PART VIII: MONETARY MODELS OF EXCHANGE RATES

LECTURE 24 --
• Building blocs
  - Interest rate parity
  - Money demand equation
  - Goods markets

• Flexible-price version: monetarist/Lucas model
  - derivation
  - applications: news; speculative bubbles...

LECTURE 25 --
• Sticky-price version: Dornbusch overshooting model
Motivations of the monetary approach

Because $S$ is the price of foreign money (vs. domestic money), it is determined by the supply & demand for money (foreign vs. domestic).

Key assumptions:

- Perfect capital mobility => speculators are able to adjust their portfolios quickly to reflect their desires.
  
  + There is no exchange risk premium

  $\Rightarrow$ UIP holds: $i - i^* = \Delta s^e$.

Key results:

- $S$ is highly variable, like other asset prices.
- Expectations are central.
Building blocks

Uncovered interest parity
+ Money demand equation

+ Flexible goods prices $\Rightarrow$ PPP
  $\Rightarrow$ Lucas model.

or

+ Slow goods adjustment $\Rightarrow$ sticky prices
  $\Rightarrow$ Dornbusch overshooting model.
Recap of interest rate parity conditions

Covered interest parity
\[ i - i^{*}_{\text{offshore}} = fd \]
across countries
holds to the extent capital controls & other barriers are low.

Uncovered interest parity
\[ i - i^{*} = \Delta s^e \]
holds if risk is unimportant,
which is hard to tell in practice.

Real interest parity
\[ i - \pi^e = i^{*} - \pi^{*e} \]
may hold in the long run
but not in the short run.
MONETARIST/LUCAS MODEL

PPP: \( S = \frac{P}{P^*} \)

+ Money market equilibrium \( M/P = L(i, Y) \) \( ^{1/} \) \( \implies P = \frac{M}{L(,)} \)

\( P^* = \frac{M^*}{L^*(,)} \)

Experiment 1a:

\( M \uparrow \implies S \uparrow \) in proportion

1b:

\( M^* \uparrow \implies S \downarrow \) in proportion

Why? Increase in supply of foreign money reduces its price.

\( ^{1/} \) The Lucas version provides some micro-foundations for \( L \).
Experiment 2a:
\[ Y \uparrow \Rightarrow L \uparrow \Rightarrow S \downarrow. \]

2b:
\[ Y^* \uparrow \Rightarrow L^* \uparrow \Rightarrow S \uparrow. \]

Why? Increase in demand for foreign money raises its price.

Experiment 3:
\[ \pi^e \uparrow \Rightarrow i \uparrow \Rightarrow L \downarrow \Rightarrow S \uparrow \]

Why?
\[ i-i^* \text{ reflects expectation of future depreciation } \Delta s^e \ (\leq \text{ UIP}), \]
due (in this model) to expected inflation \( \pi^e \).

So investors seek to protect themselves: shift out of domestic money.
Monetary model in log form

PPP: \( \bar{s} = p - p^* \)

Money market equilibrium: \( m - p = \ell(\, , ) \equiv \log L(y, i) \)

Solve for price level: \( p = m - \ell(\, , ) \)

Same for Rest of World: \( p^* = m^* - \ell^*(\, , ) \)

Substitute in exchange rate equation:

\[
\bar{s} = [m - \ell(\, , )] - [m^* - \ell^*(\, , )]
\]

\[
= [m - m^*] - [\ell(\, , ) - \ell^*(\, , )].
\]
Consider, 1st, constant-velocity case: \( L(\cdot) \equiv KY \)

as in Quantity Theory of Money (M. Friedman): \( Mv = PY, \)

or cash-in-advance model (Lucas, 1982; Helpman, 1981): \( P = M/Y, \)

perhaps with a constant of proportionality from \( u'(C). \)

=> \( \bar{s} = (m - m^*) - (y - y^*) \)

Note the apparent contrast in models’ predictions, regarding \( Y-S \) relationship. You have to ask \textit{why} \( Y \) moves.

Recall:

i) in the Keynesian or Mundell-Fleming models, \( Y \uparrow \Rightarrow \) depreciation -- because demand expansion is assumed the origin, so \( TB \) worsens.

But

ii) in the flex-price or Lucas model, an increase in \( Y \) originates in supply, \( \bar{Y} \), and so raises the demand for money \( \Rightarrow \) appreciation.
But velocity is not in fact constant.

Also we would like to be able to consider the role of expectations.

So assume Cagan functional form: \[ l(, ) = y - \lambda i, \]
(where we have left income elasticity at 1 for simplicity).

Then, \[ \bar{s} = (m - m^*) - (y - y^*) + \lambda(i - i^*). \]

Of the models that derive money demand from expected utility maximization, the approach that puts money directly into the utility function gives results similar to those here. (See Obstfeld-Rogoff, 1996, 579-85.)

A 3rd alternative, the Overlapping Generations model (OLG), is not really a model of demand for money per se, as opposed to bonds.
\[ \bar{s} = (m-m^*) - (y-y^*) + \lambda(i-i^*). \]

Note the apparent contrast in models’ predictions, regarding \(i-S\) relationship. You have to ask why \(i\) moves.

In the **Mundell-Fleming** model, \(i \uparrow \Rightarrow \) appreciation, because \(KA \uparrow\).

But in the **flex-price** model (**monetarist or Lucas**), \(i \uparrow\) signals \(\Delta s^e \uparrow \& \pi^e \uparrow. \Rightarrow \) lower demand for \(M \Rightarrow \) depreciation.

Broader lessons:

(i) For predictions regarding relationships among endogenous macro variables, you need to know exogenous source of disturbance.

(ii) Different models are useful in different circumstances.
The opportunity-cost variable in the flex-price / Lucas model can be expressed in several ways:

\[ \bar{S} = (m-m^*) - (y-y^*) + \lambda(fd). \]

\[ \bar{S} = (m-m^*) - (y-y^*) + \lambda(\Delta s^e). \]

\[ \bar{S} = (m-m^*) - (y-y^*) + \lambda(\pi^e - \pi^{*e}). \]

Example -- hyperinflation, driven by steady-state rate of money creation: \( \pi^e = \pi = g_m. \)
The spot rate depends on expectations of future monetary conditions

\[ s_t = \tilde{m}_t + \lambda (\Delta s^e_t) \quad \text{where} \quad \tilde{m}_t \equiv (m_t - m^*_t) - (y_t - y^*_t). \]

Rational expectations:

\[ \Delta s^e_t \equiv s^e_{t+1} - s_t = E_t (s_{t+1}) - s_t. \]

\[ \Rightarrow s_t = \tilde{m}_t + \lambda (E_t s_{t+1} - s_t) \]

Solve: \[ s_t = \frac{1}{1+\lambda} \tilde{m}_t + \frac{\lambda}{1+\lambda} (E_t s_{t+1}). \]

E.g., a money shock known to be temporary has less-than-proportionate effect on \( s \).

What determines \((E_t s_{t+1})?\) Use rational expectations:

\[ \Rightarrow s_{t+1} = \frac{1}{1+\lambda} \tilde{m}_{t+1} + \frac{\lambda}{1+\lambda} (E_{t+1} s_{t+2}). \]
\[ E_t s_{t+1} = \frac{1}{1+\lambda} E_t \tilde{m}_{t+1} + \frac{\lambda}{1+\lambda} (E_{t+1} s_{t+2}). \]

Substituting, \( \Rightarrow \)

\[ s_t = \frac{1}{1+\lambda} \tilde{m}_t + \frac{\lambda}{1+\lambda} \left[ \frac{1}{1+\lambda} E_t \tilde{m}_{t+1} + \frac{\lambda}{1+\lambda} (E_t s_{t+2}) \right]. \]

Repeating, to push another period forward,

\[ s_t = \frac{1}{1+\lambda} \left[ \tilde{m}_t + \frac{\lambda}{1+\lambda} E_t \tilde{m}_{t+1} + \left( \frac{\lambda}{1+\lambda} \right)^2 (E_t \tilde{m}_{t+2}) + \left( \frac{\lambda}{1+\lambda} \right)^3 (E_t s_{t+3}) \right]. \]

And so on...
Spot rate is present discounted sum of future monetary conditions:

\[ S_t = \frac{1}{1+\lambda} \sum_{\tau=0}^{T} \left[ \left( \frac{\lambda}{1+\lambda} \right)^\tau E_t \tilde{m}_{t+\tau} \right] + \left( \frac{\lambda}{1+\lambda} \right)^{T+1} E_t S_{t+T+1} \]

It’s a speculative bubble if \( \lim_{T \to \infty} \text{last term} \neq 0 \).

Otherwise, just fundamentals: \( S_t = \frac{1}{1+\lambda} \sum_{\tau=0}^{\infty} \left[ \left( \frac{\lambda}{1+\lambda} \right)^\tau E_t \tilde{m}_{t+\tau} \right] \).

Example –

News that something will happen \( T \) periods into the future:

\[ \Delta S_t = \frac{1}{1+\lambda} \left( \frac{\lambda}{1+\lambda} \right)^\tau \Delta E_t \tilde{m}_{t+\tau}. \]
An example of the importance of expectations: Mexico’s peso fell immediately on news of the US election, even though no economic fundamentals had yet changed.

“The peso was the biggest victim of ... Mr Trump’s triumph, sliding as much as 13.4 % to a record low of 20.8 against the dollar before moderating its fall to 9.2 % on Wednesday,” Financial Times, “Mexican peso hit as Trump takes US presidency,” Nov. 9, 2016.
Illustrations of the importance of expectations, $\Delta s^e$:

- **Effect of “News”:** In theory, $S$ jumps when, and only when, there is new information, e.g., regarding monetary fundamentals.

- **Hyperinflation:**
  Expectation of rapid money growth and loss in the value of currency $\Rightarrow L\downarrow \Rightarrow S\uparrow$, even ahead of the actual inflation and depreciation.

- **Speculative bubbles:**
  Occasionally a shift in expectations, even if not based in fundamentals, causes a self-justifying movement in $L$ and $S$.

- **Target zone:** If a band is credible, speculation can stabilize $S$ -- pushing it away from the edges even before intervention.

- **“Random walk”:** Today’s price already incorporates information about the future (but RE does not imply zero forecastability like a RW)
Limitations of the monetarist/Lucas model of exchange rate determination

No allowance for SR variation in:

- the real exchange rate $Q$
- the real interest rate $r$.

One approach: International versions of Real Business Cycle models assume all observed variation in $Q$ is due to variation in LR equilibrium $\bar{Q}$ (and $r$ is due to $\bar{r}$), in turn due to shifts in tastes or productivity.

But we want to be able to talk about transitory deviations of $Q$ from $\bar{Q}$ (and $r$ from $\bar{r}$), arising for monetary reasons.

$\Rightarrow$ Dornbusch overshooting model.
## Monetary Approaches

<table>
<thead>
<tr>
<th>Assumption:</th>
<th>If exchange rate is fixed, the variable of interest is $BP$: $MABP$</th>
<th>If exchange rate is floating, the variable of interest is $E$: $MA$ to Exchange Rate</th>
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<tbody>
<tr>
<td>$P$ and $W$ are perfectly flexible $\Rightarrow$ New Classical approach</td>
<td>Small open economy model of devaluation</td>
<td>Monetarist/Lucas model focuses on monetary shocks.</td>
</tr>
<tr>
<td>$P$ is sticky</td>
<td>Mundell-Fleming (fixed rates)</td>
<td>Dornbusch-Mundell-Fleming (floating)</td>
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Appendix: Generalization of monetary equation
for countries that are not pure floaters:

Our equation, \[ \bar{s} = [m - m^*] - [\ell (, ) - \ell^*(,)] \]
can be turned into a more general model of other regimes, including fixed rates & intermediate regimes expressed as “exchange market pressure”:

\[ \bar{s} - [m - m^*] = [\ell^*(, ) - \ell (, )] . \]

When there is an increase in demand for the domestic currency, it shows up partly in appreciation, partly as an increase in reserves & money supply, with the split determined by the central bank.