6 Lecture 6: The elasticity approach to the trade balance. Mundell-Fleming

Associate reading: Krugman-Obstfeld chapter 16, or Dornbusch, Fischer and Starz ch. 12.6 + Krugman-Obstfeld p. 434-439 (my graphical analysis follows Dornbusch et al.).

6.1 A long run exchange rate model with demand effects

Up to now we have treated the real exchange rate as determined by some theory outside our model of the nominal exchange rate (e.g. PPP). Our analysis though has not allowed for it to be affected by aggregate demand shocks.

We now want to determine both real and nominal exchange rates within a simple model which allows for an impact of demand shocks. This is the Mundell-Fleming model familiar from Macro 2. Before discussing it, we want to spell out its assumption concerning the impact

of a real depreciation on the trade balance.

6.1.1 The elasticity approach to the trade balance

NX, measured in units of home output, is determined by the following equation:

$$NX\left(\underbrace{RER}_{+},\underbrace{Y}_{-}\right) = X\left(\underbrace{RER}_{+}\right) - RERM\left(\underbrace{RER}_{-},\underbrace{Y}_{+}\right) \tag{89}$$

- NX, measured in units of home output, equals exports, measured in units of home output, minus imports, measured in units of foreign output, times the relative price of foreign output in terms of the home one.
- Higher home output reduces net exports by increasing imports.
- Depreciation of the real exchange rate is assumed to improve NX. Two effects:

– Real depreciation increases X and reduces M (volume effect). This improves NX.

– Real depreciation worsens terms of trade (price effect); i.e. increases cost of imports in terms of units of home output. This worsens NX.

It is assumed that the volume effect prevails. For this to hold the following condition must be satisfied.

Marshall-Lerner condition: $\eta_X - \eta_M - 1 > 0$.

Where η_X and η_M are respectively the elasticity of export and imports with respect to the real exchange rate.

We want to prove that the Marshall-Lerner condition implies that a real depreciation improves NX starting from a situation of balanced-trade; i.e $NX = 0$.

Let's differentiate the trade balance with respect to the real exchange rate

$$\frac{dNX}{dRER} = \frac{dX}{dRER} - \frac{dM}{dRER}RER - M. \tag{90}$$

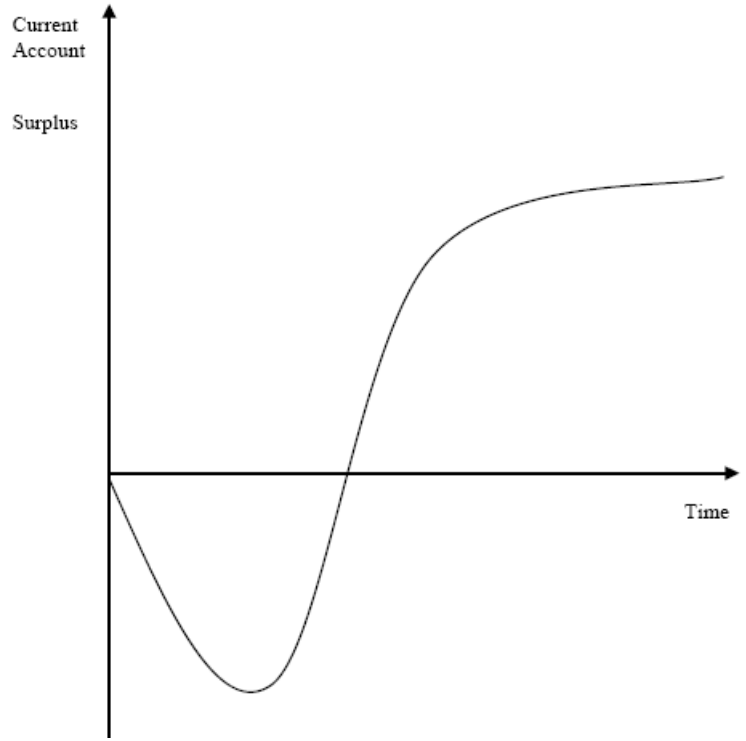
We require the right hand side to be positive. Dividing by M, it can be rewritten as

$$\frac{dX}{dRER}\frac{1}{M} - \frac{dM}{dRER}\frac{RER}{M} - 1 = \frac{dX}{dRER}\frac{RER}{X} - \frac{RER}{M}\frac{dM}{dRER} - 1 > 0, \tag{91}$$

where the last equality follows from $NX = 0$; i.e. $X = RER\ M$.

- J-curve: in the short-run the Marshall-Lerner condition might not hold. In the short-run exports and imports volume do not change that much, so that the price effect may dominate. Immediate worsening of the trade balance following a depreciation of the exchange rate.

The evolution of the trade balance following a depreciation is illustrated by a J-curve.



6.1.2 Mundell-Fleming model in the long run

Other ingredients:

- The non-reserve component of the financial account satisfies

$$FA = \gamma \left(i - i^* + \Delta e^e \right) \tag{92}$$

with $\gamma = \infty$ (perfect capital mobility). LOP does not hold (arbitrage in tradables does not determine the nominal exchange rate).

Recall that

$$BoP = CA + FA + \Delta R = 0 \tag{93}$$

where R is the net change in foreign reserves held by the home central bank.

- Long run framework, small country, perfect capital mobility:

$$\text{MRLE } Y = \bar{Y} \tag{94}$$

$$\text{IS } Y = C(Y - \bar{T}) + I(r) + \bar{G} + NX\left(RER, Y, \bar{Y}^*\right) \tag{95}$$

$$\text{LM } \frac{M}{P} = \frac{Y}{V(i)} \tag{96}$$

$$\text{Fisher eq. } i = r + \pi^e \tag{97}$$

$$\text{UIP } i = i^* + \Delta e^e \tag{98}$$

- MRLE describes medium run labour market equilibrium, IS goods market equilibrium and LM asset markets equilibrium. The model assumes exogenous expectations of depreciation; i.e. Δe^e is exogenous. So, strictly speaking, it is appropriate to use it to study the effect of *unexpected* shocks. Replacing for i using Fischer equation in the UIP equation we obtain

$$r = r^* + (\pi^*) + \Delta e^e - \pi^e = r^* + \Delta rer^e. \tag{99}$$

Let us assume, with little loss of generality, static espectations: $\Delta rer^e = 0$.

This implies the model is described by

$$\text{MRLE } Y = \bar{Y} \tag{100}$$

$$\text{IS } Y = C(Y - \bar{T}) + I(r) + \bar{G} + NX\left(RER, Y, \bar{Y}^*\right) \tag{101}$$

$$\text{UIP' } r = r^* \tag{102}$$

$$\text{LM } \frac{M}{P} = \frac{Y}{V(r)}. \tag{103}$$

MRLE, IS and UIP' determine real variables $(Y,\ r,\ EP^*/P)$. Given these, LM curve determines $(P,\ E)$ or M if E is fixed.

- Monetary side of the model works as in the monetary model. The only difference is that the real exchange rate is now determined on the labour and goods market rather than by PPP.
- Goods and labour market shocks affect the real exchange rate.
- Under **flexible exchange rates, money market shocks** affect only the price level and the nominal exchange rate. Money neutrality and the classical dichotomy hold.
- Under **fixed exchange rate**, the central bank does not control the **money supply.** Price level determined on labour+ goods market as E is fixed. M cannot increase as P, r, Y are all determined by equilibrium on labour (MRLE), goods (IS) and international capital markets (UIP).

- Increases in aggregate demand are associated with real exchange rate appreciations and worsening of the trade balance. Intuition: increases in demand fall on both tradables and nontradables. The real interest rate cannot adjust to clear the goods market as it has to ensure no arbitrage. Given that total home output supply is given by labour market equilibrium, the increase in demand can only be satisfied if the increase in demand is met out of imports. Only tradables can be imported, so demand has to be reallocated from nontradables to tradables which requires the former to become relatively more expensive and results in a real exchange rate appreciation.

- As in the monetary model. (a) Exogenous increases in *level* of the money supply does not affect the nominal interest rate; (b) increases in the nominal interest rate are associated with a nominal exchange rate depreciation; (c) only real shocks imply a correlation between the nominal and real exchange rates $\rightarrow EP^*/P$ has to adjust but P is unchanged if M is unchanged.

6.1.3 Short run models of the exchange rate

Exchange rate stylized facts:

1. Exogenous decreases in the money supply and interest rate increases are associated with appreciations of the nominal exchange rate (Eichenbaum and Evans [1993]).

2. The nominal and real exchange rates are highly positively correlated at short but not long horizons.

3. High short run volatility of both the nominal and real exchange rates and slow reversion to long run values (overshooting).

4. The monetary model does a decent job at predicting the exchange rate in the long run,

but is outperformed by a simple random walk in the short run (Meese and Rogoff [1983]).

One clue to a possible reason behind the first two pieces of evidence is that if prices are sticky changes in the nominal exchange rate should be reflected in changes in the real exchange rate. Sticky prices seem also to be supported by the evidence in Engel (1993), Engel and Rogers (1994) and Rogers and Jenkins (1995) discussed in lecture 2.

6.1.4 Mundell-Fleming model: sticky prices and exogenous expectations

The difference is that $MRLE$ above is replaced by

$$\text{SRAS } P = \bar{P} \tag{104}$$

$$\text{IS } Y = C(Y - \bar{T}) + I(r) + \bar{G} + NX\left(RER, Y, \bar{Y}^*\right) \tag{105}$$

$$\text{UIP' } r = r^* \tag{106}$$

$$\text{LM } \frac{M}{P} = \frac{Y}{V(r)}. \tag{107}$$

Now it is P which is predetermined while Y is not. So, now output cannot be determined independently from the goods market. Demand shocks affect the equilibrium level of output.

Mundell-Fleming under flexible exchange rates

$\Delta R = 0$ the central bank does not intervene on the foreign exchange by buying/selling reserves. So, it has to be $BoP = CA + FA = 0$.

M is exogenous, while E is endogenous.

- **Goods market shocks.** Goods market shocks (e.g. fiscal policy) cannot affect the level of demand and output, but only change its composition between home and foreign demand. Expansionary fiscal policy tends to raise the interest rate above the level consistent with no arbitrage. Given perfect capital mobility, this generates an inflow of capital at infinite rate as long as $r > r^*$. If home bonds can only be bought using the home currency, this induces an increase in demand for the home currency and an appreciation of the nominal (and real) exchange rate. The only way the increase in the home interest rate can be avoided is if the exchange rate adjusts by an amount sufficient to keep aggregate demand in line with supply at an unchanged interest rate. The real appreciation induces a worsening of the trade balance. The deficit of the trade balance fully crowds out the increase in home demand (i.e. the increase in home demand falls on foreign goods).

- **Money market shocks.** Money market shocks (e.g. changes in the money supply) affect the level of demand and output. Given fixed prices, an expansionary monetary policy tends to drive the interest rate below the level consistent with no arbitrage. Given perfect capital mobility, this generates an outflow of capital at infinite rate as long as $r < r^*$. This reduces the demand for the home currency and leads to a nominal (and given fixed prices real) depreciation. The real depreciation induces an improvement in the current account as foreign imports (and, given fixed prices, home exports) become relatively more expensive (cheaper) for home (foreign) residents. The improvement in the current account increases the demand for the home output and money demand thus reestablishing equilibrium.

- Note that, consistently with the empirical evidence, the nominal and real exchage rates are positively correlated in response to both goods and money market shocks. Also, at least for an instant, an increase in the money supply and a fall in the nominal exchange rate are associated with a nominal depreciation.

  Note, that the exchange rate behaves in a way similar to the monetary model but with output rather than prices increasing.

Fixed exchange rates

E is exogenous, while M is endogenous as the central bank as sell and buy reserves to keep E fixed. So, it has to be $BoP = CA + FA + \Delta R = 0$.

- **Goods market shocks.** Goods market shocks (e.g. fiscal policy) affect the level of demand and output. An expansionary fiscal policy raises the interest rate above the level consistent with no arbitrage. Given perfect capital mobility, this generates an inflow of capital at infinite rate as long as $r > r^*$. This increases the demand for the home currency. To keep the exchange rate constant the central bank has to supply enough money, increase reserves ($\Delta R > 0$), to meet the increase in demand for the home currency. The increase in reserves increases the money supply. Output increases to reestablish money market equilibrium at unchanged r. The current account worsens as part of the increase in demand falls on foreign goods.

- **Money market shocks.** Money market shocks (e.g. changes in the money supply) cannot affect the level of demand and output. Given fixed prices, an expansionary monetary policy drives the interest rate below the level consistent with no arbitrage. Given perfect capital mobility, this generates an outflow of capital at infinite rate as long as $r < r^*$. This reduces the demand for the home currency. To keep the exchange rate constant the central bank has to take money out of circulation, sell reserves ($\Delta R < 0$), to meet the fall in demand for the home currency. The fall in reserves reduces the money supply. The interest rate can stay at its original level only if the money supply goes back to its initial level. The current account is unaffected.

- Monetary policy is ineffective under fixed exchange rate as it is endogenous. As the nominal and real exchange rates cannot change output cannot adjust to ensure money market equilibrium. Nor can the interest rate. So, the real (and, given fixed prices, the nominal) supply of money cannot change. Fixed exchange rates imply giving up an independent monetary policy.