Financial Contagion: What do we Mean? What do we Know?

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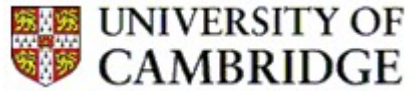


Roadmap for seminar

1. Introduction – Definitions of Contagion
2. Why does Contagion arise: Theory
3. Contagion Case Studies
4. Empirical Evidence
5. Generalisations by Asset Market
6. Contagion in Developed and Developing Markets
7. Summary and Policy Implications

1.Introduction and background

Background factors

- Financial crises seem to occur together
- Observe big shifts in financial markets
  - Large changes in exchange rates: SE Asian crises 1997-1998
  - Large changes in equity prices (October 1987 DJIA crash, 2000 dot.com bubble burst)
  - Shifts in bond markets: Russian crisis 1998, Brazil 1999
- Policy concern is that they occur across many countries – HOW?

Some important recent dates

- Devaluation of Mexican peso – 20 Dec 1994
- Devaluation of Thai baht – 2 July 1997
- Russian default – 17 August 1998
- LTCM recapitalisation begins – 23 Sept 1998
- Hong Kong stock market crash – 28 Oct 1998
- Brazil devaluation – 13 Jan 1999
- Collapse of Argentine currency board – Dec 2001
- Brazil – runup to presidential election – 2003

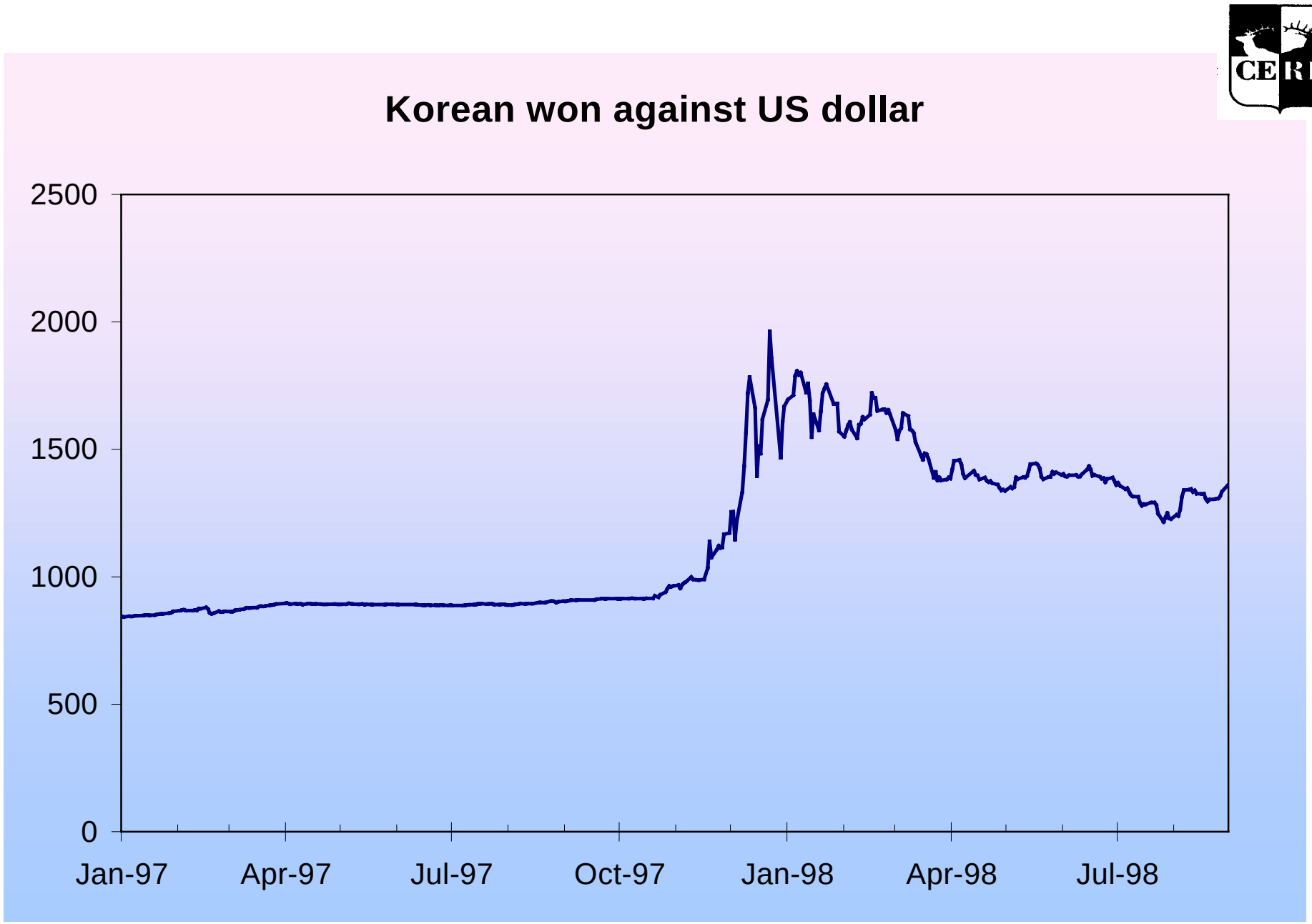
And some that didn't seem to attract as much attention

- US and EU dot.com collapse – April 2000
- Brazilian election – October 2002
- Turkey banking and currency crises – 2000

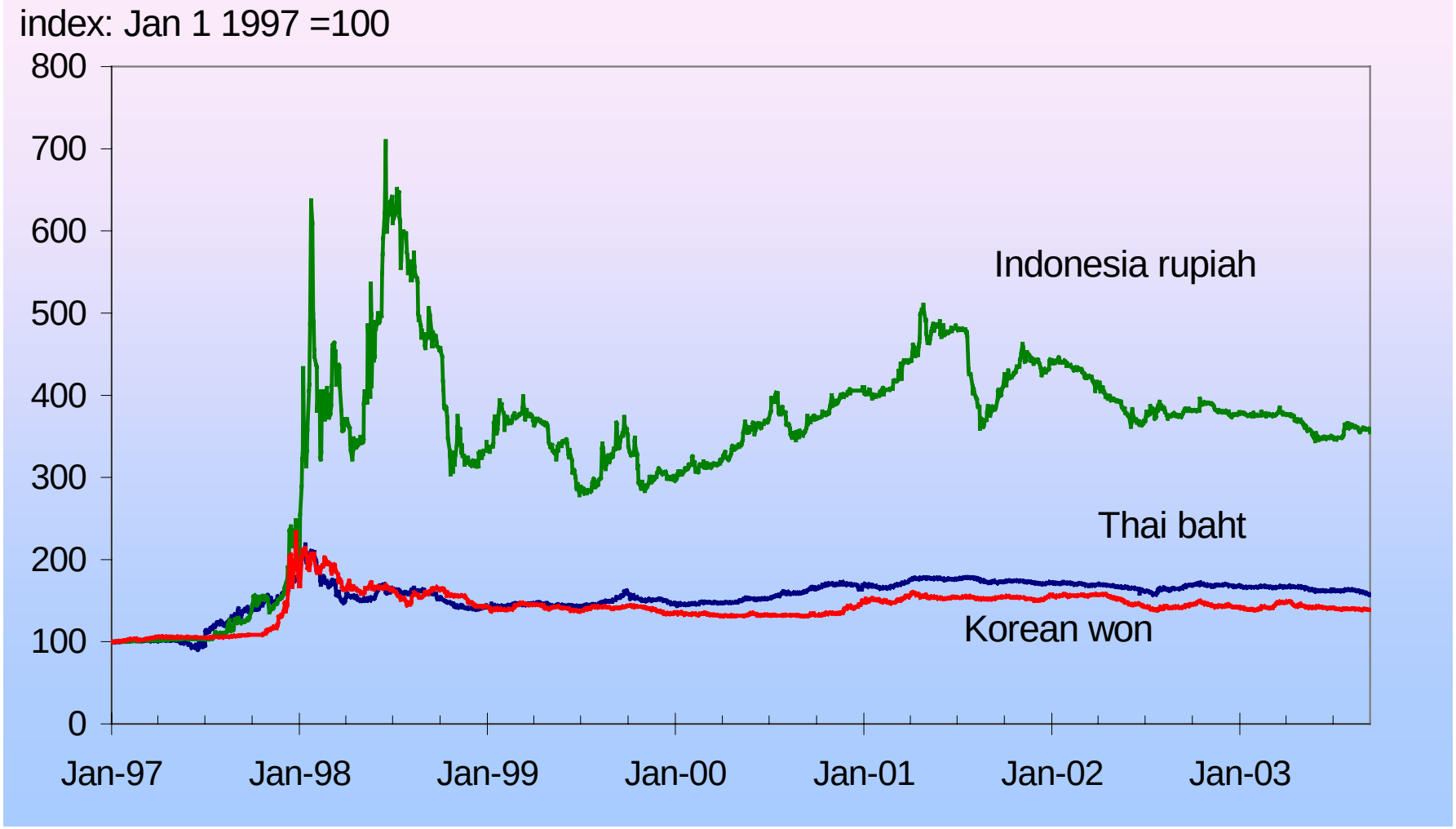
- What will be the final outcome for the current Argentine problems – seems no contagion

Thai baht against US dollar

Indonesian rupiah against US dollar

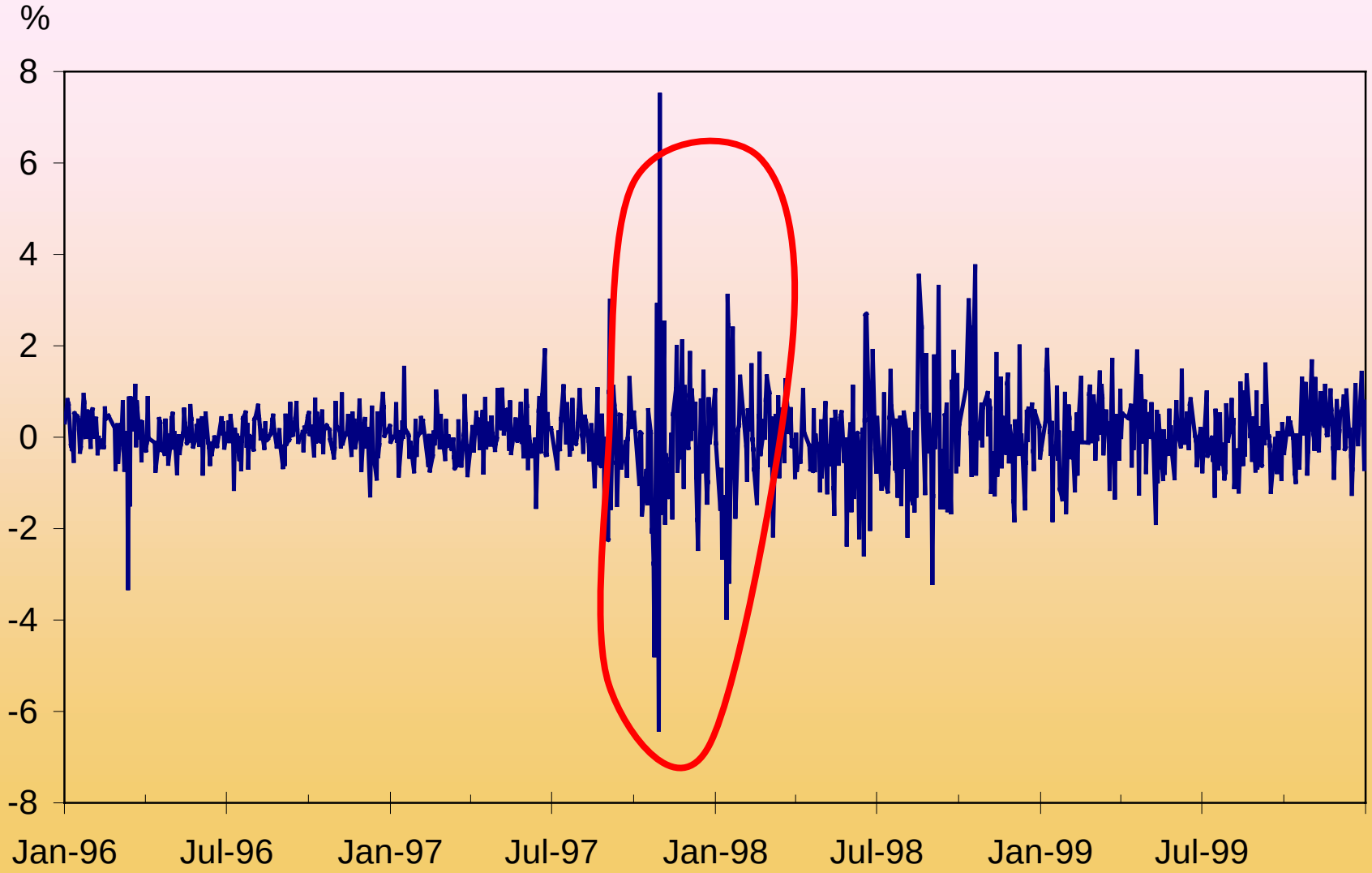

Korean won against US dollar
2500
2000
1500
1000
500
0
Jan-97
Apr-97
Jul-97
Oct-97
Jan-98
Apr-98
Jul-98

East Asian currencies against USD

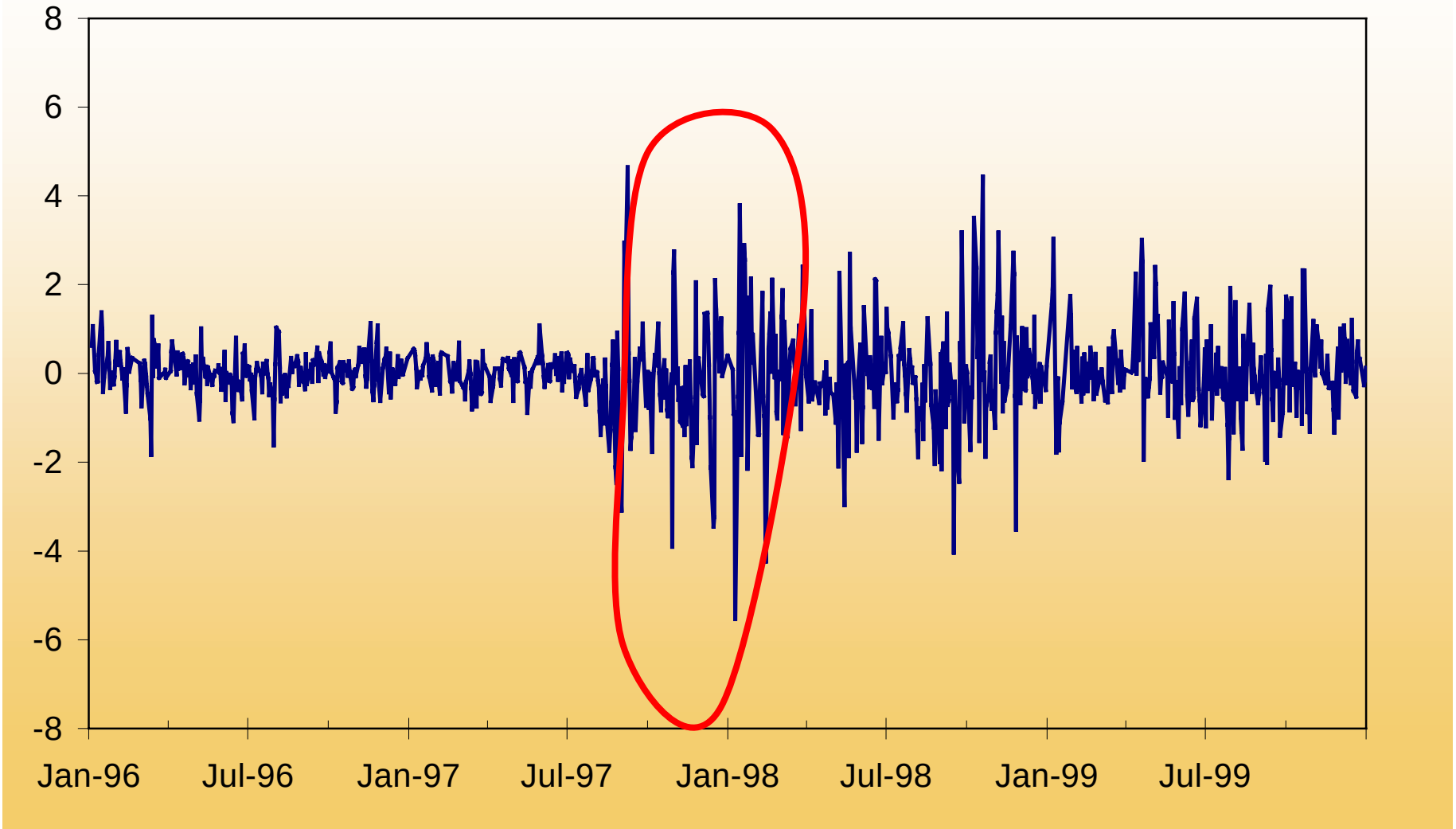


East Asian equity indices 1990-2003

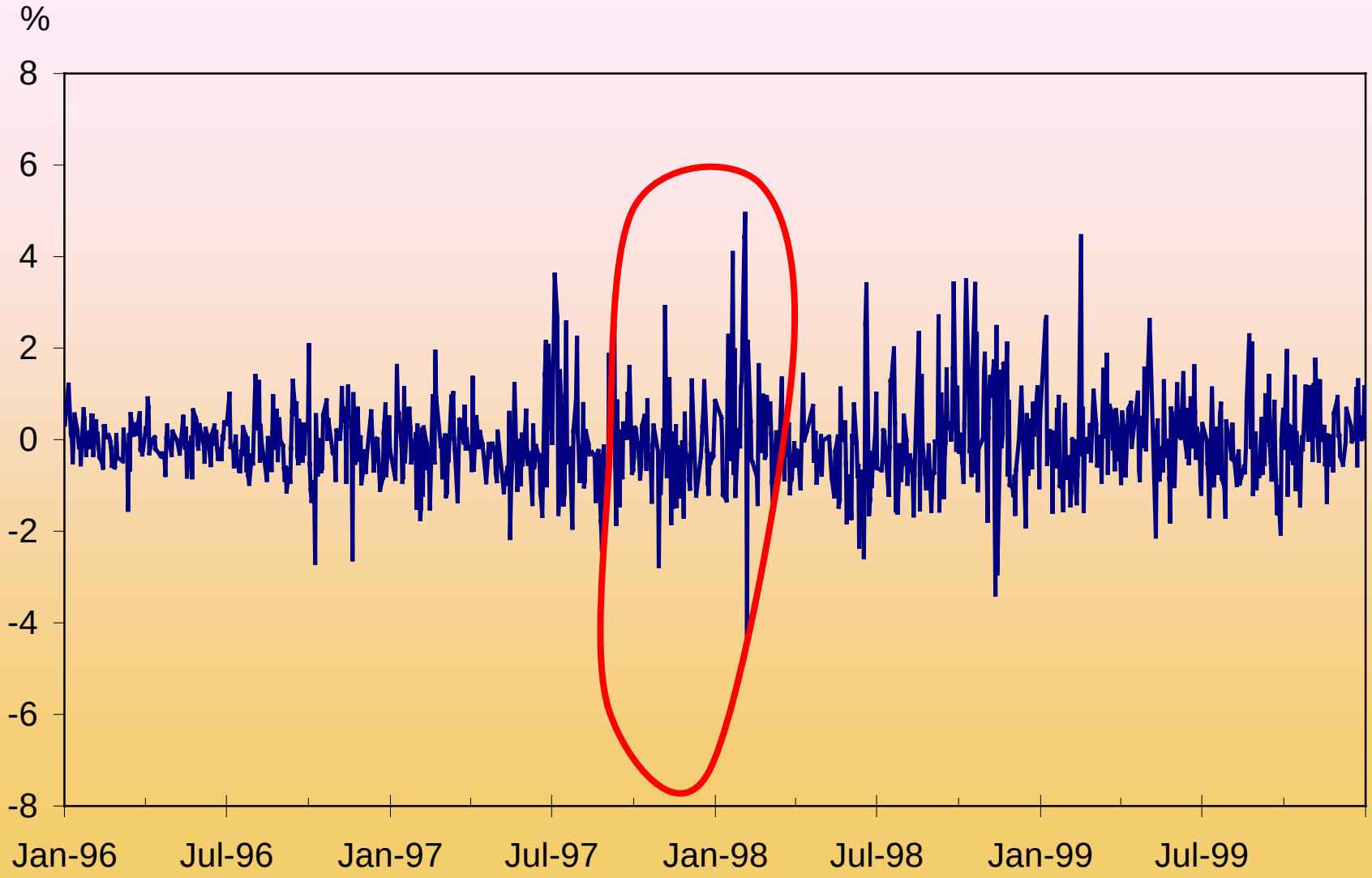
Returns: Hong Kong equity index 1996-1999



Returns: Indonesian equity index 1996-1999



Returns: Thai equity index 1996-1999



Bond spread: Russian sovereign - US Treasury

Bond spread: Bulgarian sovereign - US Treasury

Bond spread: Argentinian sovereign - US Treasury

Policy makers' and market participants' views

- "Malaysia is concerned that the risks of ***contagion*** from the Asian crisis have increased…."

  Mustapa Mohamed
  Malaysian Finance Minister 4/10/98

- "It's like there are two businesses here. The old business, which works fine under normal conditions, and this stand-by business, when the world goes mad."

  Eric Rosenfeld of Long-Term Capital,
  New York Times Magazine, January 24, 1999[1]

Why is contagion a ‘problem’?

- Contagion is seen as a feature of financial crises.
- Internationally diversified portfolios to protect against country risk.
- In times of financial crisis the relationships used to diversify break down through unanticipated shocks = CONTAGION
- How do we cope with this?

Defining contagion

- Myriad of definitions
- Problems across theory and empirical work
- Attempt to draw this together using the World Bank's definitions
- First, taxonomies of transmission paths during crises

Lowell et al 98	Perry & Lederman 98	Goldstein 98	IMF 99
Economic Linkages	Demand Effects Competition Effects	Competitive Dynamics	Spillovers
Heightened Awareness	Demonstration Effects	Wake up call	Shifts in Investor sentiment
Portfolio adjustment Herd behavior	Flight to Safety Cash in effects		Financial linkages

Broad definition of contagion (World Bank)

- "Contagion is the cross-country transmission of shocks or the general cross-country spillover effects"

- This is very broad. Includes fundamentals linkages such as due to trade, terms of trade effects, things which we can name.
- Most of the literature distinguishes 'fundamental' linkages from contagion.
- *Eg Lowell, Neu and Tong (1998), Reside & Cochoco-Bastista (1999), Calvo and Reinhart (1996) 'fundamentals-based' contagion, Kaminsky and Reinhart (2000)*

Restrictive Definition (World Bank)

- "Contagion is the transmission of shocks to other countries or the cross-country correlation, beyond any fundamental link among the countries and beyond common shocks."

- Excludes herding behavior and so forth.
- Fundamental links include:
  - Financial - Real (- Political)
    more on these later

Eg. Eichengreen, Rose and Wyplosz (1995,1996)

Very Restrictive Definition (World Bank)

- "Contagion occurs when cross-country correlations increase during 'crisis times' relative to correlations during 'tranquil times.'"

- This needs to control for general volatility rising during financial crises (*Forbes and Rigobon (2002))*
- The fundamental linkages are again not acknowledged
- Only increases in correlation are recognized as contagion

Our preferred version – akin to the restrictive definition

- The transmission of shocks beyond the fundamental linkages

- Other terms:‘unwarranted contagion’, ‘pure contagion’
- Closest in the empirical literature is *Eichengreen, Wyplosz and Rose (1995,96)* and *Pesaran and Pick (2003)* who want to control for a large variety of fundamentals first.
- Measured contagion may be relative to the particular fundamentals chosen

2. Why does contagion arise? Theoretical models

Micro-foundations of contagion

- The cross-section dimension as opposed to the time domain.
- Investors' actions do not reveal their *private* information.
- Herds arise when Information gets trapped: underlying signals driving investment decisions are not revealed.
  - For example, when traded asset prices are not market-determined.
- Investors can then rationally decide to mimic the behavior of others.

Rational herding behavior by international investors

- Herding arises when there is incomplete information about a country's fundamentals and investors are free to choose when they move.
- Different classes of investors may change positions at the same point in time:
  - Banks, corporates, multinationals, hedge funds
- The potential for destabilizing collective action by herding investors.

How to prevent herding?

- In a bad equilibrium, bank runs or speculative attacks on a currency can be unrelated to fundamentals.
- Therefore unpredictable!
- The importance of enlarging the amount of *public* information available.
- Need to enhance the *transparency* of institutions, objectives and governance (see also policy implications I).

International illiquidity and ‘sudden stops’

- Capital account reversals have become more severe for developing economies.
- The availability of a rescue package (country bailout option) can make the problem worse because of moral hazard.
- Reliance on short-term financing can lead to sharp real slowdown if capital inflows stop.
- International creditors covering losses in other markets can lead to contagion (portfolio links).

The international debate on the speed of capital account liberalization: I

- Comparing the costs and benefits of capital market integration.
- Against the costs, arguments for less capital controls include:
  - Increase the overall availability of funds for financing socially valuable projects
  - Promote transparency and accountability
  - Reduce moral hazard and liquidity problems
  - Improve the functioning of the financial system (though not necessarily deepening it!)

The international debate on the speed of capital account liberalization: II

- The conventional view: the benefits outweigh the costs (Rogoff (1999)).
- The recent microstructure view: more market interconnectedness is bad because it leads to cross-market hedging and contagion (Kodres and Pritsker (2002)).
- The middle way: phasing in of opening up capital short-term flows

The role of fundamentals

- Control variables – spillovers.
- Fundamentals-based contagion – Calvo and Reinhart (1996), Kaminsky and Reinhart (2000).
- Usually there is a unique equilibrium for each possible set of fundamentals.

The role of beliefs

- Control variables – expectations.
- Hard to measure and even harder to manipulate.
- Beliefs-based contagion – Calvo and Reinhart (1996), Kaminsky and Reinhart (2000).
- There can be multiple equilibria even with complete and symmetric information if investors are sufficiently forward-looking (Jeanne and Masson (2000)).

3. Contagion Case Studies

The European Monetary System's ERM crises: 1992-93

- Germany's problems at the 'center' affected 'periphery' countries: UK, Italy, Spain, Portugal, Sweden, Finland, France.
- A case study for the self-fulfilling crisis view? (Contagion unrelated to fundamentals)
- Not really: in most crisis countries, high unemployment and interest rates were very undesirable, including politically. Also systemic banking sector problems in Scandinavia
- Need to distinguish the credibility of policies from the credibility of policymakers.

The Mexican peso crisis 1994

1. Driven by fundamentals
   - role of weak banking, weak reserves
2. Evidence of contagion
   - coined the term ‘Tequila effect’
   - tests provide mixed results
3. Was it regional
   - largely confined to Latin America
4. Which asset markets were affected
   - currency and equities

The East Asian crises: 1997-98

1. Driven by fundamentals
   - terms of trade effects due to export competing nations
2. Evidence of contagion
   - mixed evidence from formal testing
   - much commentary says that Indonesia particularly was contagion
3. Was it regional
   - largely
   - relatively little spillover to developed markets
4. Which asset markets were affected?
   - questions as to whether the crisis started in the equity rather than currency market as commonly presumed

The Russian and LTCM crises: 1998

1. Driven by fundamentals
   - liqudity crisis and credit crisis
   - promulgated by hedging
2. Evidence of contagion
   - were these crises connected by contagion
3. Was it regional
   - very widespread
   - Russia affects developing markets, LTCM affects developed
   - did Russian crisis prompt the Brazilian crisis
4. Which Asset Markets were affected
   - bonds, equities

Recent Latin American financial crises

1. Driven by fundamentals
   - Brazil 1999
   - Argentina 2001
2. "Twin crises": spillover from currency to banking and vice versa
3. Little evidence of international contagion
4. Was it regional?
5. Which financial markets were affected?

   - primarily currency and bonds

4. Empirical Evidence on Financial Contagion

Methods of testing for contagion

A taxonomy loosely based on the World Bank's classification:

- **Unexpected shocks or news**
  - Dungey et al (2002,2003), Favero and Giavazzi (2003)
- **Correlation tests**
  - Forbes and Rigobon (2002), Baig and Goldfajn (1999)
- **Probability tests**
  - Eichengreen, Rose and Wyplosz (1995), Kaminsky and Reinhart (2000)
- **Extreme returns tests**
  - Bae, Karolyi and Stultz (2003), Baur and Schulze (2002)
- **Other tests**
  - Glick and Rose (1999), Lowell, Neu and Tong (1998)

Empirical Tests for Contagion

1. Contagion as 'unexpected shocks' or news

- contagion arises because transmission arises over and above the anticipated links
- the reaction is beyond what could have been expected beforehand
- Sometimes links are so complex so as to behave as if there is contagion *(Kiyotaki and Moore (2002))*

Egs. Dungey et al (2002,2003), Favero and Giavazzi (2002)

Empirical tests for contagion

2. **Correlation Tests**

Contagion as a significant increase in the correlation between assets during a period of crisis, compared with a period of calm

Eg. Forbes and Rigobon (2002)

- consistent with World Bank's 'very restrictive' definition

Empirical tests for contagion

3. **Probability Tests**

- if the probability of a domestic crisis is affected by the occurrence of a foreign crisis this is consistent with contagion

Eg. Eichengreen, Rose and Wyplosz (1995,1996)

Empirical tests for contagion

4. **Extreme Returns Tests**

- the transmission between asset markets is different in times of extreme returns (*crisis times*) from that of *normal times*

Eg. Bae, Karolyi and Stulz (2003)

Empirical tests for contagion

5. **Other Tests**

- encompassing spillovers (fundamental linkages)

  Glick and Rose (1999) trade

  van Rickjem and Weder (2001) financial links

- other things

  Lowell, Neu and Tong (1998) fundamentals

Some key practical issues

- How to define the crisis sample period?
  - Practically either ad hoc or data driven
- How to define the threshold at which a crisis occurs?
  - Sample dependence
- How to deal with different time zones?
- How to deal with missing observations?

5. Generalisations on contagion by Asset Markets

Foreign exchange markets

1. Fundamentals

   - often in conjunction with a banking system crisis; exchange rate pressure often leads banking problems

   - a large devaluation is often a trigger – used as a critical date, eg float of Thai baht, devaluation of Mexican peso

2. Evidence of contagion

3. Regional

   - crises seem to spread across wide range of currencies, both spillovers and contagion

Equity markets

1. Fundamentals
2. Evidence of Contagion

   - Forbes and Rigobon result that ‘no contagion, only interdependence’

   - Other methods wide ranging evidence of contagion

3. Regional nature of crises and contagion

   - That developed markets act as a conduit for crises between developing regions

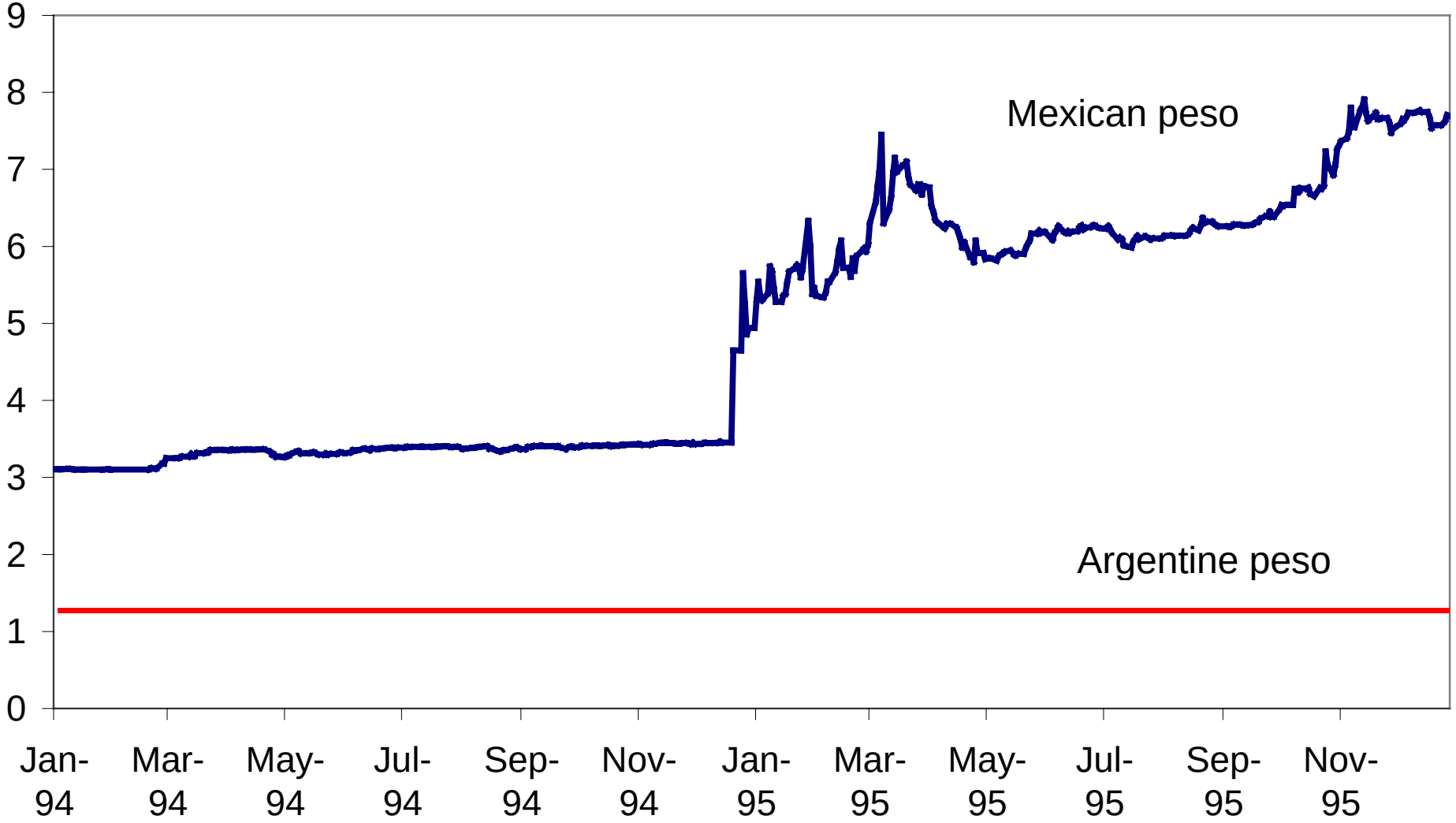
Fixed income markets

1. Fundamentals
2. Evidence of contagion
   - Much more limited evidence, lack of data
3. Regional effects
   - seem less pronounced
   - Less evidence that developed markets act as conduits

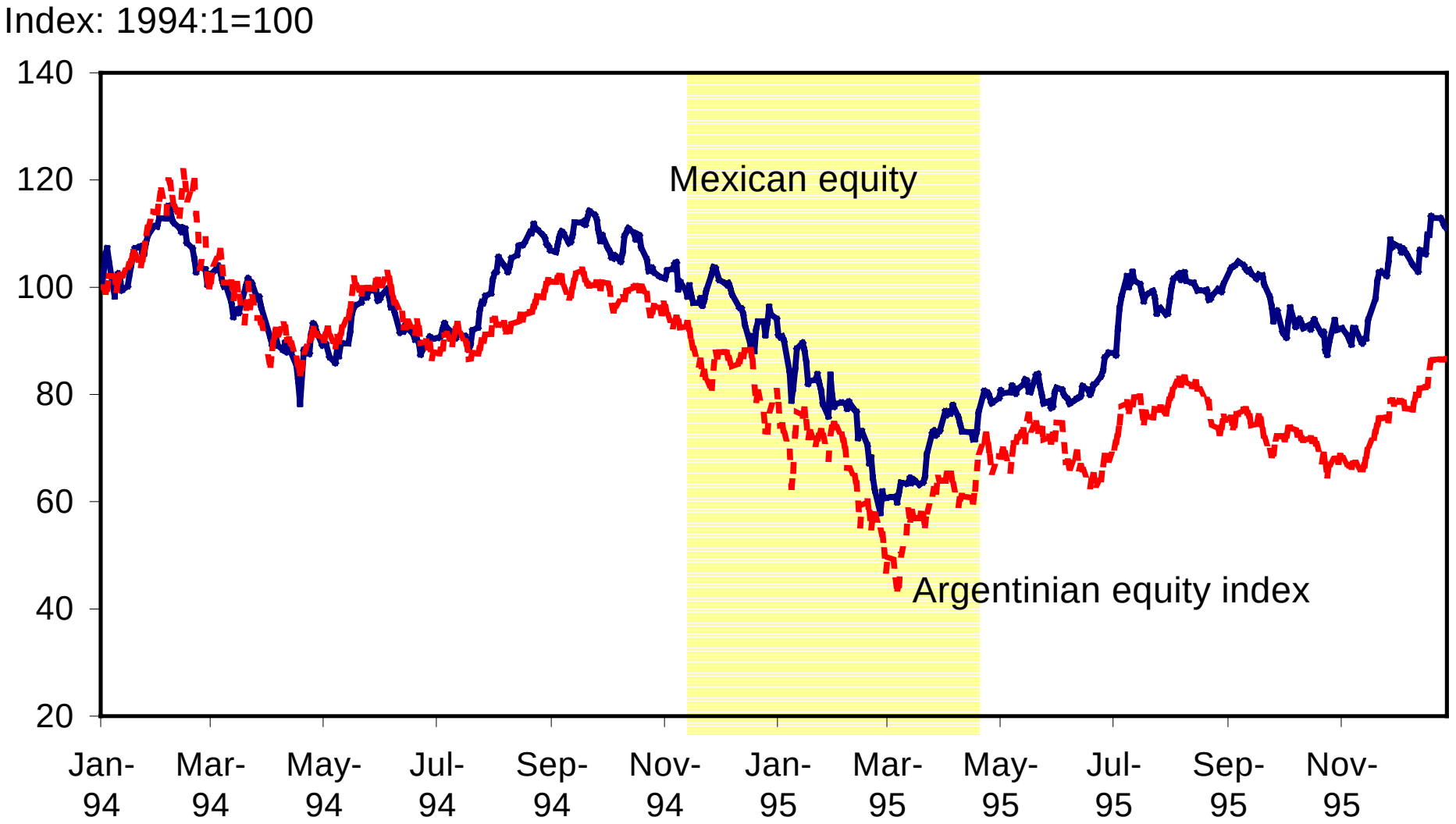
Cross-market studies

- No clear causation from one market to another
- Most work concentrated on geographical separation (Bayoumi et al (2003))
- Evidence not yet systematic enough to be sure
- Growing area of research, and certainly important for the policy agenda

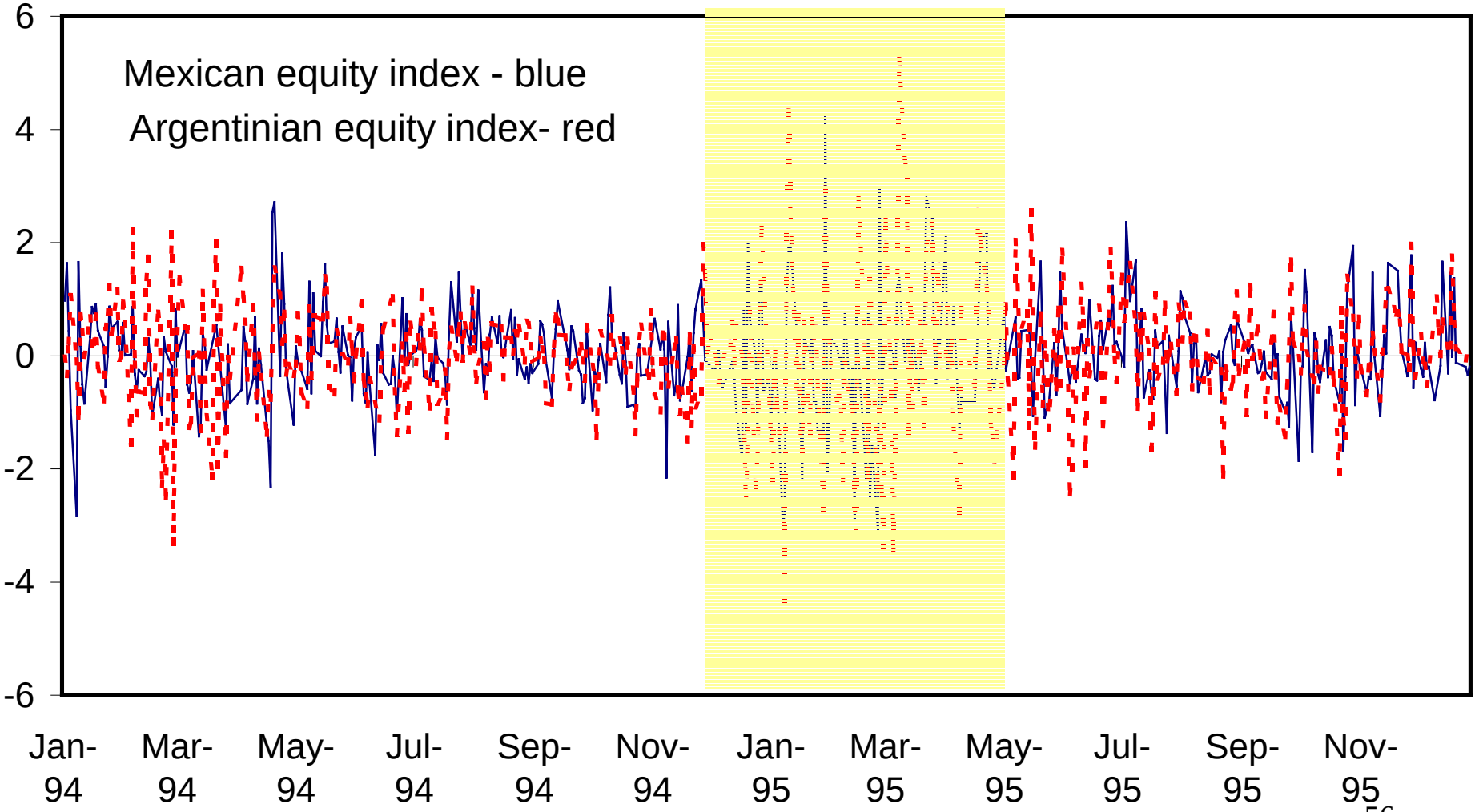
Mexican and Argentine peso against the USD: 1994-1995

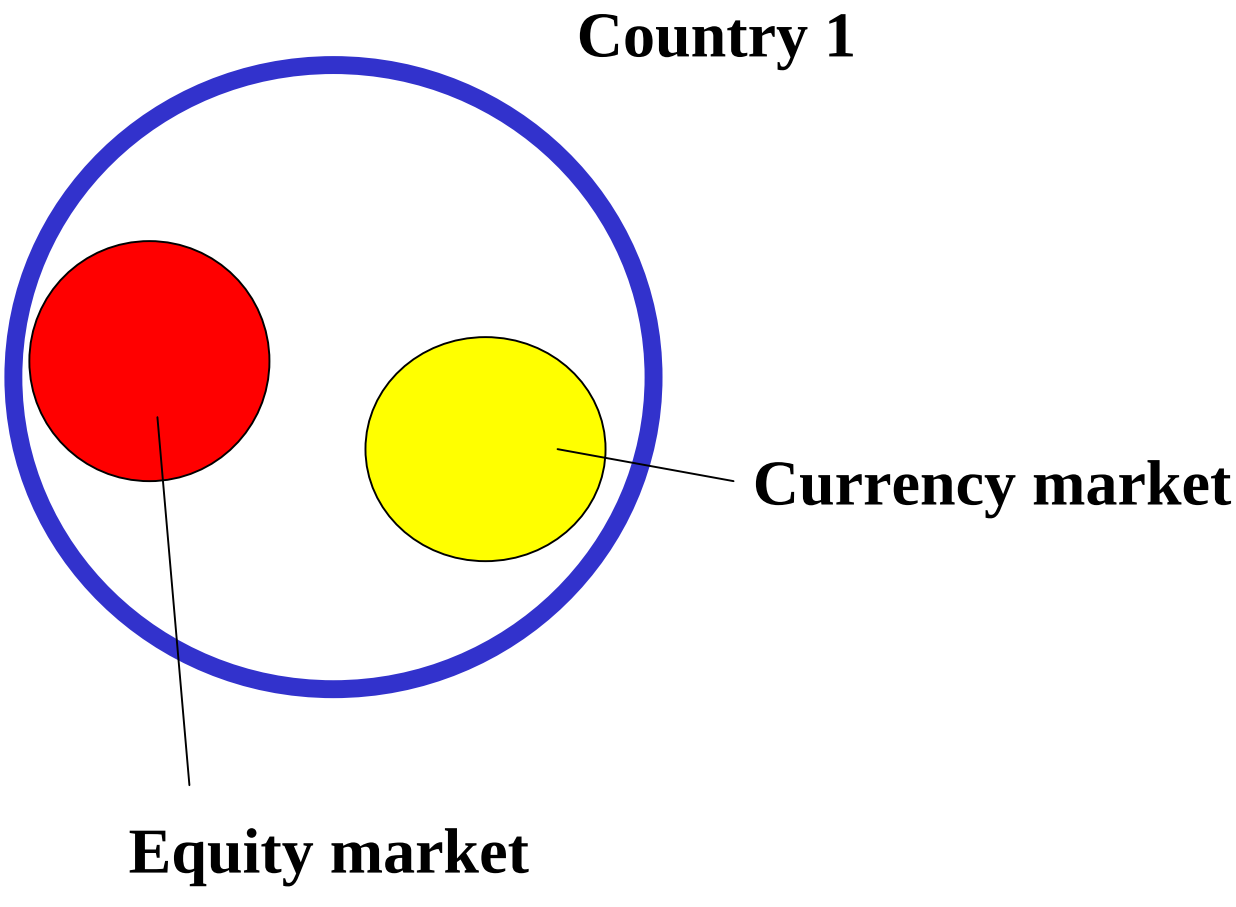


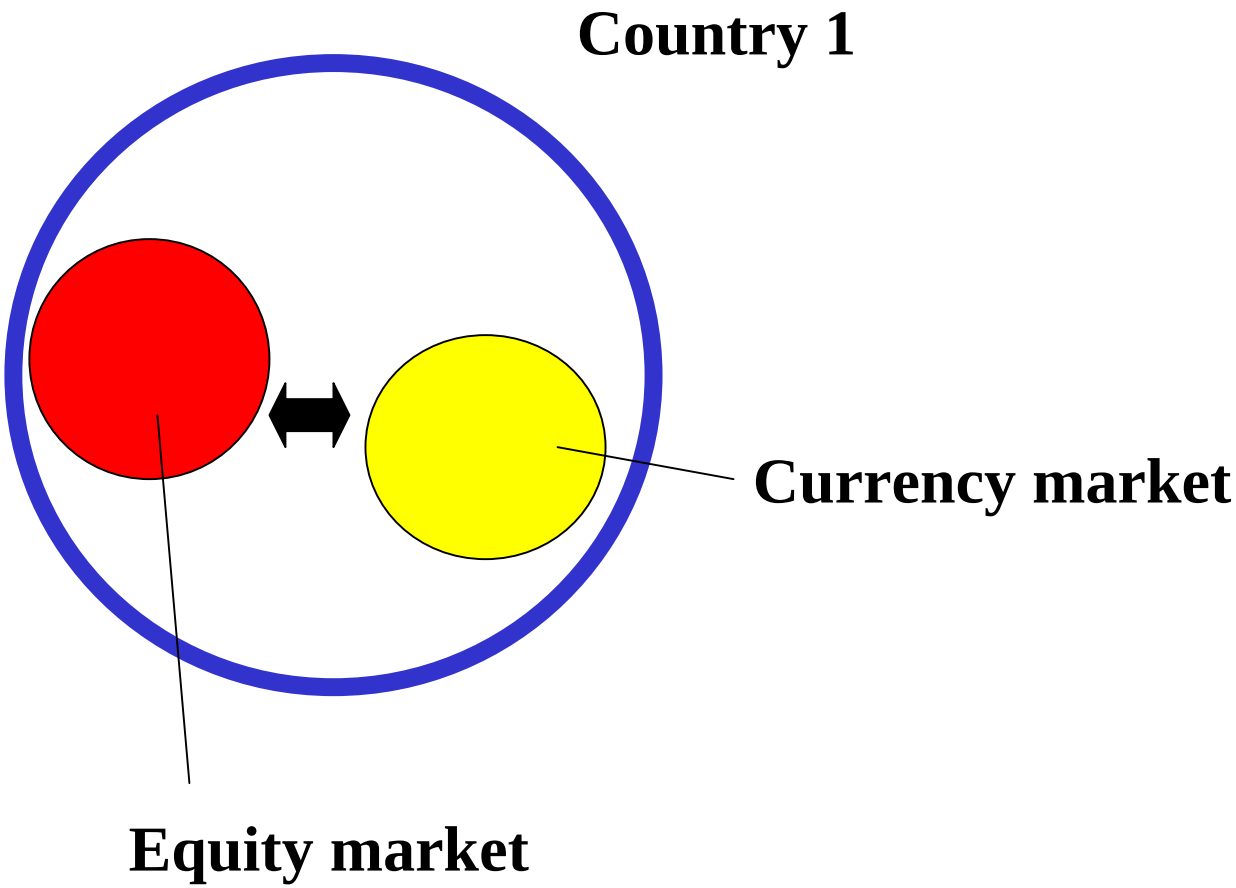
The equity indices of Mexico and Argentina during the 1994-1995 crisis

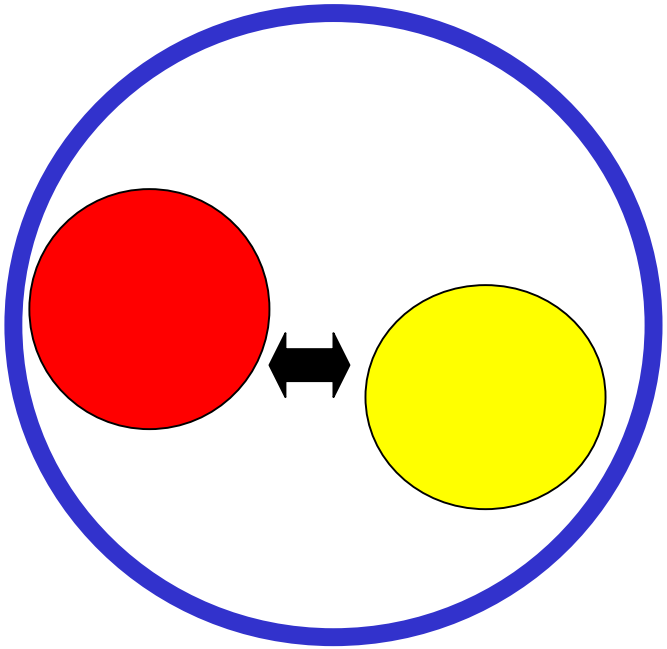


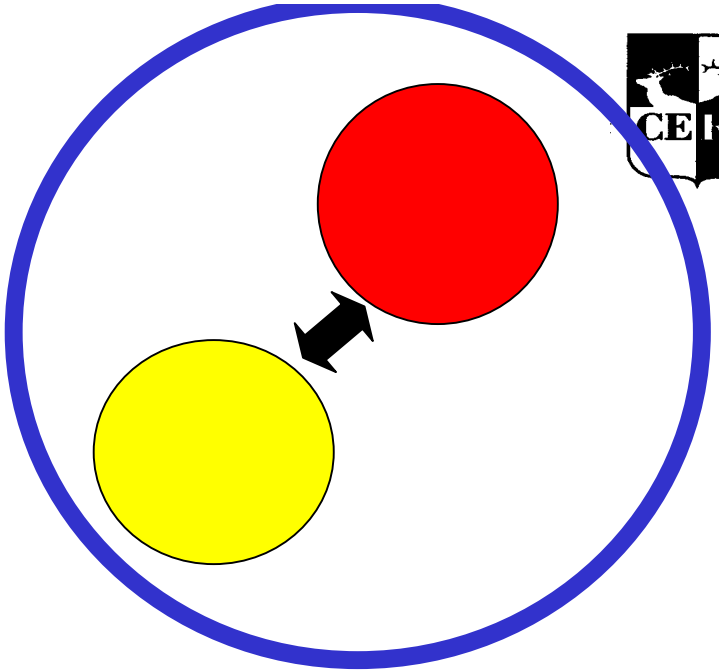
Equity index returns

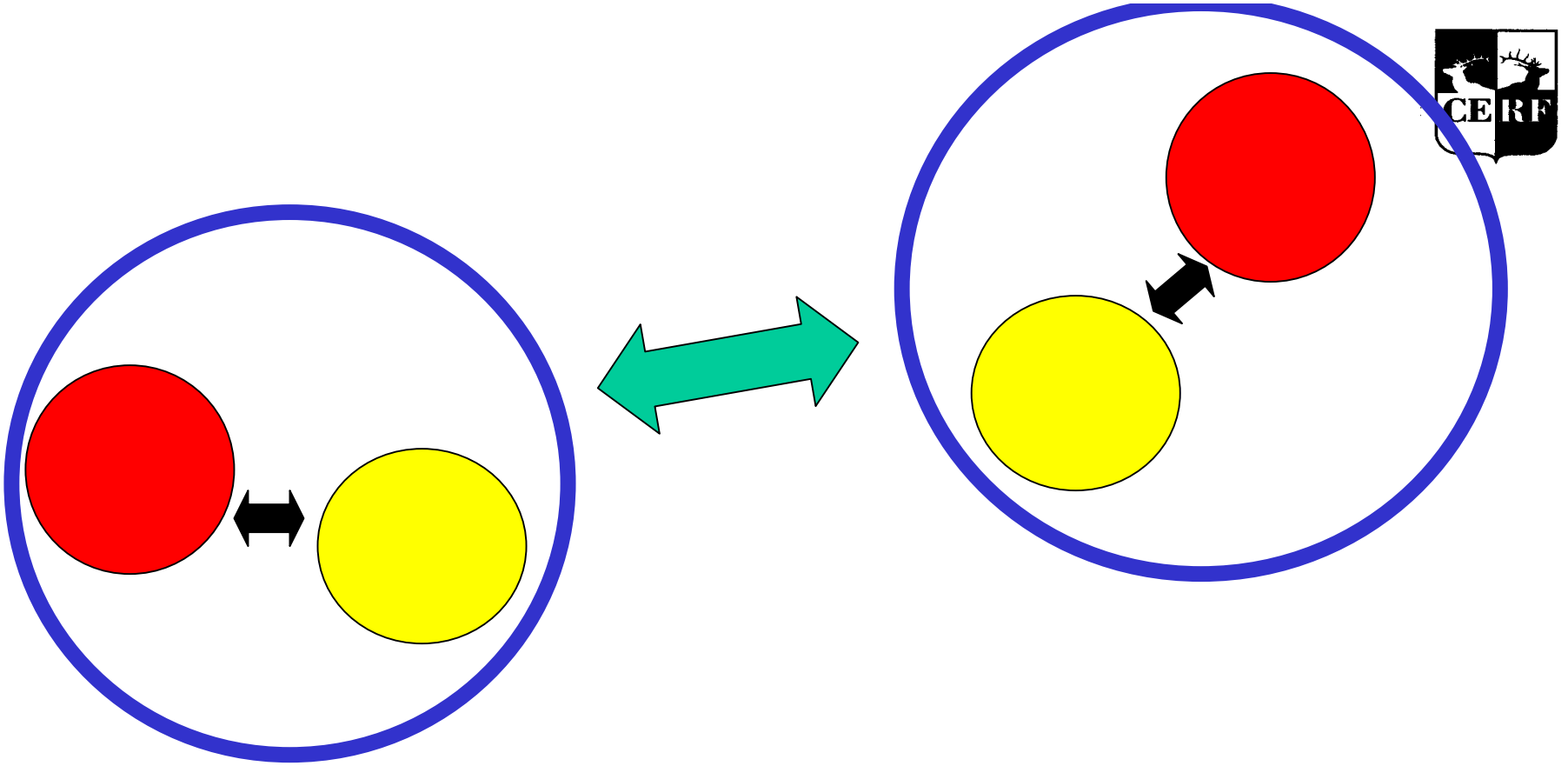


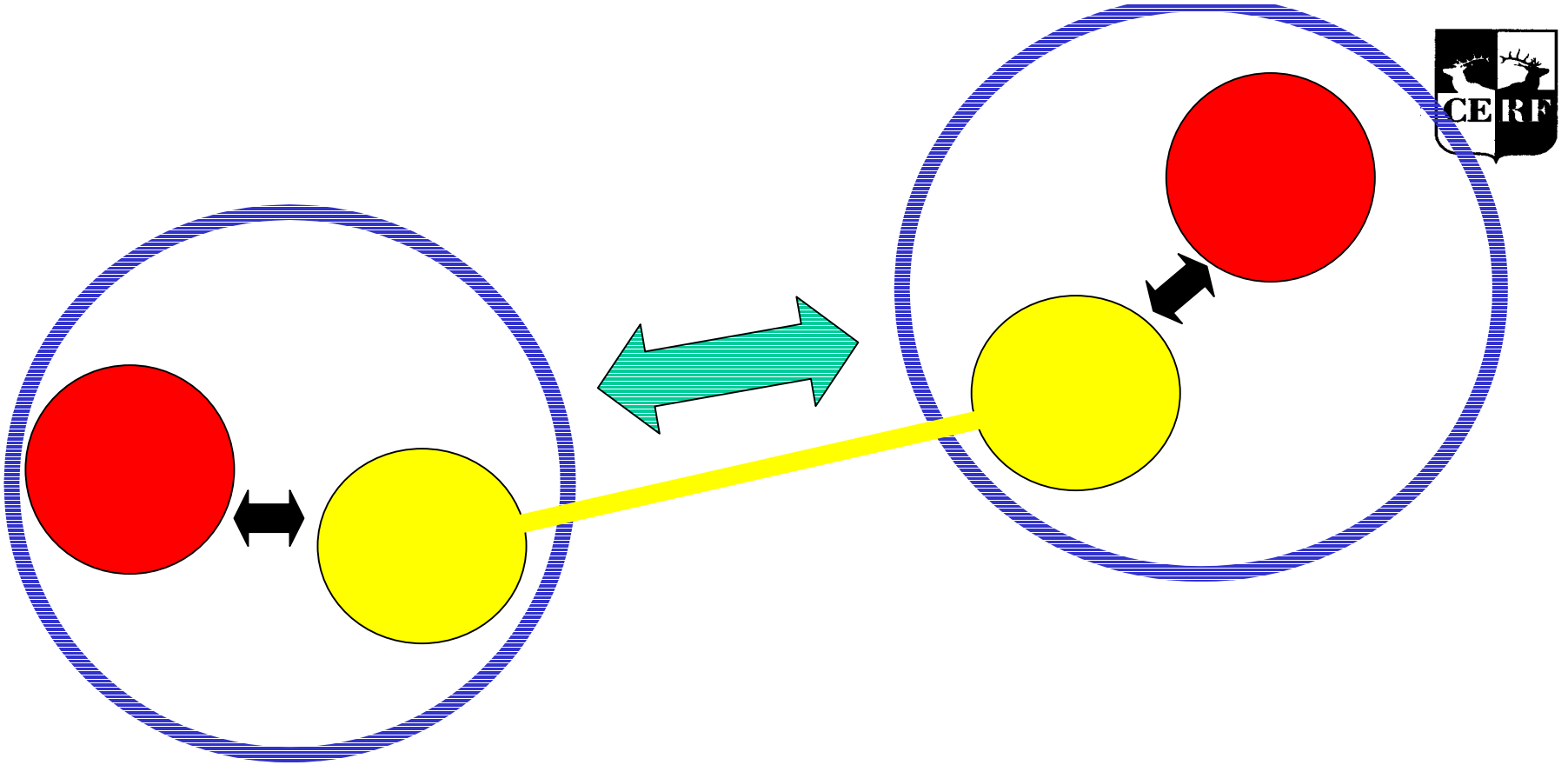

Country 1
Currency market
Equity market

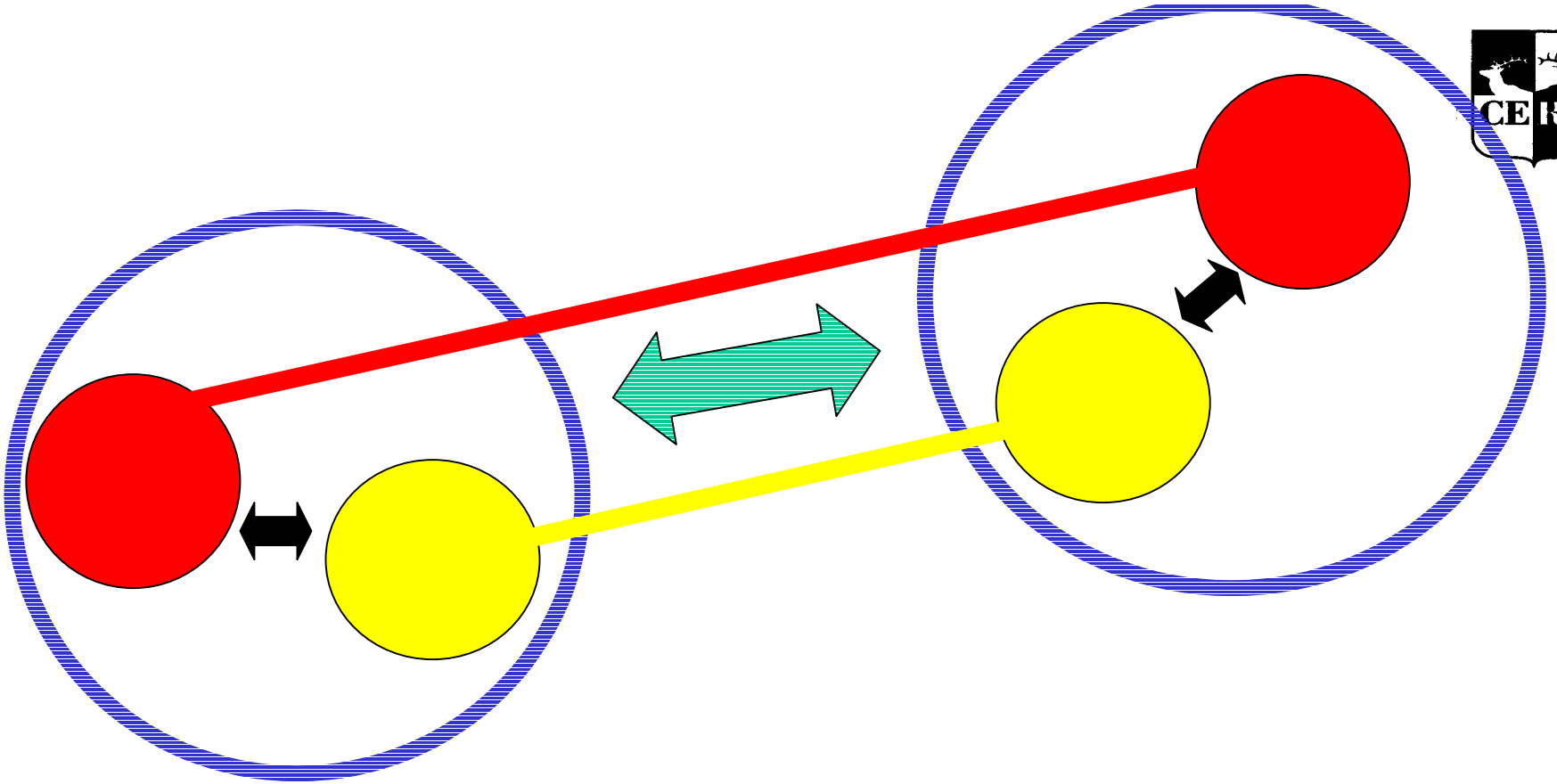

Country 1
Currency market
Equity market

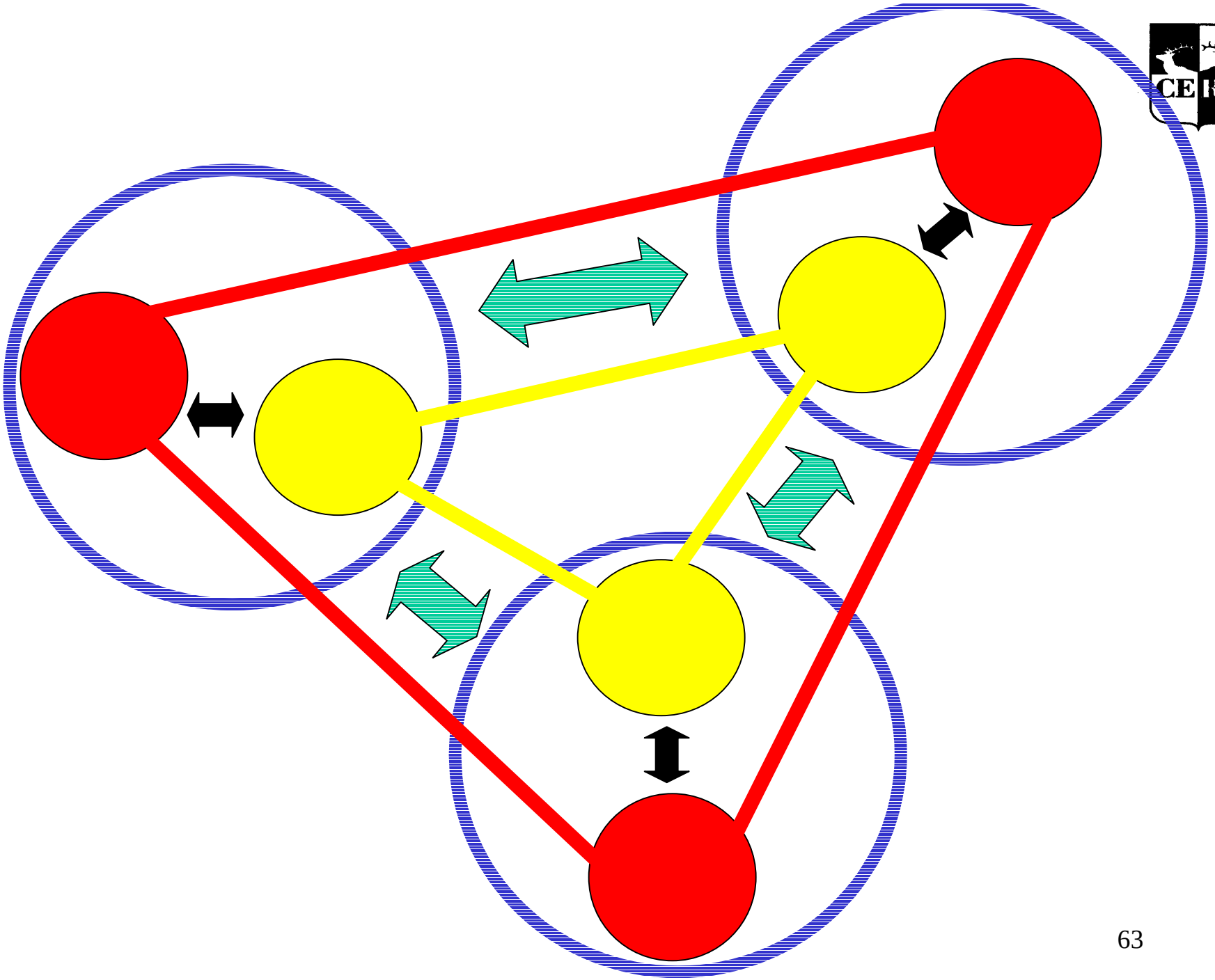




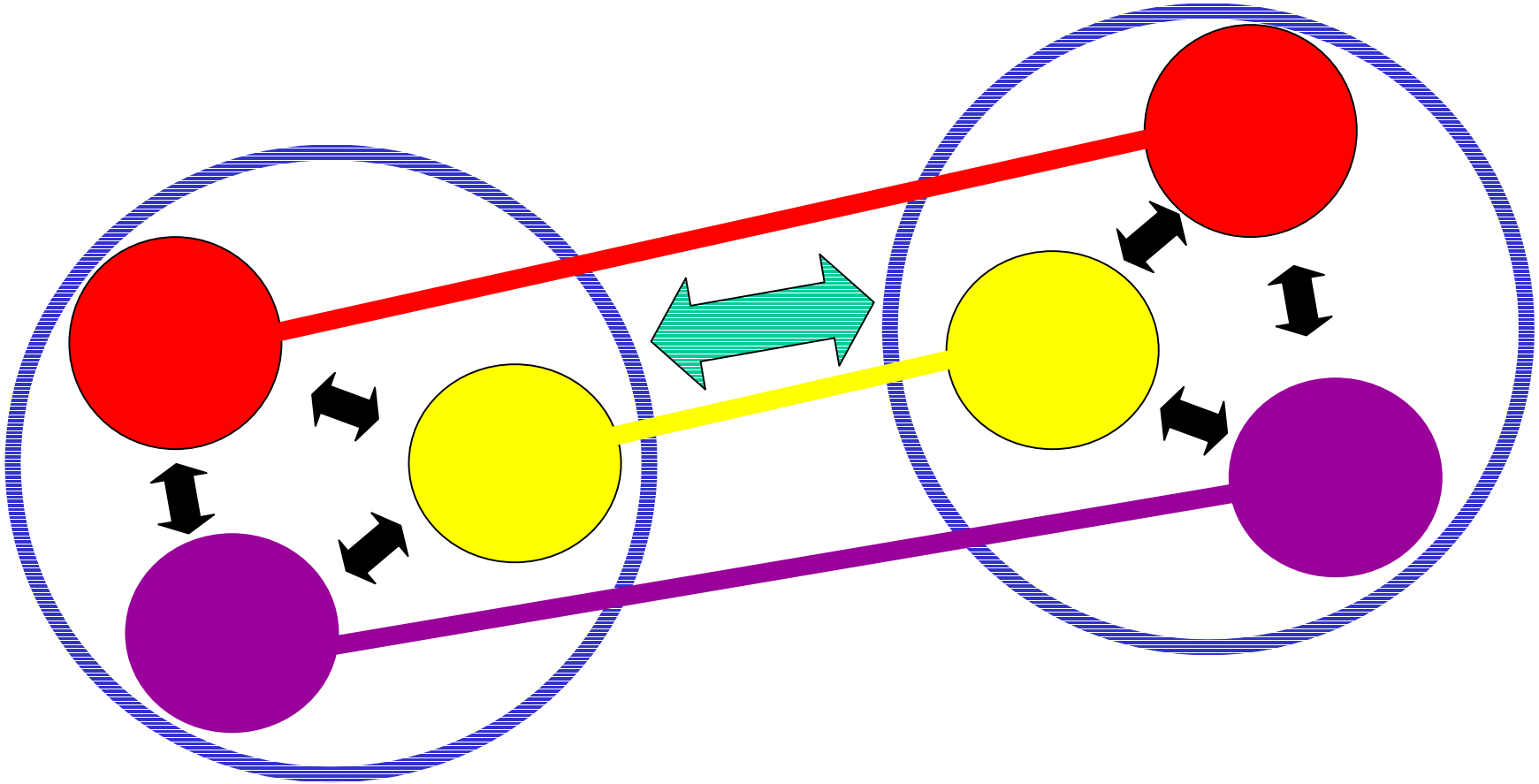








- Bonds, equities and currencies



6. Contagion in Developing and Developed Financial Markets

Relating the stage of financial market development and contagion

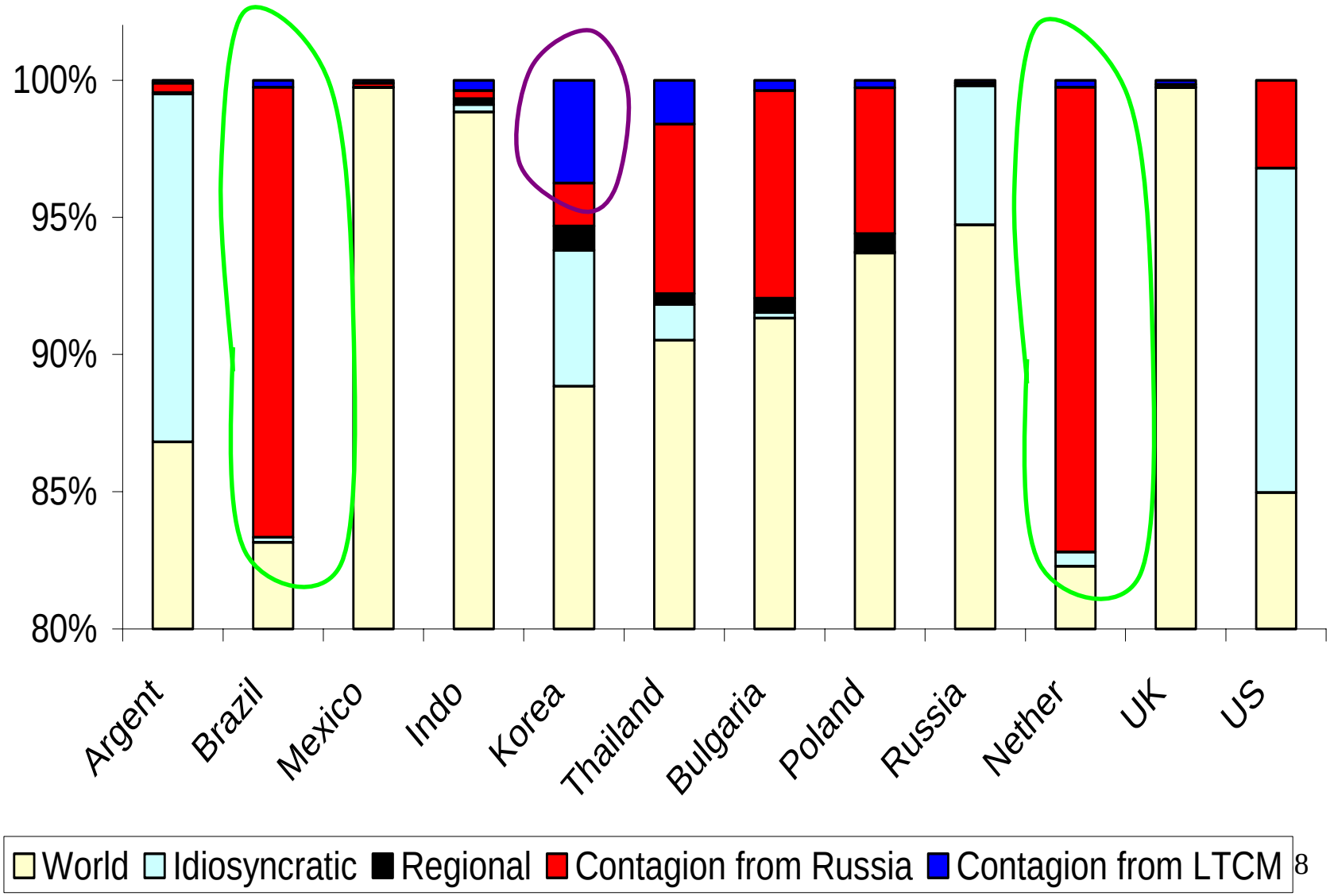
- Developed markets seem less affected
- Developing markets have largest contagion effects
- Regional nature of contagion and crises usually involves regions of developing – and opening - financial markets (Latin America, Eastern Europe, East Asia)

The Russian and LTCM crises

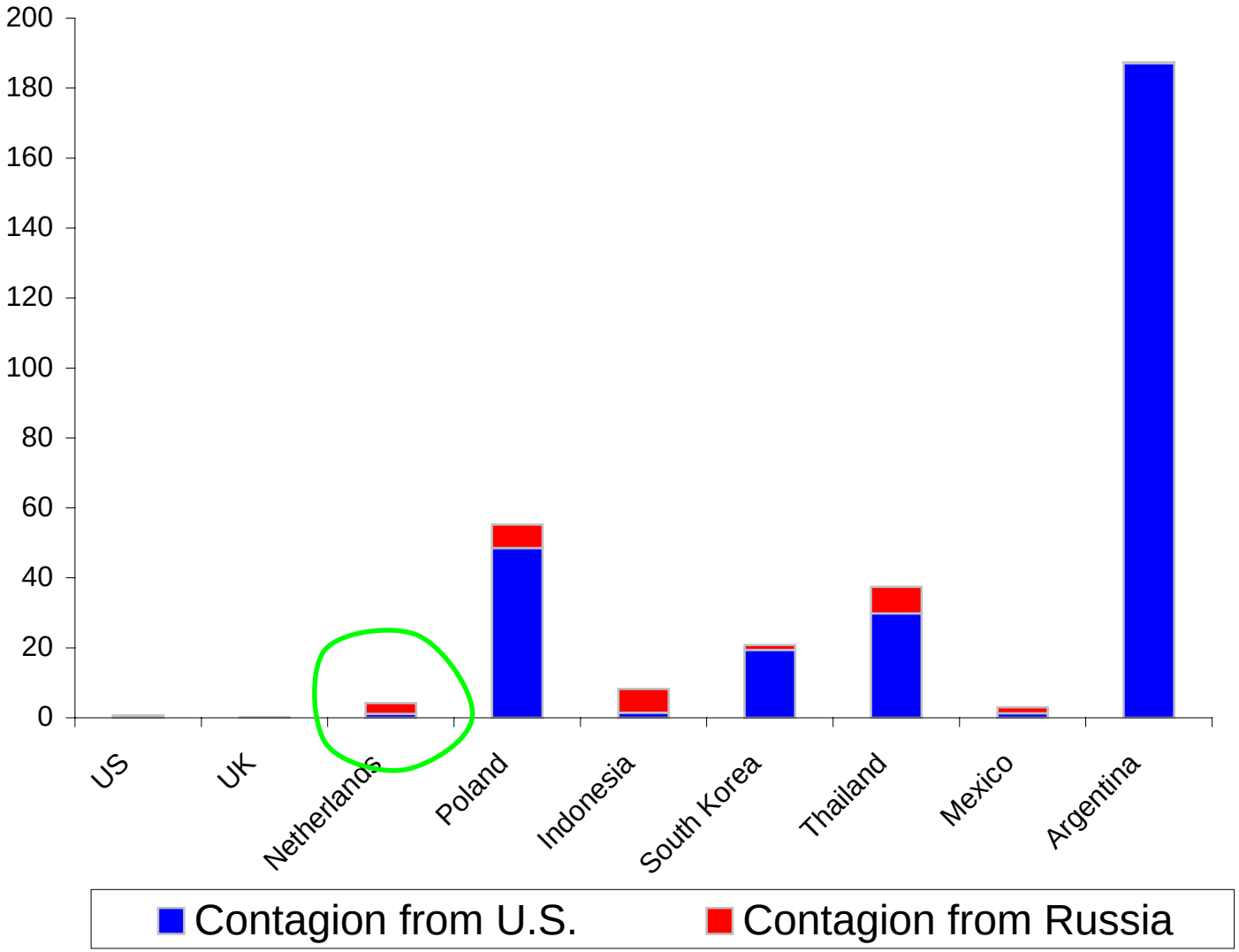
- Did
  - Russian crises mainly affect developing markets and
  - LTCM mainly affect developed markets

  As claimed by BIS (1999) ??

Volatility Decomposition: Bond spreads in Russian and LTCM crises



Contagion in basis points
- the smaller contributions



Contagion in basis points
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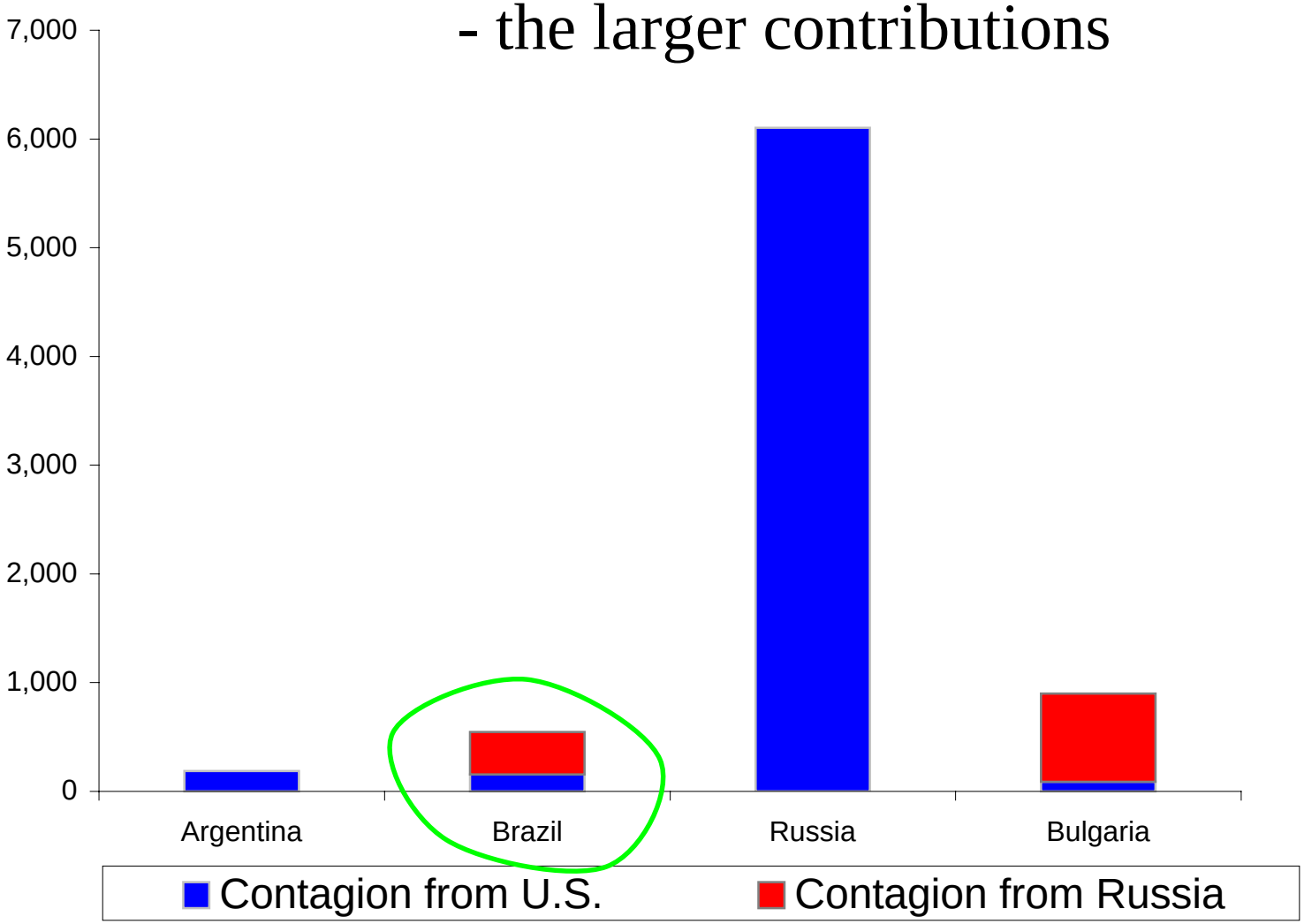

7. Summary and Policy Implications

Summary of questions and evidence

1. Contagion is an important problem
   - Statistically significant contagion occurs
   - It is not usually the dominant cause of volatility (cost-benefit trade off required)
2. Contagion is a regional issue
   - Varies across crises (and asset markets)
   - Some evidence that developed markets operate as a conduit between regions
3. Asymmetry: developing countries are more affected by contagion than developed countries
   - True in terms of the levels effect
   - Not clear in terms of proportionate effect on volatility

Policy Implications I

If contagion is statistically significant:

- Implications of responding – moral hazard
- How can we improve the outcomes
  - improved transparency (information)
  - improved fundamentals (policy formation)
  - improved public institutions (infrastructure, bankruptcy laws)

Policy Implications II

If contagion is regional:

- Argument for greater regional cooperation in terms of shared information
- concern that the current focus of the international institutions does not adequately reflect regional concerns
- disadvantage could be parochialism

Policy Implications III

If developed markets transmit crises between developing regions:

- Do developed markets then have some responsibility to the developing regions in helping to cope with this effect
- Possibly transmitted through portfolio rebalancing effects
- Repeated prisoner's dilemma game: better outcome for all participants if they cooperate

Policy Implications IV

If developed and developing markets are proportionally both affected:

- What is more important, the proportion or level of the effect?

If developing markets see the larger levels effects:

- developing markets provide profitable capital opportunities for capital, settling for lower global capital allocations ultimately means lower global growth

More resources:

- http://www.cerf.cam.ac.uk/links/index.php

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