The Mundell-Fleming-Tobin model
Lecture 11, ECON 4330

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(Adopted from Asbjørn Rødseth)

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Outline

Literature

Rødseth 3.1 and 6.1-6.4

Policy regimes: Targets at different levels

1. Welfare of population
2. Price stability, low unemployment
3. Inflation rate 2.5, Price of dollar 7.15 kr
4. Interest rate, quantity of money

- Day to day targets: Interest rate, exchange rate, quantity of money, central bank credit
- Only two can be set independently
- If UIP, only one can be set independently

Norway:

Period	System	Exogenous variables
1945-1971	Fixed (USD) Bretton-Woods	E and i
1971-1986	Fixed (European baskets)	E and i
1987-1991	Fixed (European baskets)	E and F_g
1992-2001	Floating (Restoration rule)	i and F_g
2001-2008	Floating (Inflation target)	i and F_g

Demand for money

The demand for money is given by the activity in the economy, Y, and the interest rate, i.

$$\frac{M}{P} = m(i, Y)$$

$m'_i < 0$ and $m'_Y > 0$

The higher GDP, the more transactions take place and people need more cash. The higher the interest rate, the higher the cost of holding money in stead of bonds and demand drop.

The financial balance sheets

Sector Asset	Private	Government	Foreign	Sum
Money (kr)	M	$-M$	0	0
Kr-bonds	B	$-B$	0	0
$-assets	F_p	F_g	F_*	0
Net assets	$M + B + EF_p$	$EF_g - M - B$	EF_*	0

Exogenous and endogenous variables in six policy regimes

Regime		Exogenous	Endogenous
Fixed exchange rate:			
I	Fixed interest rate	E, i	F_g, M, B
II	No sterilization	E, B	F_g, M, i
III	Full sterilization	E, M	F_g, B, i
Floating exchange rate:			
IV	Fixed interest rate	F_g, i	E, M, B
V	No sterilization	F_g, B	E, M, i
VI	Full sterilization	F_g, M	E, B, i

Restrictions on policy

Central Bank balance sheet:

$$EF_g - B - M = EF_{g0} - B_0 - M_0$$

- Quantities: M (money), B (NOK bonds), F_g (USD bonds)
- Prices: i (NOK interest rate), E (NOK/USD exchange rate)
- i_* (USD interest rate) given, money no interest
- Assets are bought with assets
- Cannot decide both price and quantity in a market
- Perfect capital mobility means there is only one bond market

Sterilization

- When CB buy foreign currency, it pays with money
- Equilibrium in the money market requires that demand equals supply:
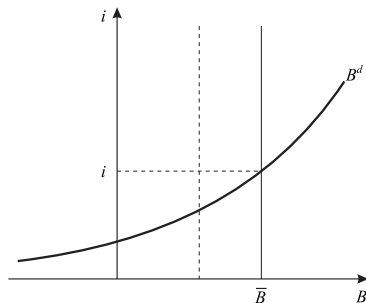
$$\frac{M}{p} = m(i, Y)$$

- A purchase of foreign currency raises M and lowers i
- Sterilization means that CB finances the purchase by selling bonds
- The money paid is withdrawn
- Same result can be achieved by intervening in the forward market
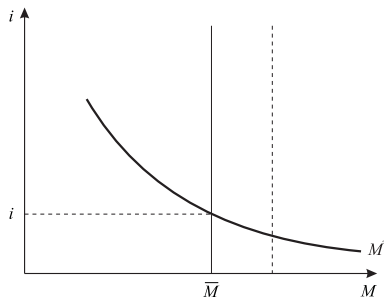
Sterilization

$$M = Pm(i, Y)$$

No sterilization

$$\frac{B}{P} = W_p - f(i - i_* - e_e(E), W_p)$$
$$- \quad m(i, Y)$$

Sterilization, fixed rate

When capital mobility is perfect and the exchange rate fixed, sterilization is impossible.

$$M = m(i_* + e_e(E), Y)$$

CB cannot control the money supply.

The MFT-model: Intro

- Standard Keynesian Open Economy model
- Home and foreign goods
- Goods prices change only gradually
- Small economy
- Portfolio approach to financial side
- Mundell - Fleming - Tobin

Focus and simplifications

- Short-run variations in activity
- Importance of capital mobility
- Regimes where CB sets interest rate or exchange rate (or both)
- Foreigners do not hold domestic currency

$$Y = C(Y_p, W_p, \rho, \rho_*) + I(\rho, \rho_*) + G + X(R, Y, Y_*) \tag{1}$$

$$Y_p = Y - \rho_* \frac{EF_*}{P} - T \tag{2}$$

$$W_p = \frac{B_0 + EF_{p0} + M_0}{P} \tag{3}$$

$$\rho = i - p_e \tag{4}$$

$$R = \frac{EP_*}{P} \tag{5}$$

Output (Y) Consumption (C), Investment (I), Government purchases (G), net exports(X),
Disposable income (Y_p), net Taxes and Transfers T
ρ is the real interest rate, i nomainal interest rate and R real exchange rate.
$0 < C_Y < 1$, $C_W > 0$, $C_\rho < 0$, $C_{\rho*} < 0$, $I_\rho < 0$, $I_{\rho*} < 0$.

Marshall-Lerner Condition

$$X = Z_* - RZ = Z_* - \frac{EP_*}{P}Z$$

Z, Z_*Import volumes. Import demand functions:

$$Z = Z(R, Y) \quad Z_R < 0; \ Z_Y > 0$$

$$Z_* = Z_*(R, Y_*) \quad Z_{*R} > 0; \ Z_{*Y} > 0$$

$X_Y < 0$, and $X_{Y_*} > 0$ follows
$X_R > 0$ Positive quantity effects, negative price effects
$X_R > 0$, $X_Y < 0$ assumed - quantity effects dominates
Marshall-Lerner: Sum of demand elasticities > 1

$$r = i - i_* - e_e(E) \qquad (6)$$

$$\frac{B}{P} = W_p - f(\delta, W_p) - m(i, Y) \qquad (7)$$

$$\frac{M}{P} = m(i, Y) \qquad (8)$$

$$\frac{EF_p}{P} = f(r, W_p) \qquad (9)$$

$$F_g + F_p = -F_* \qquad (10)$$

δ = risk premium, $e_e(E)$ = expected rate of depreciation
$f_\delta < 0$, $0 < f_W < 1$, $e'_e < 0$.

Determination

- Given from abroad: P_*, i_*, Y_*, ρ_*
- Predetermined: P, $\dot{p}_e$, F_*, B_0, F_{p0}
- Policy; Fiscal: G, T,Monetary: E, F_g, i, B, M
- Remaining: Y, Y_p, R, δ, ρ, W_p, F_p (7 in all)

Ten equations, twelve potentially endogenous variables $\Rightarrow$
Two monetary policy variables can be chosen freely

Forex Market

Recall chapter 1:

- Equilibrium condition: $F_g + F_p + F_* = 0$
- or after inserting demand function

$$F_g + (P/E)f(i - i_* - e_e(E), (B_0 + EF_{p0})/P) + F_* = 0$$

Fixed:

- E, i exogenous, F_g endogenous
- Lower i means loss of reserves, F_g down
- More capital mobility ($|f'_\delta|$ high) means greater loss of reserves

Floating:

- F_g, i exogenous, E endogenous
- Lower i means depreciation (E up)
- More capital mobility means stronger depreciation

In both cases are i and F_g unaffected by the goods market

Regimes we shall look at

1. Fixed exchange rate, i and E fixed, interventions used to keep E on target
2. Floating exchange rate, i and F_g fixed, E floats
3. Fixed by interest rate: F_g and E fixed, i used instead of interventions

Compare first 1 and 2, come to 3 later

To analyze the model let's first simplify it. First we can insert from (2)-(5) into (1). This gives us our IS-curve:

$$Y = C(Y - \rho_* \frac{EF_*}{P} - T, \frac{B_0 + EF_{p0}}{P}, i - p_e, \rho_*) + I(i - p_e, \rho_*) + G + X(\frac{EP_*}{P}, Y, Y_*) \quad (11)$$

Also we can insert from (2) into (7), which gives us the BB-curve:

$$\frac{B}{P} = W_p - f(i - i_* - e_e(E), W_p) - m(i, Y) \quad (12)$$

The LM-curve is given by (8):

$$\frac{M}{P} = m(i, Y) \quad (13)$$

And inserting for foreign demand into the foreign exchange market clearing condition gives us the FX-curve:

$$F_g + (P/E)f(i - i_* - e_e(E), (B_0 + EF_{p0})/P) + F_* = 0 \quad (14)$$

This leaves us with 4 equations and 6 potential endogenous variables. Y is always endogenous plus the three policy variables we leave floating.

Let's first fix the exchange rate and interest rate and illustrate this in a IS-LM type diagram.
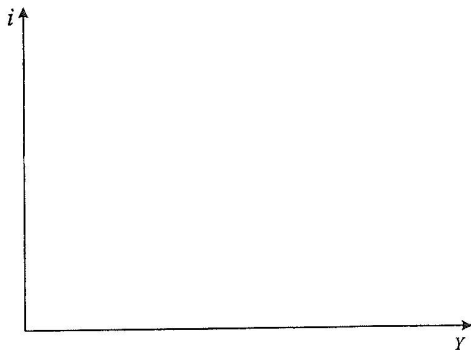
Need to know the relationships between Y and i as given by our four functions.

As E is constant we can ignore the FX-curve for now. Implicit derivation of the IS-, LM- and BB-curves gives us the slopes:

$$\frac{\partial i}{\partial Y} = \frac{1 - C'_{Y_p} - X'_Y}{c'_\rho + l'_\rho} < 0 \quad \text{from IS} \tag{15}$$

$$\frac{\partial i}{\partial Y} = -\frac{m'_Y}{m'_i} > 0 \qquad \text{from LM} \tag{16}$$

$$\frac{\partial i}{\partial Y} = -\frac{m'_Y}{f'_\delta + m'_i} > 0 \qquad \text{from BB} \tag{17}$$
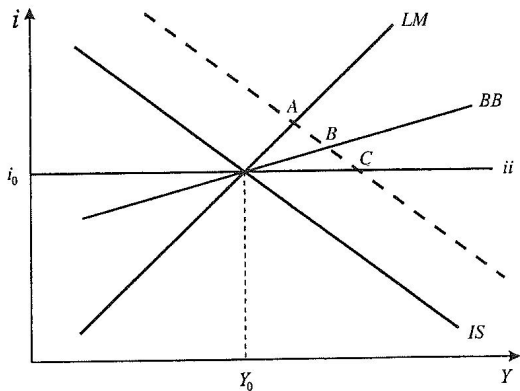
Figure 6.1 Equilibrium in the goods market and the financial markets.

How do we know they all line up like this? The government makes it so.

The effect of shifts in the IS-curve:

- Move along the original LM-curve if M is fixed
- Move along the original ii-curve if i is fixed
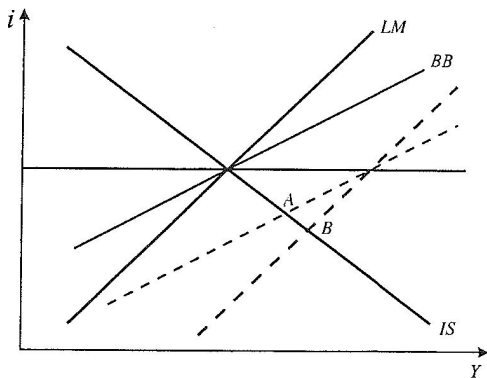- Move along the original BB-curve if B is fixed

Figure 6.2 Effects of a monetary expansion.

An increase in M, a monetary expansion. New equilibrium is A if the expansion is not sterilized and B if it is sterilized.

Aggregate demand: Fixed

Fixed rate IS-curve:

$$Y = C(Y - \rho_* \frac{EF_*}{P} - T, \frac{B_0 + EF_{p0}}{P}, i - \dot{p_e}, \rho_*) + I(i - \dot{p_e}, \rho_*) + G + X(\frac{EP_*}{P}, Y, Y_*)$$

Note the effects of a devaluation (E up) when $F_* < 0$ and $F_{p0} < 0$:

- Interests payments on the foreign debt increase leading to reduced consumer demand
- Real wealth goes down leading to a further reduction in consumer demand
- Imports become more expensive leaving less to be spent on home goods
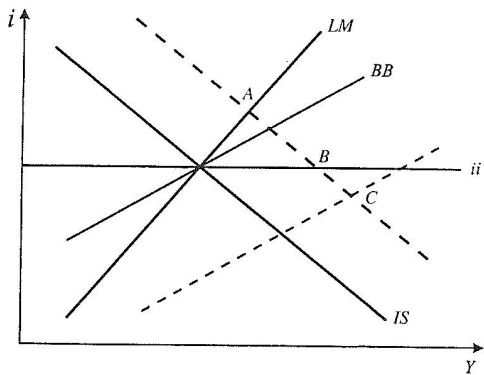- Home goods become relatively cheaper shifting demand towards them

Figure 6.3 Effects of a devaluation.

Floating exchange rate

Now we let E be determined endogenously together with one of the other government variables M, i, B or F_g. This means that we have to take the foreign exchange market explicitly into consideration since i and E will influence each other. The way we choose to do this is to combine the IS- and FX-curve into one ISFX-curve by inserting E from the FX-curve into the IS-relationship.

Because of the unspecified expectations function we cannot solve explicitly for E, but it is defined implicitly by the FX-equation as $E(i, i_*, P, F_g)$.

The derivations on the slope of the curve is done in the book and it behaves like the regular IS curve.
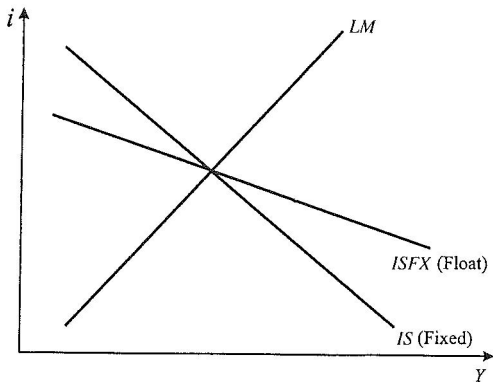
The ISFX curve is slightly less steep than the IS curve because a higher interest rate now affects both GDP and the exchange rate. Higher interest rates will appreciate the local currency which will shift demand away from domestic goods and reduce GDP.

So a positive shock to the economy(say increased G) will need a smaller interest rate increase to maintain balance.

Aggregate demand: Float

ISFX - IS with $E(i, i_*, F_g)$ inserted - shows the combinations of i and Y that are consistent with equilibrium in both the goods market and the foreign exchange market.

The positive direct effect of a cut in i on Y is often (usually?) reinforced by the accompanying depreciation

- This is more likely
  - the lower the foreign currency debt
  - the higher the trade surplus
  - the closer substitutes home and foreign goods are

- An interest rate cut may fail to raise Y if
  - foreign currency debt is high
  - the trade deficit is large
  - substitution is weak between home and foreign goods
  - direct interest rate effects are weak

Fixed versus flexible: Effects of shocks

Assume that i given and that an increase in E raises aggregate demand

- Demand shocks (including fiscal policy) with fixed interest rate
    - have full effect on output
    - have no effect on exchange rate or forex-reserves
- Disturbances in the forex-market
    - fixed exchange rate insulates the goods market
    - floating rate means shocks are transmitted from forex to goods through the E
    - high capital mobility makes E and, hence, Y, more sensitive to shifts in exchange rate expectations.

Fixed exchange rate insulates against outside shocks but does nothing against domestic shocks. Floating exchange rate can mitigate domestic shocks, but gives no insulation against foreign shocks.

Fixed versus float - effect of interest rates

- Reduced Interest rate
  - stronger output effect when floating
  - necessitates use of forex-reserve when fixed
    - potential revenue loss if i differs too much from i_*
    - high capital mobility means lager interventions
- i can be used to target output or home goods inflation
- More capital mobility means lager interventions needed
- Interventions lose their effect when capital mobility perfect

Fixed versus float: Policy opportunities

- In both cases i can be used to pursue any one of a large number of potential targets, e.g.m output, home goods inflation, M_2
- A fixed exchange rate will be undermined over time if interest rate is set without concern for price stability
- More capital mobility means lager interventions needed to get a given output effect

Managed exchange rates

- Fixed exchange rates with occasional devaluations / revaluations
- Floating exchange rates with occasional interventions

In principle one can achieve the same results

Classical fix: Output determination

Slope of *IS*-curve is

$$\left.\frac{dY}{di}\right|_{IS} = \frac{C_\rho + I_\rho}{1 - C_Y - X_Y} < 0 \tag{18}$$

- i can be used to target output or home goods inflation
- More capital mobility means lager interventions needed to get a given output effect

Exchange rate fixed by interest rate

F_g and E exogenous, i used to keep E on target

$$F_g + (P/E)f(i - i_* - \dot{e}_e(E), (B_0 + EF_{p0})/P) + F_* = 0$$

- Disturbances in foreign exchange market transmitted to goods market through the interest rate.
- Works also with perfect capital mobility
- Prone to speculative attacks when countries are hit with asymmetric disturbances
- Strength of such attacks can increase tremendously when capital mobility is high

Today

- Introduced money
- Looked at sterilized and unsterilized interventions in the FX-market
- Established short term equilibrium in both goods and FX-markets
- Analyzed different policy regimes

Next week

- Take a slightly longer time horizon
- Model inflation
- New policy regime: Inflation targeting

Midterm evaluation

To improve the course we are dependent on good feedback. Please answer the following questions honestly and directly. I will leave the room and you can keep your privacy.

1. What is the best part of the course?
2. What needs improvement in the course?
3. What do you think about the lectures?
4. What do you think about the seminars?
5. What do you think about the curriculum?

Answer as many questions as you like, but no one should hand in a blank page.