

Lecture Twelve

International Financial Network and Policies

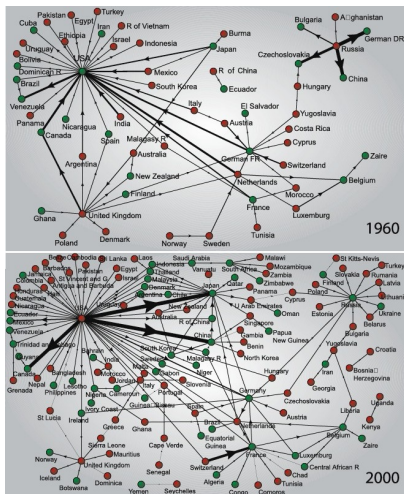
Fan Xiaoyan

SOE, Fudan University

Outline

1. International Economic Networks
 - 1.1 International Economic Networks
 - 1.2 Basics of Network
 - 1.3 Look into the Financial Networks
2. Understanding the Financial Crisis with Networks
 - 2.1 Financial Network: Formation and Characteristics
 - 2.2 Shin(2012): Global Banking Glut
 - 2.3 Using the Network for Policy
3. International Policy and Global Strategies
 - 3.1 Game of Currency Policy among Countries
 - 3.2 Strategies of Countries

Trade Network: 1960 and 2000



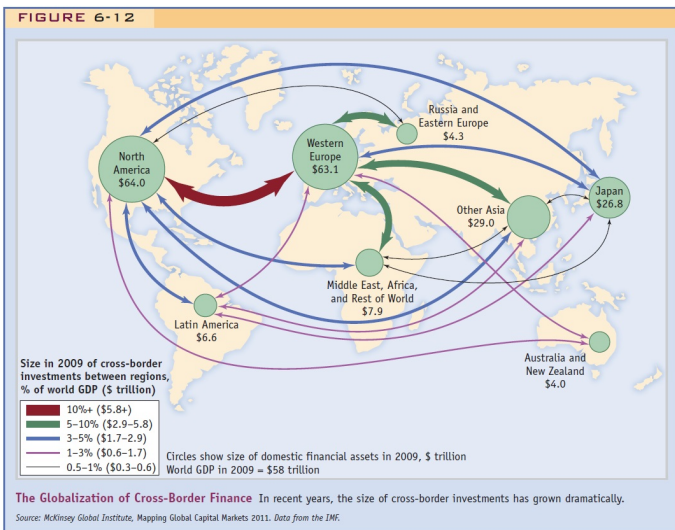
Source: Serrano, M.Á., M. Boguñá, and A. Vespignani, 2007, Patterns of dominant flows in the world trade web, *Journal of Economic Interaction and Coordination*, Vol.2(2), P111-124

Migration Network: 2000



Source: Fagiolo, G. and M. Mastrorillo, 2014, Does human migration affect international trade? A complex-network perspective, *PloS One*, Vol.9(5), e97331

Financial Network: 2009



What is Network?

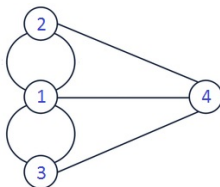
- Seven Bridges of Königsberg



- Definition:

- **Nodes (or Vertices):** $\mathbf{N} = \{1, 2, \dots, N\}$
- **Links (or Edges):** Matrix(or Set) with elements $g_{ij} \in \mathbb{R}$ representing the relationship between nodes $i, j \in \mathbf{N}$
- **Network (or Graph):** $G = (\mathbf{N}, g)$

Network of the Seven Bridges: $G = (\mathbf{N}, g)$



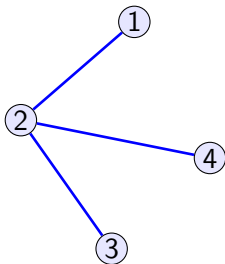
- Nodes: $\mathbf{N} = \{1, 2, 3, 4\}$

- Links:

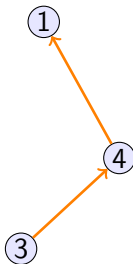
$$g = \begin{bmatrix} 0 & 2 & 2 & 1 \\ 2 & 0 & 0 & 1 \\ 2 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}, \quad g = \{12, 12, 13, 13, 14, 24, 34\}$$

Categories of Networks

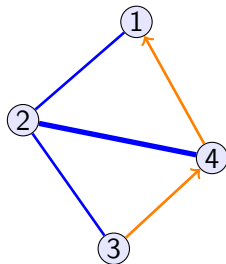
- **Weightless** ($g_{ij} \in \{0, 1\}$, $g_{ii} = 0$) vs. **Weighted** ($g_{ij} > 0$)
- **Undirected** ($g_{ij} = g_{ji}$) vs. **Directed** ($g_{ij} \neq g_{ji}$)



(a) Undirected

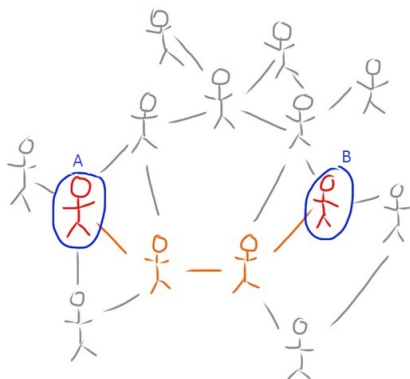
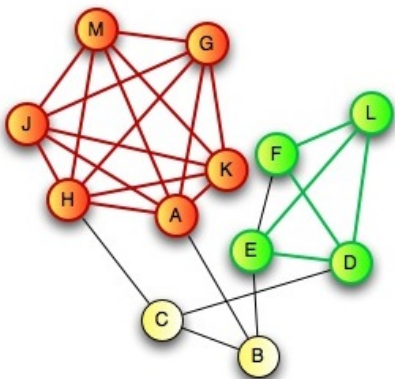


(b) Directed



(c) Mixed and Weighted

Clique and Shortest Path



Measure the Importance of Nodes: Centrality

- Degree centrality:

$$C_i^d = \frac{d_i}{N-1}$$

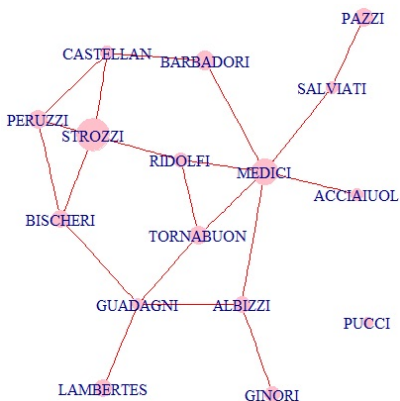
- Betweenness centrality: a measure of centrality in a graph based on shortest paths.

$$C_i^b = \sum_{k \neq j, i \notin (k,j)} \frac{P_i(kj)/P(kj)}{(N-1)(N-2)/2}$$

where $P(kj)$ is the total number of shortest paths from k to j , and $P_i(kj)$ is the number of those paths that pass through i .

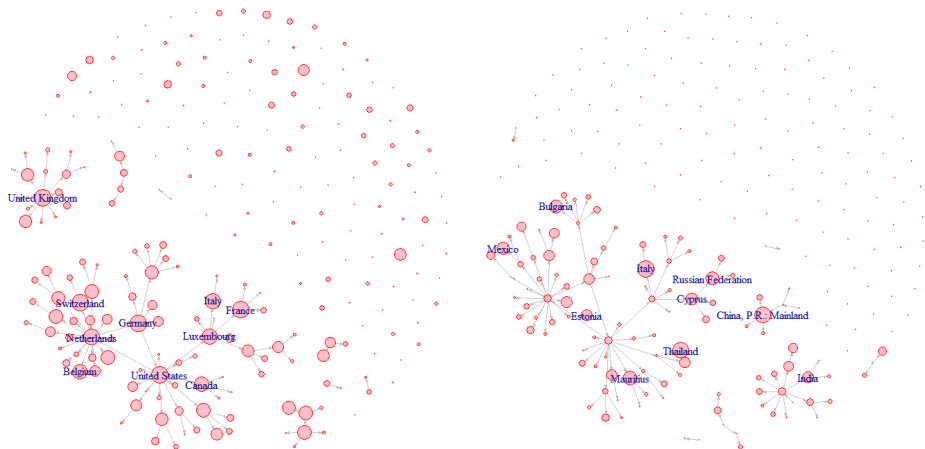
Example: Why did the Medici family rise?

Among the families in Florence in the 15th century, Medici was not as wealthy as Strozzi, but Medici had the highest Betweenness Centrality in the marriage network of the families.



Note: Data "florentine" in R package "ergm", with original data from Padgett and Ansell(1993). The node size represents the wealth of families.

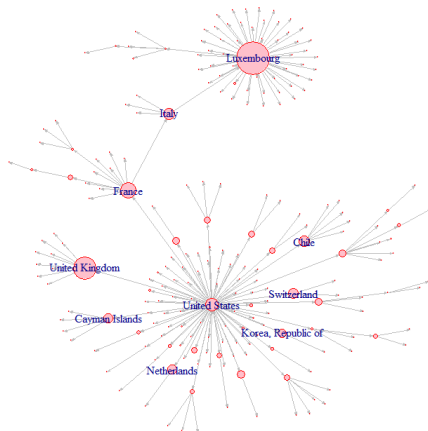
International Direct Investment: 2017



Data Source: Coordinated Direct Investment Survey(CDIS), IMF.

Note: The nodes size indicates the centrality of out-degree(left) and in-degree(right) respectively.

International Portfolio Investment: 2017



Data Source: Coordinated Portfolio Investment Survey, IMF.

Note: The nodes size indicates the betweenness centrality.

International Financial Network: Inter-institutions

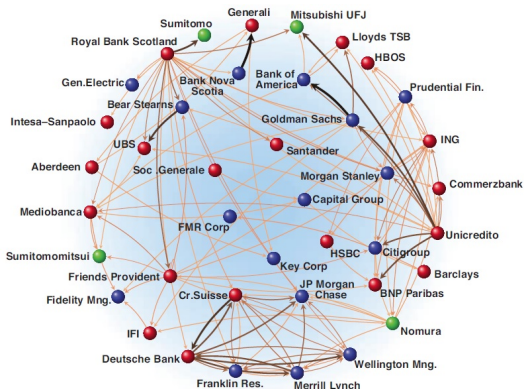
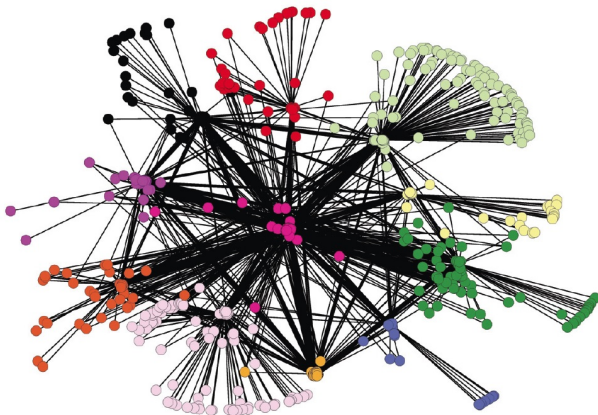


Fig. 2. A sample of the international financial network, where the nodes represent major financial institutions and the links are both directed and weighted and represent the strongest existing relations among them. Node colors express different geographical areas: European Union members (red), North America (blue), other countries (green). Even with the reduced number of links displayed in the figure, the network shows a high connectivity among the financial institutions that have mutual share-holdings and closed loops involving several nodes. This indicates that the financial sector is strongly interdependent, which may affect market competition and systemic risk and make the network vulnerable to instability.

Sources: Schweitzer et al.(2009).

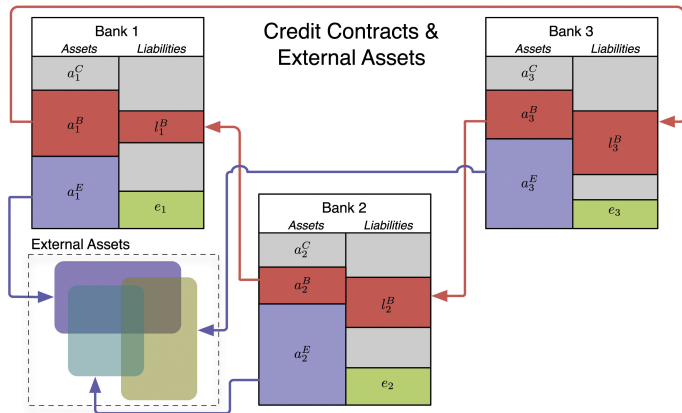
International Financial Network: Interbank



Source: Boss, M., H. Elsinger, M. Summer, and S. Thurner, 2004, Network topology of the interbank market, *Quantitative Finance*, Vol.4(6), P677-684

Note: The Austrian interbank network. Clusters are grouped and colored. The core of the sectors' head institutions are connected to each other and connected to their peripheral affiliated institutions.

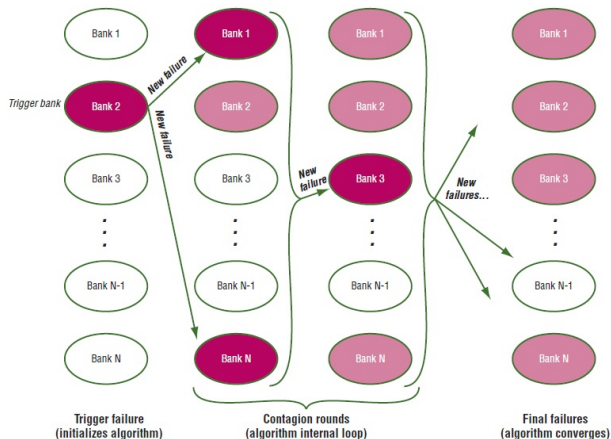
From Balance Sheet to Financial Network



Source: Battiston, S., G. Caldarelli, R.M. May, T. Roukny, and J.E. Stiglitz, 2016, The price of complexity in financial networks, *PNAS*, Vol.113(36), P10031-10036

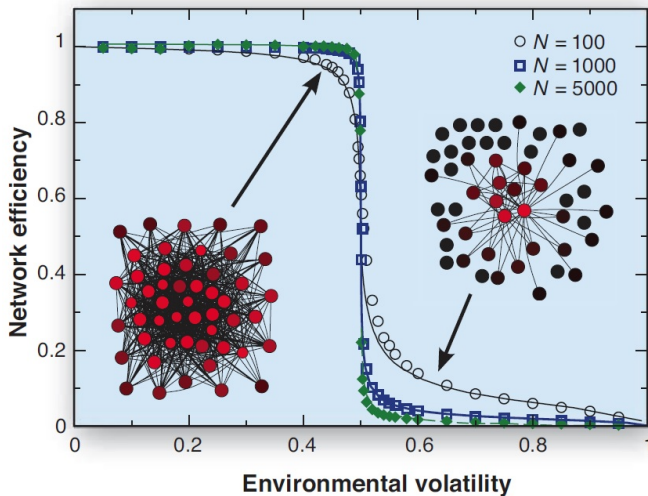
Note: Credit contracts are represented as arrows (pale red) from the lender to the borrower. Pale blue arrows represent investment in assets issued by entities external to the banking system.

Contagion on the Network



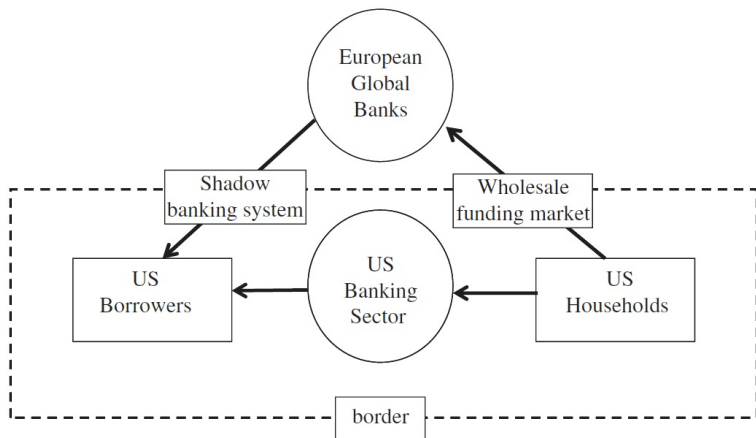
Sources: IMF(2009), Figure 2.1. This figure depicts the dynamics of the network analysis. Starting with a matrix of interbank exposures, the analysis consists of simulating shocks to a specific institution (the trigger bank) and tracking the domino effect to other institutions in the network.

Tipping Point of Network: Efficiency vs. Stability



Sources: Schweitzer et al.(2009).

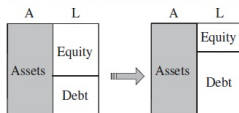
European Global Banks and U.S. Banking System



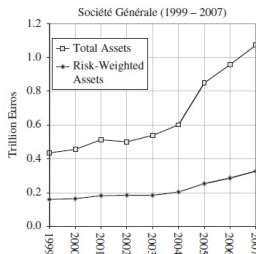
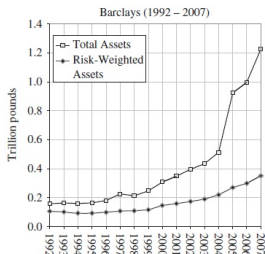
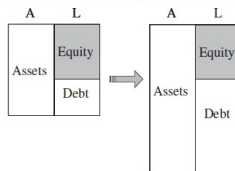
Note: Shin(2012) Figure 1. "European Global Banks Add Intermediation Capacity for Connecting U.S. Savers and Borrowers".

Leveraging Up and Acculation of Risky Assets

Mode 1: Increased leverage with assets fixed

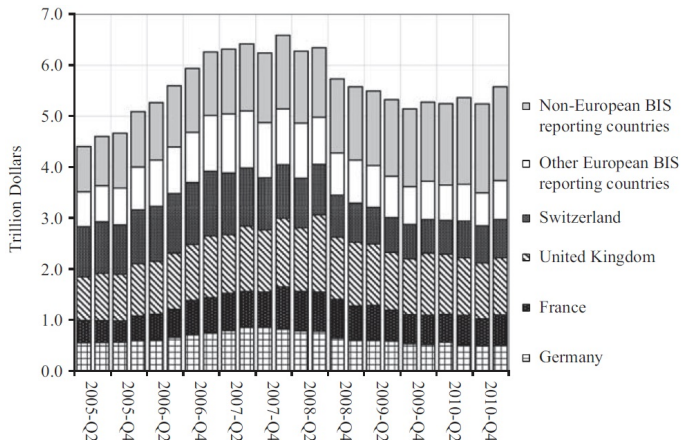


Mode 2: Increased leverage via asset growth



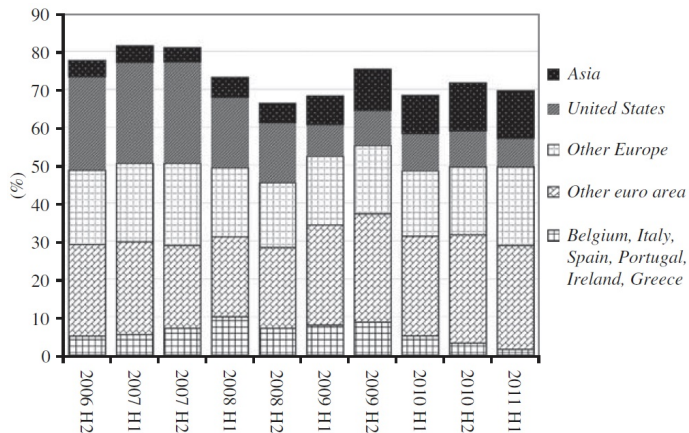
Note: Shin(2012) Figure 3 “Two Modes of Leveraging Up”, and Figure 4 “Total Assets and Risk-Weighted Assets of Barclays and Société Générale”.

Foreign Bank Claims on U.S. Counterparties



Note: Shin(2012) Figure 8, "Foreign Claims of BIS Reporting Banks on U.S. Counterparties", data from BIS consolidated banking statistics, Table 9D.

Amount Owed by Banks to U.S. Prime MMFs

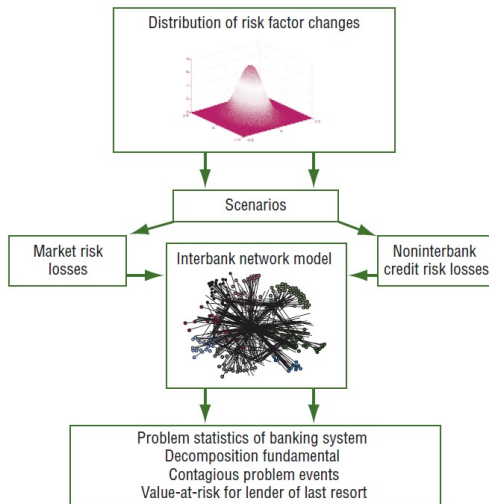


Note: Shin(2012) Figure 12 "Amount Owed by Banks to U.S. Prime Money Market Funds (% of Total), Based on Top 10 Prime MMFs, Representing \$755 Billion of \$1.66 Trillion Total Prime MMF Assets, Classified by Nationality of Borrowing Bank", originally from IMF GFSR September 2011, data from Fitch.

Shin(2012): Global Banking Glut

- **European global banks** intermediating U.S. dollar funds are important in influencing credit conditions in the United States.
- U.S. dollar-denominated assets of banks outside the United States are comparable in size to the total assets of the U.S. commercial bank sector, but the large gross cross-border positions are masked by the netting out of the gross assets and liabilities. As a consequence, **current account imbalances do not reflect the influence of gross capital flows on U.S. financial conditions.**
- The culprit for the easy credit conditions in the United States up to 2007 may have been the **“Global Banking Glut”** rather than the **“Global Savings Glut.”**

Using the Network for Policy

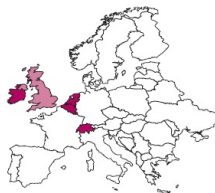


Sources: IMF(2009), Figure 2.14 "Basic Structure of the Systemic Risk Monitor Model", originally from Central Bank of Austria (OeNB).

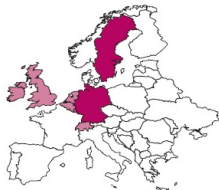
Contagion Path Triggered by the U.K. Failure



Panel 1 (trigger failure)
Affected Countries: United Kingdom



Panel 2 (1st contagion round)
Affected Countries: United Kingdom, Belgium,
Ireland, Netherlands, Switzerland



Panel 3 (2nd contagion round)
Affected Countries: United Kingdom, Belgium,
Ireland, Netherlands, Switzerland, Sweden, Germany

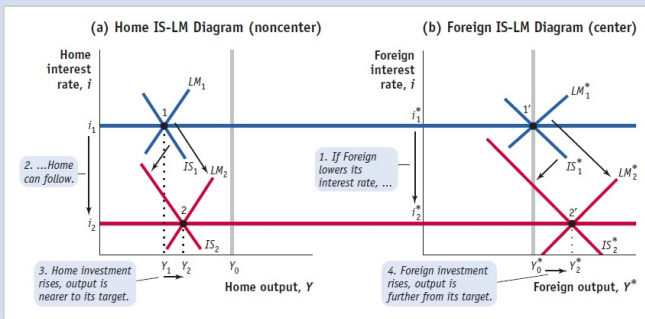


Panel 4 (final round)
Affected Countries: United Kingdom, Belgium,
Ireland, Netherlands, Switzerland, Sweden, Germany, France

Sources: IMF(2009), Figure 2.4.

Interest Rate Policies by the Center Country

FIGURE 8-11



Cooperative and Noncooperative Interest Rate Policies by the Center Country In panel (a), the noncenter home country is initially in equilibrium at point 1 with output at Y_1 , which is lower than desired output Y_0 . In panel (b), the center foreign country is in equilibrium at its desired output level Y_0^* at point 1'. Home and Foreign interest rates are equal, $i_1 = i_1^*$, and Home is unilaterally pegged to Foreign. Foreign has monetary policy autonomy. If the center country makes no policy concession, this is the noncooperative outcome.

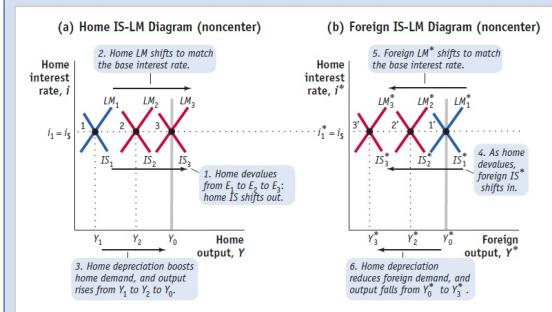
With cooperation, the foreign country can make a policy concession and lower its interest rate and home can do the same and maintain the peg. Lower interest rates in the other country shift each country's IS curve in, but the easing of monetary policy in both countries shifts each country's LM curve down. The net effect is to boost output in both countries. The new equilibria at points 2 and 2' lie to the right of points 1 and 1'. Under this cooperative outcome, the foreign center country accepts a rise in output away from its desired level, from Y_0^* to Y_2^* . Meanwhile, Home output gets closer to its desired level, rising from Y_1 to Y_2 .

Noncooperative Policies to Trigger Crisis

- In the crisis of 1992 the German Bundesbank ignored pleas from Italy, Britain, and other countries for an easing of German monetary policy as recessions took hold in the bloc of countries pegging to the German mark. When the test of cooperation came along, Germany wanted to stabilize Germany's output, and no one else's. Thus, even in a group of countries as geographically and politically united as the European Union, it was tremendously difficult to make this kind of cooperation work.
- The United States took the same position in the Plaza Accord in 1985. Japan was forced to get yen appreciated, and to bear the cost of the depression and bubble crisis afterwards.

Exchange Rate Adjustments by Noncenter Countries

FIGURE 8-12



Cooperative and Noncooperative Exchange Rate Adjustments by Noncenter Countries In panel (a), the noncenter home country is initially in equilibrium at point 1 with output at Y_1 , which is lower than desired output Y_0 . In panel (b), the noncenter foreign country is in equilibrium at its desired output level Y_0^* at point 1'. Home and Foreign interest rates are equal to the base (dollar) interest rate and to each other, $i_1 = i_1^* = i_s$, and Home and Foreign are unilaterally pegged to the base.

With cooperation, Home devalues slightly against the dollar (and against foreign) and maintains a peg at a higher exchange rate. The Home interest and Foreign interest rates remain the same. But the Home real depreciation causes Home demand to increase: IS shifts out to IS₂. This is also a Foreign real appreciation, so foreign demand decreases: IS^{*} shifts in to IS₂^{*}. Under this cooperative outcome at points 2 and 2', foreign accepts a fall in output away from its desired level, from Y_0^* to Y_2^* . Meanwhile, Home output gets closer to its desired level, rising from Y_1 to Y_2 .

With noncooperation, Home devalues more aggressively against the dollar. After a large Home real depreciation, IS shifts out to IS₃ and IS^{*} shifts in to IS₃^{*}. Under this noncooperative outcome at points 3 and 3', Home gets its desired output Y_0 by "exporting" the recession to foreign, where output falls all the way to Y_3^* .

Noncooperative Policies to End Fixed FX System

- The noncooperative policy between non-center countries is also called a **beggar-thyneighbor policy**, where the Home can improve its position at the expense of Foreign and without Foreign's agreement.
- If Home engages in such a policy, it is possible for Foreign to respond with a devaluation of its own in a **tit-for-tat** way. If this happens, the pretense of a fixed exchange rate system is over.
- For example, the British pound and the Italian lira devalued against the dollar and later the German mark on numerous occasions from the 1960s to the 1990s.

Discussion

Please watch the videos and discuss with your friends on the following topics:

- In *The Ascent of Money*, Professor Ferguson put forward the concept of **Chimerica**. What do you think about the economic relationship between China and the United States in the future?
- President Xi proposed **the Belt and Road Initiative(BRI)** as a global development strategy in 2013. What's your comment on the strategy?