Voluntary Debt Exchanges in Sovereign Debt Markets[1]

Preliminary and Incomplete

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[1] The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management, the Federal Reserve Bank of Richmond, or the Federal Reserve System.

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- From these episodes, we study those in which:
  1. the government doesn't miss any debt payment,
  2. there is a decline in the government's debt burden, and
  3. there are capital gains from participating in the restructuring
- We identify these episodes as "Voluntary Debt Exchanges"

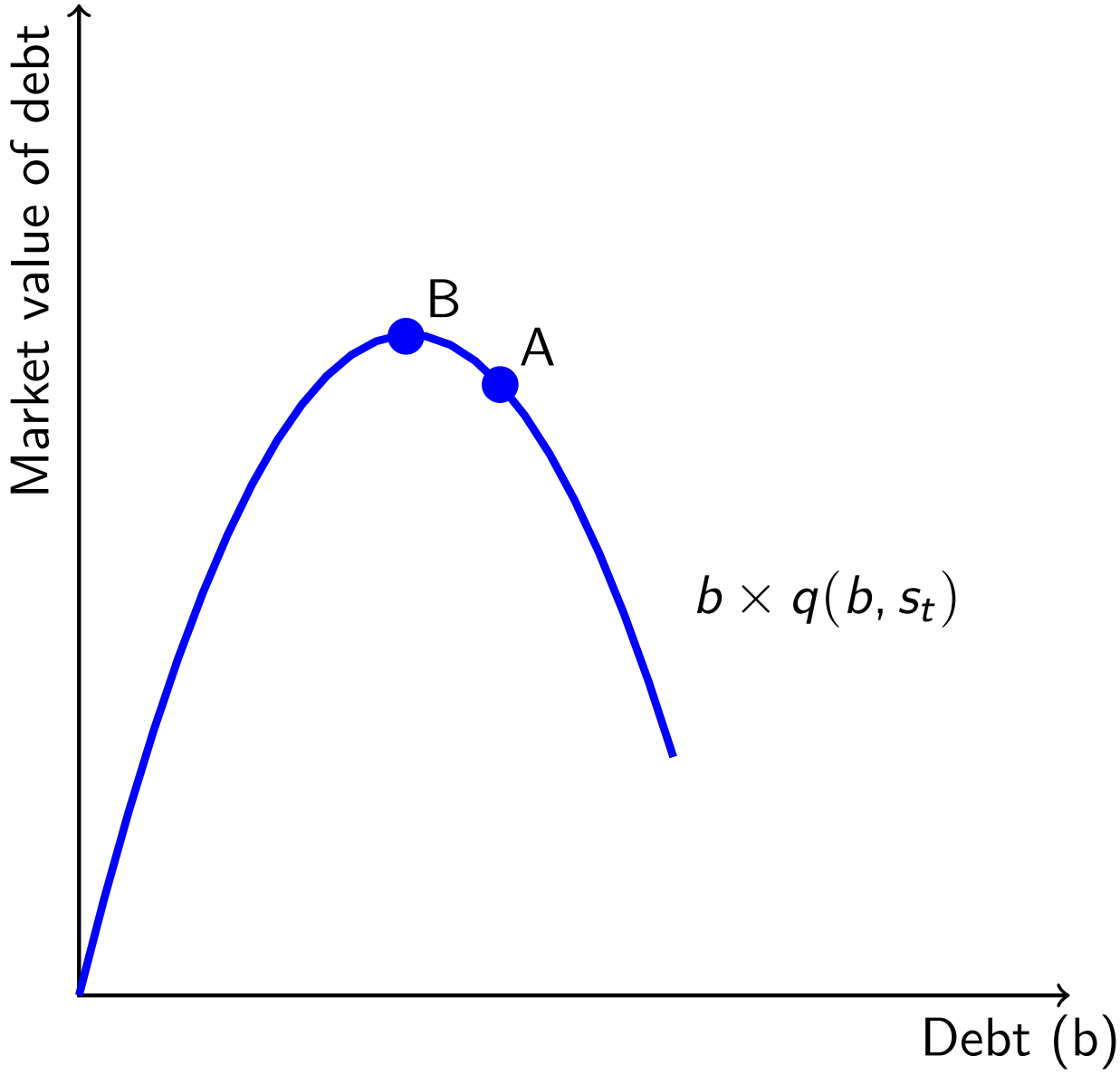

Figure : The market value of debt claims in period t is represented by $b \times q(b, s_t)$, where b denotes the number of bonds and $q(b, s_t)$ denote the price of each bond. The price may depend on other state variables represented by s_t.

Outline

1. Review of recent Voluntary Debt Exchanges
2. Related literature
3. Model
4. Calibration
5. Results
6. Conclusions

Recent Voluntary Debt Exchanges

Our definition of VDE has 3 components: no missed payments, reduction in debt burden, positive capital gains.

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1. **No missed payments:** Cruces and Trebesch (2013) study 180 restructurings episodes between 1970 and 2010. In 77 of those 180 no debt payment was missed.

2. **Reduction in debt burden:** one measure is the "haircut". Sturzenegger and Zettelmeyer (2005) define it as:

$$Haircut = 1 - \frac{\text{PDV of debt obtained in the restructuring}}{\text{PDV of debt surrendered in the restructuring}}, \quad (1)$$

Cruces and Trebesch (2013) report that in 174 out of 180 episodes, the haircut was positive.

Recent Voluntary Debt Exchanges - cont'd

3 **Capital gains:** when debt portfolio $(B_1, ..., B_J)$ is exchanged for the debt portfolio $(B_{J+1}, ..., B_{J+I})$

$$\text{Capital gain} = \frac{\sum_{i=J+1}^{J+I} q_i(T) \times B_i}{(1+r)^{T-t} \sum_{j=1}^{J} q_j(T-t) \times B_j} - 1, \qquad (2)$$

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Numerator: post-exchange market value
Denominator: pre-exchange market value
T : period of the exchange, t : period when "old" debt is surrender

Recent Voluntary Debt Exchanges - cont'd

- Secondary market bond prices make it easier to compute the market values of debt for bond debt restructurings than for bank debt restructurings.
- Cruces and Trebesch show that 18 out of the 180 episodes were bond restructurings.
- 9 out of those 18 occurred w/o missed debt payments: Belize, Dominica, **Dominican Republic**, Grenada, Kenya, Moldova, **Pakistan**, **Ukraine**, and **Uruguay**.
- We have bond prices only for countries in **bold**.

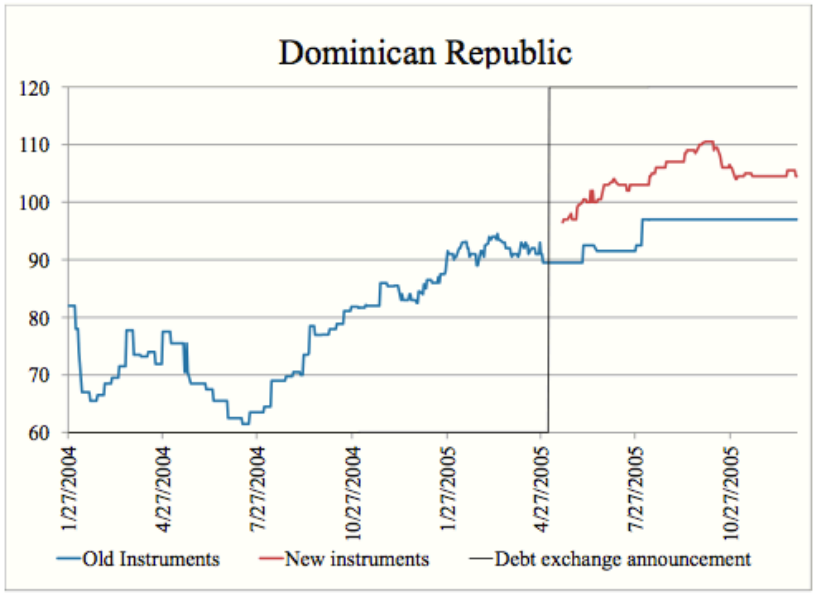
▸ coerciveness data

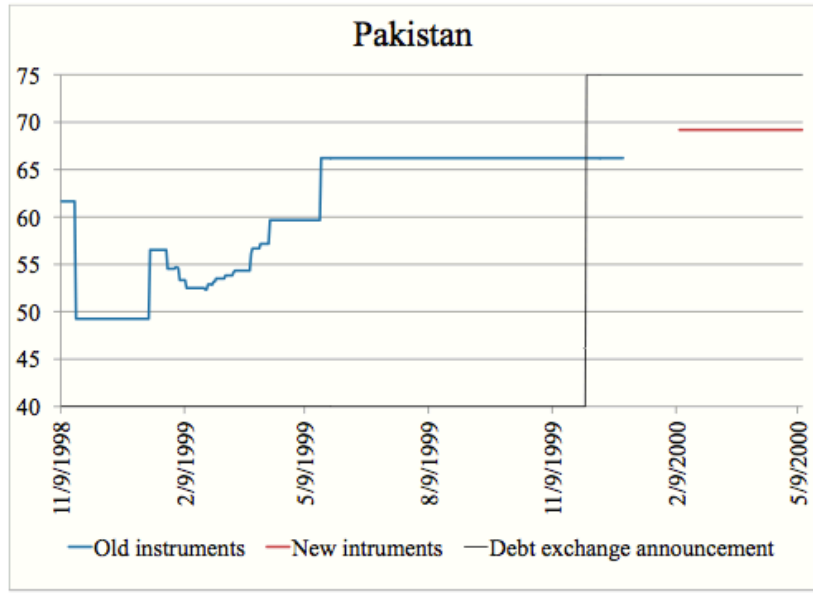
Recent Voluntary Debt Exchanges - cont'd

	Dominican Rep.	Pakistan	Ukraine	Uruguay
Exchange announcement	3/30/2005	8/15/1999	2/4/2000	4/10/2003
Launch of the exchange	4/20/2005	11/15/1999	2/14/2000	4/10/2003
Deadline for participating (DP)	5/16/2005	12/15/1999	3/15/2000	5/29/2003
First date with data for all bond prices	5/18/2005	n.a.	03/30/2000	09/23/2003
Capital gains with price of surrendered portfolio at				
First date with data for all bond prices	0.08	n.a.	-0.02	0.05
Deadline for participating	0.08	0.07	0.14	0.11
Launch of the exchange	0.04	0.06	0.18	0.13
Exchange announcement	0.06	0.02	0.25	0.34
One month before exchange announcement	0.06	0.01	0.31	0.26
Six months before exchange announcement	0.34	0.21	0.09	0.30
Acceptance rate	0.94	0.99	0.99	0.95
Haircut	0.05	0.15	0.18	0.10

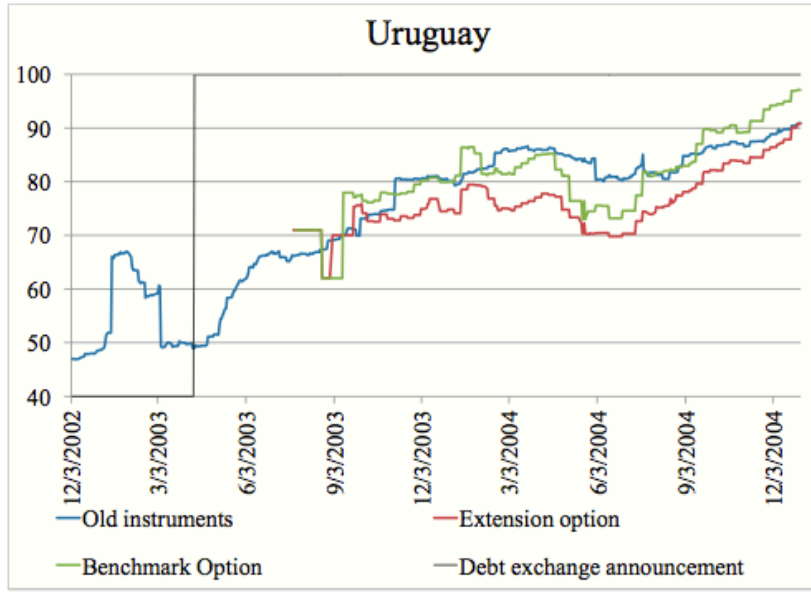
Table 1: Capital gains from holdings of restructured debt in recent sovereign debt restructurings.

Recent Voluntary Debt Exchanges - cont'd





Recent Voluntary Debt Exchanges - cont'd



Related Literature

1. Debt Overhang
   - "Exogenous debt:" Krugman (1988a), Krugman (1988b), Sachs (1989), Froot (1989), among others
   - "Endogenous debt:" Aguiar et al. (2009)
2. Sovereign Default
   - No Renegotiation: Aguiar and Gopinath (2006), Arellano (2008), among others
   - Post-Default Renegotiation: Yue (2010), Benjamin and Wright (2008)

What we do

- We already argued that some recent sovereign debt restructurings can be understood as Voluntary Debt Exchanges
- Next, we extend a sovereign default model à la Eaton and Gersovitz (1981) to account for voluntary exchanges.
- We show that even though there are ex-post Pareto gains, these exchanges may not be ex-ante optimal for the gov't:
  - Eliminating the possibility of conducting these exchanges may improve welfare.

Endowment and preferences

- Stochastic exchange economy.

$$\log(y_t) = (1-\rho)\mu + \rho \log(y_{t-1}) + \varepsilon_t$$

where $\mid \rho \mid < 1$, and $\varepsilon_t \backsim N(0, \sigma_\varepsilon^2)$

- Objective of the government:

$$\max E_t \left[\sum_{s=0}^{\infty} \beta^s u(c_{t+s}) \right]$$

where

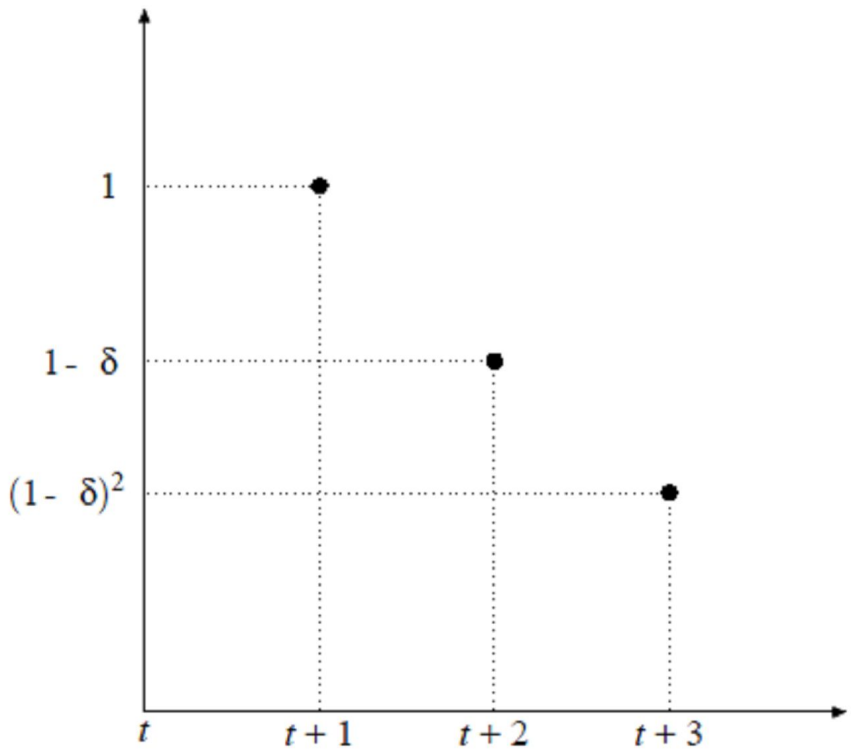
$$u(c) = \frac{c^{1-\sigma}}{1-\sigma}$$

Borrowing opportunities

- Only non-contingent bonds $\rightarrow$ incomplete markets.
- Competitive risk-neutral lenders
  - Bond price satisfies expected zero profit condition.
- Opportunity cost of lending: risk-free bonds paying r

Long-term bonds

Perpetuities with geometrically decreasing coupon obligations (Hatchondo and Martinez 2009, Arellano and Ramanarayanan 2012)



Defaults

- The government cannot commit to honoring debt contracts.
- Total defaults: If the government defaults, it will not pay any current or future coupon obligations contracted in the past. (acceleration and cross-default debt covenants)
- If the government defaults, it gets excluded from int'l financial markets for a random number of periods.
- During exclusion output is reduced by $\phi(y)$. We follow Chatterjee and Eyigungor (2012) and model the output cost as:

$$\phi(y) = d_0 y + d_1 y^2$$

Voluntary Debt Exchanges

- Every period in which it is in good standing, the gov't can do an exchange.
- We assume that the cost of debt exchanges is stochastic and may be either low (zero) w/ prob. π or high w/ prob. $1 - \pi$.
- If cost is high, it prohibitively high $\rightarrow \nexists$ exchange.
- If cost is low, gov't chooses whether to repay, conduct a voluntary exchange, or do an outright default

Equilibrium concept: Markov Perfect Equilibrium

- The government cannot commit to future outright default, exchange, and borrowing decisions:
  - Each period the government makes exchange, default and borrowing decisions taking as given its future exchange, default and borrowing strategies.
- Strategies depend on payoff-relevant state variables, i.e., beginning-of-period debt and endowment.

Recursive formulation

b: coupon claims outstanding at beginning of period t
$\theta \in \{L, H\}$: exchange cost shock

$$V(b, y, L) = \max\left\{V^E(y), V^P(b, y), V^D(y)\right\}, \tag{3}$$

and

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$$V^P(b, y) = \max_{b' \geq 0, c} \left\{ u(c) + \beta \mathbb{E}_{(y', \theta')|y} V(b', y', \theta') \right\}, \tag{5}$$

subject to

$$c = y - b + q(b', y) \left[b' - (1 - \delta) b \right],$$

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$$V^D(y) = u(y - \phi(y)) + \beta \mathbb{E}_{(y', \theta')|y}\left[(1 - \psi)V^D(y') + \psi V(0, y', \theta')\right], \tag{6}$$

Recursive formulation - cont'd

$$V^E(y) = u(c) + \beta \mathbb{E}_{(y',\theta')|y} V(\hat{b}^P(\hat{b}^E(y), y), y', \theta'), \tag{7}$$

subject to

$$c = y - \hat{b}^E(y) + [\hat{b}^P(\hat{b}^E(y), y) - (1-\delta)\,\hat{b}^E(y)] q(\hat{b}^P(\hat{b}^E(y), y), y)$$

where

$$\hat{b}^E(y) = \underset{b}{\text{argmax}} \{MV(b, y)\} \tag{8}$$

denotes the function that describes the post-exchange coupon obligations, and

$$MV(b, y) = \left[1 - \hat{d}(b, y)\right] b \left[1 + (1-\delta)\, q\left(\hat{b}^P(b, y), y\right)\right] \tag{9}$$

Zero-Profit bond price

$$q(b', y)(1 + r) = \tag{10}$$

$$\mathbb{E}_{(y',\theta')|y} \left\{ \hat{e}\left(b', y', \theta'\right) \frac{\hat{b}^E(y)}{b'} \left[1 + (1-\delta)\, q(\hat{b}^P(\hat{b}^E(y'), y'), y')\right] \right.$$
$$\left. + \left[1 - \hat{e}\left(b', y', \theta'\right)\right] \left[1 - \hat{d}\left(b', y', \theta'\right)\right] \left[1 + (1-\delta)\, q(\hat{b}^P(b', y'), y')\right] \right\}$$

$\hat{e}$: denote government's exchange strategy

$\hat{d}$: denote government's default strategy

$\frac{\hat{b}^E(y)}{b'} \leq 1 \rightarrow$ number of bonds received in the exchange per bond surrendered.

The model equivalent of the definition of haircut: $1 - \frac{\hat{b}^E(y)}{b'}$.

▸ to MPE definition

Calibration

We use Mexico (archetypical emerging economy) as reference for the calibration. Period lenght: 1 quarter

Risk aversion	γ	2
Risk-free rate	r	0.01
Discount factor	β	0.975
Probability of reentry after default	ψ	0.083
Income autocorrelation coefficient	ρ	0.94
Standard deviation of innovations	σ_ϵ	1.5%
Mean log income	μ	$(-1/2)\sigma_\epsilon^2$
Debt duration	δ	0.033
Income cost of defaulting	d_0	-1.01683
Income cost of defaulting	d_1	1.18961
Probability of low exchange shock	π	0.02

Table : Benchmark parameter values.

Calibration - Targeted Moments

We calibrate the values of d_0, d_1, and π targeting the average levels of spread and debt between 1995 (do to data availability) and 2011, and a share of voluntary debt exchanges to default episodes of 33%.

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	Targets	Simulations
Mean Debt-to-GDP	44	41
Mean r_s	3.40	3.34
Voluntary debt exchanges / defaults	0.33	0.36

Table : Calibration targets. Moments for the simulations correspond to the mean value of each moment in 375 simulation samples.

Simulation Results

	Mexico	Simulations
$\sigma(r_s)$	1.6	1.3
$\rho(r_s, y)$	-0.5	-0.7
$\sigma(c)/\sigma(y)$	1.3	1.3
$\rho(tb, y)$	-0.7	-0.8
$\rho(r_s, tb)$	0.8	0.8

Table : Non-targeted simulation moments.

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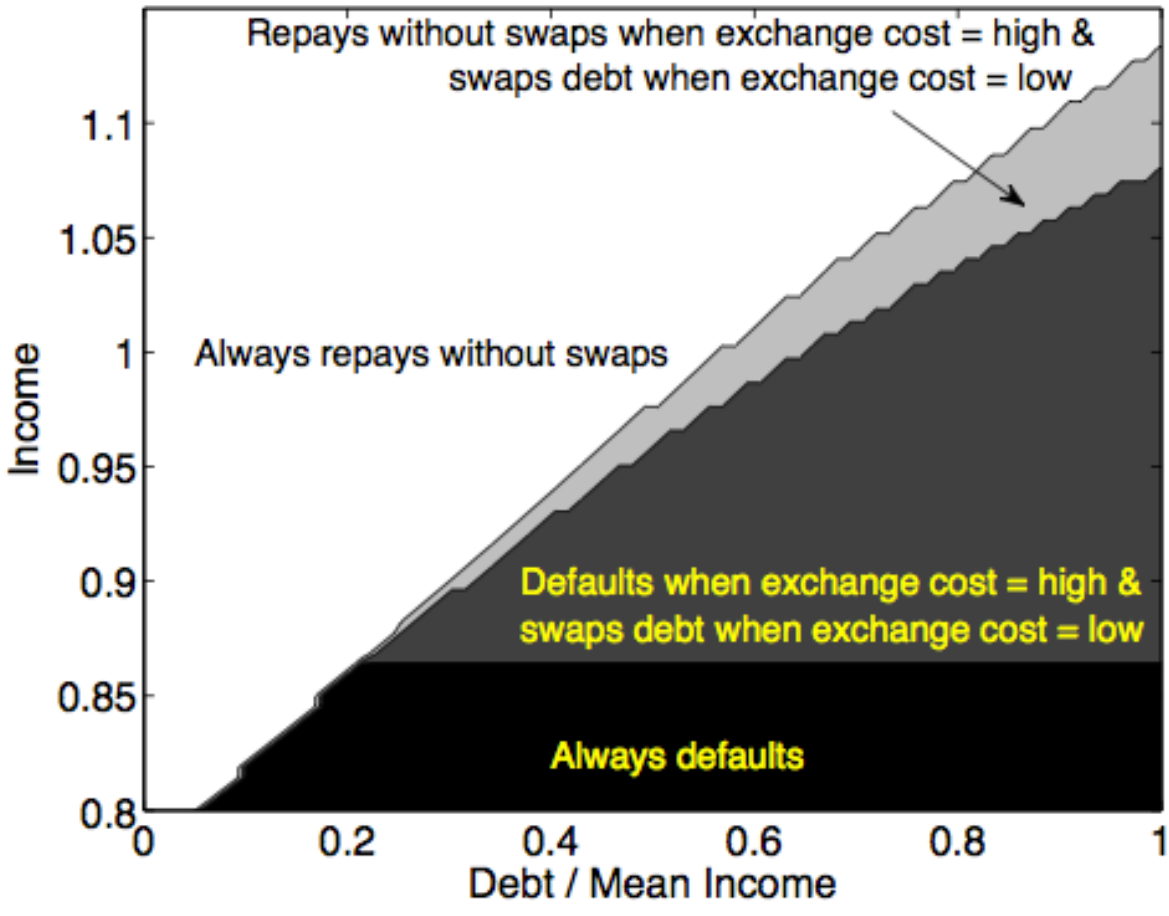

VDEs Opportunities - cont'd

VDEs opportunities arise for 2 reasons:

1. Gov't may choose to end a period with a debt level that has a negative marginal effect on the market value of debt claims outstanding at the end of the period.

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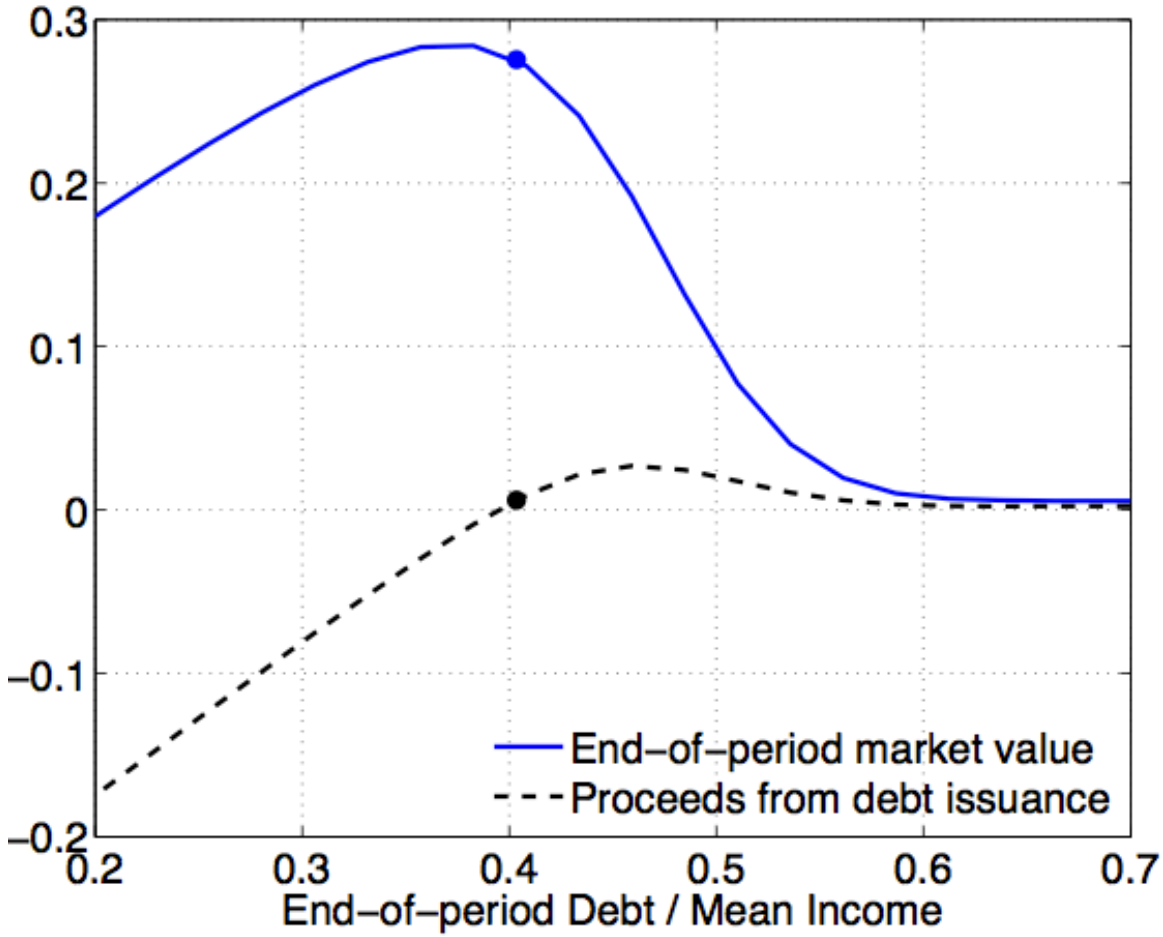

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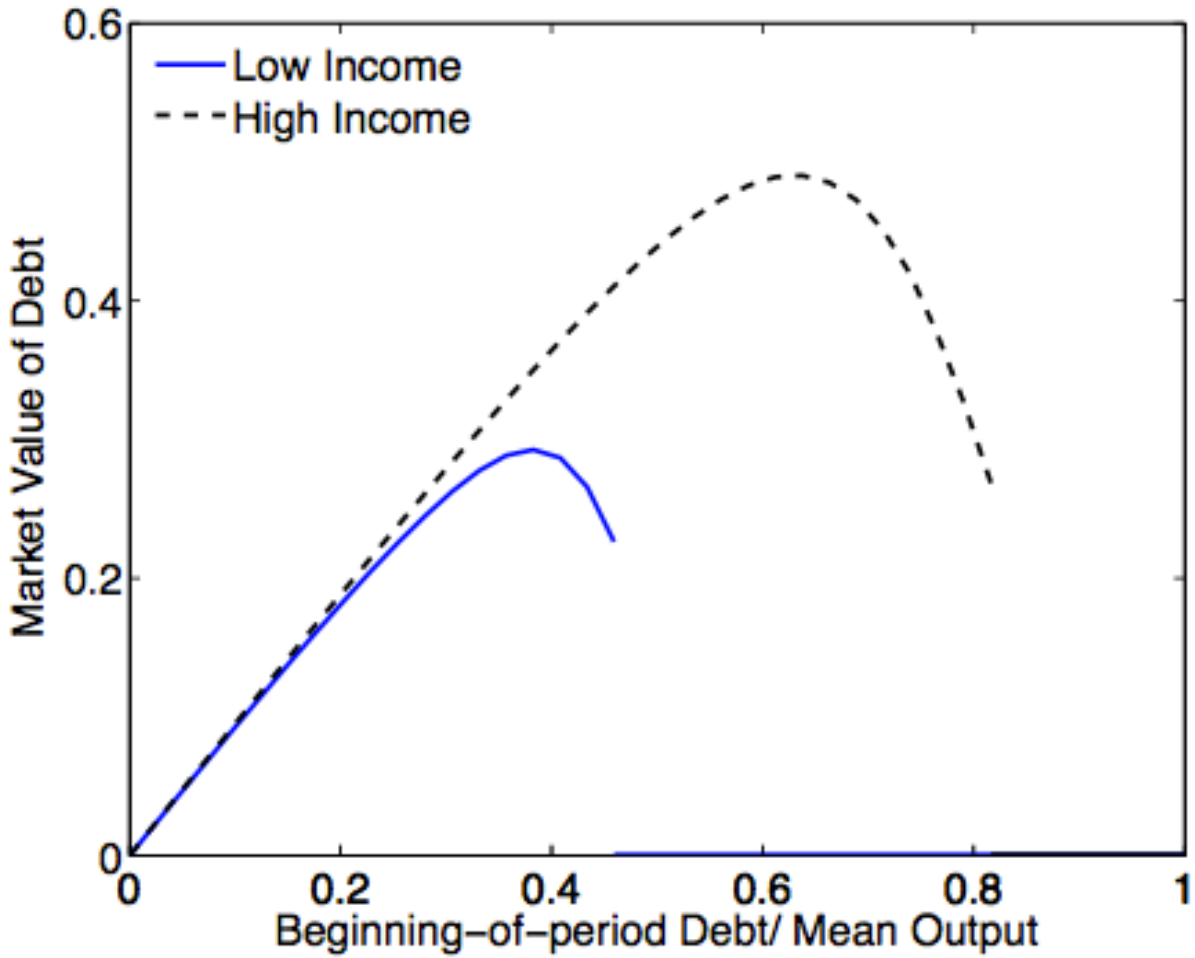

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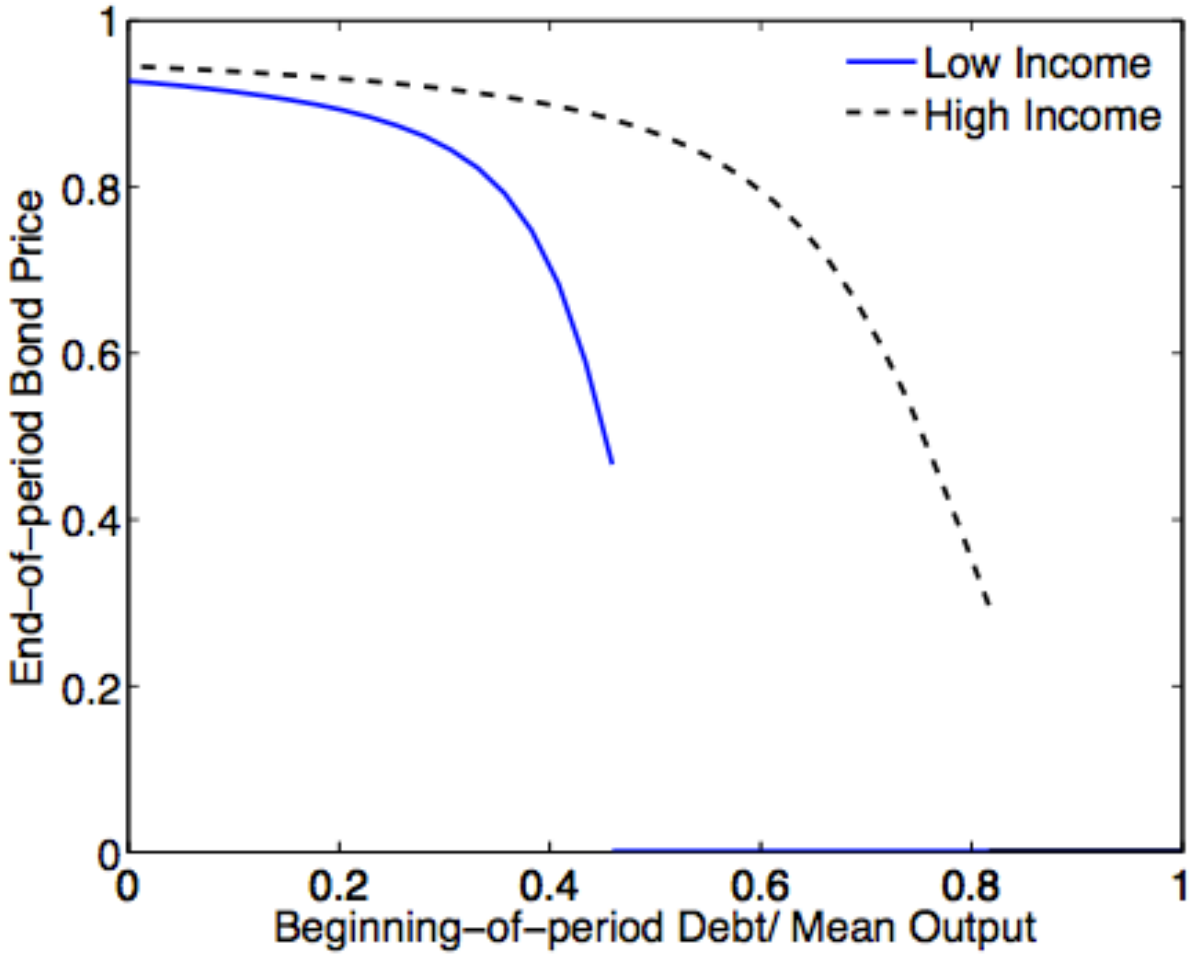

Gains at the moment of the exchange

	Exchs. that prevent defaults	Other exchanges
Average capital gain	155%	3%
Average haircut	24%	5%
Average welfare gain	0.7%	0.3%

Table : Gains from a voluntary debt exchange. Capital gains for exchanges that prevent an outright default are computed using the market value of the debt stock the quarter before the exchange.

Ex-ante gains from eliminating VDEs ($\pi = 0$)

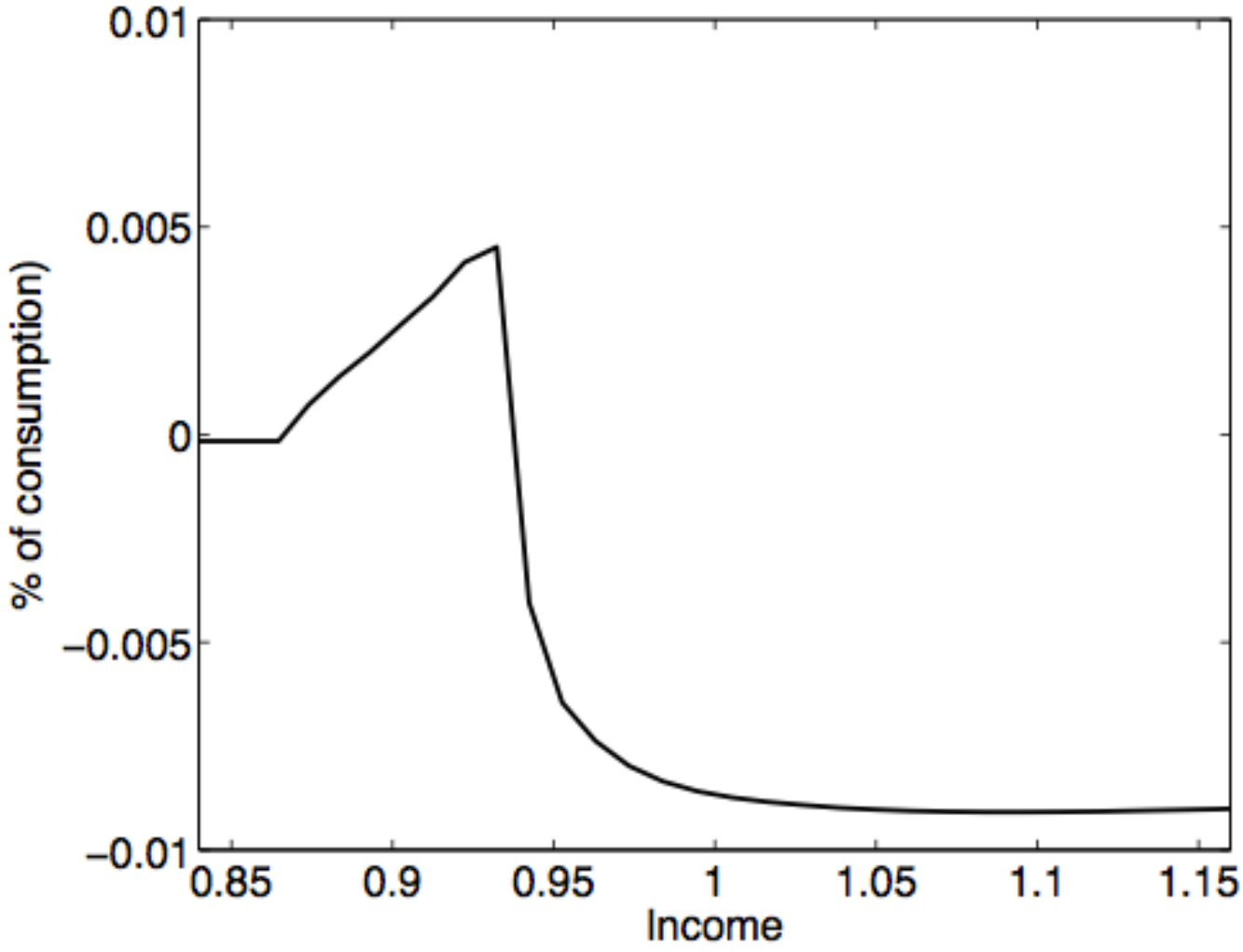

Figure : Welfare gains from eliminating the possibility of voluntary exchanges. Welfare gain is evaluated at a debt level equal to the mean debt observed in the simulations and before current exchange cost realization.

Conclusions

- We discussed the possibility of voluntary debt exchanges defined as debt restructurings that occur before an outright default and produce both debt reductions and capital gains for holders of restructured debt.

- In contrast with standard debt overhang arguments, the paper presents a theory where Pareto gains are possible without any effect of the debt reduction in production. These gains arise only because of the decline of sovereign risk implied by the debt reduction.

- In this theory, voluntary exchanges are possible after negative income shocks, but do not require an outright default to be imminent.

Conclusions - cont'd

- The paper presents an attempt to enrich the understanding of gains from renegotiation between creditors and debtors
- And highlights a time inconsistency problem: in spite of the Pareto improvement at the time of VDEs the government may prefer an environment in which conducting these exchanges is more difficult.
- The discussion of these issues would be enriched with:
  - a more thorough analysis of the possibility of Pareto gains in past sovereign debt restructuring experiences,
  - richer theories that, for instance, endogenize renegotiations both after outright defaults and in voluntary debt exchanges.

BACK-UP SLIDES

Equilibrium Definition

A *Markov Perfect Equilibrium* is characterized by

1. a set of value functions V, V^E, V^P, V^D, and
2. rules for voluntary exchanges $\hat{e}$, default $\hat{d}$, and borrowing $\hat{b}^P$,
3. and a bond price function q,

such that:

i. given a bond price function q, the policy functions $\hat{d}$, $\hat{e}$, and $\hat{b}^P$ and the value functions V, V^E, V^P, and V^D solve the Bellman equations (3), (4), (7), (5), and (6).

ii. given policy rules $\hat{d}$, $\hat{e}$, and $\hat{b}^P$,the bond price function q satisfies condition (11).

◂ to $q(b', y)$ definition

Coerciveness data

Dominican Rep.	1 (negotiation breakdown)
Pakistan	2 (assets freeze; threats)
Ukraine	1 (threats)
Uruguay	0

Table : Coerciveness in recent sovereign debt restructurings.

Index from Enderlein, Trebesch and von Daniels (Forthcoming) includes data on:
Payment Missed, Payment suspension: Full Suspension?, Unilateral Suspension?, Moratorium Declaration, Freeze on external assets, Forced Restructuring, Explicit Threats, Data Disclosure Problems, Negotiation's Breakdown or Delay.

go back