Welfare Analysis of Currency Regimes with Defaultable Debts

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May 2012

Presentation

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1. MOTIVATION

Use the self-fulfilling debt crisis model of Cole-Kehoe to evaluate financial aspects of currency regimes:

- Dollarization
- Common Currency
- Local Currency

The optimal currency regime depends on:

- Correlation of External Shocks (Refinancing Risks) among countries of a monetary union
- Risk of Political Inflation

2 - The Cole-Kehoe Model

Review of Economic Studies(2000)

It has two parts:

a) a dynamic, stochastic general equilibrium model, with probability π of a self-fulfilling debt crisis occurring;

b) a simulation exercise to obtain the debt-crisis zone and the welfare levels for an economy under a possible speculative attack on its public debt.

2 - The Cole-Kehoe Model

- One good: $f(k_t)$;
- Three participants:
  - (i) national consumers;
  - (ii) international bankers; and
  - (iii) the government.
- One **sunspot** ζ_t: bankers' confidence that government will not default; i.i.d., uniform [0,1] and P [$\zeta_t \leq \pi$] = π
- ζ_t also indicates the **refinancing risk** faced by indebted economies.
- **Foreign-currency debt**, B_t: in the hands of int'l bankers; probability π of no rollover in the crisis zone; if there is default, it is **full**. ($z_t = 0$). No default ($z_t = 1$).

2 - The Cole-Kehoe Model

(i) Consumer's problem

$$\max_{c_t, k_{t+1}} E \sum_{t=0}^{\infty} \beta^t \left[\varrho c_t + v\left(g_t\right) \right]$$

s.t.

$$c_t + k_{t+1} - k_t \leq (1-\theta) \left[a_t f\left(k_t\right) - \delta k_t \right]$$

$$k_0 > 0$$

a_t - productivity factor

If the government has defaulted, then $a_t = \alpha$, $0 < \alpha < 1$.

Otherwise, $a_t = 1$.

2 - The Cole-Kehoe Model

(ii) International bankers' problem

$$\max_{x_t, b_{t+1}} E \sum_{t=0}^{\infty} \beta^t x_t$$

s.t.

$$x_t + q_t^* b_{t+1} \leq \overline{x} + z_t b_t$$

$$b_0 > 0$$

q^*_t - price, at *t*, of one-period government bond that pays one good, if there is no default.

2 - The Cole-Kehoe Model

(iii) Government

Benevolent and with no commitment.

Decision variables: B_{t+1}, z_t, g_t

Budget constraint

$$g_t + z_t B_t \leq \theta\,[a_t f(k_t) - \delta k_t] + q_t^* B_{t+1}$$

Strategic behavior since foresees q^*_t, c_t, k_{t+1}, g_t , z_t , a_t

2 - The Cole-Kehoe Model

- Timing of actions within a period

a) ζ is realized and state $s = (K, B, a_{-1}, \zeta)$

b) government, given $q^* = q^*(s, B')$, chooses B'

c) bankers decide whether to purchase B'

d) government chooses z and g

e) consumers, given $a(s,z)$, choose c and k'

2 - The Cole-Kehoe Model

- An Equilibrium

a) Characterization of consumers and bankers behavior

Consumers: k' takes three values: $k^n > k^\pi > k^d$

depending on $E\,[a']$

k^n, $E\,[a'] = 1$; k^π, $E\,[a'] = 1 - \pi + \pi\alpha$; k^d, $E\,[a'] = \alpha$

Bankers: q^* takes three values: β, $\beta(1-\pi)$, 0

depending on $E\,[z']$ since $q^* = \beta\, E\,[z']$

β, $E\,[z'] = 1$; $\beta(1-\pi)$, $E\,[z'] = 1 - \pi$; 0, $E\,[z'] = 0$

2 - The Cole-Kehoe Model

b) Definition: **Crisis Zone** with probability π

Debt interval that a crisis can occur with probability π.

For one-period gov't bonds and $s = (k^{\pi}, B, 1, \zeta)$:

$$\left(\bar{b}(k^n), \bar{B}(k^{\pi}, \pi)\right]$$

c) Government choices:

$B' \leq \bar{b}(k^n)$ - no crisis zone

$\bar{b}(k^n) < B' \leq \bar{B}(k^{\pi}, \pi)$ - crisis zone

$B' > \bar{B}(k^{\pi}, \pi)$ - full default only zone

3 – Local-currency debt model

Araujo and Leon (RBE, 2002)

- Public debt denominated in two currencies: foreign, B_t , and local, D_t
- A **full default** on B_t may be avoided through a **partial default** on debt denominated in local currency, D_t
- D_t only in the hands of national investors; credit rollover always.
- Government decision variable to partial default, υ.

No partial default, local bond pays one good ($\upsilon = 1$).

Otherwise, it pays less than one good, ($\upsilon = \phi$), $\phi < 1$.

3 – Local-currency debt model

- Cost of partial default: productivity falls to $\alpha^{\phi} > \alpha$

If z = 0 (full default on B_t), then $a = \alpha$ forever

If $\upsilon = \phi$ (partial default on D_t), then $a = \alpha^{\phi}$ forever

- <u>Intense speculative attack</u>:

  If $\zeta_t < \pi^d$, then z = 0 and full default on B_t

- <u>Moderate speculative attack</u>*:*

  If $\pi^d < \zeta_t < \pi^{up}$, then z = 1 and a fraction φ of B_t is renewed and there is partial default on D_t to avoid a full default on B_t.

3 – Local-currency debt model

- Political Inflation

If $\pi^{up} < \zeta_t < \pi^{up\psi}$, then z = 1 and total B_t is renewed, but there is partial default on D_t.

- Risk of political inflation, π^p

$$\pi^p = \pi^{up\psi} - \pi^{up}$$

- Partial default revenues:
  - $\rightarrow$ to avoid full default on B_t ; or
  - $\rightarrow$ for political purposes (risk of political inflation)

3 – Local-currency debt model

An equilibrium is analogous to the original C-K

- Consumers' new budget constraint:

$$c_t + k_{t+1} - k_t + q_t d_{t+1} \leq (1-\theta)\,[a_t f(k_t) - \delta k_t] + \upsilon_t d_t$$

besides c_t and k_{t+1} also chooses d_{t+1}

- Government new budget constraint:

$$g_t + z_t B_t + \upsilon_t D_t \leq \theta[a_t f(k_t) - \delta k_t] + q_t^* B_{t+1} + q_t D_{t+1}$$

besides B_{t+1}, z_t and g_t also chooses D_{t+1} and υ_t

4. Common-currency debt model

- I countries in a monetary union and a central government
- Each country i issues debt in common currency, D^i_t
- Possibility of a partial default on common-currency debt, which depends on decision process.
- Partial-default decision: Member-countries vote: $\upsilon^{\mathbf{i}}$; and Union decision: $\upsilon^{\mathbf{u}}$

4. Common-currency debt model

- Two decision processes are considered:
  1) The right of veto: $\upsilon^{u} = \phi \Leftrightarrow \upsilon^{i} = \phi$, for all i
  2) Political influence over the union's central bank:

     Each member implements its decision with probability $\mathbf{pw^i}$ and $\mathbf{\Sigma pw^i = 1}$.

- <u>Correlation of external shocks</u>, ρ

  The external shock (refinancing risk), ζ^{i}, of each country *i* correlates with the one from the other countries.

5. Computed Model Results

- Numerical Findings follow from the welfare analysis of alternative currency regimes, depending on the risk of political inflation, π^p, and the correlation of external shocks (refinancing risks), ρ.
- A country (country A) has to decide either to maintain its local-currency regime, or to join a common-currency regime with a partner country (country B), or to dollarize by adopting the currency of a third country.
- Country B is assumed to have all parameters equal to those of country A, except for a possible change in the risk of political inflation.

5. Computed Model Results

- **Numerical Finding 1**

  The bigger the risk of political inflation, the larger the region where dollarization maximizes welfare. *(See Figure 2)*

- **Numerical Finding 2**

  The larger the correlation of external shocks ρ, the larger the region where common-currency maximizes welfare. *(See Figure 2)*

5. Computed Model Results

- **Numerical Finding 3**

As π^{pB} decreases the range for ρ in which the common-currency regime is optimal increases over the *Dollar* region and decreases over the *Local-Currency* region. (*Compare Figures 2 and 3*)

Note: In Figure 2, the risk of political inflation of country B, π^{pB}, is 0.7 and, in Figure 3, is zero.

5. Computed Model Results

- **Numerical Finding 4**

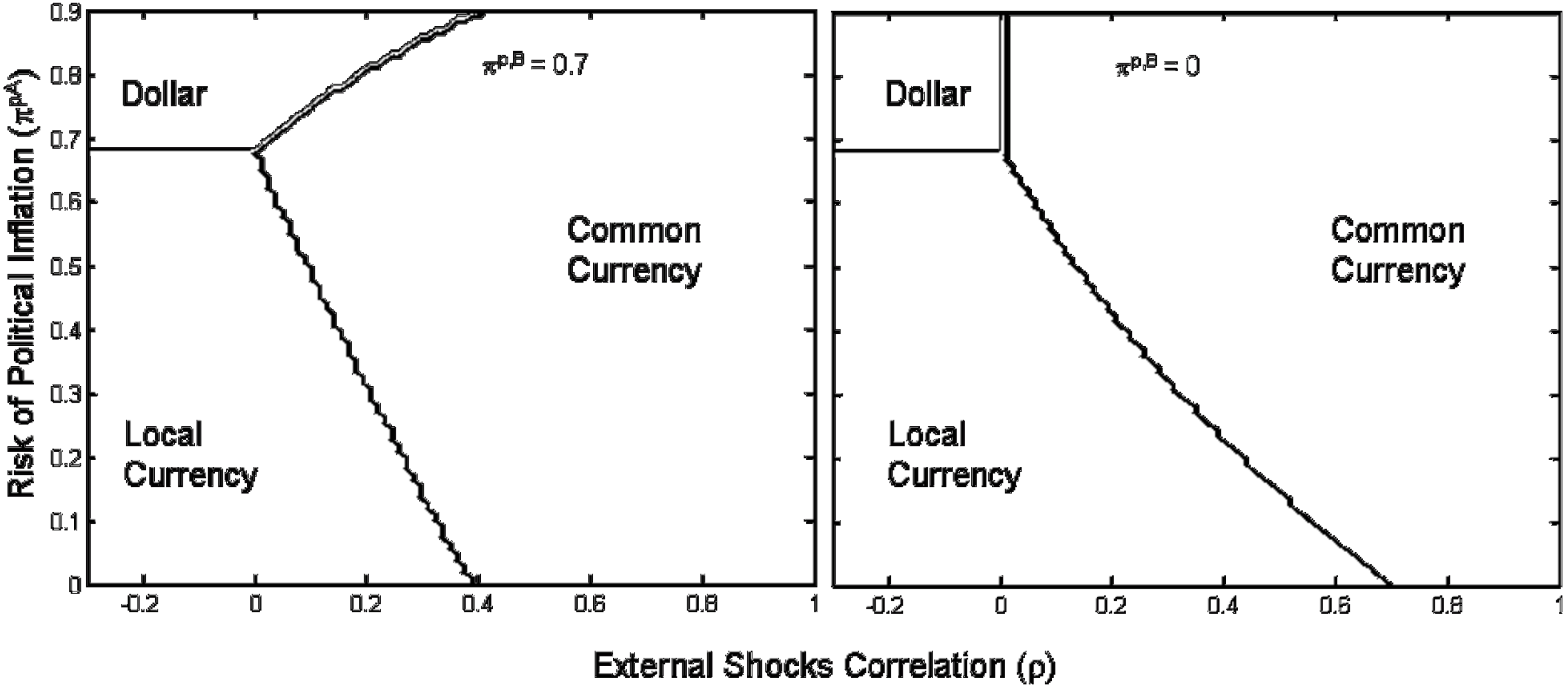
  For high levels of the risk of political inflation in country A, π^{pA}, the region where dollarization is preferred increases as $\mathbf{p}^{wA}$ increases.

  (*See Figure 4*)

Optimal Monetary Arrangement (n=2)
Decision process: Right of Veto
Risk of political inflation in the other country (B): 0.7 and 0

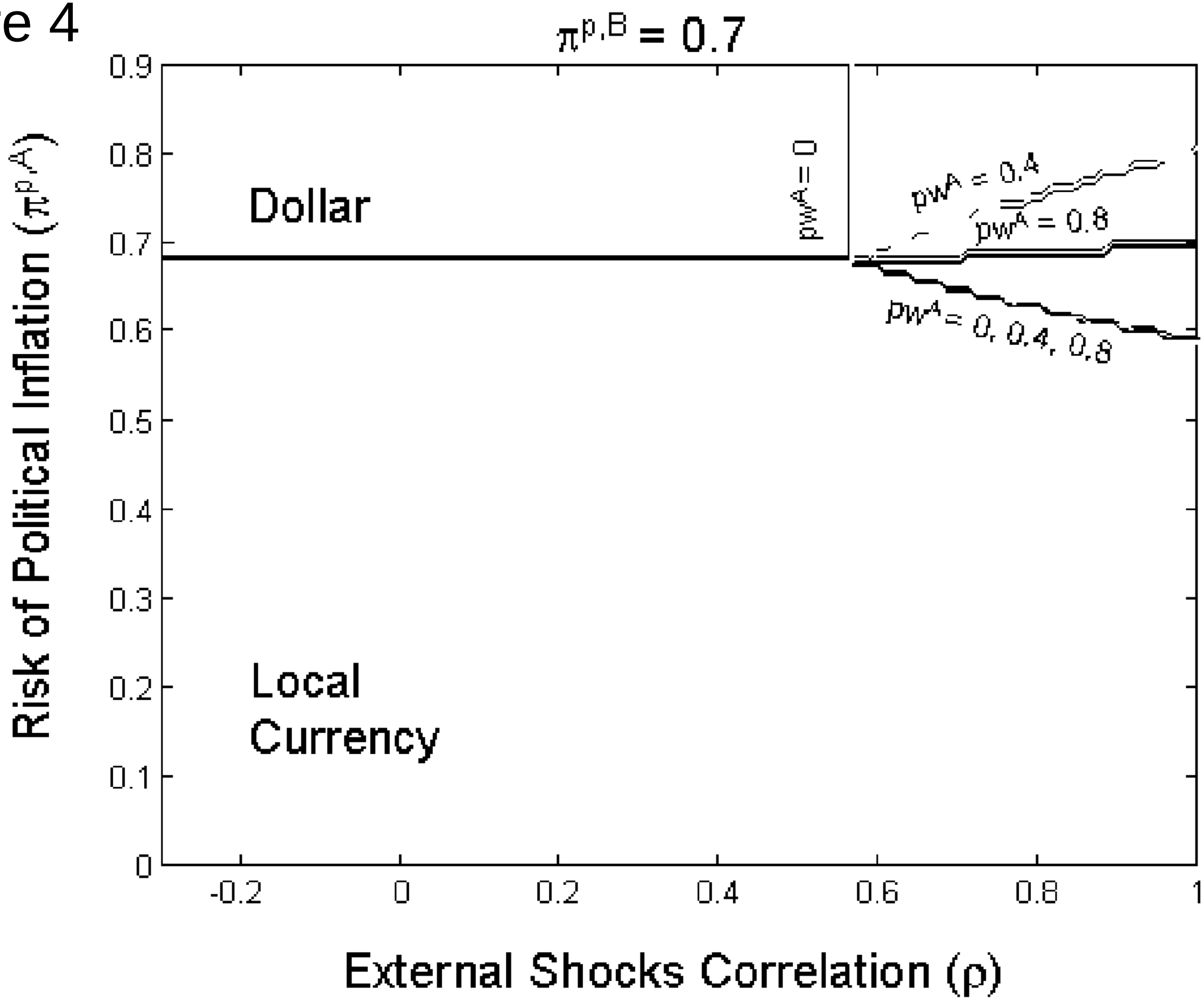
Figure 2

Figure 3



Optimal Monetary Arrangement (n=2)
Political Weight in the decision process: 0, 0.4 and 0.8
Risk of political inflation in the other country (B): 0.7

Figure 4



6. Conclusions

- Choices of currency regimes considering financial aspects:

Low risk of political inflation
and low external correlation $\Rightarrow$ Local-currency regime

High risk of political inflation
and high external correlation $\Rightarrow$ Common-currency regime

High risk of political inflation
and low correlation $\Rightarrow$ Dollarization

THANK YOU FOR YOUR ATTENTION

5. Computed Model Results

Benchmark: the Brazilian economy (1998/2001)

Length (Years)	Model	Brazil (98-01)
Average Maturity	1	$\in$[.4;2.2]
Average Duration	1	$\in$ [.2;.9]
Variables Relative to GDP	**Model**	**Brazil (98-01)**
External Debt	45	$\in$ [31;45]
External Public Debt	45	$\in$ [9;24]
Local Currency Public Debt	30	$\in$ [27;31]
Capital Outflow	4	-
Investment	16	$\in$ [20;22]
Private consumption	60	$\in$ [61;62]
Public Expenditure	20	19

Parameters	Model
β	0.95
θ	0.30
υ (g)	ln(g)
$f(k)=k^{\lambda}$	$k^{0.4}$
δ	0.05
α	0.95
α^{ϕ}	0.998
φ	0.62
ϕ	0.85
π^{d}	0.04
π^{i}	0.04
π^{p}	$\in$[0;0.9]
ρ	$\in$[-0.3;1]

ρ is the correlation between moderate attacks, conditional to the no occurrence of an intense one.