

**Banco de México**  
**Documentos de Investigación**

**Banco de México**  
**Working Papers**

**N° 2006-02**

**Sovereign Default, Interest Rates and Political  
Uncertainty in Emerging Markets**

**Gabriel Cuadra**  
Banco de México

**Horacio Sapriza**  
Rutgers University

February 2006

La serie de Documentos de Investigación del Banco de México divulga resultados preliminares de trabajos de investigación económica realizados en el Banco de México con la finalidad de propiciar el intercambio y debate de ideas. El contenido de los Documentos de Investigación, así como las conclusiones que de ellos se derivan, son responsabilidad exclusiva de los autores y no reflejan necesariamente las del Banco de México.

The Working Papers series of Banco de México disseminates preliminary results of economic research conducted at Banco de México in order to promote the exchange and debate of ideas. The views and conclusions presented in the Working Papers are exclusively the responsibility of the authors and do not necessarily reflect those of Banco de México.

# Sovereign Default, Interest Rates and Political Uncertainty in Emerging Markets<sup>\*</sup>

Gabriel Cuadra<sup>†</sup>  
Banco de México

Horacio Sapriza<sup>‡</sup>  
Rutgers University

## Abstract

Emerging economies tend to experience larger political uncertainty and more default episodes than developed countries. This paper studies the effect of political uncertainty on sovereign default and interest rate spreads in emerging markets. The paper develops a quantitative model of sovereign debt and default under political uncertainty in a small open economy. Consistent with empirical evidence, the quantitative analysis shows that higher levels of political uncertainty significantly raise the default frequency and both the level and volatility of the spreads. When parties borrow from international credit markets, the presence of political uncertainty induces a short-sight behavior in politicians.

**Keywords:** Default, Sovereign Debt, Political Risk.

**JEL Classification:** F34,F41

## Resumen

Las economías emergentes sufren mayor inestabilidad política y registran mayores casos de default soberano que las economías desarrolladas. Este artículo estudia el efecto del riesgo político sobre el default soberano y las tasas de interés en economías emergentes. Se desarrolla un modelo cuantitativo de deuda soberana y default con incertidumbre política para una economía pequeña y abierta. Consistente con los datos, el análisis cuantitativo muestra que mayores niveles de riesgo político aumentan la tasa de default así como el nivel y volatilidad de los spreads. Al pedir prestado en el exterior, la inclusión de incertidumbre política genera una visión corta por parte de los gobiernos.

**Palabras Clave:** Default, Deuda Soberana, Riesgo Político.

---

<sup>\*</sup>We are very much indebted to Per Krusell for encouragement and advice. We particularly thank Alan Stockman for his suggestions. For useful comments we thank Rafael Del Villar.

<sup>†</sup> Dirección General de Investigación Económica. Email: gcuadra@banxico.org.mx.

<sup>‡</sup> Rutgers Business School. Email: hsapriza@andromeda.rutgers.edu.

## 1. Introduction

Emerging markets usually face larger political uncertainty, and are more crisis prone than developed economies. In the last two decades, small developing economies have experienced several episodes of sovereign default and high political uncertainty, some of the most recent being Ecuador in 1999 and Argentina in 2001 among others. Indeed, empirical studies by Citron and Nickelsburg (1987), Balkan (1992), Li (1992), Rivoli and Brewer (1997) and Peter (2002) find evidence of the importance of political factors in studying sovereign debt and default issues. They find a significant relationship between the probability of default and the level of political instability, thus pointing out political risk as an important component of a country's credit worthiness. This paper models this feature and provides a quantitative assessment of the impact of political uncertainty on default incentives, on sovereign debt and thus on the behavior of country interest rate spreads.

Fragile and often unstable political institutions have been the norm in Latin America. Most Latin American countries have weaker public institutions than those found in the investment-grade countries of Europe and Asia, a factor that contributes to their more volatile economic performance. Significant increases in short term interest rate volatility from political risk has been evidenced in Brazil, Bolivia, Ecuador and Venezuela in 2005. In fact, one of the biggest threats to economic stability has come from the political uncertainty derived from the general discontent in many countries with politicians and with the way political institutions function<sup>1</sup>. These features sug-

---

<sup>1</sup>In 1997, less than two years before the Ecuador's default, president Abdala Bucaram was overthrown. Between 2001 and 2002 two presidents were forced to resign in Argentina, Fernando De la Rúa and Adolfo Rodríguez Saa. In the last two years two presidents were overthrown in Bolivia, Gonzalo Sánchez de Lozada in 2003 and Carlos Mesa in 2005.

gests that political uncertainty may have a significant role on business cycle fluctuations, foreign debt sustainability and the level and volatility of country interest rate spreads in developing countries.

The objective of this paper is to study the effects of political uncertainty on incentives to default and equilibrium interest rates in developing countries using a dynamic stochastic model of a small open economy with endogenous default and political risk. The quantitative model is based on the willingness to pay approach developed by Eaton and Gerzovitz (1981). Arellano and Mendoza (2002) discuss how this approach can be used to explain emerging market features. The model captures some of the main empirical regularities present in these markets: default occurs in equilibrium, the current account, default risk and interest rate spreads are countercyclical, and the default rate, the interest rate spreads and their volatility increase significantly as the level of political uncertainty raises.

There are two types of households in the economy, each represented by a political party that has a given probability of being reelected next period if it is in office today. The benevolent and rational current incumbent party, i.e., the government in the economy, has access to international financial markets where it can borrow or lend to foreign lenders. Markets are incomplete because the government buys and sells one period non-contingent discount bond and it cannot commit to repay its sovereign debt.

The model provides insight on how do changes in the reelection probabilities of these parties impact on the countries' risk of default, and thus, affect spreads. It is observed that a lower probability of the incumbent to remain in office may lead to higher country interest rate spreads. When parties borrow from international credit markets, they know that there is a positive probability of being out of power next period. In that case

they would not be asked to pay the country's foreign debt. Therefore, they are willing to borrow more at higher interest rates. This short-sight behavior due to political risk is also present in Amador (2003) where political uncertainty reduces the ability of a country to save and in Azzimonti (2004) where under-investment in infrastructure and overspending in public goods results from the presence of political risk.

The paper is related to Arellano (2004) who develops a quantitative model based on the willingness to pay approach in order to study output, real exchange rates and country spreads in emerging markets. Her analysis, however, does not address the issue of political uncertainty. Aguiar and Gopinath (2004b) analyze the effect of stochastic productivity trends to improve the empirical predictions of the model without including political risk. Yue (2004) analyzes the quantitative effects of sovereign debt renegotiation on country interest rate spreads but again she does not consider any political factor in her study.

The paper proceeds as follows: the economic environment and the theoretical model are presented in section 2, the equilibrium is defined in section 3, the quantitative implications of the model are analyzed in sections 4 and 5 and the conclusions are presented in section 6. The algorithm is described in the appendix.

## **2. The Model**

Consider a neoclassical small open economy model with two types of domestic agents, each represented by a political party, and foreign lenders. Each period one of the two parties is in office and the incumbent remains in power with a given probability  $\pi$ . The only asset traded in international financial markets is a one period non contingent real discount bond that is available to the party in office, that is, to the government. Debt

contracts are not enforceable as the party in office has the option to default on them. When it defaults, the country is temporarily cut off from credit markets. Foreign lenders charge a premium to account for the probability of not being paid back.

Each period the country receives an endowment of goods  $y$ . The endowment is assumed to follow a Markov process. Let  $Q(y_{t+1}|y_t)$  denote the Markov transition function. The ruling party decides on the allocation of the endowment between households and on the purchase of foreign bonds. However, it lacks commitment to repay its sovereign debt. This feature, together with the political uncertainty included in this otherwise standard neoclassical framework, are intended to capture some relevant empirical regularities and take into account commonly observed features of emerging economies.

The representative agent of type  $i$ , where  $i = 1, 2$ , derives utility from the consumption of a tradable good and has preferences given by the present value of the sum of instantaneous utility functions. The period utility function is concave, strictly increasing, twice differentiable and follows the CRRA specification:

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

where  $\sigma \in (0, 1)$ , so  $u(0) = 0$ .

## 2.1. The Government

Political party 1 represents agent 1 and faces the following decisions: when in office it must initially decide whether to default or not on the country's foreign debt, and if it does not default it decides on the allocation of the endowment that the country receives, on the consumption allocation for each agent and on the foreign debt for next period. If it defaults it only decides on the allocation of the endowment between the two agents. If not in office, the party receives the resource allocations that the other party

in government optimally chooses. The parties face intertemporal problems which are expressed in a recursive dynamic programming form where the state variables for the incumbent are  $B$ ,  $y$  and  $d$ , such that  $d = 1$  if the economy has access to credit markets and 0 otherwise. The value function of the incumbent, party 1, who has access to credit markets and begins the period with an amount of foreign assets  $B$  and endowment  $y$  is denoted by  $V_0(B, y)$ . The party must decide whether to default or not by comparing the value of paying back and remaining in the credit market  $V^c(B, y)$ , with the value of defaulting and living in temporary autarky  $V^d(y)$ .

Therefore, the initial default decision for party 1 when in office and the economy is participating in financial markets can be written as follows

$$V_0(B, y) = \max\{V^c(B, y), V^d(y)\} \quad (2.1)$$

The party can choose between paying the current country's debt or defaulting on it. This decision results from comparing the net benefits of the two alternatives, that is, by optimally balancing the cost of exclusion given by the foregone benefits of consumption smoothing against the direct costs of repayment given by the short-run disutility of repaying the loan. The optimal default decision can be characterized by

$$D(B, y) = \begin{cases} 1 & \text{if } V^d(y) > V^c(B, y) \\ 0 & \text{otherwise} \end{cases}$$

which indicates that party 1 optimally defaults whenever the discounted value of choosing to default is equal or higher than the continuation value. The default policies determine a repayment set  $\Gamma(B)$  defined as the set of values of the exogenous shocks such that repayment is optimal given asset holding level  $B$ ,

$$\Gamma(B) = \{y \in \Upsilon : D(B, y) = 1\}$$

and a default set  $F(B)$  defined as the set of values of the exogenous shocks such that default is optimal given asset holding level  $B$ ,

$$F(B) = \{y \in \Upsilon : D(B, y) = 0\}$$

When party 1 decides to pay, it can issue new debt and faces the following budget constraint:

$$C_1 + C_2 = y + B - q(B', y)B'$$

where  $C_i$  denotes the consumption allocation for agent  $i$  made by party 1 in office.

A negative value of  $B$  implies that the country has foreign debt,  $q(B', y)$  is the price of the bond that pays one unit of goods next period if the next government does not default. When party 1 borrows, it sells bonds in the international credit market, and when it lends, it buys bonds from foreign creditors. A sell of  $B'$  in bonds - a negative value of  $B'$  - implies that the party receives  $q(B', y)B'$  units of the good from foreign creditors on the current period and promises that next period's ruling party will pay  $B'$  units conditional on not defaulting. In the same way, a purchase of bonds of value  $B'$  implies that the party lends  $q(B', y)B'$  units of the good to foreign creditors and next period's ruling party will receive  $B'$  units the following period. It is assumed that foreign creditors always pay their debts, so the only agent who may decide not to commit to repay is the domestic ruling party. When the incumbent borrows, the price of the bond reflects the possibility that the next period's ruling party defaults, so this price should depend on  $B'$  (the amount that is borrowed) and on  $y$  (since today's endowment shocks affect the probability distribution for next period endowments) because the incentives to default depend on both factors.

Therefore, the government's problem when it participates in international credit

markets can be expressed as follows:

$$V^c(B, y) = \max_{C_1, C_2, B'} \left\{ u(C_1) + \beta \left[ \sum_{y'} [\pi V_0(B', y') + (1 - \pi) \bar{V}_0(B', y')] Q(y'/y) \right] \right\} \quad (2.2)$$

*s.t.*

$$C_1 + C_2 = y + B - q(B', y)B'$$

$\bar{V}_0$  is the discounted continuation value for party 1 when party 2 is in office and the country has access to international credit markets, so that party 2 has the option to default or repay, and its expression is as follows:

$$\begin{aligned} \bar{V}_0(B, y) &= \bar{V}^c(B, y) & (2.3) \\ \text{for } D^*(B, y) &= 0 \\ B^{*'} &= G^*(B, y) \\ &C_1^*, C_2^* \end{aligned}$$

where  $C_i^*$  denotes the consumption allocation for agent  $i$  made by party 2 in office, and  $G^*(B, y)$  its borrowing decision.

$$\bar{V}^c(B, y) = u(C_1^*) + \beta \left[ \sum_{y'} [(1 - \pi)V_0(B^{*'}, y') + \pi \bar{V}_0(B^{*'}, y')] Q(y'/y) \right], \quad (2.4)$$

which means that party 2 did not default and therefore is choosing foreign assets for next period  $B^{*'}$  as well as consumption allocations  $C_1^*, C_2^*$ .

When party 2 defaults, the expression for  $\bar{V}_0$  can be written as follows

$$\begin{aligned} \bar{V}_0(B, y) &= \bar{V}^d(B, y) & (2.5) \\ \text{if } D^*(B, y) &= 1 \end{aligned}$$

When the party in office, party 1 in this case, decides not to pay the outstanding foreign debt, the country loses access to international credit markets for a stochastic number of periods, so the economy is temporarily in financial autarky without being able to save or borrow. Therefore, the problem for party 1 when the country is in autarky is as follows:

$$V^d(y) = \max_{C_1, C_2} \left\{ u(C_1^d) + \beta \left\{ \begin{array}{l} \mu \sum_{y'} [\pi V_0(0, y') + (1 - \pi) \bar{V}_0(0, y')] Q(y'/y) + \\ + (1 - \mu) \sum_{y'} [\pi V^d(y') + (1 - \pi) \bar{V}^d(y')] Q(y'/y) \end{array} \right\} \right\} \quad (2.6)$$

*s.t.*

$$(1 - \gamma)y = C_1^d + C_2^d$$

which shows that the country has no instruments now to smooth household consumption and it loses a fraction  $\gamma$  of output while in autarky.  $\mu$  denotes the probability of reentering financial markets next period. When the economy returns to financial markets, it does so with no debt burden,  $B = 0$ . The expression for the utility of party 1 when it is not in office and the country is in autarky,  $\bar{V}^d$ , is:

$$\bar{V}^d(y) = u(C_1^{*d}) + \beta \left\{ \begin{array}{l} \mu \sum_{y'} [(1 - \pi)V_0(0, y') + \pi \bar{V}_0(0, y')] Q(y'/y) + \\ + (1 - \mu) \sum_{y'} [(1 - \pi)V^d(y') + \pi \bar{V}^d(y')] Q(y'/y) \end{array} \right\} \quad (2.7)$$

where  $C_i^{d*}$  denotes the consumption allocation for agent 1 made by party 2 in office when the country is in autarky.

The problem for party 2 is analogous to the one for party 1 and the following notation is used:

$J_0(B, y)$  is the value function of party 2 when it is in office, it has access to credit markets and it begins the period with an amount of foreign assets  $B$  and endowment  $y$ .

$J^c(B, y)$  represents the utility from repaying debt for party 2 when it is in office.

$J^d(y)$  represents the utility of not repaying for party 2 (it is in office).

$\bar{J}_0(B, y)$  represents the utility for party 2 when party 1 is in office, the country has access to international credit markets and party 1 has the option to default.

$\bar{J}^c(B, y)$  represents the utility for party 2 when party 1 is in office and decided to pay the debt.

$\bar{J}^d(y)$  is the utility for party 2 when party 1 is in office and decided to default.

$C_1^*, C_2^*, B^{*'}$  are the optimal consumption and saving choices made by party 2 when the country is in financial markets,  $D^*(B, y)$  is the optimal default decision and  $C_1^{*d}, C_2^{*d}$  are the optimal consumption choices made by party 2 when the country is in autarky.

## 2.2. Foreign Creditors

There is a large number of identical, infinitely lived foreign lenders. Each lender can borrow or lend resources at the risk free rate  $r_f$  and lends in a perfectly competitive market to the small open economy. The individual lender is risk neutral. As pointed out by Cole and Kehoe (1996), the assumption of risk neutrality of lenders captures the idea that the domestic economy is small compared to world credit markets.

Creditors have perfect information regarding the economy's endowment and political processes and each period they can observe the endowment level, as well the ruling party. They choose loans  $B'$  to maximize expected profits taking into account the probability of each of the parties being in office tomorrow. Then, when party 1 is in office, lenders maximize the following expression:

$$\Phi = -qB' + \frac{\pi(1 - \lambda(B', y))}{1 + r_f}B' + \frac{(1 - \pi)(1 - \lambda^*(B', y))}{1 + r_f}B'$$

and if party 2 is in office, lenders maximize

$$\Phi = -q^*B^{*'} + \frac{\pi(1 - \lambda^*(B^{*'}, y))}{1 + r_f}B^{*'} + \frac{(1 - \pi)(1 - \lambda(B^{*'}, y))}{1 + r_f}B^{*'}$$

where  $q$  is the price of a one-period non contingent bond if party 1 is the incumbent and  $q^*$  is the price if party 2 is the incumbent,  $B'$  is the amount of assets issued by the government if party 1 is in office and  $B^{*'}$  is the corresponding amount if party 2 is in office.  $\lambda$  and  $\lambda^*$  are the endogenous default probabilities for party 1 and party 2 respectively.  $\pi$  is the probability of staying in office for any incumbent. Note that only the incumbent borrows from capital markets.

Perfect competition in the credit market implies that the zero expected profit condition for the foreign creditor must be satisfied. The correspondent bond prices if party 1 or 2 are in office today are then:

$$\begin{aligned} q(B', y) &= \frac{\pi(1 - \lambda(B', y))}{1 + r_f} B' + \frac{(1 - \pi)(1 - \lambda^*(B', y))}{1 + r_f} B' \\ q^*(B^{*'}, y) &= \frac{\pi(1 - \lambda^*(B^{*'}, y))}{1 + r_f} B^{*'} + \frac{(1 - \pi)(1 - \lambda(B^{*'}, y))}{1 + r_f} B^{*'} \end{aligned}$$

### 3. Equilibrium

The paper focuses on Markov Perfect Equilibria, i.e. subgame perfect equilibria that use Markov strategies. It is assumed that parties play only stationary Markov strategies: their decisions are only a function of the payoff relevant (state) variables at a given point in time. There is no reputation building under this assumption, so that whatever occurred in the past does not affect the current income and the future does not matter for the politicians' behavior.

**Definition 3.1.** *A Stationary Markov strategy for parties 1 and 2 is a profile of consumption  $C_i(B, y), C_i^d(y), C_i^*(B, y), C_i^{*d}(y)$  for  $i = 1, 2$ , default functions  $D(B, y), D^*(B, y)$  and asset functions  $G(B, y), G^*(B, y)$  such that  $X = \{D(B, y), G(B, y), C_i(B, y), C_i^d(y)\}$  for party 1 and  $X^* = \{D^*(B, y), G^*(B, y), C_i^*(B, y), C_i^{*d}(y)\}$  for party 2*

Thus, the consumption correspondence  $C_i(B, y)$   $i = 1, 2$  determines the consumption allocation to all parties that party 1 will choose if she is in power at some time with an asset level  $B$ , endowment level  $y$  and the country having access to credit markets. A consumption allocation  $C_2(B, y)$  is the consumption party 1 will provide to party 2 if she were in power with an asset level  $B$ , endowment level  $y$  and the country participating in financial markets. The function  $G(B, y)$  reflects the savings in the foreign asset if party 1 is in power with assets  $B$  and endowment  $y$ .

**Proposition 1** *If parties play Markov strategies and party  $i$  does not value the consumption of agent  $j$  then  $C_j = 0$  and  $C_j^d = 0$*

If parties play Markov strategies and party 1 does not value the consumption of agent 2, when party 1 is in office it chooses  $C_2 = 0$  and  $C_2^d = 0$ . In a Markov equilibrium the consumption allocation decisions do not affect the state for tomorrow, therefore party 1 sets the consumption allocations to maximize the per period utility of agent 1, this implies giving all the resources to household 1. Analogously, since party 2 does not value the consumption of agent 1, when party 2 is in office it chooses  $C_1^* = 0$  and  $C_1^{*d} = 0$ .

**Definition 3.2.** *A recursive equilibrium for this small open economy is characterized by*

- i. *a set of value functions  $V_0, V^c, V^d, \bar{V}_0, \bar{V}^c, \bar{V}^d$  for party 1 and  $J_0, J^c, J^d, \bar{J}_0, \bar{J}^c, \bar{J}^d$  for party 2,*
- ii. *a set of policies for consumption  $C_i(B, y), C_i^d(y), i = 1, 2, C_i^*(B, y), C_i^{*d}(y) i = 1, 2,$  default policies  $D(B, y), D^*(B, y)$  and asset holdings  $G(B, y), G^*(B, y)$  for parties 1 and 2 respectively,*
- iii. *a set of default probability functions:  $\lambda(B', y)$  for party 1 and  $\lambda^*(B', y)$  for party 2 and a set of bond price functions:  $q(B', y)$  for party 1 and  $q^*(B', y)$  for party 2*

such that

1. Given the bond price function  $q(B', y)$  and party 2's strategies, party 1's value functions  $V_0, V^c, V^d, \bar{V}_0, \bar{V}^c, \bar{V}^d$  and default policy  $D(B, y)$  solve problem (2.1) and party 1's policies for foreign asset holdings  $G(B, y)$  and for consumption  $C_i(B, y), i = 1, 2$  solve problem (2.2),  $C_i^d(y), i = 1, 2$  solves problem (2.6) and analogously for party 2 for value functions  $J_0, J^c, J^d, \bar{J}_0, \bar{J}^c, \bar{J}^d$  and policies  $D^*(B, y), G^*(B, y), C_i^*(B, y), C_i^{*d}(y), i = 1, 2$ , given the bond price function  $q^*(B^{*l}, y)$  and party 1's strategies.

2. Given  $\lambda(B', y)$  and  $\lambda^*(B', y)$  the bond price functions  $q(B', s)$  and  $q^*(B', s)$  are such that all agents in the small open economy are optimizing and international lenders get zero expected profits:

$$\begin{aligned} q(B', y) &= \frac{\pi(1 - \lambda(B', y))}{1 + r_f} B' + \frac{(1 - \pi)(1 - \lambda^*(B', y))}{1 + r_f} B' \\ q^*(B^{*l}, y) &= \frac{\pi(1 - \lambda^*(B^{*l}, y))}{1 + r_f} B^{*l} + \frac{(1 - \pi)(1 - \lambda(B^{*l}, y))}{1 + r_f} B^{*l} \\ \text{where } B' &= G(B, y), B^{*l} = G^*(B, y) \end{aligned}$$

The equilibrium implies that if party 2 follows  $X^*$  then the best response of party 1 is  $X$ , and if party 1 follows  $X$  then the best response of party 2 is  $X^*$ . We focus on a symmetric equilibrium: both parties play the same strategies, so the problem faced by the parties in this small open economy is the same. For any given state of the economy  $(B, d, y)$  the party in office faces the same problem, no matter which party is.

**Definition 3.3.** A Symmetric Markov Equilibrium (SME) is a set of policies for consumption, default and asset holdings  $(X^S)$  for each party such that for any  $B, y, d$  and any other feasible values  $X$ ,  $V_0(B, y/X_s, X_s) \geq V_0(B, y/X, X_s)$  for party 1 and  $J_0(B, y/X_s, X_s) \geq J_0(B, y/X, X_s)$  for party 2.

In the SME the value generated by following  $X_s, X_s$  is equal or larger than the one generated by any other feasible allocation  $X$  while the given party is in power and when the other party follows  $X_s$ .

In the symmetric equilibrium parties choose optimal consumption, the optimal default policy and optimal asset holding policy subject to the resource constraint and foreign lenders optimizing by satisfying their zero profit condition from the debt contract. In those states where party 1 defaults, party 2 will also default: default sets and repayment sets are equal for both parties. Thus, when parties do not default while in office, they choose the same amount of foreign assets. Therefore, their asset decisions are the same and for any given state  $(B, y)$  both parties make the same default decision  $D_s(\cdot)$  and asset holding decision  $G_s(\cdot)$ , so the unique default probability function is denoted as  $\lambda_s(B', y)$ .

Therefore, in the symmetric equilibrium, the bond price collapses to

$$q_s(B', y) = \frac{(1 - \lambda_s(B', y))}{1 + r_f}$$

where  $B' = G_s(B, y)$

The symmetric equilibrium bond price  $q_s(B', y)$  reflects the probability of default of the incumbent,  $\lambda_s(B', s)$ , which results from

$$\lambda_s(B', y) = \sum_{y' \in F_s(B')} Q(y'/y)$$

so that the default probability is zero when  $F_s(B') = \emptyset$  and it is one when  $F_s(B') = \Upsilon$ .

## 4. Quantitative Analysis

The model is solved numerically and the parameters are based on existing data and empirical work on emerging markets. Argentina is used as a benchmark because a long time series on country interest rates is available. However, many of the business cycles features observed in Argentina are shared by other emerging market economies, Aguiar and Gopinath (2004a). The data are seasonally adjusted quarterly real series obtained from the Ministry of Economy and Production (MECON) of Argentina. The interest rates for Argentina are taken from Neumeyer and Perri (2004)<sup>2</sup>. Output and consumption are in logs and the current account is presented as a percentage of GDP. Spreads correspond to the difference between Argentina interest rates and US three month treasury bond rate. All series are filtered with the Hodrick-Prescott filter. Table 1 shows the data.

Figures 1 and 2 in appendix illustrate the correlations between political risk, interest rates spreads and GDP movements for Argentina, as figure 2 shows, there is a strong negative correlation between interest rate spreads and political risk<sup>3</sup>. In addition, Figure 1 shows the counter-cyclical of Argentinian interest rates spreads.

The calibration involved choosing the functional form of the utility function and the values of the parameters. The utility function follows a CRRA where  $\sigma \in (0, 1)$  so that  $u(0) = 0$  which allows for utility comparisons given that in any period one of the two agents will consume a zero amount of the consumption good in equilibrium.

The discount factor  $\beta$  is set at 0.95. One weakness of previous quantitative models

---

<sup>2</sup>The serie for the interest rate for Argentina stars in 1983

<sup>3</sup>Political risk ratings are taken from International Country Risk Guide (ICRG): Risk ratings range from a high of 100 (least risk) to a low of 0 (highest risk)

of sovereign default without political risk is that they require a high level of impatience to generate default in equilibrium, so low values of the discount factor are employed to match the default rates. Arellano (2004), Aguiar and Gopinath (2004b) and Yue (2004) use values of 0.84, 0.80 and 0.74 respectively. The inclusion of political uncertainty allows us to use a more standard value for the discount factor.

In order to analyze the effects of political uncertainty on incentives to default and sovereign interest rate spreads, different probability values were considered for the re-election probability, with 0.7 as the benchmark . Since quarterly data is considered and elections take place every four or five years, we can interpret  $\pi$  as the likelihood that the ruling party is overthrown by the other party. The value of 0.7 helps to match the default rate in Argentina. According to Reinhart, Rogoff and Savastano (2003) Argentina defaulted four times from 1824 to 1999. In addition, this country defaulted one more time in 2002 which adds up to five defaults in the last 180 years.

The probability of reentering financial markets after default  $\mu$  is set to 0.1 which is in line to the estimates of Gelos et al. (2003). They find that during the default episodes of the 1980's and 1990's countries were excluded from the capital markets on average less than 3 years. The probability of redemption equal to 0.1 implies that a defaulting country will return to financial markets in about 10 quarters after defaulting on its foreign debt.

The fraction of output lost in times of default  $\gamma$  is set equal to 0.02, which is the percent in output contraction estimated by Puhán and Sturzenegger (2003) following the default episodes in the 1980's in Latin America.

The endowment  $y_t$  for the small open economy is composed of a stochastic trend  $\Upsilon_t$  :

$$y_t = \Upsilon_t$$

and the trend follows

$$\begin{aligned}\Upsilon_t &= g_t \Upsilon_{t-1}, \\ \ln g_t &= (1 - \rho_g) \ln \eta_g + \rho_g \ln g_{t-1} + \epsilon_t^g\end{aligned}$$

where  $\rho_g \in (-1, 1)$ ,  $\epsilon_t^g \sim N(0, \sigma_g^2)$ .

We denote the growth rate of trend income as  $g_t$  with long run mean  $\eta_g$ . The log growth rate follows an AR(1) process with AR coefficient  $\rho_g \in (-1, 1)$ . Note that a positive shock  $\epsilon_t^g$  implies a permanently higher level of output, and to the extent that  $\rho_g > 0$ , a positive shock today implies that the growth of output will continue to be higher beyond the current period. This first order autoregressive process is approximated by a discrete first order Markov chain with 25 values using Hussey and Tauchen's (1991) procedure.

This endowment process is motivated by the work of Aguiar and Gopinath (2004a). They find that shocks to trend growth are the primary source of fluctuations in emerging markets rather than transitory fluctuations around a stable trend. Aguiar and Gopinath (2004b) use an endowment process with trend shocks to study sovereign default and they show that the ability of the model to match the data is improved when trend shocks are included. Yue (2004) shows that the argentinian output is characterized by a stochastic trend and uses an endowment process with shocks to the trend growth rate to study sovereign default and debt renegotiation in emerging markets economies. Since emerging economies are subject to substantial volatility in the trend growth rate relative

to developed markets, a volatile stochastic trend is considered for the endowment process and the values of the parameters are taken from Yue (2004). She calibrates the process to the argentinian output using quarterly data for the period of 1980 Q1 to 2003 Q4 from MECON.

Since a realization of the growth shock  $g$  permanently affects  $\Upsilon$ , output is nonstationary with shocks to the trend growth rate. Therefore, as in Aguiar and Gopinath (2004a) and Yue (2004) the model is detrended by the lagged endowment level  $y_{t-1}$  and the detrended counterpart is denoted by  $\hat{x}_t$ :

$$\hat{x}_t = \frac{x_t}{y_{t-1}}$$

We normalize by  $y_{t-1}$ , which ensures that if  $x_t$  is the agent's information set at period  $t$ , so is  $\hat{x}_t$ .

The parameters for the benchmark model are shown in Table 2.

## 5. Results

This section analyzes the simulation results and the statistical properties of the model economy. The business cycle moments for the benchmark economy are presented in Table 2. Business cycles statistics are average values over 100 simulations of 100 realizations each, drawn from a stationary distribution. The simulated series are logged and filtered as the data. The model can match several features of emerging market economies.

Spreads are countercyclical: the negative correlation of output with spreads is consistent with the data for emerging economies, though the magnitude is lower. Output and spreads are negatively correlated due to the asset structure of the model: there is

only one asset available to the ruling party, a one period non-contingent bond, so asset markets are incomplete. Given this market structure, default is tempting in times when output and consumption are low since a given debt-service payment reduces utility more strongly in those states. Since repayment of non-contingent loans are more painful in bad states of nature, incentives to default tend to be stronger in times of low output. Risk neutral creditors are willing to supply loans that in bad states of the world will result in default by charging a higher risk premium. In this way, the model can generate counter-cyclical interest rate spreads. Aggregate consumption is used when calculating the output-consumption correlation. In any period the consumption of one of the two agents is zero, thus if party  $i$  is in office then aggregate consumption is simply the consumption of agent  $i$ . Table 3 shows that aggregate consumption is almost as volatile as output, and highly correlated with it.

The model can account for the negative correlation between the current account and output as observed in the data. The fact that both the current account and spreads are countercyclical implies that political parties borrow more in good times at a lower interest rate. Aguiar and Gopinath (2004b) also get this result when they consider trend shocks. As they explain in detail, with shocks to the growth trend a good shock is expected to persist, thus the incumbent has incentives to borrow more. Although bond prices are decreasing in the level of foreign debt, a persistent good shock lowers the expected probability of default which implies a favorable shift in the interest rate schedule. If the later effect dominates then it is possible to get a countercyclical current account and spreads.

Figure 3 plots the discount bond price schedule as a function of assets for the highest and lowest values of the shock. As the figure shows, bond prices fall in three ranges. For

small levels of foreign debt, the ruling party always pays back the country's foreign debt, so it borrows from credit markets at the international risk free interest rate. Therefore, bond price is simply the inverse of the gross risk free rate. For values of foreign debt up to 15.70 % of output, the government does not have any incentive to default so it still faces risk free interest rates. However, as foreign debt goes up, at a certain debt level bond prices start to fall. For intermediate foreign asset levels, prices are between zero and the inverse of the risk free rate, and the price is increasing in the level of assets. The higher the levels of foreign debt the lower the bond prices because the incentives to default increase in foreign assets. At debt levels above 22.53% of output the incumbent always defaults regardless of the value of the shock. At that point bond prices are zero since the ruling party will default for sure, thus the model predicts that large indebted countries have more incentives to default.

Figure 4 shows the default region for the calibrated economy, i.e., the combinations of foreign debt levels and shock values for which default is optimal. Given the level of assets, if default is optimal for a certain value of the shock, it will be optimal for all lower values. This implies that incentives to default are stronger when the economy receives a low growth shock. Therefore, quantitatively the model predicts that default is more likely in bad times.

In order to assess the influence of political uncertainty on default incentives and country spreads, different values of  $\pi$  were considered. Table 4 illustrates the impact of different levels of political uncertainty on the behavior of interest rate spreads in the model economy.

As the country faces a higher degree of political risk, the volatility and the maximum spread levels increase significantly. The default rate is also higher. The percentage

increments in these variables appear not to be linear in the change of the of re-election probability.

Political parties are not permanently in office, the political process implies that the current incumbent maybe will be out of office next period. The fact that political parties alternate randomly in power influences politicians' behavior. It is assumed that only the incumbent has access to international credit markets. When the party in power borrows from abroad, it promises that next period ruling party will honor the country's foreign debt. If the incumbent, who is borrowing from foreign lenders today, is out of power next period, it will not have to pay back the amount borrowed today from abroad: it will be the other party that will have to deal with foreign creditors next period. Hence, political uncertainty implies that politicians maybe will not be asked to pay the loans that they are requesting, so political parties are willing to borrow more at higher interest rates. In this way, the presence of political uncertainty induces a short-sight behavior in politicians. Since bond prices are decreasing in the level of foreign debt, additional borrowing implies higher interest rates which are associated with larger default risk. It follows that the lower the probability of remaining in office the higher the spreads and more default episodes are observed in equilibrium.

In the economy without political uncertainty,  $\pi = 1$ , the same party is continuously in power and default is a very rare event as it occurs on average only 8 times in 10,000 periods (quarters), implying that the country defaults every 312 years. As the party in office borrows, the bond price starts to decrease. If the incumbent wants to borrow any extra amount, it has to pay a higher interest rate, i.e., the marginal cost of borrowing increases. The ruling party takes into account the effect of additional borrowing on the interest rate the country has to pay and therefore does not borrow as much as in

the case with political risk. The increase in the interest rate means that bonds are not good instruments for insurance and consumption smoothing purposes. So in the model without political uncertainty the party borrows from capital markets paying either low risk premia or not premia at all. Since low levels of risk premia are related to very low default probabilities, default is not a frequent event. This feature also explains the low volatility of spreads obtained in the model. The standard deviations of spreads obtained in the model is 0.0761 for the case without political uncertainty. This value is lower than the one usually observed in data for emerging markets economies. The fact that default episodes are rare events implies a low volatility of country spreads.

Once we include political uncertainty in the model, political parties are willing to borrow at higher interest rates. As in the case without political risk if the ruling party borrows more from abroad then the bond price falls, which implies higher country spreads. Though the cost of foreign loans increases, politicians are willing to go on borrowing since there is a positive probability that they would not have to pay back. A lower bond price implies a higher probability of sovereign default, thus more default cases are observed when political uncertainty is included. When we set the value of  $\pi$  to 0.6, the default cases in 10,000 periods increase from 8 to 80, implying that the country defaults almost every 30 years. Since default is a less rare event with political uncertainty, higher country spreads are observed and their volatility is also larger.

## **6. Conclusions**

This paper analyses the impact of political uncertainty on country interest rate spreads and default incentives in emerging markets by developing a stochastic equilibrium model of a small open economy with two political parties that stochastically alternate in office

and where default is an equilibrium outcome. The focus is on a symmetric Markov perfect equilibrium. The disagreement between the political parties and the Markov equilibrium approach used in the paper make any equilibrium solution based on coordination between the parties be suboptimal.

The model mimics the behavior of several macroeconomic variables such as the countercyclicality of default risk, of interest rate spreads and of the current account. Including political uncertainty in the model allows to improve results from previous studies, with a more reasonable discount rate.

The results of the model are derived as an equilibrium outcome of the interaction between risk-neutral competitive creditors and the two political parties in the small open economy. The parties are risk averse borrowers, they cannot commit to repay the foreign debt when in office and each cares for a different type of agent. Default probabilities are endogenous to the economy's incentives to default and they affect the equilibrium interest rates. As observed in international credit markets, governments have access to non contingent foreign debt, and risk neutral competitive lenders are willing to provide debt contracts that in some states will result in default by charging a higher premium on these contracts. Market incompleteness generates counter-cyclical default risk because it is more costly to repay non-contingent loans in times when output and consumption are low, than in booms.

The presence of political uncertainty induces higher levels and volatility of spreads, higher default rates that closely match that observed in data. As the country faces a higher degree of political uncertainty, the default rate increases. Political risk implies that parties are not permanently in power. The incumbent, who is borrowing from foreign lenders today, may be out of office the following period. Therefore, political

uncertainty implies that politicians may not be asked to pay the loans that they are requesting, so the political parties are willing to borrow at higher interest rates, which are associated with higher spreads and more default episodes.

Interesting extensions for further research include an endogenous political process and a production structure which reflects more closely the structural characteristics of emerging market economies.

## 7. Appendix

### 7.1. Algorithm

The following algorithm solves for a symmetric equilibrium, where both parties make the same decisions. Thus only the problem for one party is considered, since the problem for the other party would be the same. The problem of party 1 is solved assuming that the other party is following the same policies. Hence, convergence of policies is required.

The following algorithm is used:

1. Assume an initial function for the price of the bond  $q_0(B', y)$ . To calculate the initial value of the bond, use the inverse of the risk free rate.

2. Given  $q_0$  and the initial values of  $(V_0)^0$ ,  $(V^d)^0$ ,  $(\bar{V}_0)^0$  and  $(\bar{V}^d)^0$  use equation 2.6 to get  $(V^d)^1$  and equations 2.2 and 2.1 to get  $(V_0)^1$  as well as the decision rules  $(D(B, y))^1$  for the default decision and  $(G(B, y))^1$  for the debt decision, regarding the consumption allocation to agent 2,  $C_2 = C_2^d = 0$ .

3. Consider  $C_1^{*d} = 0$  and the initial values of  $(V_0)^0$ ,  $(V^d)^0$ ,  $(\bar{V}_0)^0$  and  $(\bar{V}^d)^0$  and use 2.7 to get  $(\bar{V}^d)^1$ .

4. Consider  $G^*(B, y) = (G(B, y))^1$  and  $C_1^* = 0$ , and use  $(V_0(G^*(B, y), y'))^0$  and  $(\bar{V}_0(G^*(B, y), y'))^0$  to get  $\bar{V}^c$  using 2.4

5. Consider  $D^*(B, y) = (D(B, y))^1$  and use  $(\bar{V}^d)^1$  and  $\bar{V}^c$  to get  $(\bar{V}_0)^1$  using 2.3 and 2.5

6. Iterate following steps 2 to 6 and solve for value functions and policies.

7. Given the initial price of the bond  $q_0$ , and the default function  $D(B, y)$ , update the price of the bond using the following equation:

$$q_1 = \frac{(1 - D_0(B, y))}{1 + r_f}$$

8. Use the updated price of the bond  $q_1$  to repeat steps 1 to 7 until the following condition is satisfied:

$$q_i - \frac{(1 - D_i(B, y))}{1 + r_f} < \epsilon$$

where  $i$  represents the number of iterations on the bond price and  $\epsilon$  is a small number.

## 7.2. Figures and Tables

Table 1. Argentinian Business Cycle Statistics (1980.1 - 2003.4)			
	Std Dev	Correlation with GDP	Correlation with Spread
GDP	4.45		-0.61
Consumption	5.12	0.96	-0.64
Current Account	1.59	-0.85	0.69
Spread	5.55	-0.61	
Default Rate	0.0069		

Table 2. Parameter Values			
Discount Factor	$\beta$	0.95	
Re-election Probability	$\pi$	0.7	
Risk Aversion	$\sigma$	0.5	
Re-entry Probability	$\mu$	0.1	
Endowment shock	$\eta_g$	1.004	
	$\sigma_g$	0.025	
	$\rho_g$	0.406	
U.S. Real Interest Rate	$r_f$	0.01	
Output loss in Autarky	$\gamma$	0.02	

Table 3. Simulation Results			
	Std Dev	Correlation with GDP	Correlation with Spread
GDP	4.64		-0.05
Consumption	4.83	0.97	-0.04
Current Account	1.22	-0.15	0.12
Spread	0.67	-0.05	
Default Rate	0.0060		
Risk Free debt Limit	15.70		
Maximum Spread	2.36		

Table 4. Sensitivity Analysis					
	$\pi = 1$	$\pi = 0.9$	$\pi = 0.8$	$\pi = 0.7$	$\pi = 0.6$
StDev Spread	0.0770	0.2846	0.4299	0.6728	1.0086
Max Spread	0.2479	0.9700	1.3579	2.3661	2.7841
Default Rate	0.0008	0.0012	0.0032	0.0060	0.0080

Figure 1  
GDP-Spread Argentina, 1994-2004

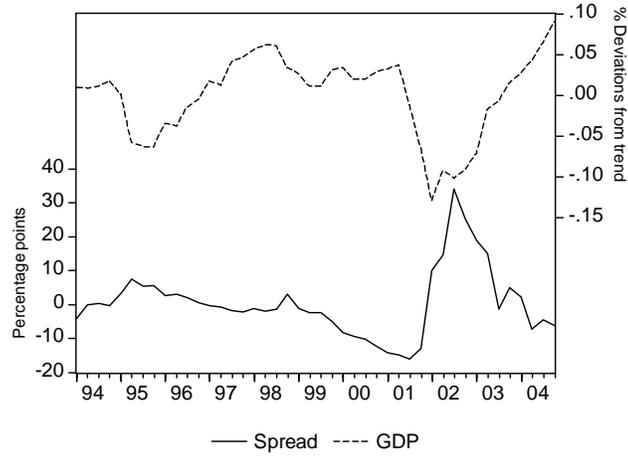


Figure 2  
Political Risk-Spread Argentina, 1994-2004

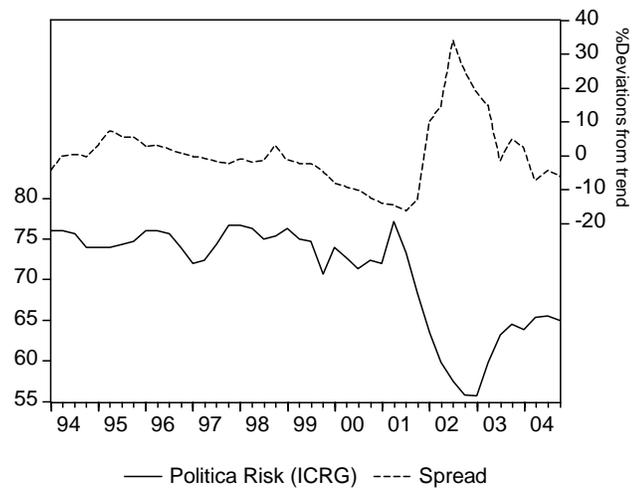


Figure 3. Bond Price

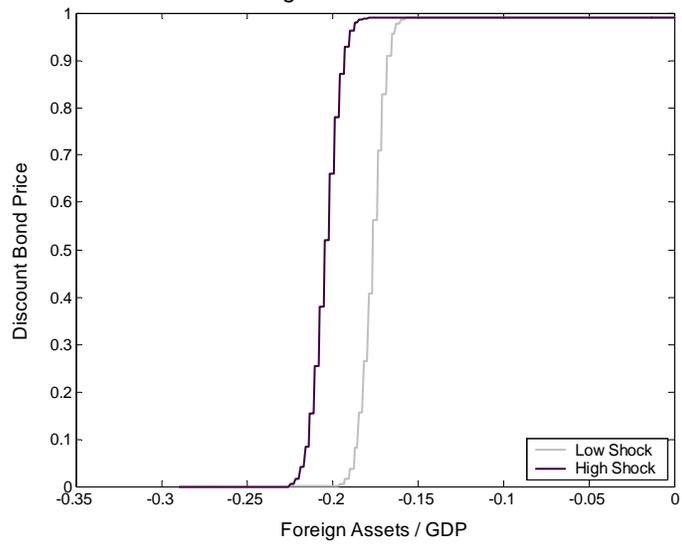
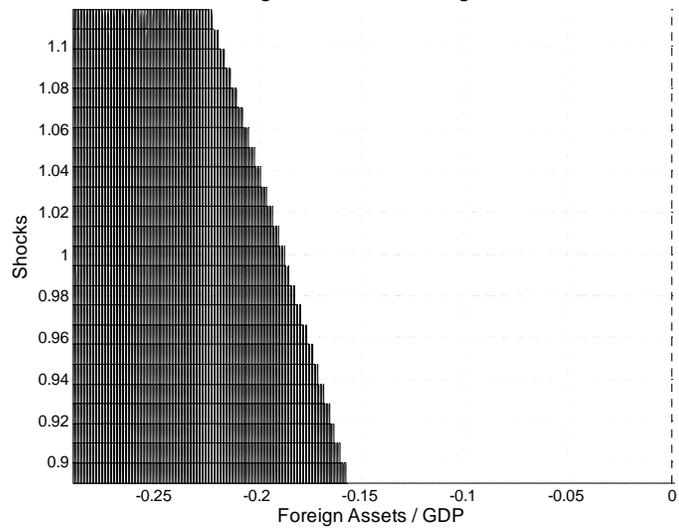


Figure 4. Default Region



## References

- [1] Aguiar, M. and G. Gopinath, 2004. Emerging Markets Business Cycles: The Cycle is the Trend, NBER Working Paper 10734.
- [2] Aguiar, M. and G. Gopinath, 2004. Defaultable Debt, Interest Rates and the Current Account, Working Paper, Chicago Graduate School of Business.
- [3] Alesina, A. and G. Tabellini, 1990. A Positive Theory of Fiscal Deficits and Government Debt in a Democracy, *Review of Economic Studies*.
- [4] Alesina, A. and G. Tabellini, 1988. External Debt, Capital Flight and Political Risk, *Journal of International Economics*.
- [5] Amador Manuel, 2003. A Political Economy Model of Sovereign Debt Repayment, Working Paper, Stanford University.
- [6] Arellano Cristina, 2004. Default Risk, the Real Exchange Rate and Income Fluctuations in Emerging Economies, Working Paper, Duke University.
- [7] Arellano, Cristina and Enrique Mendoza, 2002. Credit Frictions and Sudden Stops in Small Open Economies: An Equilibrium Business Cycle Framework for Emerging Markets Crises, NBER Working Paper 8880
- [8] Azzimonti, Marina, 2004. On the Dynamic Inefficiency of Governments, Working Paper, University of Iowa.
- [9] Balkan, Erol, 1992. Political Inestability, Country Risk and Probability of Default, *Applied Economics*.

- [10] Bulow, J. and K. Rogoff, 1989. Sovereign Debt: Is to Forgive to Forget?, *American Economic Review*.
- [11] Cantor, R. and F. Packer, 1996. Determinants and Impact of Sovereign Credit Ratings, Economic Policy Review, Federal Reserve Bank of New York.
- [12] Citron J. and G Nickelsburg, 1997. Country Risk and Political Instability, *Journal of Development Economics*.
- [13] Cole, H. and T. Kehoe, 2000. Self-fulfilling Debt Crises, *Review of Economic Studies*.
- [14] Eaton, J. and M. Gerzovitz, 1981. Debt with Potential Repudiation: Theoretical and Empirical Analysis, *Review of Economic Studies*.
- [15] Gelos, G., and R. Shahay, 2003. Sovereign Borrowing by Developing Countries: What Determines Market Access?, Working Paper, IMF.
- [16] Hussey, R., and G. Tauchen, 1991. Quadrature-Based Methods for Obtaining Approximate Solutions to Nonlinear Asset Pricing Models, *Econometrica*.
- [17] Li, Carmen, 1992. Debt Arrears in Latin America: Do Political Variables Matter?, *Journal of Development Studies*.
- [18] Marcet, Peter, 2002. Estimating Default Probabilities of Emerging Market Sovereigns: A new Look at a Not-So-New Literature, Working Paper, The Graduate Institute of International Studies, Geneva.
- [19] Neumeier, P. and F. Perri, 2001. Business Cycles in Emerging Economies: The Role of Interest Rates, Working Paper, New York University.

- [20] Puhán, C. and F. Sturzenegger, 2003. Default Episodes in the 1990's: What have we learned?, *Handbook of Managing Volatility* (forthcoming).
- [21] Reinhart, C., K. Rogoff and M. Savastano, 2003. Debt Intolerance, NBER Working Paper 9908.
- [22] Rivoli, P. and T. Brewer, 1997. Political Instability and Country Risk, *Global Finance Journal*.
- [23] Rose, Andrew, 2003. One Reason Countries Pay Their Debts: Renegotiation and International Trade, NBER Working Paper 8853.
- [24] Uribe, M. and V. Yue, 2003. Country Spreads and Emerging Countries: Who Drives Whom?, NBER Working Paper 10018.
- [25] Yue, Vivian, 2004. Sovereign Default and debt renegotiation, Working Paper, University of Pennsylvania.