Deception, Self Deception, and Sovereign Debt Statistics

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Motivation

- Data on sovereign debt are used for many purposes, including:
  - Monitor and control indebtedness: debt limits, covenants, stand-by agreements
  - Guide investment decisions and debt management
  - Allocate debt relief and advise on debt restructuring

- If debt markets complete and frictionless, information can be read off market prices
  - No need for accountants, accounting manuals, and “book values”

- But sovereign debt is interesting because markets are not complete or frictionless
What We Do

- Argue existing measurement concepts have significant limitations
  - Deception: debtors can manipulate debt issuance to hit targets
  - Self deception: measures often not designed to answer questions of interest

- Show that there are three reasons for this:
  - ‘Principal’ emphasized over ‘interest’ for historical reasons
  - Accounting measures inherently deterministic: struggle with state contingent debts
  - Ignore possibility that valuations differ across agents

- Propose alternative measures and implement on Argentine debt securities data
The Big Picture: Finance and Financial Accounting

- An old joke: In 50 years, finance evolved from valuing assets using

$$\sum_{t=0}^{T} D_t Y_t$$

to

$$E_0 \left[ \sum_{t=0}^{T} M_t Y_t \right]$$

- Sovereign debt accounting is the art of moving from

$$E_0 \left[ \sum_{t=0}^{T} M_t Y_t \right]$$

to

$$\sum_{t=0}^{T} \left( \frac{1}{1+r} \right)^t Y_t$$

- Different accounting measures are different rules for constructing deterministic cashflows and single discount rate

- Plan for talk:
  - Describe historical evolution of measurement concepts, & propose new measures
  - Illustrate concepts first using a simple (mostly not state contingent) bond
  - Add more state contingencies and different valuation perspectives
Face value is the undiscounted sum of future principal payments

Still widely used today:
- US Debt Limit (Partially revised 1989)
- Maastricht Debt Limit (NB: Also, Budget Deficit Limit)
- Polish Debt Limit
- Australian Debt Limit (2008-2013)

If principal is state contingent (eg CPI indexed), may allow face value to rise with index (Poland) or not (Australia)

If indexed to foreign currency, face value of debt rises with spot exchange rate
Weakness of Face Values: Enables (Self) Deception

- Given face value, increase borrowing by shortening maturity or increasing coupon
  - Italy 2002: reduced face value of debt by 1.9% GDP by swap low-face/high-coupon for high-face/low-coupon debt

- Manipulate level of principal
  - Jamaican “Capital Accretion Bond”
  - Poway Unified School District “Capital Appreciation Bond”
  - Poland 2009 and 2011 manipulated value of zloty

- Can combine debt limit with interest expense/budget deficit limit. But ...
  - Argentina 1996: stand-by agreement changed to face value debt limit with primary deficit limit
Solution: Equivalent Values and Accrual Accounting

- **Equivalent Values/Present Values:**
  - Proposed in 19th Century. Pick arbitrary constant interest rate (zero, 5%, etc).
  - Derive deterministic cashflows assuming no default or change in indices
  - Measure implied face value of debt with equivalent cashflows but paying this interest rate
  - Turns out to be the same as present values (for given discount rate)

- **Accrual Accounting and Nominal Values:**
  - *External Debt Statistics Manual* (EDS) and *International Public Sector Accounting Standards* (IPSAS) specify rules for constructing deterministic cashflows
  - Constant interest rate = yield to maturity at issue assuming no default
  - Nominal value = face value of debt with equivalent cashflows but paying this interest rate
Example: Argentine 5.875 maturing 01/11/2028

- USD 4.25 billion
- 10 Year Bond
- Coupon paid in January and July
- Issue price 99.1 (yield to maturity at issue approx 6%)
- US investor faces default and price level risk
Comparing Measurements: Face Value

- Face value is constant for life of bond
- (Assuming no reopening or buyback)
Comparing Measurements: Market Value

- Issued almost at par
- Market value declines substantially over time
Comparing Measurements: Equivalent Values

- Zero coupon equivalent is face value of portfolio of zero coupon debts with same cashflows

- 5% and 10% equivalent values for reference
Comparing Measurements: Nominal Value

- EDS and IPSAS equivalent in this example

- Issue price close to par results in small difference from face values

- Not true in general

<table>
<thead>
<tr>
<th>Year</th>
<th>USD Billions</th>
<th>Face Value</th>
<th>Market Value</th>
<th>Zero Coupon Equivalent Value</th>
<th>5% Coupon Equivalent Value</th>
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Graph showing the trend of various equivalent values from 2018 to 2028.
How Useful Are Nominal Values?

- Equivalent and Nominal values limit some forms of deception by debtors
  - But not all form of deception: eg exchange rate manipulation

- For debt portfolio at nominal value, must also look at weighted average yields

- Nominal/book values also used for other purposes:
  - Ratio of market to book values often used as indicator of default risk (especially when CDS not available or illiquid)

- Next, we’ll derive an new measure designed for this purpose
No Default Risk Value

- US investor values USD cashflows $Y_t$ according to market value

\[ V_0^M = E_0 \left[ \sum_{t=0}^{\infty} m_t \frac{Y_t}{P_t} \right] \equiv E_0 \left[ \sum_{t=0}^{\infty} M_t Y_t \right]. \]

- With no default, $Y_t$ is known, and no default risk value equals

\[ V_0^{ND} = \sum_{t=0}^{\infty} E_0 [M_t] Y_t. \]

- $E_0 [M_t]$ can be read off US Treasury yield curve

- Intuitively, this is value of debt to investor had it been issued by US government
Comparing Measurements: No Default Value

- Difference between market and no default values purely reflects default risk

- In this example

  nominal $\simeq$ face $< ND$

  but nominal/ND pretty stable.

- In general,

  nominal/ND is not stable.

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Nominal Values and State Contingent Debts

- How do nominal values handle state contingent debts? How map into deterministic cashflows?
  - Matters for calculation of yield to maturity at issue
  - Valuation of future cashflows thereafter

- Answer varies by accounting manual and type of state contingency
  - EDS: Assume everything stays constant
  - IPSAS: Use expected value of interest rates, price index. But assume exchange rate remains constant

- Consider our example bond from perspective of Argentine resident
Sources of Disagreement over Debt Valuation

- Argentine investor valuing USD denominated debt

\[ V_0^{M*} = E_0 \left[ \sum_{t=0}^{\infty} m_t^* \frac{Y_t}{Q_t P_t^*} \right] = E_0 \left[ \sum_{t=0}^{\infty} M_t^* \frac{Y_t}{Q_t} \right]. \]

- If asset markets complete/frictionless, US-Argentine investors agree because:

\[ \frac{m_t}{P_t} = \frac{m_t^*}{Q_t P_t^*} \]

- If domestic Argentine assets markets not complete/frictionless, residents will not agree on values
  - Grantees of debt forgiveness/relief may want to account for this
Consistent Nominal Values

- Both EDS and IPSAS compute cashflows assuming exchange rates is constant

- Calculate yield to maturity at issue from

\[ V_{0}^{M*} = \sum_{t=0}^{T} \left( \frac{1}{1+r} \right)^t \frac{Y_t}{Q_0} , \]

- Same yield as USD calculation; nominal values convert at spot exchange rate

- Suppose we treat forex debt like other indexed debt under IPSAS

- Use expected cashflows and calculate yield from

\[ V_{0}^{M*} = \sum_{t=0}^{\infty} \left( \frac{1}{1+r} \right)^t E_0 \left[ \frac{1}{Q_t} \right] Y_t . \]
Comparing ARS Measurements

- Face and nominal values convert at spot exchange rate
- If allow for expected depreciation, nominal values vary with path of expected spot rates
- In ARS, yield to maturity at issue 8.2%
- Could use forward rates instead of expected future spot rates

<table>
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<th>Face Value</th>
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<th>New Nominal Value</th>
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ARS Billions

---------|--------|--------|--------|--------|--------
$60      | $65    | $70    | $75    | $80    | $85    |
Valuations for Debt Relief and Forgiveness

- A creditor country government might care about average Argentine’s instead of Argentine investors

- Need theory to map effect of debt relief into Argentine welfare

- One starting point: CCAPM using Argentine consumption data

\[
W_0 = \sum_{t=0}^{\infty} E_0 \left[ \beta_t u'(c_t) \frac{P_0^*}{u'(c_0)} \frac{P_t^*}{Q_t P_t^*} Y_t \right].
\]
CCAPM Measure

- Typically, CCAPM value less than market value
  - "Buyers" (creditors) value goods more than "sellers" (debtors)
- Difference in values = possible Pareto-improving debt restructuring
Conclusion and Future Work

- Accountants/book values useful because financial markets not complete or frictionless.
- Current measures not designed for different valuations or state contingent debts.
- Could work directly with state contingent payoffs, but opaque and complicated.
- Simpler measures lose information; “right” measure specific to question asked.
- We propose some new measures designed to answer very specific questions; Different questions will require different measures.
- **Future work:** explore higher order moments of sovereign debt cashflows and values.