



The Trilemma and Reserves: Measurement and Policy Implications

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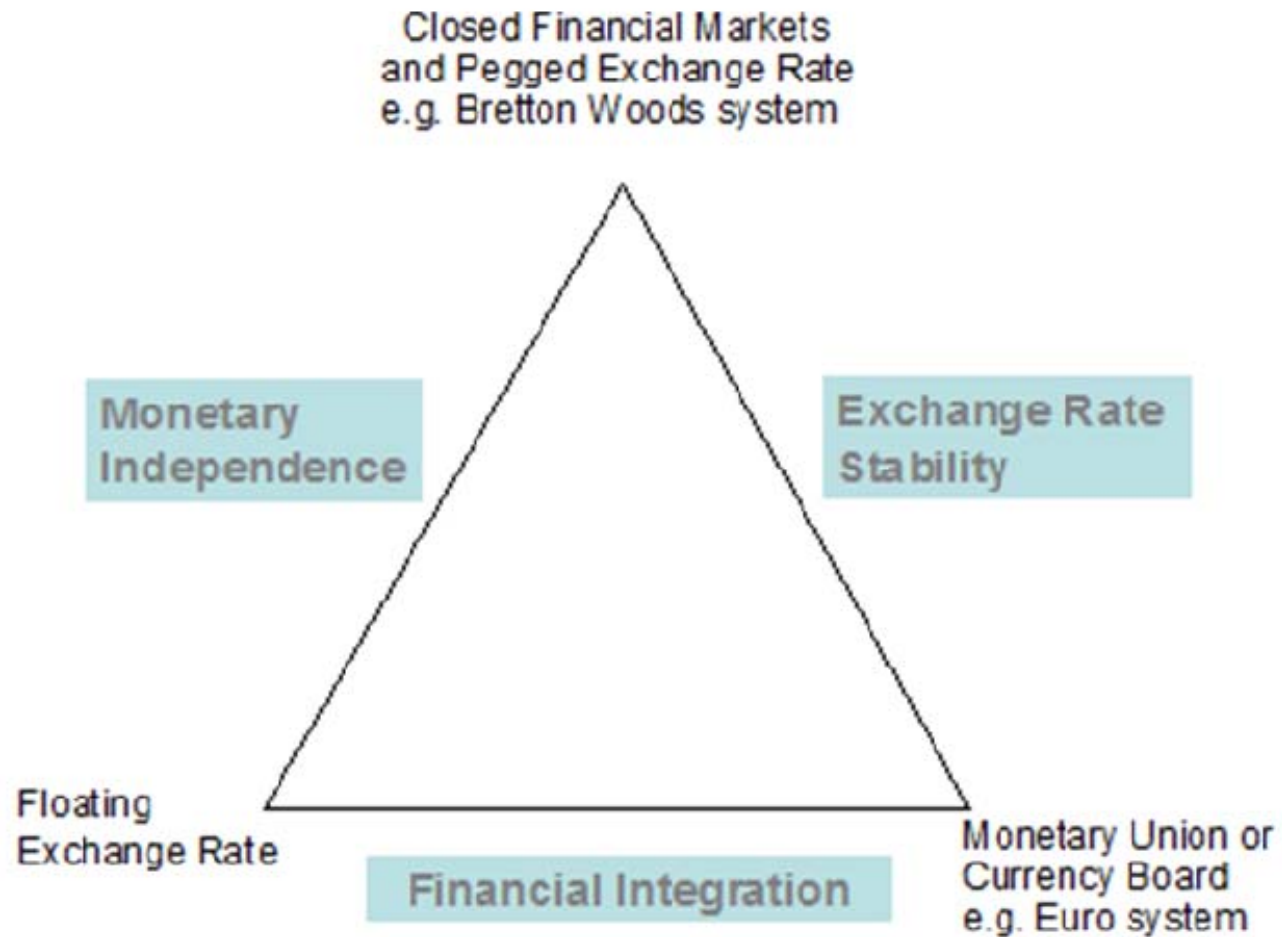
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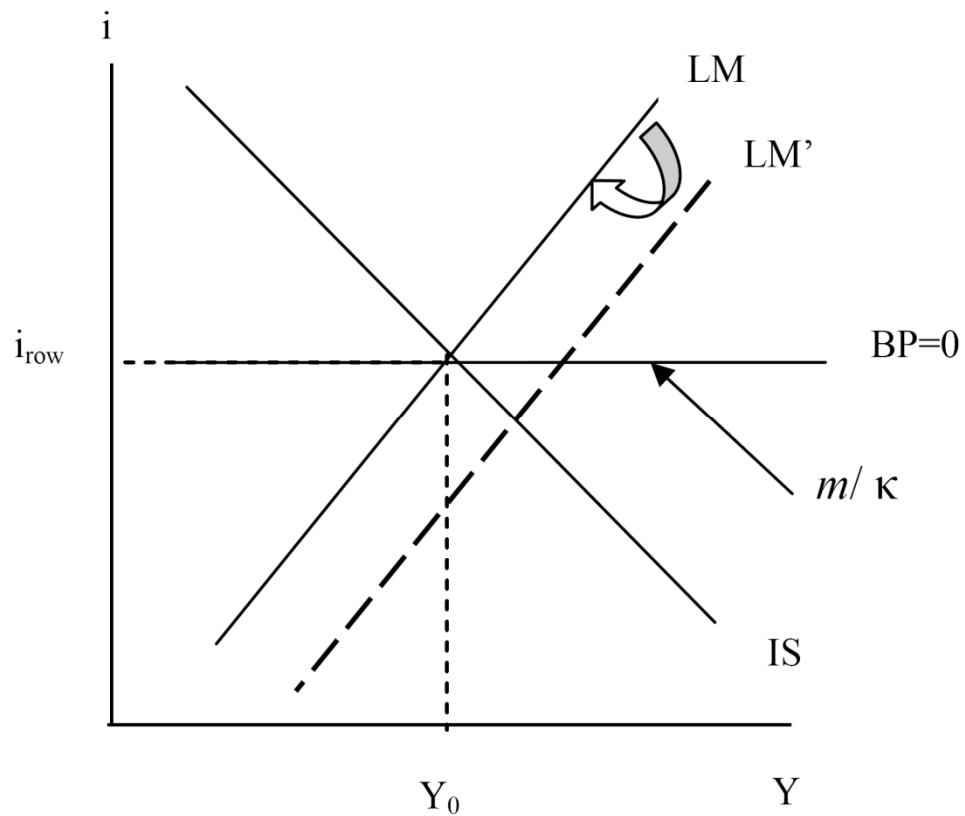
Outline

1. The Trilemma
2. Measuring Trilemma goals
3. The Evolution of the Trilemma, and Reserves
4. Inflation/Output Implications
5. Reserve Accumulation, Again

The Trilemma, aka “The Impossible Trinity”

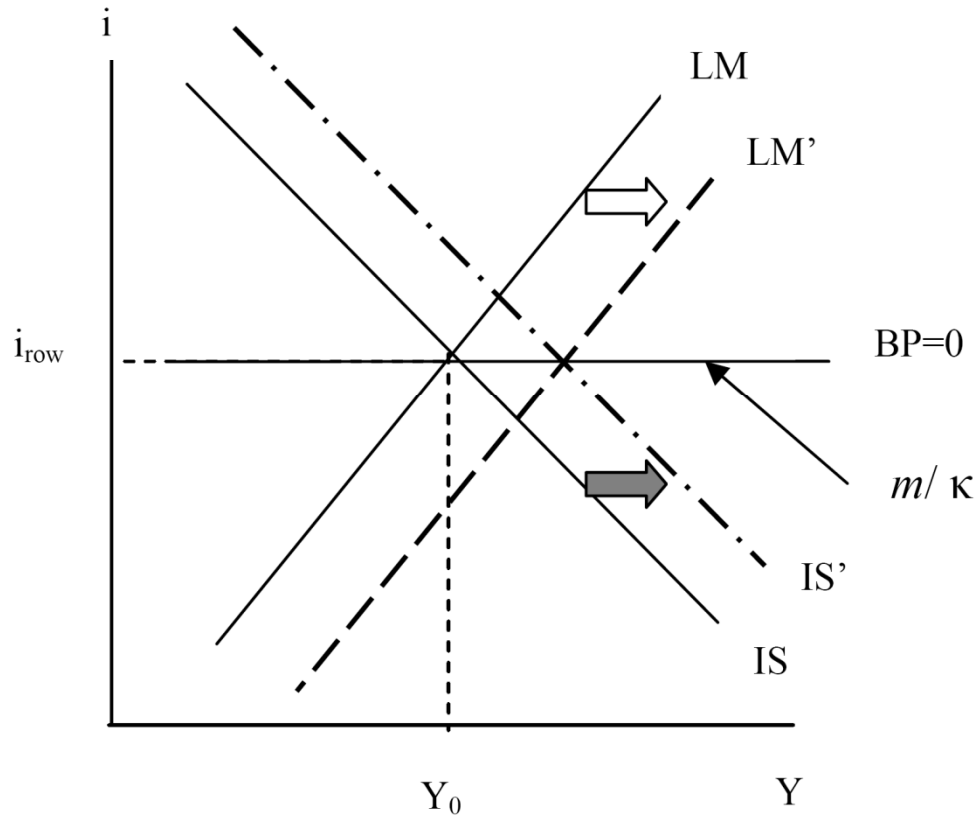


Mundell-Fleming Interpretation



Monetary policy under fixed exchange rates and perfect capital mobility

Mundell-Fleming Interpretation



Monetary policy under flexible exchange rates and perfect capital mobility; note IS moves as exchange rate depreciates



What's Missing?

- Credibility issues
- Other constraints (incl. financial stability)
- Other markets – including loan market
- Consider a Bernanke-Blinder CC-LM model with imperfect capital mobility
- Rey's "Dilemma not Trilemma"



Measuring the Trilemma Goals

Monetary Independence

$$MI = 1 - \frac{\text{corr}(i_i, i_j) + 1}{2}$$

where i refers to home countries and j to the base country.

Exchange Rate Stability

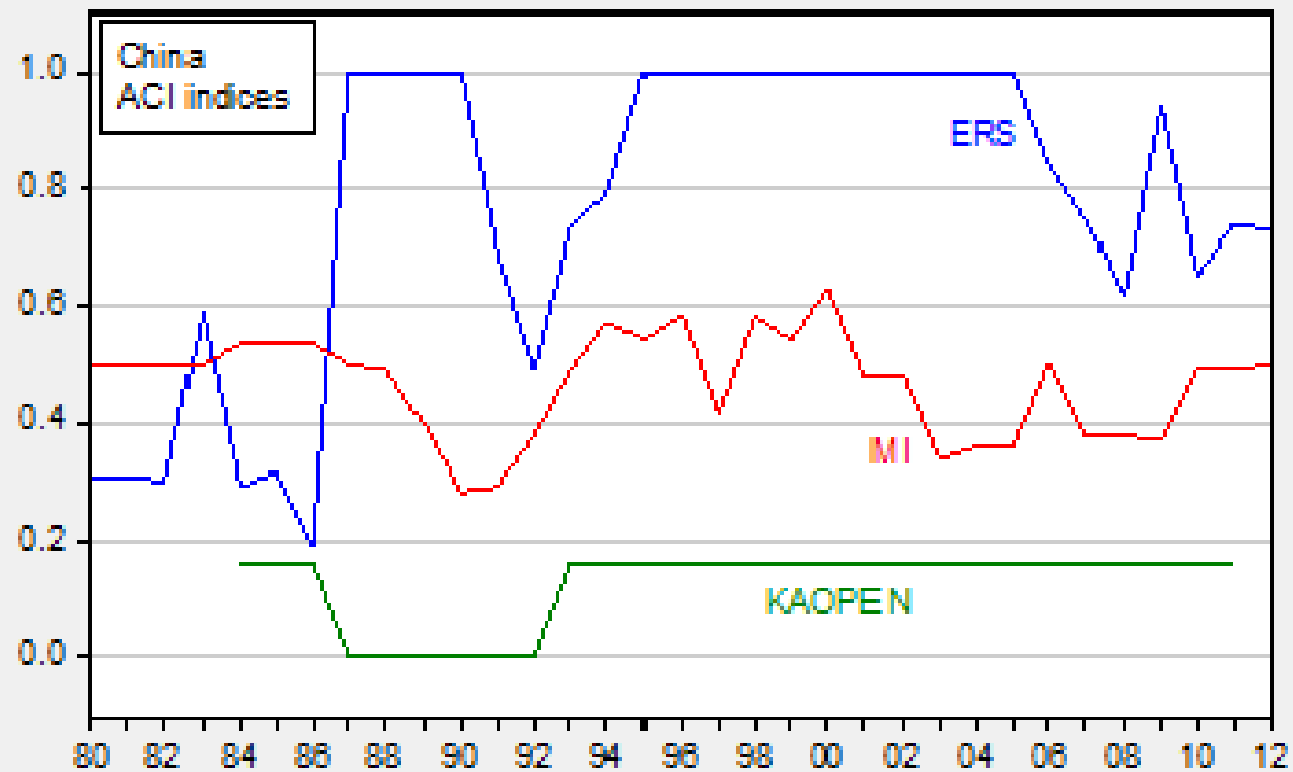
$$ERS = \frac{0.01}{0.01 + \text{stdev}(\Delta(\log(\text{exch_rate})))}$$

Financial Openness

KAOPEN = Chinn-Ito (2006) index of capital account openness, based on the information in IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*

All three indexes are normalized b/w 0 and 1. For all indexes, higher values indicate higher extents of achievement in each of the three policy goals. 7

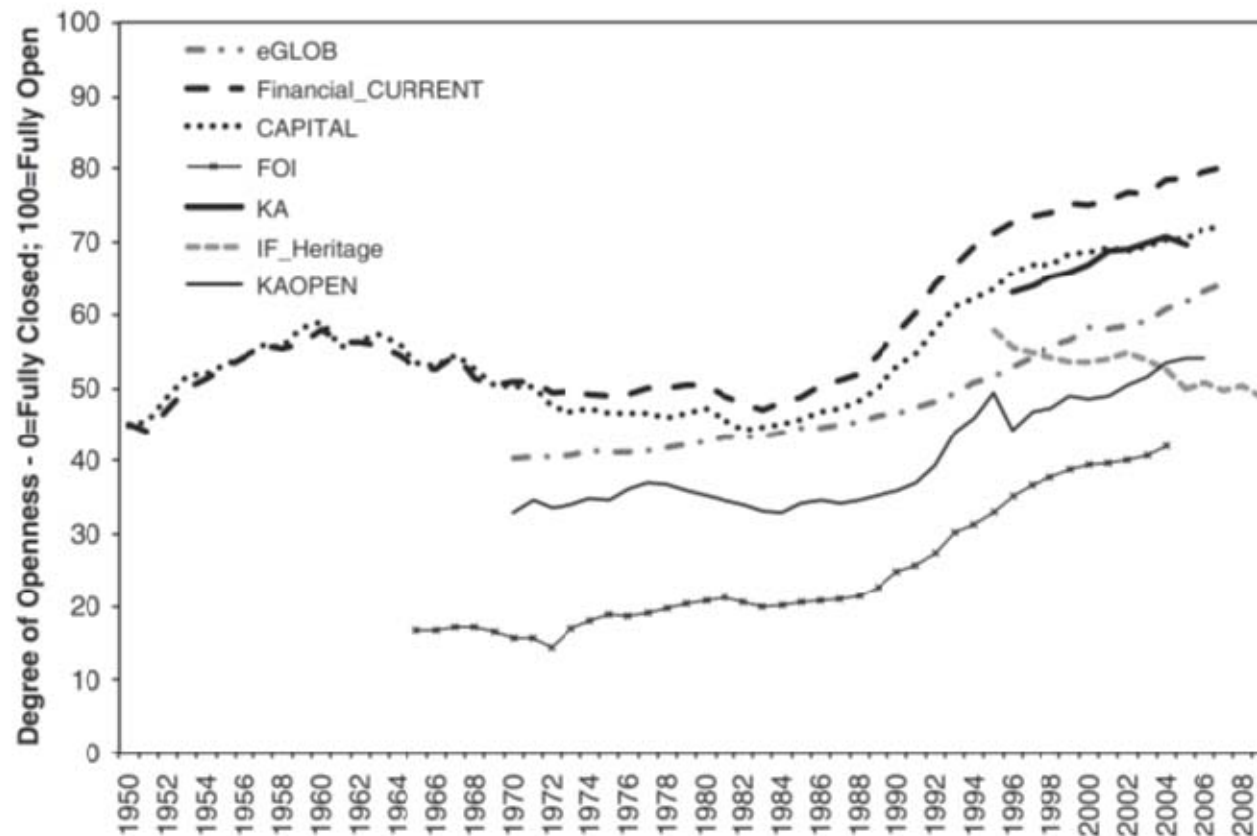
An Example: China



Source: http://web.pdx.edu/~ito/trilemma_indexes.htm

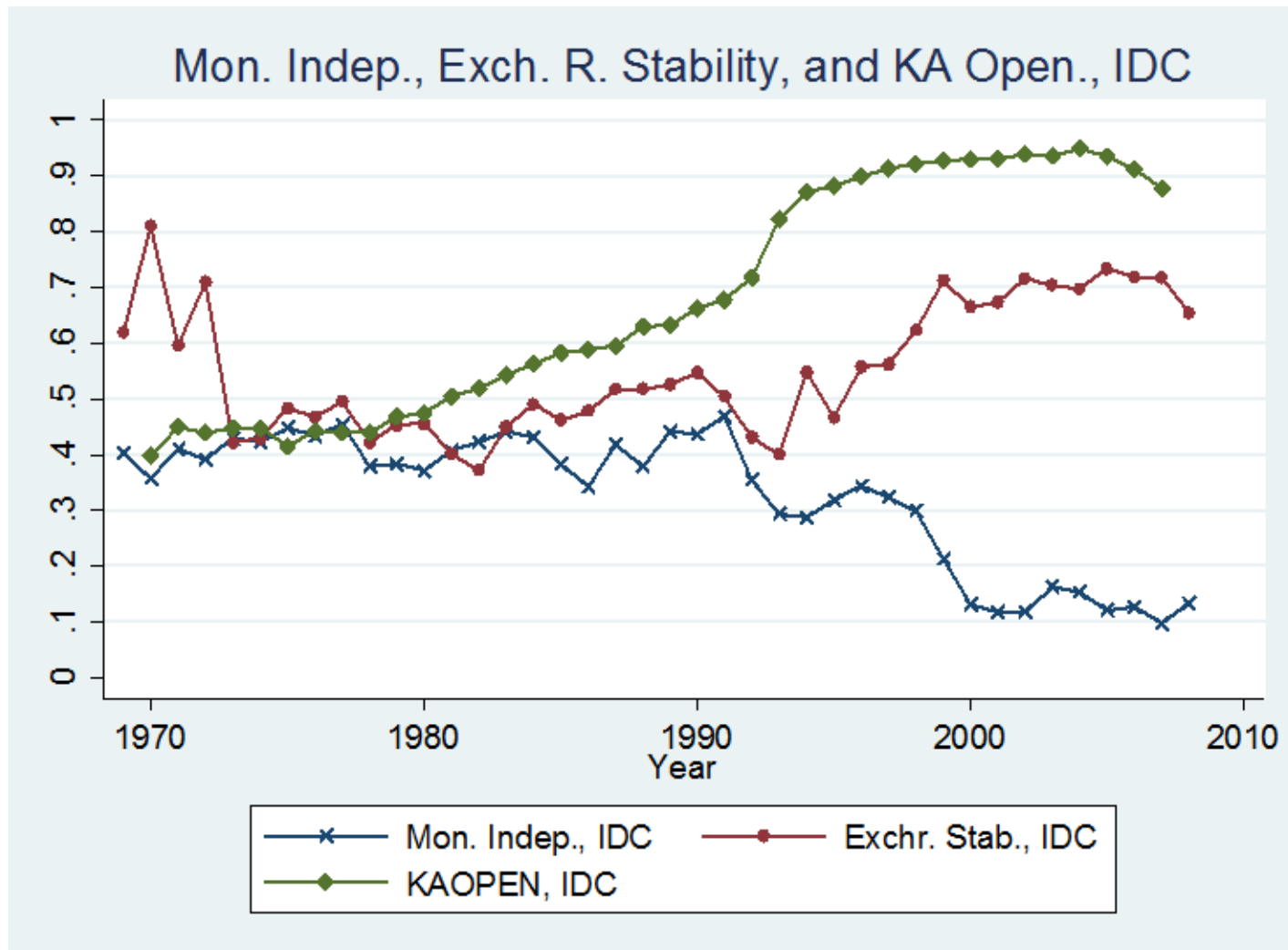
Alternative Measures: Capital Openness

Figure 1. Global Averages of Capital Account and Current Account Indicators Rescaled 0 to 100–1950–2009

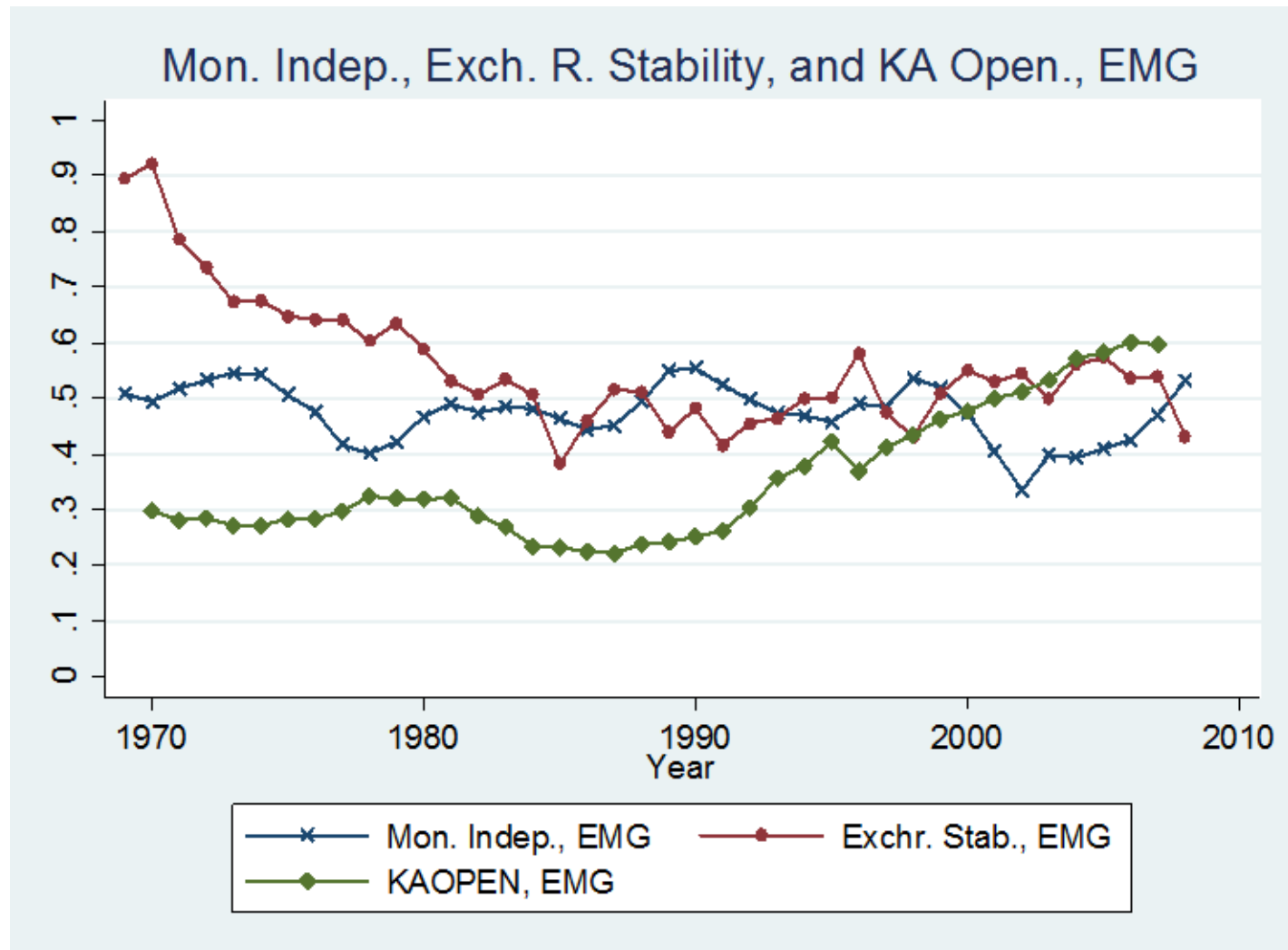


Source: Quinn, Schindler, and Toyoda (2011)

Indices for Industrial Countries

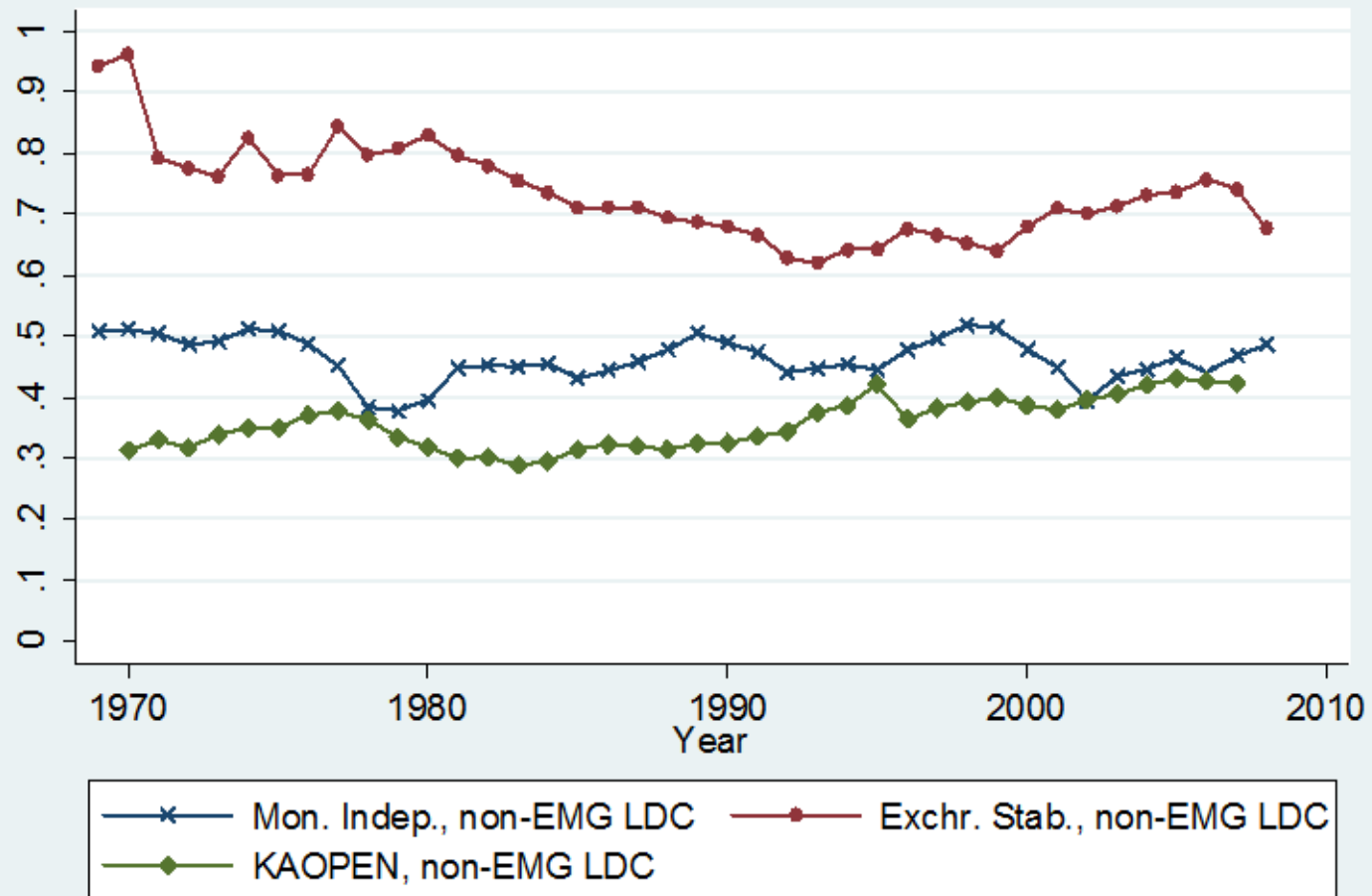


Indices for Emerging Markets



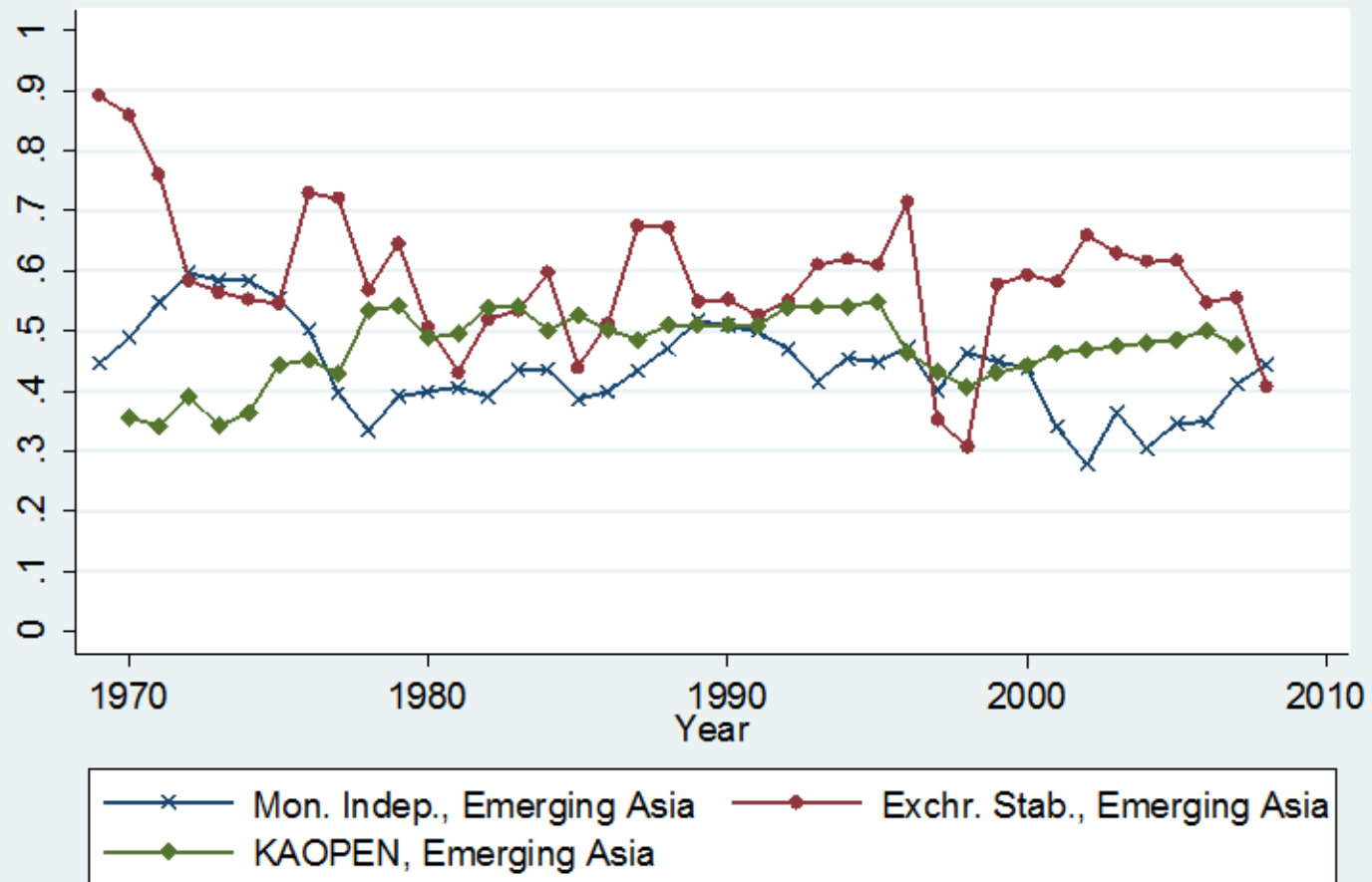
Indices for Less Developed Countries

Mon. Indep., Exch. R. Stability, and KA Open., non-EMG LDC

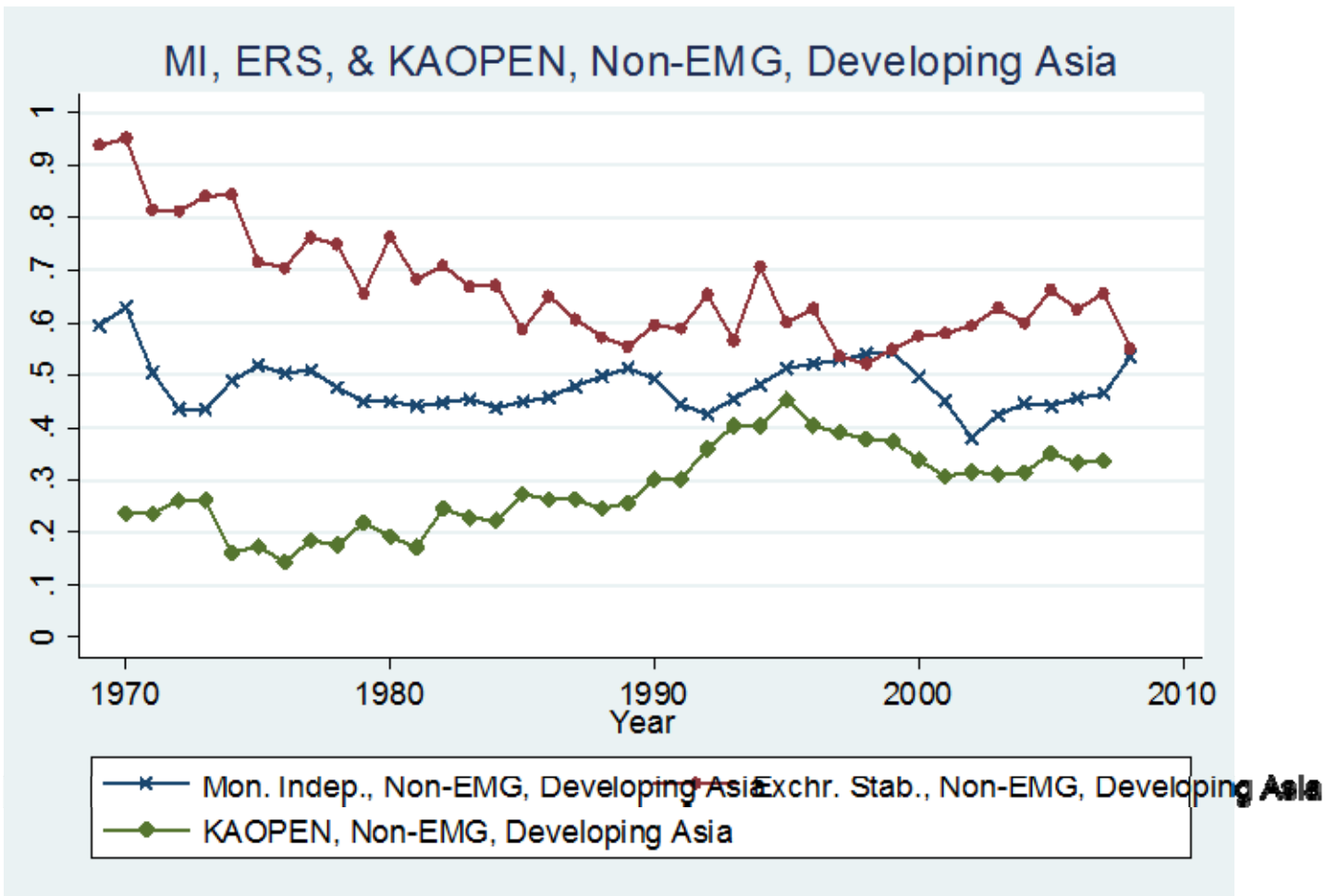


Indices for Emerging Asia

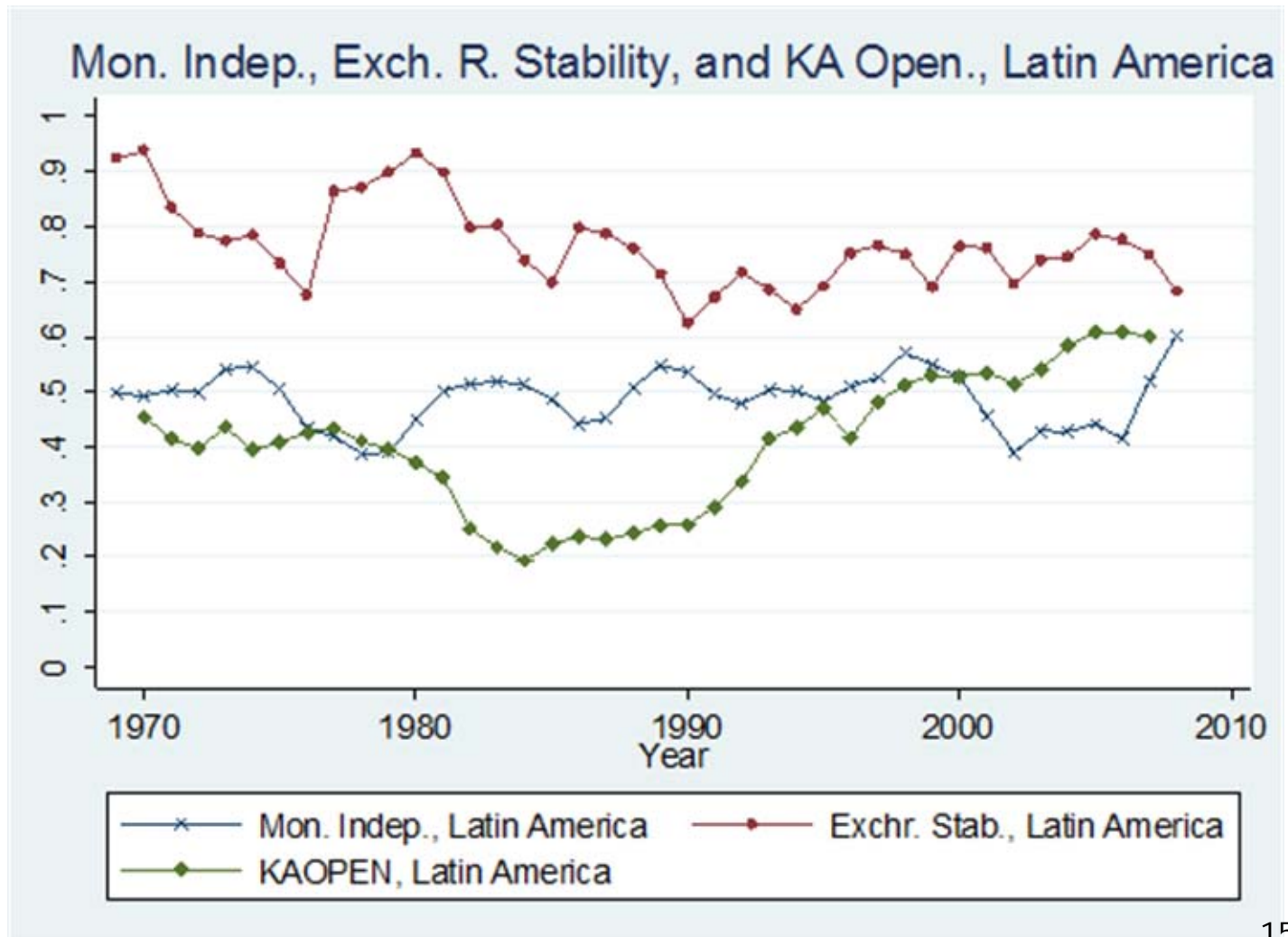
Mon. Indep., Exch. R. Stab., & KA Open., Emerging Asia



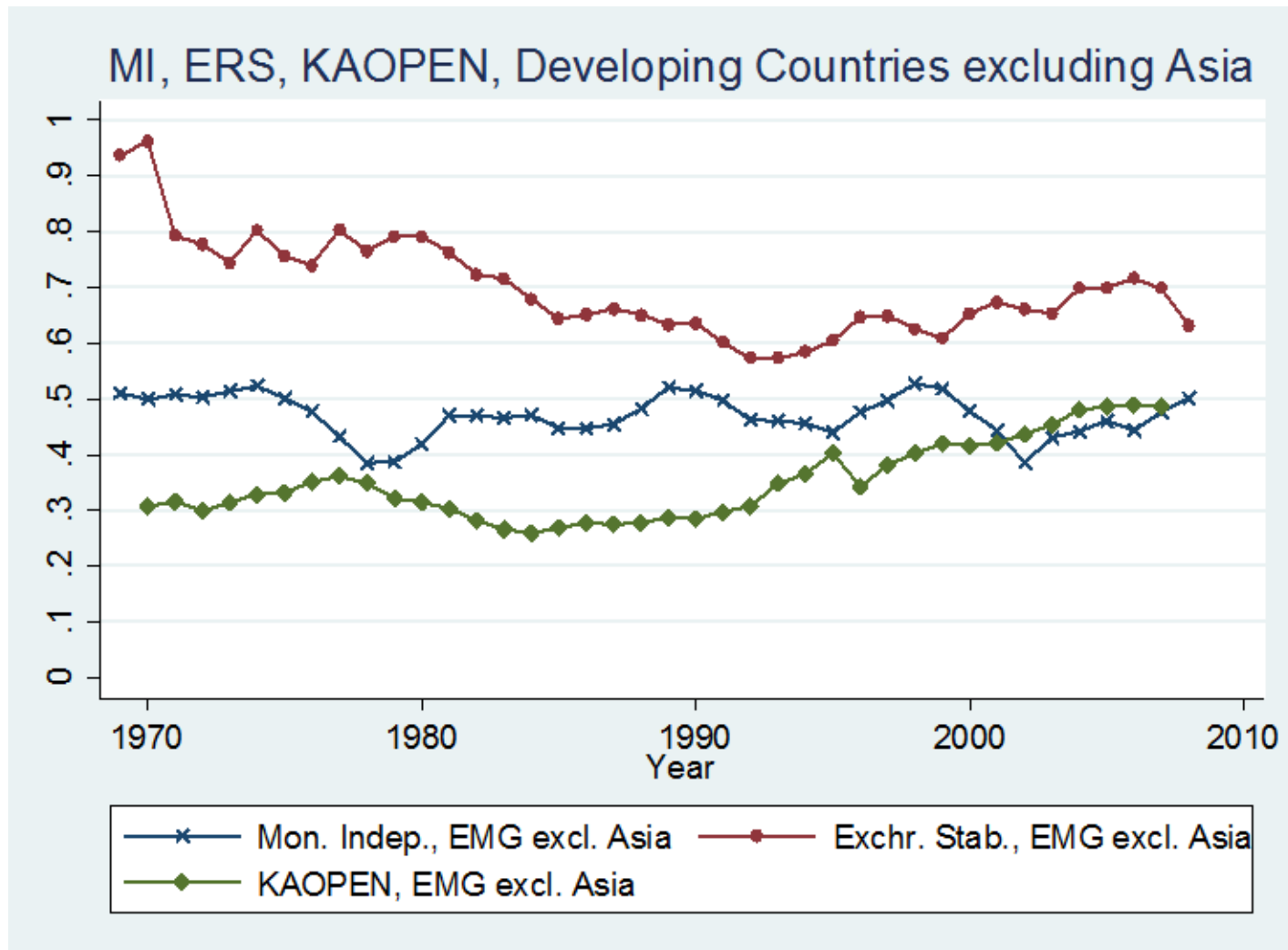
Indices for Developing Asia



Indices for Latin America



Indices for Less Developed Countries ex.-Asia

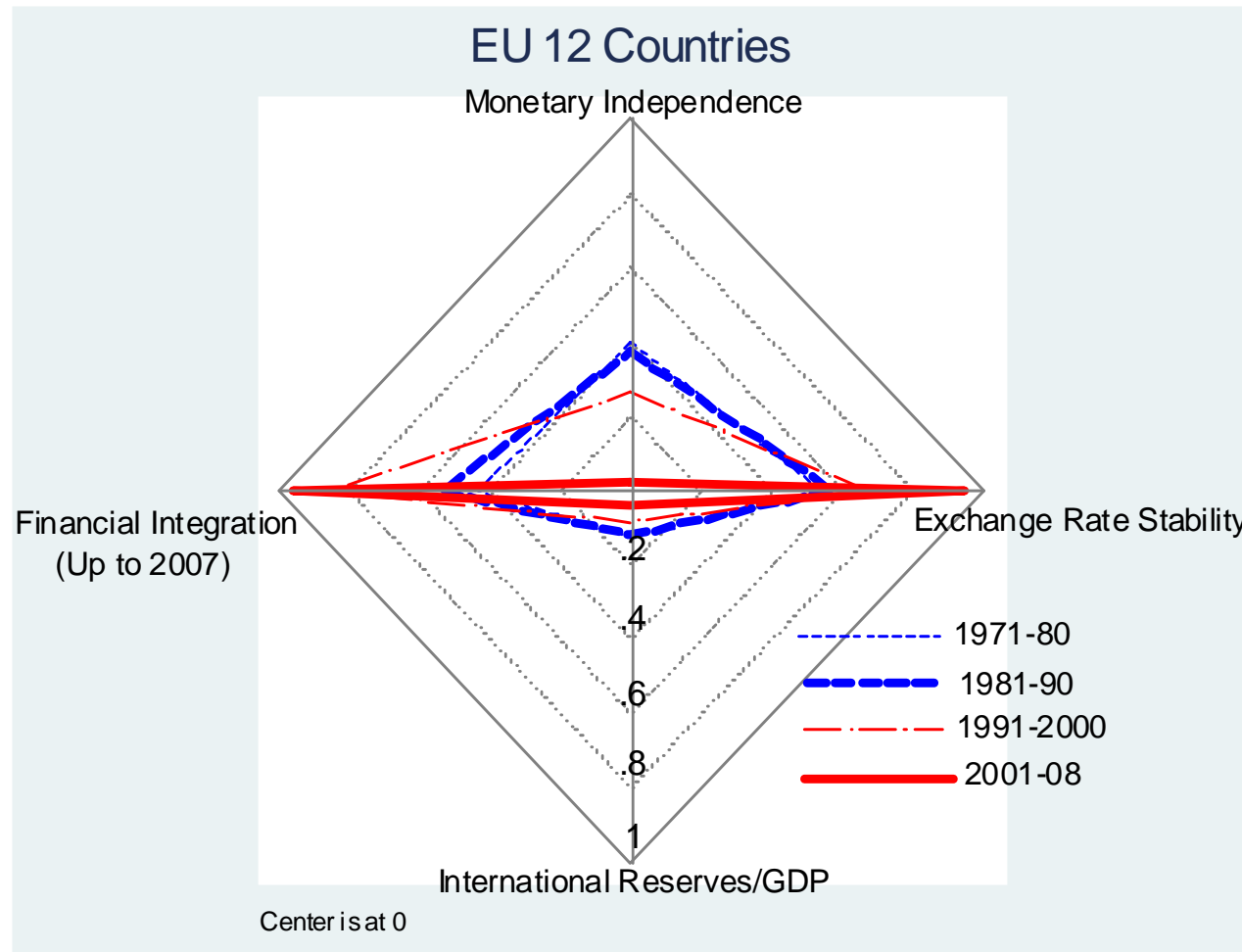




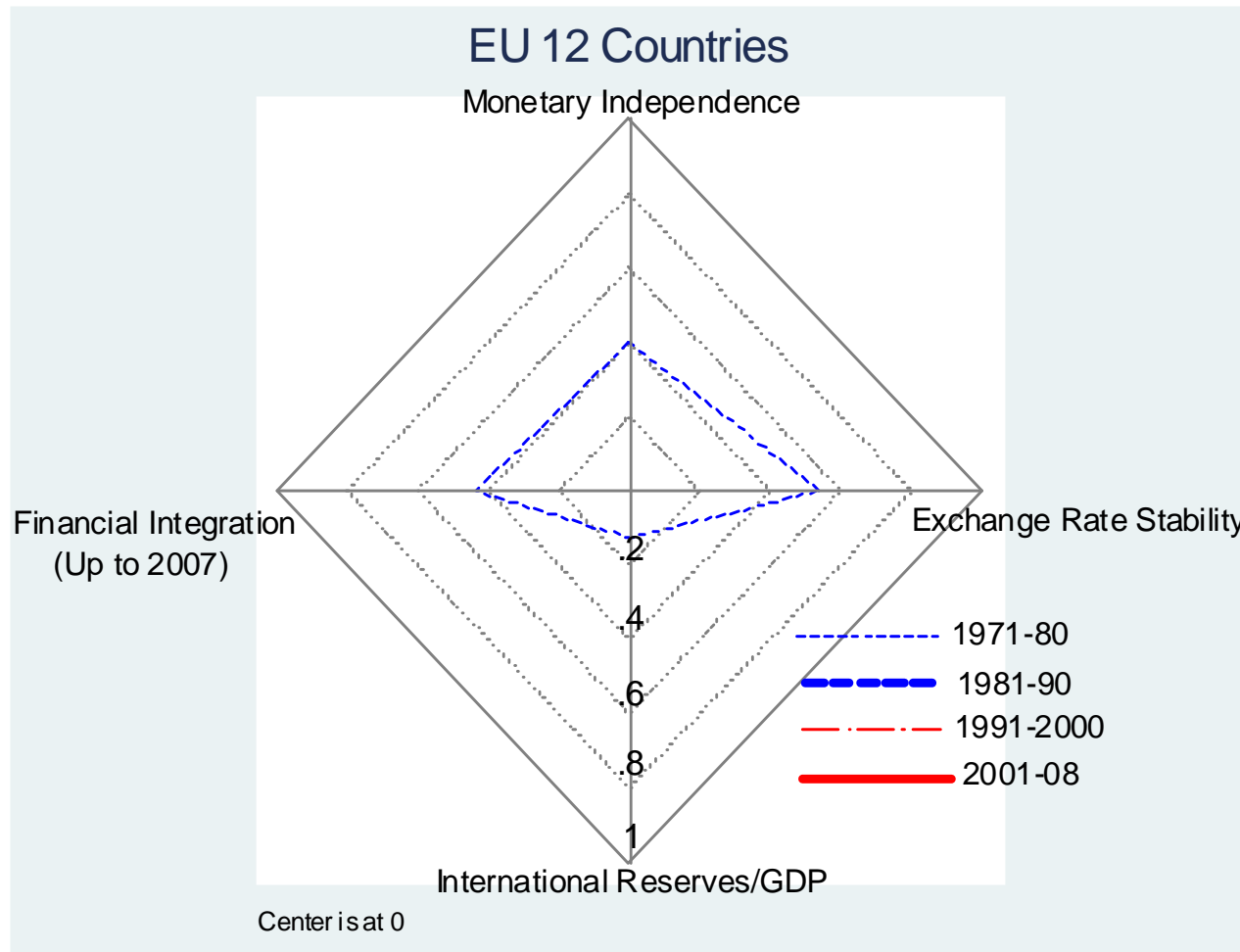
How Do Reserves Fit In?

- Trilemma measures are not perfect representations
- Reserves can be accumulated in order to (temporarily) escape the trilemma

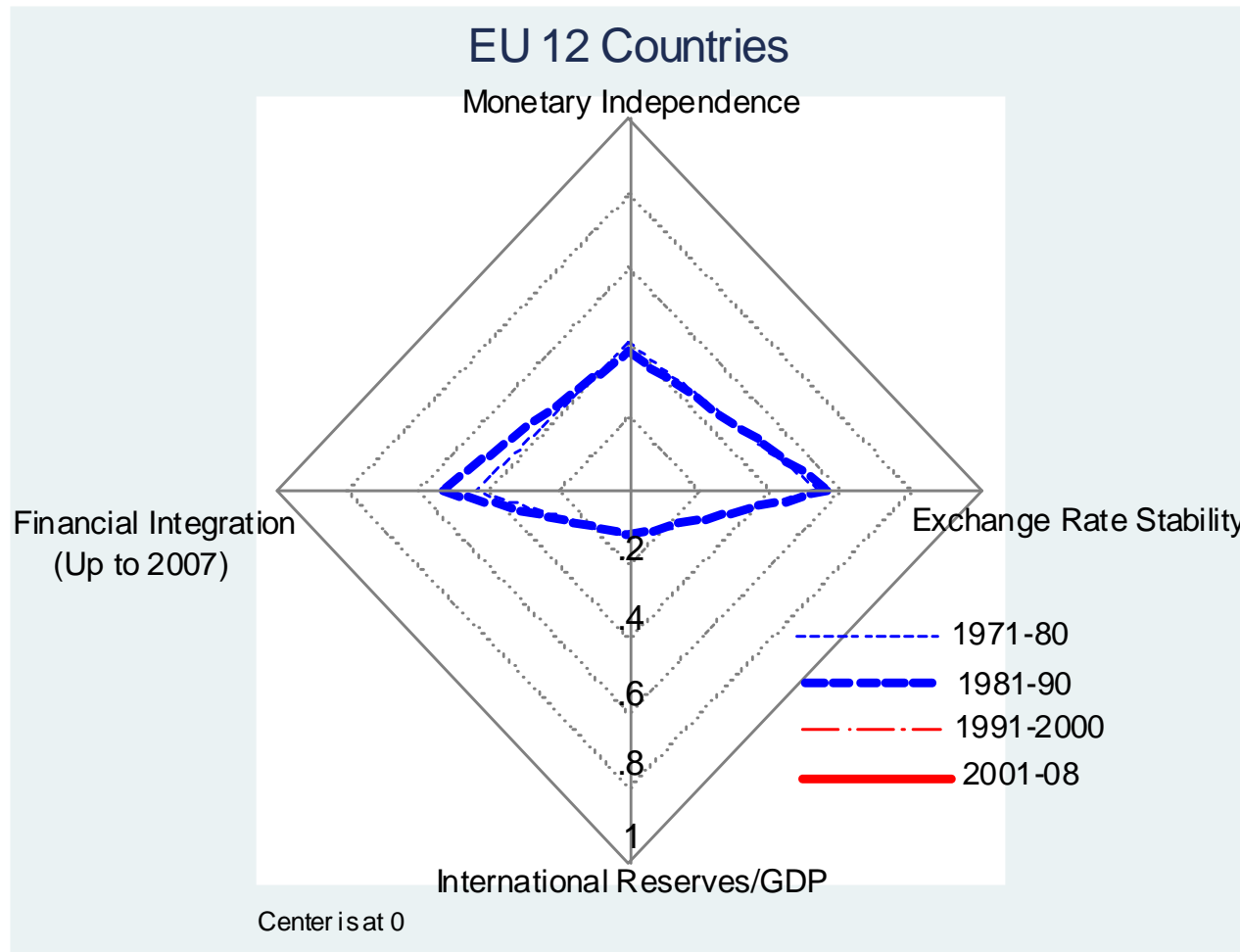
EU 12



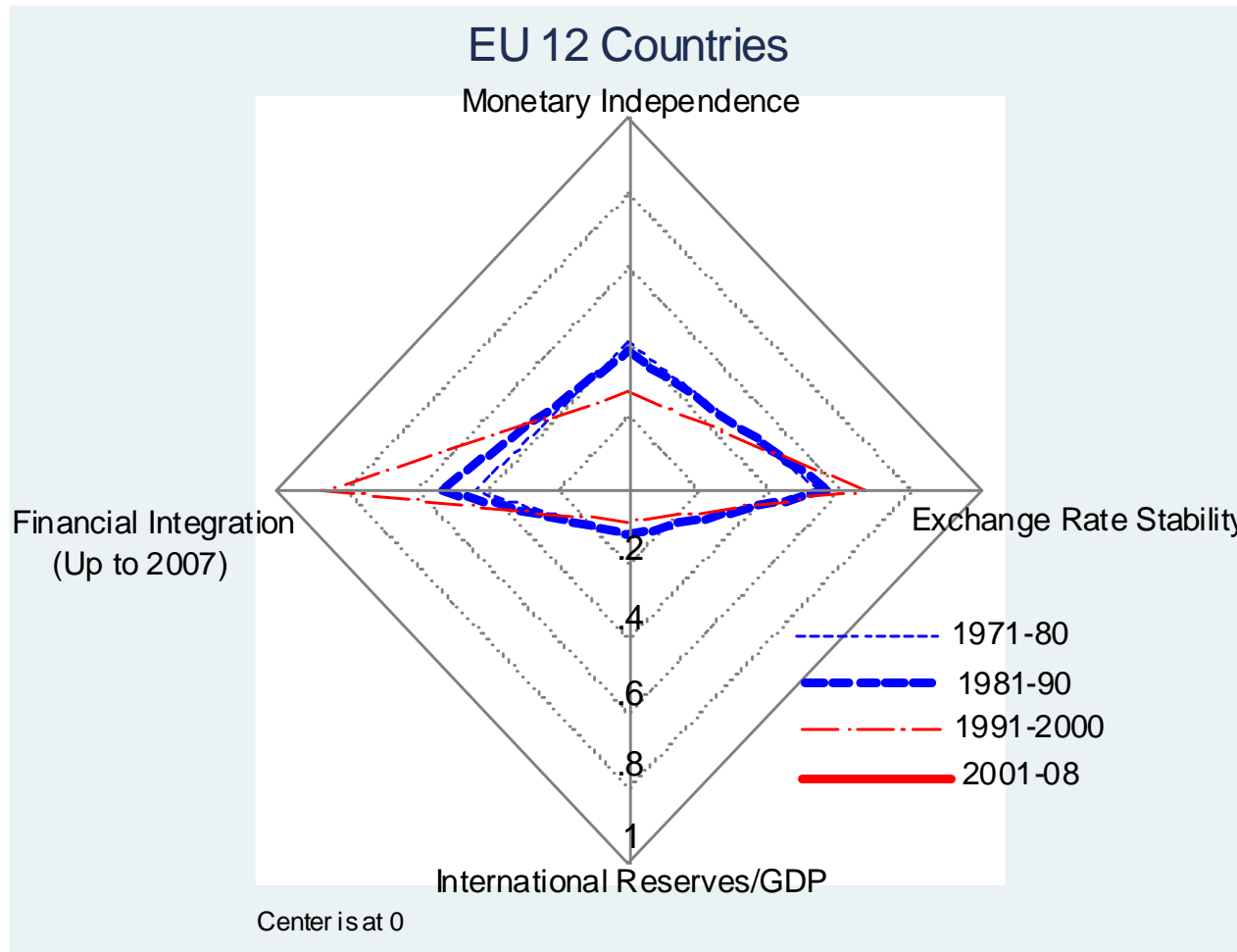
EU 12: 1971-1980



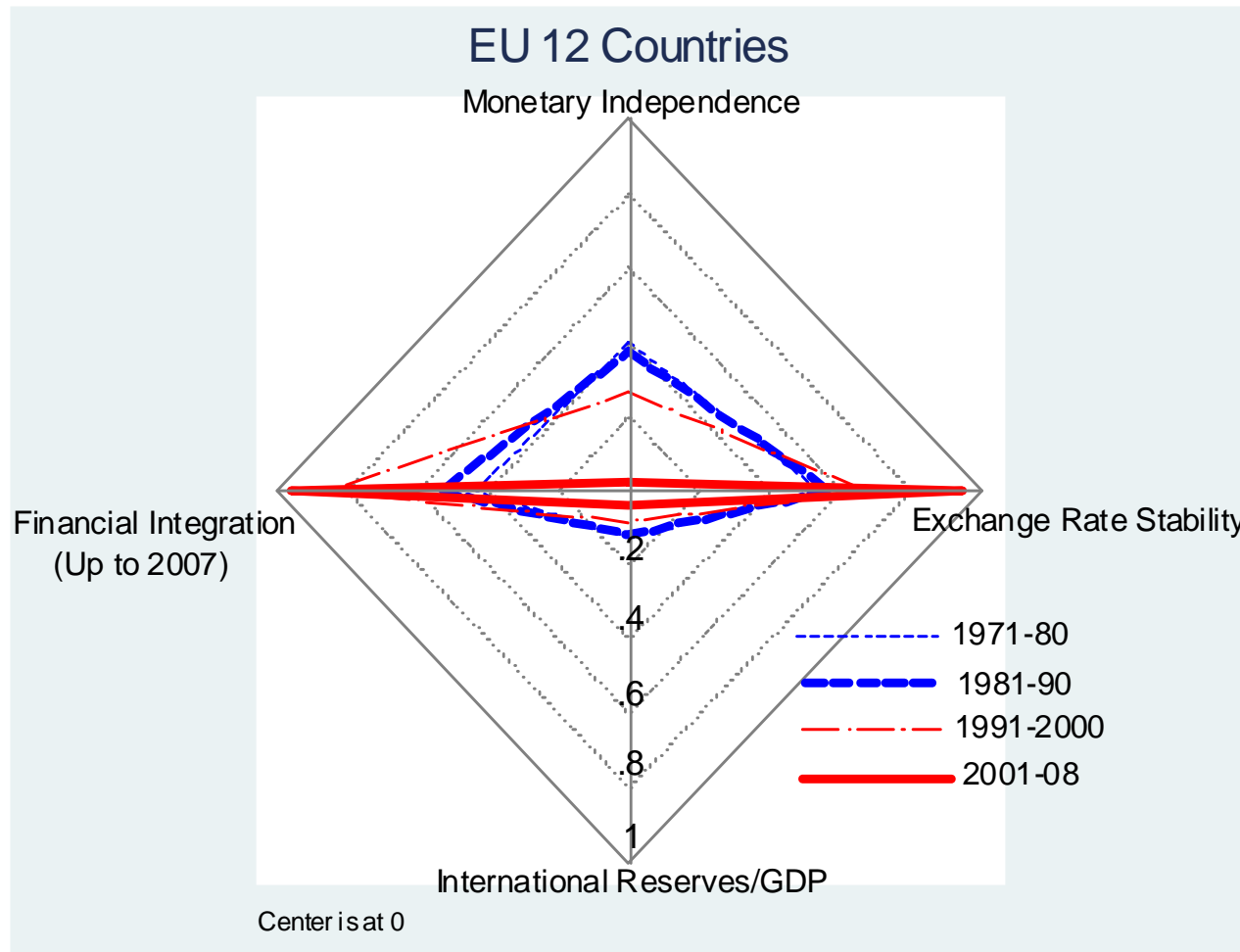
EU 12: 1971-1990



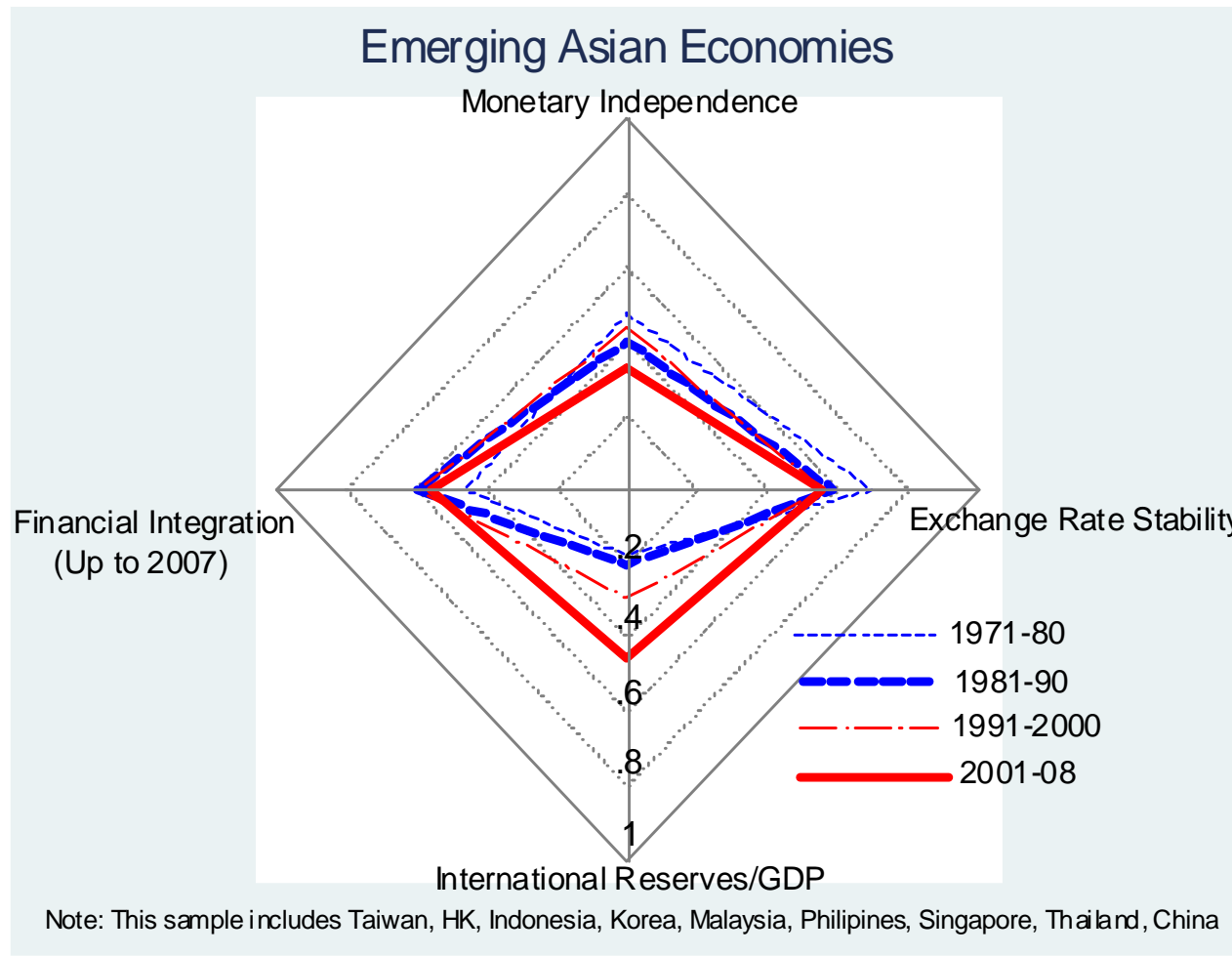
EU 12: 1971-2000



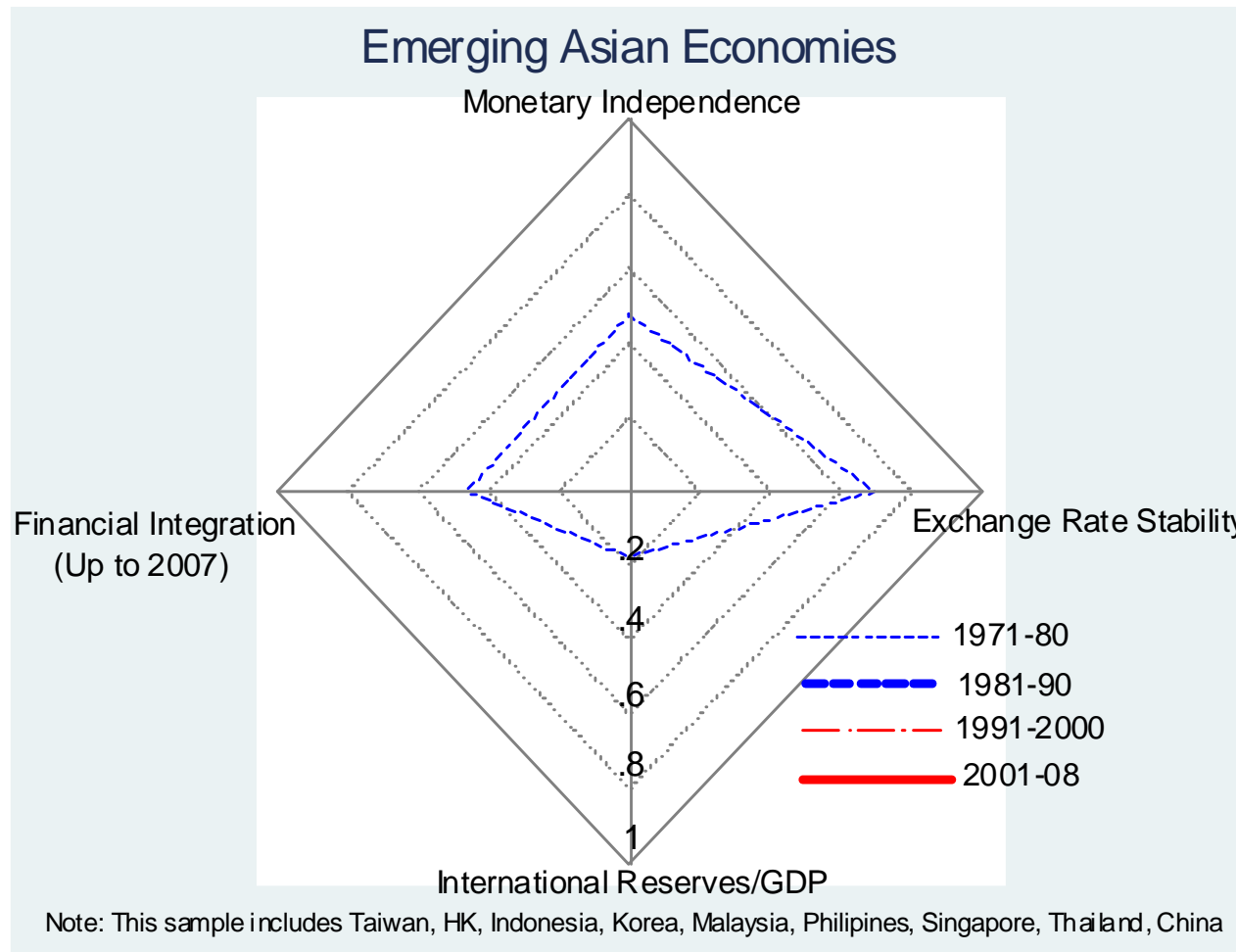
EU 12: 1971-2008



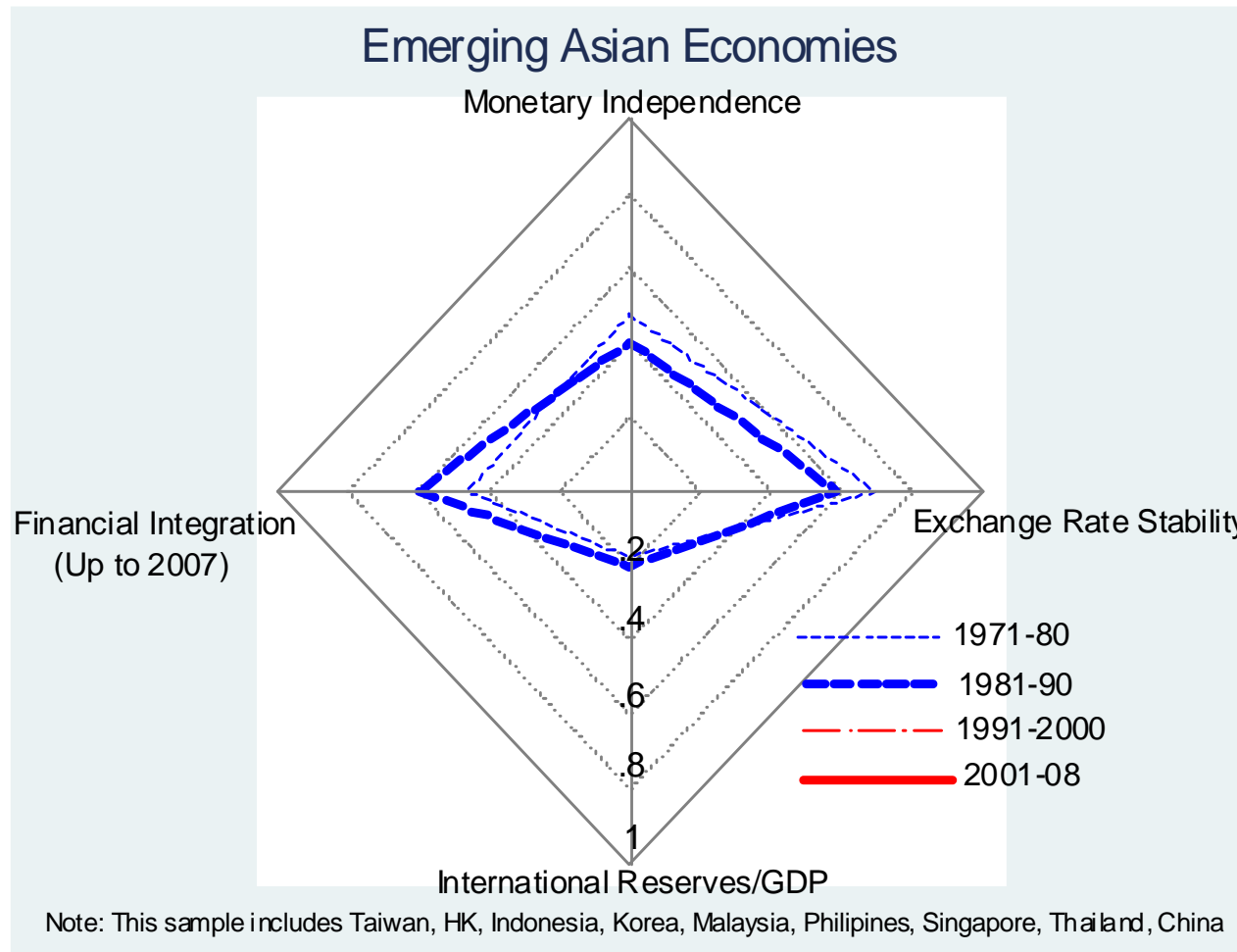
Emerging Asian Economies



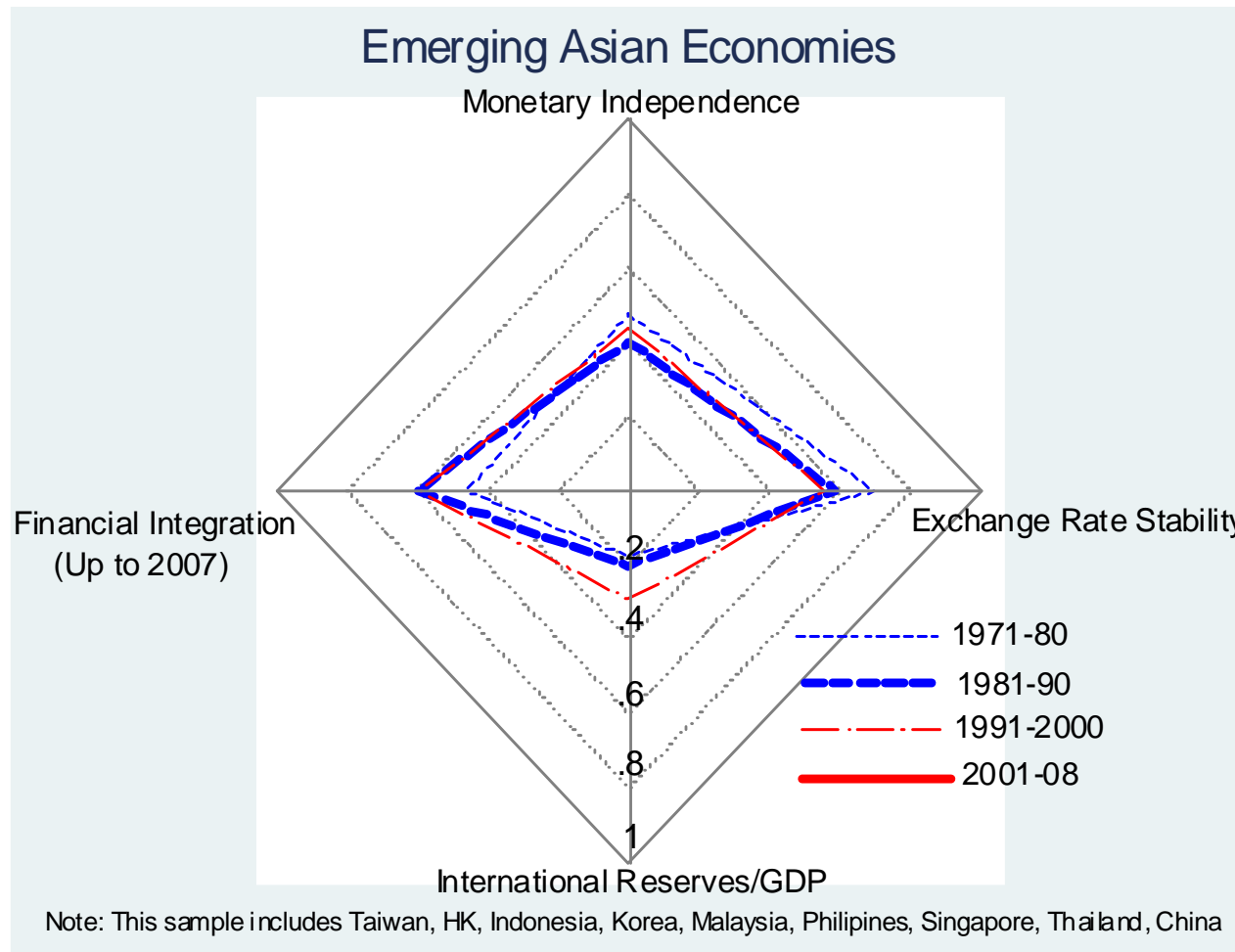
Emerging Asian Economies: 1971-80



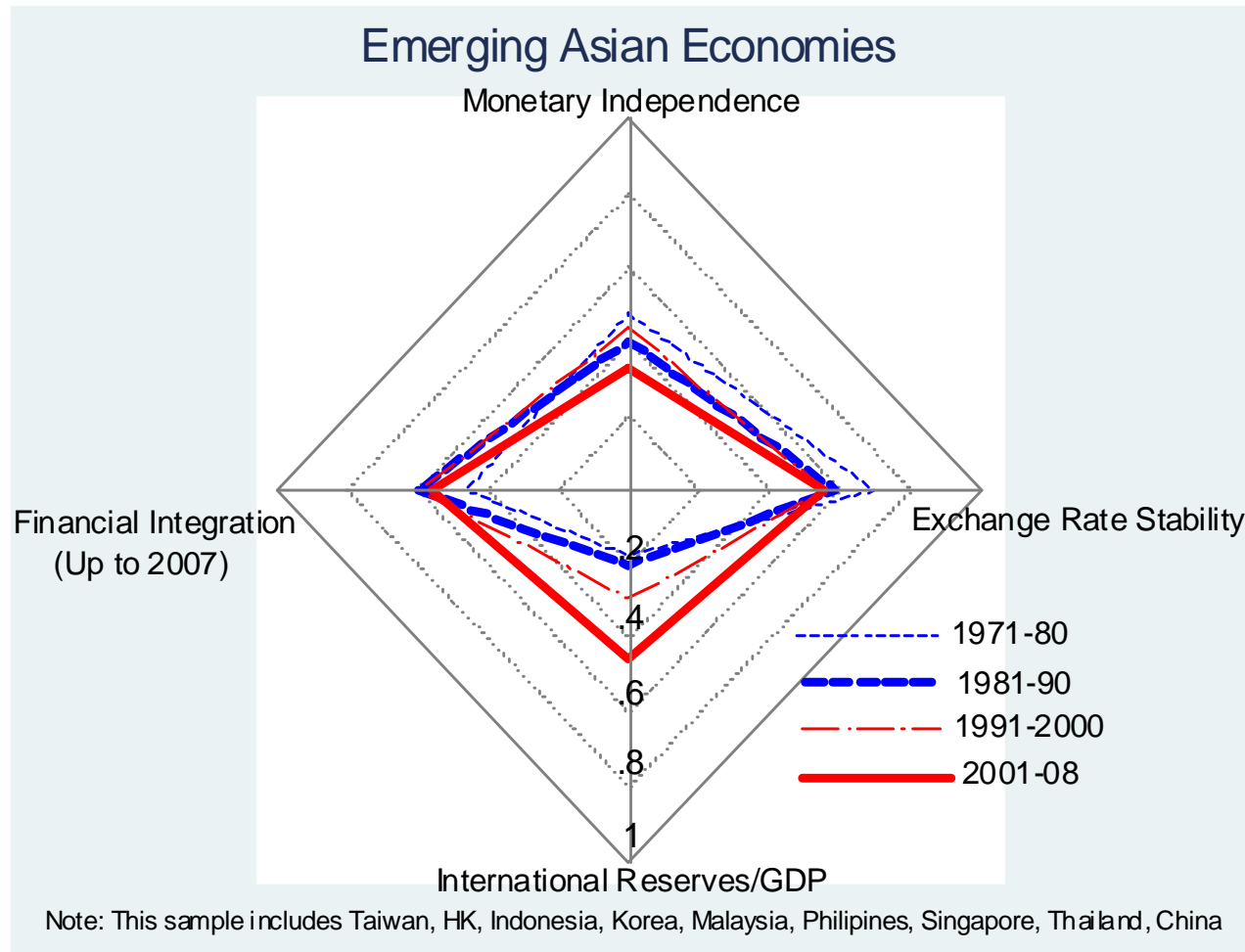
Emerging Asian Economies: 1971-90



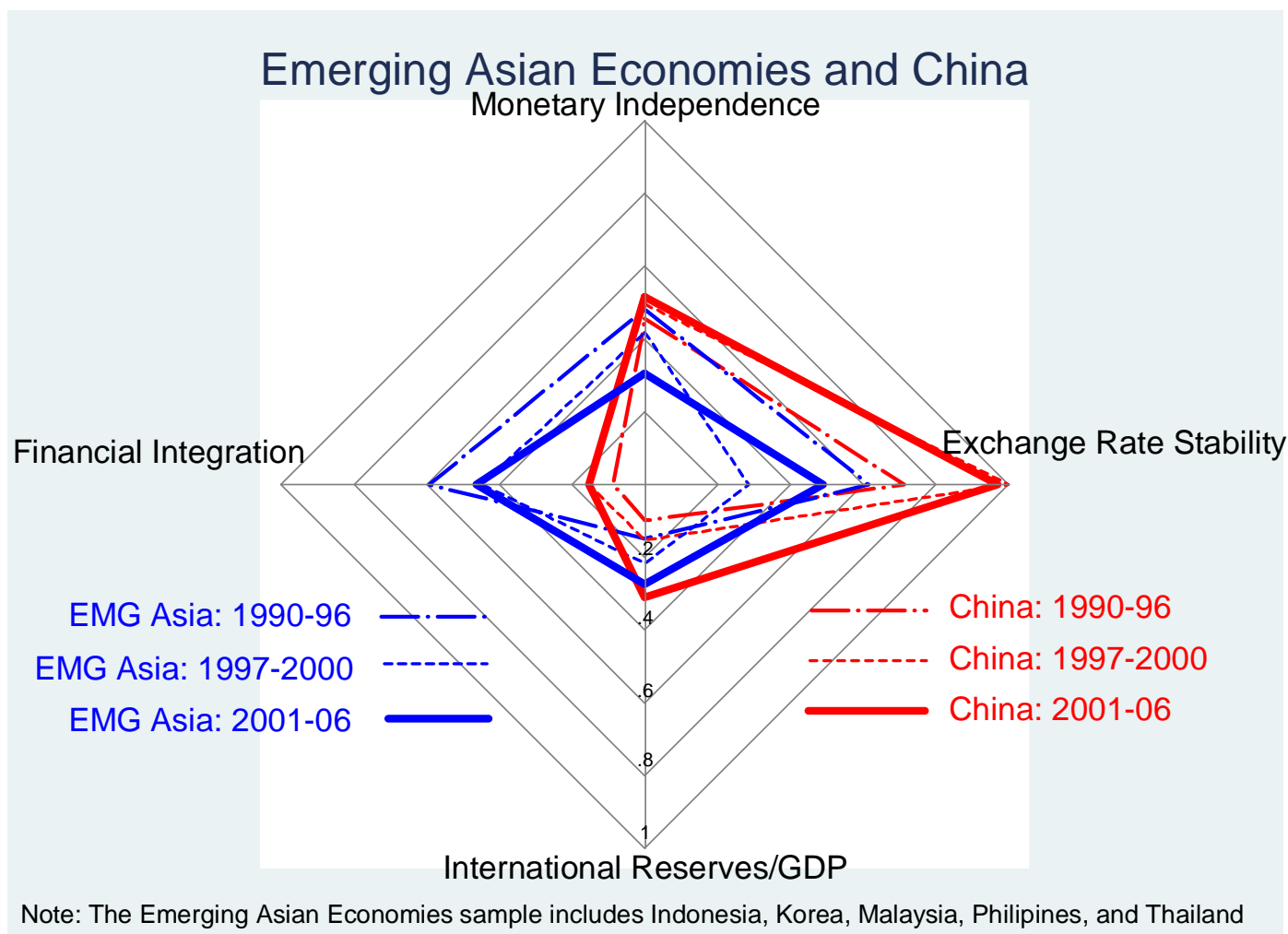
Emerging Asian Economies: 1971-2000



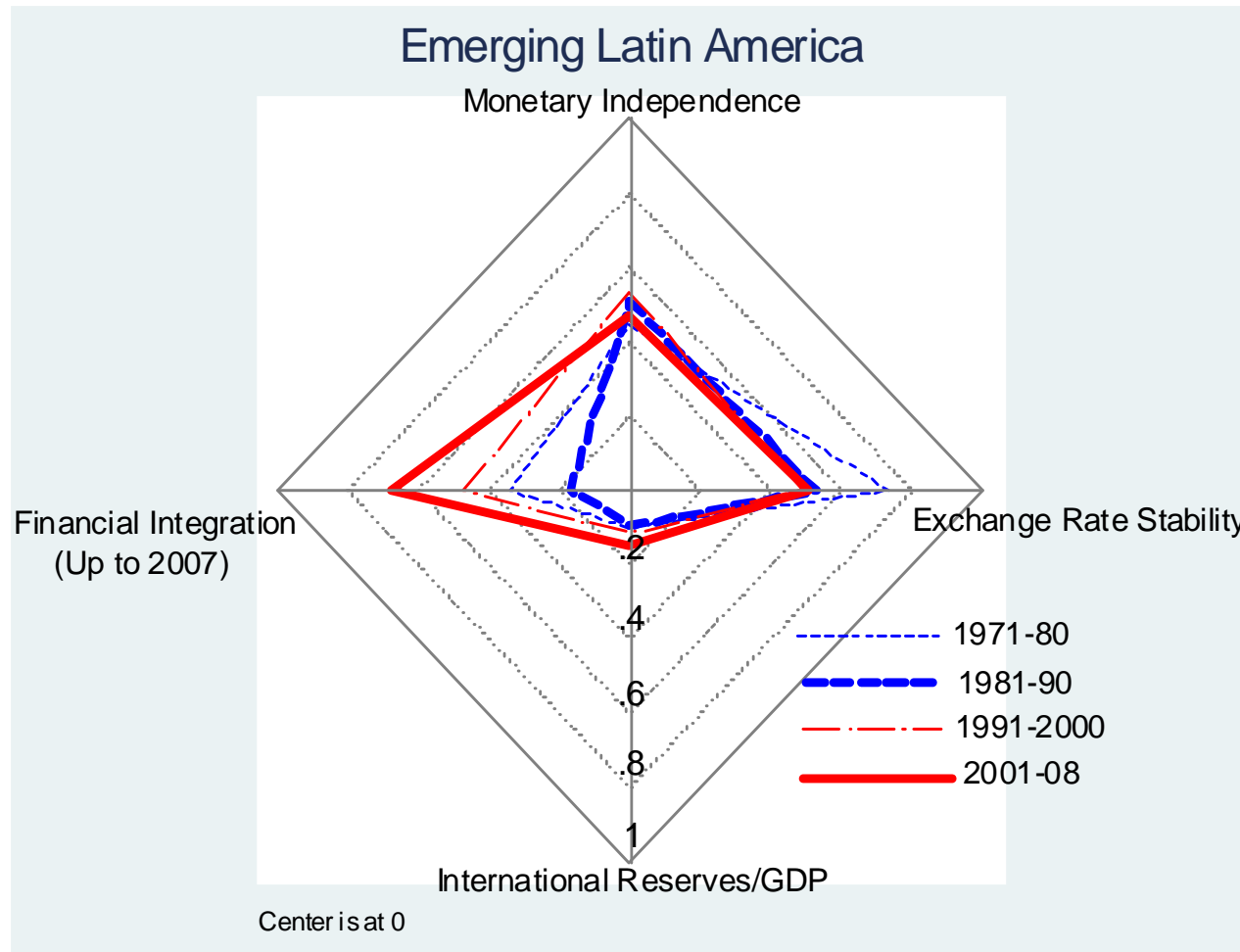
Emerging Asian Economies: 1971-2008



Emerging Asia ex.-China, and China

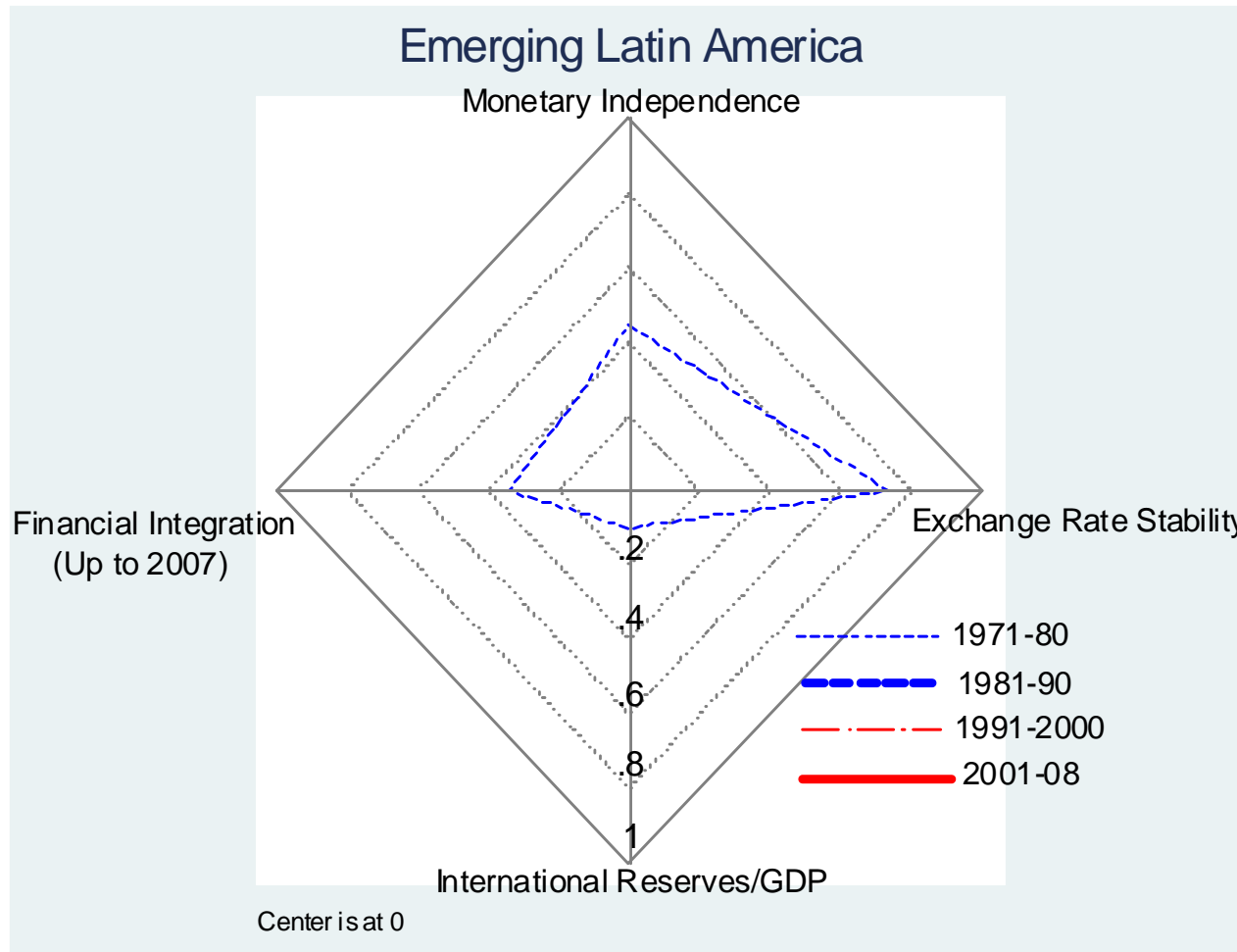


Emerging Latin America

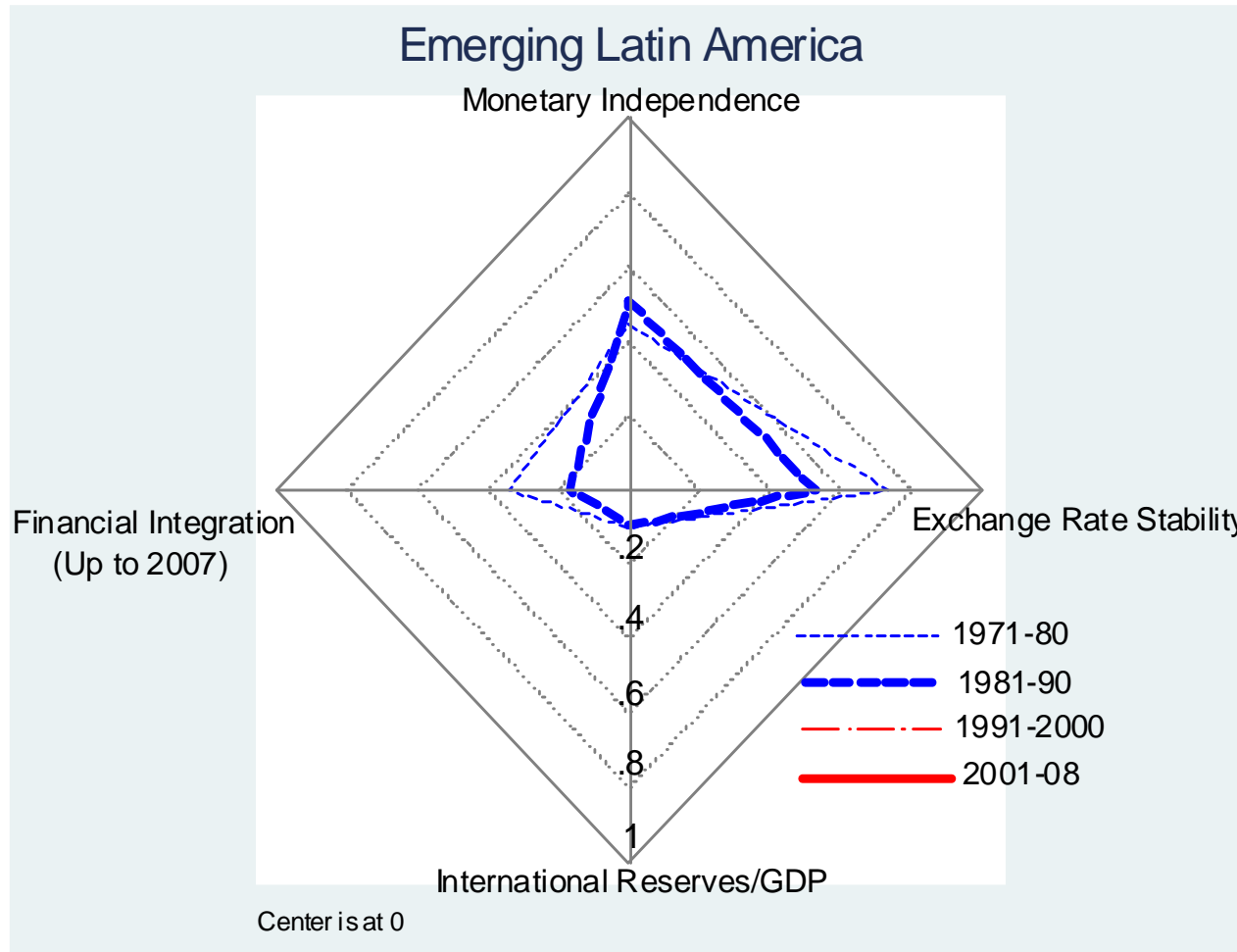


includes Argentina, Brazil, Chile, Colombia, Ecuador, Jamaica, Mexico, Peru, Trinidad and Tobago, and Venezuela.

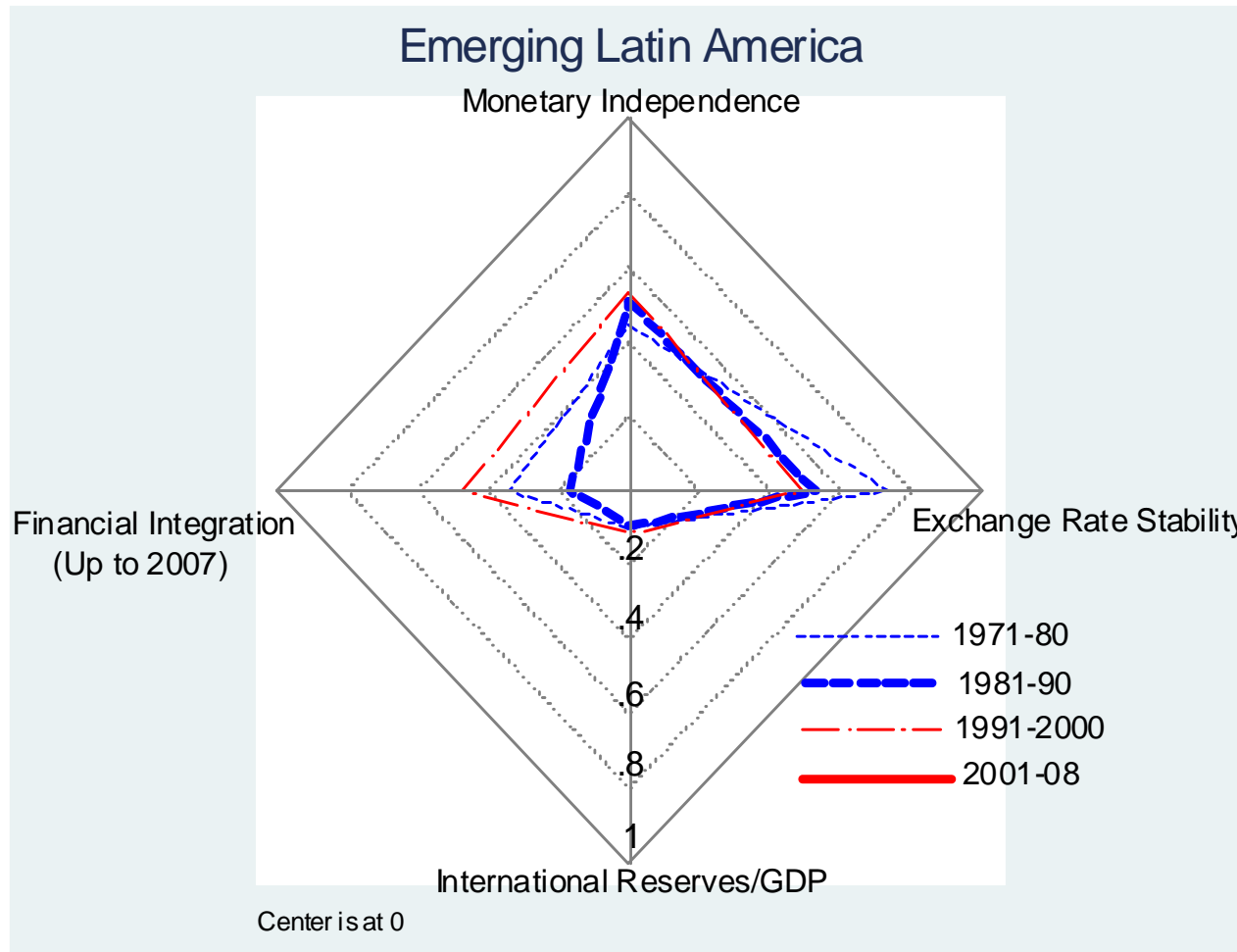
Emerging LatAm: 1971-80



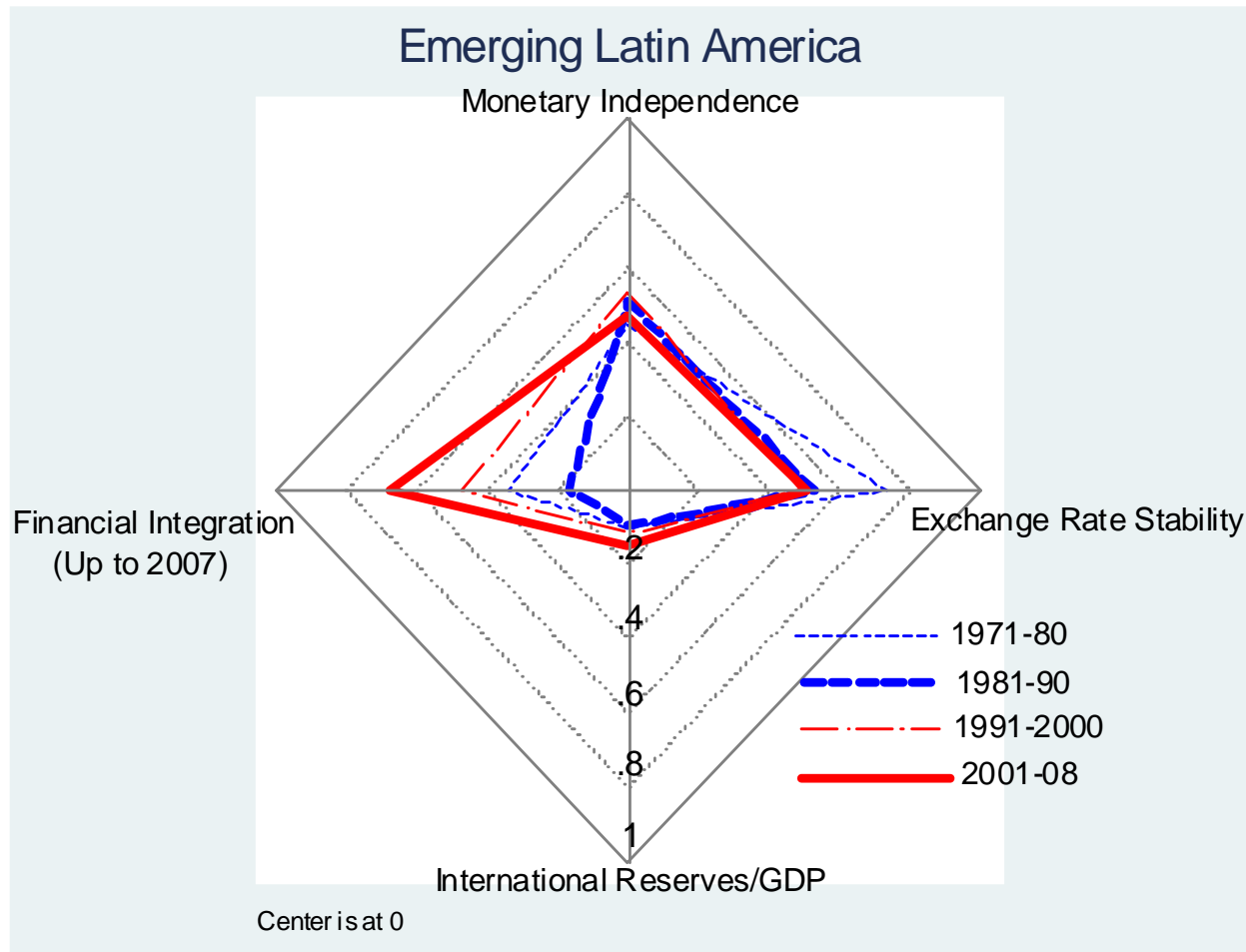
Emerging LatAm: 1971-90



Emerging LatAm: 1971-2000



Emerging LatAm: 1971-2008



“Emerging Latin America” include Argentina, Brazil, Chile, Colombia, Ecuador, Jamaica, Mexico, Peru, Trinidad and Tobago, and Venezuela.



Evolution over Time

- Gradual, but steady increase in financial integration among LDCs over the last 20 years
- Since the 1990s, emerging market countries converged to the “middle-ground,” which means they pursued, along with financial liberalization,
 - Managed exchange rate flexibility
 - Medium level of monetary independence
 - Sizable increase in IR holding
- Emerging Asian economies differ from other groups with their balanced targeting and high levels of IR holdings



Punctuated Equilibria

- Find structural breaks in the series of the indexes corresponding to major economic events
 - the collapse of the BW system
 - debt crisis of 1982
 - Asian crisis of 1997-98
 - the emergence of rapid globalization (1990) and the rise of China (2001)
- Countries do alter policy configurations when they experience major shocks



Inflation/Output Implications

- How do policy configurations affect macro performance such as output volatility, inflation volatility, and the level of inflation?
- Interactions with
 - International Reserves
 - Financial Development
 - External Finances



Inflation/Output Implications

- ACI (2011) relate the trilemma variables to macro outcomes: per capita output growth volatility, inflation volatility, and inflation rates
- Use a comprehensive dataset composed of more than 100 countries in 1972 – 2006
- Estimate for LDC, Commodity exporters, EMGs



Inflation/Output Implications

- OLS with non-overlapping 5-year panels
- y_{it} is either
 - output volatility (measured as the 5-year standard deviations of the per capita real output growth rate);
 - inflation volatility (as the 5-year standard deviations); or
 - the level of inflation (as 5-year averages), for country i in year t .
- TLM_{it} is a vector of any *two* of the three trilemma indexes (MI , ERS , $KAOPEN$).
- TR_{it} is the level of IR as a ratio to GDP

$$y_{it} = \alpha_0 + \alpha_1 TLM_{it} + \alpha_2 TR_{it} + \alpha_3 (TLM_{it} \times TR_{it}) \\ + X_{it} \mathbf{B} + Z_t \mathbf{\Gamma} + D_i \mathbf{\Phi} + \varepsilon_{it}$$

Inflation/Output Implications

X_{it} – Macroeconomic control variables

- relative income (to the U.S.);
- trade openness $(=(EX+IM)/GDP)$;
- the TOT shock; fiscal procyclicality;
- M2 growth volatility;
- private credit creation as a ratio to GDP as a measure of financial development;
- the inflation rate; and inflation volatility.

Z_t – Global shocks

- change in U.S. real interest rate;
- world output gap; and
- relative oil price shocks.

D_i – Characteristic dummies.

$$y_{it} = \alpha_0 + \alpha_1 TLM_{it} + \alpha_2 TR_{it} + \alpha_3 (TLM_{it} \times TR_{it}) \\ + X_{it} B + Z_t \Gamma + D_i \Phi + \varepsilon_{it}$$



Inflation/Output Implications

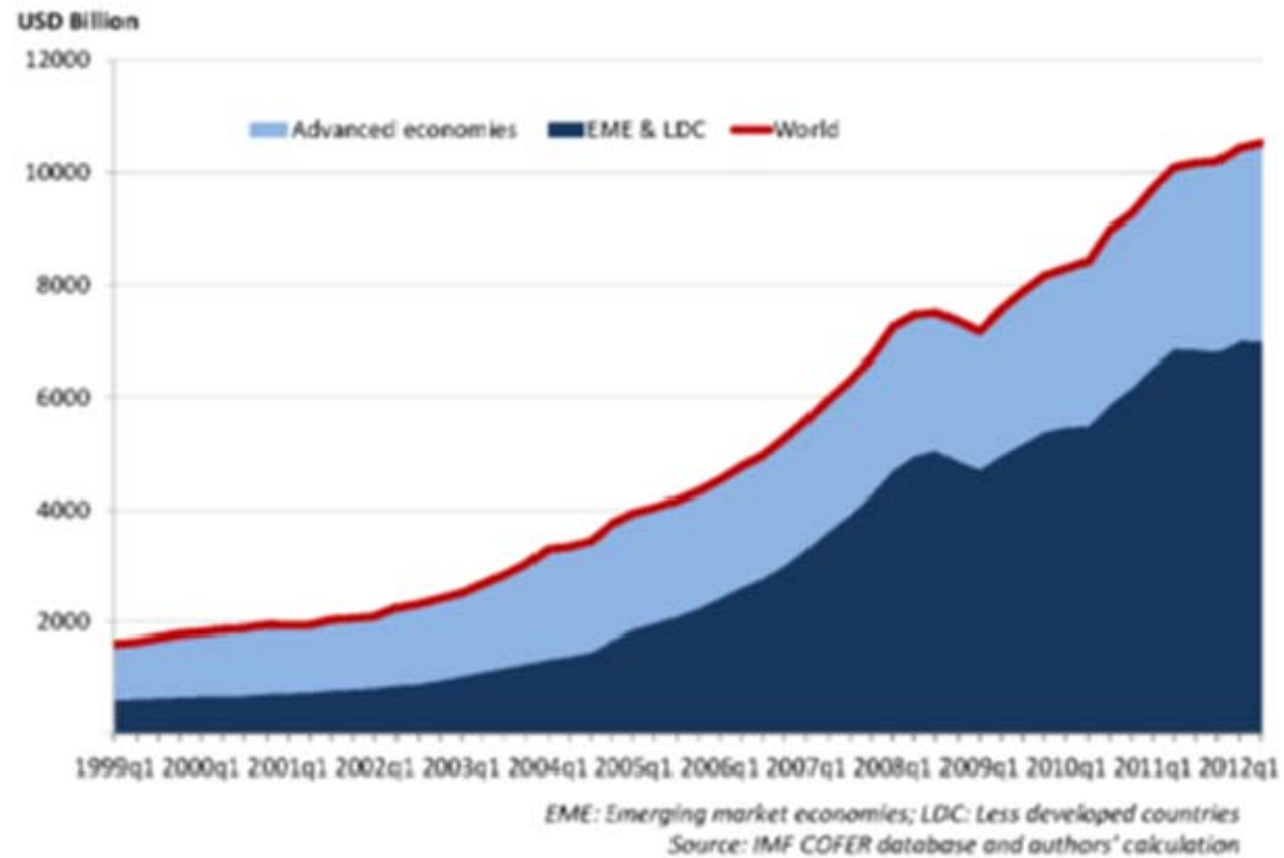
1. Greater monetary independence associated with dampened output volatility
2. Greater exchange rate stability implies greater output volatility for emerging market countries. However, this effect is mitigated by holding IR greater than 19-22% of GDP.



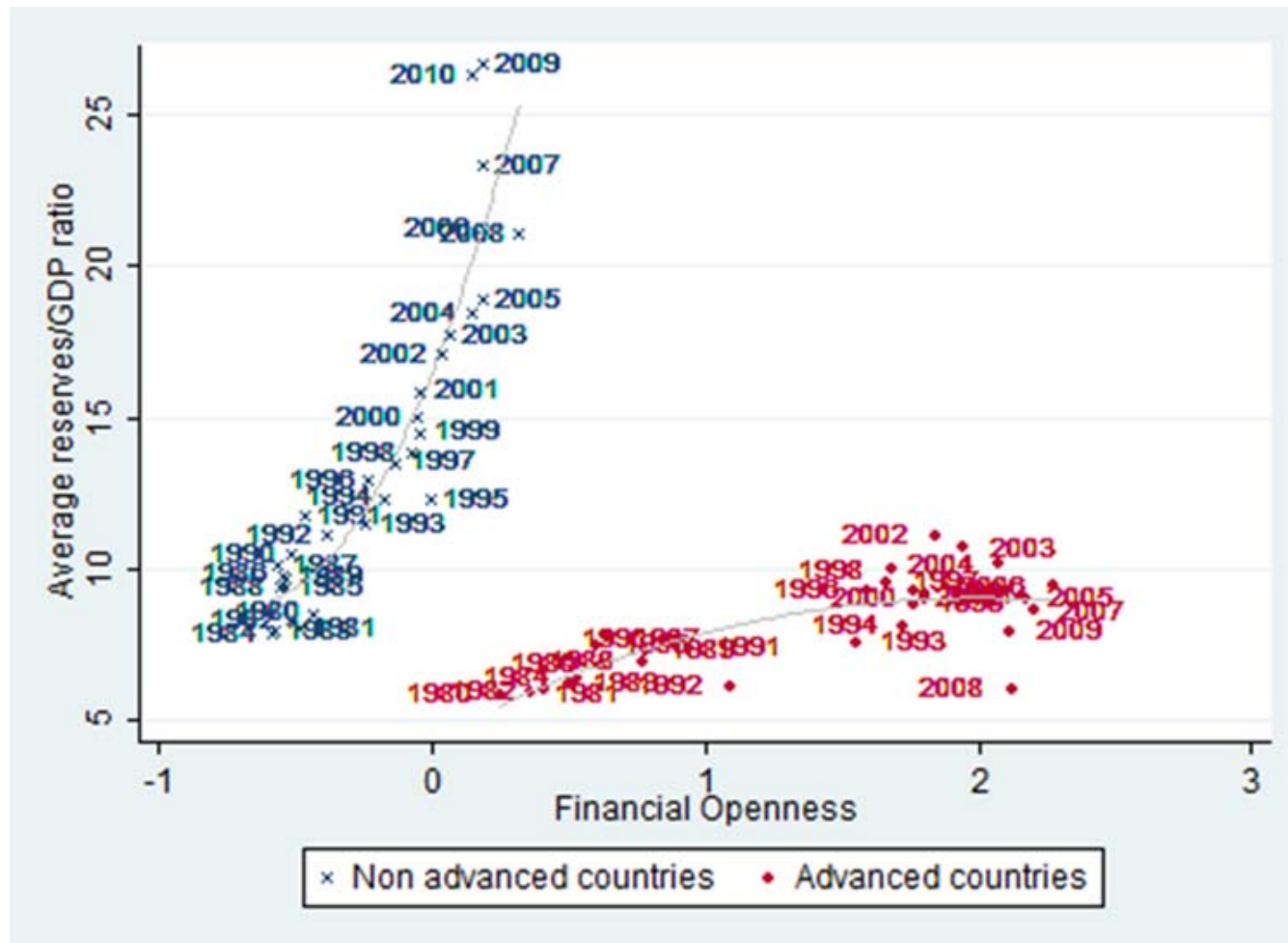
Additional findings

- Little significant findings for the estimation on inflation volatility
- Countries with more monetary autonomy tend to experience higher inflation
- Countries with higher exchange rate stability tend to experience lower inflation
 - Countries w/ higher ERS but also high IR would experience *higher* inflation
- Financial openness is associated with lower inflation

Reserves, Again

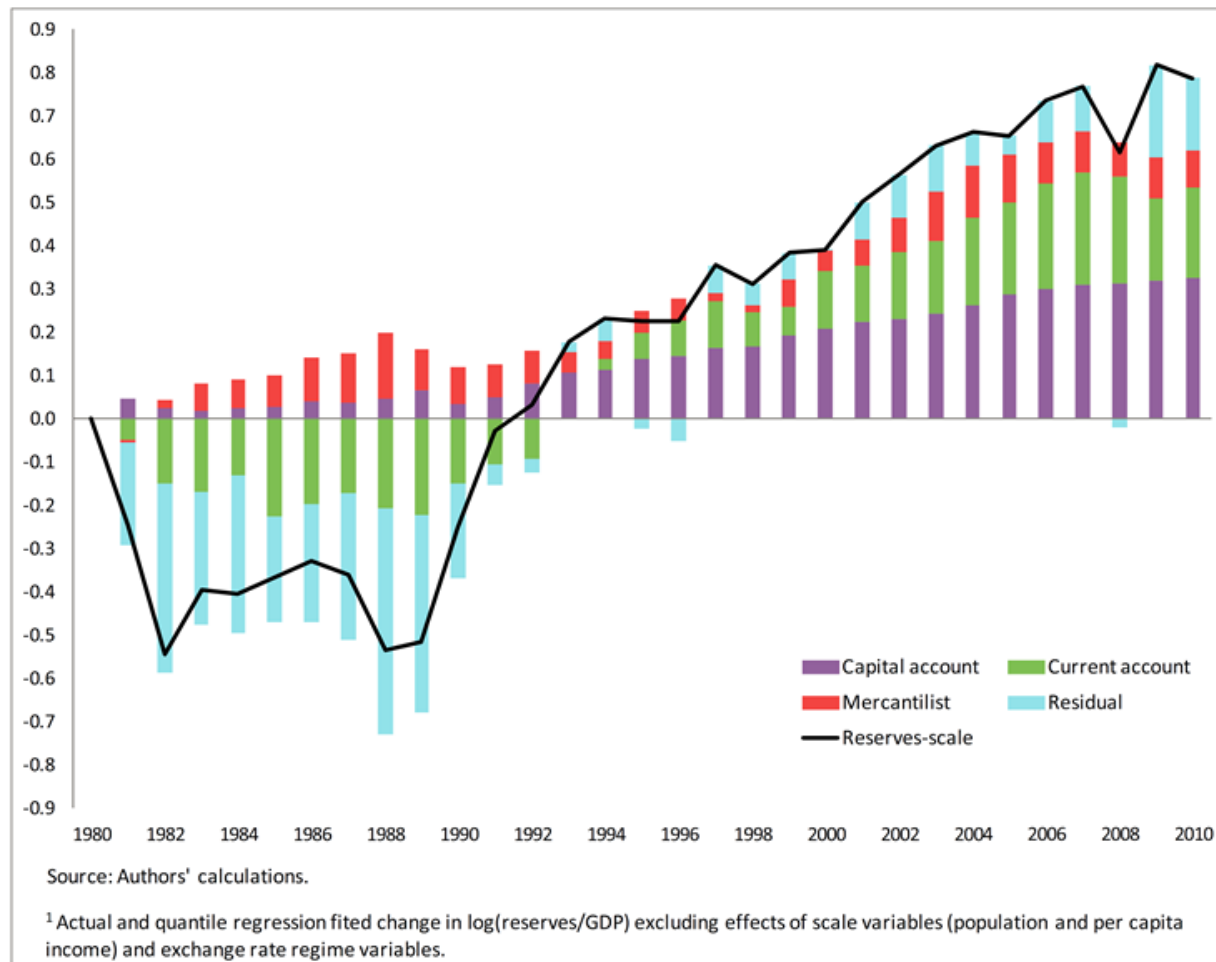


Differing Paths



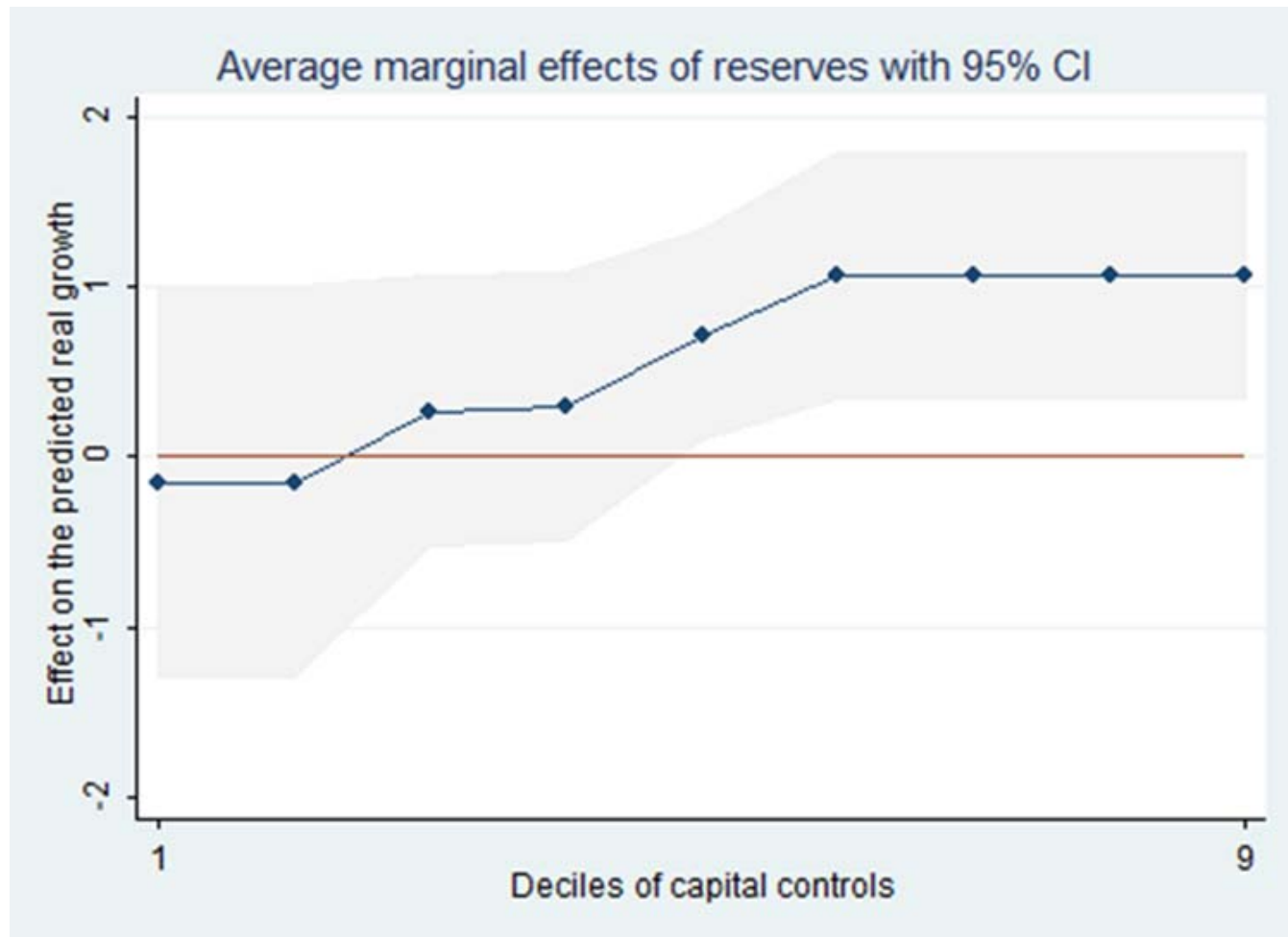
Source: Bussiere, Chen, Chinn and Lisack (2014)

Shifting Motives



Source: Ghosh, Ostry and Tsangarides (2012).

Insurance against GDP Loss



Source: Bussiere, Chen, Chinn and Lisack (2014)



Insurance against GDP Loss

A doubling of the reserves-to-ST debt ratio is associated with a 0.4 to 0.5 percentage point faster growth rate during the global recession