Deception, Self Deception, and Sovereign Debt Statistics

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November 7th, 2019

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

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

- Sovereign debt accounting is the art of moving from

$$E_0 \left[\sum_{t=0}^{T} M_t Y_t \right] \qquad \text{to} \qquad \sum_{t=0}^{T} \left(\frac{1}{1+r} \right)^t Y_t$$

- 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

Historical Measurement Concept: Face Value

- 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

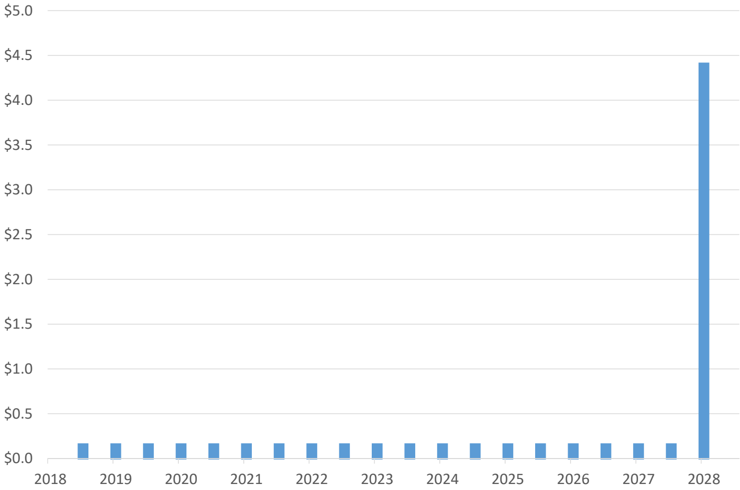
- Can combine debt limit with interest expense/budget deficit limit. But ...
  - Argentina 1996: stand-by agreement changed to face value debt limit with primary deficit limit

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

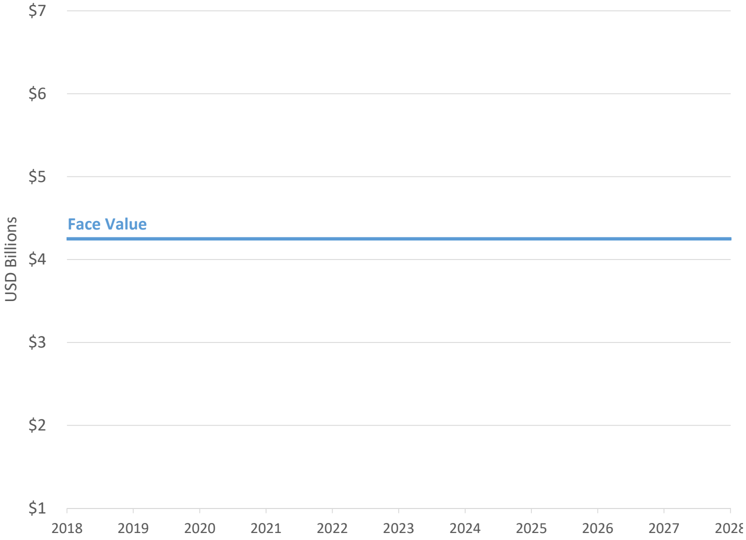
Example: Argentine 5.875 maturing 01/11/2028

- 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



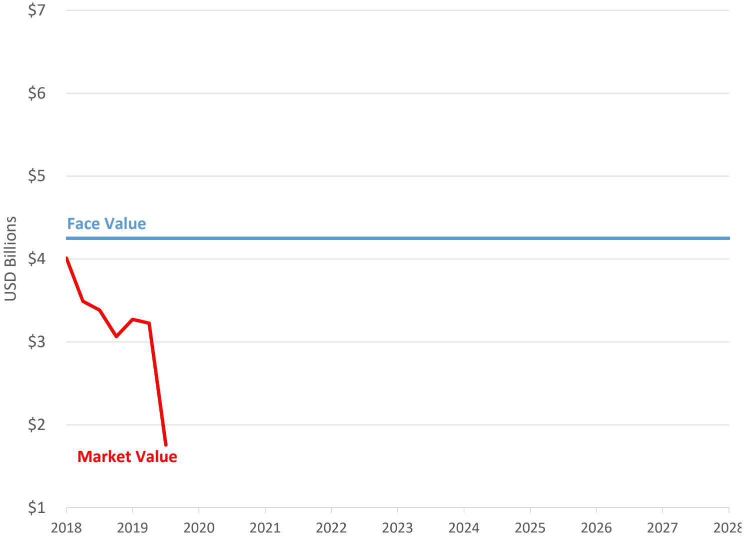
Comparing Measurements: Face Value

- Face value is constant for life of bond
- (Assuming no reopening or buyback)



Comparing Measurements: Market Value

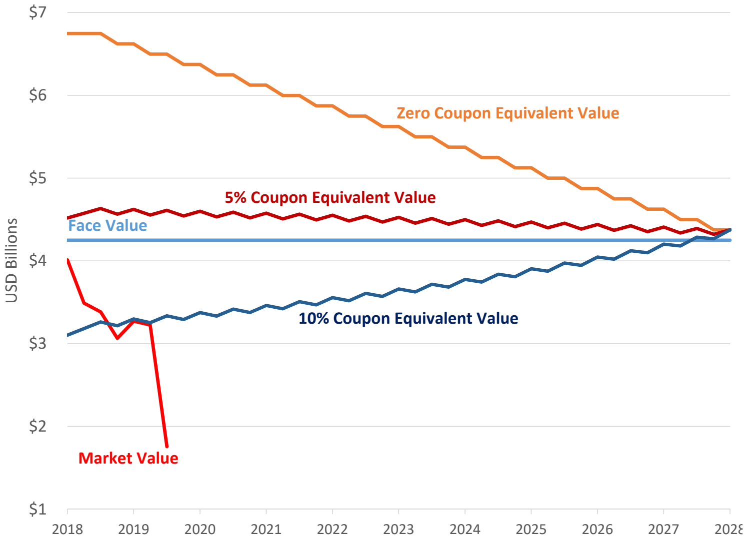
- Issued almost at par
- Market value declines substantially over time



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

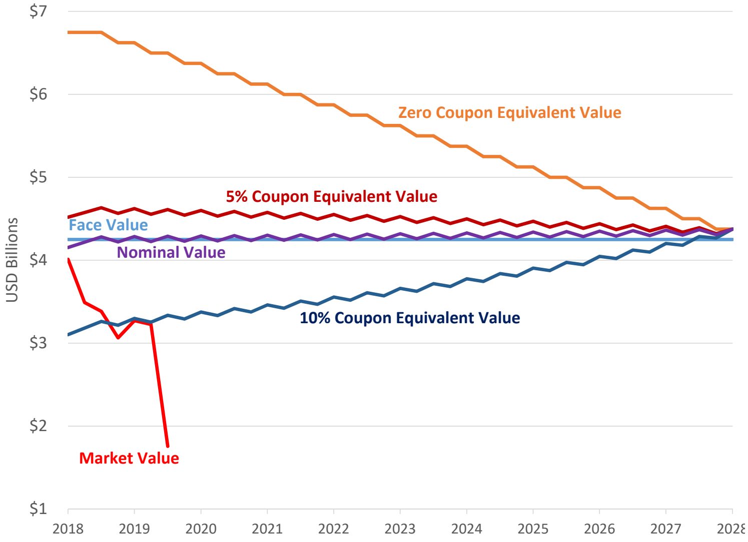


Comparing Measurements: Nominal Value

- EDS and IPSAS equivalent in this example

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

- Not true in general



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

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

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

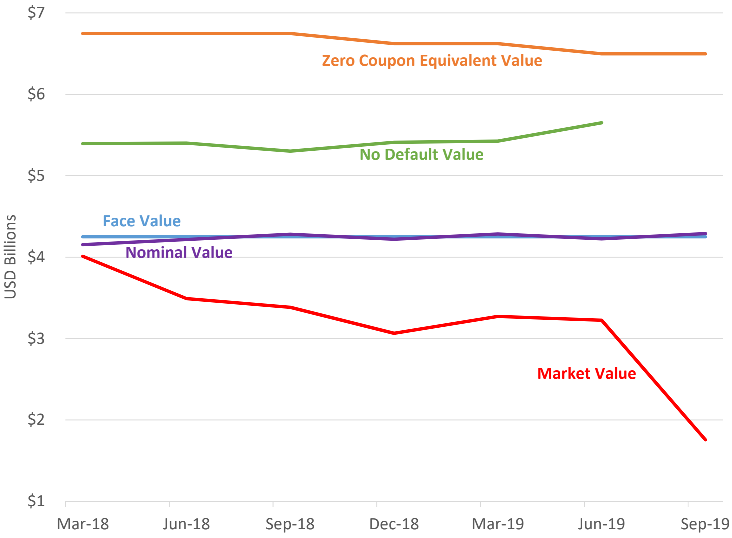
- Intuitively, this is value of debt to investor had it been issued by US government

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.



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

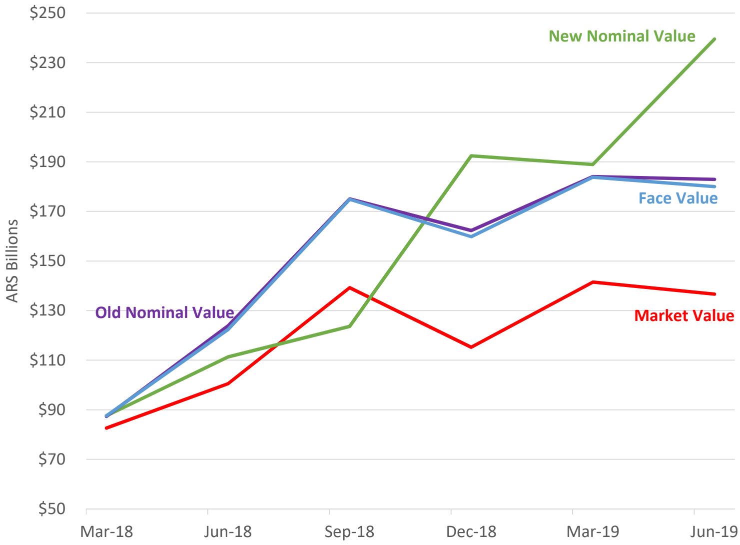
$$V_0^{M*} = \sum_{t=0}^{T} \left(\frac{1}{1+r} \right)^t \frac{Y_t}{Q_0},$$

  - 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



Valuations for Debt Relief and Forgiveness

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

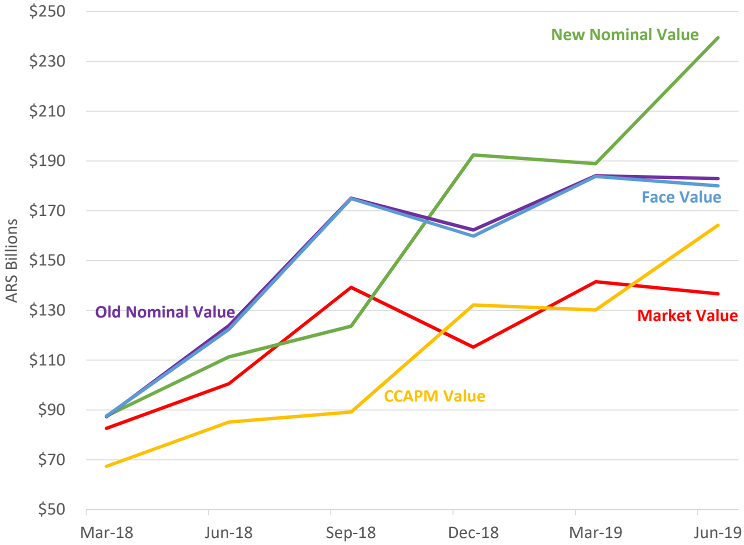
- Need theory to map effect of debt relief into Argentine welfare

- One starting point: CCAPM using Argentine consumption data

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

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