Topic 11: Monetary Union

Part 1. Introduction

- **Definition:** Monetary union, currency union, currency area: Multiple countries sharing a single medium of exchange controlled by a single central bank.

- Technical definition used in empirical literature: Money inter-changeable between countries at 1:1 par for extended time.

- An extreme form of fixed exchange rate regime.

- Renewed interest in the topic when plans began for Europe Economic and Monetary Union (EMU), created in 1999.

Many Currency Unions pre-EMU

- CFA Franc zone (15 West Africans)
- ECCA (8 Caribbeans)
- Panama, Ecuador, Guatemala, El Salvador use US dollar
- Many others (Pacific, South Africa, Europe, …)

Optimal Currency Area theory:

- Largely due to Robert Mundell, who won the Nobel prize in 1999.

- Whether countries are an optimal currency area depends on comparing
  - costs versus
  - benefits…

Benefits from a currency union: it promotes trade

- Takes away transactions costs of exchanging currencies
- Takes away uncertainty of exchange rate movements
- Takes away currency crises: it is a permanent fixed exchange rate.

Costs of a currency union:

- Main cost: lose independent monetary policy. One central bank means one monetary policy:

- What if one region is in a recession and needs loose monetary policy, while another region is not in a recession and needs tight monetary policy?

What features would make this cost small:

- Regions have recessions at the same time. (symmetry of shocks)

- Unemployed workers can move to the other region (integrated labor markets).

- A common fiscal system transfers income to the region in recession (fiscal federalism).

Conclude: So the cost is less if economies are more integrated in these various ways.

2. Rose (*Economic Policy*, 2000)

(Thanks to Rose posted slides for material in slides)

Question: What is the effect of currency union on international trade?

Answer: Very large and very significant. Entering CU doubles bilateral trade.

This result has been called the most significant finding in international macro in the last decade, while it also has attracted much skepticism.

Methodology

- Large panel data set: annual data 1948-1997 for 217 “countries”
- Use bilateral “gravity” model of trade

Gravity Model

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \ln D_{ij} + \beta_2 \ln(Y_i Y_j)_t + \beta_3 \ln(Y_i Y_j / Pop_i Pop_j)_t + \beta_4 Lang_{ij} +$$

$$\beta_5 Cont_{ij} + \beta_6 Landl_{ij} + \beta_7 Island_{ij} + \beta_8 \ln(Area_i Area_j) +$$

$$\beta_9 ComCol_{ij} + \beta_{10} CurCol_{ijt} + \beta_{11} Colony_{ij} +$$

$$\beta_{12} ComNat_{ij} + \beta_{13} FTA_{ijt} + \gamma CU_{ijt,} + \Sigma_t \phi_t T_t + \varepsilon_{ijt}$$

where i and j denotes trading partners, t denotes time.

Estimation: OLS with year effects, dyadic fixed effects, robust standard errors

Parameter of Interest: γ

Data Set

- Trade data from IMF's *Direction of Trade*
  - Real US $
  - 217 trading entities, most global trade covered
  - 1948-1997 (with gaps)
  - Average (4 measures of) bilateral exports and imports
- PWT, WDI, IFS for population, GDP
- CIA's website

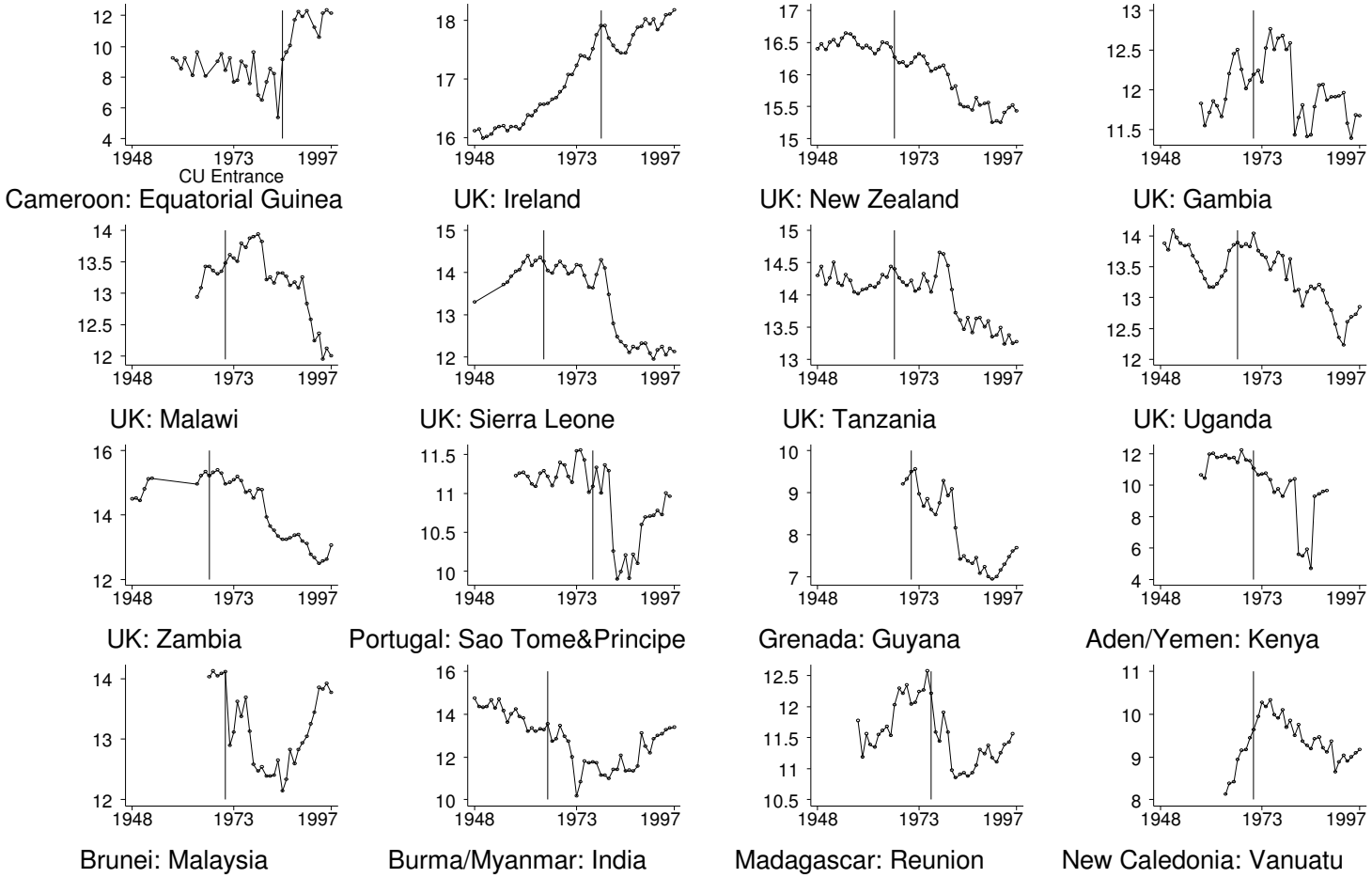
Estimation Results

- γ=.65 (standard error = .05)
  - Big effect: exp(.65)-1 = .92
  - Currency Union almost doubles trade!

Small Literature Now Exists

- 34 studies estimate effect of currency union on trade
- Summing over all 34 using “meta-analysis” gives large positive effect:
- Trade rises by between 30% and 90%

Event Studies: CU Dissolutions



Log Real $ Trade; vertical scales differ. Currency Union Exit marked.

Trade and Currency Union Dissolutions

More Studies: Focus on EMU

- Euro only physically introduced in 2002
- Although data small due to short duration of EMU, several studies estimate effect on trade (such as Still, Micco, Stein & Ordonez, Baldwin papers)
- Effect is statistically significant, smaller in magnitude than in studies of other currency unions: average about 15%.

Questions

- There are several critiques made of this result.
- Is there an economic reasons why the effect of Currency Union on trade so big?
- Why might the effect in EMU be smaller? (See paper by Frankel)

3. Bergin and Lin (2009): "Exchange Rate Regimes and the Extensive Margin of Trade"

- This paper decomposes the trade effects of monetary unions in the original Rose data set into

  - extensive margin (new goods), and

  - intensive margin (greater volume of existing goods).

- This distinction helps discriminate between alternative theories, and has implications for welfare and resource allocation.

- The paper also studies the effects of pegged exchange rate regimes.

Main findings: Empirical

- Pegs and currency unions tend to work through distinct channels:
  - Currency union mainly at extensive margin
  - Direct peg exclusively at intensive margin

Main findings: Theoretical

- The paper augments the model of Bacchetta - van Wincoop (AER 2000) to include entry decisions.
- The empirical facts explainable if we study how exch. rate uncertainty affects pricing and entry decisions.
  - Pegs eliminate exchange rate uncertainty over horizon of price setting (about 1 year), which lowers export prices and raises overall trade.
  - Currency unions last longer, eliminating uncertainty over horizon of investment in fixed cost of entry, expanding extensive margin.
  - Predicts a permanent elimination of exch. rate variability should work all at extensive margin.

Empirical Set-up:

- Conduct panel gravity regressions like Rose, but with three different dependent variables: overall trade, extensive margin, intensive margin.
- Regressors:
  - Exchange rate regime indicators: currency union, direct peg, indirect peg.
  - Exchange rate volatility
  - Gravity variables: distance, GDP, population, trade agreements, language, colonial rel
  - Alternative sets of country and country-year fixed effects to control for multilateral resistance in trade

Measurement of margins:

- Use definitions of Hummels and Klenow (2005).
- Extensive margin: weighted count of country *j*'s categories exported to country *m* relative to all categories exported to *m*.

$$EM_m^j = \frac{\sum_{i \in I_m^j} X_{m,i}^W}{X_m^W}$$

- Intensive margin: country *j*'s export value relative to weighted categories in which *j* exports to *m*.

$$IM_m^j = \frac{X_m^j}{\sum_{i \in I_m^j} X_{m,i}^W}$$

- Country *j*'s share of world exports to country *m* is product of extensive and intensive margins:

$$Exports_m^j = \frac{X_m^j}{X_m^W} = EM_m^j IM_m^j$$

Data

- Coverage: 148 countries, annual frequency, 1973-2000. Large data sets (years and countries) are needed for significant results.
- Disaggregated bilateral trade flows for extensive margins: NBER-UN World Trade Data, 4-digit SITC.
- Exchange rate regime classifications, from Klein and Shambaugh (2006, 2007)
- Gravity variables from Rose data set.

bilateral exports of 148 countries from 1973-2000			
	Panel Regression with Country Year Fixed effects		
Dependent Variable	**logarithm of the extensive margin**	**logarithm of the intensive margin**	**logarithm of the export share**
Currency Union	0.612** (0.162)	-0.002 (0.120)	0.610** (0.187)
Direct Peg	-0.003 (0.082)	0.223** (0.061)	0.221* (0.092)
Indirect Peg	-0.078* (0.0331)	-0.042 (0.027)	-0.121** (0.040)
Exchange Rate Volatility	-0.142 (0.399)	-0.402 (0.305)	-0.543 (0.440)

** significant at 1%; *significant at 5%

Results

- Main case: country year fixed effects, which allows for multilateral trade resistance to vary over time
- Currency union: raises overall trade share by 84%, extensive margin by 84%, statistically significant. No significant effect on intensive margin.
- Direct peg: raises overall trade share by 25%, intensive margin by 25%, statistically significant. No significant effect on extensive margin.
- Exchange rate volatility insignificant effects on all; indirect peg lowers overall trade share.

Results

- The main results are robust to:
  - Instrumental variables estimation to control for endogeneity of policy regime
  - Longer time sample 1962-2000, including Bretton Woods period.

bilateral exports of 148 countries from 1973-2000			
	IV, Panel Regressions with Country Fixed effects		
Dependent Variable	**logarithm of the extensive margin**	**logarithm of the intensive margin**	**logarithm of the export share**
Currency	0.903** (0.167)	-0.082 (0.110)	0.821** (0.182)
Direct Peg	-0.078 (0.136)	0.504** (0.124)	0.425** (0.170)
Indirect Peg	-0.039 (0.029)	-0.039 (0.023)	-0.079* (0.035)
Exchange Rate Volatility	-0.062* (0.030)	0.051* (0.023)	-0.011 (0.036)

** significant at 1%; *significant at 5%

bilateral exports of 148 countries from 1962-2000			
	Panel Regression with Country Year Fixed effects		
Dependent Variable	**logarithm of the extensive margin**	**logarithm of the intensive margin**	**logarithm of the export share**
Currency Union	0.930** (0.122)	0.028 (0.077)	0.958** (0.138)
Direct Peg	0.064 (0.063)	0.194** (0.053)	0.258** (0.074)
Indirect Peg	-0.036 (0.021)	-0.013 (0.017)	-0.048 (0.025)
Exchange Rate Volatility	-0.132** (0.031)	0.100** (0.023)	-0.032 (0.036)

** significant at 1%; *significant at 5%

Theory: key model features

- Stochastic general equilibrium monetary model: similar to Bacchetta and van Wincoop (AER 2000), augmented with firm entry and other trade features.
- Two symmetric countries.
- Uncertainty via monetary shocks, which drive the exchange rate.
- Sticky prices in local currency units.
- Include love for variety; abstract from firm heterogeneity.
- Fixed cost of entry into domestic and export markets.

Timing convention

- Shocks realized, production and sales take place at the end of year (denote this t_2)
- Firms choose price beginning of year (t_1). Exchange rate regimes adopted at this time.
- Firms must commit to entry decision earlier than this, at the end of the previous year (t_0), before exchange rate regime is known for next year.

Exchange rate regime assumptions

- Both a direct peg ($DPeg$) and a currency union (CU) fully eliminate exchange rate volatility. But the regimes differ in expectations about the future…
- In our data set:
  - Only 56% of pegs survive more than one year.
  - But only 9 of the 65 currency union pairs changed during the entire 28 year sample.
- We assume a currency union present in a year is expected by firms to continue on the next year.
- But a peg is expected to last just one year; for analytical tractability, firms expect a float to resume for the next year.

Goods market structure:

- Continuum of n_H home firms producing differentiated good in home market;
- A subset of these, n_H^* export to foreign market.
- Foreign country symmetric, $n_F^* = n_H$ and $n_F = n_H^*$
- Monopolistically competitive, with elasticity μ with other varieties of good from same country.
- CES aggregator of home and foreign sub-aggregates, with aggregate elasticity ϕ.

Households

- Endogenous labor supply, where we assume consumption and leisure are substitutes.
- Income from labor earnings at wage rate W, and profits from ownership of firms.
- Love of variety degree γ : utility gain from spreading consumption expenditure over one more variety.

$$C_{Ht_2} \equiv n_{Ht_2}{}^{\gamma-\frac{\mu}{\mu-1}} \left(\int_0^{n_{Ht}} \left(c_{Ht_2}(i) \right)^{\frac{\mu-1}{\mu}} di \right)^{\frac{\mu}{\mu-1}} = n_{Ht_2}{}^{\gamma} c_{Ht_2}(i)$$

- Hold money because of cash in advance constraint.
- Balanced trade in goods

Firms

- Production linear in labor, with productivity term A.
- Iceberg cost τ of setting in foreign market.
- Firm i sets prices $p_H(i)$ for the home market, and $p_H^*(i)$ in foreign currency units for foreign market.
- Pay a fixed cost F of entry into domestic market; F^* into foreign market, where $F^*>F$ due to language, legal barriers, or product standards.

Price setting decision

- Objective: maximize expected discounted profits:

$$\max E_{t_1}\left[u_{ct_2}\pi_{Ht_2}(i)+u_{ct_2}\pi^*_{Ht_2}(i)\right]$$

$$\text{where } \pi_{Ht_2}(i)=\left(p_{Ht_1}(i)-\frac{W_{t_2}}{A}\right)c_{Ht_2}(i)-W_{t_2}F$$

$$\text{and } \pi^*_{Ht_2}(i)=\left(s_{t_2}p^*_{Ht_2}(i)-\frac{W_{t_2}}{A(1-\tau)}\right)c^*_{Ht_2}(i)-W_{t_2}F^*$$

- Optimal price setting (as in Bacchetta and van Wincoop, 2000):

$$p_{Ht_1}(i)=\left(\frac{\mu}{\mu-1}\right)\frac{P_{t_1}}{A}\frac{E_{t_1}\left[u_{lt_2}M_{t_2}\right]}{E_{t_1}\left[u_{ct_2}M_{t_2}\right]}$$

$$p^*_{Ht_1}(i)=\left(\frac{\mu}{\mu-1}\right)\frac{P_{t_1}}{A(1-\tau)}\frac{E_{t_1}\left[u_{lt_2}M^*_{t_2}\right]}{E_{t_1}\left[u_{ct_2}M_{t_2}\right]}$$

Price setting

- If the exchange rate is fixed (Currency union or direct peg) $M=M^*$:

$$E_{t_1}\left[u_{l\,t_2}M_{t_2}\right]=E_{t_1}\left[u_{l\,t_2}M^{*}{}_{t_2}\right]$$

- But under float (and C-I substitutability)

$$E_{t_1}\left[u_{l\,t_2}M_{t_2}\right]<E_{t_1}\left[u_{l\,t_2}M^{*}{}_{t_2}\right]$$

- So greater price wedge for exports under a float:

$$\frac{\overline{p}^{*}_{H,CU}(i)}{\overline{p}_{H,CU}(i)}=\frac{\overline{p}^{*}_{H,DPeg}(i)}{\overline{p}_{H,DPeg}(i)}<\frac{\overline{p}^{*}_{H,float}(i)}{\overline{p}_{H,float}(i)}$$

reflecting greater riskiness in value of profits from export sales (assuming consumption and leisure are substitutes).

Entry decision:

- Zero profit condition: expected profit equals expected value of fixed cost:

$$E_{t_0}\left[u_{ct_2}\pi^*_{Ht_2}(i)\right]=E_{t_0}\left[u_{ct_2}\left\{\left(s_{t_2}p^*_{Ht1}(i)-\frac{W_{t_2}}{A_{t_2}(1-\tau)}\right)c^*_{Ht2}(i)-W_{t_2}F^*\right\}\right]=0$$

- Implies entry condition:

$$n^*_{Ht_0}=\left\{\frac{\frac{1}{2}\left[E_{t_0}\left[u_{ct_2}M_{t_2}\left(p^*_{Ht_1}(i)\right)^{1-\phi}P^{*(\phi-1)}_{t_1}\right]-E_{t_0}\left[u_{ct_2}M^*_{t_2}\frac{W_{t_2}}{A_{t_2}(1-\tau)}\left(p^*_{Ht_1}(i)\right)^{-\phi}P^{*(\phi-1)}_{t_1}\right]\right]}{E_{t_0}\left[u_{ct_2}W_{t_2}\right]F^*}\right\}^{\frac{1}{\gamma+(1-\gamma)\phi}}$$

Entry condition cont.

Simplifies greatly if take as ratio to analogous domestic entry condition:

- Currency union (CU): $$\frac{n^*_{H,CU,t_0}}{n_{H,CU,t_0}} = \left(\frac{\bar{p}^*_{H,CU}(i)}{\bar{p}_{H,CU}(i)}\right)^{\frac{1-\phi}{\gamma(1-\phi)+\phi}} \left(\frac{F^*}{F}\right)^{\frac{1}{\gamma+(1-\gamma)\phi}}$$
- Float: $$\frac{n^*_{H,float,t_0}}{n_{H,float,t_0}} = \left(\frac{\bar{p}^*_{H,float}(i)}{\bar{p}_{H,float}(i)}\right)^{\frac{1-\phi}{\gamma(1-\phi)+\phi}} \left(\frac{F^*}{F}\right)^{\frac{1}{\gamma+(1-\gamma)\phi}}$$
- Direct Peg (DP): $$\frac{n^*_{H,DPeg,t_0}}{n_{H,DPeg,t_0}} = \left(\frac{\bar{p}^*_{H,float}(i)}{\bar{p}_{H,float}(i)}\right)^{\frac{1-\phi}{\gamma(1-\phi)+\phi}} \left(\frac{F^*}{F}\right)^{\frac{1}{\gamma+(1-\gamma)\phi}}$$

Rel. Price term | Fixed cost term

- Conclude: $$\frac{n^*_{H,CU,t_0}}{n_{H,CU,t_0}} > \frac{n^*_{H,DPeg,t_0}}{n_{H,DPeg,t_0}} = \frac{n^*_{H,float,t_0}}{n_{H,float,t_0}} \quad \text{for } \phi > 1 \text{ and } \gamma \le \phi/(\phi-1)$$

Comparing to empirical results

- Approximate empirical definitions in a 2-country world by scaling relative to domestic levels:

- Extensive margin: $EM \equiv \frac{n^*_{Ht_0}}{n_{Ht_0}}$ (as above)

- Export share: $Exports = \frac{P^*_{Ht_1} C^*_{Ht_2}}{P_{Ht_1} C_{Ht_2}}$

- Intensive margin: $IM \equiv \left(\frac{P^*_{Ht_1} C^*_{Ht_2}}{n^*_{Ht_0}} \right) / \left(\frac{P_{Ht_1} C_{Ht_2}}{n_{Ht_0}} \right)$

Compare impacts on overall trade

Solve for currency union:

$$\frac{Exports_{CU}}{Exports_{float}} = \left(\frac{EM_{CU}}{EM_{float}} \right)^{(\phi-1)(\gamma-1)} \left(\frac{E_{t_1}\left[u_{l t_2} M^*_{t_2} \mid float \right]}{E_{t_1}\left[u_{l t_2} M_{t_2} \mid float \right]} \right)^{(\phi-1)}$$

And for direct peg: $$\frac{Exports_{DPeg}}{Exports_{float}} = \left(\frac{E_{t_1}\left[u_{l t_2} M^*_{t_2} \mid float \right]}{E_{t_1}\left[u_{l t_2} M_{t_2} \mid float \right]} \right)^{(\phi-1)}$$

Which implies

$$\frac{Exports_{CU}}{Exports_{float}} = \left(\frac{EM_{CU}}{EM_{float}} \right)^{(\phi-1)(\gamma-1)} \frac{Exports_{DPeg}}{Exports_{float}}$$

Conclusion: The rise in trade for a currency union is greater than for a peg, by a factor proportional to the rise in the extensive margin (with the proportionality depending on love for variety).

Compare impacts on margins of trade

- Direct Peg: Since it was found above there was no extensive margin impact $\left(n^*_{H,Peg,t_0}/n_{H,Peg,t_0} = n^*_{H,float,t_0}/n_{H,float,t_0}\right)$ all of rise in trade occurs at the intensive margin.

- Currency union: solving out…

$$\frac{Exports_{CU}}{Exports_{float}} = \left(\frac{EM_{CU}}{EM_{float}}\right)^{(1-\phi)(1-\gamma)} \left(\frac{p^*_{H,CU}(i)/p_{H,CU}(i)}{p^*_{H,float}(i)/p_{H,float}(i)}\right)^{1-\phi} = \frac{EM_{CU}}{EM_{float}}$$

  Since the export share measure is same as extensive margin share, all of the rise in trade occurs at the extensive margin.

  Somewhat surprising: might have expected that when firms hedge against risk in price setting, this could help hedge entry also.