

# Austere Sovereign Debtors

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- ▶ Asymmetric information is a pervasive feature of sovereign debt markets
- ▶ Such information frictions tend to be exaggerated around times of government change as creditors struggle to determine the sovereign's creditworthiness (Brazil, 2001, Greece, 2015)
- ▶ How does incomplete information shape the strategies of the borrower and her creditors and determines debt quantities and prices?
- ▶ Under what *conditions*, through which *means*, and to what *effect*, does a sovereign borrower choose to communicate (signal) her private information to the creditors

## Key features of the model

### Features from standard sovereign debt model

- ▶ Non-contingent debt
- ▶ Lack of commitment to repay debt
- ▶ In case of default, the borrower suffers a type specific cost
- ▶ The borrower may or may not be able to commit to doing certain other things (such as the amount of investment to undertake)
- ▶ Risk neutral, competitive creditors

## Features from standard credit rationing model

- ▶ The borrower's type (credit risk, willingness to repay) is private information
- ▶ Loan contracts specify price and quantity and may include additional features (such as investment requirements, the undertaking of structural reforms,..)

## Preview of main results (two borrower types, high and low crediworthiness)

- ▶ **Austerity** is the outcome of incomplete information about credit risks
- ▶ High type always suffers austerity (consumes less than what he would have liked and been able to finance)
  - ▶ In pooling equilibria, austerity arises from the inability of the creditors to determine the credit risk of the borrower
  - ▶ In separating equilibria (where the borrower's type is revealed by his actions) austerity arises in order to prevent the misrepresentation of credit risks

## Main results (cont'ed)

- ▶ **Investment:** Can investment requirements be included in the loan contracts to improve outcomes for creditworthy borrowers?
- ▶ YES. Investment can be a tool for establishing credibility (separating types) and allow more creditworthy countries to borrow more
- ▶ But there is over-investment
  1. The borrower must invest more than what he would have liked given the size of the loan
  2. At the margin, the borrower has to invest some own funds (sacrifice consumption) )
- ▶ This makes austerity more severe. Nonetheless creditworthy borrowers prefer investment requirements

## Noteworthy:

- ▶ This property of investment is independent of its collateral creation potential
- ▶ The amount of new loans procured may not be a reliable measure of austerity suffered due to composition (consumption vs investment) effects
- ▶ More severe austerity may lead to higher growth and welfare

The model is used to also study additional related issues

- ▶ **Structural reforms** in lieu of investment

⇒ (sacrifice of current in favor of future consumption)

Similar results

- ▶ **Spending multipliers**

- ▶ Novel perspective: Multipliers matter for optimal size of austerity through credit risk *identification* channels (whether they matter for economic growth and ability to pay or not)
- ▶ Ambiguous relationship between size of spending multipliers and optimal level of austerity



## Relevant Literature

- ▶ Monetary policy games literature of the 80s-90s (wet vs hard nose central bankers)  
Green and Porter (1984), Backus and Driffill (1985), Canzoneri (1985), Vickers (1986)
- ▶ Sovereign debt  
Eaton and Gersovitz (1981), Obstfeld and Rogoff (1996, ch. 6), Atkeson (1991)
- ▶ Credit rationing  
Stiglitz and Weiss (1981), Bester (1985), Meza and Webb (1987), Brennan and Kraus (1987), Milde and Riley (1988)

## The model

- ▶ Two periods
- ▶ Two types,  $\lambda^h, \lambda^l, \lambda^h > \lambda^l$ .  $\lambda$  is the cost of default for the borrower (share of income lost)
- ▶ Type is private information
- ▶ Prior:  $\text{Prob}(\lambda = \lambda^h) = \theta$ . Posterior depends on actions
- ▶ One period, non-contingent debt issued in period 1,  $b_2$ . Debt due in period 1,  $b_1$
- ▶ Risk neutral, competitive lenders. They break even
- ▶ Equilibrium selection: Creditors maximize borrower's ex ante welfare,  $W = W^h + \omega W^l, \omega \geq 0$

## Timing-Decisions

- ▶ Period 1:
  1. Default or not on outstanding debt,  $b_1$
  2. Borrow amount  $b_2$  at price  $q = \theta\beta$
- ▶ Period 2: Default or not on  $b_2$

A simple example:  $\lambda^l = 0, \lambda^h = \infty, \omega = 0$

Complete information

High:  $u(Y_1 - b_1 + \beta b_2^h) + \delta(Y_2 - b_2^h), b_2^h = \tilde{b}$

Low:  $u(Y_1) + \delta u(Y_2), b_2^l = 0$  (autarky)

## Incomplete information: Separating equilibrium

- ▶ High type repays in first period, low defaults

- ▶ Low type defaults on  $b_1$  if:

$$u(Y_1) + \delta u(Y_2) \geq u(Y_1 - b_1 + qb_2^{ND}) + \delta u(Y_2) \Rightarrow b_2^{ND} \leq \frac{b_1}{q}$$

- ▶ Debt contracts:  $b_2^h = b_2^{ND} = \frac{b_1}{\beta}, b^l = b_2^D = 0, q = \beta$

- ▶ Implications:

1. Current account,  $b_1 - \beta b_2^h$  cannot be negative
2. There is austerity for H:

$$\tilde{c}_1 - c_1 = \beta(\tilde{b} - \frac{b_1}{\beta}) > 0$$

## Incomplete information: Pooling equilibrium

- ▶ Debt contracts:
- ▶  $q = \theta\beta, b_2^{ND} = b_2^p, b_2^D = 0$
- ▶  $b_2^{ND} : u(Y_1) + \delta u(Y_2) \leq u(Y_1 - b_1 + qb_2^{ND}) + \delta u(Y_2)$   
 $b_2^p : \theta\beta u'_{1h} - \delta u'_{2h} = 0$
- ▶ Implication: There is austerity for H,  $\tilde{c}_1 - c_{1h}^p > 0$   
because  $\beta > \theta\beta$

## Selection of optimal equilibrium across pooling and separating equilibria

- ▶ Criterion

$$W^p - W^s =$$

$$u(Y_1 - b_1 + \theta\beta b_2^p) + \delta u(Y_2 - b_2^p) - [u(Y_1) + \delta u(Y_2 - \frac{b_1}{\beta})]$$

- ▶ At  $\theta = 1$   $b_2^p = \tilde{b}$  and  $W^p$  coincides with first best
- ▶ At  $\theta = 0$ ,  $q = 0$  thus optimal  $b_2^p = 0$   
 $\Rightarrow W^p = u(Y_1 - b_1) + \delta u(Y_2) < u(Y_1) + \delta u(Y_2 - \frac{b_1}{\beta}) = W^s$
- ▶ There exists a  $\theta = \theta^*$  : for  $\theta > \theta^*$  pooling is preferred and for  $\theta < \theta^*$  separating is preferred

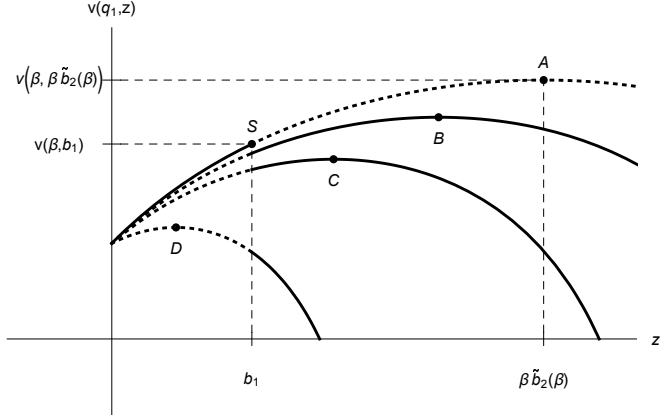


FIGURE : Optimal equilibrium in the endowment model.



## Generalization

Costly "signalling" for the high type,  $\lambda Y_1 < b_1$

- ▶  $\lambda^l = 0, \lambda^h = \lambda, \lambda Y_1 < b_1$
- ▶ Have now to worry about H defaulting
- ▶  $u(Y_1 - b_1 + \beta b_2^s) + \delta u(Y_2 - b_2^s) > u(Y_1(1 - \lambda)) + \delta u(Y_2)$
- ▶  $b_2 < \lambda Y_2$  repayment constraint
- ▶  $b_2 \leq \frac{b_1}{\beta}$  loan cannot be too high; otherwise L mimics H
- ▶  $b_2 \gg 0$  loan cannot be too low; otherwise H defaults

Main result: Optimal austerity can be neither too severe nor too light (the loan supporting separation is bounded from both below and above)

## Investment (with commitment to invest)

$$u(Y_1 - b_1 + \beta b_2^h - I_h) + \delta(Y_2 + F(I_h) - b_2^h)$$

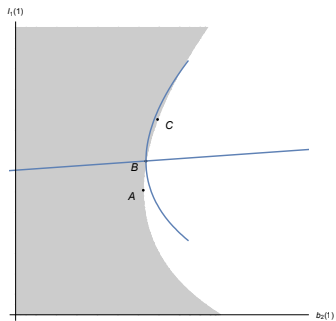
- ▶ Well known result: Investment increases collateral (cost of default), supports higher consumption and improves welfare for every type
- ▶ We suggest a novel role for investment. Investment matters for the agency problem even when it does not contribute to collateral
- ▶ It thus matters for austerity

- ▶ Proposition 1: For any  $b_2$ , optimal  $I_l$  less than optimal  $I_h$
- ▶ Marginal benefit from a unit of investment lower for L because of L's lower marginal utility in period 2 (due to default)
- ▶ Can this fact be exploited in order to alleviate the agency problem?

YES

## Results

- ▶ The investment requirement involves "over-investment"
  1. High type has to invest more than what he would have liked
  2. At the margin, the borrower has to invest some own funds (skin in the game)
- ▶ → Over-investment is so severe as to make the high type's consumption lower than it would have been were it not possible to use investment as a device for that purpose. *It makes austerity –consumption gap– worse*
- ▶ In the optimal equilibrium, more severe austerity is associated with higher welfare for the high type as well as higher growth



**FIGURE :** Indifference curves of high type and selection constraint of low type in  $(b_2, I_1)$ -space

# Richer dynamics: A three period model

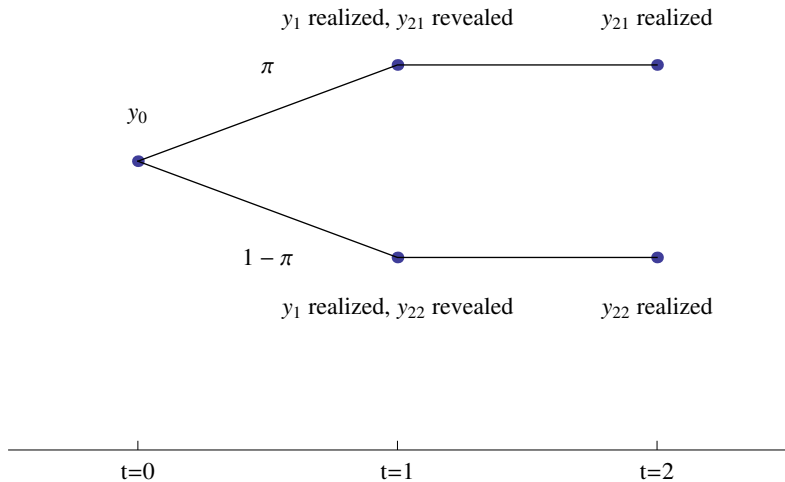


FIGURE : Event tree

## Best equilibrium

- ▶ In period  $t = 0$ , high and low types pool—they repay debt due,  $b_0$ , and issue new debt,  $b_1$ , at price  $q_0$ .
- ▶ In period  $t = 1$ , both repay outstanding and issue new debt if the prospects for output growth remain good (which happens with probability  $\pi$ ).
- ▶ If growth prospects are poor then only the high type repays and issues new debt.

Interesting property: Outstanding debt increases over time as long as "prospects" remain good

TABLE : Three period model: Debt dynamics

$b_0$	$b_1$	$q_0$	$b_{21}$	$q_{21}$	$b_{22}$	$q_{22}$
0.10	0.73	0.81	1.01	0.72	0.30	0.90

A model with several periods can capture the debt dynamics observed in a country like Greece whose indebtedness kept growing for some time, but new issuance collapsed (and default occurred) when economic conditions worsened.



**TABLE :** Three-period model with pooling and separation (government type distribution risk): Debt dynamics

$b_0$	$b_1$	$q_0$	$b_{21}$	$q_{21}$	$b_{22}$	$q_{22}$
0.10	0.25	0.78	0.38	0.76	0.32	0.80

## Reforms and austerity

- ▶ Reform measures are completely analogous to investment (financially costly in the short run, bring output rewards in the medium-long run  
$$u(Y_1 - b_1 + \beta b_2^h - R_h) + \delta(Y_2 + F(R_h) - b_2^h)$$
- ▶ The extension of more financing in combination with stricter requirements for structural reform (as currently being discussed for Greece) should not be misinterpreted as leniency
- ▶ In the optimal equilibrium it represents more severe –nonetheless growth and welfare improving– austerity

## APPLICATION

- ▶ Shed light on recent Greek sovereign debt experience.
- ▶ Syriza win in February elections (campaigned on the basis of a threat to default on the country's external debt unless the country were granted substantial debt relief and also offered generous funding).
- ▶ Secondary market yields on 10-year Greek bonds rose from 5.8% in July 2014 to 14% in July 2015.
- ▶ No default, no debt relief and tough new terms
- ▶ After a decline in economic activity and consumption, the economy has started recovering and default risk premia have plummeted.
- ▶ By the beginning of 2018, the secondary market yield on 10-year Greek bonds had fallen to 3.6%.
- ▶ It seems that following the election, investors substantially downgraded their beliefs about the government's creditworthiness before reversing their assessment subsequently.

- ▶ According to our model: Syriza is a high type who was perceived as a low type (rhetoric, early actions).
- ▶ Our analysis suggests that the optimal outcome under such circumstances can involve a switch in the optimal equilibrium from pooling to separation with reduced funding, but at favorable interest rates, and an *expanded* set of reform commitments.
- ▶ Neither the standard sovereign debt model without information frictions nor the existing variants of the incomplete information model are capable of reproducing such a constellation of features.
- ▶ According to the former, a smaller loan derives from a higher probability of default in the future and thus carries higher interest rates and lower investment undertakings.
- ▶ According to the latter, the switch to separation leads to increased levels of funding without credit rationing.

- ▶ Observed profiles of consumption, output, and default risk premia for Greek debt in line with our model.
- ▶ ( so far) no default, initial consumption decline accompanied by decrease in default premia and followed by higher growth.
- ▶ In line with implication of our model that lower current consumption may go hand in hand with higher future output and consumption growth.
- ▶ Validation of “German view” on optimal policy in European debt crisis: belt tightening signals creditworthiness-leads to higher future growth.

- ▶ Patterns not consistent with other versions of sovereign debt model (standard/incomplete info).
- ▶ In the former: A reduction in current consumption reflects lower future income and consumption and a higher probability of default.
- ▶ In the latter, separation brings about an increase rather than a decrease in current consumption.
- ▶ Alesina et al evidence of positive effects of government spending based consolidations.

## Conclusions

- ▶ Fusion of sovereign debt with credit rationing literatures
- ▶ An operational definition of austerity: consumption drop due to commitment problems.
- ▶ Extra decline in consumption of creditworthy sovereigns' either because the borrower's credit risk cannot be identified; or, as a means of deterring the misrepresentation of credit risks
- ▶ Investment requirements can help. Make austerity *harsher* but lead to *higher* growth and welfare
- ▶ Multiperiod extension can account for increasing indebtedness and abrupt collapse of funding
- ▶ Multiperiod extension can account for key features of loan to Greece in 2015.