Hidden Debt Revelations

Sebastian Horn (WB)   David Mihalyi (WB)

Philipp Nickol (UDE, Kiel)   César Sosa-Padilla (Notre Dame, NBER)

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Can we quantify the underreporting problem?

- **Key idea:** When previously undisclosed debt gets reported, past debt statistics need to be revised.

- We quantify the magnitude, characteristics and timing of hidden debts by systematically tracking ex-post revisions to the World Bank's debt statistics.

Our paper

Empirics: Novel dataset of the full history of World Bank debt reports

- Debt stocks are <u>systematically underreported</u>, in particular debt to bilateral and non-bond private creditors

- Hidden debt: ∗ builds up in good times and is revealed in bad times

    ∗ is associated w/ higher haircuts

Theory: model of sovereign default with hidden debt revelations

- Assess the implications of hidden debt on defaults, spreads, and welfare

- Higher default frequency, higher and more volatile spreads

- Significant <u>welfare costs</u>

Motivation: Mozambique's hidden debt scandal

Bloomberg

Politics

# Mozambique Indicts 20 People Over $2 Billion Hidden-Debt Scandal

By Borges Nhamire and Matthew Hill
9. August 2019, 10:38 MESZ
Updated on 9. August 2019, 12:40 MESZ

▶ Charges include money laundering, blackmail, abuse of office

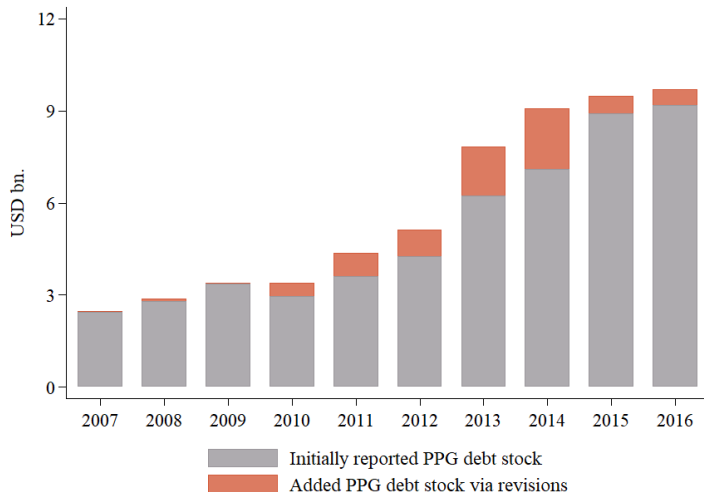▶ Authorities now go after ex-finance minister for alleged role

Source: Bloomberg (2019)

Mozambique's initially reported debt stocks, 07-16

Mozambique's initially reported debt stocks, 07-16, revised
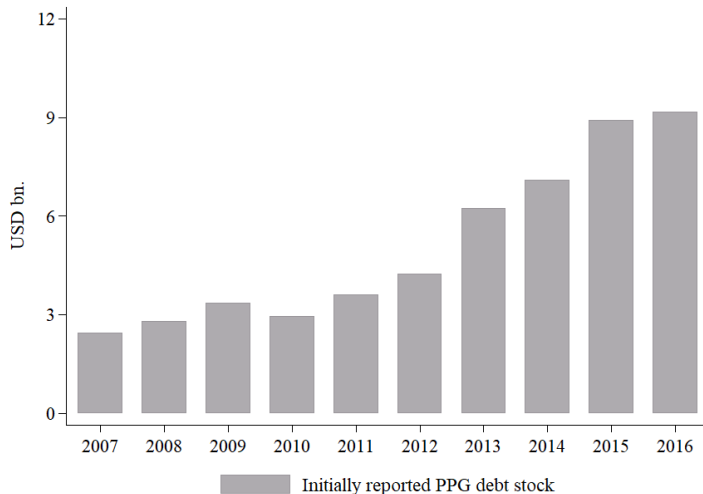
Source: World Bank GDF (2012) and World Bank IDS (various years)
Note: initially and most recently reported public and publicly guaranteed debt stocks for Mozambique between 2007 and 2016 in billion USD. Black bars show initially reported debt stocks. Red bars show additional cumulative debt stocks added over the whole history of debt stock revisions.

Market reaction?

Market reaction? **Yes**
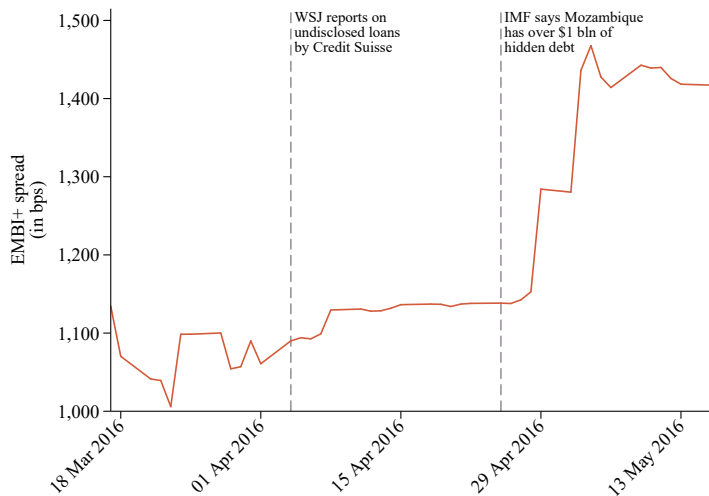
Sources: Wall Street Journal (2016, April 3). *"Tuna and Gunships: How $850 Million in Bonds Went Bad in Mozambique"*, Reuters (2016, April 23) *"IMF says Mozambique has over $1 bln of hidden debt"*, J.P. Morgan (2022). *Notes:* EMBI+ spread for a time window of 15 weekdays before the initial article by the WSJ and 15 weekdays after the IMF's assessment that the hidden debts of Mozambique exceed USD 1 billion. Since both events shown in the figure took place on the weekend, dashed lines mark the Mondays following each announcement. EMBI+ spread in basis points.

Measuring Debt Revelations

A new and comprehensive database of debt data revisions

We digitize all past vintages of the World Bank's International Debt Statistics and its predecessors, 1973–2023, and systematically track ex-post revisions to debt and loan statistics across their entire reporting history.

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- Debt data from 1970 to 2021
- Approx. 140 low- and middle-income countries

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- Debt data from 1970 to 2021
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Interpretation:

- All data points are debtor reported through Debtor Reporting System
- No valuation changes
- Reporting rules: very stable across 40-year history of WB statistics
- Underreporting not necessarily linked to intentional hiding (as in Mozambique) but can also be a result of insufficient capacity

Debt stocks are systematically underreported
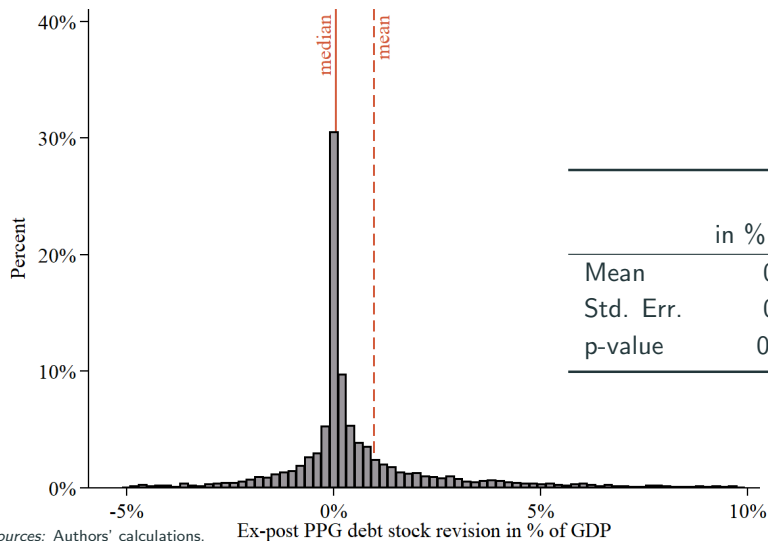
	Debt stock	
	in % of GDP	in USD mln.
Mean	0.96	133.89
Std. Err.	0.13	41.77
p-value	0.000	0.001

Sources: Authors' calculations.

Ex-post PPG debt stock revision in % of GDP

Underreporting more severe in countries w/ weak institutions...
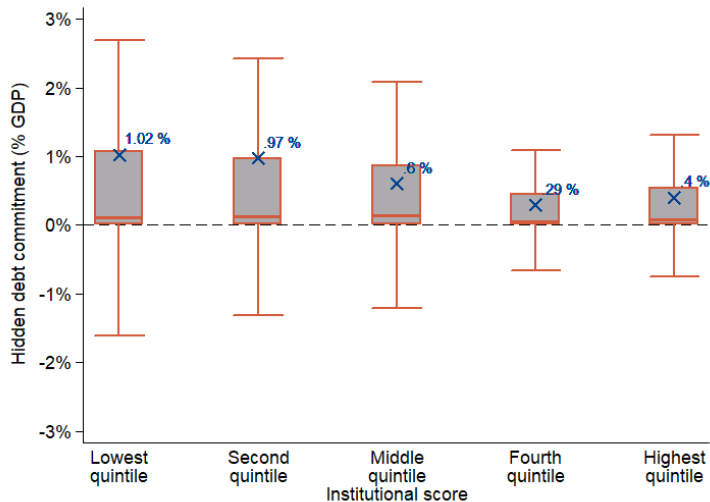
Sources: Authors' calculations.

... and for non-bond private and bilateral creditors
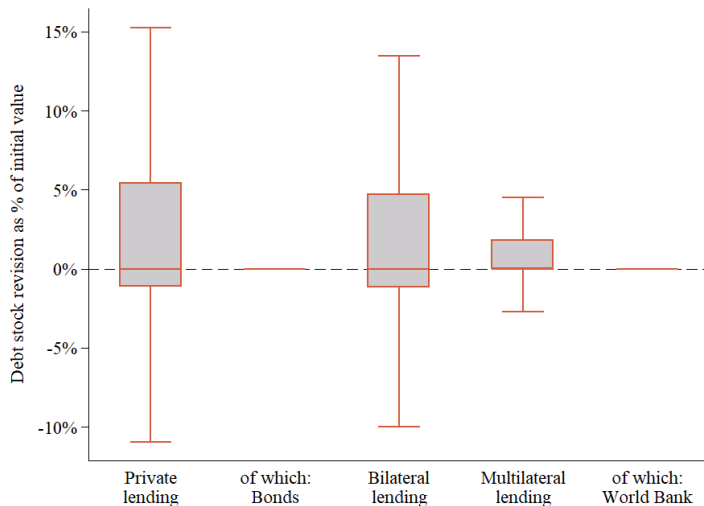
Sources: Authors' calculations.

Hidden debt builds up in good times, gets revealed in bad times
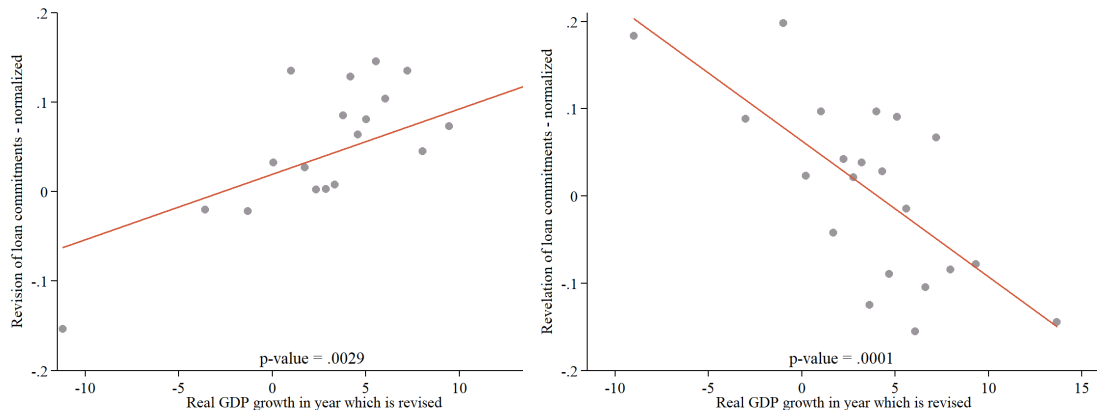
Sources: Authors' calculations.
Notes: The left panel shows the association between debt revisions and GDP growth in the year that is being revised. The vertical axis shows normalized loan commitment revisions. The right panel shows the association between debt revelations and GDP growth in the vintages of the revision, where the vertical axis shows normalized loan commitment revelations.

Revelations are associated with bad times ...

	Dep. variable: Hidden debt revelations, 1970-2020			
Real GDP growth	-0.04**			-0.04**
	(0.02)			(0.02)
External sovereign default		0.17***		0.13**
		(0.06)		(0.07)
IMF program			0.12***	0.12**
			(0.05)	(0.05)
[Obs. ; $R2$]	[3,242; 0.047]	[3,378; 0.047]	[3,378; 0.047]	[3,242; 0.049]
Country FE, Vintage FE	✓	✓	✓	✓

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Country FE, Vintage FE	✓	✓	✓	✓

… and with higher haircuts

	Dep. variable: Haircuts	
Hidden debt	0.29**	0.29***
	(0.11)	(0.10)
Controls		✓
[Obs. ; $R2$]	[124; 0.045]	[133; 0.309]

A Sovereign Default Model with Debt Revelations

Model: simplest framework with default and long-term debt

- Default model à la Eaton-Gersovitz (Aguiar-Gopinath; Arellano) with long-term debt (Chatterjee-Eyigungor; Hatchondo-Martinez) and recovery.

- Objective of the government: $\quad \mathbb{E}_t \sum_{j=t}^{\infty} \beta^{j-t} u\left(c_j\right), \quad u\left(c\right) = \frac{c^{1-\gamma}}{1-\gamma}$

- Stochastic exchange economy: $\quad \log(y_t) = (1-\rho)\mu + \rho \log(y_{t-1}) + \nu_t$

- Borrowing opportunities:
  - Competitive risk-neutral lenders
  - Non-contingent long-term bonds, b
  - Bond pays $\kappa\left[1, (1-\delta), (1-\delta)^2, (1-\delta)^3, ...\right]$

Model: debt revelations

- Debt revelations, ε, are random draws from a distribution $G(\varepsilon|\cdot)$

  - $G(\varepsilon|\cdot)$ can depend on previous revelations, current/past income, default status, etc.

  - assume country and lenders have same info about $G(\varepsilon|\cdot)$

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- Essentially: ε shock to initial debt.
  - model of debt revelations as *statistical incapacity* (... for now)

Model: defaults

- **Positive recovery:** if the gov. defaults, it pays nothing while excluded
  - Upon reentry, its debt becomes $b_D = \min\{\alpha, \tilde{b}\}$

- **Exclusion cost:** a government in default cannot borrow. Stochastic reentry.

- **Income cost:** each period the gov is in default current income is reduced by

$$\phi(y) = \max\{y[\lambda_0 + \lambda_1[y - \mathbb{E}(y)]], 0\}$$

Model: recursive formulation

Let $s \equiv \{y, \varepsilon\}$ and recall $\tilde{b} = b + \varepsilon$

$$V(b,s) = \max_{d \in \{0,1\}} \left\{ d\, V_1(b,s) + (1-d)\, V_0(b,s) \right\} \tag{1}$$

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$$V_1(b, s) = u(y - \phi(y)) + \beta\, \mathbb{E}_{s'|s} \left[\theta\, V(b_D, s') + (1 - \theta)\, V_1(b_D, s') \right] \tag{2}$$

with $b_D = \min\{\alpha, \tilde{b}\}$

$$V_0(b, s) = \max_{b' \geq 0} \left\{ u(c) + \beta\, \mathbb{E}_{s'|s} V(b', s') \right\} \tag{3}$$

subject to

$$c = y + q(b', s)\left[b' - (1 - \delta)\tilde{b} \right] - \kappa\, \tilde{b}$$

$$b' > (1 - \delta)\tilde{b} \quad \text{only if} \quad q(b', s) > \underline{q}$$

Model: recursive formulation (II)

$$
\begin{aligned}
q(b', s) \;=\;& e^{-r}\, \mathbb{E}_{s'|s}\left[1 - \hat{d}\left(b', s'\right)\right]\left[\kappa + (1-\delta)\, q\left(\hat{b}\left(b', s'\right), s'\right)\right] \quad (4)\\
&+ e^{-r}\, \mathbb{E}_{s'|s}\left[\hat{d}\left(b', s'\right) q^{D}(b', s')\right]
\end{aligned}
$$

where

$$
\begin{aligned}
q^{D}(b, s) \;=\;& (1-\theta)\, e^{-r}\, \mathbb{E}_{s'|s}\left[\frac{b_D}{\tilde{b} + \varepsilon'} q^{D}(b_D, s')\right]\\
&+ \theta\, e^{-r}\, \mathbb{E}_{s'|s}\left[1 - \hat{d}\left(b_D, s'\right)\right]\frac{b_D}{\tilde{b} + \varepsilon'}\left[\kappa + (1-\delta)\, q\left(\hat{b}(b_D, s'), s'\right)\right]\\
&+ \theta\, e^{-r}\, \mathbb{E}_{s'|s}\left[\hat{d}\left(b_D, s'\right)\frac{b_D}{\tilde{b} + \varepsilon'}\, q^{D}(b_D, s')\right] \quad (5)
\end{aligned}
$$

Calibration

- Annual freq. Panel of EMEs.
- We assume ε is *iid*. Use our novel data to estimate $G(\varepsilon)$
   - Discretization of nonparametric non-gaussian distributions (Toda, 2021)

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|			
Risk aversion	γ	2	Standard
Risk-free rate	r	0.04	Standard
Discount factor	β	0.90	Standard
Income autocorrelation coefficient	ρ	0.60	Estimated
Standard deviation of innovations	σ_ν	0.03	Estimated
Probability exclusion ends	θ	0.33	$\mathbb{E}(\text{exclusion}) = 3$ years
Debt duration	δ	0.31	Debt duration $= 5$ years
Bond coupon	κ	$(r + \delta)e^{-r}$	Risk-free bond price $= e^{-r}$
Recovery	α	0.09	Cruces-Trebesch (2013)
Income cost of defaulting	λ_0	0.176	Avg. market debt $= 26\%$
Income cost of defaulting	λ_1	3.20	Avg. spread $= 3.9\%$
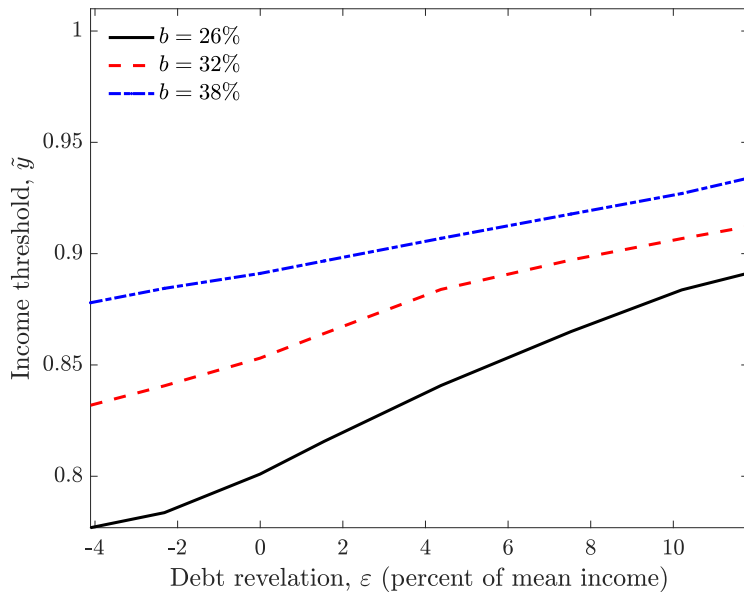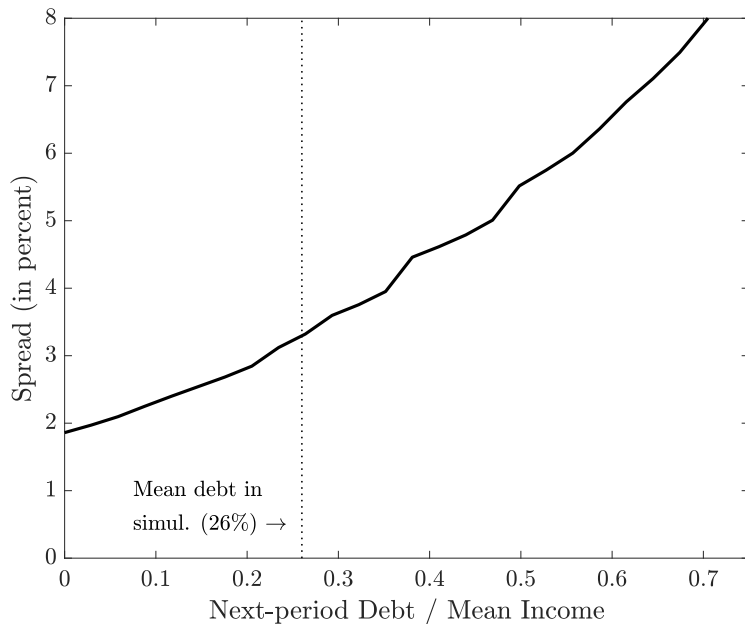
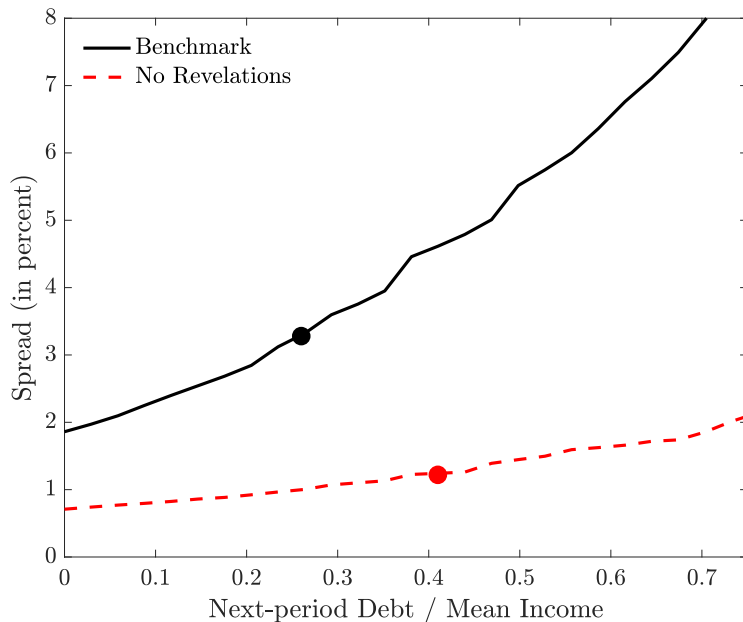## Debt-Spread Menu
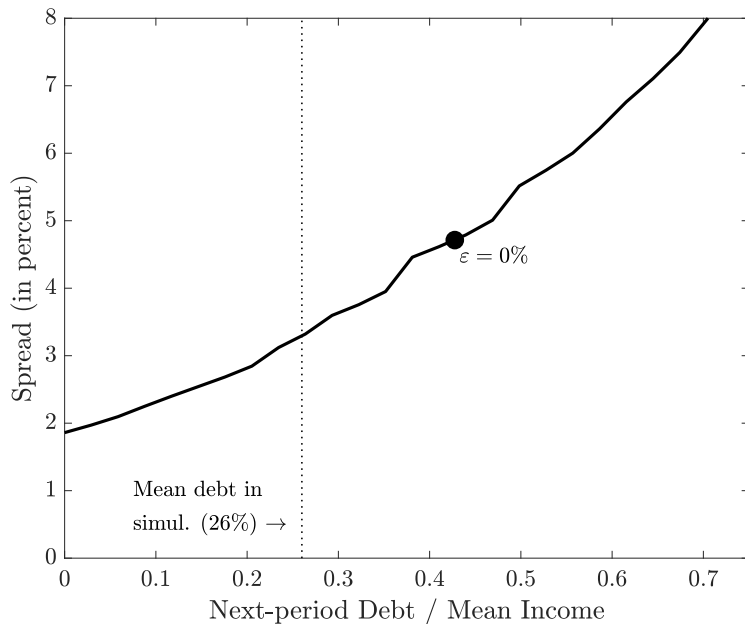
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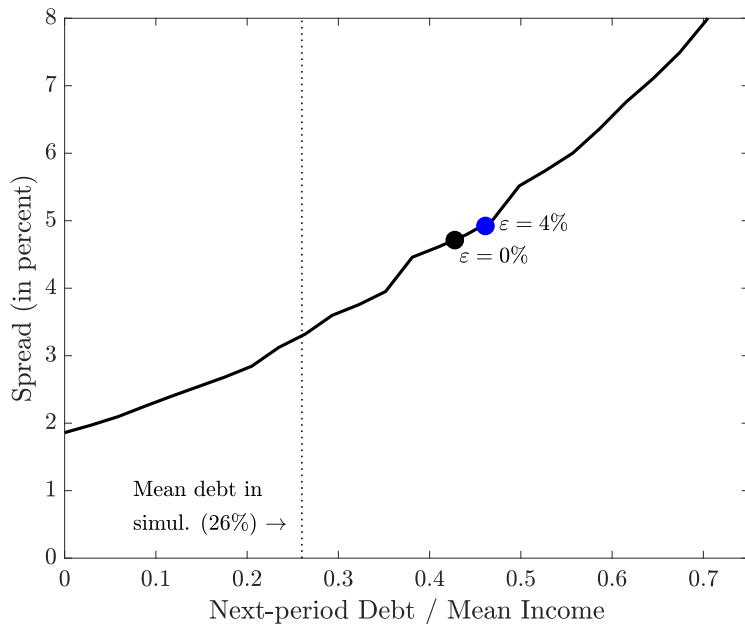
Debt-Spread Menu
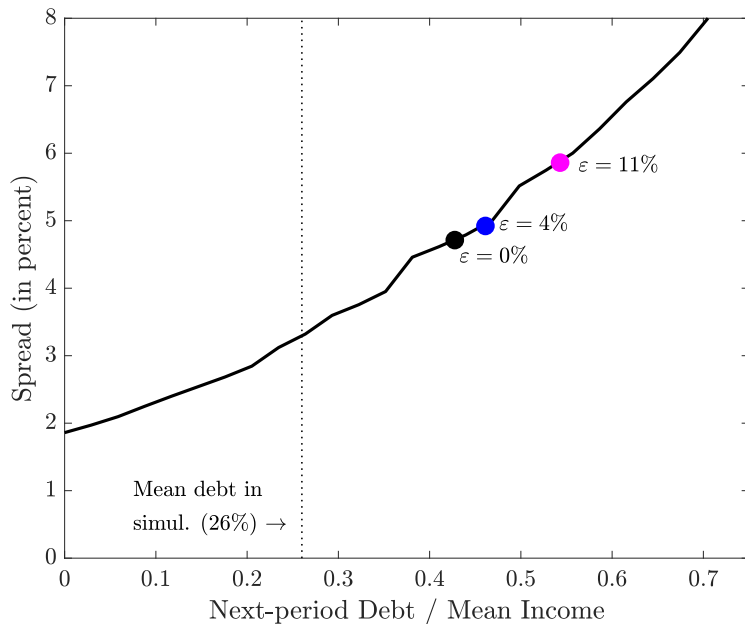
Debt-Spread Menu

Debt-Spread Menu: comparison across models

How costly is it to be subject to debt revelations?

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	Data	Model	
		Benchmark	No-Revelation
Targeted moments			
Mean Debt-to-GDP	26	26	41
Mean spread (r_s)	3.9	3.9	1.5
Non-Targeted moments			
$\sigma(c)/\sigma(y)$	1.1	1.7	2.3
$\rho(c, y)$	0.9	0.3	0.2
$\rho(r_s, y)$	-0.1	-0.2	-0.3
$\sigma(r_s)$	2.8	2.5	0.7
$\rho(Revel, HC)$	0.29	0.24	-.-

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- Higher and more volatile spreads
- Lower debt capacity $\rightarrow$ lower consumption (3% lower)

Welfare gains of eliminating revelations
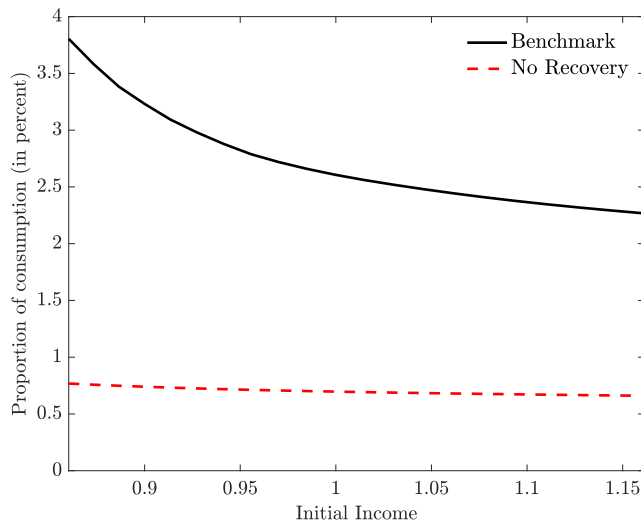
- On average: 2.6% of permanent consumption
- Without recovery: 0.7%

Conclusions

Novel dataset: First to quantify size, timing and charac. of hidden debt revel.

1. Large number of frequent revisions: noisy and upwardly biased
2. Hidden debt: ∗ builds up in good times and is revealed in bad times

   ∗ is associated w/ higher haircuts
3. Suggestive evidence for both: statistical incapacity and strategic hiding

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Theory: Sovereign debt model with debt revelations

- ↑ default incentives, ↓ asset prices, worsens borrowing opp.
- Negative welfare implications; worst if low-institutional quality
- Interacts w/ positive recovery

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Going forward: Endogenous hidden debt $\rightarrow$ asymmetric info

Appendix

Good reasons to use IDS data

1. Based on direct debtor reporting
   - Omissions/revisions traced back to debtor's decisions
2. Information at loan level, nominal values
   - No valuation effects
3. Obligation to report for countries that borrow from WB
   - High coverage over time
4. Very stable reporting guidelines

Caveats and Limitations

1. Not all cases are related to *malicious intent* or *hiding*
   - Statistical incapacity can be important
2. Loan initially missing from IDS *may* have been reported elsewhere
   - still violation of WB req. but implies less secrecy
3. Revelation in IDS may follow a revelation elsewhere w/ a lag
   - So: caution in interpreting our measure as "news shocks"

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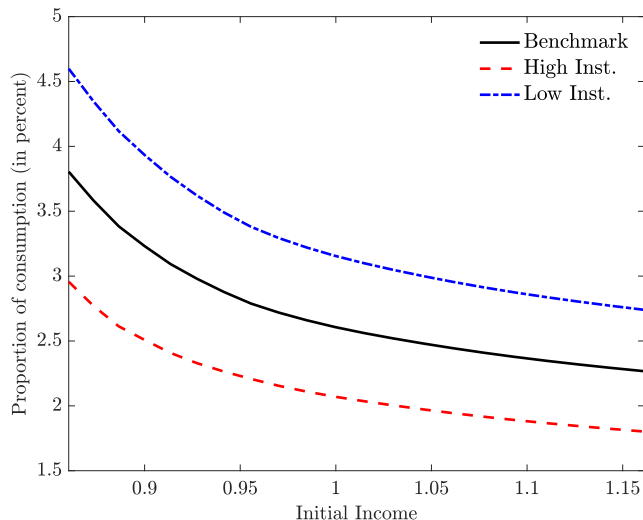
Our measure: **lower bound** for true hidden debt

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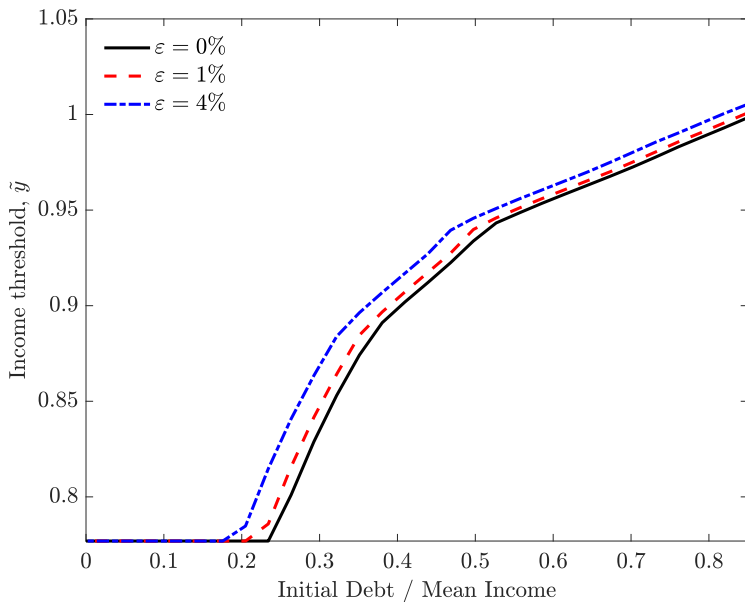
Welfare gains of eliminating revelations

- Baseline: 2.6% of permanent consumption
- High Institutional Quality: 2.1%; Low Inst. Quality: 3.2%