Foreign Exchange Market

Notes on Mishkin, Chapter 20

Prof. Leigh Tesfatsion

Economics, Iowa State University

Last Revised: 1 July 2013

Basic Topics Covered

- Exchange rates and the foreign exchange market
- Nominal vs. real exchange rates
- Exchange rate determination (long/short run):
  - Purchasing Power Parity (PPP)
  - Interest Parity (real and nominal form)
  - International Fisher Effect
- The creation of the European Union & Euro Area

Key In-Class Discussion Questions

- Why is **arbitrage** considered to be a powerful organizing principle for financial transactions?

- How can the arbitrage principle of **purchasing power parity** be used to predict exchange rates?

- How can the arbitrage principle of **interest parity** be used to predict exchange rates?

- *Case Study:* Will the intro of the **Euro** benefit the adopting countries? Will it benefit Europe as a whole?

Foreign Exchange Rates

- *Exchange Rate* – A price of one country's currency measured in terms of another.
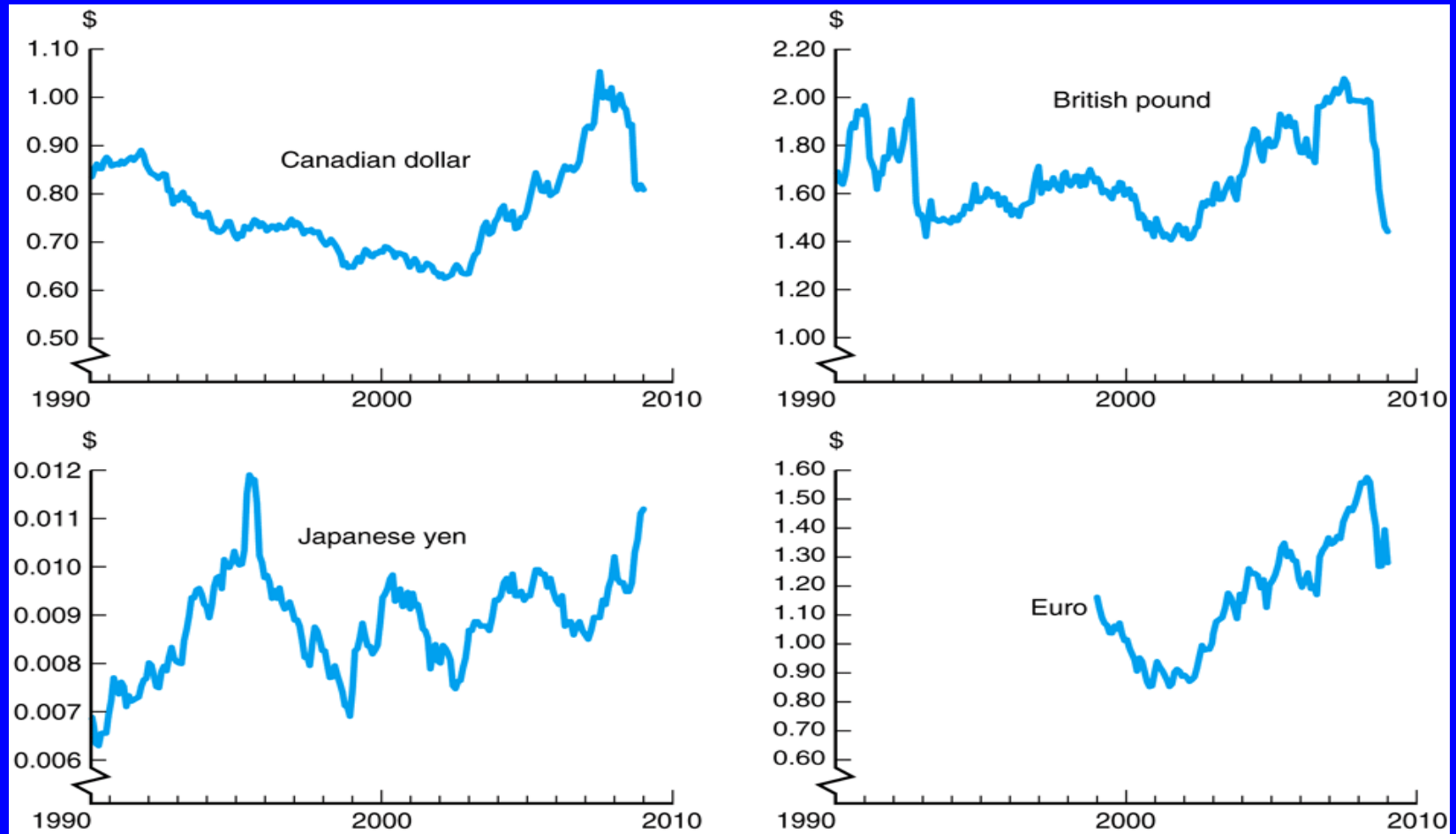
  Example: *Yen price of a U.S. Dollar 10/11/2010*

  81.97 Yen per 1 USD, i.e.,

  1 USD can be exchanged for 81.87 Yen

- All exchange rates have reciprocals

  - For example, Mishkin Figure 1 (p. 500) gives USD prices of various foreign currencies over time.

Mishkin Fig. 1: Foreign Exchange Rates in USDs (i.e., US $) per foreign currency unit

3/20/11: 1.4176 USDs = 1 Euro

Exchange Rate: Euros per USD
(May 1 through October 11, 2010)

EUR

0.845755

0.818336

0.790918

0.763499

0.73608

0.708662

May 24   Jun 22   Jul 21   Aug 19   Sep 20

(c)2010 x-rates.com

3/20/2011   0.7054 Euros = 1 USD

Exchange Rate Transactions

- **Spot transactions** – spot exchange rate

- **Forward transactions** – forward exchange rate

- Foreign exchange market is
  - an over-the-counter (OTC) market
  - conducted by dealers (mostly banks)
  - trades typically involve exchange of deposit accounts in excess of $1 million in value
  - **$1.2 to 1.5 trillion daily is traded**

- Retail market (smaller trades at higher prices) conducted by banks, American Express, etc.

Changes in a Currency's Value

- Consider USD price measured in foreign currency

  E(T) = Foreign currency per USD in Period T

  – USD **appreciation** in period T → E(T) **increases**

  – USD **depreciation** in period T → E(T) **decreases**

- **USD Appreciation** – U.S. goods more expensive for foreigners & foreign goods cheaper for U.S. citizens

- **USD Depreciation** – U.S. goods cheaper for foreigners & foreign goods more expensive for U.S. citizens

Two-Country Assumption

- For simplicity, assume world divided into **two countries:**
  - Home Country (HC)
  - Rest-of-the-World (ROW)

- Following Mishkin (p. 506, footnote 2), denote HC exchange rate for period T by:

  E(T) = Number of ROW currency units received in exchange for each HC currency unit in period T

- An **increase** in E(T) is a **strengthening (appreciation)** of HC currency; a **decrease** in E(T) is a **weakening (depreciation)** of HC currency.

Real Exchange Rate

- **Nominal Exchange Rate for HC in Period T**

  $E(T) = ROW$ currency per unit of HC currency

- **Real Exchange Rate for HC in Period T:**

  $E_r(T) = E(T) * [\, P(T) \, / \, PROW(T) \,]$

  where

  "*" denotes multiplication;

  $P(T)$ = Period-T Price Level in HC;

  $PROW(T)$ = Period-T Price Level in ROW.

- Real exchange rate corrects for HC/ROW prices

Real Exchange Rate…Continued

❑ Real Exchange Rate $E_r(T)$ for the HC in Period T:

$$E_r(T) = E(T) * [P(T) / PROW(T)]$$

As detailed in html "Notes on Mishkin Chapter 20",

$E(T) * P(T) \approx$ Period T Price of a "unit" of HC Production measured in terms of ROW currency (e.g., yen price of a bushel of US wheat)

$PROW(T) \approx$ Period T Price of a "unit" of ROW Production measured in ROW currency (e.g., yen price of a bushel of Japanese wheat)

$E_r(T) \approx$ Period-T Price of HC Production measured in terms of ROW production (e.g., J wheat bushels per US wheat bushel)

Exchange Rate Determination

Basic Common-Sense Observation

- Suppose a change in some factor results in a **shift right in the demand curve for HC goods (all else equal).**

- This will **shift right the demand curve for HC currency** relative to ROW currency ….

- which will cause an **appreciation of HC currency** relative to ROW currency (i.e., E ↑)

Illustration of Shift Right in the Demand for USDs (relative to Euros) in the Foreign Exchange Market
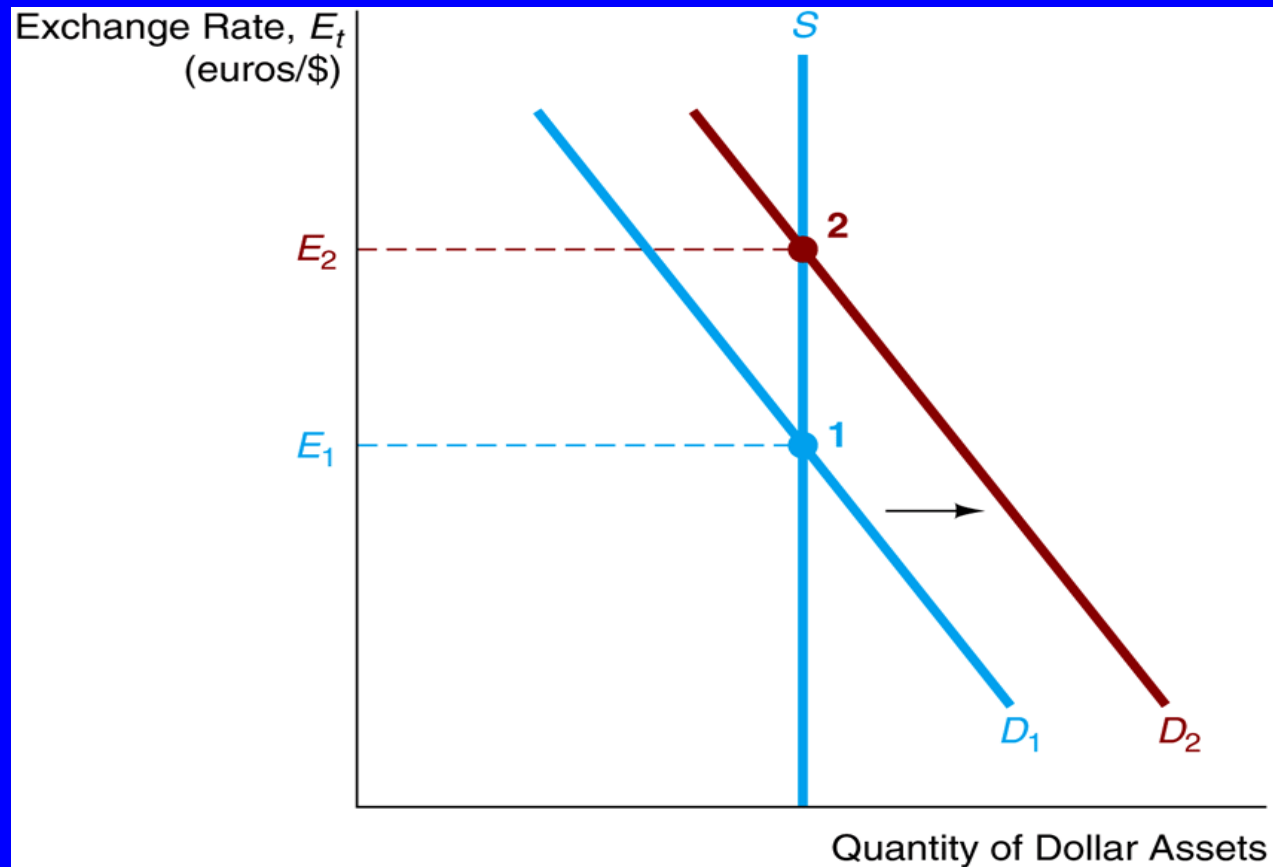
Factors Affecting the Exchange Rate E

- Relative price levels

- Trade barriers – tariffs and quotas

- Preferences for domestic vs. foreign goods

- Higher productivity relative to other countries (allows lower prices domestically)

Factors Affecting the Exchange Rate E (Mishkin, Table 1, Page 507)

SUMMARY Table 1 **Factors That Affect Exchange Rates in the Long Run**

Factor	Change in Factor	Response of the Exchange Rate, E*
Domestic price level†	↑	↓
Trade barriers† **(against imports)**	↑	↑
Import demand	↑	↓
Export demand	↑	↑
Productivity†	↑	↑

*Units of foreign currency per dollar: ↑ indicates domestic currency appreciation; ↓ , depreciation.

†Relative to other countries.

Note: Only increases (↑) in the factors are shown; the effects of decreases in the variables on the exchange rate are the opposite of those indicated in the "Response" column.

Basic Principle: If a change in some factor increases demand for domestic goods relative to foreign goods, then E ↑ all else equal

Factors Affecting E…Continued (Mishkin, Table 2, Page 513)

Factor	Change in Factor	Change in Quantity Demanded of Domestic Assets at Each Exchange Rate	Response of Exchange Rate, E_t	
Domestic interest rate, i^D	↑	↑	↑	
Foreign interest rate, i^F	↑	↓	↓	
Expected domestic price level*	↑	↓	↓	
Expected trade barriers*	↑	↑	↑	
Expected import demand	↑	↓	↓	
Expected export demand	↑	↑	↑	
Expected productivity*	↑	↑	↑	

*Relative to other countries.

Note: Only increases (↑) in the factors are shown; the effects of decreases in the variables on the exchange rate are the opposite of those indicated in the "Response" column.

Arbitrage Opportunity

- **Definition:** An *arbitrage opportunity* is an opportunity to make profits **FOR SURE** by:

  – Taking out a loan (borrowing money);

  – Using the borrowed money to engage in one or more trades **guaranteed** to yield enough return to pay back the loan (principal plus interest) and still have some money left over.

- Exploitation of an arbitrage opportunity is a *dynamic process* typically involving exploitation of "misaligned prices" via a sequence of actions/events. For example:
  - Buy low now and resell later at a higher price (temporal opportunity);
  - Buy low here and resell there at a higher price (spatial opportunity)
  - Buy an "underpriced" bond now at price Pb and receive a sequence of future bond payments whose present value exceeds Pb.

Purchasing Power Parity (PPP):
Global Law of One Price

- Suppose that traders in the HC and ROW

  - produce exactly the same bundle of goods and services
  - have no barriers to trade (no transactions costs, tariffs,etc.)
  - are perfectly informed about the availability of goods and services in both the HC and ROW

- Then **Purchasing Power Parity (PPP)** asserts the price of HC production measured in ROW currency should equal the price of ROW production measured in ROW currency:

$$E(T)*P(T) \;=\; PROW(T)$$

i.e., the **REAL** exchange rate $E_r(T) = E(T)*[P(T)/PROW(T)]$ should satisfy

$$E_r(T) \;=\; 1$$

PPP and Arbitrage: Example

- Suppose US and Japan both produce same type of wheat & no trade barriers exist between US and J
- P = 2 USD per bushel of wheat
- PROW = 4 yen per bushel of wheat
- E = Yen per USD (nominal exchange rate)
- PPP says E*P/PROW = 1, that is

    E*P (yen price of US wheat) = PROW (yen price of J wheat)

    E = PROW/P   = [4 yen/1 bush wheat]* [1 bush wheat/2 USD]

    = [4 yen/2 USD] = 2 yen/USD

- If E differs from 2 yen/USD, traders have an arbitrage opportunity that can be exploited by a sequence of trades (see html "Notes on Mishkin Chapter 20").

Purchasing Power Parity: Alternative Rates-of-Change Form

- Suppose that PPP holds from period T to period T+1, meaning E_r stays constant at 1 from T to T+1

- This means that E*P and PROW must be growing at exactly the same rate from T to T+1

- As shown in html "Notes on Mishkin Chapter 20," this implies that PPP can be re-expressed as follows:

$$[E(T+1) - E(T)]/E(T) \quad = \quad INF_{row}(T,T+1) \quad - \quad INF_{hc}(T,T+1)$$

Rate of change
in E from T to T+1

Inflation rate in
ROW from T to T+1

Inflation rate in
HC from T to T+1

Problems with PPP as a Short-Run Predictor of the Exchange Rate

- Bundles of goods sold by different countries are not always close substitutes

- Prices of goods only traded domestically enter P and PROW, but do not actually affect E

- Trade barriers (transactions costs)

→ Speculative movements in/out of currencies that are **unrelated** to trade can change E.

PPP: U.S. and U.K 1973-2008:
E = PROW/P ?
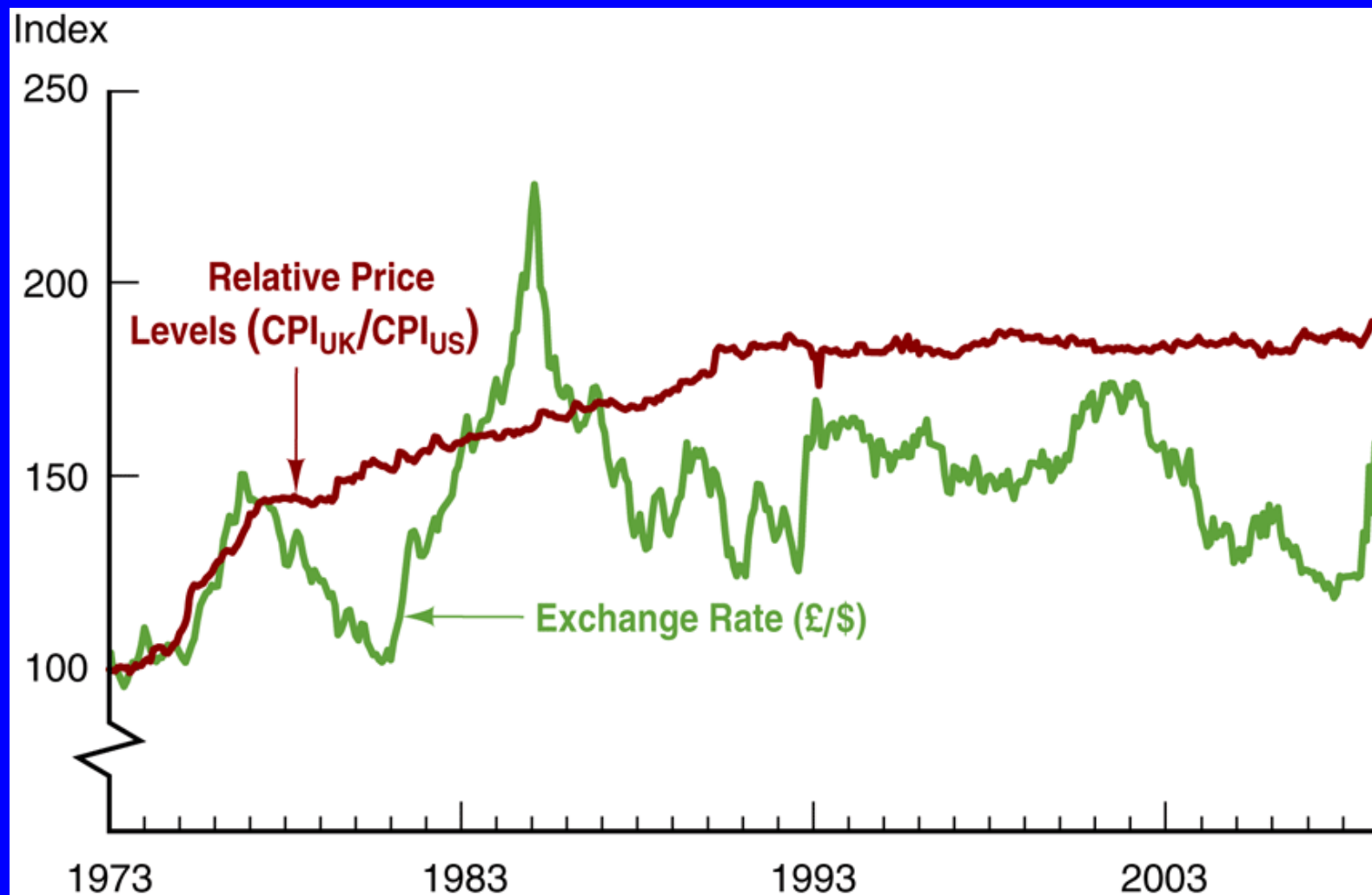
Short Run Exchange Rate Determination: An Alternative Approach

Key Observations

- U.S. foreign exchange market transactions are well over 25 times greater in value than U.S. export and import transactions.

- The exchange rate E is thus better viewed as the relative price of **currency** determined by demand and supply conditions in the foreign exchange market.

Exchange Rate Determination in the Short Run…Continued

- Asset demand theory (Mishkin Chapter 5) suggests that risk and return are two critical factors affecting demand for financial assets.

- Suppose holders of HC deposits face **exactly the same risk** as holders of ROW deposits.

- Then the demand for HC deposits relative to ROW deposits will be largely determined by the **relative expected return** on these assets.

Factors Determining Expected Real Return

- **First Important Fact:** Movements in exchange rates can open up profit opportunities.

  Example: Cf. html "Notes on Mishkin Chapter 20"

  Suppose an investor **correctly** anticipates a RISE in the Yen/USD real exchange rate E_r.

  – Assuming sufficiently small transactions costs, he can then make profits **for sure** by
    - exchanging yen for dollars **now** (when E_r is low);
    - exchanging dollars for yen **later** (when E_r is higher).

Factors Determining Expected Real Return…Continued

- **Second Important Fact:** Differences in real interest rates can present profit opportunities.

  Example: Cf. "Notes on Mishkin Chapter 20" (html)

  – Suppose an investor **correctly** anticipates that the U.S. real interest rate will be **HIGHER** than the Japanese real interest rate during period T.

  – Assuming a constant real exchange rate over period T, he should then then move funds **OUT** of Japanese deposit accounts and **INTO** U.S. deposit accounts for the duration of period T.

Factors Determining Expected Real Return…Continued

Combining these two observations for general HC & ROW investors...

- To calculate the expected real return to saving money in a ROW vs. an HC deposit account over a desired holding period, an investor needs to consider **two possible sources of profit or loss:**

  – Expected movement in the real exchange rate E_r over the desired holding period;

  – Real interest rate in the ROW and in the HC during the desired holding period.

Interest Parity (Real Form)

- Suppose ROW and HC deposit accounts are **equally risky** as financial investments.

- Suppose, also, that there are **no barriers to currency flows** between the ROW and the HC.

- Then currency will flow between the ROW and the HC until the **expected real return rates** on ROW and HC deposit accounts are brought into equality from vantage point of either investor.

- **Expected real return rate**

  = Real interest rate + Expected real profit (or loss)

  per unit of currency swapped

Equation Representation for the Interest Parity Condition (Real Form)

$$r_{HC}(T) + [E^e_r(T+1) - E_r(T)]/E_r(T) = r_{ROW}(T)$$

where:

r_{HC} is the HC **real** interest rate;

r_{ROW} is the ROW **real** interest rate;

E_r is the HC **real** exchange rate;

$[E^e_r(T+1) - E_r(T)]/E_r(T)$

= the expected rate of appreciation (+) or depreciation (-) in E_r from T to T+1

= expected real profit (or loss) per unit of currency swapped

Empirical Support?

- **Empirical Observation:**

  – In the U.S., the **real** interest rate and the effective (i.e., trade weighted) exchange rate tend to rise and fall together.

  – Cf. time series plot: Mishkin, Figure 9 (p. 519)

- **Question:** Can Interest Parity help to explain this observed positive correlation?

Real Interest and the Exchange Rate in the U.S.

1. Value of $ and real rates rise and fall together, as theory predicts
2. No association between $ and nominal rates: $ falls in late 70s as nominal rate rises
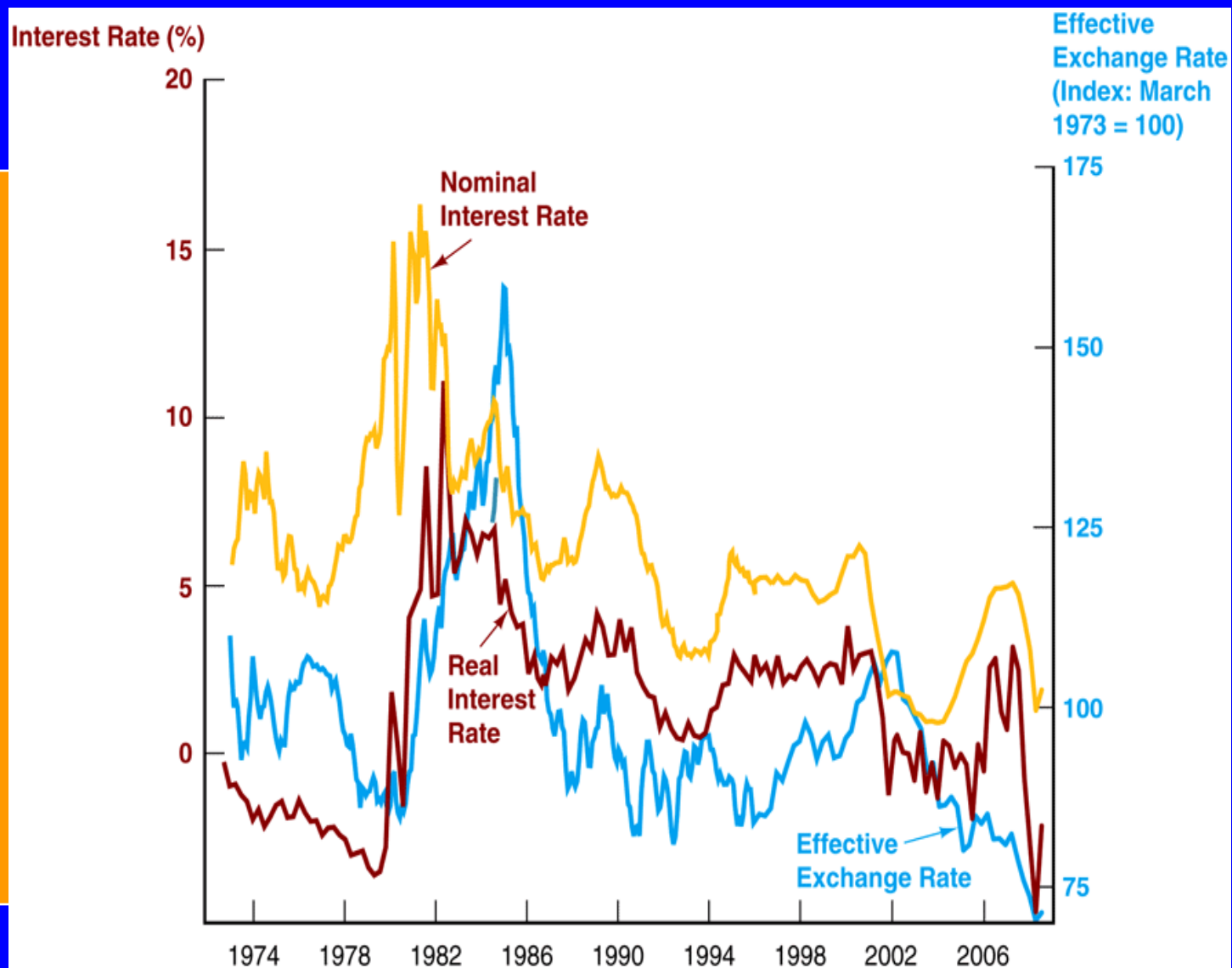
Empirical Evidence…Continued

- According to the Interest Parity Condition:
    - A **rise in the HC real interest rate** raises the expected return on HC deposit accounts while leaving the expected real return on ROW deposit accounts unchanged.
    - The resulting **increased demand** for HC deposits (and sales of ROW deposits) then increases the demand for HC currency relative to ROW currency.
    - This should **increase** the HC exchange rate E

- Bottom Line: The Interest Parity Condition helps to explain the observed positive correlation between the U.S. real interest rate and the effective exchange rate.

Equation Representation for the Interest Parity Condition (Nominal Form):

Cf. Mishkin 20 (Appendix) and the html "Notes on Mishkin 20"

$$i_{HC}(T) + [E^e(T+1) - E(T)]/E(T) = i_{ROW}(T)$$

where:

i_{HC} = the HC **nominal** (market) interest rate;

i_{ROW} = the ROW **nominal** (market) interest rate;

E = the HC **nominal** exchange rate ;

$[E^e(T+1) - E(T)]/E(T)$

= the expected rate of appreciation (+) or depreciation (-) in E from T to T+1.

International Fisher Effect

- Combining the Interest Parity Condition (I PC) with the Purchasing Power Parity Condition (PPP) gives:

$$[i_{ROW}(T) - i_{HC}(T)] = INF_{row}(T,T+1) - INF_{hc}(T,T+1)$$

Interest rate differential between ROW and HC in period T

Inflation rate in ROW, T to T+1

Inflation rate in HC, T to T+1

- ***Remarks:*** Recall Fisher equation: $i = i_r + INF^e$. PPP says E_r constant over time; PPP plus I PC in real form shows HC and ROW **real** interest rates equal over time. Fisher equation then shows difference in **nominal interest rates** must equal difference in **inflation rates**.

Current Events Application: The Introduction of the Euro

- *NOTE:* This section expands on the brief discussions of euro-related issues in Mishkin Chapters 20 and 21.

- Historical Time-Line of Euro-Related Events

- Potential Benefits and Costs of Monetary Union

Europe and Environs (2007)

Historical Time-Line of Events

- **1979:** European Monetary System Established

- **1992-3:** Maastricht Treaty on European Union signed

  - Ratified By 12: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, UK

  - Proposal to create an **Economic and Monetary Union (EMU)** in 3 stages, ultimately with single currency (UK & Denmark opt out)

- **1993:** Maastricht Treaty goes into effect

- **1995:** Austria, Finland, and Sweden join EU (i.e. ratify the Maastricht Treaty), thus forming the "Europe of the 15"

Historical Time-Line of Euro-Related Events...

- **January 1999:** Creation of a single currency

  – In 1/99, EMU has 11 members (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain)

  – The euro is introduced as a unit of account only;

  – A new *European Central Bank (ECB)* takes over monetary policy from the individual central banks of EMU countries;

  – Primary mandate of ECB is inflation control.

Historical Time-Line of Euro-Related Events...

- **January 2001:** Greece joins the EMU (total=12)

- **January 2002:** Circulation of euro notes and coins in physical form begins

- **June 2002:** Complete phasing out of national currencies of all current (12) EMU members

  - National currencies shredded or melted down;

  - Euro becomes the only legal-tender currency for all current (12) members of the EMU

  - EU members adopting euro as their only legal-tender currency are often referred to as the **eurozone** (or **euro area**)

Recent Euro-Related Events

- **2004-2007:** Enlargement of EU and EMU (eurozone)

  - 10 additional countries join EU (Total=25): Cypress, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia
  - Slovenia joins eurozone in 2007 (total=13)

  - In due course, the remaining nine countries above are expected to join the eurozone as well.

- **2007-2011:** Bulgaria and Romania join EU (Total=27); Cypress, Estonia, Malta, Slovakia join eurozone (Tot=17)

- **2011:** Croatia, Turkey, Iceland, and Former Republic of Macedonia (FYROM) are official candidates for EU membership.

- **2013:** Croatia becomes a member of the EU.

European Debt Crisis

- The global financial crisis beginning in 2007 has led to major debt problems for four eurozone member countries: Greece, Ireland, Portugal, and Spain

- The current debt/deficit situations of these four countries are in conflict with the Maastricht Convergence Criteria for eurozone membership (see html "Notes on Mish 20").

- On March 14, 2011, EU leaders announced a debt crisis package to help out Greece with increased bailout loans and lower interest rates on these loans

- Hopes were held out for similar help to Portugal & Spain.

- Ireland was not given easier terms on its bailout loans since it refused to raise its super-low corporate tax rate.
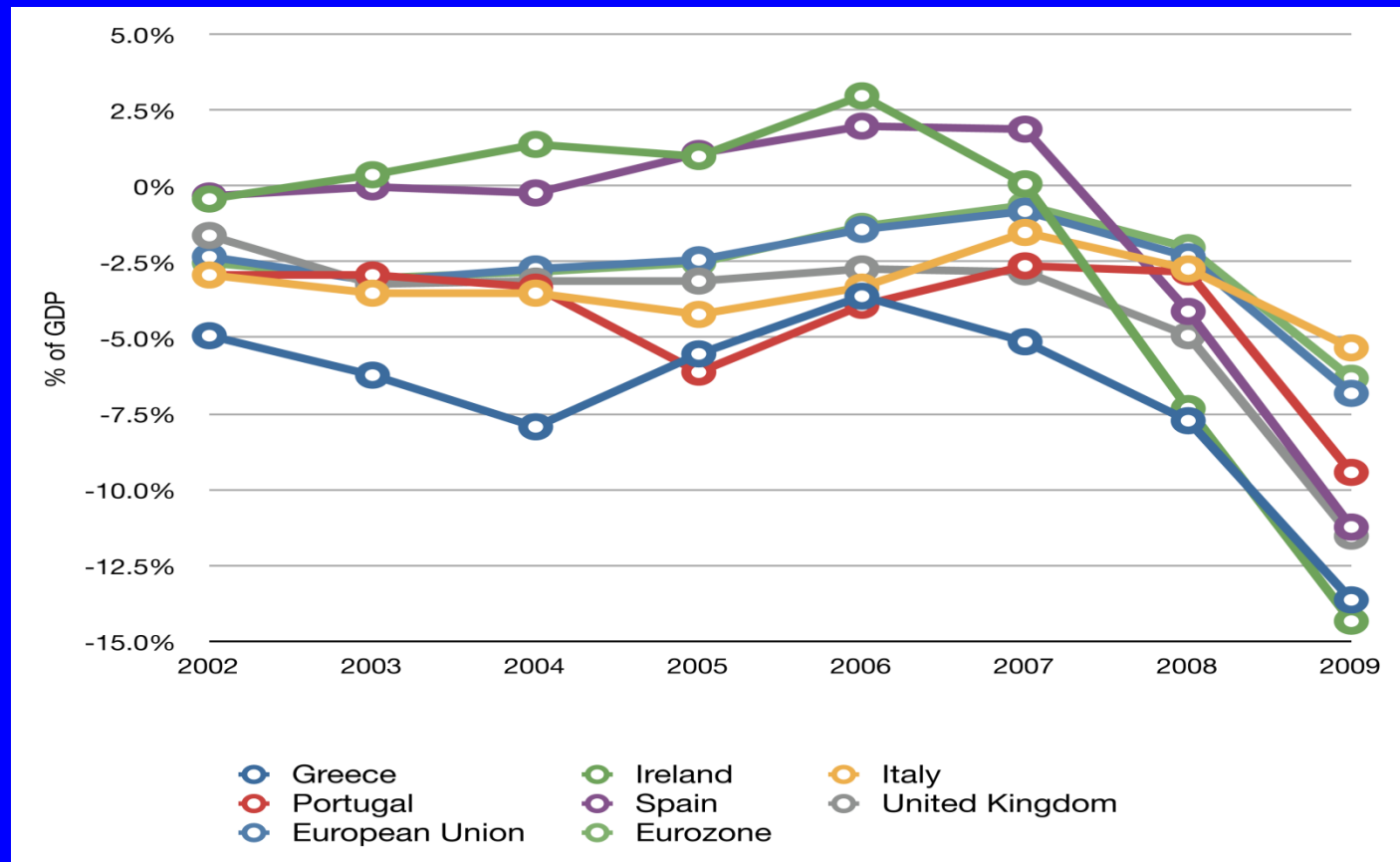
European Debt Crisis…Who's Next

CHART 3
EUROPEAN DEBT CRISIS: WHO'S NEXT?
10-Year Spread vs Germany (ppts: as of March 17, 2011)

Public Debt as Percentage of GDP: 2009/2010

100%+
90-100%
80-90%
70-80%
60-70%
50-60%
40-50%
30-40%
20-30%
10-20%
0-10%

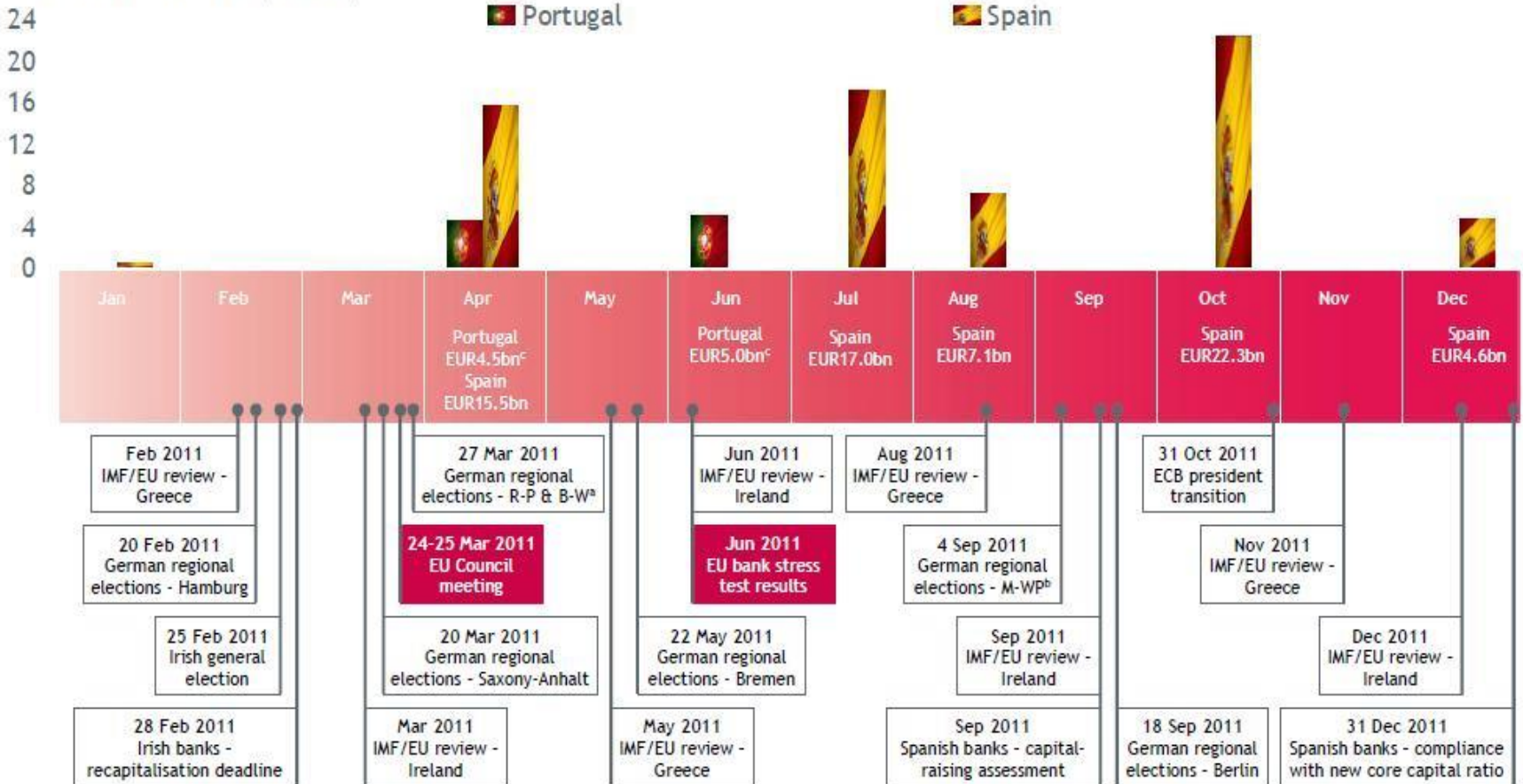# EU Member Country Surpluses & Deficits as Percentage of GDP: 2002 - 2009
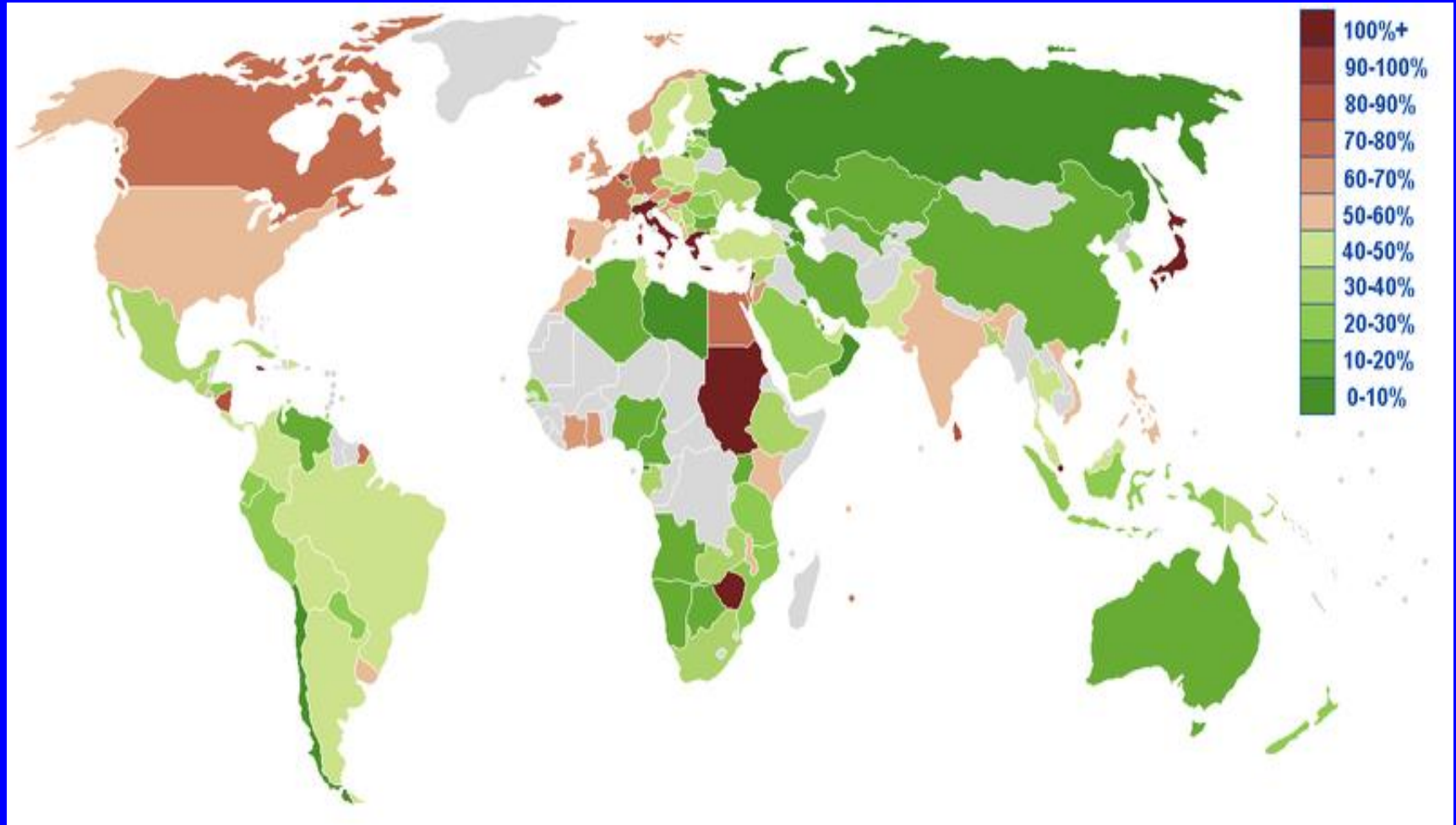
Source: Wikipedia Commons

Potentially-Problematic Debt Maturities for Portugal & Spain (Source: FitchRatings.com)


Eurozone Sovereigns – Key Events Timeline 2011

Summary of European Union:
28 Member Countries (as of 7/1/2013)

- **1952:** Belgium, France, West Germany, Italy, Luxembourg, The Netherlands (founding EEC members)
- **1973:** Denmark, Ireland, United Kingdom join EEC
- **1981:** Greece joins EEC
- **1986:** Portugal & Spain join EEC
- **1990:** East + West Germany = Germany
- **1992 Maastricht Treaty: Above 12 Countries form EU**
- **1995:** Austria, Finland, Sweden join EU
- **2004:** Cyprus, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, & Slovenia join EU
- **2007:** Bulgaria and Romania join EU
- **2013:** Croatia joins EU

European Union:
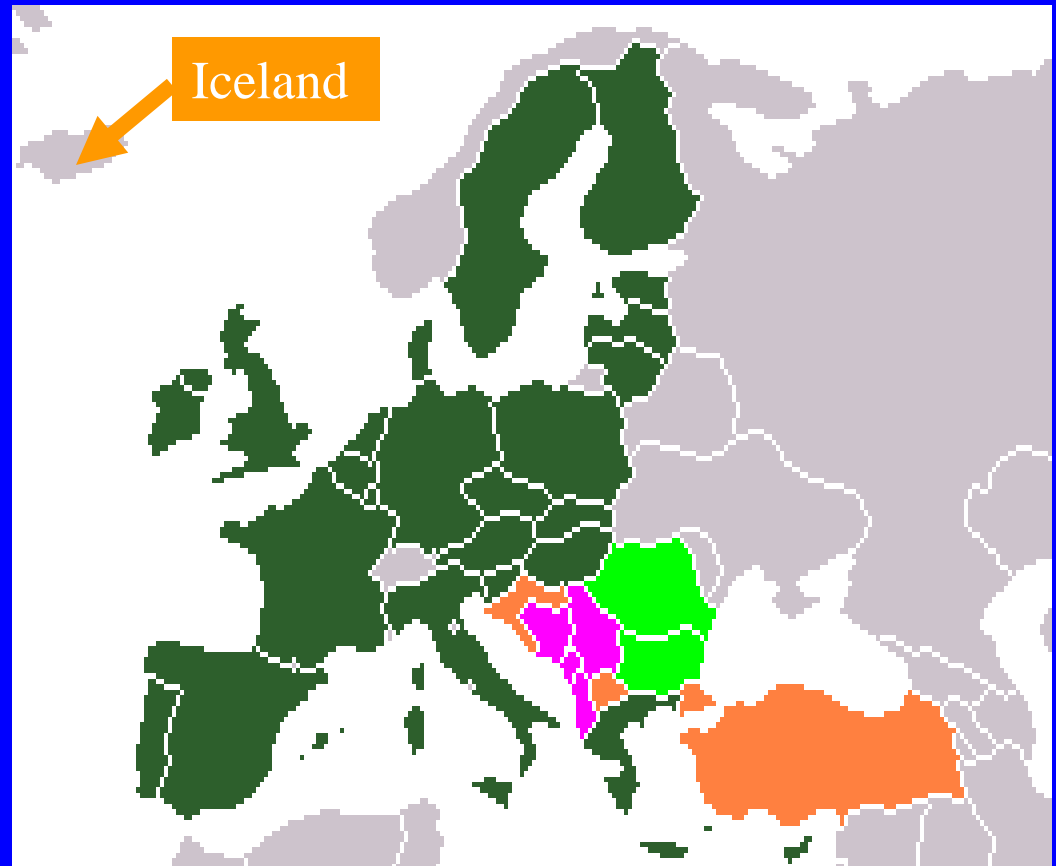# 28 Member Countries as of 7/1/2013
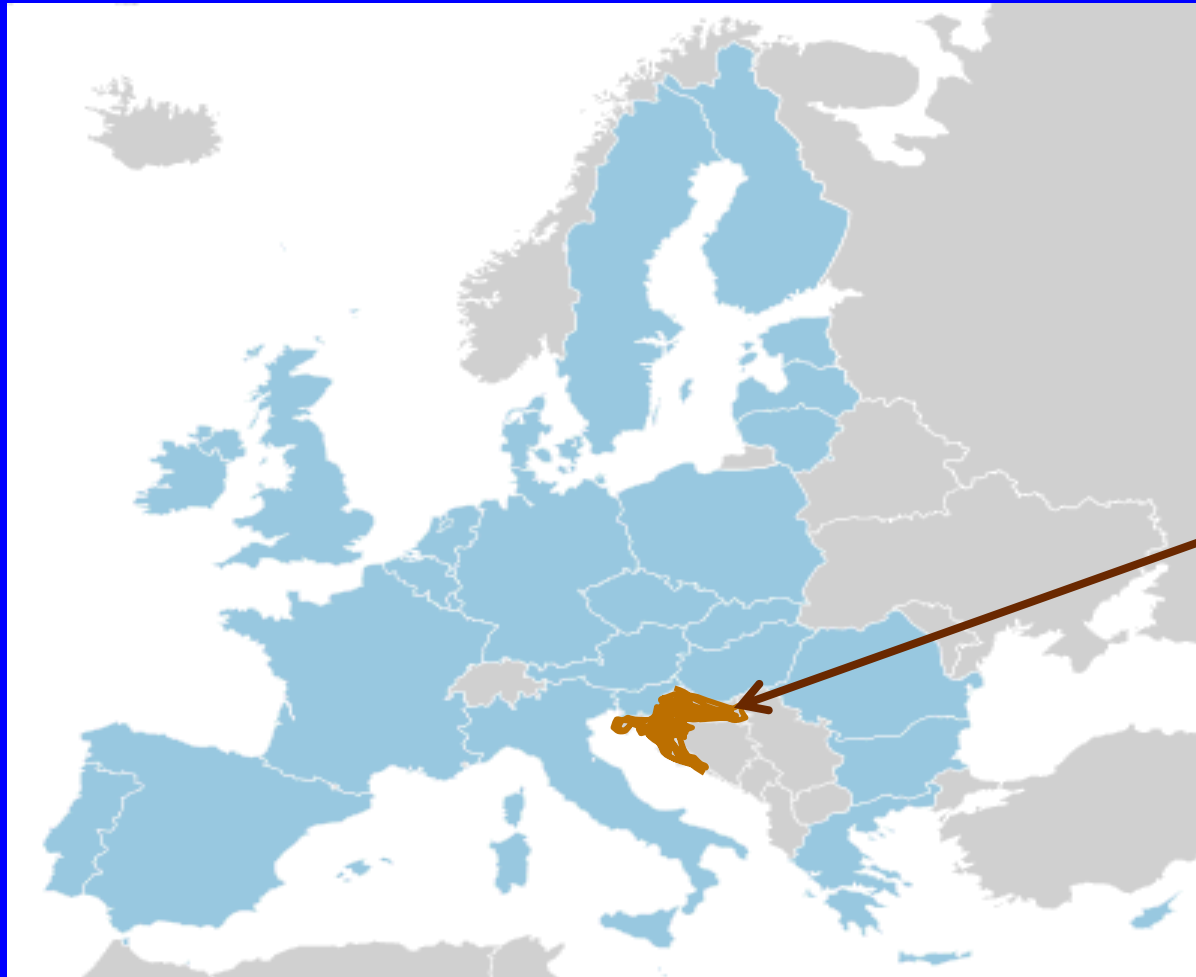
Croatia 7/1/2013

European Union: 7/1/2013
28 Member Countries (Yellow/Gold)

European Union (3/20/2011): Possible Future Expansion

- DARK GREEN = Pre-2007 Members

- BRIGHT GREEN = Joined in 2007

- ORANGE = Official candidate countries (includes Croatia)

- PINK = Potential candidate countries

Iceland

Summary: Members of the Eurozone:
(EU members with euro = only legal-tender currency)

- As of 7/1/2013, only 17 of the 28 EU member countries are eurozone members:

  Austria, Belgium, Cypress, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain

Status of EU Countries Vis-à-Vis the Euro

Blue = Older eurozone Red = Cypress joined eurozone on 1/08

Orange = Slovakia joined eurozone on 1/09

Olive = Estonia joined the eurozone on January 1, 2011

Yellow = Countries with "derogation" (opt-out) of eurozone participation

Light Green = Bound by treaty to ultimately join the eurozone
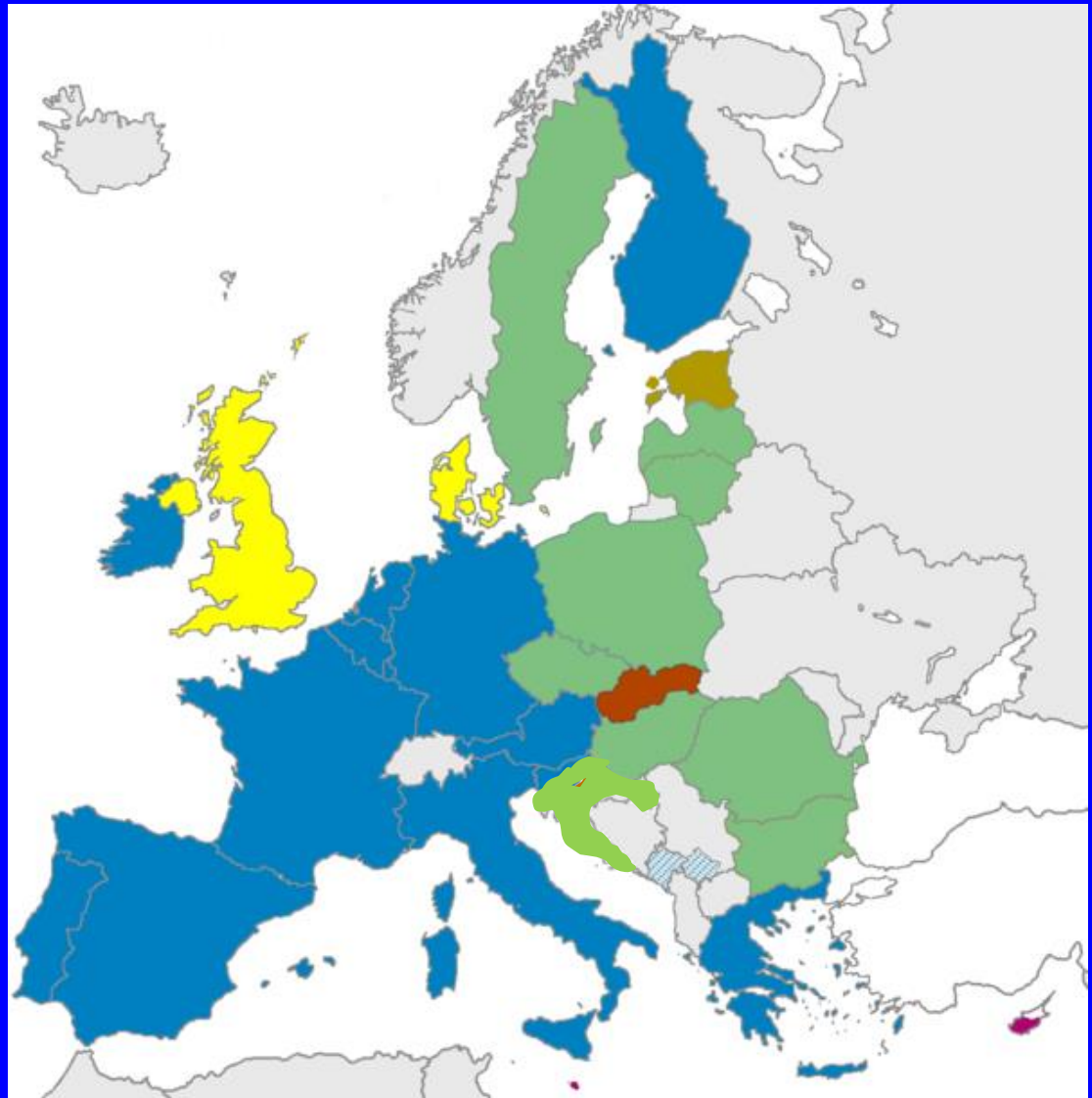
Potential Benefits of Monetary Union

- Elimination of transaction costs

- Elimination of exchange rate risk

- Increased transparency regarding true costs of barriers to trade maintained by EMU members

- Promotion of further **economic** integration among EMU member countries

- Promotion of further **political** integration among EMU member countries

- Euro could rival USD as **world reserve currency**

Potential Costs of Monetary Union

- Surrender of domestic monetary policy autonomy

- Primary focus of European Central Bank (ECB) on inflation control could conflict with goals of individual EMU member countries (e.g., higher employment)

- ECB might be unable to maintain its political independence from powerful EMU members

- Lack of integration in other economically important ways could cause tensions (asymmetric regional growth patterns, asymmetric responses to internal/external shocks, and so forth.)

Would You Vote for a Monetary Union?

- **January 2012:** Suppose a Monetary Union Treaty for U.S., Canada, & Mexico is scheduled to be put to referendum vote

  - Establishment of **Canmexus Central Bank (CCB)** for all three countries

  - Intro of a common currency called **ameros**

  - National currencies shredded and burned – ameros are now the only legal tender in all three countries

  - CCB takes over responsibility for monetary policy for all three countries

  - Each country must keep their government budget deficit below 3% of their GDP or face a stiff fine