Sovereign debt
Lecture 9, ECON 4330

Nicolai Ellingsen
(Adopted from Tord Krogh)

March 13, 2017

Outline

Today we will extend our framework from last time in one important dimension. We are going to add capital and see how that affects:

- The ability to repay debt
- The willingness to repay debt
- And the value of debt to creditors

Sovereign risk

Sovereign risk refers to the possibility of government default and seizure of foreign assets (in the country). Is a natural part of an inter-connected world economy since there is no institutional framework that exist to legally enforce countries to stand by their obligations.

Still some ways to enforce payments:

- Reject defaulting countries access to credit markets in the future
- Threats of higher interest rates in the future
- Trade sanctions

Sovereign risk II

Sanctions available to the creditors are for simplicity assumed to involve a possibility to confiscate an η share of output and assets. Last time that was only a share of an endogenous income, but now they can confiscate parts of the endogeneous output, $Y_t = A_t F(K_t)$, in addition to a share of the countries remaining capital, K_t.

Hence if the country defaults in period t, the creditors will manage to get

$$\eta(A_t F(K_t) + K_t)$$

back through different sanctions.

Two-period model with default

In the first part of the lecture, we will use a simple two-period model (potentially with uncertainty) to discuss various sovereign risk issues. The model earlier in the course involved solving the problem:

$$
\begin{aligned}
\max_{C_1, C_2} \quad & u(C_1) + \beta u(C_2) \\
s.t. \quad & C_1 + (K_2 - K_1) + B_2 = Y_1 \\
& C_2 = Y_2 + K_2 + (1 + r)B_2
\end{aligned}
\tag{1}
$$

where $Y_2 = A_2 F(K_2)$ and given $Y_1 = A_1 F(K_1)$. The first-order conditions to this problem are:

- The standard Euler equation
- and the optimal investment condition: $A_2 F'(K_2) = r$

Two-period model with default II

But earlier we have implicitly assumed that there is no sovereign risk (no possibility to default). Assume instead that the period-by-period budget constraints are:

$$C_1 + (K_2 - K_1) + B_2 = A_1 F(K_1)$$
$$C_2 = A_2 F(K_2) + K_2 - R$$

where

$$R = \min\left\{-(1+r)B_2, \eta(A_2 F(K_2) + K_2)\right\}$$

Here we see that the country only repays the full loan with interest if it is less than the cost of not doing so. If η is very small, the country 'always' defaults.

Two-period model with default III

Will discuss four issues in light of this model

- Debt ceiling
- Debt overhang
- Debt Laffer curve
- Debt buy-backs

Outline

1 Sovereign risk

2 Debt ceiling

3 Debt overhang

4 Debt Laffer curve and buybacks

5 Summary

Debt ceiling

When there was no sovereign risk, the country could borrow unlimited amounts from aborad. With the possibility of default, the country will have a debt ceiling, $\bar{D}$, which foreign creditors are unwilling to exceed.

The ceiling is defined as follows:

For any level of debt below the ceiling, $-B_2 = D_2 \leq \bar{D}$,

the creditors want to make sure that $\min \{(1+r)D_2, \eta(A_2 F(K_2) + K_2)\} = (1+r)D_2$

holds when the sovereign chooses K_2 optimally (to maximize domestic utility).

Debt ceiling II

Whether this holds or not depends on the optimal investment strategy, since the size of K_2 determines the size of $\eta(A_2 F(K_2) + K_2)$.

For instance, consider the effect of increasing the debt marginally to increase investment by increasing debt from some level $\hat{D}_2$. What is the minimum of $(1 + r)D_2$ and $\eta(A_2 F(K_2) + K_2)$?

- The first term is raised by $1 + r$
- while the second term is raised by $\eta(1 + A_2 F'(K_2))$.

For high enough levels of K_2, and therefore most likely $\hat{D}_2$, the increase in the last term will be so small that the minimum-condition may fail to hold (since $F'(K_2)$ is likely to fall in K_2).

Debt ceiling III

We can calculate $\bar{D}$ for a given utility function, production function, etc. (as in Section 6.2.1).
Steps you need to go through are:

- For a given level of $D_2 = -B_2$, what is the maximum utility of the country if it defaults $(= U^D(D_2))$?
- And what is the maximum level of utility if it repays the whole loan $(= U^N(D_2))$?
- Finally: Find the value $D_2 = \bar{D}$ for which $U^D(\bar{D}) = U^N(\bar{D})$.

Try to do this at home!

Debt ceiling IV

With the assumptions of O&R, the ceiling is

- Increasing in η
- Decreasing in r
- Increasing in the discount factor β
- Increasing in capital productivity α

Debt ceiling V

What happens if the country gets to borrow $\bar{D} + \Delta$? The optimal rate of investment will fall (a lot), since the country willl default in any case, making it less attractive to have period 2 output and assets. The fall will be discontinuous.
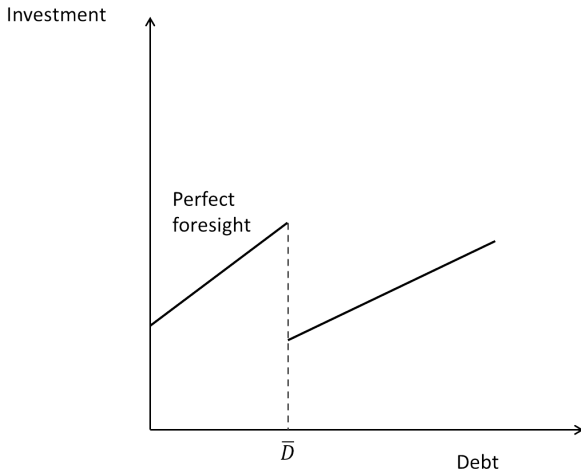
Debt ceiling VI

If future productivity, A_2, is stochastic, this may make the investment function continuous (see Figure 6.5 in O&R).
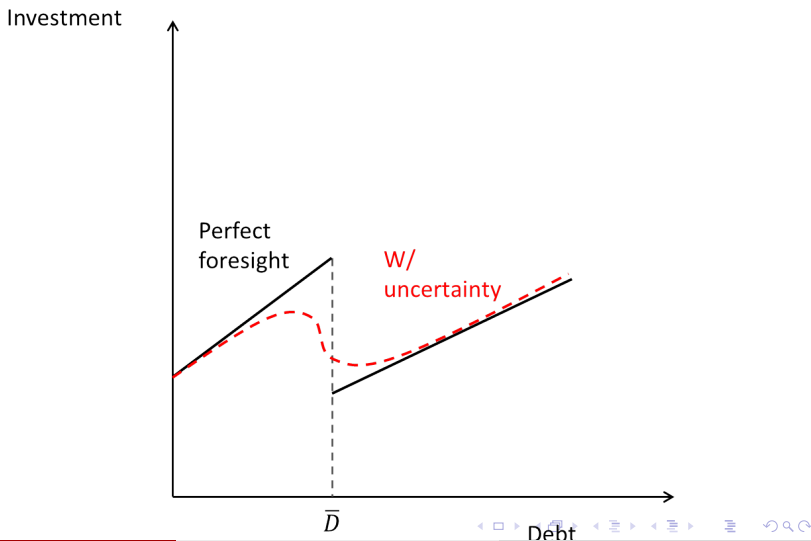
Debt ceiling VII

- **If** the country can credibly commit to a given level of investment *before* creditors are granting loans, this will partly ease the problems, but not fully.
- The fact that commitment may help is an example of **dynamic inconsistency**.
- The country may promise a high level of investment beforehand, but once the loans are granted, it is tempting to consume more instead. Rational creditors do not accept this, of course. Limits the possibility for pre-commitments.

Effect of a debt ceiling

A debt ceiling illustrates that presence of sovereign risk may limit a country's access to international borrowing. This will cause inefficiency if the debt ceiling is binding, since then the country is unable to invest the optimal amount.

Outline

1. Sovereign risk

2. Debt ceiling

3. Debt overhang

4. Debt Laffer curve and buybacks

5. Summary

Debt overhang

The second issue we'll discuss is the effect of starting out with a huge debt burden, and how sovereign risk will then impede growth.

In our two-period model, assume therefore that $-B_1 = D > 0$, so the country starts out with a given level of debt. Let the utility function be (the very simple)

$$U = C_1 + E(C_2)$$

and take period 1 output as given, while period 2 output is $A_2 F(K_2)$, where $K_2 = I_1$ (capital depreciates completely after one period) and A_2 is random. Further, assume that the world interest rate is zero ($r = 0$).

Debt overhang II

The period-by-period budget constraints facing the country are:

$$C_1 + K_2 = Y_1$$
$$C_2 = A_2 F(K_2) - \min[\eta A_2 F(K_2), D]$$

(Since utility is linear, it will never bother to borrow any extra from abroad)
Inserting for these conditions, the country will choose K_2 in order to maximize:

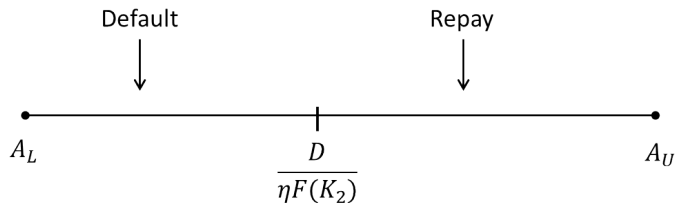$$Y_1 - K_2 + \mathbf{E_t} \{A_2 F(K_2) - \min[\eta A_2 F(K_2), D]\}$$

Debt overhang III

Assume that A_2 has distribution $\pi(A_2)$ over $A_2 \in [A_L, A_U]$ with $\mathbf{E_t}(A_2) = 1$. This makes $\mathbf{E_t}\{A_2 F(K_2)\} = F(K_2)$, such that the maximization problem is simply:

$$\max_{K_2} Y_1 - K_2 + F(K_2) - \mathbf{E_t}\{\min[\eta A_2 F(K_2), D]\}$$

Debt overhang IV

What is this expected value? For a given level of K_2, we understand that whether the country defaults or repays depends on A_2:

Debt overhang V

When it defaults, the creditors get $\eta A_2 F(K_2)$. If it repays, they get D. The expected value is therefore given by the function $V(D, K_2)$:

$$V(D, K_2) = \eta F(K_2) \int_{A_L}^{\frac{D}{\eta F(K_2)}} A_2 \pi(A_2) dA_2 + D \int_{\frac{D}{\eta F(K_2)}}^{A_U} \pi(A_2) dA_2$$

Interpretation? If productivity is high enough, debt is repaid and everything is fine. But if productivity is low, the country ends up defaulting. In those cases a share η of output is 'taxed' by foreign creditors.

Debt overhang VI

The effect of debt overhang can be seen from the first-order condition for K_2 (Need Leibniz rule):

$$F'(K_2) \left[1 - \eta \int_{A_L}^{\frac{D}{\eta F(K_2)}} A_2 \pi(A_2) dA_2 \right] = 1$$

(see p. 393 and footnote 43 in O&R).

The possibility of default makes the country invest less than the optimal amount (which would give $F'(K_2) = 1$).

Debt overhang VII

Intuition: Increasing investment has two effects:

- Investing increases output in the second period: Positive effect
- Investing increases what you must repay in the default state: Negative effect

This leads to too low investment

Debt overhang VIII

This shows how a large initial stock of debt depresses investment activity. Possibility of default creates an uncertain investment environment.

We will see this illustrated graphically in the next section.

# Outline

Debt Laffer curve

Realizing that countries may suffer from a debt overhang effect; what is it optimal for creditors to do? Consider the creditors of Greece. If they cut the debt by Δ this will have two effects on the value of debt(expected repayment):

- They have a direct loss of Δ if the loan is repaid
- But this may reduce the overhang effect, and make default less likely

The last effect can dominate!

Debt Laffer curve II

Implies a debt Laffer curve, as discussed by Krugman (1989) and Sachs (1989).

Value of debt, V
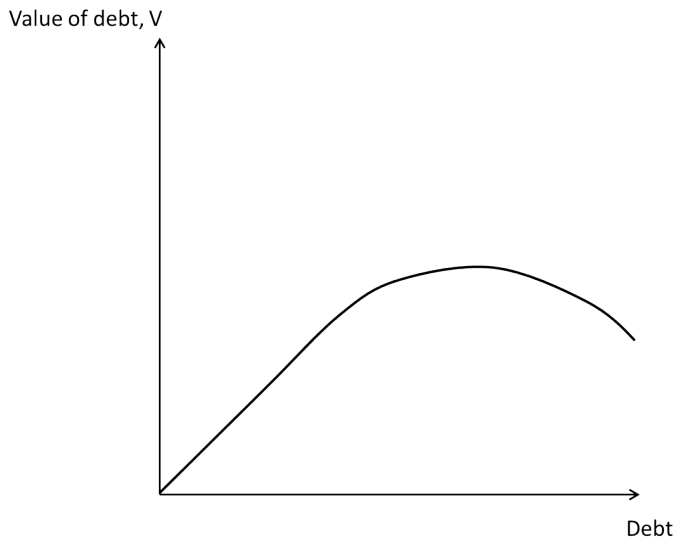
Debt

Debt Laffer curve III

Challenges:

- How to coordinate the debt writedown?
- No proper coordinator on the international level
- Even in Europe: very difficult

Debt buy-back

What about debt buy-backs?

When a country is likely to default, the value of the debt to creditors is low. That implies that the price of that debt in secondary markets, $p = \frac{V(D,K)}{D}$, is low.

So in theory a country could buy back it's own debt cheaply and reduce the debt burden. Everybody would be better off.

Debt buy-back II

Is that a good solution for heavily indebted countries? Not necessarily because:

- The country has to pay the 'average' price for its debt,
- while it only gains the 'marginal' price of debt, which is lower
- Still there is a positive overhang effect, so net effect may be positive, but not necessarily

Should be accompanied by creditor-concessions(discounts).

Debt buy-back III

The example of Bolivia from O&R is a good illustration.

	Pre	Post
Face value of debt	$670 million	$362 million
Price per dollar	0.06	0.11
Total market value	$40.2 million	$39.8 million

Since the market value is almost unchanged, the market evaluated Bolivia's position to be virtually unchanged.

Missing points that work in favor of debt-buy back:

- External effects of default
- Depressed govt bond markets may not give the correct prices

Debt buy-back IV

Did it work? List of credit events in Bolivia since 1988:

Month	Year
03	1988
11	1988
03	1990
01	1992
04	1993
03	1995
12	1995
10	1998
07	2001

Outline

Today

- Incentives to invest are distorted when some of the gains of your investment goes to creditors
- Commitment problems leads to too little borrowing and too little investment
- An inherited debt may cause too little investment
- Creditors may gain by giving up parts of their claim, but difficult to coordinate

Next time:

International financial markets

Read AR chapters 1-2