

# LEARNING OBJECTIVES

## 4. Debt and Default

- Describe how sovereign debt is a contingent claim in context of financial market penalties and broader macroeconomic costs.
- Determine the probability of default and the repayment threshold.
- Analyze how changes in debt burden and output volatility affect lending rate and probability of default.
- Analyze how changes in output volatility affect loan demand and loan supply.
- Analyze Argentina default case, 2001-2002.

# Debt and Default

- Overview

Historically, sovereign defaults occurred in today's advanced economies.

Today's advanced economies do not default, but emerging markets and developing countries do.

Puzzle: Why do emerging markets and developing countries get into default trouble at relatively low levels of debt?



The Granger Collection

Old style punishment: In response to a default, the French invaded and occupied Mexico in 1862.

# A Few Peculiar Facts about Sovereign Debt

- Repayment of debt a choice for borrowing government.
- Evaluate the costs and benefits associated with default versus repayment.

Benefit: country keeps the funds borrowed.

Cost: Financial market penalties.

Debtors that default are excluded from credit markets for some period after default, leaving them unable to finance investment or smooth consumption by borrowing.

Cost: Broader macroeconomic costs.

Lost investment, trade, and output associated with adverse financial market conditions arising from default.

# A Few Peculiar Facts about Sovereign Debt

- Summary

Sovereign debt is a **contingent claim**.

Government will repay only if the costs of default exceed the benefits.

With a simple model of this decision, we can better understand why countries default, and why emerging markets and developing countries default at lower levels of debt.

# A Model of Default, Part One: The Probability of Default

- Assumptions

Country will borrow to smooth its consumption.

Repayment contingent on losses from output fluctuations.

Fluctuations are exogenous, with output taking on some value between a minimum  $Y - V$  and a maximum  $\bar{Y}$ .

Government is the sole borrower, borrowing an amount  $L$ , at the lending rate,  $r_L$ .

Loan supplied by foreigners with access to funds from world capital market constant risk-free interest rate,  $r$ .

$L$  is repaid once the country knows the level of output in the current period.

# A Model of Default, Part One: The Probability of Default

- Borrower Chooses Default versus Repayment

Assume borrower suffers some cost associated with default,  $cY$ .

If government repays, it has output less the repayment of the debt:  $Y - (1 + r_L)L$

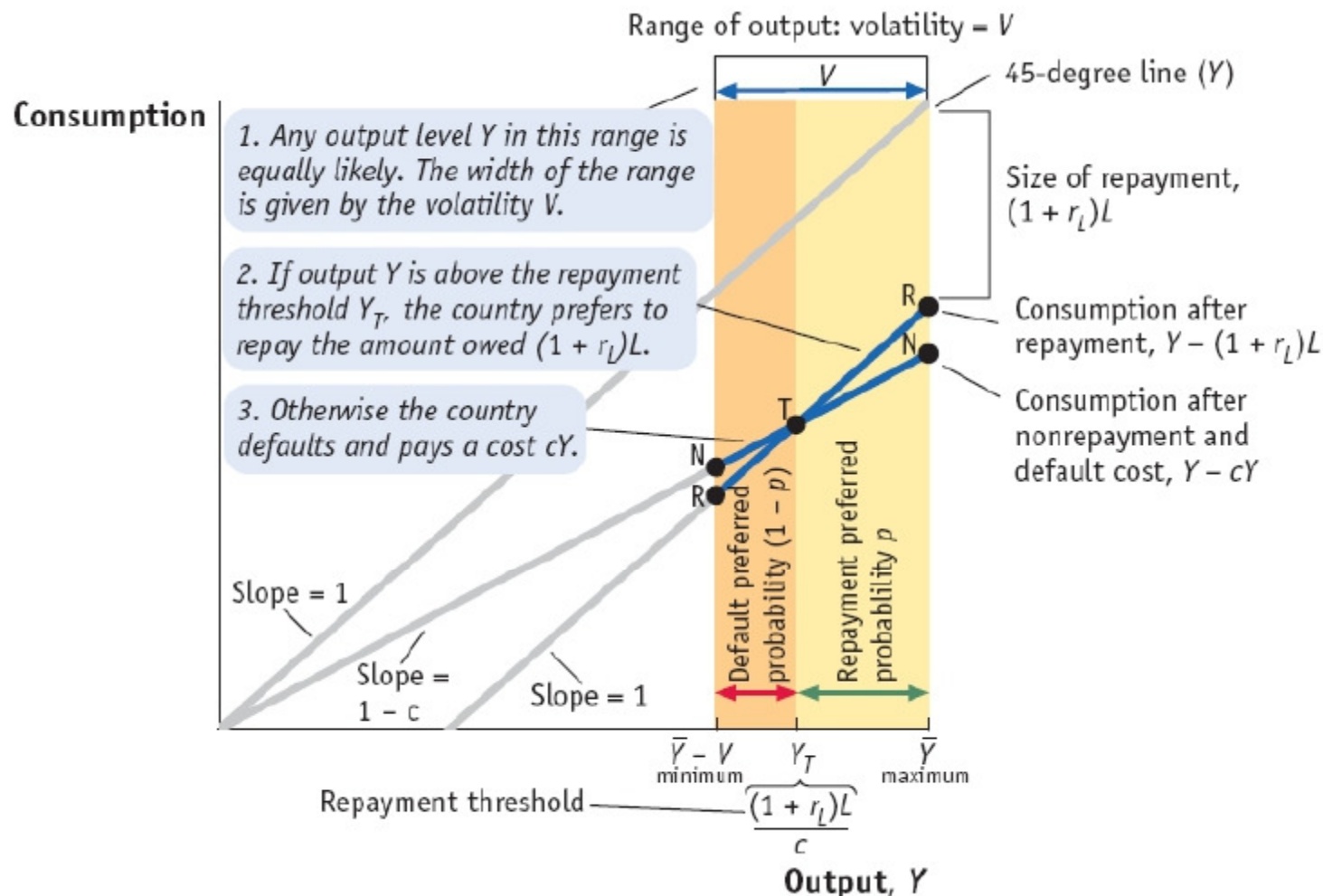
If the government defaults, it has output less the cost of default:  $(1 - c)Y$

Condition for repayment:

$$\text{Repay if } \underbrace{Y - (1 + r_L)L}_{\substack{\text{Consumption after repayment} \\ \text{(line RR)}}} > \underbrace{Y - cY}_{\substack{\text{Consumption after nonrepayment} \\ \text{and default (line NN)}}$$

# A Model of Default, Part One: The Probability of Default

- Borrower Chooses Default versus Repayment



# A Model of Default, Part One: The Probability of Default

- Borrower Chooses Default versus Repayment

Interpreting the diagram:

RR: repayment line, with slope = 1, where each extra dollar in output goes toward consumption.

NN: nonrepayment line, with slope =  $(1-c)$ , with each extra dollar in output, only  $(1-c)$  goes toward consumption.

Size of repayment region relative to the default region reveals the likelihood of repayment,  $p$ .

The value of  $p$  depends on two things:

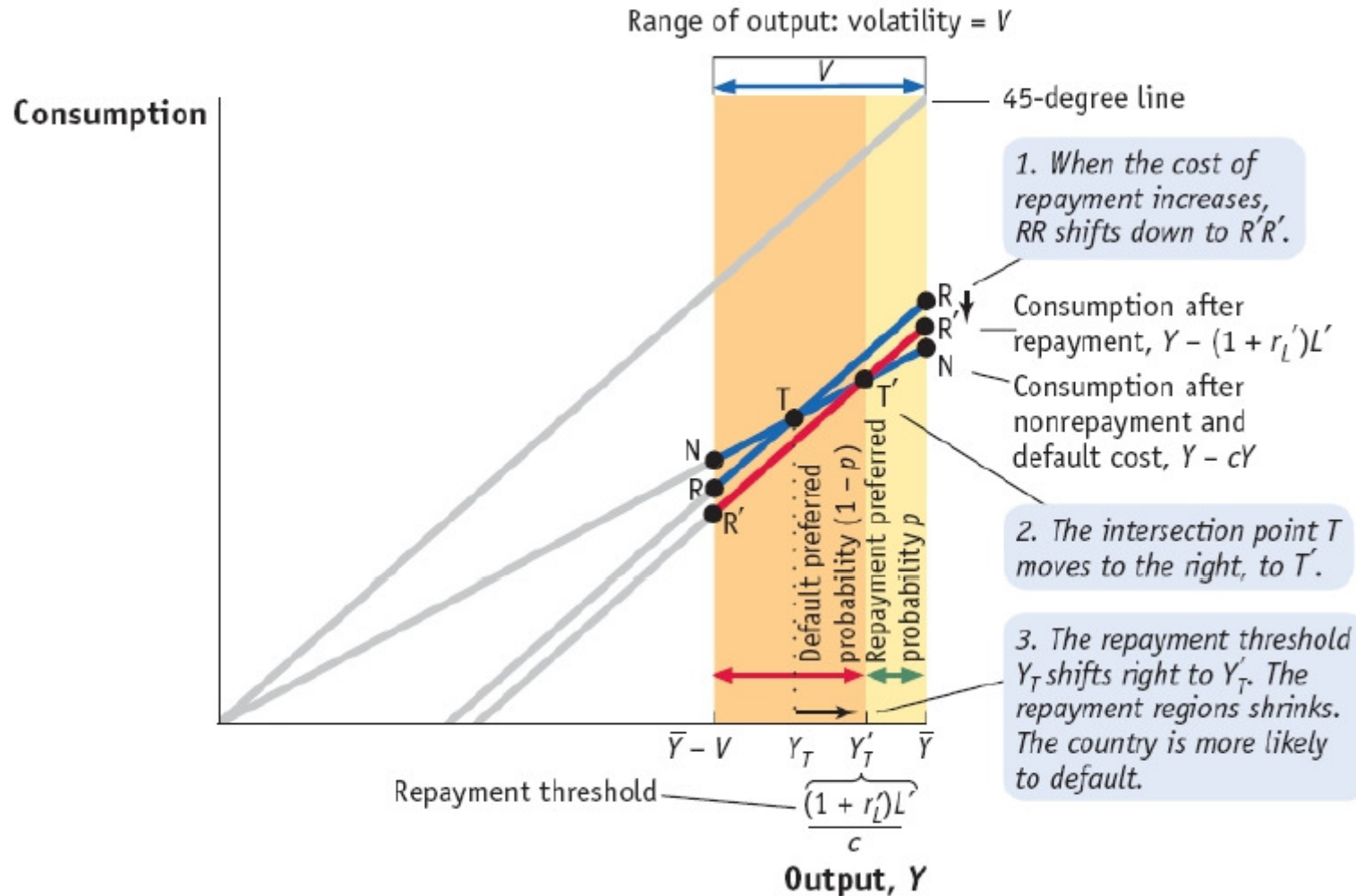
volatility of output and

how burdensome debt repayment is.



# A Model of Default, Part One: The Probability of Default

- An Increase in the Debt Burden



# A Model of Default, Part One: The Probability of Default

- An Increase in the Debt Burden

Interpreting the diagram:

The RR line shifts downward to R'R'.

The cost of repayment is higher.

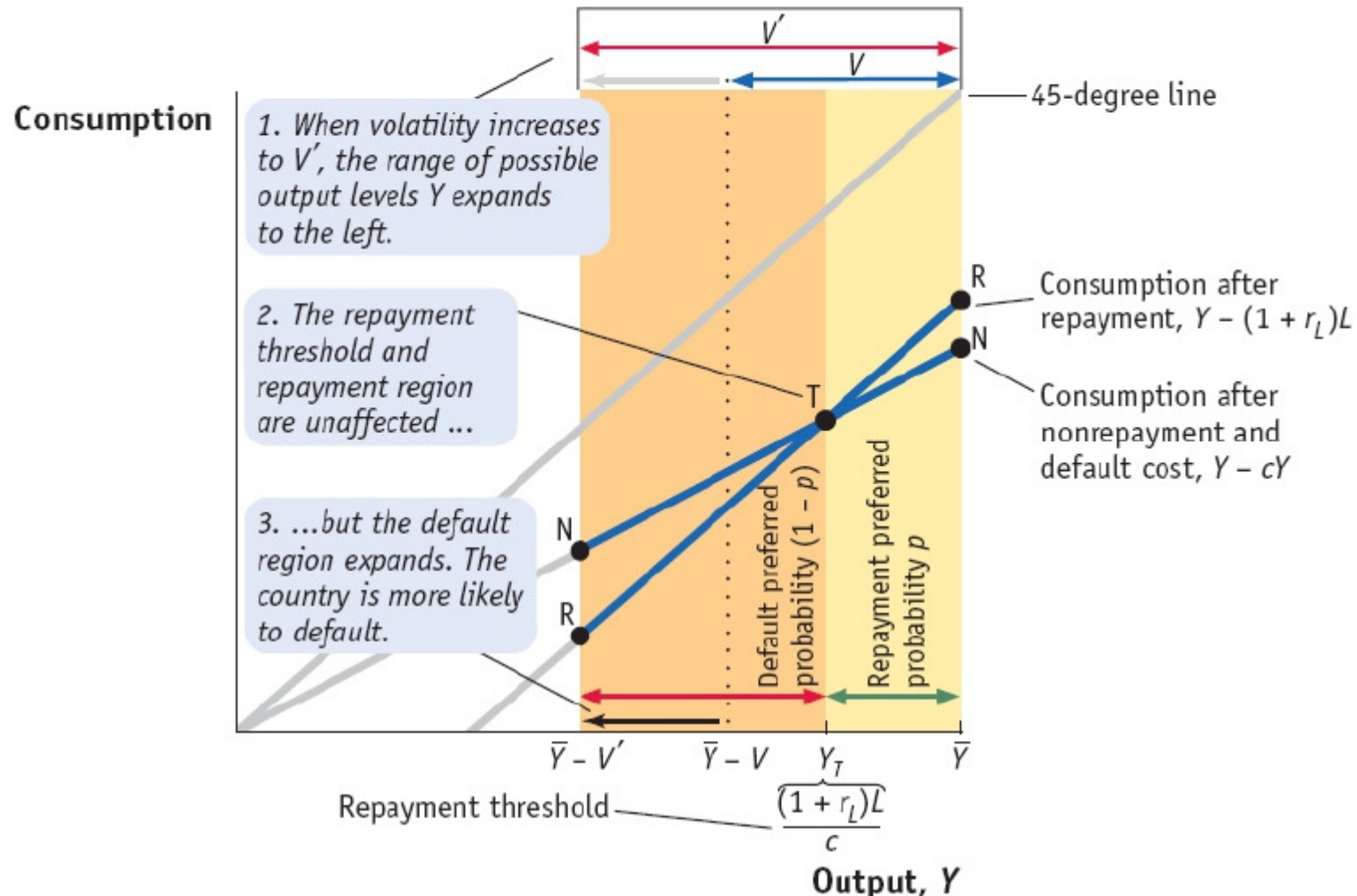
This increases the region where default is preferred to repayment.

The probability of repayment,  $p$ , decreases.

An exogenous decrease in debt burden would have the reverse effect, increasing the probability of repayment.

# A Model of Default, Part One: The Probability of Default

- An Increase in Volatility of Output



# A Model of Default, Part One: The Probability of Default

- An Increase in Volatility of Output

Interpreting the diagram:

Consumption levels along RR and NN are unaffected.

Potential for greater losses in output, making default more likely.

This increases the region where default is preferred to repayment, leaving the region where repayment is preferred unaffected.

The probability of repayment,  $p$ , decreases.

A decrease in output volatility will increase the probability of repayment.

# Summary

- We have seen that the probability of repayment depends on the total burden of the debt  $L$
- Given  $r_L$ , it is possible to determine the two limits of  $L$  for which the debt is repaid with a positive (but lower than 1) probability
- However, the interest rate  $r_L$  depends on the probability of default and this requires a different approach

# A Model of Default, Part One: The Probability of Default

- The Lender Chooses the Lending Rate

Competition in financial markets means that lenders will just break even, so the lender will set the interest rate such that the revenues exactly equal the costs:

Break-even condition for lender:

$$\underbrace{p}_{\text{Probability of repayment}} \times \underbrace{(1 + r_L)}_{\text{Lender's revenue if repaid}} = \underbrace{(1 + r)}_{\text{Lender's costs}}$$

Lender's expected revenue

The term on the left-hand side of the expression is the revenue the lender expects to collect.

The term on the right-hand side is the cost of forgone investment opportunities in financial markets.

# A Model of Default, Part Two: Loan Supply and Demand

- Loan Supply

When loan amount is low, less than some value  $L_v$ :

loan will be repaid with 100% probability

no risk premium,  $r_L = r$  and loan supply has zero slope.

When loan amount is high, above some value  $L_{MAX}$ :

loan amount will never be repaid (0% probability)

lending rate is infinite and loan supply curve has infinite slope at  $L_{MAX}$

# A Model of Default, Part Two: Loan Supply and Demand

- Loan Supply

As loan amount increases, above  $L_v$  (less than  $L_{MAX}$ ):

the probability of loan repayment decreases

lending rate increases with the risk premium, so  $r_L > r$

Loan supply curve has a positive slope above  $r$ .

- Loan Demand

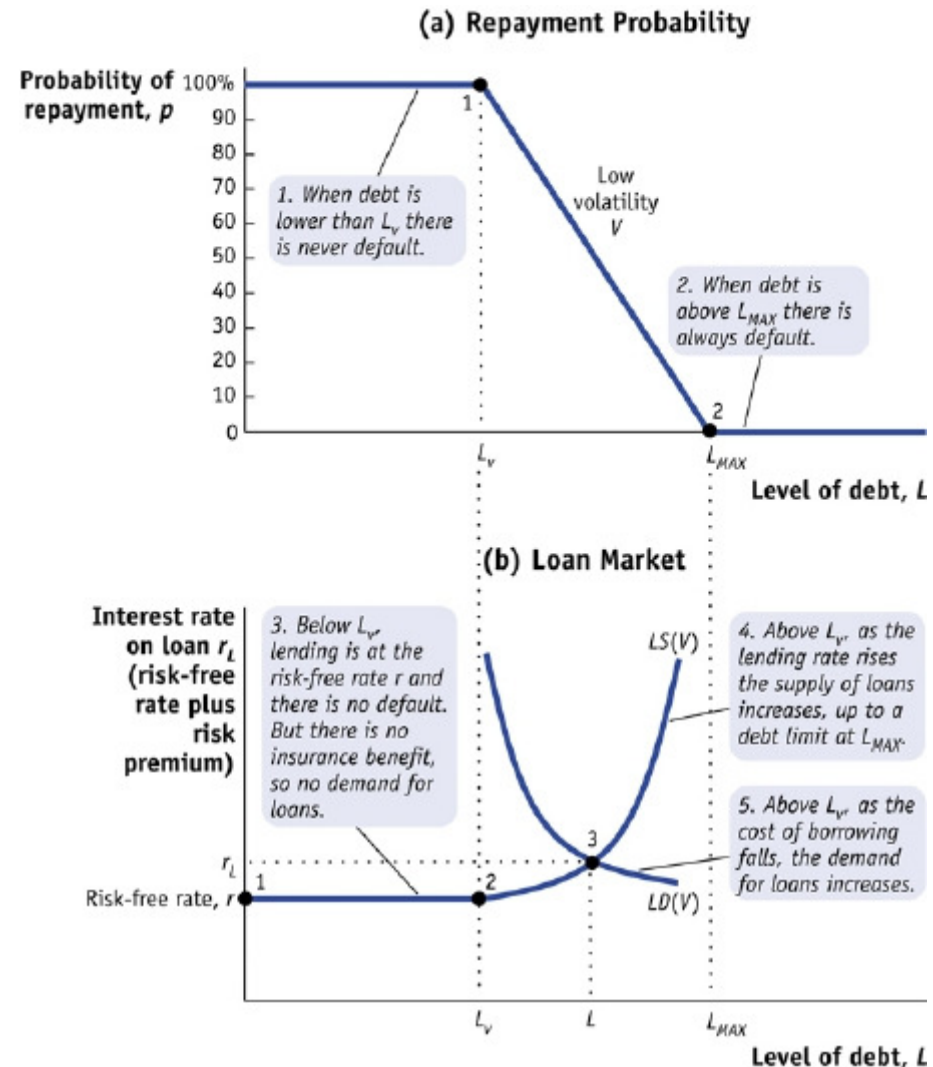
Slope of  $LD(V)$  depends on two factors: the lending rate,  $r_L$ , and output volatility,  $V$ .



# A Model of Default, Part Two: Loan Supply and Demand

- Loan Demand

Equilibrium is determined by the intersection of  $LD(V)$  and  $LS(V)$ . Equilibrium must lie between  $L_V$  and  $L_{MAX}$  because otherwise there would be no loans.



# A Model of Default, Part Two: Loan Supply and Demand

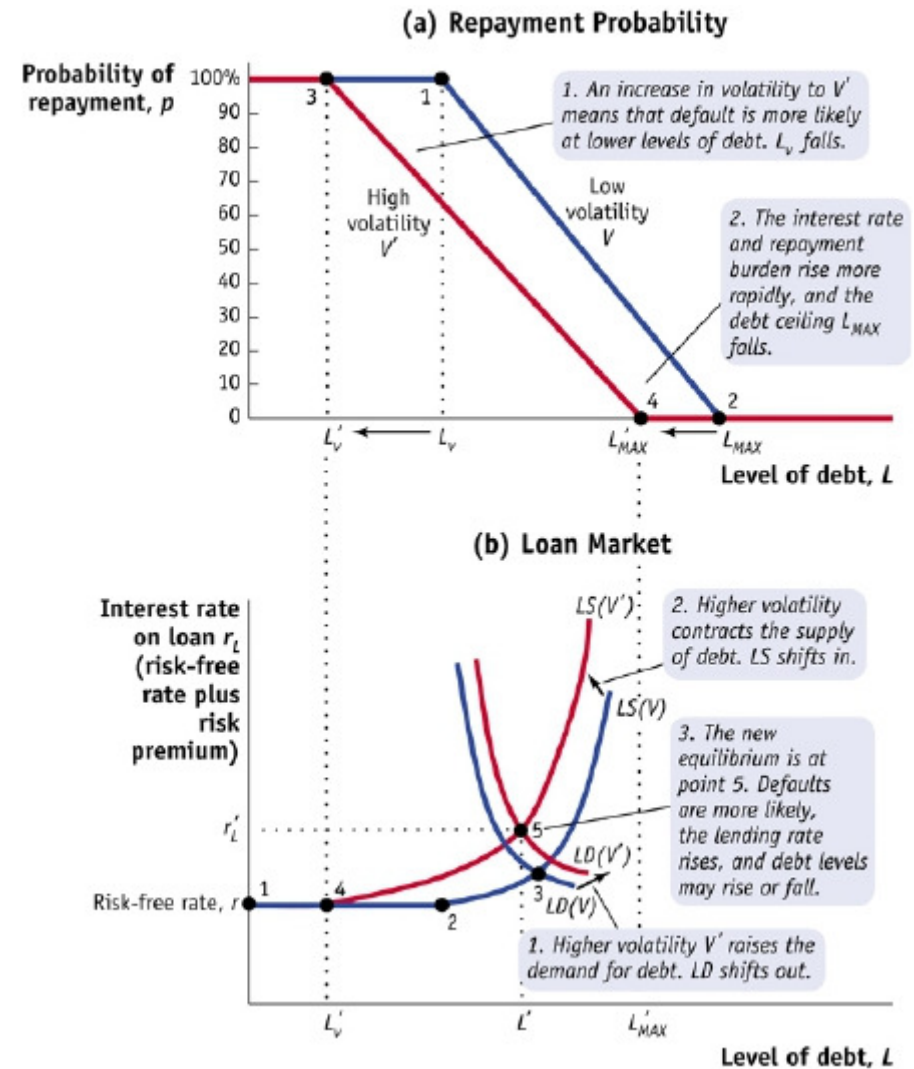
- Increase in Volatility

## Shifts

- Increase in probability of default.
- Loan supply decreases (lower repayment probability).
- Loan demand increases (higher output volatility).

## Changes in equilibrium

- Increase in lending rate.
- Ambiguous effect on amount borrowed.



# *The Costs of Default*

## APPLICATION

- Financial Market Penalties

Countries that default excluded from further borrowing until the default is resolved through negotiations with creditors.

Default is associated with a downgrade in credit ratings and an increase in risk premiums.

Defaulters may not be able to borrow in their own currency in the future.

Having a large share of external liabilities denominated in a foreign currency can be destabilizing.

# *The Costs of Default*

## **APPLICATION**

- **Broader Macroeconomic Costs and the Risk of Banking and Exchange Rate Crises**

Damage to domestic financial system creates potential for banking crises.

Domestic banks hold a large share of their bonds in government debt, pressured to hold an even larger share immediately before a default.

When banks face a shortfall in credit (because of sovereign default), bailout not an option.

Reduced financial intermediation limits investment, negative wealth effects, reducing consumption and output.

Potential to reduce international trade through disruption of availability of short-term credit.

# *The Costs of Default*

## **APPLICATION**

- **Broader Macroeconomic Costs and the Risk of Banking and Exchange Rate Crises**

Damage to domestic financial system creates potential for banking crises.

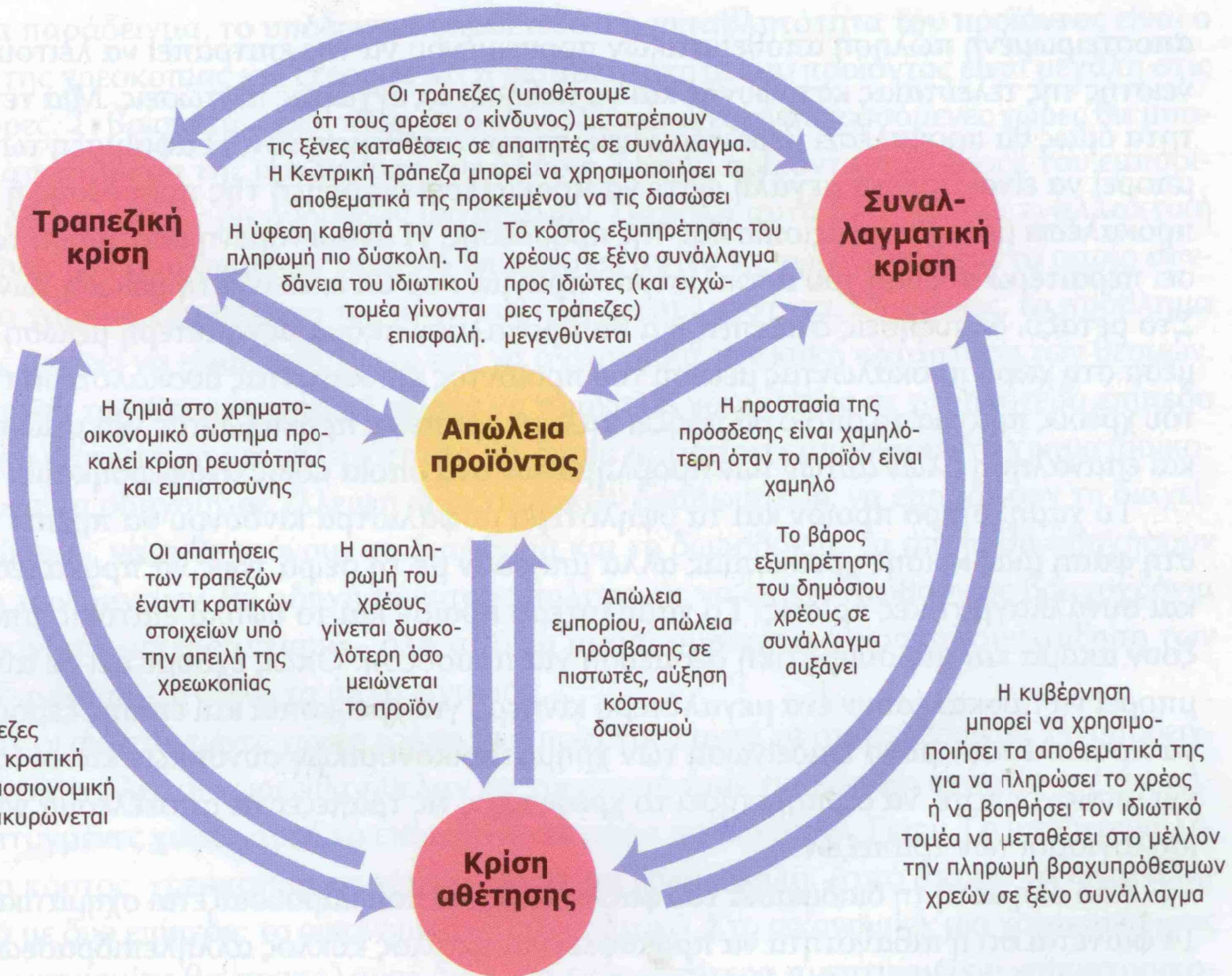
Increase in risk premiums on government loans increase in interest rates on bank deposits, especially if investors expect the exchange rate peg to break.

Central bank may be under pressure to conduct sterilized sale of reserves, to act as a lender of last resort.

Rising interest rates will reduce investment, making it harder for borrowers to honor private debts, further exacerbating the crises.



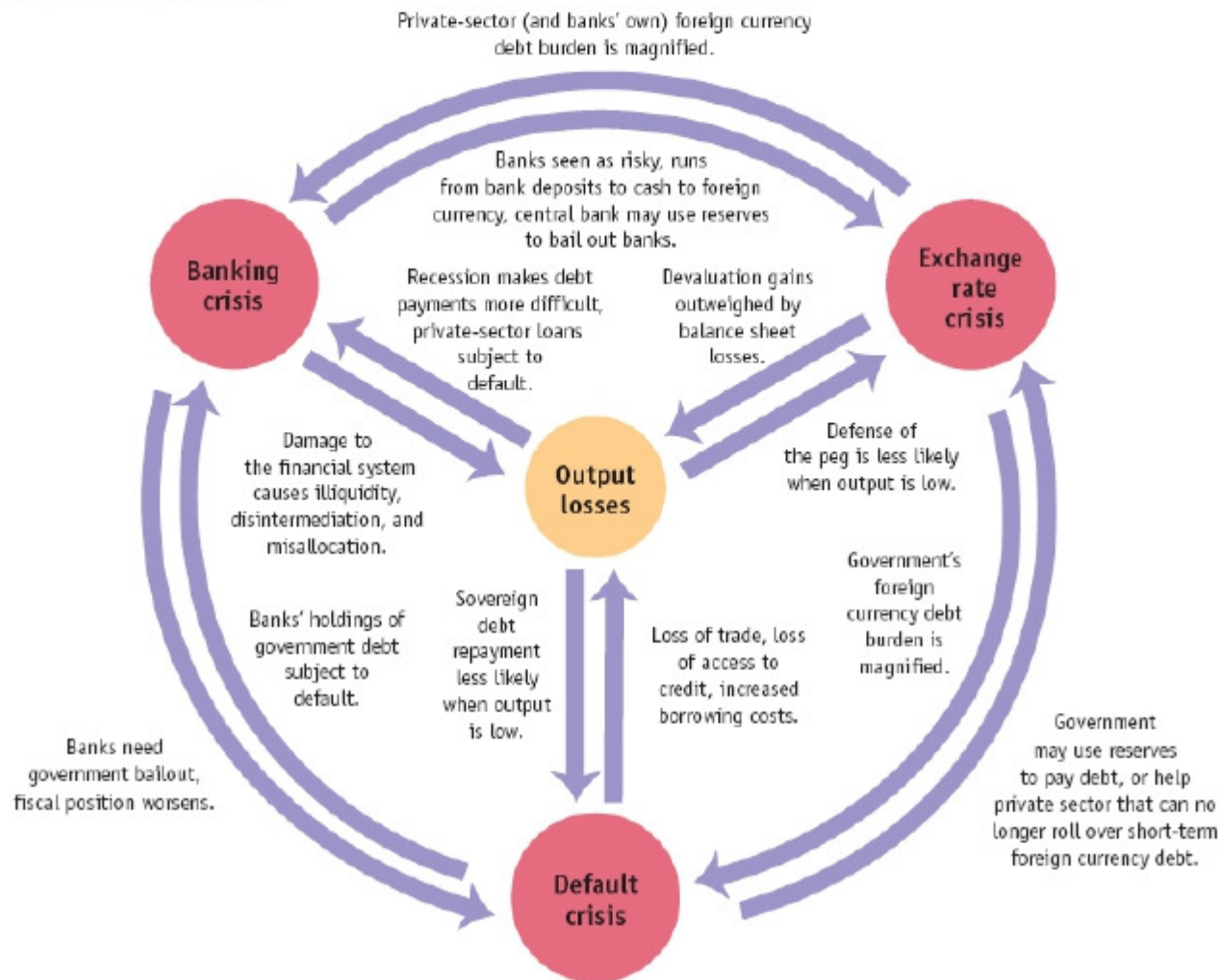
Το κόστος εξυπηρέτησης του χρέους σε ξένο συνάλλαγμα προς ιδιώτες (και εγχώριες τράπεζες) μεγενθύνεται





# The Costs of Default

## APPLICATION



# *The Costs of Default*

## APPLICATION

- Broader Macroeconomic Costs and the Risk of Banking and Exchange Rate Crises

Decrease in output and increase in risk premiums expected during a default crisis.

Triggers banking and exchange rate crises, making default more likely.

Type of Crisis	Number of Crises	Average Length (years)	Mean Cost per Year (% of GDP)
Default only	4	3	-1.0
Default and exchange rate crisis	13	5	10.3
Default and banking crisis	7	8	13.2
Triple crisis	21	10	21.7
All crises	45	8	15.1



# Conclusions

- Model sovereign debt as a contingent claim that the government will not repay if the costs of repayment exceed the benefits.
- Key implication: output volatility is a source of default.

Since output volatility tends to be higher in emerging markets and developing countries, this explains why they are more prone to default, even at lower levels of debt, relative to advanced economies.

# *The Argentina Crisis of 2001-02*

## **APPLICATION**

- **Background**

Convertibility Plan: 1-to-1 peg against U.S. dollar.

Argentine economy grew rapidly from 1994 up to 1998, with the government borrowing large amounts at low interest rates.

Argentina's external debt rose.

Emerging market risk premiums rose because of 1997 crisis in Asia, Russia sovereign default, and Brazil's depreciation.

Appreciation in U.S. dollar led to appreciation in Argentine peso. This coupled with higher interest rates and lower demand abroad led to recession.

# *The Argentina Crisis of 2001-02*

## *APPLICATION*

- Dive

Public debt soared. Government tax revenues declined and social expenditures increased during recession.

Foreign creditors saw deficits as unsustainable, risk premium on Argentina debt increased.

Bank balance sheets deteriorated with lower aggregate demand (loan defaults).

Threat to exchange rate peg.

Concern central bank would cutoff expansion of domestic credit to honor Convertibility Plan, pushing economy further into recession.

# *The Argentina Crisis of 2001-02*

## **APPLICATION**

- **Crash**

By mid-2001, foreign creditors abandoned Argentina. Sovereign default imminent.

Government tried to attract lenders by swapping short-term for long-term debt at high interest rate.

Investors did not respond much, realizing this would worsen Argentina's sovereign debt situation.

IMF loan in August 2001 made little difference.

Banks holding large amounts of government debt.

Since the dollar debt carried a high interest rate, both default of default risk and exchange rate risk.

Depositors knew banking crisis was more likely as exchange rate crisis was looming.

# *The Argentina Crisis of 2001-02*

## **APPLICATION**

- The End

November 2001: IMF and Argentine government could not agree on new loan conditions.

End of IMF assistance.

Government imposed capital controls (*corralito*) to stop capital flights from bank deposits.

This triggered political unrest, and threatened a coup.

President de la Rúa followed by numerous successors.

Default, peso left to float.

Banks were “pesified”, with large volumes of dollar liabilities that were no longer honored.

Taxes were raised, spending was cut, and the economy plunged deeper into recession.

# *The Argentina Crisis of 2001-02*

## APPLICATION

- Postscript

Since 2001, there have been no major crises, with many countries building up foreign exchange reserves.

IMF's handling of crises 1997-2001 led many to question its effectiveness.

Dramatic growth in international private flows may make the IMF's role as a lender of last resort obsolete.

Still, many reluctant to abandon only international release valve.

# *Is the IMF Pathetic?*

## ~~HEADLINES~~-----

- Background

Following Asian crisis in 1997 and Argentina's crises in 2001, politicians have continued to blame the IMF for the extent of the crises.

Korea and other East Asian countries have responded by stockpiling currency reserves as a cushion, avoiding the need for IMF bailouts.

Recent IMF policy decisions have led some to propose abolishing the institution.

IMF lending has decreased from \$81 billion in 2004 to \$11.8 billion in March 2007.

# *Is the IMF Pathetic?*

## ~~HEADLINES~~ -----

- Key Points

John Lipsky: “It’s ironic to my mind that people say the fund isn’t needed anymore because nothing in the global financial system is broken at the moment.”

Why are the IMF and World Bank needed?

IMF not set up to handle crises in the 1990s, but can be called upon the instant a crisis spreads from one country to another, as a sort of “fire brigade”.

While things may go wrong before and after IMF intervenes, it has the potential to improve the situation.

Persistent global imbalances suggest the IMF may be needed in the near future.



# Key Points

## Debt and Default

- Sovereign debt default is a contingent claim, based on the cost and benefits of default.
- Model shows how risk premium is determined and how default can be an equilibrium outcome.
- Many factors can precipitate default: triple crises.