

# Mundell–Fleming model

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The **Mundell-Fleming model** is an economic model first set forth by Robert Mundell and Marcus Fleming. The model is an extension of the IS-LM model. Whereas the traditional IS-LM Model deals with economy under autarky (or a closed economy), the Mundell-Fleming model tries to describe an open economy.

Typically, the Mundell-Fleming model portrays the relationship between the nominal exchange rate and an economy's output (unlike the relationship between interest rate and the output in the IS-LM model) in the short run. The Mundell-Fleming model has been used to argue that an economy cannot simultaneously maintain a fixed exchange rate, free capital movement, and an independent monetary policy. This principle is frequently called "the Unholy Trinity," the "Irreconcilable Trinity," the "Inconsistent trinity" or the Mundell-Fleming "trilemma."

## Basic set up

The traditional model is based around the following equations.

- $Y = C + I + G + NX$  (*The IS Curve*)
  - Where  $Y$  is GDP,  $C$  is consumption,  $I$  is investment,  $G$  is government spending and  $NX$  is net exports.
- $\frac{M}{P} = L(i, Y)$  (*The LM Curve*)
  - Where  $M$  is money supply,  $P$  is average price,  $L$  is liquidity,  $i$  is the interest rate and  $Y$  is GDP.
- $BoP = CA + KA$  (*The BoP Curve (Balance of Payments)*)
  - Where  $CA$  is the current account and  $KA$  is the capital account.

## IS components

- $C = C(Y - T, i - E(\pi))$ 
  - Where  $C$  is consumption,  $Y$  is GDP,  $T$  is taxes,  $i$  is the interest rate,  $E(\pi)$  is the expected rate of inflation.
- $I = I(i - E(\pi), Y_{-1})$ 
  - Where  $I$  is investment,  $i$  is the interest rate,  $E(\pi)$  is the expected rate of inflation,  $Y_{-1}$  is GDP in the previous period.
- $G = G$ 
  - Where  $G$  is government spending, an exogenous variable.
- $NX = NX(e, Y, Y^*)$ 
  - Where  $NX$  is net exports,  $e$  is the real exchange rate,  $Y$  is GDP,  $Y^*$  is the GDP of a foreign country.

## BoP components

- $CA = NX$ 
    - Where  $CA$  is the current account and  $NX$  is net exports.
  - $KA = z(i - i^*) + k$ 
    - Where  $z$  is the level of capital mobility,  $i$  is the interest rate,  $i^*$  is the foreign interest rate,  $k$  is capital investments not related to  $i$ , an exogenous variable
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## Mechanics of the model

One important assumption is the equalization of the local interest rate to the global interest rate.

### Under flexible exchange rate regime

We speak of a system of flexible exchange rates when governments (or central banks) allow the exchange rate to be determined by market forces alone.

#### Changes in money supply

An increase in money supply shifts the LM curve downward. This directly reduces the local interest rate and in turn forces the local interest rate lower than the global interest rate. This depreciates the exchange rate of local currency through capital outflow. (Hot money flows out to take advantage of higher interest rate abroad and hence currency depreciates.) The depreciation makes local goods cheaper compared to foreign goods and increases export and decreases import. Hence, net export is increased. Increased net export leads to the shifting of the IS curve (which is  $Y = C + I + G + NX$ ) to the right to the point where the local interest rate equalizes with the global rate. At the same time, the BoP is supposed to shift too, as to reflect (1) depreciation of home currency and (2) an increase in current account or in other words, the increase in net export. These increase the overall income in the local economy.

A decrease in money supply causes the exact opposite of the process.

#### Changes in government spending

An increase in government expenditure shifts the IS curve to the right. The shift causes the local interest rate to go above the global rate. The increase in local interest causes capital inflow, and the inflow makes the local currency stronger compared to foreign currencies. Strong exchange rate also makes foreign goods cheaper compared to local goods. This encourages greater import and discourages export and hence, lower net export. As a result, the IS returns to its original level, where the local interest rate is equal to the global interest rate. The level of income of the local economy stays the same. The LM curve is not at all affected. A decrease in government expenditure reverses the process.

#### Changes in global interest rate

An increase in the global interest rate causes an upward pressure on the local interest rate. The pressure subsides as the local rate closes in on the global rate. When a positive differential between the global and the local rate occurs, holding the LM curve constant, capital flows out of the local economy. This depreciates the local currency and helps boost net export. Increasing net export shifts the IS to the right. This shift continues to the right until the local interest rate becomes as high as the global rate. A decrease in global interest rate causes the reverse to occur.

### Under fixed exchange rate regime

We speak of a system of fixed exchange rates when governments (or central banks) announce an exchange rate (the parity rate) at which they are prepared to buy or sell any amount of domestic currency.

#### Changes in money supply

Under the fixed exchange rate system, the local central bank or any monetary authority only changes the money supply to maintain a specific exchange rate. If there is pressure to depreciate the domestic currency's exchange rate because the supply of domestic currency exceeds its demand in foreign exchange markets, the local authority buys domestic currency with foreign currency to decrease the domestic currency's supply in the foreign exchange market. This returns the domestic currency's exchange rate back to its original level. If there is pressure to appreciate the domestic currency's exchange rate because the currency's demand exceeds its supply in the foreign exchange market, the local authority buys foreign currency with domestic currency to increase the domestic currency's supply in the

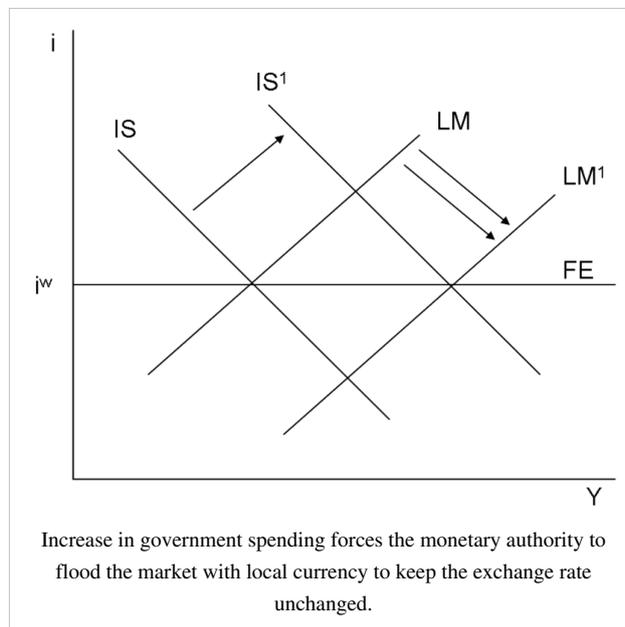
foreign exchange market. This returns the exchange rate back to its original level.

A revaluation occurs when there is a permanent increase in exchange rate and hence, decrease in money supply. Devaluation is the exact opposite of revaluation.

### Changes in government expenditure

Increased government expenditure shifts the IS curve to the right. The shift results are a rise in the interest rate and hence, an appreciation of the exchange rate. However, the exchange rate is controlled by the local monetary authority in the framework of a fixed system. To maintain the exchange rate and eliminate pressure from it, the monetary authority purchases foreign currencies with local currency until the pressure is gone, i.e., back to the original level. Such action shifts the LM curve in tandem with the direction of the IS shift. This action increases the local currency supply in the market and lowers the exchange rate—or rather, return the rate back to its original state. In the end, the exchange rate stays the same but the general income in the economy increases.

The reverse is true when government expenditure decreases.



### Changes in global interest rate

To maintain the fixed exchange rate, the central bank must offset the capital flows (in or out), which are caused by the change of the global interest rate to the domestic rate. The central bank must restore the situation where the real domestic interest rate is equal to the real global interest rate to stop net capital flows from changing the exchange rate.

If the global interest rate increases above the domestic rate, capital flows out to take advantage of this opportunity. (Hot money flows out of the economy) This would depreciate the home currency, so the central bank may buy the home currency and sell some of its foreign currency reserves to offset this outflow. This decrease in the money supply shifts the LM curve to the left until the domestic interest rate is the global interest rate.

If the global interest rate declines below the domestic rate, the opposite occurs. Hot money flows in, the home currency appreciates, so the central bank offsets this by increasing the money supply (sell domestic currency, buy foreign currency), the LM curve shifts to the right, and the domestic interest rate becomes the global interest rate.

## Differences from IS-LM

It is worth noting that some of the result from this model differs from the IS-LM because of the open economy assumption. Result for large open economy on the other hand falls within the result predicted by the IS-LM and the Mundell-Fleming models. The reason for such result is because a large open economy has both the characteristics of an autarky and a small open economy.

In the IS-LM, interest rate is the key component in making both the money market and the good market in equilibrium. Under the Mundell-Fleming framework of small economy, interest rate is fixed and equilibrium in both market can only be achieved by a change of nominal exchange rate.

## Example

A much simplified version of the Mundell-Fleming model can be illustrated by a small open economy, in which the domestic interest rate is exogenously predetermined by the *world interest rate* ( $r=r^*$ ).

Consider an exogenous increase in government expenditure, the IS curve shifts upward, with LM curve intact, causing the interest rate and the output to rise (partial crowding out effect) under the IS-LM model.

Nevertheless, as interest rate is predetermined in a small open economy, the LM\* curve (of exchange rate and output) is vertical, which means there is exactly one output that can make the money market in the equilibrium under that interest rate. Even though the IS\* curve can still shift up, it causes a higher exchange rate and same level of output (complete crowding out effect, which is different in the IS-LM model).

The example above makes an implicit assumption of flexible exchange rate. The Mundell-Fleming model can have completely different implications under different exchange rate regimes. For instance, under a fixed exchange rate system, with perfect capital mobility, monetary policy becomes ineffective. An expansionary monetary policy resulting in an outward shift of the LM curve would in turn make capital flow out of the economy. The central bank under a fixed exchange rate system would have to intervene by selling foreign money in exchange for domestic money to depreciate the foreign currency and appreciate the domestic currency. Selling foreign money and receiving domestic money would reduce real balances in the economy, until the LM curve shifts back to the left, and the interest rates come back to the world rate of interest  $i^*$ .

## See also

- Optimal currency area

## References

- Young, Warren; Darity, William, Jr. (2004), "IS-LM-BP: An Inquest"<sup>[1]</sup>, *History of Political Economy* **36** (Suppl 1): 127–164, doi:10.1215/00182702-36-Suppl\_1-127 (Tells the difference between the IS-LM-BP model and the Mundell-Fleming model.)

## Further reading

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