utility under his regime relative to the perceived expected utility under a new leader.

2.4 The Default Option, Timing and Market Arrangement

The provision of the public good is financed from tax revenues and (potentially) from the issuance of long-term debt to foreigners. The sovereign reserves the right to default on the debt, so investors bear default risk. In the event of default, creditors do not receive any payment and the sovereign is excluded from the international capital markets from some random length of time. During the period of financial autarky, the endowment or revenues are lower by some constant fraction \( \phi \in (0, 1) \) regardless of the growth regime.

The timing of events within a period is as follows: A country that has access to credit in the previous period arrives into a period with some existing debt \( B_t \leq 0 \) and a prior
$s_t \in (0, 1)$ that the economy is in a good growth regime.\footnote{We abstract from accumulation of foreign assets by the sovereign. This simplifies the statement of the sovereign’s decision problem and the restriction never binds in the quantitative exercises performed in the paper.} At the start of the period the country learns the current growth rate $g_t$ and whether there will be an election or not. If an election is called, the outcome determines the political leader for period $t$, otherwise the incumbent leader continues in power for sure. Once the period $t$ leader is chosen, he decides whether to repay or default on the debt. In the event of repayment, $B_{t+1}$ is chosen; in the even of default, $B_{t+1} = 0$ and level of endowment shrinks by the proportion $\phi$. These decisions determine the level of the public good provided to citizens (and the political leader’s private gain from this provision) and the period comes to a close.

A country with no access to credit enters the period with $B_t = 0$ and a prior $s_t$ that the economy is in a good growth regime. The country learns the value of $g_t$, whether there will be an election or not, and whether its exclusion from credit market is over. If exclusion is over, which occurs with probability $(1 - \xi)$, period $t$’s political leader can borrow in the international credit market. Otherwise, the country continues in a state of financial autarky.

We assume that investors are risk-neutral and care only about the one-period expected return on the debt. The period $t$ price of a unit of sovereign debt then depends on the endowment level $Y_t$, the growth rate $g_t$, investors’ posterior belief that the economy is in the good growth regime, $\theta_t$, and the level of debt outstanding at the start of next period, $B_{t+1}$. Because of the possibility of a future default, these variables inform the expected one-period rate of return on the debt. We denote period $t$’s bond price by $q(Y_t,g_t,\theta_t,B_{t+1})$. Under competition, $q(Y_t,g_t,\theta_t,B_{t+1})(1 + r_f)$ must equal the expected return on the debt, where $r_f$ is the world risk-free interest rate.

### 2.5 State Transitions

We now describe the state transition equations for the exogenous states $Y_t$, $g_t$, $m_t$, and $\theta_t$. We begin with the state transition for $\theta$. Since there is a chance the economy may stochastically change regimes, the probability that it starts next period in good regime, denoted $s_{t+1}(\theta_t)$, is $\alpha_G \theta_t + (1 - \alpha_B)(1 - \theta_t)$. Then, the state transition equation for $\theta_{t+1}$, conditional on $\theta_t$
and \( g_{t+1} \), is

\[
\theta_{t+1}(\theta_t, g_{t+1}) = \frac{s_{t+1}(\theta_t) f(g_{t+1}|g_t, G)}{s_{t+1}(\theta_t) f(g_{t+1}|g_t, G) + (1 - s_{t+1}(\theta_t)) f(g_{t+1}|g_t, B)}.
\]

(6)

Here \( f(g_{t+1}|g_t, i) \) is the density of \( g_{t+1} \) conditional on \( g_t \) and \( i \) implied by (5).

Next, since \( g_{t+1}, Y_{t+1} \) and \( m_{t+1} \) are random variables, the corresponding state transitions are conditional probability distributions. For \( g_{t+1} \) this distribution is

\[
P[g_{t+1} \leq \tilde{g}] (g_t, \theta_t) = s_{t+1}(\theta_t) \int_{-\infty}^{\tilde{g}} f(g_{t+1}|g_t, G) dg + (1 - s_{t+1}(\theta_t)) \int_{-\infty}^{\tilde{g}} f(g_{t+1}|g_t, B) dg,
\]

(7)

for \( Y_{t+1} \) it is

\[
P[Y_{t+1} \leq \tilde{Y}] (g_t, \theta_t) = s_{t+1}(\theta_t) \int_{-\infty}^{\tilde{Y}/Y_t} f(g_{t+1}|g_t, G) dg + (1 - s_{t+1}(\theta_t)) \int_{-\infty}^{\tilde{Y}/Y_t} f(g_{t+1}|g_t, B) dg,
\]

(8)

and for \( m_t \) it is

\[
P[m_{t+1} \leq \tilde{m}] = \int_{-\infty}^{\tilde{m}} h(m) dm.
\]

(9)

In what follows, we denote the triple \((Y_t, g_t, m_t)\) by \( \omega_t \), refer to (6) as the function \( H(\theta_t, \omega_{t+1}) \), and equations (7) - (9) as the transition function \( F(\omega_t, \theta_t, \omega_{t+1}) \).

3 Decision Problem of the Leader

We first consider the recursive decision problem of a leader when the country has access to international credit markets. Let, \( W_P(\omega, \theta, B) \) be the optimal value of a leader in power given \( \omega = (Y, g, m) \), perceived likelihood of the good regime \( \theta \), and inherited debt \( B \). Let \( V_P(\omega, \theta, B) \) and \( X_P(\omega, \theta) \) be his optimal values from repayment and default, respectively. Let \( W_O(\omega, \theta, B), V_O(\omega, \theta, B) \) and \( X_O(\omega, \theta) \) denote the analogous quantities for the politician
out of power. Then,

\[
V_P(\omega, B) = \max_{B' \leq 0} [\zeta + \tau^{1-\gamma}/1 - \gamma]U(X + m) + \\
\beta \int_{\omega'} \{[1 - \pi + \pi I(\omega', \theta')]W_P(\omega', \theta', B') + \pi[1 - I(\omega', \theta')]W_O(\omega', \theta, B')\} F(\omega, \theta, d\omega')
\]

s.t.

\[
(1 + \tau)X + q(\omega, \theta, B')[B' - (1 - \lambda)B] = Y + [\lambda + z(1 - \lambda)]B,
\]

\[
\theta' = H(\theta, \omega')
\]

where \(I(\omega, \theta)\) is an indicator function that takes the value 1 if there is an election and the incumbent wins. We denote \(A(\omega, \theta, B)\) as the leader’s optimal borrowing decision under repayment. Next

\[
X_P(\omega, \theta) = [\zeta + \tau^{1-\gamma}/1 - \gamma]U([1 - \phi](Y + m)) + \\
\beta \int_{\omega'} \{\xi[[1 - \pi + \pi N(\omega', \theta')]X_P(\omega', \theta') + \pi(1 - N(\omega', \theta'))X_O(\omega', \theta)] + \\
(1 - \xi)[[1 - \pi + \pi I(\omega', \theta')]W_P(\omega', \theta', 0) + \pi(1 - I(\omega', \theta'))W_O(\omega', \theta, 0)]\} F(\omega, \theta, d\omega')
\]

where \(N(\omega, \theta)\) is an election indicator function similar to \(I(\omega, \theta)\) that applies when the economy is excluded from the credit market. As before, \(\theta' = H(\theta, \omega')\). And, finally,

\[
W_P(\omega, \theta, B) = \max\{V_P(\omega, \theta, B), X_P(\omega, \theta)\},
\]

which also defines the leader’s optimal default rule \(D(\omega, \theta, B)\).

Turning to the values of the politician when he is out of power,

\[
V_O(\omega, \theta, B) = \zeta U(A(\omega, \theta, B)) + \\
\beta \int_{\omega'} \{[1 - \pi + \pi I(\omega', \theta')]W_O(\omega', \theta') + \pi[1 - I(\omega', \theta')W_P(\omega', \theta)]\} F(\omega, \theta, d\omega'),
\]
\[ X_O(\omega, \theta) = \zeta U((1 - \tau)[1 - \phi](Y + m)) \quad + \]
\[ \beta \int \omega' \{ \xi \left[ 1 - \pi + \pi (1 - \tau)[1 - \phi] (Y + m) \right] X_O(\omega', \theta') + \pi (1 - N(\omega', \theta') \} F(\omega, \theta, d\omega'), \]
\[ (1 - \xi)(1 - \pi) \left[ 1 - \pi \right] W_O(\omega', \theta', 0) + \pi (1 - I(\omega', \theta')) W_P(\omega', \theta, 0) \} \}
\[ F(\omega, \theta, d\omega'), \]

and
\[ W_O(\omega, \theta, B) = [1 - D(\omega, \theta, B)] V_O(\omega, \theta, B) + D(\omega, \theta, B) X_O(\omega, \theta). \quad (15) \]

4 Voters

Citizens do not make any decisions other than to choose who to vote for in an election. For citizens, the only difference between the incumbent and the opposition is the probability that the economy is in the good growth regime. For the incumbent this probability is \( \theta \) and for the opposition it is \( \bar{\theta} \).

Let \( \tilde{\theta} \in \{ \theta, \bar{\theta} \} \) and let \( V(\omega, \tilde{\theta}, B) \) and \( X(\omega, \tilde{\theta}) \) be the utility of citizens if the country has access to credit markets and no access, respectively. Then,

\[ V(\omega, \tilde{\theta}, B) = U(A(\omega, \tilde{\theta}, B)) \quad + \]
\[ \beta \int \omega' \{ 1 - \pi + \pi I(\omega', \theta') V(\omega', \theta') + \pi (1 - I(\omega', \theta')) V(\omega', \theta) \} F(\omega, \theta, d\omega') \]
\[ \text{s.t. } \theta' = H(\tilde{\theta}, \omega'), \]

and

\[ X(\omega, \tilde{\theta}) = U((1 - \tau)[1 - \phi] Y) \quad + \]
\[ \beta \int \omega' \{ \xi \left[ 1 - \pi + \pi N(\omega', \theta') \right] X(\omega', \theta') + \pi (1 - N(\omega', \theta') \} F(\omega, \theta, d\omega') \]
\[ (1 - \xi)(1 - \pi) \left[ 1 - \pi \right] W(\omega', \theta', 0) + \pi (1 - I(\omega', \theta')) W_P(\omega', \theta, 0) \} \}
\[ F(\omega, \theta, d\omega'), \]
\[ \text{s.t. } \theta' = H(\tilde{\theta}, \omega'). \]

If every citizen cast his vote according to his utility under the two leaders, he would vote for the if and only if his utility under the incumbent is at least as high as his utility under
the opposition. This would make $I(\omega, \theta)$ and $N(\omega, \theta)$ step functions that take the value 0 or 1 with probability 1. In the real world, however, there is always some uncertainty regarding the outcome of an election. We recognize this uncertainty by assuming that $I(\omega, \theta, B)$ is equal to 1 with probability

$$
\frac{\exp(V(\omega, \theta, B)/\kappa)}{\exp(V(\omega, \theta, B)/\kappa) + \exp(V(\omega, \theta, B)/\kappa)}.
$$

(18)

and $N(\omega, \theta)$ is equal to 1 with probability

$$
\frac{\exp(X(\omega, \theta)/\kappa)}{\exp(X(\omega, \theta)/\kappa) + \exp(X(\omega, \theta)/\kappa)}.
$$

(19)

Here $\kappa > 0$ is a measure of the “noise” in the election. When $\kappa$ is very large, the expressions in (18) and (19) are close to 1/2 which means the outcome of the election is almost random. In contrast, when $\kappa$ is close to zero then $I(\omega, \theta, B)$ (for instance) equal to 1 with probability close to 1 (or 0) depending on whether $V(\omega, \theta, B) \geq (\text{ or } <) V(\omega, \theta, B)$.

5 Investors

Investors are risk-neutral and compete to lend to the country. Thus,

$$
q(\omega, \theta, B') = (1 + r_f)^{-1} \times
$$

$$
E_{(\omega', \theta' | \omega, \theta)} \left\{ \begin{array}{l}
[1 - \pi + \pi I(\omega', \theta')][1 - D(\omega', \theta', B')][\lambda + (1 - \lambda)[z + q(\omega', \theta', A(\omega', \theta', B'))]

\pi(1 - I(\omega', \theta'))[1 - D(\omega', \theta', B')][\lambda + (1 - \lambda)[z + q(\omega', \theta', A(\omega', \theta', B'))]
\end{array} \right.
$$

6 Calibration and Findings (Incomplete)

Data: For Peru, 1980Q1-2015Q2 real GDP, for Mexico 1980Q1-2015Q2 real GDP, and for Turkey 1980Q1-2015Q2 real GDP. These are converted to growth rates, and the mean growth is taken out. A Markov process with common autocorrelation and different mean and standard deviations are estimated. Estimated Markov Process for each country:
<table>
<thead>
<tr>
<th></th>
<th>PER</th>
<th>MX</th>
<th>TUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \rho )</td>
<td>0.430</td>
<td>0.280</td>
<td>0.193</td>
</tr>
<tr>
<td>( \mu_H )</td>
<td>0.0038</td>
<td>0.0016</td>
<td>0.0020</td>
</tr>
<tr>
<td>( \mu_L )</td>
<td>-0.0058</td>
<td>-0.0028</td>
<td>-0.0017</td>
</tr>
<tr>
<td>( \sigma_H )</td>
<td>0.0087</td>
<td>0.0067</td>
<td>0.0069</td>
</tr>
<tr>
<td>( \sigma_L )</td>
<td>0.0380</td>
<td>0.0182</td>
<td>0.0319</td>
</tr>
<tr>
<td>( \alpha_H )</td>
<td>0.0660</td>
<td>0.0394</td>
<td>0.1020</td>
</tr>
<tr>
<td>( \alpha_L )</td>
<td>0.1070</td>
<td>0.0655</td>
<td>0.1137</td>
</tr>
</tbody>
</table>

The AR1 Process estimated for each country:

<table>
<thead>
<tr>
<th></th>
<th>PER</th>
<th>MX</th>
<th>TUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \rho )</td>
<td>0.405</td>
<td>0.316</td>
<td>0.054</td>
</tr>
<tr>
<td>( \mu )</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>( \sigma )</td>
<td>0.0258</td>
<td>0.0125</td>
<td>0.0230</td>
</tr>
</tbody>
</table>

The parameter values chosen independently are displayed in 1.
For PERU:

<table>
<thead>
<tr>
<th></th>
<th>data</th>
<th>AR(1)</th>
<th>Markov</th>
<th>Mar+Politics (π = 1/8)</th>
<th>Mar+Politics (π = 1/12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_H$</td>
<td>0.0660</td>
<td>N/A</td>
<td>0.0677</td>
<td>0.0659</td>
<td>0.0666</td>
</tr>
<tr>
<td>$\alpha_L$</td>
<td>0.1070</td>
<td>N/A</td>
<td>0.1070</td>
<td>0.1070</td>
<td>0.1070</td>
</tr>
<tr>
<td>Spreads</td>
<td>3.37%</td>
<td>3.44%</td>
<td>3.68%</td>
<td>3.45%</td>
<td>3.39</td>
</tr>
<tr>
<td>Unsecured Debt</td>
<td>55.8%</td>
<td>55.5%</td>
<td>55.6%</td>
<td>55.5%</td>
<td>55.8%</td>
</tr>
<tr>
<td>Spread volatility</td>
<td>1.96%</td>
<td>0.77%</td>
<td>1.39%</td>
<td>2.29%</td>
<td>2.11%</td>
</tr>
<tr>
<td>Relection prob</td>
<td>0.6</td>
<td>0.6</td>
<td>0.60</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>Vol of relection prob</td>
<td>0.0</td>
<td>0.0</td>
<td>0.39</td>
<td>0.38</td>
<td></td>
</tr>
<tr>
<td>Corr(spr,$\theta$)</td>
<td>-0.68</td>
<td>N/A</td>
<td>-0.24</td>
<td>-0.68</td>
<td>-0.66</td>
</tr>
<tr>
<td>Corr(spr,$g$)</td>
<td>-0.31</td>
<td>-0.70</td>
<td>-0.58</td>
<td>-0.59</td>
<td>-0.60</td>
</tr>
<tr>
<td>Corr($g$, $\theta$)</td>
<td>0.36</td>
<td>N/A</td>
<td>0.23</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>Corr($g$, $nx$)</td>
<td>0.04</td>
<td>-0.48</td>
<td>-0.43</td>
<td>-0.43</td>
<td>-0.43</td>
</tr>
<tr>
<td>Corr(spr, $nx$)</td>
<td>0.31</td>
<td>0.47</td>
<td>0.46</td>
<td>0.33</td>
<td>0.35</td>
</tr>
</tbody>
</table>

For MEXICO
### Table 1: Parameters Chosen Independently

<table>
<thead>
<tr>
<th>Parm.</th>
<th>Desc.</th>
<th>Targets: (PER, MX, TUR)</th>
<th>Values: (PER, MX, TUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\zeta$</td>
<td>Conflict</td>
<td>Avg. Spreads (3.4, 3.4, 3.4, 3.9)</td>
<td>(0.28, 0, 0.23)</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>Risk Aversion</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>$\theta$</td>
<td>Prob. New Government is $G$</td>
<td>Avg. Dur. of Incumbency 5 years</td>
<td>0.125</td>
</tr>
<tr>
<td>$\pi$</td>
<td>Prob. of Election</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>$r$</td>
<td>Risk-free Rate</td>
<td>$(\frac{1}{1+r} - 0.0025, \frac{1}{1+r} - 0.016, \frac{1}{1+r} - 0.0025)$</td>
<td>$(\frac{1}{1+r} - 0.0025, \frac{1}{1+r} - 0.016, \frac{1}{1+r} - 0.0025)$</td>
</tr>
<tr>
<td>$\beta$</td>
<td>Discount Factor</td>
<td>$(\frac{1}{1+r} - 0.0025, \frac{1}{1+r} - 0.016, \frac{1}{1+r} - 0.0025)\times(150, 92, 91)$</td>
<td>$(\cdot, \cdot, 0.0139)$</td>
</tr>
<tr>
<td>$\xi$</td>
<td>Prob of Re-entry</td>
<td>Avg. Time to Settlement (4 years)</td>
<td>0.25</td>
</tr>
<tr>
<td>$\eta$</td>
<td>Prop. Def. Cost</td>
<td>Average Haircut $\times$ Average(b/y) $0.37\times(150, 92, 91)$</td>
<td>$(\cdot, \cdot, \cdot)$</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>Maturity of debt</td>
<td>$(\cdot, \cdot, \cdot)$</td>
<td>$(\cdot, \cdot, \cdot)$</td>
</tr>
<tr>
<td>$z$</td>
<td>Coupon</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>Smoothing Parameter</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>$\sigma_m$</td>
<td>Smoothing Parameter</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>data</td>
<td>AR(1)</td>
<td>Markov</td>
</tr>
<tr>
<td>------------------</td>
<td>------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>$\alpha_H$</td>
<td>0.0394</td>
<td>N/A</td>
<td>0.0405</td>
</tr>
<tr>
<td>$\alpha_L$</td>
<td>0.0655</td>
<td>N/A</td>
<td>0.0657</td>
</tr>
<tr>
<td>Spreads</td>
<td>3.4%</td>
<td>3.36%</td>
<td>3.61%</td>
</tr>
<tr>
<td>Unsecured Debt</td>
<td>34.0%</td>
<td>34.0%</td>
<td>33.4%</td>
</tr>
<tr>
<td>Spread volatility</td>
<td>2.5%</td>
<td>0.15%</td>
<td>0.66%</td>
</tr>
<tr>
<td>Relection prob</td>
<td>0.6</td>
<td>0.6</td>
<td>0.60</td>
</tr>
<tr>
<td>Vol of relection prob</td>
<td>0.0</td>
<td>0.0</td>
<td>0.37</td>
</tr>
<tr>
<td>Corr(spr,\theta)</td>
<td>-0.59</td>
<td>N/A</td>
<td>0.91</td>
</tr>
<tr>
<td>Corr(spr,g)</td>
<td>-0.34</td>
<td>-0.61</td>
<td>0.03</td>
</tr>
<tr>
<td>Corr(g,\theta)</td>
<td>0.26</td>
<td>N/A</td>
<td>0.24</td>
</tr>
<tr>
<td>Corr(g,nx)</td>
<td>-0.05</td>
<td>-0.22</td>
<td>-0.17</td>
</tr>
<tr>
<td>Corr(spr,nx)</td>
<td>0.73</td>
<td>0.58</td>
<td>0.25</td>
</tr>
</tbody>
</table>

For TURKEY
<table>
<thead>
<tr>
<th></th>
<th>data</th>
<th>AR(1)</th>
<th>Markov</th>
<th>Mark+polt((\pi = 1/8))</th>
<th>Mark+polt((\pi = 1/12))</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\alpha_H)</td>
<td>0.1020</td>
<td>N/A</td>
<td>0.1036</td>
<td>0.1027</td>
<td>0.1021</td>
</tr>
<tr>
<td>(\alpha_L)</td>
<td>0.1137</td>
<td>N/A</td>
<td>0.1141</td>
<td>0.1137</td>
<td>0.1142</td>
</tr>
<tr>
<td>Spreads</td>
<td>3.9%</td>
<td>3.90%</td>
<td>3.92%</td>
<td>3.84%</td>
<td>3.93%</td>
</tr>
<tr>
<td>Unsecured Debt</td>
<td>33.6%</td>
<td>34.3%</td>
<td>34.3%</td>
<td>34.4%</td>
<td>34.4%</td>
</tr>
<tr>
<td>Spread volatility</td>
<td>2.2%</td>
<td>0.29%</td>
<td>0.54%</td>
<td>1.28%</td>
<td>1.38%</td>
</tr>
<tr>
<td>Relection prob</td>
<td>0.6</td>
<td>0.6</td>
<td>0.60</td>
<td></td>
<td>0.54</td>
</tr>
<tr>
<td>Vol of relection prob</td>
<td>0.0</td>
<td>0.0</td>
<td>0.33</td>
<td></td>
<td>0.36</td>
</tr>
<tr>
<td>Corr(spr,(\theta))</td>
<td>-0.35</td>
<td>N/A</td>
<td>0.02</td>
<td>-0.84</td>
<td>-0.86</td>
</tr>
<tr>
<td>Corr(spr,(g))</td>
<td>-0.37</td>
<td>-0.75</td>
<td>-0.63</td>
<td>-0.44</td>
<td>-0.42</td>
</tr>
<tr>
<td>Corr((g, \theta))</td>
<td>0.13</td>
<td>N/A</td>
<td>0.09</td>
<td></td>
<td>0.08</td>
</tr>
<tr>
<td>Corr((g, nx))</td>
<td>-0.28</td>
<td>-0.27</td>
<td>-0.27</td>
<td>-0.27</td>
<td>-0.26</td>
</tr>
<tr>
<td>Corr(spr, (nx))</td>
<td>0.84</td>
<td>0.55</td>
<td>0.44</td>
<td>0.17</td>
<td>0.16</td>
</tr>
</tbody>
</table>
References


