Introduction to Exchange Rates and Prices

Consider some hypothetical data on prices and exchange rates in the U.S. and U.K.:

- Prices of U.S. and U.K. CPI baskets
  - 1970 \( P_{\text{UK}} = £100 \)  
  - 1990 \( P_{\text{UK}} = £110 \)
  - 1970 \( P_{\text{US}} = $175 \)  
  - 1990 \( P_{\text{US}} = $175 \)
- Exchange rates (£/$)
  - 1970 \( E_{\text{US}} = 0.57 \)  
  - 1990 \( E_{\text{US}} = 0.63 \)

- Prices of baskets in common currency (U.S. $)
  - UK 1970 \( $175 (= £100/0.57) \)
  - 1990 \( $175 (= £110/0.63) \)
  - US \( $175 \) in both years

- Is it coincidence that the exchange rate and price levels adjusted in this way?

The Law of One Price

- Key assumption – frictionless trade
  - No transaction costs
  - No barriers to trade
  - Identical goods in each location
  - No barriers to price adjustment

- General idea:
  - Prices must be equal in all locations for any good when expressed in a common currency.
  - Otherwise, there would be a profit opportunity from buying low and selling high.
The Law of One Price

- Consider a single good, \( g \), in 2 different markets.
- The law of one price (LOOP) states that the price of the good in each market must be the same.
- This is a microeconomic concept, applied to a single good, \( g \).
- Relative price ratio for \( g \):

\[
q_{E/US}^g = \frac{P_E^g}{P_{US}^g}
\]

The Law of One Price

- If LOOP holds then (for each good \( g \)):

\[
q_{E/US}^g = 1 \quad \iff \quad E_{E/US}P_E^g = P_{US}^g
\]

This means the price of good \( g \) is the same in Europe and in the U.S.

Purchasing Power Parity

- Macroeconomic counterpart to LOOP.
  - If LOOP holds for every good in CPI basket, then the prices of the entire baskets must be the same in each location.
  - The purchasing power parity (PPP) hypothesis states that these overall price levels in each market must be the same.
- Relative price level ratio:

\[
q_{E/US} = \frac{P_E}{P_{US}}
\]
The Real Exchange Rate

- The relative price level ratio \( q \) is an important concept. It is called the real exchange rate (REER).

\[
q_{E/US} = \frac{\left( \frac{E_{ES} P_E}{P_{US}} \right)}{P_{US}}
\]

- Remember the key difference to avoid confusion.
  - Nominal exchange rate \( E \) is the ratio at which currencies trade.
  - Real exchange rate \( q \) is the ratio at which goods baskets trade.

Absolute PPP and the Nominal Exchange Rate

- We can now see that PPP supplies a reference level for the exchange rate.
- Rearrange the PPP equation:

\[
E_{ES/E} = \frac{P_{US}}{P_{ES}}
\]

- PPP implies that the exchange rate at which two currencies trade is equal to the relative price levels of the two countries.
- PPP theory can be used to predict exchange rate movements—these simply reflect relative prices, so all we need to do is predict prices.

Relative PPP, Inflation, and Exchange Rate

- Depreciation

\[
\Delta E_{ES/E} = \frac{E_{ES/E, t+1} - E_{ES/E, t}}{	ext{rate of depreciation of the nominal exchange rate}}
\]
Relative PPP and Inflation

- The rate of change in relative prices ($P_{US}/P_{F}$) is the home-foreign inflation differential:

$$\frac{\Delta P_{US/F}}{P_{US/F}} = \frac{P_{US,F+1} - P_{US,F}}{P_{US,F}} = \frac{P_{F,F+1} - P_{F,F}}{P_{F,F}}$$

- Result is Relative PPP:

$$\frac{\Delta E_{E_{US,F}}}{E_{E_{US,F}}} = \frac{\pi_{US,F+1} - \pi_{US,F}}{\pi_{US,F}}$$

Relative PPP implies that the rate of depreciation of the nominal exchange rate equals the inflation differential.

Empirical Evidence on PPP

- According to relative PPP, the percentage change in the exchange rate should equal the inflation differential.

Empirical Evidence on PPP

- According to absolute PPP, relative prices should converge over time.
How Slow is Convergence to PPP?

- Two measures:
  - Speed of convergence: how quickly deviations from PPP disappear over time (estimated to be 15% per year).
  - Half-life: how long it takes for half of the deviations from PPP to disappear (estimated to be about four years).
- These estimates are useful for forecasting how long exchange rate adjustments will take.

Forecasting Real Exchange Rates

\[
\frac{\Delta E_{s, t}}{E_{s, t}} = \frac{\Delta q_{uS, t}}{q_{uS, t}} + (\pi_{US, t} - \pi_{E, t})
\]

- Example
  - You find that US inflation is 3%, Eurozone inflation is 2%.
  - Based on the inflation differential, you predict a 1% rate of depreciation of the US dollar, or E to rise by 1%.
  - Then you also discover that the US dollar is 10% overvalued against the euro (q=0.90), relative to a PPP value of 1.
  - You expect 15% of that deviation of -0.1 to vanish in one year, so you expect q to rise (real depreciation) by 1.5%.
  - Adding the inflation differential, you now expect E to rise by 2.5%.

What Explains Deviations from PPP?

- Transaction costs
  - Recent estimates suggest transportation costs may add about 20% to the cost of goods moving internationally.
  - Tariffs (and other policy barriers) may add another 10%, with variation across goods and across countries.
  - Further costs arise due to the time taken to ship goods.
- Nontraded goods
  - Some goods are inherently nontradable.
  - Most goods fall somewhere in between freely tradable and purely nontradable.
  - For example: a cup of coffee in a café. It includes some highly-traded components (coffee beans, sugar) and some nontradable components (the labor input of the barista).
What Explains Deviations from PPP?

- Imperfect competition and legal obstacles
  - Many goods are differentiated products, often with brand names, copyrights, and legal protection.
  - Firms can engage in price discrimination across countries, using legal protection to prevent arbitrage
    - E.g., if you try to import large quantities of a pharmaceuticals, and resell them, you may hear from the firm’s lawyers.

- Price stickiness
  - One of the most common assumptions of macroeconomics is that prices are “sticky” prices in the short run.
  - PPP assumes that arbitrage can force prices to adjust, but adjustment will be slowed down by price stickiness.

Why do Richer Economies tend to have a Higher Cost of Living?

\[ P_{\text{rich}} > E \times P_{\text{poor}} \]

- Richer countries tend to demand more services, which are usually nontradeable and labor-intensive. This increases relative price of nontradeables.
- Richer countries tend to have much higher labor productivity for tradeable goods, but not for nontradeables.
- Tradeable goods converge towards PPP, so richer countries have higher real wages. This makes nontradeable services cost relatively more.
- For tradeables, \( P_{\text{rich}} = E \times P_{\text{poor}} \)
- For nontradeables, \( P_{\text{rich}} > E \times P_{\text{poor}} \)
- Average price level \( P \) includes tradeables and nontradeables.

The Big Mac Index

- For over 20 years The Economist newspaper has used PPP to evaluate whether currencies are undervalued or overvalued.
  - Recall, home currency is \( x\% \) overvalued/undervalued when the home basket costs \( x\% \) more/less than the foreign basket.
- The test is really based on Law of One Price because it relies on a basket with one good.
  - Invented (1986) by economics editor Pam Woodall. She asked correspondents around the world to visit McDonald’s and get prices of a Big Mac, then compute price relative to the U.S.
Our hot tips

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<tr>
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<td>-0.5</td>
</tr>
<tr>
<td>Turkey</td>
<td>+0.5</td>
</tr>
</tbody>
</table>

Source: No Source!

PPP as a Theory of the Exchange Rate

- **In levels we have Absolute PPP:**
  \[
  \frac{E_{i,t}}{E_{i,t-1}} = \frac{P_{i,t}}{P_{i,t-1}}
  \]

- **In rates of change we have Relative PPP:**
  \[
  \frac{\Delta E_{i,t}}{E_{i,t-1}} = \frac{\pi_{US,t}}{\pi_{i,t}}
  \]

What Is Money?

- **Money** is an object that serves three functions:
  - **Store of value**
    - Money is an asset that can be used to buy goods in the future. Financial assets (stocks and bonds) and property are other stores of value that are not money.
  - **Unit of account**
    - How prices are expressed.
    - A unit of account is used to measure value of different items.
  - **Medium of exchange**
    - Money is generally accepted as a means of payment for goods.
    - Money is the most liquid form of payment: an asset that is easily converted into goods and services.
Measurement of Money

- Different measures of money
  - Monetary base = Currency
    - Currency in circulation plus currency in banking system
  - M1 = Currency in circulation + demand deposits
    - Demand deposits are checking accounts payable on demand by the bank customer.
  - M2 = M1 + other less liquid assets
    - Other less liquid assets include savings accounts, small time deposits, and money market mutual funds.

M0, M1, and M2 in the United States (2007)

- We often focus on M1, the predominant type of money that we use for transactions.
- We will assume (falsely) that the nominal money supply $M = M1$ is controlled by the central bank.
  - In fact, the central bank directly controls only part of $M$, namely the monetary base (M0).
  - However, central banks can indirectly control M1 by using interest rate policies and other tools (such as reserve requirements) to influence the total amount of bank deposits created ($M1 - M0$).
The Demand for Money: A Simple Model

- We assume that the demand for nominal money is driven by the need to use money to undertake transactions.
- In the simplest model, the quantity theory: the amount of transactions assumed to be proportional to the dollar value of nominal income $PY$ (where real income is $Y$).

\[ \frac{M^d}{P} = L \times \frac{PY}{L} \]

- $L$ is the inverse of “velocity.”

The Demand for Money: A Simple Model

- Rearrange to get an expression for the demand for real money balances (nominal value of money demand deflated by the price level $P$):

\[ \frac{M^d}{P} = L \times \frac{PY}{L} \]

- The demand for real money balances is a constant multiple of the real income level $Y$.

The Monetary Approach: A Simple Model of Prices

- More building blocks:
**The Monetary Approach: A Simple Model of the Exchange Rate**

- Recall that PPP shows us the relationship between the price level and exchange rates.
  - PPP says $E$ equals the ratio of the price levels.
    \[
    E = \frac{P_{x}}{P_{y}}
    \]
  - Substituting for prices using the money market equilibrium conditions we get the Fundamental equation of the monetary model of the exchange rate:
    \[
    E = \text{Fundamental Equation}
    \]

**The Monetary Approach: Money, Growth, and Depreciation**

- The monetary theory is better expressed in terms of rates of change.
  - Let growth rate of money supply $M$ be $\mu$:
    \[
    \mu = \frac{M_{t+1} - M_{t}}{M_{t}}
    \]
  - Let growth rate of real income $Y$ be $g$:
    \[
    g = \frac{Y_{t+1} - Y_{t}}{Y_{t}}
    \]
  - These expressions apply to growth rates in Europe too.

**The Levels Equation**

- The levels equation:
  \[
  P_{x} = \frac{M_{y}}{Y_{y}}
  \]
  - The same equation in growth rates ($L$ is assumed to be constant for the moment):
    \[
    \pi = \mu - g
    \]
    - Important result: inflation equals the excess of money growth over real output growth.
    - Same for Europe:
      \[
      \pi = \mu - g
      \]
Exchange Rate Forecasts Using the Simple Model

- **Case 1**: One-time x% increase in money supply M – if L is fixed
  - Real money balances remain unchanged (Y fixed).
  - The home price level P increases by x%.
  - The exchange rate E increases by x%.
  - Result: a one-time jump of x % in all nominal variables.

- **Case 2**: Home increases rate of money growth μ by Δ μ
  - We discuss this case first using a diagram...

---

**Diagram for Case 2**

- (a) Home Money Supply, M
- (b) Home Real Money Balances, K/P
- (c) Home Price Level, P
- (d) Home Exchange Rate, E

---

**Inflation differential 1975–2005**

- Relationship predicted by quantity theory

<table>
<thead>
<tr>
<th>Money growth rate differential 1975–2005 (% per year relative to U.S.)</th>
</tr>
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<tbody>
<tr>
<td>Inflation differential 1975–2005 (% per year relative to U.S.)</td>
</tr>
</tbody>
</table>
Evidence for the Monetary Approach

- There are two possible reasons why these relationships may not hold exactly in the data.
  - First, real income growth may change over time, reflecting another source of inflation differentials.
  - Second, we assumed the money demand parameter \( L \) was constant. We relax this assumption in the following section to incorporate interest rates into the model.

Evidence from Hyperinflations

- Hyperinflation occurs when the monthly inflation rate equals 50% or more over a sustained period.
  - Relative PPP predicts the large inflation differentials should lead to equally large depreciations in the currency.
Evidence from Hyperinflations

- In our simple model, $L$ is constant, and real money balances $M/P$ remain constant (assuming $Y$ fixed).
- Not true in reality, especially in hyperinflations (where $M/P$ falls much more than output). Why?

The Demand for Money: The General Model

- Assume an individual decides how much money she wants to hold, based on the costs and benefits of holding money, relative to an alternative asset.
- **Benefits of holding money**
  - Individuals hold money to conduct everyday transactions.
  - From the quantity theory of money used in the simple model, assume this is proportionate to nominal income $PY$.
  - As $PY$ increases, transactions increase, so the quantity of money balances demanded will decrease.
- **Costs of holding money**
  - Compared with other assets, money earns no interest.
  - The opportunity cost is $i$, the nominal interest rate.
  - As $i$ increases, the opportunity cost of holding money rises, so the quantity of money balances demanded will decrease.

The Demand for Money: The General Model

- Mathematically:
  - Nominal money demand is $M^d_{nominal} = P \times Y$.
  - Therefore, the **real money demand function** is $M^d_{real} = \frac{L(i)}{P}$.
The Demand for Money

Inflation and Interest Rates in the Long Run

Combine two expressions that are equal:

- Relative PPP (and take expectations)
  \[ \frac{\Delta E^c}{E_s} = \frac{\pi^c}{\pi^s} \]

- UIP (approximation)
  \[ \frac{\Delta E^c}{E_s} = \frac{i^d - i^e}{i^e} \]

- Right hand sides must be equal.

The Fisher Effect

Relative PPP and UIP imply:

\[ i^d - i^e = \frac{\pi^c}{\pi^s} \]

- This is known as the Fisher effect.
- An increase in the inflation rate in one country leads to a one-for-one increase in the nominal interest rate in that country.
Real Interest Parity in the Long-Run

- This expression can be rewritten as:
  \[ i_s - \pi_{s,n} = i_f - \pi_{f} \]
- This is known as real interest parity.
- Real interest parity implies that (expected) real interest rates should be equal across countries:
  \[ r_{s}^{*} = r_{f}^{c} \]

Real Interest Parity

- According to real interest parity, we can define an expected world interest rate \( r^{*} \) for all countries:
  \[ r_{s}^{*} = r_{f}^{*} = r^{*} \]
- Nominal interest rates in the home and foreign countries are therefore given by \( r^{*} \) plus expected inflation in each country:
  \[ l_{s} = r^{*} + \pi_{s}^{d} \quad l_{f} = r^{*} + \pi_{f}^{d} \]

Evidence on Fisher Effect

- The Fisher effect: nominal interest rate differentials should move one-for-one with inflation differentials.
Evidence on Real Interest Parity

RIP: real interest rates should equalize in the long run.

Exchange Rate Forecasts Using the General Model

- Revisit Policy Predictions, Case 2 to see what's new:
  - Assumptions
    - Both countries
    - Constant money growth rate $\mu$, fixed level of output $Y$
    - Foreign
      - Money growth $\mu$ is zero, inflation $\pi$ is zero
    - Home
      - Money growth $\mu$ is positive, inflation $\pi$ is positive
  - Home increases its rate of money growth $\mu$ by $\Delta \mu$.
  - What happens to key variables in the long run (flexible price) case, when we use the general model and $L = L(i)$?
  - NB: Assume inflation and interest rate are constant before and after the policy change. We can verify assumption later as a consistency check.
Exchange Rate Forecasts Using the General Model

- Results of an increase in the money growth rate:
  - The home inflation rate increases by \( \Delta \mu \).
  - The nominal interest rate increases by \( \Delta \mu \).
  - A one-time decrease in real money balances \( M/P \) because of the increase in the nominal interest rate.
  - A one-time increase in \( P \) and \( E \).
  - The rate of exchange rate depreciation increases by \( \Delta \mu \) percentage points after \( E \) jumps up.

- The importance of expectations
  - If people know that a change in money growth is coming in the future, they will adjust their expectations of the inflation rate and exchange rates accordingly.
  - Even if a change is not implemented, expectation of a change has consequences for the variables in the model.

---

Monetary Regimes and Exchange Rate Regimes

- Policy makers are concerned with costs of inflation
  - Inflation is unpopular and has macroeconomic costs
  - These costs are severe when inflation rates are high.
  - This is why inflation targets are desirable.

- The monetary approach shows how policymakers can choose among different **nominal anchors** to achieve their inflation goal.
  - The monetary regime they choose specifies what are the rules, objectives, policies followed by the central bank.
  - The exchange rate regime is part of the monetary regime, and must be consistent with it; is the exchange rate fixed or floating?

---

The Long Run: Nominal Anchor via \( E \)

- **Exchange rate target**
  \[
  \pi_H = \frac{\Delta \pi_H / E_H}{P_H / P_F} + \pi_F
  \]
  
  - Can be applied not just to pegs (\( E = \text{constant} \)), but also to crawls and managed float regimes.

- **Tradeoffs**
  - **Pros**: Simple and transparent.
  - **Cons**: Possibility of "imported inflation" from other country.
    - With a fixed exchange rate, relative PPP means the home country inflation equals the foreign country inflation rate.
    - Choice of which country to fix to is crucial.
The Long Run: Nominal Anchor via $M$

**Money supply target**

$$\pi_M = \mu_M - \sigma_M$$

**Tradeoffs**

- **Pro:** Mechanical. There is little decision-making for central bankers.
- **Con:** Can only achieve target rate of inflation if real income growth is known.
  - Example: $M$ growth 4%, $Y$ growth 2% means inflation of 2%
  - What if $Y$ growth is 1% 3%?
  - Problem: nobody knows future real income growth, not even central bankers.

The Long Run: Nominal Anchor via $i$

- **Inflation target plus interest rate policy**

$$\pi^u = \pi_M - r^*$$

- **Tradeoffs**
  - **Pro:** Flexibility for central bankers.
    - In the short run the central bank has the freedom to let $i$ fluctuate temporarily, but in long run promises to set $i$ on average at a “neutral level” dictated in the above equation by the inflation target plus the world real interest rate.
  - **Con:** Neither simple, nor transparent
    - Requires credibility, if central bankers are to assure people that expected rates of inflation and depreciation are firm.
    - As we see in the next chapter, serious instability results if people think the central bank has made a permanent change in its policy and the anchor is lost.

The Choice of a Nominal Anchor

- There are two important considerations in choosing a monetary regime.
  - Choosing more than one target (or weighting) can work sometimes, but it may be problematic.
  - Different regimes may call for different policy responses, causing confusion.
  - Success in anchoring inflation may be affected by a more vague and discretionary policy framework.
  - A country with a nominal anchor sacrifices monetary policy autonomy in the long run.
  - Hitting the target will only be possible if the central bank picks the right levels of $M$ or $E$ or $i$.
  - Unpopular choices at times.
Nominal Anchors in Theory and Practice

- There has been a steady decline in inflation among advanced economies. The decline in inflation among emerging/developing countries is more recent.
- Explanations? Rise of central bank independence and better nominal anchoring (inflation targets on the rise).

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</table>

PPP is not useful as a short-run theory

- "The long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is past the ocean is flat again."
  - John Maynard Keynes, *A Tract on Monetary Reform*, 1923

- The monetary approach, based on PPP, only has a chance of working as a long-run theory when prices are flexible.
- But prices may fail to adjust in the short run ("sticky prices"), so the monetary approach is NOT valid for short-run analysis. So what do we do?
- In this chapter we develop the asset approach, which complements the monetary approach to provide a unified theory of exchange rates.

Risky Arbitrage

- From Chapter 13: uncovered interest parity (UIP):

\[
\frac{E_{i+1}}{E_t} \cdot \frac{P_t}{P_t} = \frac{E_{i+1}}{E_t} + \left( \frac{I_t^e - I_t^f}{E_{i+1}} \right)
\]

- Interest rate on dollar deposits
- Interest rate on euro deposits
- $E_{i+1}$ - Expected exchange rate of dollar in period $t+1$
- $E_t$ - Actual exchange rate at time $t$
- $P_t$ - Price level at time $t$
- $P_{t+1}$ - Price level at time $t+1$
- $I_t^e$ - Expected nominal interest rate on dollar deposits
- $I_t^f$ - Actual nominal interest rate on euro deposits
- $\Delta E_{i+1}$ - Expected depreciation of the dollar

- Fundamental equation of the asset approach.
- Changes in the spot exchange rate come from:
  - $E^e$: Expected exchange rate. Forecasts of (future) exchange rate come from the monetary approach.
  - $I_t^e$ and $I_t^f$: Interest rates at home and abroad. Nominal interest rates come from the money market (home and foreign).
Equilibrium in the FX Market: An Example

- Asset approach to exchange rates.
- The fundamental equation of the asset approach is the equilibrium condition in the foreign exchange market.
- We can illustrate the foreign exchange market, using an FX market diagram showing the relationship between domestic returns and foreign returns.
- Next: a numerical example of the FX market diagram.
  - Show the link between the money market and FX market.
  - Use the FX market diagram to understand how changes at home and abroad affect the economy in the short run according to the asset approach.


<table>
<thead>
<tr>
<th>Domestic Return</th>
<th>Foreign Ex Return</th>
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<td>1.224</td>
</tr>
<tr>
<td>0.25</td>
<td>1.224</td>
</tr>
</tbody>
</table>

Market equilibrium: 0.25 0.01 1.25 1.224 0.02 0.05

FX Market

Equilibrium: when the domestic dollar return equals the expected foreign dollar return, uncovered interest parity holds.

Domestic return: $i_d = 5\%$.

Foreign return: $i_d = 3\%$, $E^{f}_{t+1} = 1.224$. Today's dollar/euro spot exchange rate, $E_{t+1}$.
Changes in Domestic and Foreign Returns and FX Market Equilibrium (a)

- Increase in the domestic interest rate, $i_d$
  - DR shifts upward.
  - $E_{de}$ decreases (home currency appreciates).

Changes in Domestic and Foreign Returns and FX Market Equilibrium (b)

- Decrease in the foreign interest rate, $i_e$
  - FR shifts downward.
  - $E_{de}$ decreases (home currency appreciates).

Changes in Domestic and Foreign Returns and FX Market Equilibrium (c)

- Decrease in expected exchange rate $E^t_{de}$
  - FR shifts downward.
  - $E_{de}$ decreases (home currency appreciates).
Money Market Equilibrium in the Short Run: How Nominal Interest Rates are Determined

- In the short run, the nominal interest rate adjusts to bring the money market into equilibrium, given fixed price levels.

$$\frac{M_{US}}{P_{US}} = L(h) \times Y_{US}$$

U.S. supply of real money balances

$$\frac{M_{EUR}}{P_{EUR}} = L(e) \times Y_{EUR}$$

European supply of real money balances

Money Market Equilibrium in the Short Run: Graphical Solution

- Supply of real money balances.
  - M is set by the central bank.
  - P is assumed to be fixed in the short run.
  - In the long run, P adjusts to bring the money market into equilibrium.
  - Notice, both of these variables are independent of the nominal interest rate. Therefore, the money supply (MS) curve is vertical.

Money Market Equilibrium in the Short Run: Graphical Solution

- Demand for real money balances.
  - Money demand is a decreasing function of the nominal interest rate.
    - As the nominal interest rate increases, the opportunity cost of holding money increases, so the demand for money balances decreases.
    - Since the quantity of real money balances demanded decreases with an increase in the nominal interest rate, the money demand curve is downward sloping.
Money Market Equilibrium in the Short Run: Graphical Solution

Suppose interest rates are "too high" at point 2 on the real money demand curve.

- Real money demand < Real money supply.
- Excess money supply.
  - The public will want to reduce cash holdings by exchanging money for assets such as bonds, saving accounts etc. That is, they will save more and seek to lend their money to borrowers.
- But borrowers will not want borrow more unless the cost of borrowing falls.
  - So, the interest rate will be driven down as eager lenders compete to attract scarce borrowers.
  - Movement along MD from point 2 toward equilibrium at point 1.

Another Building Block: Short-Run Money Market Equilibrium

The nominal interest rate is based on money supply and real income (money demand).

- The interest rate is in each country is then linked to the exchange rate through UIP.
Changes in Money Supply and the Nominal Interest Rate – Money rises

(a) Increase in Money Supply, $M$

Changes in Money Demand and the Nominal Interest Rate – Income rises

(b) Increase in Money Demand, $ND$

Money Market Equilibrium: The Short Run versus the Long Run

- A central bank that had previously kept the money supply constant, now lets $M$ grow at 5% per year.
  - In the long run, the predictions of the long-run monetary model and Fisher effect are clear:
    - All else equal, a 5% increase in the rate of money growth causes a 5% increase in the rate of inflation, and
    - a 5% increase in the nominal interest rate. The home interest rate will rise in the long run.
  - In the short run, the model tells a very different story.
    - If the money supply expands, the immediate effect is an excess supply of real money balances.
    - The home interest rate will fall in the short run.
Money Market Equilibrium:
The Short Run versus the Long Run

- These different outcomes illustrate the importance of the assumptions we make about price flexibility.
- They also underscore the importance of the nominal anchor in monetary policy formulation, and the limits that central banks have to confront.
  - In the short run, if the central bank temporarily changes its money supply without causing prices to become unsticky (triggering inflation), then looser money means lower interest rates, which might be temporarily desirable for some purposes.
  - But, if the same loose monetary policies were permanent and persisted in the long run, prices will not remain fixed and eventually looser money will mean higher inflation rates and higher interest rates, which might be rather undesirable.

The Monetary Model:
The Short Run versus the Long Run

- To sum up, expanding M leads to a weaker currency. But:
  - In the short run, low interest rates are associated with a weaker currency (depreciation).
  - In the long run, high interest rates are associated with a weaker currency.

  What is the intuition for this?

  - **Short run**
    - A temporary policy will not tamper with the nominal anchor.
    - Study impact of a lower interest rate, “all else equal.” Assume expectations do not change concerning future exchange rates, so P and E will be unchanged in long run.

  - **Long run**
    - If the policy turns out to be permanent, assumption fails.
    - P will be flexible. Money growth, inflation, and depreciation all move in concert—the “all else” is no longer equal.

The Asset Approach to Exchange Rates:
Graphical Solution

![Graphical Solution](image-url)
During the 1990s, many countries followed monetary policies that used long-run nominal anchors.
- While the European Central Bank has an explicit inflation target, the Federal Reserve uses an implicit one.
- According to the Fisher effect, nominal anchoring should keep the inflation differentials between countries constant (since the inflation rates in each region are constant).
- In the short run, policy makers may deviate from these long-run anchors, in pursuit of other macroeconomic objectives.
The Rise and Fall of the Dollar, 1999-2004

- **1999-2000**
  - Fed raised interest rates faster and higher than ECB.
- **2000-2002**
  - Fed lowered interest rates aggressively vs. the ECB, in response to recession and 9/11.
  - Interest differential falls and then changes sign.
- **2002-2004**
  - Fed funds rate pushed down further and still well below ECB rate.
- What does our model predict for the $/€ exchange rate?

Unifying the Monetary and Asset Approaches

- **Asset Approach (3 equations, 3 unknowns)**
  - **Money Market**
    \[ P_{m} = \frac{M_{m}}{L(t_{m}) \times Y_{m}} \]
    \[ F_{ex} = \frac{M_{ex}}{L(t_{ex}) \times Y_{ex}} \]
  - **Uncovered Interest Parity (UIP)**
    \[ f_{s} = l_{m} + \frac{E_{s} \times (E_{m} - E_{s})}{E_{s}} \]
  - In the asset approach, the spot exchange rate and nominal interest rates adjust to ensure the money market is in equilibrium and UIP condition is satisfied.
  - The expected future exchange rate can be found from the monetary approach.
A Complete Theory: Unifying the Monetary and Asset Approaches

- Monetary Approach (3 equations, 3 unknowns)
  - Money Market
    \[ P_{t+1} = \frac{E[P_{t+1}]}{E[P_t]} \times \frac{E[R_t]}{E[R_{t+1}]} \]
  - Purchasing Power Parity
    \[ E[P_{t+1}] = \frac{P_{t+1}}{P_t} \times \frac{E[R_t]}{E[R_{t+1}]} \]
  - The expected exchange rate is based on expected prices, which in turn, depend on the expectations of money supplies, nominal interest rates, and real income at home and abroad.
  - To determine \( E[P_t] \), we need interest rates, and can predict this in the long-run with the Fisher effect.

Confessions of a Forex Trader

- Three basic strategies for forecasting exchange rates.
  1. **Economic fundamentals.**
     Investor assumes that exchange rates behave according to economic fundamentals, such as the money supply, price level, and real income.
  2. **Politics.**
     Factors such as war influence investors’ perception of risk, influencing their forecasts of the exchange rate.
  3. **Technical methods.**
     This approach relies on statistical methods to predict exchange rate movements, often independent of economic fundamentals.
Confessions of a Forex Trader

- Which one is most common in practice?
  - Depends on time horizon.
    - Most investors believe that intraday, very short-run movements in exchange rates are not based on fundamentals.
    - Over longer time horizons (6 months, 12 months, etc.), more and more traders believe fundamentals are important.
  - Based on the survey, news about money, interest rates, and GDP are quickly incorporated into exchange rate forecasts.

Policy Analysis – Money Growth

- Short run effects
  - Home interest rate decreases (DR shifts down).
  - Expected exchange rate increases (FR shifts up). Why?
  - Exchange rate increases.

Long Run Policy Analysis

- Long run effects
  - Home price level increase to bring money market to equilibrium.
  - Home interest rate returns to initial value (DR shifts back up).
  - Exchange rate increases, but less than the short run increase.
For example, suppose you are told that:
- Home M rises today permanently by 5%.
- Home nominal interest rate falls today by 4% points.
- Prices sticky now, but flexible in “long run” = one year.

What happens?
- Prices
  - Sticky prices $P$ in the short run.
  - In the long run, prices $P$ will increase by 5%.
- Exchange rates
  - Long run: exchange rate $E$ must increase by 5% (PPP).
  - Short run
    - According to UIP, the exchange rate must be expected to
decrease by 4% in the next year. But in the long run it must still
rise 5% in the end due to PPP.

Therefore, combining expected change due to PPP with UIP
condition, in the short run $E$ must increase by 9%.

The exchange rate $E$ overshoots its long run
equilibrium after a permanent change in the money
supply. Why?
- Short run: exchange rate changes for two reasons.
  - The change in the money market (source of the initial shock)
  - The effect of this change on exchange rate expectations.
- There are two reasons why investors will prefer foreign deposits
  following an increase in the home money supply.
- Long run: nominal interest rate returns to initial value.
  - The change in exchange rate expectations remain, consistent with
a long-run change predicted by PPP.
  - There is only one reason why investors prefer foreign deposits.
Overshooting in Practice

- Permanent changes in the money supply lead to exchange rate overshooting.
  - The exchange rate is more volatile than the general monetary model would predict.
  - Result discovered in 1970s by distinguished economist Rudiger Dornbusch (1942-2002)
- Why this matters in practice.
  - In the 1970s the system fixed exchange rates (of the "Bretton Woods system") collapsed.
  - Highlights the importance of the nominal anchor.
  - Under Bretton Woods system, countries used an exchange rate target.

Overshooting in Practice

- Why were floating exchange rates more volatile, given the very small changes in monetary fundamentals?
  - The Dornbusch model provided an explanation.

Bernanke’s Bold Move

- Example:
  - September 18, 2007
  - The Federal Reserve cut the overnight rate by 50 basis points.
  - Market was not sure beforehand if it would be 50 or 25.
  - The result was a large reaction in financial markets, including the forex market.
Bernanke’s Bold Move

- The figure above shows the euro-dollar spot exchange rate on September 18, 2007.
- The Fed announcement occurred at 2pm EST (14:00).

- The Federal Reserve behaved more aggressively than expected. This led to a decrease in interest rates at all maturities up to one year.
- The Federal Reserve’s policy might have signaled a shift toward tolerating higher inflation rates in the long run.
  - From our model, this means that the U.S. dollar is expected to depreciate in the long run.
  - Also, we know this move would lead to overshooting. The dollar would depreciate more in the short run than in the long run.