Exchange Rate Regimes

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Key Questions

- Theoretical arguments for floating versus pegging
- What do countries do?
  (Ilzetzki-Reinhart-Rogoff 17, Reinhart-Rogoff 04)
- Does it matter? What can be learned from it?
  (Baxter-Stockman 89, Broda 04, Krugman 89, Mussa 86)

Exchange Rate Regimes
A Very Short History

Exchange Rates in the 18th and 19th Centuries

- The dominant monetary arrangement in the 18th and 19th centuries was a spicie standard (e.g. gold or silver standard)
- A specie standard is essentially a fixed exchange rate regime
  - Exchange rate pegged to specie rather than some other currency
  - Also typically involves lower legal limit on reserves
- Gold standard therefore vulnerable to speculative attacks
  - Credibility of commitment to gold standard important
  - Countries would suspend convertability during major wars

Downfall of International Gold Standard

- All countries (except US) went off gold in WWI
- International gold standard resurected in 1920's
  - But much weaker than before
  - Rise of left wing politics had eroded political support and international cooperation was lacking (Eichengreen 92)
- Inter-war gold standard collapsed in the Great Depression
  - Great Depression may have been caused by France hoarding gold i.e., not playing by the "rules of the game"
  - Countries that left gold standard earlier suffered less in depression (Eichengreen and Sachs 85)

Bretton Woods

- After WWII new system of fixed exchange rates
  - US Dollar pegged to gold
  - Other currencies pegged to US dollar
- Not really a gold standard
  - Severe restrictions on gold trade by citizens
- Why the emphasis on fixed exchange rates?
  - See Nurkse 44, 45 for thinking of the time
- Friedman 53: famous case for flexible exchange rates

Modern Era

- Bretton Woods system collapes in early 1970s
- Since then free float among major currencies

  (e.g., USD, GBP, DEM/EUR, JPY, SWF)
- Smaller countries have frequently pegged to bigger countries
  - European Exchange Rate Mechanism
  - Asian countries pegged to US dollar
- Currency crises have been common

The Theoretical Cases for Floating and Fixing

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Mundell (1968), Poole (1970)

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- Flexible rates:
  - Shock leads to appreciation which reduces output
- Fixed rate:
  - Central bank must sell money for FX to prevent appreciation
  - This insulates economy from shock

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  - Central bank must sell money for FX to prevent appreciation
  - This insulates economy from shock
- Presumes floating monetary policy fixes money supply
- Interest rate rule takes care of this

Classic Case for Flexible Exchange Rates

Friedman (1953)

- Real country specific shocks call for relative price changes
- How to achieve these?
  - All prices in the economy can change
  - The exchange rate can adjust
- With sticky prices, exchange rate adjustment is much easier

Friedman: Price and Wage Rigidity

At least in the modern world, internal prices are highly inflexible ... an incipient deficit that is countered by a policy of permitting or forcing prices to decline is likely to produce unemployment ... unemployment produces steady downward pressure on prices and wages, and the adjustment will not have been completed until the deflation has run its sorry course.

Friedman: Role of the Unit of Account

The argument for a flexible exchange rate is...very nearly identical with the argument for daylight savings time. Isn't it absurd to change the clock in summer when exactly the same result could be achieved by having each individual change his habits? All that is required is that everyone decide to come to his office an hour earlier, have lunch an hour earlier, etc. But obviously it is much simpler to change the clock....The situation is exactly the same in the exchange market.

Low Exchange Rate Pass-Through

- Friedman's argument relies on exchange rate changes affecting relative prices across countries
- But empirically exchange rate pass-through is limited
  (Campa-Goldberg 05, Gopinath-Itskhoki-Rigobon 10, Nakamura-Steinsson 12)

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- But empirically exchange rate pass-through is limited
  (Campa-Goldberg 05, Gopinath-Itskhoki-Rigobon 10, Nakamura-Steinsson 12)
- Limits expenditure switching benefits of exchange rate flexibility
- In this case exchange rate flexibility leads to inefficient deviations from law or one price

See: Devereux-Engel 03, Corsetti-Dedola-Leduc 11

Exchange Rate Instability:

- Keynes, Nurkse argued in 1940s that flexible exchange rates would yield instability
- Friedman argued that speculators would stabilize exchange rates
  - Profitable to buy low and sell high

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  - Profitable to buy low and sell high
- Exchange rate instability of post-Bretton Woods era, arguably, vindicated Keynes and Nurkse on this point

Commitment

- A credible fixed exchange rate can replace bad domestic monetary policy with good foreign monetary policy
- But fixed exchange rates are typically imperfectly credible
  - Subject to runs and crises
  - These crises are costly

Exchange Rate Arrangements
What Do Countries Do?

Ilzetzki-Reinhart-Rogoff 17

Goal of the Paper:

- Document exchange rate arrangements for 194 countries over period 1946-2016
- Follow up on Reinhart and Rogoff (2004):
  - Improves on choice of anchor country
  - Adds more countries and longer sample period
- Document capital account restrictions

History of FX Regime Classification

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  - Many supposedly fixed rates often adjusted
  - Some supposedly flexible rates heavily managed

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  - Shambaugh (2004): Based on exchange rate variability
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- IMF has since moved to de facto classification

TABLE 1
COHERENCE OF METHODOLOGIES TO CODE EXCHANGE RATE REGIMES

	IMF	Levy-Yeyati & Sturzenegger	Reinhart & Rogoff	Shambaugh
IMF	100%			
Levy-Yeyati and Sturzenegger	59%	100%		
Reinhart and Rogoff	59%	55%	100%	
Shambaugh	68%	65%	65%	100%

Notes: Taken from table 3.3 of Klein and Shambaugh (2010). Entries are percentages of observations where different methodologies agree. All classifications are collapsed to three categories: pegged, intermediate, and floating.

Source: Rose (2011)

IMPORTANCE OF PARALLEL FX MARKETS

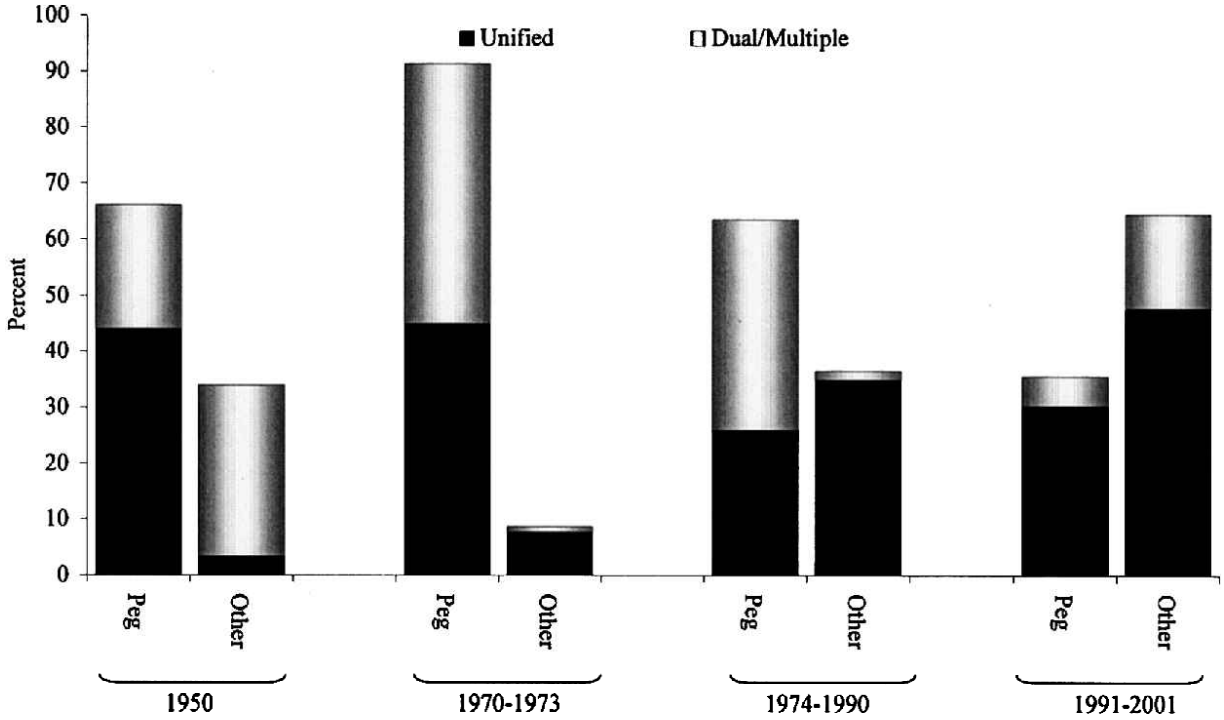

FIGURE I

The Incidence of Dual or Multiple Exchange Rate Arrangements, 1950–2001: Simplified IMF Classification

Sources: International Monetary Fund, *Annual Report on Exchange Arrangements and Exchange Restrictions and International Financial Statistics;* Pick and Sédillot [1971]; International Currency Analysis, *World Currency Yearbook,* various issues.

Exchange rate arrangements classified as "Other" include the IMF's categories of limited flexibility, managed floating, and independently floating.

Source: Reinhart and Rogoff (2004)

Importance of Parallel FX Markets

- Parallel FX markets the norm in Europe in the 40's and 50's
- Restoration of convertibility occurred in Europe in 1958
- Parallel FX market common in less developed countries

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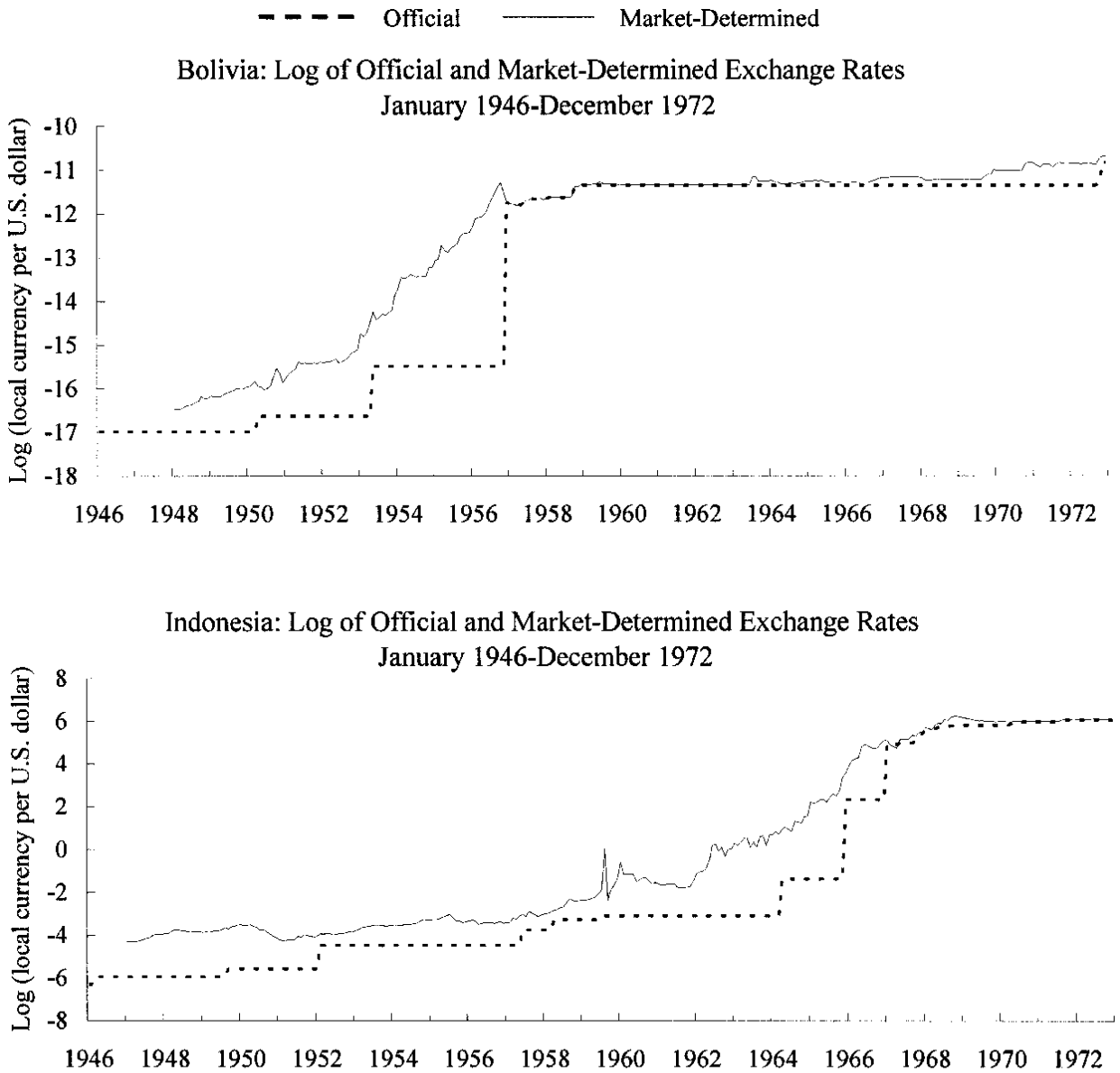
- Parallel FX market better barometer of monetary policy
  - When monetary policy is too loose to maintain peg, parallel rate will start depreciating



Source: Reinhart and Rogoff (2004)

TABLE II

INFLATION, OFFICIAL AND MARKET-DETERMINED EXCHANGE RATES: COUNTRY-BY-COUNTRY PAIRWISE CORRELATIONS

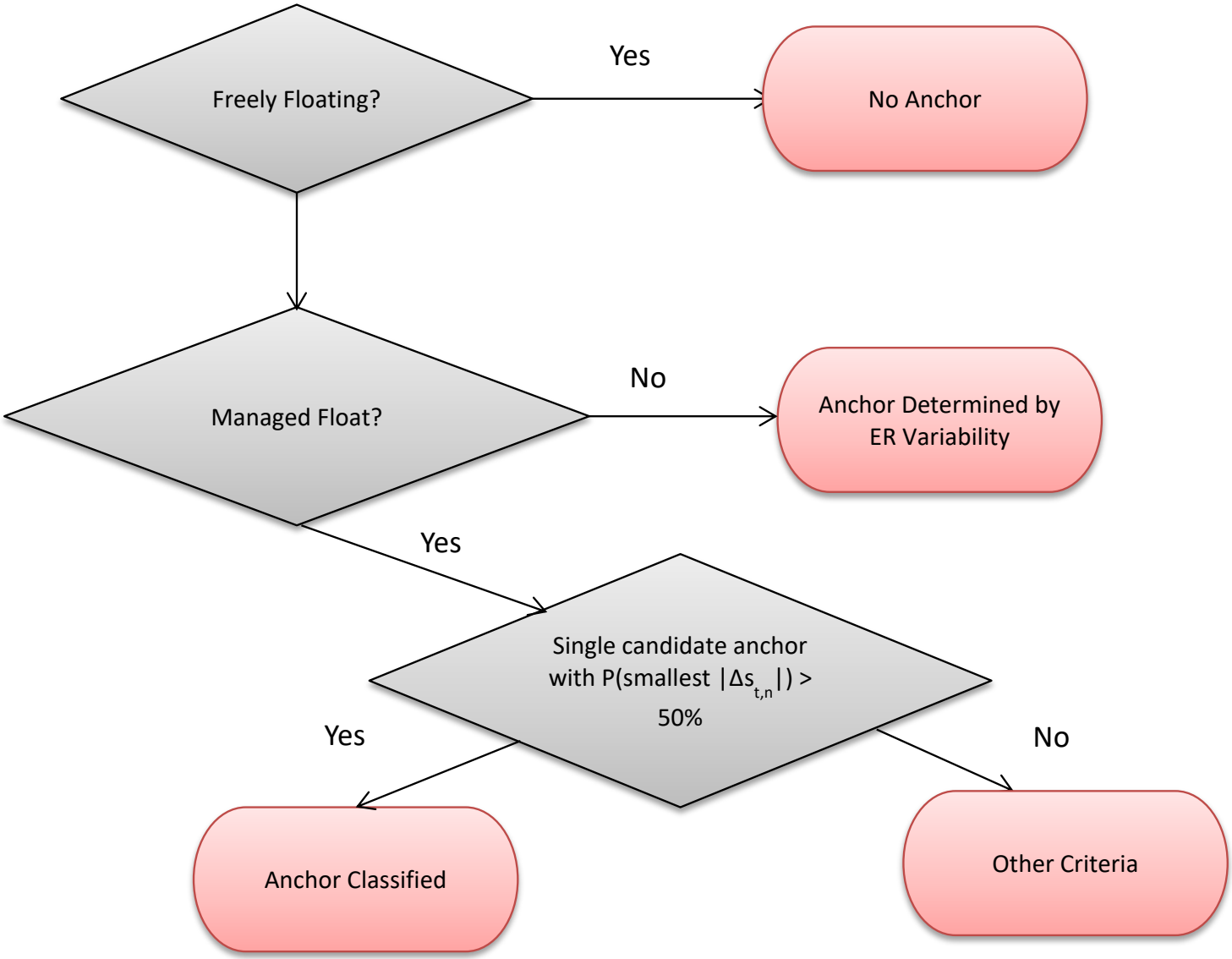
Percent of countries for which the correlations of:	
The market-determined exchange rate and inflation are higher than the correlations of the official rate and inflation	73.7
The market-determined exchange rate and inflation are lower than the correlations of the official rate and inflation	26.3

Sources: International Monetary Fund, *International Financial Statistics, Pick's Currency Yearbook, World Currency Report, Pick's Black Market Yearbook,* and the authors' calculations.

The correlations reported are those of the twelve-month percent change in the consumer price index with the twelve-month percent change in the relevant bilateral exchange rate lagged six months.

Source: Reinhart and Rogoff (2004)

Figure 1: Anchor Currency Selection Process



Source: Ilzetzki, Reinhart, and Rogoff (2017)

Table 1: Classifying the Unclassified Anchors with Supplementary Indicators

Country (anchor)	Years	Fine ERA Classification	Indicators
Brazil (USD)	2001-	12	94% of exports and 84% of imports in USD. 90% of PPG debt in USD. Anchored to USD before the 2000s.
Canada (USD)	2001-	12	70% of exports and 75% of imports in USD. Debt in domestic currency. Most recently anchored to USD.
Chile (USD)	2008-	12	No data available on invoicing, but given the large share of copper in exports and the denomination of international copper prices in USD, the lion share of exports are likely denominated in USD. Algorithm anchors the CLP to the USD as recently as 2008.
Colombia (USD)	2008-	12	Close to 100% of invoicing in USD and close to 100% of public debt in USD. Algorithm classifies a dollar anchor as recently as 2008.
Iceland (USD)	2001-	10	Very diversified invoicing between USD, GBP and EUR, but with USD the largest share. Central bank FX reserves diversified with USD the largest close to 50%.
India (USD)	2012-	10	86% of exports and 80% of imports in USD. 80% PPG debt in USD.
Israel (USD)	2005-	10	Approximately 70% of exports and imports denominated in USD. Over 60% of Bank of Israel reserves in USD. Most recently anchored to the USD.
Korea (USD)	1999-	12	Anchored to the USD in the 1990s. Other data unavailable.
Latvia (EUR)	1998-2001	10	Diversified invoicing, with EUR the majority at approximately 50% of imports and exports. The country was in transition to joining the Eurozone.
Turkey (USD)	1998-	10 (until 2000) and 12 (from 2003)	Diversified invoicing with the majority in USD. Foreign currency public debt is 60% in USD and 40% in EUR.
Uruguay (USD)	2009-	10	Anchored to the USD until the late 2000s. Other data unavailable.

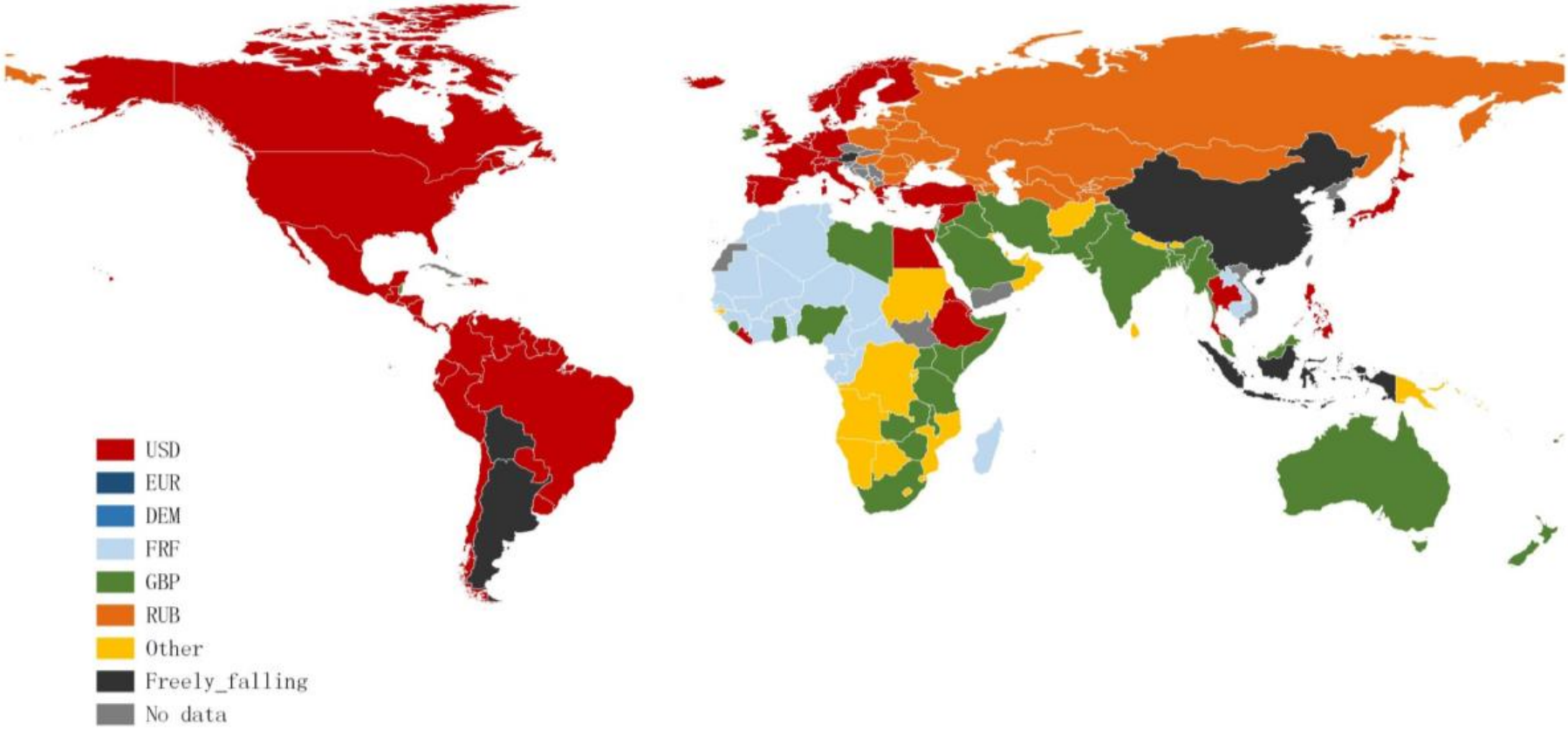
Source: Ilzetzki, Reinhart, and Rogoff (2017)

Anchor Currency Classification

- Classification of anchor and exchange rate regime somewhat intertwined
- Freely floating: No anchor
- Relatively fixed: Based on FX volatility
- Managed float:
  - Calculate one-year moving average of monthly absolute change in exchange rate with respect to all candidate anchors (USD, EUR, JPY, GBP, AUD, CNY)
  - Smallest movements with respect to single anchor more than 50% of time linked to that anchor
  - If not, treated separately

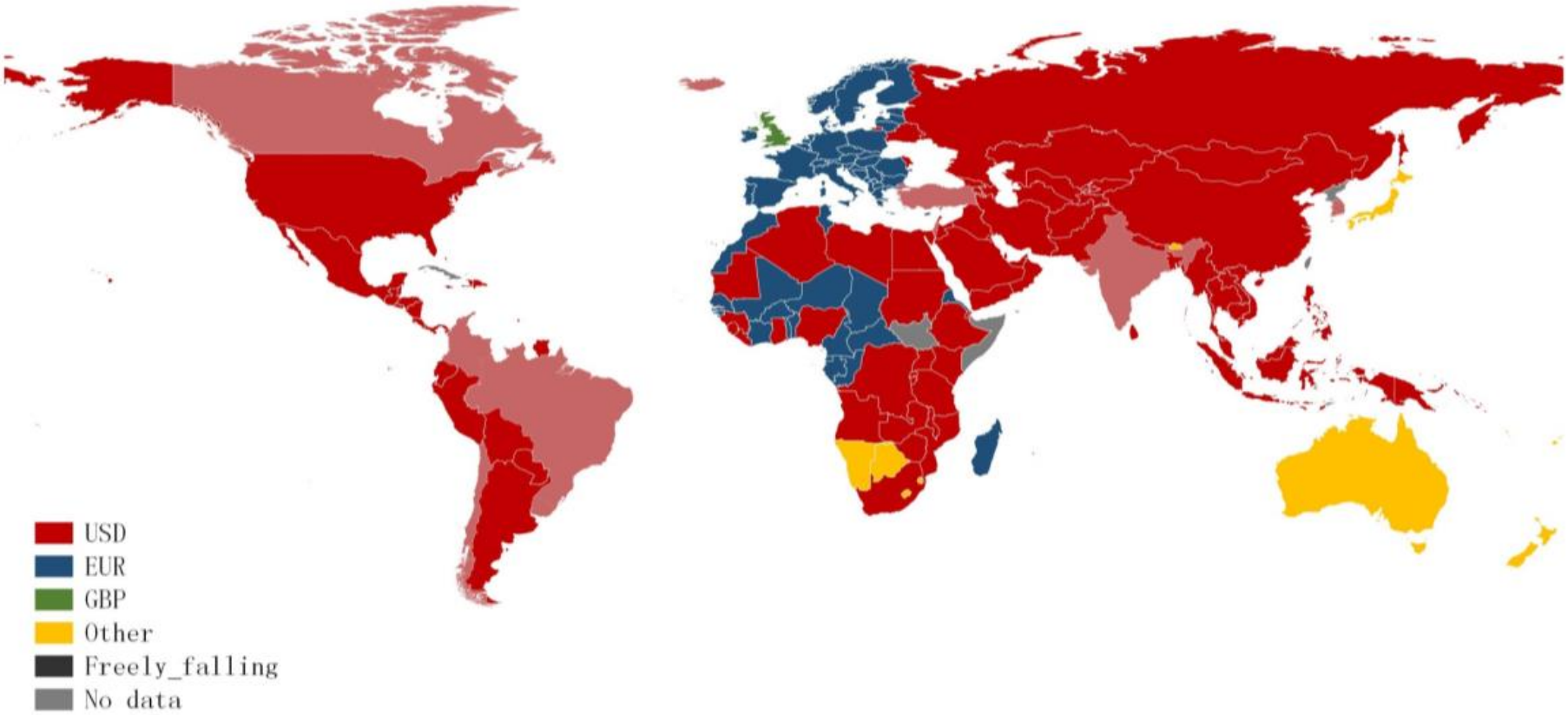
Figure 3. The Geography of Anchor Currencies, 1950 and 2015

1950



Source: Ilzetzki, Reinhart, and Rogoff (2017)

2015



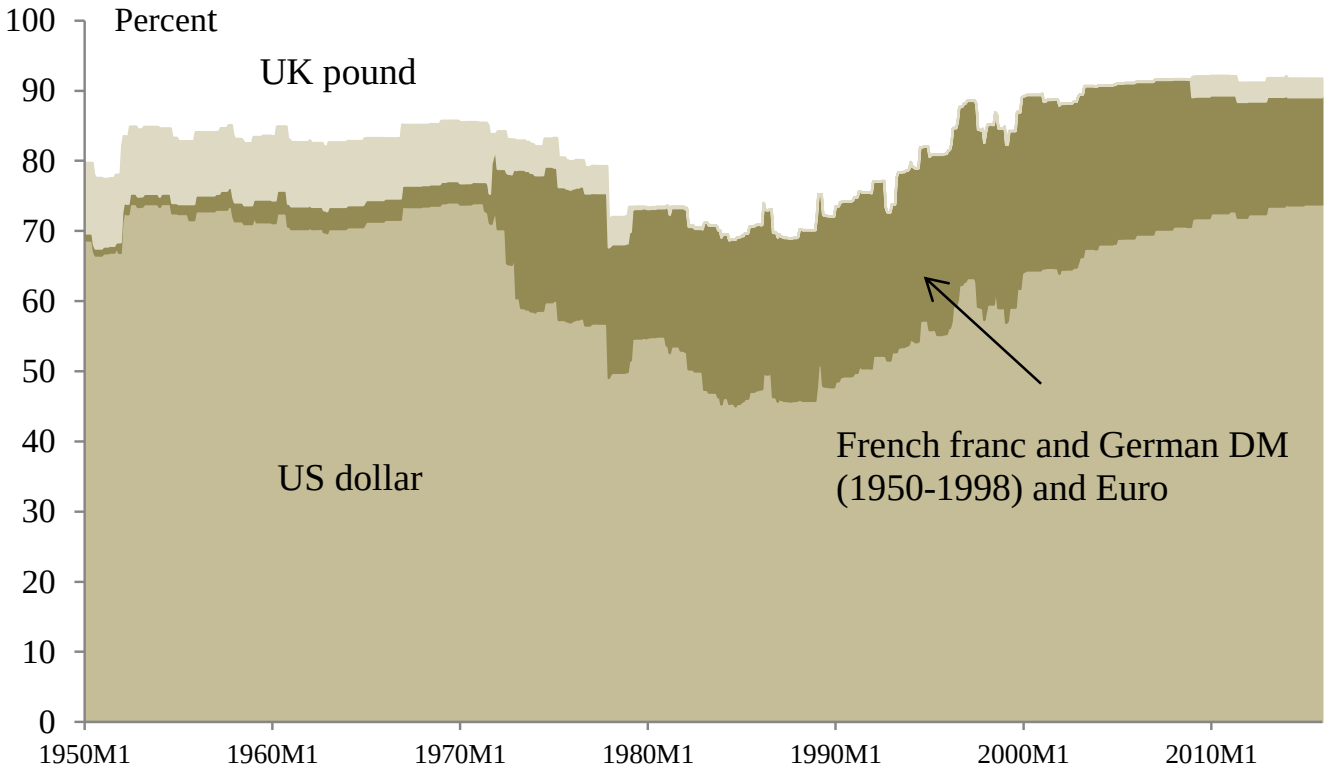
Source: Ilzetzki, Reinhart, and Rogoff (2017)

Evolution of Anchor Currencies

- Large shift towards USD as anchor
- Emergence of DEM/EUR as anchor

- Several waves:
  - Dismantling of the GBP zone
  - Breakdown of Bretton Woods leads to emergence of DEM/EUR
  - Collapse of the Soviet Union

Number of countries weighted by their share in world GDP, 1950-2015, excludes freely falling cases



Sources: The Conference Board *Total Economy Database*, International Monetary Fund *International Financial Statistics*, Reinhart and Rogoff (2004) sources cited therein, and authors' calculations
Note: The Country Chronologies that supplement this paper show the evolution of the anchor currency on a country-by-country basis.

Source: Ilzetzki, Reinhart, and Rogoff (2017)

Exchange Rate Classification

- Two classifications:
  - Fine: 15 categories
  - Course: 6 categories

	The fine classification codes are:
1	• No separate legal tender or currency union
2	• Pre announced peg or currency board arrangement
3	• Pre announced horizontal band that is narrower than or equal to +/-2%
4	• De facto peg
5	• Pre announced crawling peg; de facto moving band narrower than or equal to +/-1%
6	• Pre announced crawling band that is narrower than or equal to +/-2% or de facto horizontal band that is narrower than or equal to +/-2%
7	• De facto crawling peg
8	• De facto crawling band that is narrower than or equal to +/-2%
9	• Pre announced crawling band that is wider than or equal to +/-2%
10	• De facto crawling band that is narrower than or equal to +/-5%
11	• Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)
12	• De facto moving band +/-5%/ Managed floating
13	• Freely floating
14	• Freely falling
15	• Dual market in which parallel market data is missing.

Source: Ilzetzki, Reinhart, and Rogoff (2017)

The coarse classification codes are:

1	•	No separate legal tender
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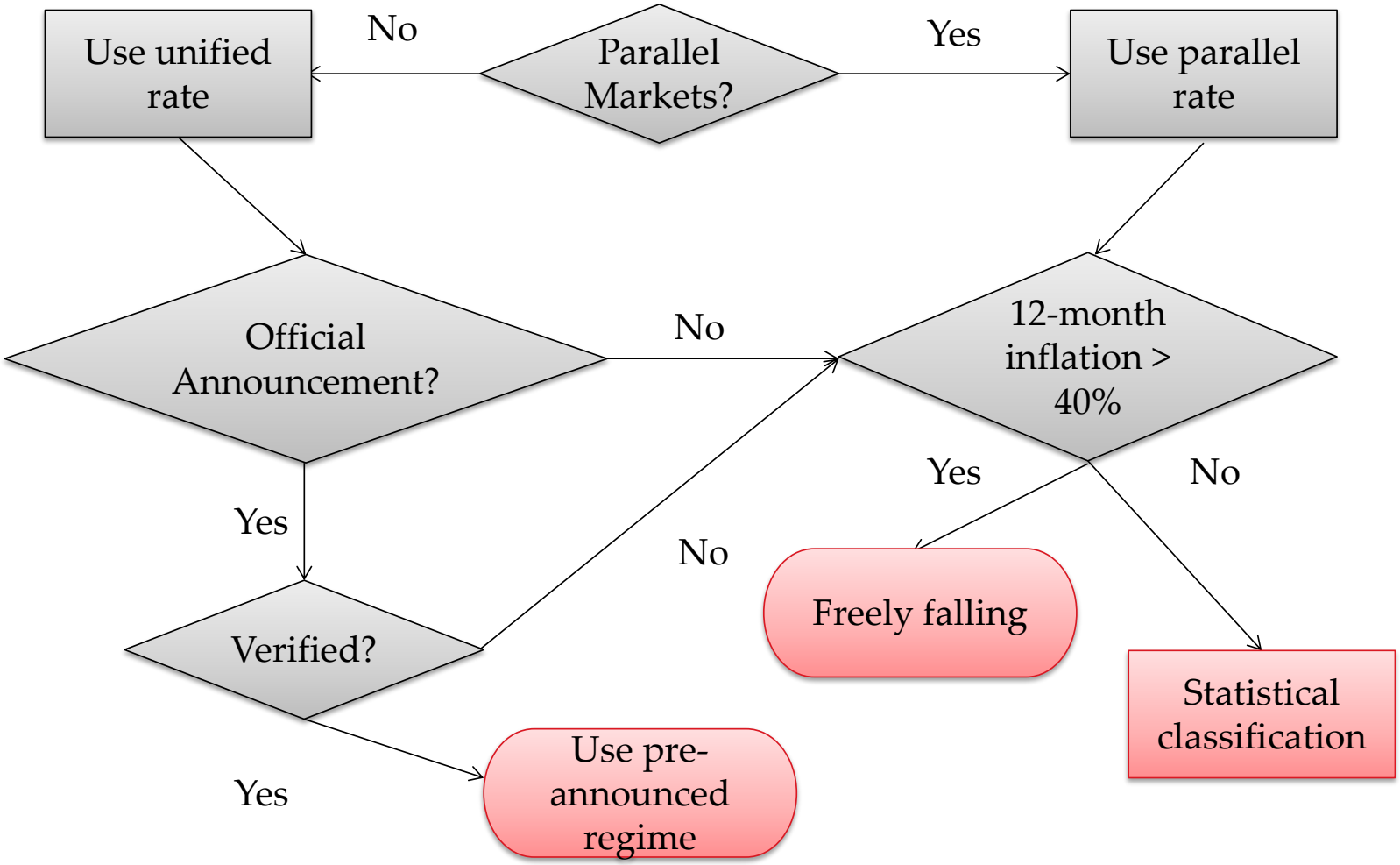
2	•	De facto crawling band that is narrower than or equal to +/-2%
3	•	Pre announced crawling band that is wider than or equal to +/-2%
3	•	De facto crawling band that is narrower than or equal to +/-5%
3	•	Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)
3	•	Managed floating
4	•	Freely floating
5	•	Freely falling
6	•	Dual market in which parallel market data is missing.

Source: Ilzetzki, Reinhart, and Rogoff (2017)

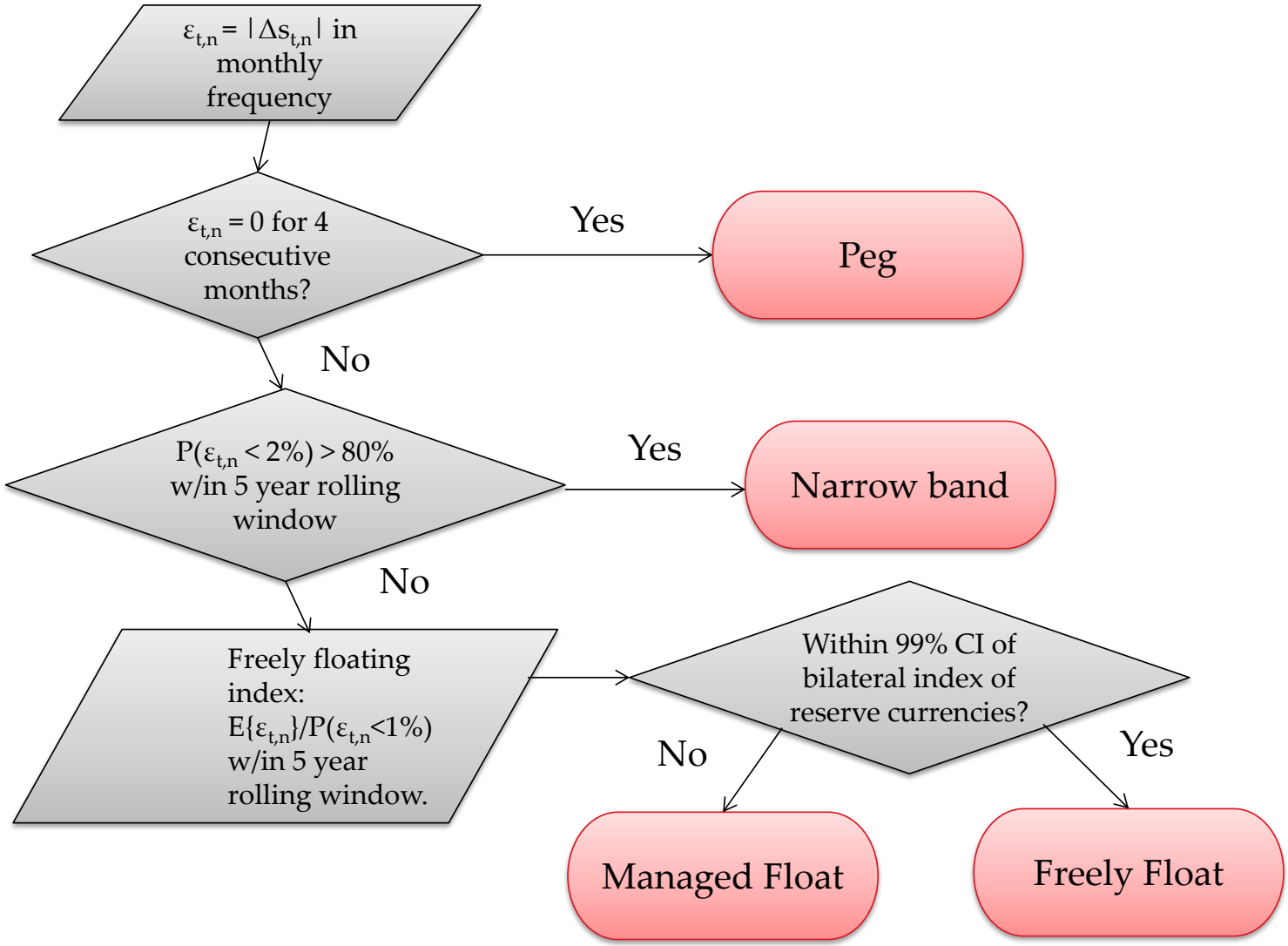
Sequence and general scheme



Source: Ilzetzki, Reinhart, and Rogoff (2017).

Exchange rate behavior examined to verify official announcements.

Statistical tests



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Managed Float

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- Create index: $E[\epsilon_{n,t}]/P(\epsilon_{n,t} < 0.01)$ where $\epsilon_{n,t} = |\Delta s_{n,t}|$
- Calculate distribution of index for anchor countries (i.e., for most obviously freely floating exchange rates)

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- If index is withing 99% CI, then freely floating
- Otherwise managed floating

Much fuller description in Reinhart-Rogoff 04

Euro Zone and Other Currency Unions

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  - Introduction of Euro should reduce FX flexibility not increase it

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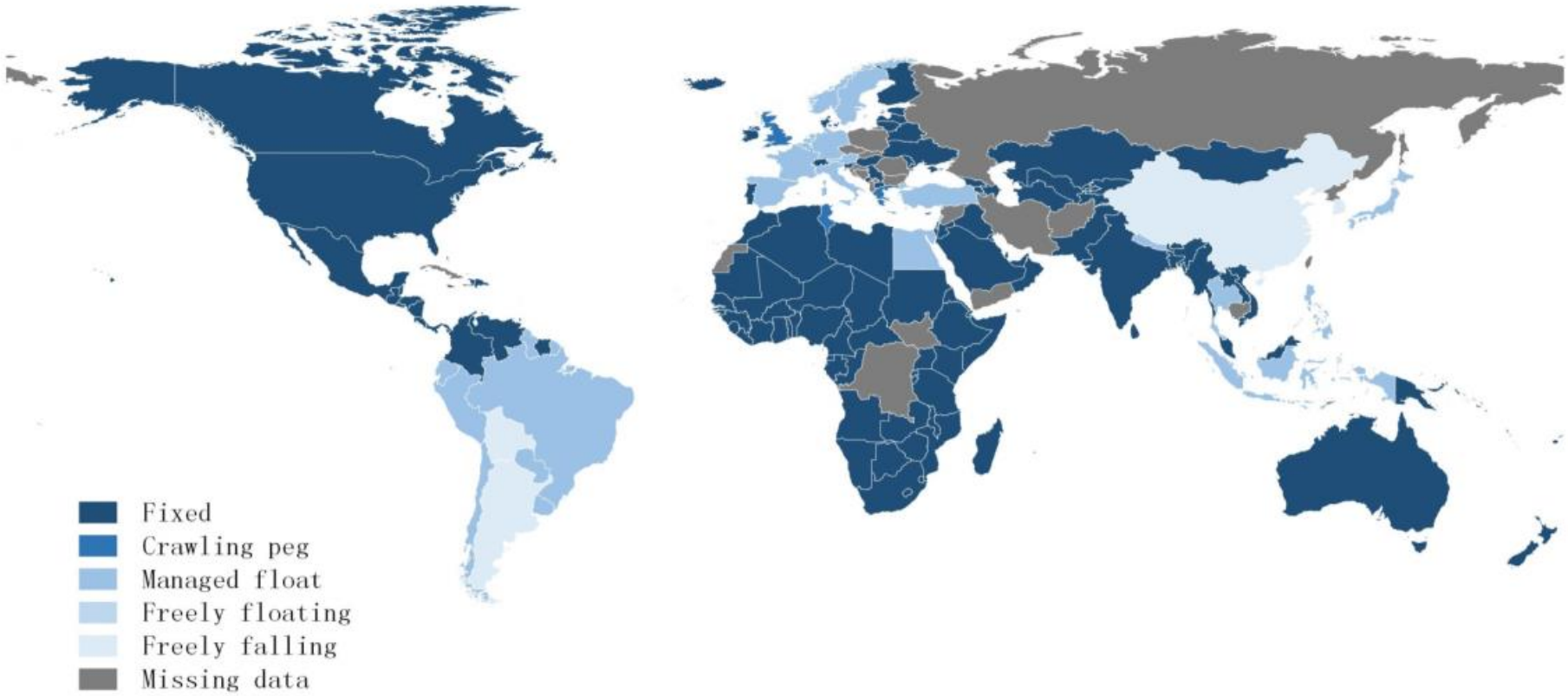
  - Even large countries have small vote share
  - Introduction of Euro should reduce FX flexibility not increase it
- Other currency unions simpler since they usually

  peg to EUR or USD

Figure 5. The Geography of Exchange Rate Arrangements, 1950 and 2015

1950



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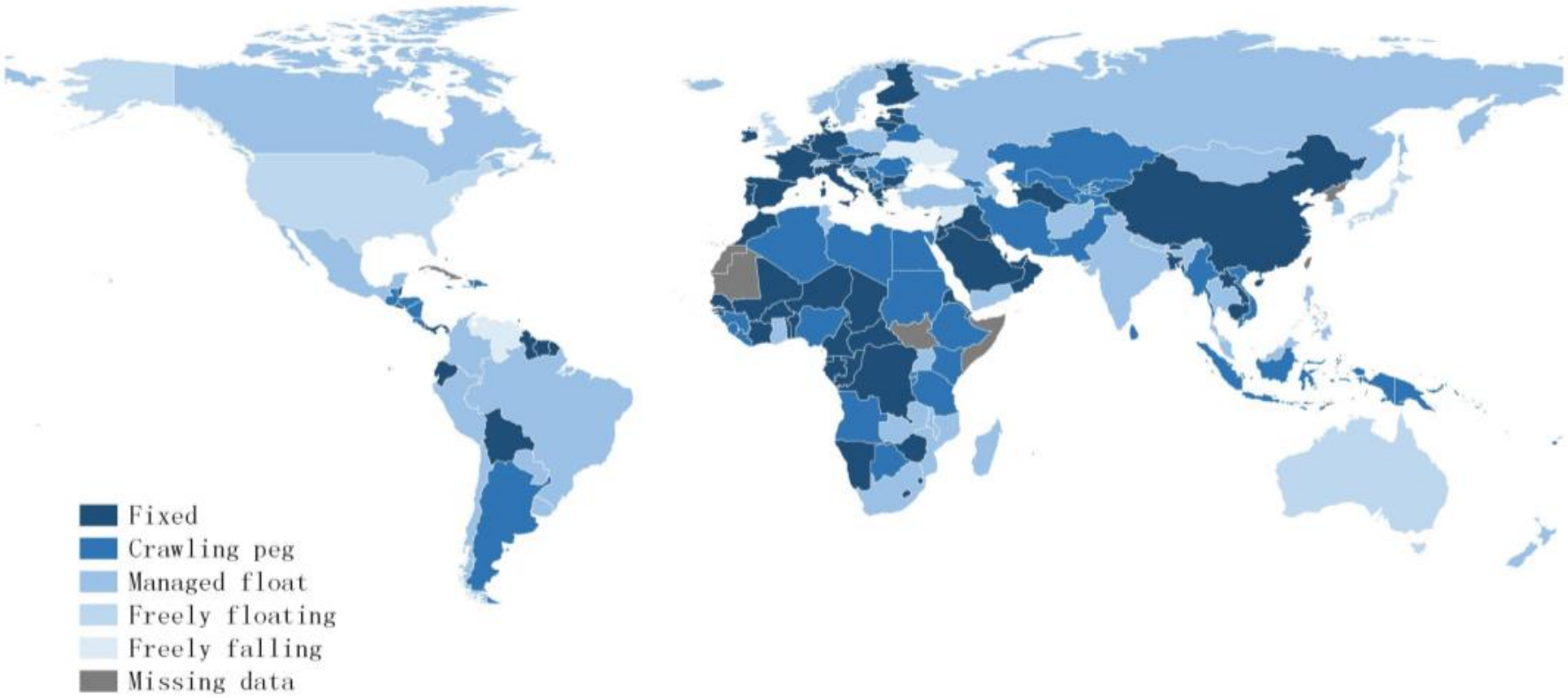
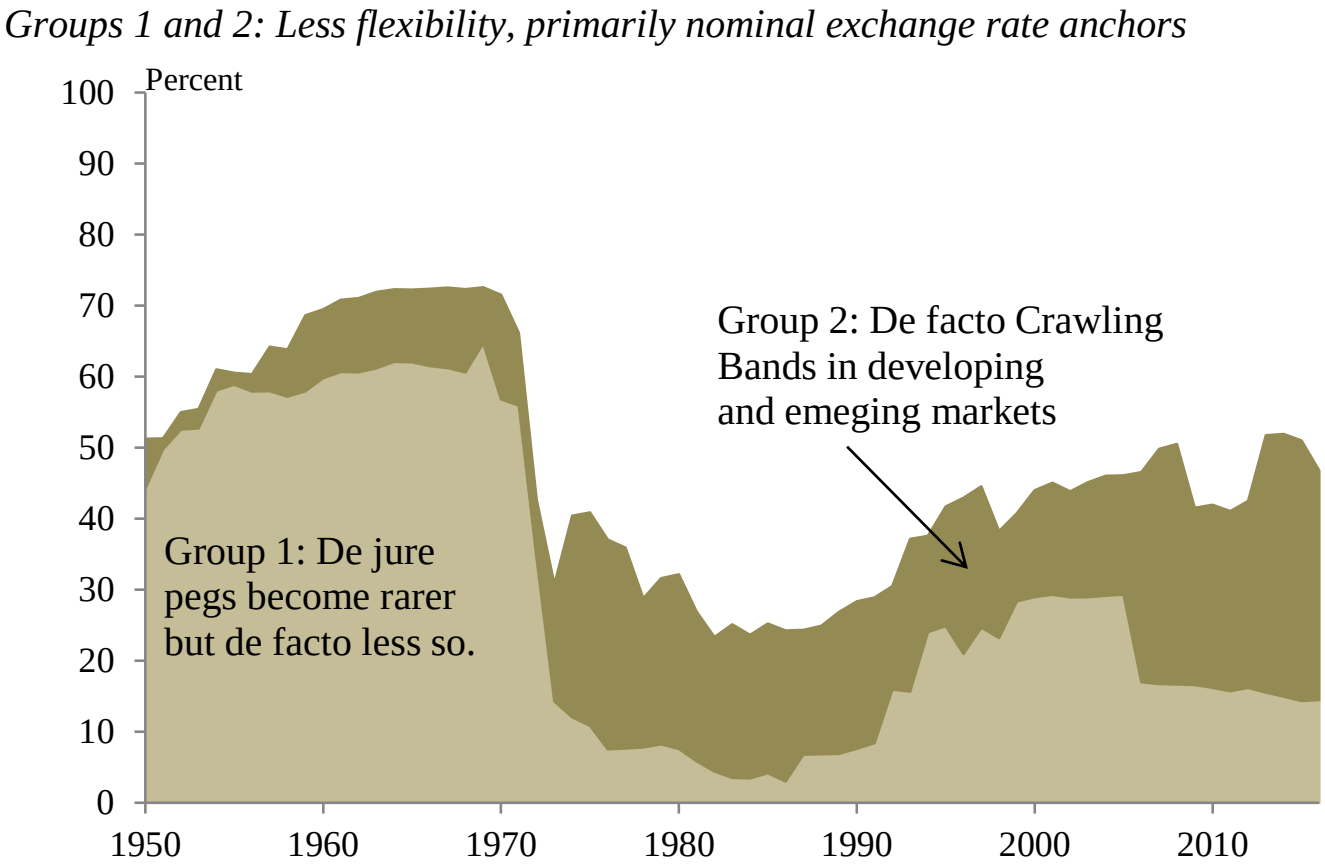
2015



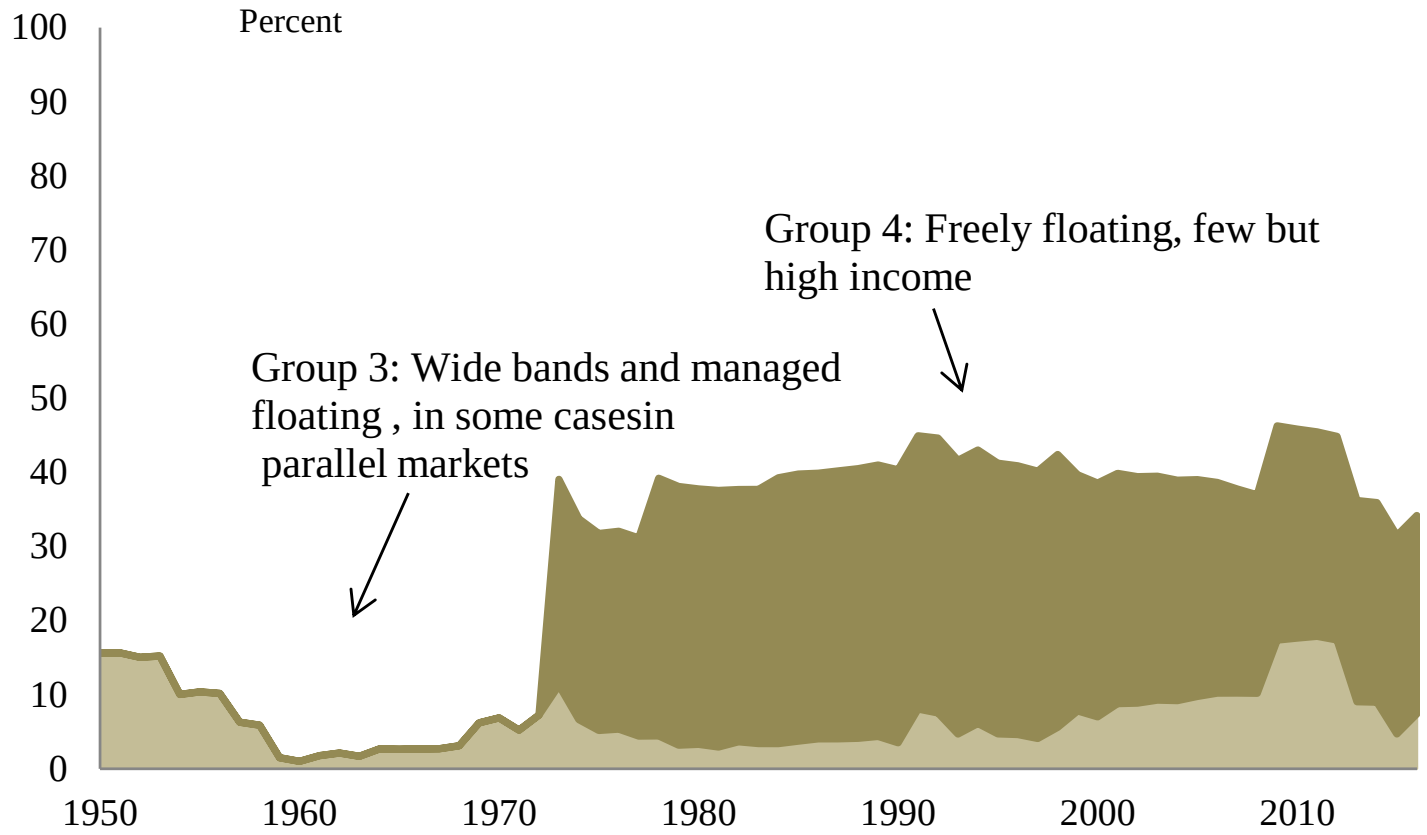
Source: Ilzetzki, Reinhart, and Rogoff (2017)

Figure 7. De Facto Exchange Rate Arrangements, Coarse Classification, 1946-2016: Arrangement Categories as Shares of World GDP



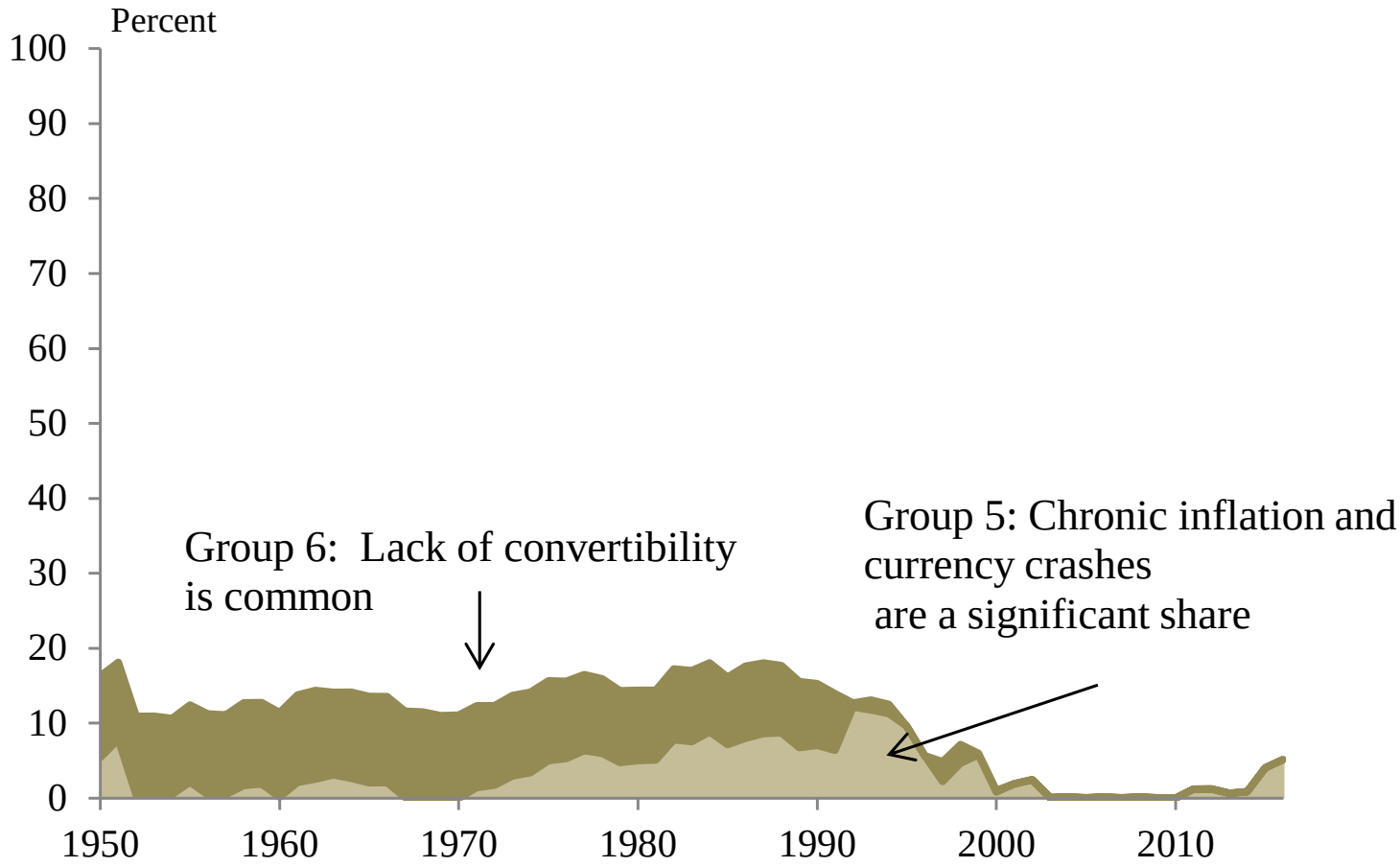
Source: Ilzetzki, Reinhart, and Rogoff (2017)

Groups 3 and 4: Flexibility, primarily interest rate, money and most (not all) inflation targeters



Source: Ilzetzki, Reinhart, and Rogoff (2017)

Groups 5 and 6: Flexibly unstable: Anchorless



Source: Ilzetzki, Reinhart, and Rogoff (2017)

Key Questions

- Theoretical arguments for floating versus pegging
- What do countries do?
  (Ilzetzki-Reinhart-Rogoff 17, Reinhart-Rogoff 04)
- Does it matter? What can be learned from it?
  (Baxter-Stockman 89, Broda 04, Krugman 89, Mussa 86)

Exchange Rate Arrangements
Does It Matter?

Does It Matter?

- Conventional wisdom: No it doesn't!
- Typical citation: Baxter-Stockman 89

BAXTER-STOCKMAN 89

Goal of the Paper:

- Are business cycles different under fixed vs. flexible exchange rate regimes?
- Compare pre-1973 to 1973-1986 for set of countries

BAXTER-STOCKMAN 89

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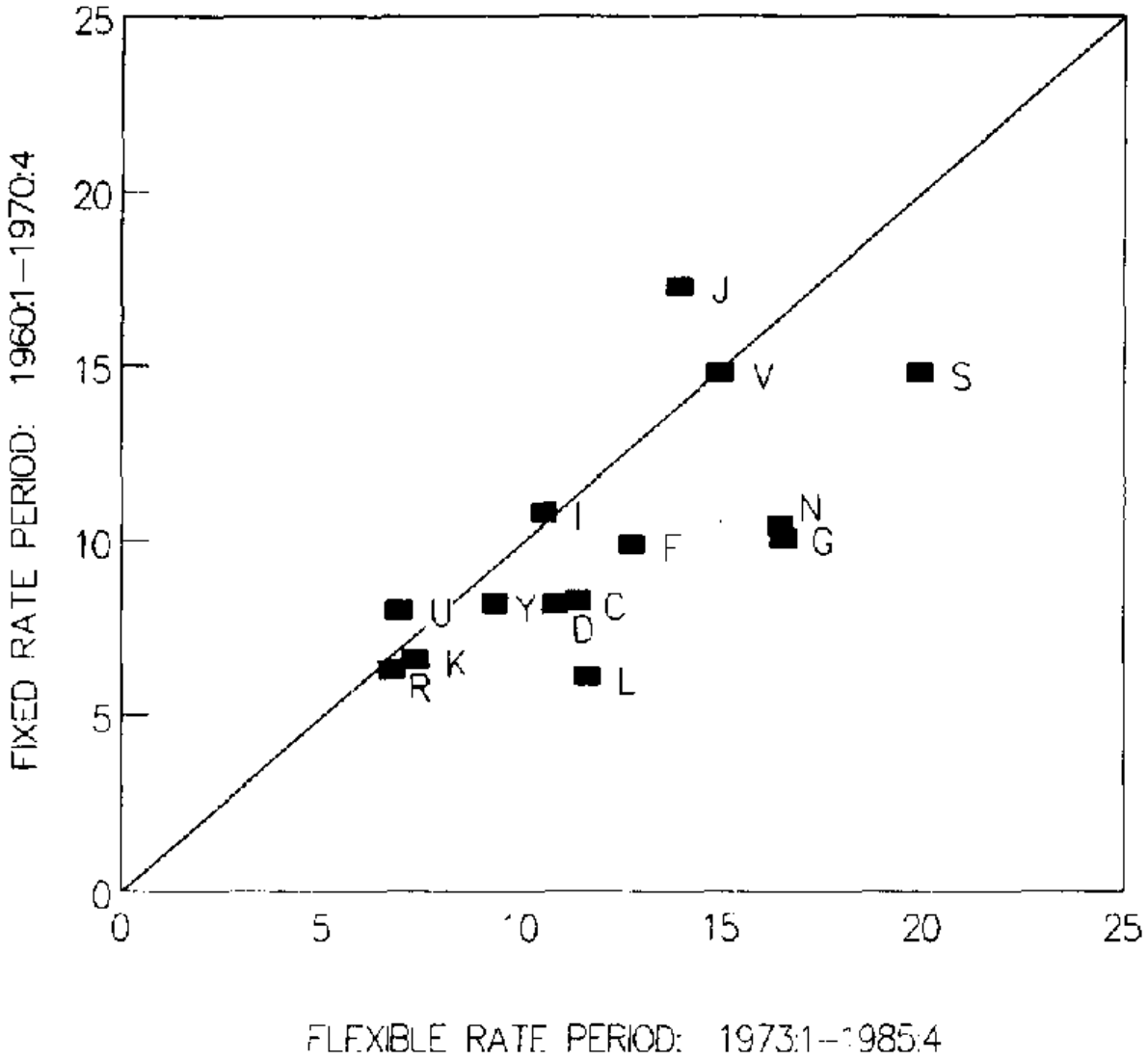
- Are business cycles different under fixed vs. flexible exchange rate regimes?
- Compare pre-1973 to 1973-1986 for set of countries
- Stated conclusion:

  Aside from greater variability of real exchange rates under flexible than pegged nominal exchange-rate systems, we find little evidence of systematic differences in the behavior of macroeconomic aggregates or international trade flows under alternative exchange-rate systems.



COUNTRY NAME	SYMBOL
USA	U
FRANCE	F
CANADA	C
ITALY	I
NETHERLANDS	N
IRELAND	R
LUXEMBOURG	L
YUGOSLAVIA	Y
FINLAND	D
GREECE	G
JAPAN	J
SPAIN	S
GREAT BRITAIN	K
SWEDEN	V

Fig. 1. Standard deviation of industrial production (%); linear trend filter.

Source: Baxter and Stockman (1989)

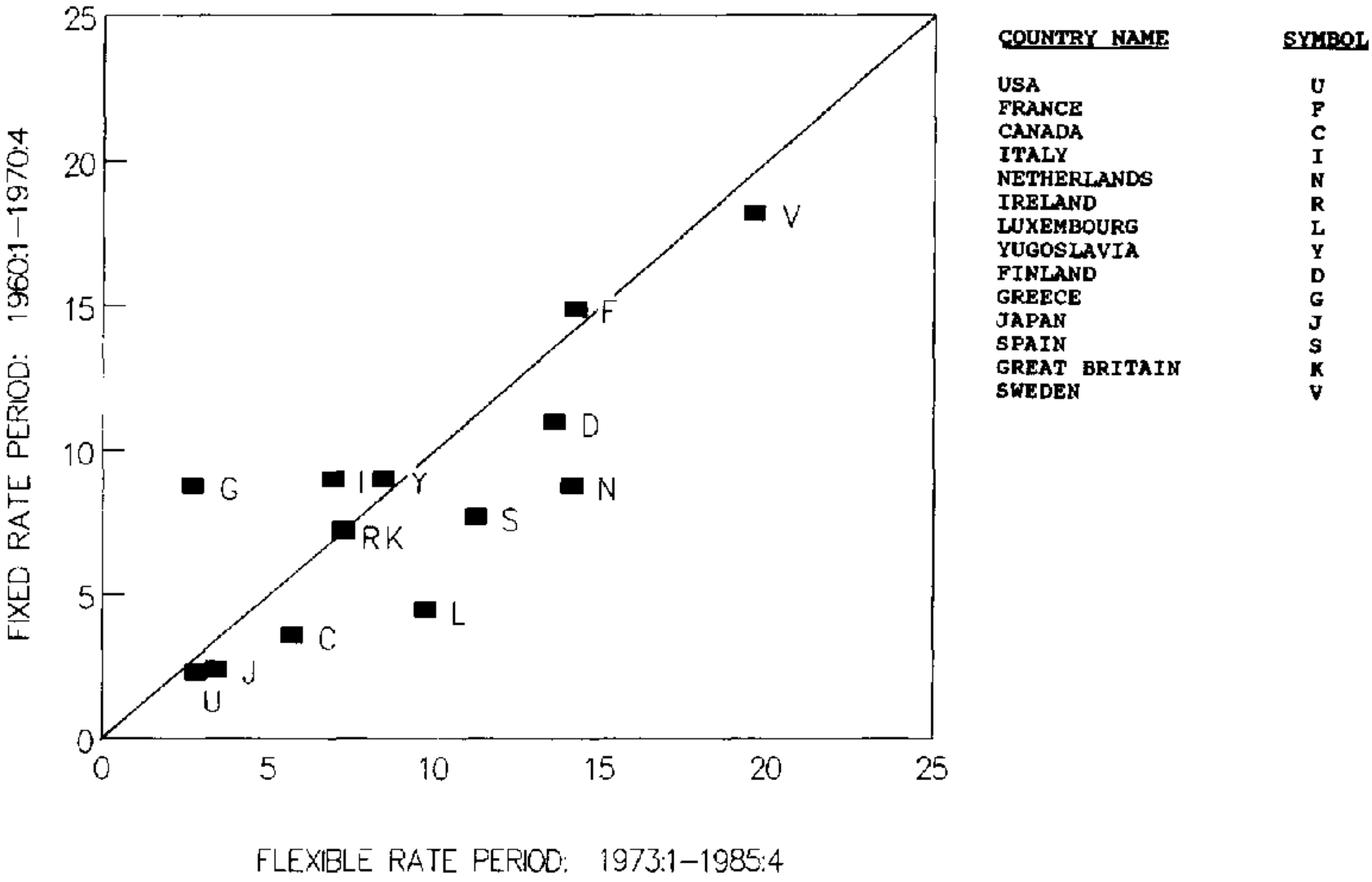
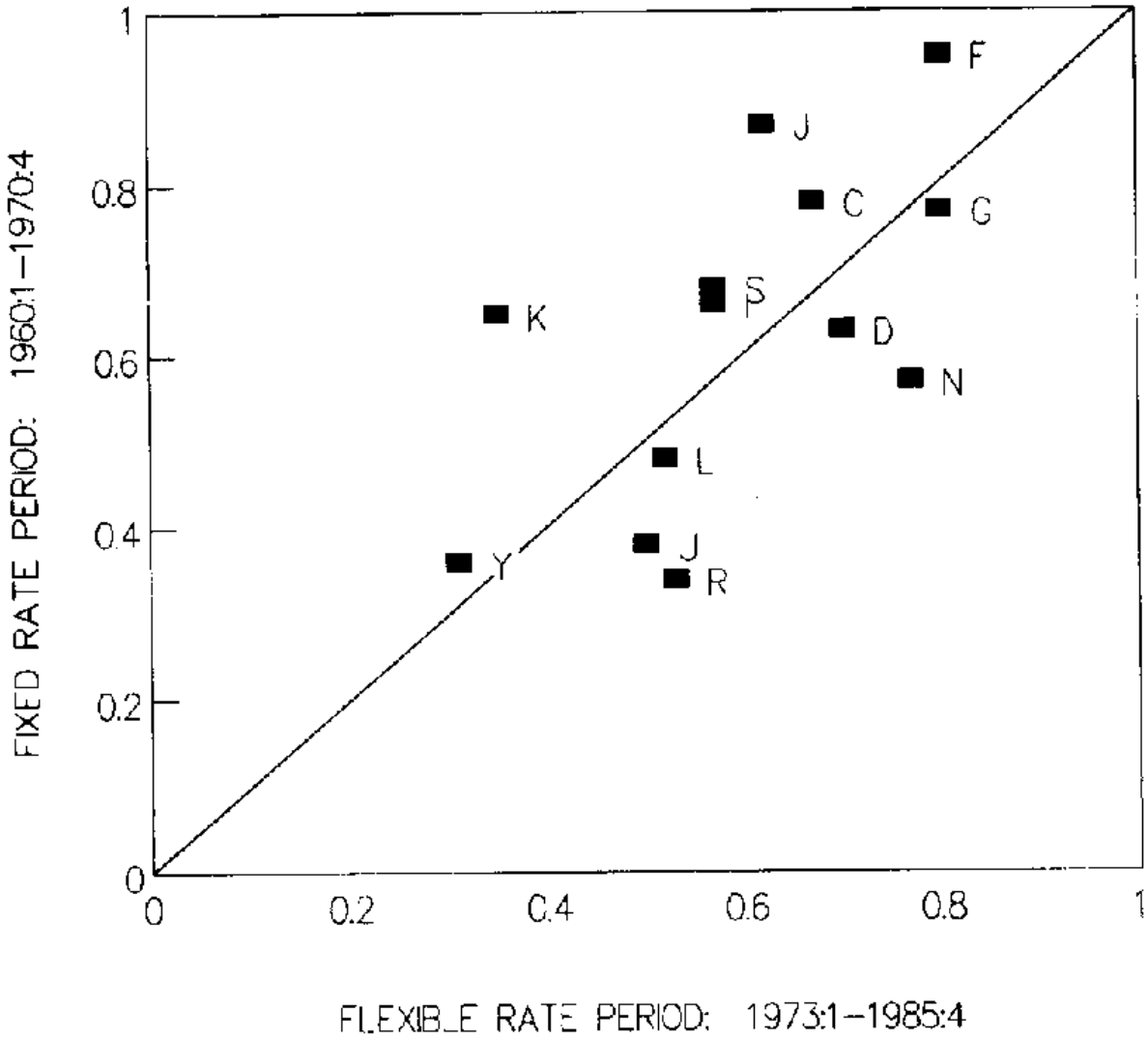


Fig. 2. Standard deviation of industrial production (%); first difference filter.

Source: Baxter and Stockman (1989)



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GREECE	G
JAPAN	J
SPAIN	S
GREAT BRITAIN	K
SWEDEN	V

Fig. 3. Correlation of industrial production with U.S.; linear trend filter.

Source: Baxter and Stockman (1989)

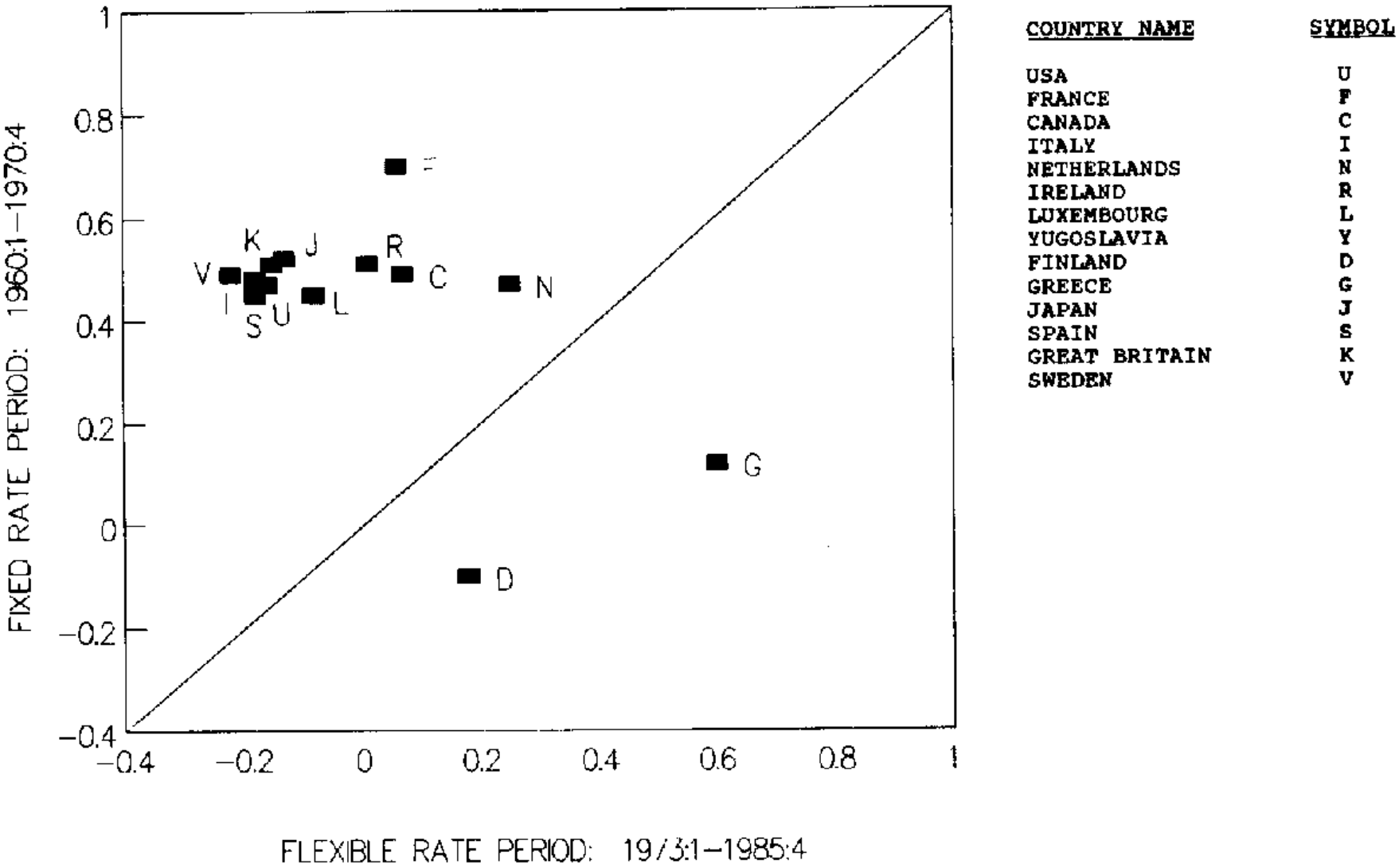

Fig. 4. Correlation of industrial production with U.S.; first difference filter.

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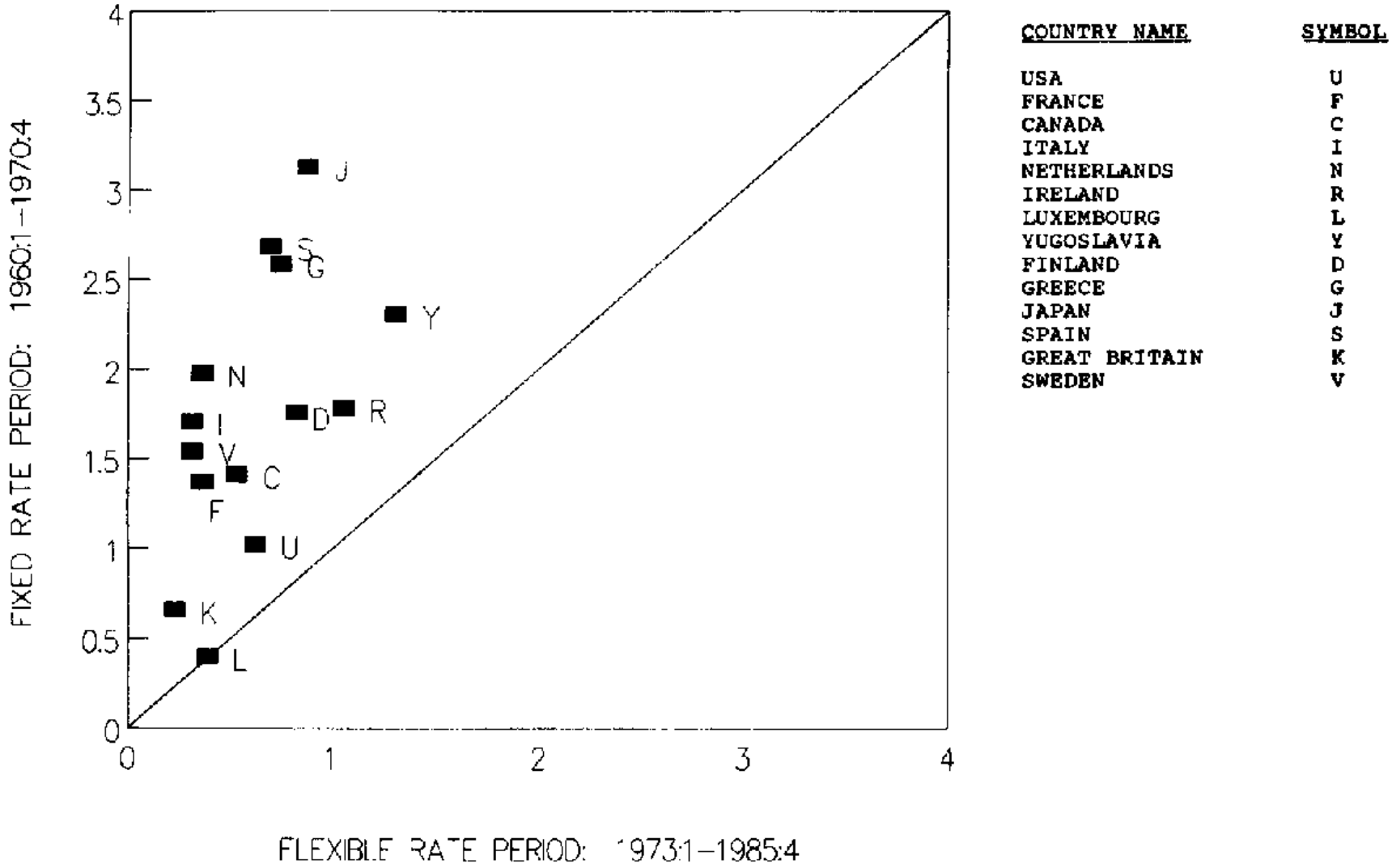

COUNTRY NAME	SYMBOL
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FINLAND	D
GREECE	G
JAPAN	J
SPAIN	S
GREAT BRITAIN	K
SWEDEN	V

Fig. 5. Average growth rate of industrial production (%).

Source: Baxter and Stockman (1989)

Results for Industrial Production

- Volatility higher for most countries in flex period
- Correlation of growth with US much lower in flex period
- Average growth much lower in flex period

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- Hard to square with stated conclusion!
- But of course this proves nothing about causal effect of money since other things are going on.

Broda 2004

Goal of the Paper:

- Do countries with flexible exchange rates react differently to terms of trade shocks from countries countries with fixed exchange rate

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  - Devalue in response to adverse terms of trade shock
  - This increases demand and makes up for adverse consequences of terms of trade shock

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- Traditional theory suggests that flexible exchange rates helps countries react to terms of trade shock
  - Devalue in response to adverse terms of trade shock
  - This increases demand and makes up for adverse consequences of terms of trade shock
- Definition of terms of trade: $tt_{it} = P_{it}^{ex} / P_{it}^{im}$ (in home currency)

Research Design

- Divides countries into fixed, flexible, intermediate regimes (R_{it})
- Runs panel VAR with coefficient different for each regime

$$A_0 Y_{it} = A(L) Y_{it} + B(L) X_{it} + u_{it}$$

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Research Design

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- Assumes that terms of trade is exogenous
  (ordered first in Cholesky decomposition)
- Controls: openness, financial development, change in current account, change in real gov expenditures as share of GDP.

Research Design

- Annual data, four lags, sample period 1973-1996
- 75 developing countries
- Requires $R_{it} = R_{it-1} = R_{it-2}$.

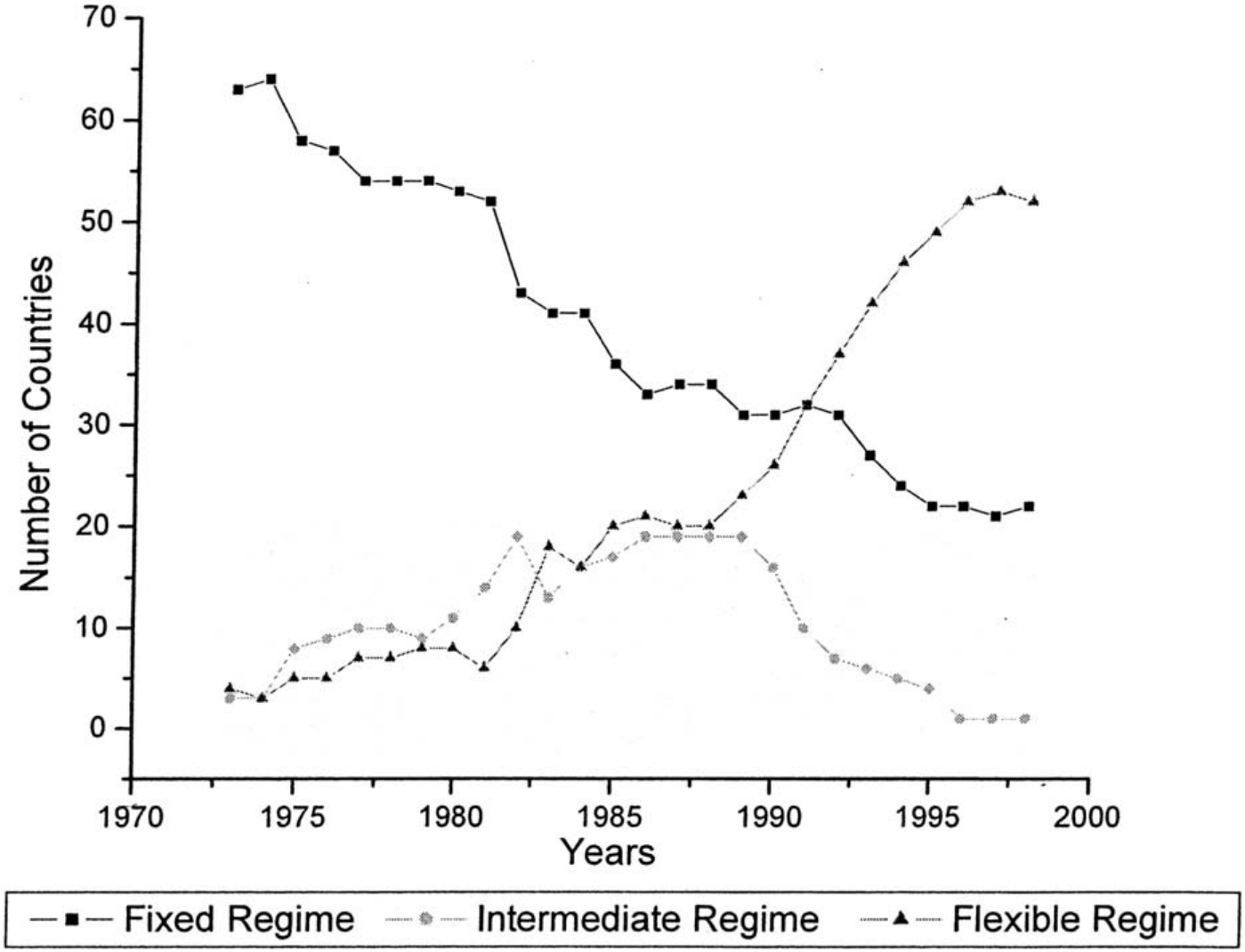
  I.e., drops regime switch years and few years after
- Estimated using seemingly unrelated regressions

Exchange Rate Classification

- de jure IMF classification doesn't reflect reality
- Why not base a classification purely on volatility of the exchange rate?
  - Stability may mean fix or may mean absence of shocks

Exchange Rate Classification

- de jure IMF classification doesn't reflect reality
- Why not base a classification purely on volatility of the exchange rate?
  - Stability may mean fix or may mean absence of shocks
- Makes use of Ghosh-Gulde-Ostry-Wolf 97 classification
  - Starts with de jure
  - Divides fixers into frequent and infrequent adjusters
  - Distinguish heavily managed floats from othe floats
  - Three way classification with intermediate regimes being: pegged frequent adjusters, cooperative arrangements, floats in pre-determined range, heavily managed floaters



Notes: The Exchange Rate Regime Classification is based on Ghosh et al (1997).

Source: Broda (2004)

Exogeneity of Terms of Trade

- Idea: small countries are price takers in international markets

Exogeneity of Terms of Trade

- Idea: small countries are price takers in international markets
- Three worries:
  - Countries may be large in a particular export
    (e.g., Chile for copper, Brazil for coffee, Malaysia for rubber, etc.)
  - May have pricing power over highly differentiated products
  - Home demand shocks would affect terms of trade
    (through prices or exchange rates)

Table 2
Goods with 15% or more world export share

SITC	Good	Country	Good's X-share in country's total X	Good's X-share in world's total X
71	Coffee and Substitutes	Brazil	5.6	17.71
281	Iron ore concentrates	Brazil	5.38	29.28
652	Cotton fabrics, woven	China	2.29	16.41
658	Textile articles nes	China	1.76	20.51
831	Travel goods, handbags	China	1.94	27.13
842	Mens outerwear nonknit	China	3.94	20.3
843	Womens outerwear nonknit	China	4.79	17.65
844	Undergarments nonknit	China	1.66	18.34
848	Headgear, nontxtl clothing	China	1.96	23.52
851	Footwear	China	4.44	18.41
894	Toys, sporting goods, etc	China	4.06	19.15
899	Other manufactured goods	China	1.91	16.38
72	Cocoa	Cote d'Ivoire	39.92	24.27
653	Woven man-made fib fabric	Korea	5.58	20.12
233	Natural rubber, gums	Malaysia	2.06	21.73
424	Fixed veg oil nonsoft	Malaysia	5.23	47.54
762	Radio broadcast receivers	Malaysia	4.77	18.74
271	Fertilizers, crude	Morocco	6.47	22.01
752	Automatic data proc equip	Singapore	15.9	15.12
74	Tea and Mate	Sri Lanka	13.06	18.67
36	Rice	Thailand	3.46	26.54
37	Fish etc prepd, prsvd nes	Thailand	3.03	18.43
232	Natural rubber, gums	Thailand	4.06	32.77
Total	22 Goods	9 Countries	6.23	22.21

Notes: By changing the cutoff line to 5 and 10%, 50 and 39 goods were selected. Source: Handbook of International Trade and Development Statistics (1996–1997), United Nations.

Source: Broda (2004)

Responses to a 10% (PV) Permanent Fall in TT

Under Fixed Regimes

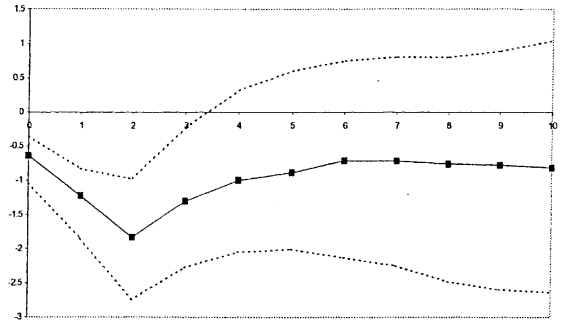


Figure 3: Real GDP Response

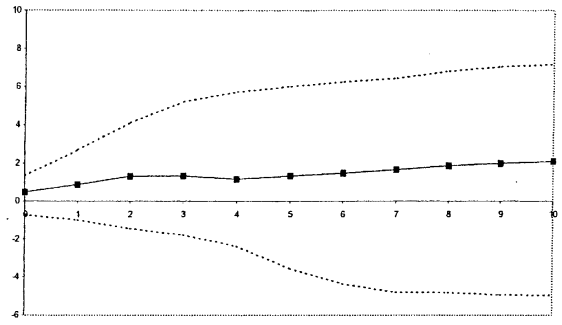


Figure 4: RER Response

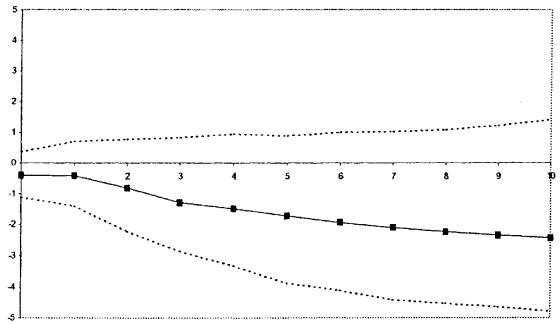


Figure 5: CPI Response

Under Flexible Regimes

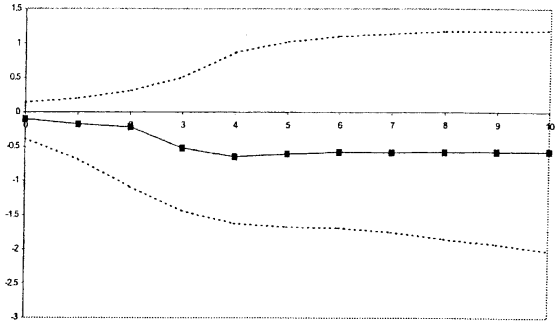


Figure 6: Real GDP Response

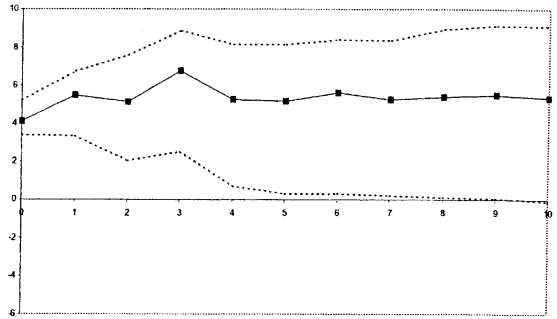


Figure 7: RER Response

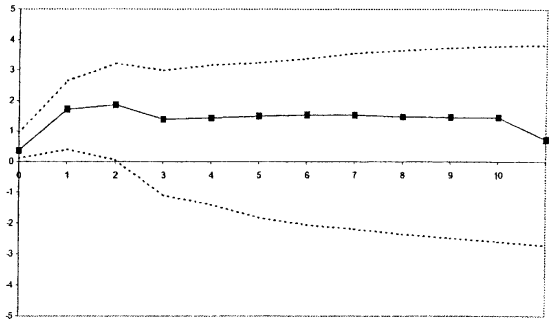


Figure 8: CPI Response

Source: Broda (2004)

Main Results

- Output losses larger for fixers
- RER response larger for floaters
- Fixers see deflation, while floaters see inflation

Asymmetry

Are these results different for positive relative to negative shocks?

- Allows for asymmetric responses to positive and negative shocks
- Does this separately for floaters and fixers

Results:

- No asymmetry for fixers
- Asymmetry for floaters

Responses to a 10% (PV) Permanent Positive (dotted line) and Negative (solid line) change in TT under Fixed Regimes

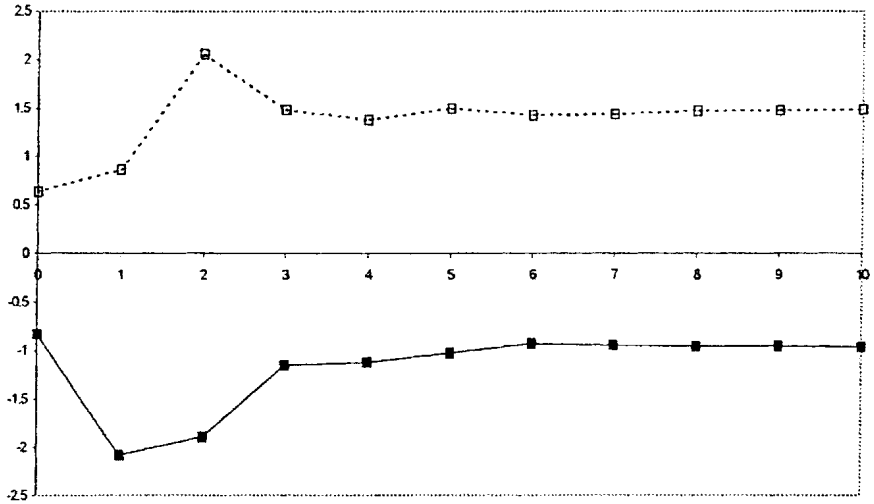


Figure 9: Real GDP Response

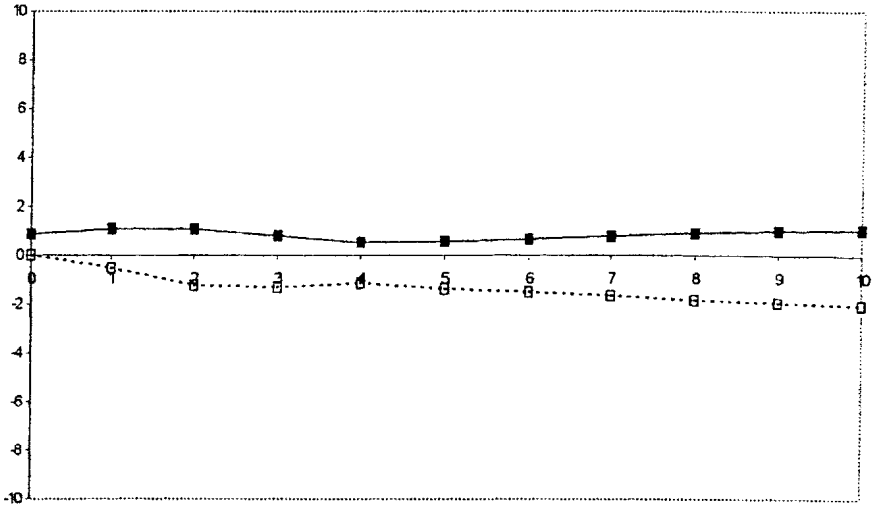


Figure 10: RER Response

Source: Broda (2004)

Responses to a 10% (PV) Permanent Positive (dotted line) and Negative (solid line) change in TT under Flexible Regimes

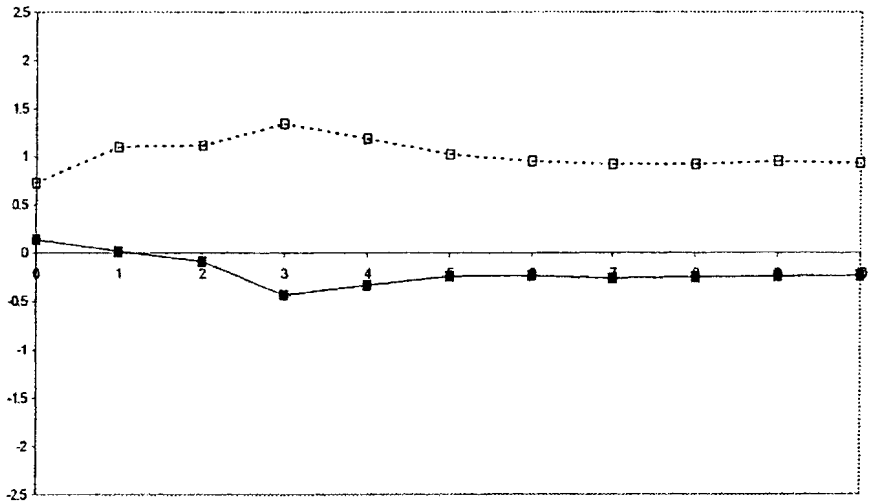


Figure 11: Real GDP Response

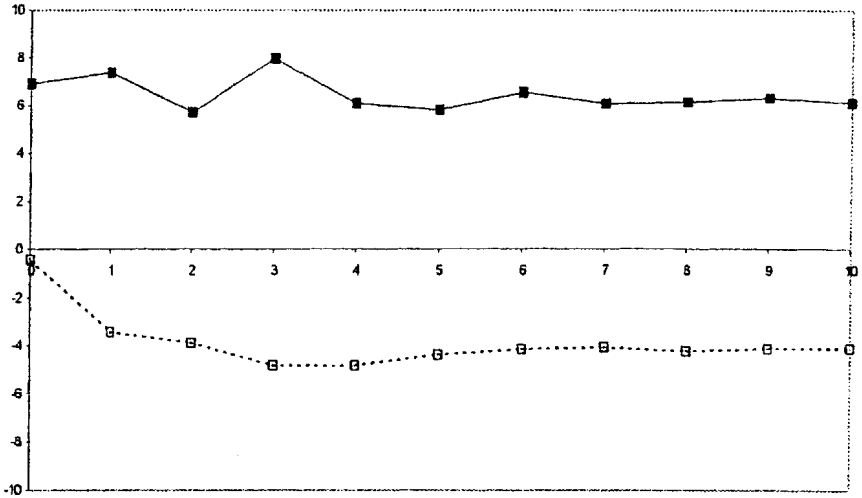


Figure 12: RER Response

Source: Broda (2004)

Alternative Research Design

- Hard to interpret results due to possible endogeneity of terms of trade
- Possible instruments:
  - Bartik instrument or sensitivity instrument
  - E.g., Global oil prices times country sensitivity of terms of trade
- Time fixed effects
  - Inclusion would eliminate time series variation
  - Broda focuses on difference, which is similar

Exchange Rates and Price Rigidity

- Can we infer anything about price rigidity from the behavior of exchange rates?

Exchange Rates and Price Rigidity

- Can we infer anything about price rigidity from the behavior of exchange rates?
- Well, nominal and real exchange rates are highly correlated

NOMINAL VS. REAL EXCHANGE RATE

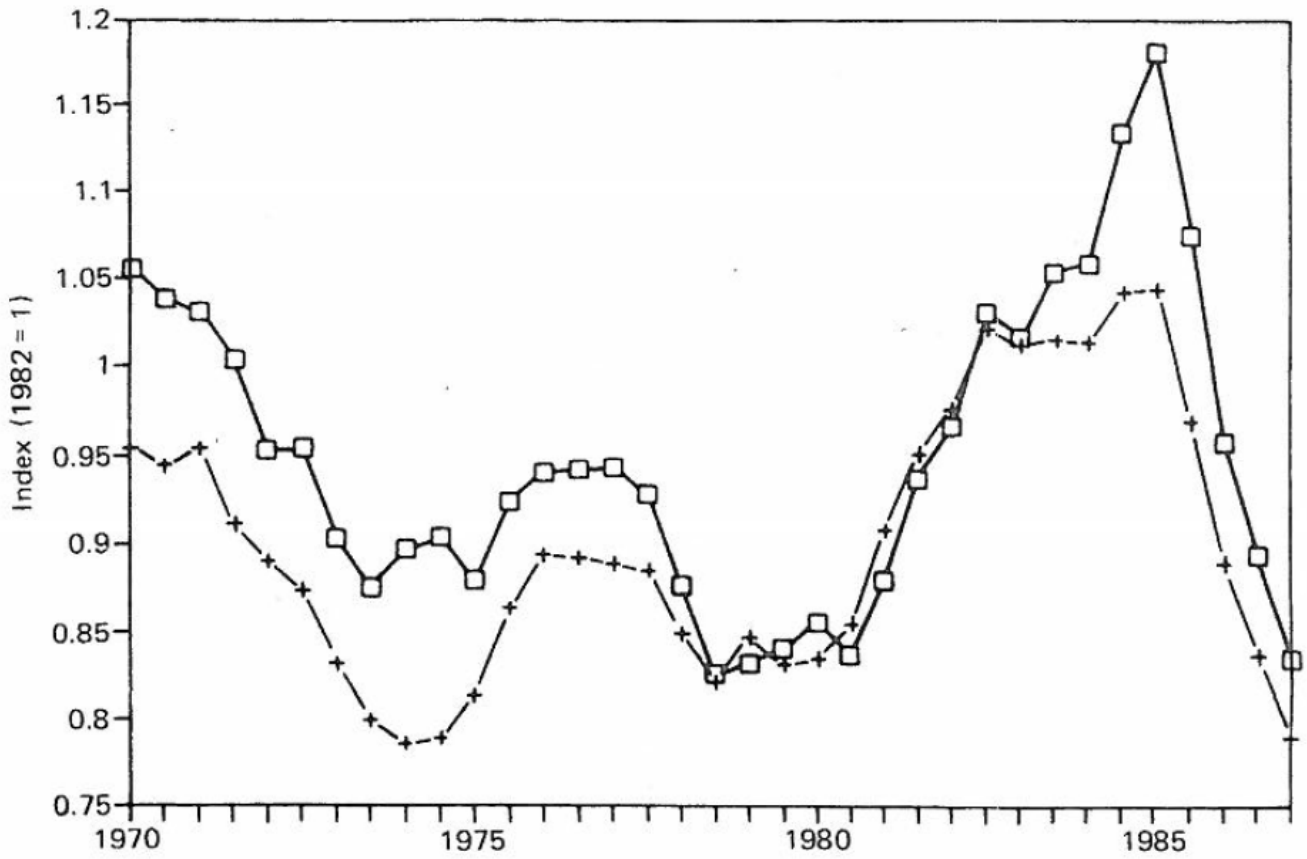


Figure 1.3
Nominal versus real exchange rate. □ : exchange rate; + : relative price.

Source: Krugman (1989)

Correlation vs. Causality

This seems straightforward enough. I would leave the subject here and go on to policy issues, except that the state of debate in contemporary economics doesn't let me. To me, the prima facie case that prices are sticky is overwhelming...For many of my colleagues, however, continuous market clearing and the absence of any money illusion are fundamental tenets, and this obliges them to explain away the appearance of price inflexibility as some kind of optical illusion....

Source: Krugman (1989)

Correlation vs. Causality

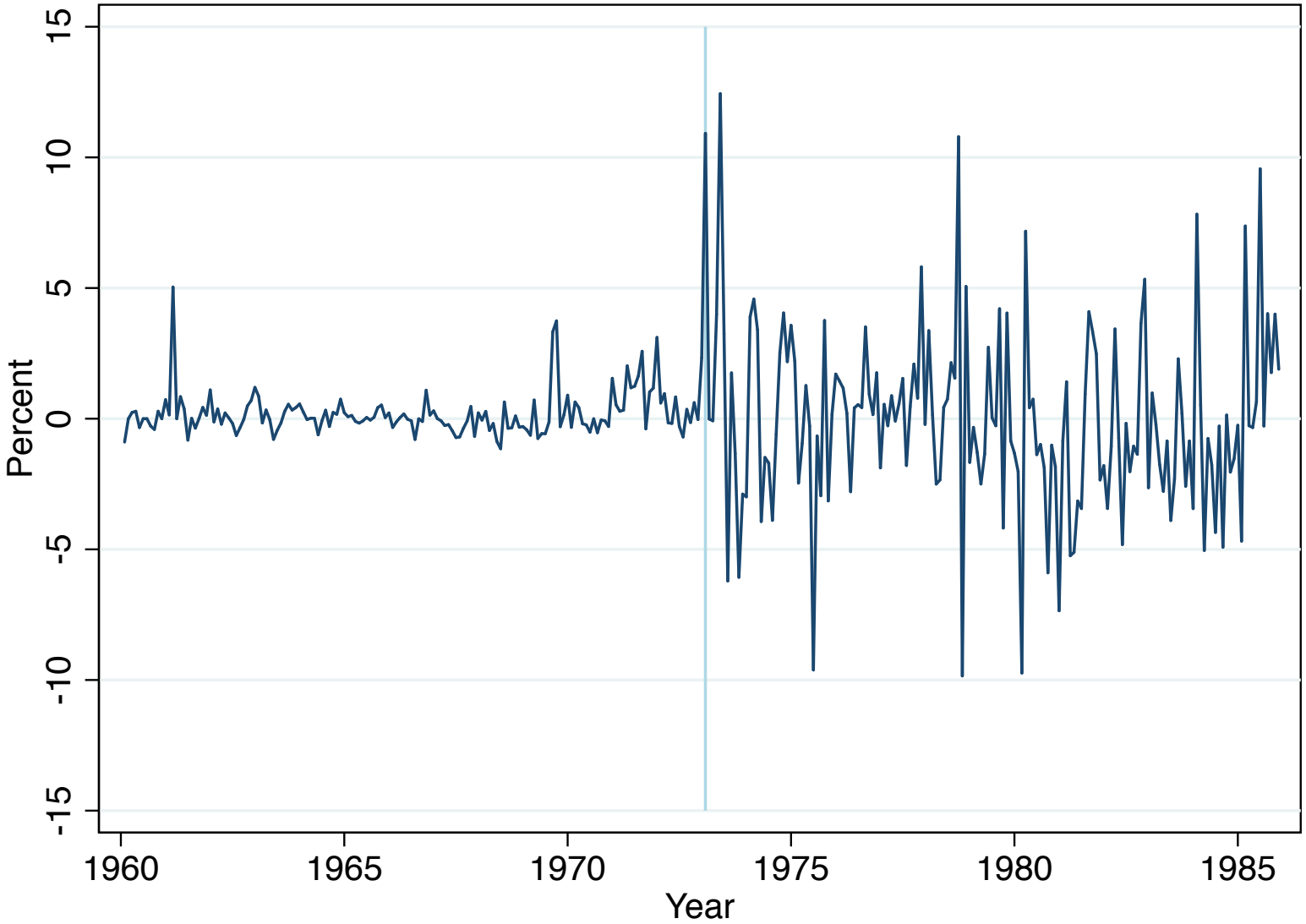
In particular, one now often hears the argument that the kind of evidence I have presented ...has got the causation backwards–that what really happens is that real exchange rates are moving around for real reasons, and the attempt of monetary authorities to stabilize domestic price levels creates the correlation between real and nominal rates.

Source: Krugman (1989)

Mussa Fact

- Do movements in nominal exchange rates (or lack thereof) "cause" movements in the real exchange rate?
- Or vice versa?
- Mussa: Look at discontinuity in the volatility of the real exchange rate at the time of changes in the exchange rate regime

Mussa 86 – Breakdown of Bretton Woods



Source: Nakamura and Steinsson (2018). Change in U.S. - German real exchange rate.

Exchange Rate Disconnect

- Floating exchange rates extremely volatile
- Exchange rate movements seem disconnected from movements of other macro variables
  - But evidence on this point is poorly developed

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- Floating exchange rates extremely volatile
- Exchange rate movements seem disconnected from movements of other macro variables
  - But evidence on this point is poorly developed
- Krugman: Exchange rates can move so much precisely because they seem to matter so little!
- We don't have a good theoretical or empirical handle on this issue!!

Interesting recent paper: Itskhoki and Mukhin (2017)