

# International Finance: Lecture 7

## Exchange Rate Regimes and Policies

Biwei Chen

*Bchen@binghamton.edu*

Department of Economics  
Harpur College · Binghamton University

# Economics of Exchange Rate Regimes

An exchange rate regime is the system that a country's monetary authority, generally the central bank, adopts to establish the exchange rate of its own currency against other currencies. Each country is free to adopt the exchange rate regime that it considers optimal via its macroeconomic policy decisions.

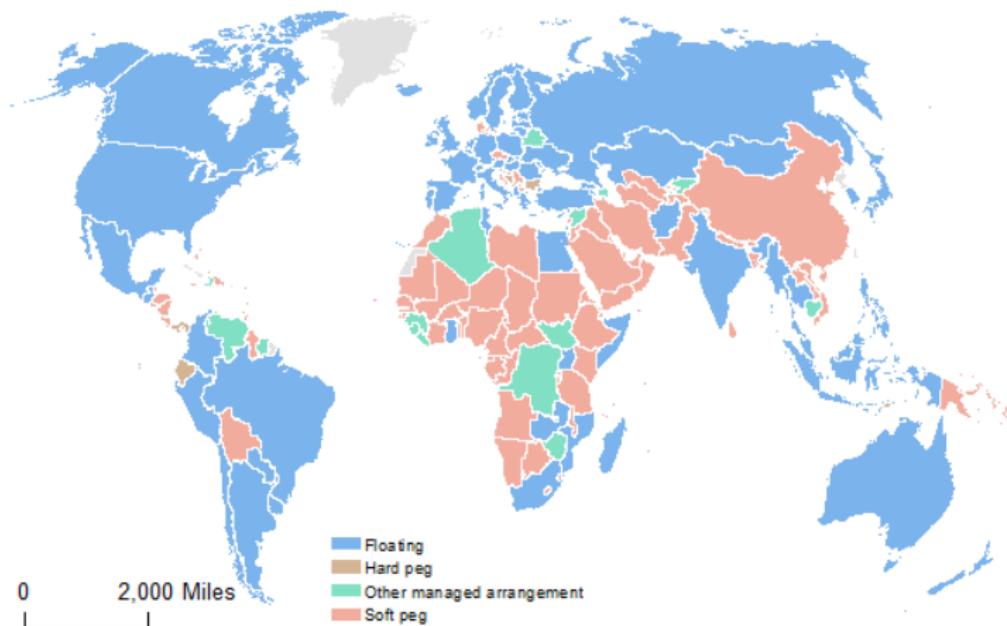
- Why do some countries choose to fix and others to float?
- Why do some countries switch regimes at different times?
- What are the benefits and costs of a particular currency regime?
- How do some countries manage to fix their exchange rates?
- Why do some countries fail to manage their currency regimes?
- What is the impossible trinity? What are the pertinent policy challenges?



# Outline

- 1 FX Regimes
- 2 FX Intervention
- 3 Policy Trilemma
- 4 IS-LM-FX Model

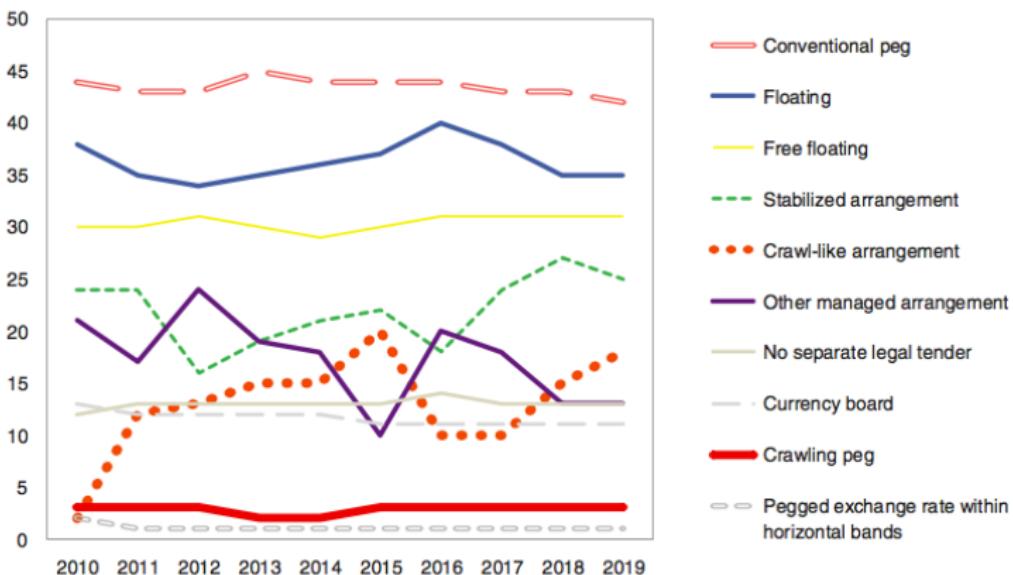
## Global Exchange Rate Regimes 2017 (w)



Source: IMF 2017 Annual Report on Exchange Arrangements and Exchange Restrictions.

## Global Exchange Rate Arrangements

(Number of countries as of end-April)



Source: AREAER database.



## Exchange Rate Regimes: IMF Classification (w)

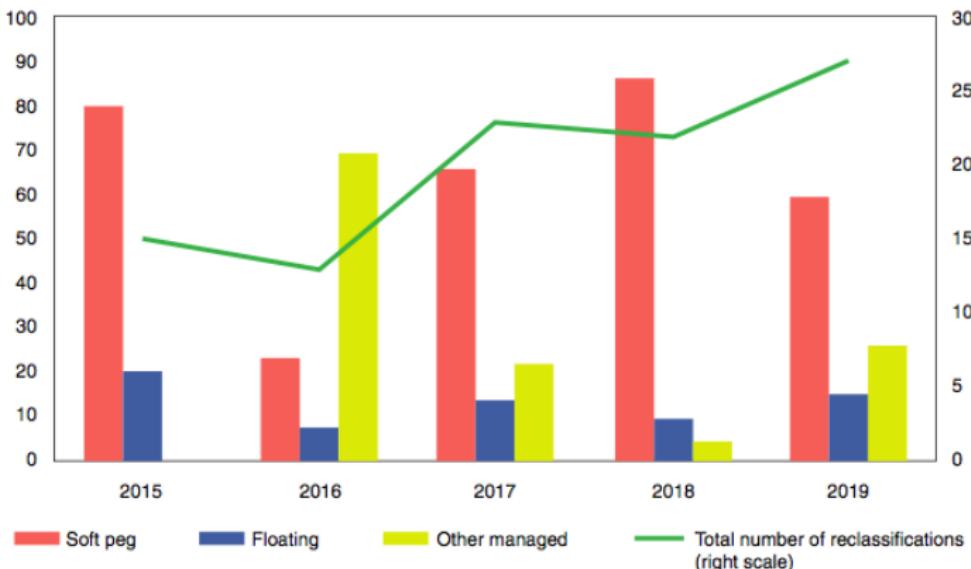
Stone, Anderson, and Veyrune (2008), Exchange Rate Regimes: Fix or Float? Finance and Development, March 2008, Volume 45, Number 1, IMF magazine. Exchange rate regimes are typically divided into three broad categories.

- ① At one end of the spectrum are hard exchange rate pegs.
- ② In the middle of the spectrum are soft exchange rate pegs—that is, currencies that maintain a stable value against an anchor currency or a composite of currencies.
- ③ At the other end of the spectrum are floating exchange rate regimes. As the name implies, the floating exchange rate is mainly market determined.

Historically, exchange rate regimes reported by the IMF were based on a country's own classification, that is, a de jure regime. But starting in 1999, the IMF also began to report de facto—that is, observed—exchange rate regimes based on the IMF staff's assessment of available information.

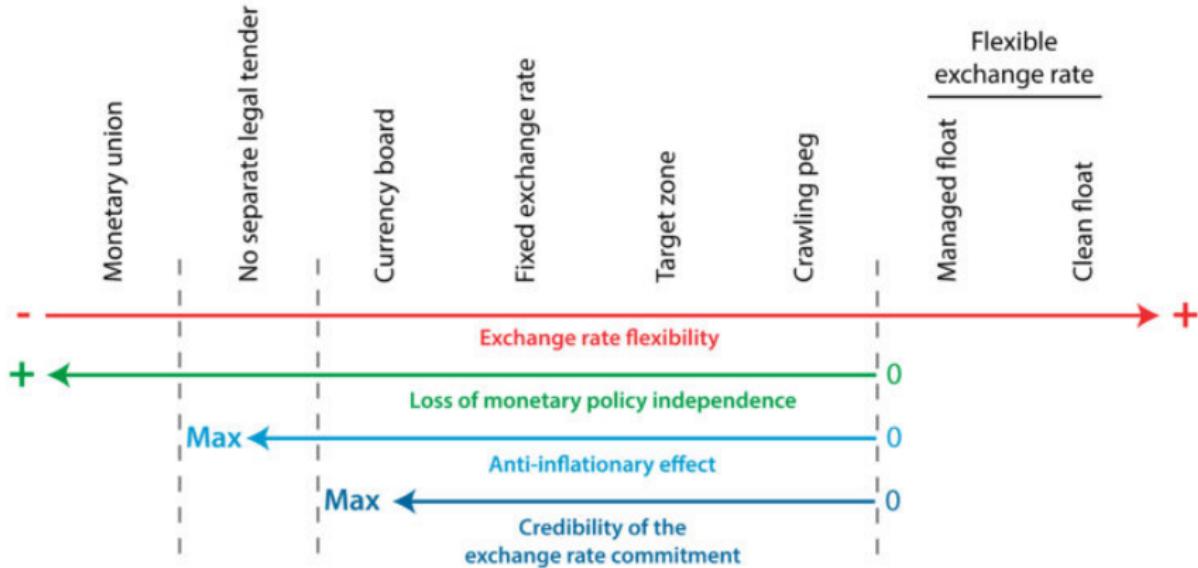
## De Facto Exchange Rate Arrangements: Reclassification

(Percent of total reclassifications as of April 30)



Source: AREAER database.

## Exchange Rate Regimes: Classification

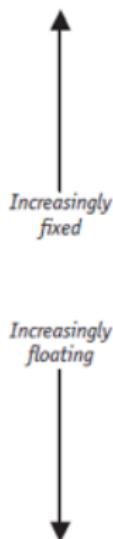


<https://policonomics.com/ip-exchange-rate-regimes-exchange-rate-regime/>

## Exchange Rate Regimes: Classification (w)

- ① Monetary union, with a shared currency, such as the Eurozone.
- ② No separate legal tender, where the use of the currency of another country takes place.
- ③ Currency board, an explicit agreement on a fixed exchange rate between two or more currencies.
- ④ Target zone arrangement, where the exchange rate is allowed to fluctuate within certain bands.
- ⑤ Crawling peg, with a periodically adjusted exchange rate.
- ⑥ Managed (dirty) float, a flexible exchange rate regime with some government intervention.
- ⑦ Free (clean) float, the exchange rate is market determined.

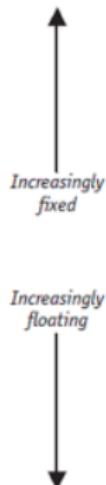
# A Spectrum of Exchange Rate Regimes



No separate legal tender (52 countries)	<i>Another currency as legal tender:</i> (13): Ecuador, El Salvador, Kiribati, Liechtenstein, Marshall Islands, Micronesia, Monaco, Montenegro, Palau, Panama, San Marino, West Bank & Gaza, Zimbabwe <i>Eurozone:</i> (19): Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain <i>Eastern Caribbean Currency Union:</i> (6): Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines <i>West African CFA Franc Zone:</i> (8): Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, Togo <i>Central African CFA Franc Zone:</i> (6): Cameroon, Central African Rep., Chad, Rep. of Congo, Equatorial Guinea, Gabon
Currency boards (6)	Bosnia and Herzegovina, Brunei, Bulgaria, Djibouti, Hong Kong, Macao
Other pegs (35)	Anguilla, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belize, Bhutan, Bolivia, China, Comoros, Costa Rica, Denmark, Eritrea, Honduras, Iran, Jordan, Kuwait, Lebanon, Lesotho, Maldives, Morocco, Namibia, Nepal, Netherlands Antilles, Oman, Paraguay, Qatar, Saudi Arabia, Solomon Islands, Suriname, Swaziland, Ukraine, United Arab Emirates, Venezuela

Source: FT (2017). This figure shows IMF classification of exchange rate regimes for 182 economies in 2010, covering the most rigidly fixed to the most freely floating.

# A Spectrum of Exchange Rate Regimes



## Bands, crawling pegs, crawling bands (43)

Algeria, Angola, Argentina, Botswana, Burundi, Cambodia, Cape Verde, Croatia, Dominican Republic, Egypt, Gambia, Georgia, Ghana, Guatemala, Guinea, Guyana, India, Iraq, Jamaica, Kazakhstan, Kyrgyz Republic, Malawi, Mauritius, Moldova, Mongolia, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Peru, Rwanda, São Tomé and Príncipe, Sierra Leone, Sri Lanka, Sudan, Tajikistan, Tanzania, Tonga, Trinidad and Tobago, Tunisia, Uganda, Vietnam, Yemen

## Wide bands, managed floating, free floating (46)

Afghanistan, Albania, Armenia, Australia, Belarus, Brazil, Canada, Chile, Colombia, Czech Republic, Haiti, Hungary, Iceland, Indonesia, Israel, Japan, Kenya, Korea, Liberia, Macedonia FYR, Madagascar, Malaysia, Mauritania, Mexico, Mozambique, New Zealand, Norway, Philippines, Poland, Romania, Russia, Samoa, Serbia, Seychelles, Singapore, South Africa, Sweden, Switzerland, Thailand, Turkey, United Kingdom, United States, Uruguay, Uzbekistan, Vanuatu, Zambia

Source: FT (2017). Six countries use an ultra-hard peg called a currency board, while 35 others have a hard peg. An additional 43 countries have bands, crawling pegs, or crawling bands, while 46 countries have exchange rates that either float freely, are managed floats, or are allowed to float within wide bands.

# Fixed Exchange Rate Regimes

- ① Fixed exchange rates were the norm in many periods, such as the decades before World War I, between the mid-1920s and 1931, and again between 1945 and 1973.
- ② Many developing countries try to peg the values of their currencies, often in terms of the dollar, but sometimes in terms of a nondollar currency or some “basket” of currencies chosen by the authorities.
- ③ Regional currency arrangements. Some countries belong to exchange rate unions, organizations whose members agree to fix their mutual exchange rates while allowing their currencies to fluctuate in value against the currencies of nonmember countries.
- ④ Managed floating. Central banks often intervene in currency markets to influence exchange rates. While the dollar exchange rates of the industrial countries’ currencies are not currently fixed by governments, they are not always left to fluctuate freely, either.

# Floating Exchange Rates: Pros and Cons (w)

## Floating Exchange Rate Advantages

## Floating Exchange Rate Disadvantages

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li><input type="checkbox"/> Supports efficiency by adhering to <b>free market</b> ideology (free trade), by allowing undisturbed supply and demand.</li><br/><li><input type="checkbox"/> No need for active management from international bodies like the IMF/Central Banks to intervene</li><br/><li><input type="checkbox"/> In the long-run, it displays the macroeconomic performance/'value' of the currency's nation, through price discovery.</li></ul> | <ul style="list-style-type: none"><li><input type="checkbox"/> <b>High volatility:</b> This means rates can appreciate/depreciate in large fluctuations. This may disrupt a stable value of exchange, for example.</li><br/><li><input type="checkbox"/> <b>Tendency to worsen existing problems:</b> Floating exchange rates may worsen existing problems such as inflation. If there is high inflation and a cheap currency, may make even more inflation.</li></ul> |
|--|--|

<https://studyretreat.weebly.com/as-economics/floating-fixed-exchange-rates>

# Fixed Exchange Rates: Pros and Cons (w)

## Fixed Exchange Rate Advantages

## Fixed Exchange Rate Disadvantages



**Price Stability:** A stable exchange rate is theorized to help economic prosperity and activity between non-speculative participants. E.g. Toyota doesn't have to put up as much cost to analyze foreign exchange risk when it has to engage in any foreign exchange transactions.

Firmer foreign exchange price stability **encourages foreign investment**, which could help stimulate domestic growth... increase GDP... stimulate employment... improve living conditions and so on and so forth.

As an example of an advantage, if an exporting economy pegged its exchange rate low, it can then make its exports more competitive, and improve the prospects for profitability for exporting firms.



**Possibly Mispricing the Country's Macroeconomic Fundamentals:** Because a rate is pegged 'artificially', it may not reflect the actual 'real value' of the currency.

**Requires a dedicated management:** You need shitloads (billions of dollars) to effectively defend an exchange rate between your desired trading bands. A central bank then needs to accumulate A LOT of currency reserves to ensure its success of implementing a fixed exchange rate mechanism.

**Importing Inflation:** Through the monetarist theory of inflation, an increase in the Money Supply in an economy, can cause inflation. Therefore, the large accumulation of foreign currency reserves might cause inflation to occur.

<https://studyretreat.weebly.com/as-economics/floating-fixed-exchange-rates>

## Fixed Exchange Rates: Advantages

A fixed exchange rate occurs when a country keeps the value of its currency at a certain level against another currency. Often countries join a semi-fixed exchange rate, where the currency can fluctuate within a small target level.

- ① Avoid currency fluctuations. If the value of currencies fluctuates, significantly this can cause problems for firms engaged in trade.
- ② Stability encourages investment. The uncertainty of exchange rate fluctuations can reduce the incentive for firms to invest in export capacity.
- ③ Keep inflation low. Governments who allow their exchange rate to devalue may cause inflationary pressures to occur.
- ④ Maintain current account. A rapid appreciation in the exchange rate will badly effect manufacturing firms who export; this may also cause a worsening of the current account.

<https://www.economicshelp.org/macroeconomics/exchangerate/advantages-disadvantages-fixed/>

## Fixed Exchange Rates: Disadvantages (w)

- ① Conflict with other macroeconomic objectives.
- ② Less flexibility and difficult to respond to temporary shocks.
- ③ Join at the wrong rate. It is difficult to know the right rate to join at. Too high will make exports uncompetitive. Too low could cause inflation.
- ④ Require higher interest rates. If the currency is falling below the exchange rate floor, the government may be forced to raise interest rates.
- ⑤ Current account imbalances. Fixed exchange rates can lead to current account imbalances for an either overvalued or undervalued currency.
- ⑥ Difficulty in keeping the value of the currency. If a currency is falling below its band the government will have to intervene.
- ⑦ Encourage speculative attacks. Speculators know if the currency is fundamentally misvalued, then the government may have to leave exchange rate altogether.

# Fixed Exchange Rates: Summary (w)

## Advantages

Avoids currency fluctuations

Encourages firms to invest

Incentive to keep inflation low

Avoids devaluation

## Disadvantages

Conflict with other macro-objectives

Less flexibility

Current account imbalance

May require higher interest rates

## Fixed Exchange Rates

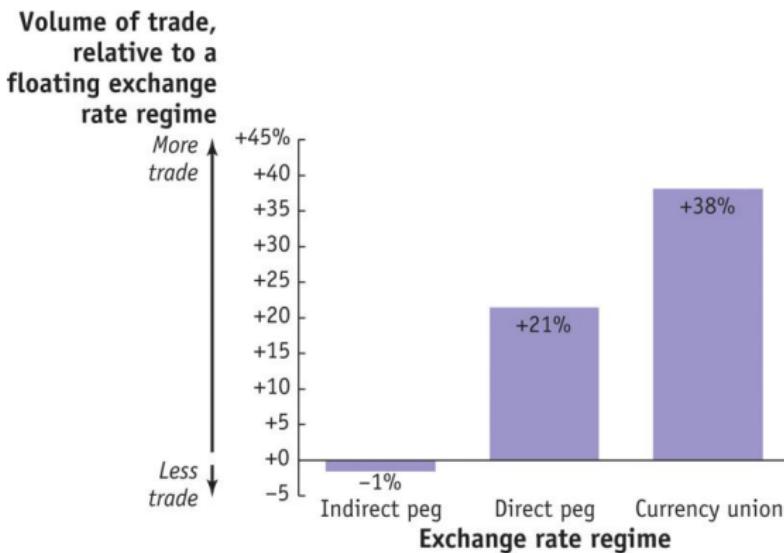
Source: Economics Help.

# Floating Exchange Rates: Benefits

In KOM (2018) CH8, the case for floating rates rested on four major claims:

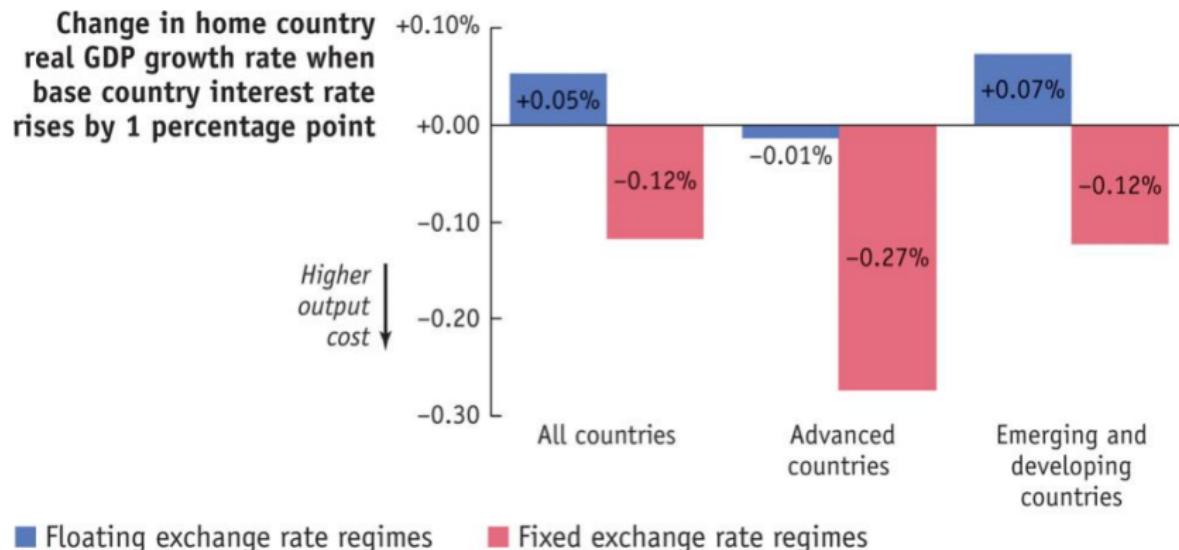
- ① Monetary policy autonomy. If central banks were no longer obliged to intervene to fix exchange rates, governments would be able to use monetary policy to reach internal and external balance. Furthermore, no country would be forced to import inflation (or deflation) from abroad.
- ② Exchange rates as automatic stabilizers. Even in the absence of an active monetary policy, the swift adjustment of market-determined exchange rates would help countries maintain internal and external balance in the face of changes in aggregate demand.
- ③ Exchange rates can adjust external balance. Market-determined exchange rates would move automatically so as to prevent the emergence of big current account deficits and surpluses.
- ④ Symmetry. Under floating rate system, the inherent asymmetries of Bretton Woods would disappear and the U.S. would no longer be able to set world monetary conditions all by itself. Meanwhile, it would have the same option as other countries to influence its exchange rate against foreign currencies.

# Fixed Exchange Rates and Trade Volume



Source: FT (2017). Estimates of the impact on trade volumes: Indirect pegs were found to have a small but statistically insignificant impact on trade, but trade increased under a direct peg by 21%, and under a currency union by 38%.

# Fixed Exchange Rates and Output Volatility



Source: FT (2017). Recent empirical work finds that shocks which raise base country interest rates are associated with large output losses in countries that fix their currencies to the base, but not in countries that float.

# Exchange Rate Regimes and Inflation Experience

Regime Type	Annual Inflation Rate (%)			
	(1) World	(2) Advanced Countries	(3) Emerging Markets and Developing Countries	(4) Emerging Markets and Developing Countries (Excluding the Year after a Regime Change)
Fixed	17.4%	4.8%	19.6%	8.8%
Limited flexibility	11.1	8.3	12.4	10.8
Managed floating	14.0	7.8	15.1	14.7
Freely floating	9.9	3.5	21.2	15.8
Freely falling	387.8	47.9	396.1	482.9

Source: FT (2017). Cross-country annual data from the period 1970-1999 can be used to explore the relationship, if any, between the exchange rate regime and the inflation performance of an economy. Floating is associated with slightly lower inflation in the world as a whole (9.9%) and in the advanced countries (3.5%) (columns 1 and 2). In emerging markets and developing countries, a fixed regime eventually delivers lower inflation outcomes, but not right away (columns 3 and 4).



# Outline

- 1 FX Regimes
- 2 FX Intervention
- 3 Policy Trilemma
- 4 IS-LM-FX Model

# Mechanics of a Fixed Exchange Rate

- To hold the exchange rate constant, a central bank must always stand ready to trade currencies at the fixed exchange rate with the private actors in the foreign exchange market. Since exchange rate is the price of one currency in term of another, the law of demand and supply governs.
- In order to maintain a targeted exchange rates, pressure on home currency appreciation can be relieved by selling home currency (buying foreign currency); tendency of home currency depreciation can be reversed by buying home currency (selling foreign currency).
- When a central bank purchases foreign assets with home currency, the country's money supply automatically increases. Similarly, a central bank sale of foreign assets automatically lowers the money supply.
- For a central bank to effectively engage in foreign exchange intervention, it must hold sufficient amount of foreign currency reserves.

# Central Bank Balance Sheet Analysis

## Assets

- ① Domestic government bonds
- ② Loans to domestic banks (called discount loans in US)
- ③ Foreign government bonds (official international reserves)
- ④ Gold (official international reserves)

## Liabilities

- ① Deposits of domestic banks
- ② Currency in circulation
- ③ Accounts payable

## Capital

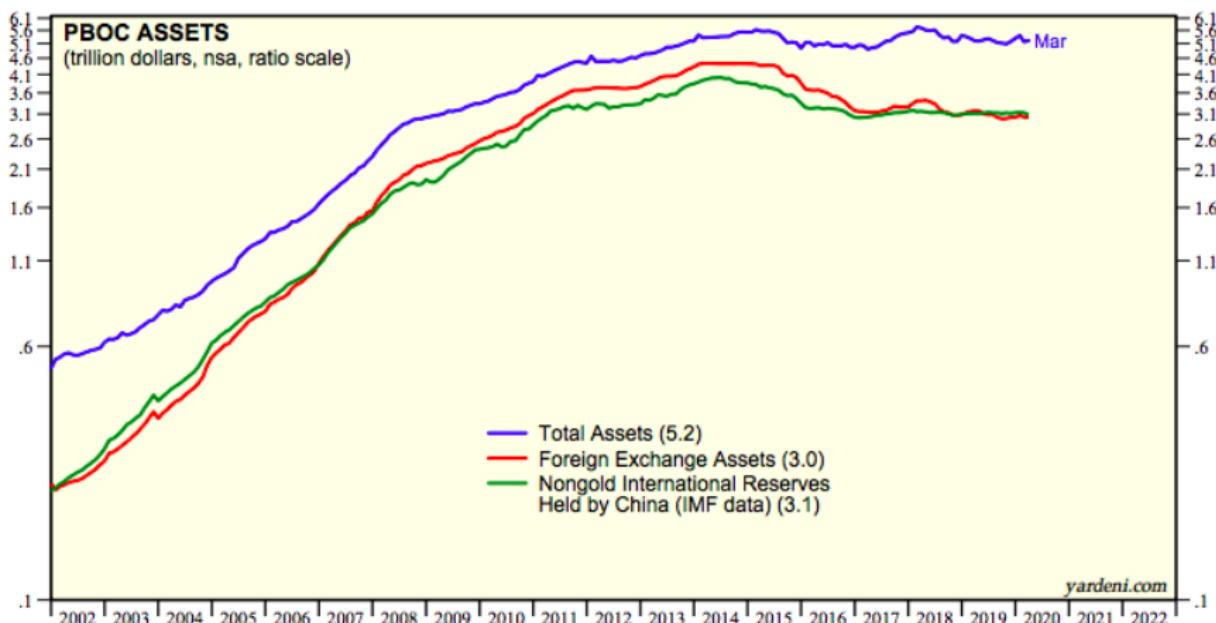
$$\text{Assets} = \text{Liabilities} + \text{NetWorth}$$

# Central Bank Balance Sheet: Example

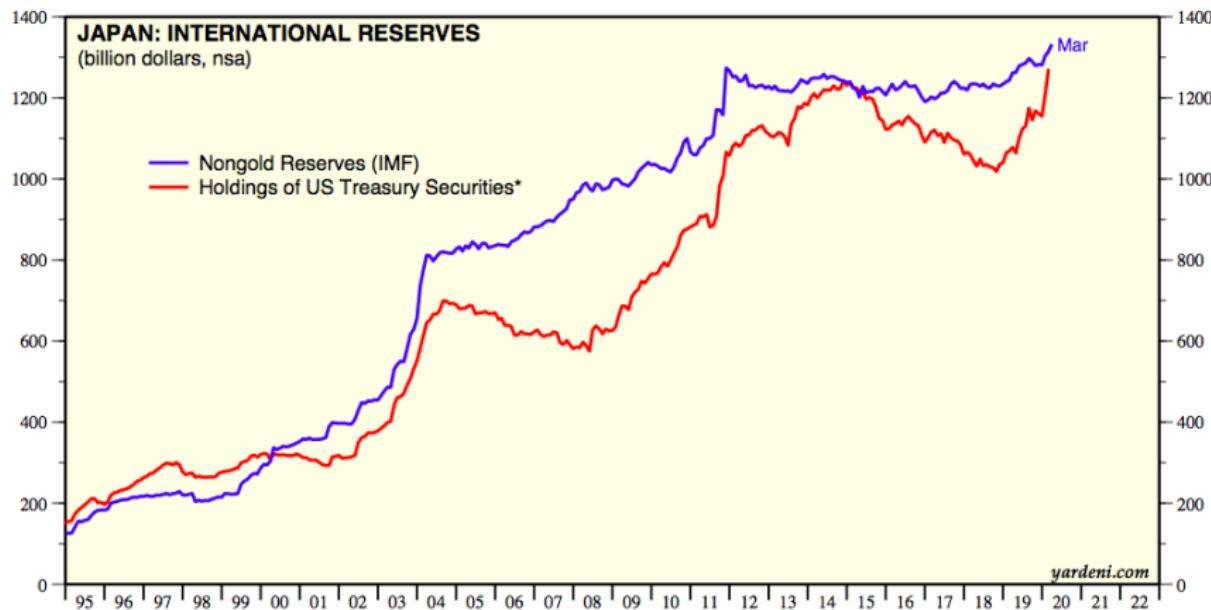
GENERAL CENTRAL BANK BALANCE (MILLIONS OF PESOS)			
Assets		Liabilities	
<b>Foreign assets</b>	950	<b>Foreign liabilities</b>	50
of which:		of which:	
<i>Foreign reserves (all currencies)</i>	950	<i>Foreign currency debt issued by the central bank</i>	50
<i>Gold</i>	0		
<b>Domestic assets</b>	500	<b>Domestic liabilities</b>	400
of which:		of which:	
<i>Domestic government bonds bought</i>	300	<i>Domestic currency debt issued by the central bank</i>	400
<i>Loans to commercial banks</i>	200		
		<b>Money supply <math>M</math></b>	1,000
		of which:	
		<i>Currency in circulation</i>	900
		<i>Reserve liabilities to commercial banks</i>	100

Source: FT (2017)

# PBOC: Asset Composition



# BOJ: Foreign Assets



\* Includes held by private and official accounts.

Source: US Department of the Treasury, Office of International Affairs and International Monetary Fund.



## Central Bank Balance Sheet: Assets

- The assets side of a central bank's balance sheet consists of two types of assets, foreign assets and domestic assets.
- Domestic assets are central bank holdings of claims to future payments by its own citizens and domestic institutions. These claims usually take the form of domestic government bonds and loans to domestic private banks.
- Foreign assets consist mainly of foreign currency bonds owned by the central bank. These foreign assets make up the central bank's official international reserves, and their level changes when the central bank intervenes in the FX market by buying or selling foreign exchange.
- For historical reasons, a central bank's international reserves also include any gold that it owns. The defining characteristic of international reserves is that they be either claims on foreigners or a universally acceptable means of making international payments (e.g., gold).

## Central Bank Balance Sheet: Liabilities

- The liabilities side of the balance sheet lists as liabilities the deposits of private banks and currency in circulation, both notes and coin.
- Private bank deposits are liabilities of the central bank because the money may be withdrawn whenever private banks need it. Nonbank firms and households generally cannot deposit money at the central bank, while banks are generally required by law to hold central bank deposits as partial backing for their own liabilities.
- Currency in circulation is considered a central bank liability mainly for historical reasons: At one time, central banks were obliged to give a certain amount of gold or silver to anyone wishing to exchange domestic currency for one of those precious metals.
- The central bank's total assets equal its total liabilities plus its net worth. Assume the net worth is constant means that the changes in central bank assets automatically cause equal changes in central bank liabilities.

# Federal Reserve System: Assets (w)

**Table 1. Assets, liabilities, and capital of the Federal Reserve System**

Billions of dollars

Item	Current July 24, 2019	Change from April 24, 2019	Change from July 25, 2018
<b>Total assets</b>	<b>3,803</b>	<b>-125</b>	<b>-474</b>
<b>Selected assets</b>			
Securities held outright	3,618	-121	-454
U.S. Treasury securities <sup>1</sup>	2,094	-59	-266
Federal agency debt securities <sup>1</sup>	2	0	-*
Mortgage-backed securities <sup>2</sup>	1,522	-62	-188
Memo: Overnight securities lending <sup>3</sup>	26	+*	8
Memo: Net commitments to purchase mortgage-backed securities <sup>4</sup>	3	2	-5
Unamortized premiums on securities held outright <sup>5</sup>	130	-5	-18
Unamortized discounts on securities held outright <sup>5</sup>	-13	+*	1
Lending to depository institutions <sup>6</sup>	*	+*	-*
Central bank liquidity swaps <sup>7</sup>	*	-*	-*
Net portfolio holdings of Maiden Lane LLC <sup>8</sup>	*	+*	-2
Foreign currency denominated assets <sup>9</sup>	21	+*	-*

Source: Federal Reserve Board.

# Federal Reserve System: Liabilities (w)

Total liabilities	3,764	-125	-475
Selected liabilities			
Federal Reserve notes in circulation	1,698	17	77
Reverse repurchase agreements <sup>10</sup>	282	12	32
Foreign official and international accounts <sup>10</sup>	274	13	25
Others <sup>10</sup>	8	-1	8
Term deposits held by depository institutions	0	0	0
Other deposits held by depository institutions	1,525	53	-422
U.S. Treasury, General Account	178	-221	-161
Other deposits <sup>11</sup>	70	15	-2
 Total capital	 39	 -*	 +*

Note: Unaudited. Components may not sum to totals because of rounding.

\* Less than \$500 million.

<sup>1</sup> Face value.

<sup>2</sup> Guaranteed by Fannie Mae, Freddie Mac, and Ginnie Mae. The current face value shown is the remaining principal balance of the securities.

<sup>3</sup> Securities loans under the overnight facility are off-balance-sheet transactions. These loans are shown here as a memo item to indicate the portion of securities held outright that have been lent through this program.

<sup>4</sup> Current face value. Includes commitments associated with outright purchases, dollar rolls, and coupon swaps.

<sup>5</sup> Reflects the premium or discount, which is the difference between the purchase price and the face value of the securities that has not been amortized. For U.S. Treasury securities, federal agency debt securities, and mortgage-backed securities, amortization is on an effective-interest basis.

<sup>6</sup> Total of primary, secondary, and seasonal credit.

<sup>7</sup> Dollar value of the foreign currency held under these agreements valued at the exchange rate to be used when the foreign currency is returned to the foreign central bank. This exchange rate equals the market exchange rate used when the foreign currency was acquired from the foreign central bank.

<sup>8</sup> Fair value. Fair value reflects an estimate of the price that would be received upon selling an asset if the transaction were to be conducted in an orderly market on the measurement date. Assets are revalued quarterly.

<sup>9</sup> Revalued daily at current foreign currency exchange rates.

<sup>10</sup> Cash value of agreements, which are collateralized by U.S. Treasury securities, federal agency debt securities, and mortgage-backed securities.

<sup>11</sup> Includes deposits held at the Reserve Banks by international and multilateral organizations, government-sponsored enterprises, designated financial market utilities, and deposits held by depository institutions in joint accounts in connection with their participation in certain private-sector payment arrangements. Also includes certain deposit accounts other than the U.S. Treasury, General Account, for services provided by the Reserve Banks as fiscal agents of the United States.

# Central Bank Transactions on Balance Sheet

Assets	Liabilities
Domestic assets \$1,500	Deposits held by private banks \$500
Foreign assets \$1,000	Currency in circulation \$2,000

The double-entry principles applies to central bank transactions:

- ① Fed sells \$100 worth of foreign bonds for U.S. dollar (Asset): -\$100  
Fed receives payment from the buyer bank (Liabilities - Currency): -\$100

Domestic assets \$1,500	Deposits held by private banks \$500
Foreign assets \$900	Currency in circulation \$1,900

- ② Fed purchases \$100 U.S. Treasury securities (Asset): +\$100  
Fed pays the seller bank with a check (Liabilities - Deposit): +\$100

Domestic assets \$1,600	Deposits held by private banks \$600
Foreign assets \$900	Currency in circulation \$1,900

# Central Bank Transaction and Money Supply

- When the central bank buys domestic bonds or foreign bonds, the transaction leads to equal increases of assets and liabilities. And the domestic money supply increases.
- If deposits at the central bank increase, commercial banks are usually able to use these additional funds to lend to customers, so amount of money in circulation increases.
- When the central bank sells domestic bonds or foreign bonds, the transaction leads to equal decreases of assets and liabilities. And the domestic money supply decreases.
- Monetary base ( $M_0$ ): currency in circulation plus bank cash reserves.
- Money supply ( $M_1$  or  $M_2$ ): domestic credit (B) plus foreign reserves (R).
- Money supply (central bank assets):  $M = B + R$  and  $\Delta M = \Delta B + \Delta R$



## Central Bank FX Intervention

- To maintain a currency peg, central banks trade foreign government bonds and other foreign assets in the foreign exchange markets.
- Foreign currency deposits and foreign government bonds are often substitutes: both are fairly liquid assets denominated in foreign currency.
- Quantities of both foreign currency deposits and foreign government bonds that are bought and sold influence the exchange rate.
- Because buying and selling of foreign bonds in the foreign exchange markets affects the domestic money supply, a central bank may want to offset this effect. This offsetting effect is called **sterilization**.
- If the central bank sells foreign bonds in the foreign exchange markets, it can buy domestic government bonds in bond markets, hoping to leave the amount of money in circulation unchanged. **In this case, the effect of the CB intervention in FX market is sterilized.**

# Central Bank FX Intervention and Money Supply

**TABLE 18-1 Effects of a \$100 Foreign Exchange Intervention: Summary**

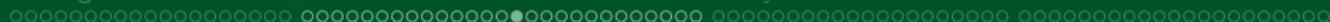
Domestic Central Bank's Action	Effect on Domestic Money Supply	Effect on Central Bank's Domestic Assets	Effect on Central Bank's Foreign Assets
Nonsterilized foreign exchange purchase	+\$100	0	+\$100
Sterilized foreign exchange purchase	0	-\$100	+\$100
Nonsterilized foreign exchange sale	-\$100	0	-\$100
Sterilized foreign exchange sale	0	+\$100	-\$100

Source: KOM (2018). If central banks are not sterilizing and the home country has a BoP surplus, any associated increase in the home central bank's foreign assets implies an increased home money supply; any associated decrease in a foreign central bank's claims on the home country implies a decreased foreign money supply.



# Balance of Payments and Money Supply

- A country's balance of payments (or official settlements balance) as net purchases of foreign assets by the home central bank less net purchases of domestic assets by foreign central banks.
- The balance of payment equals the current account plus capital account balances less the nonreserve component of the financial account balance, that is, the international payments gap that central banks must finance through their reserve transactions.
- A home balance of payments deficit means the country's net foreign reserve liabilities are increasing: Some combination of reserve sales by the home central bank and reserve purchases by foreign central banks is covering a home current plus capital account deficit not fully matched by net private sales of assets to foreigners, or a home current account surplus that falls short of net private purchases of financial claims on foreigners.



# The Role of Foreign Currency Reserves

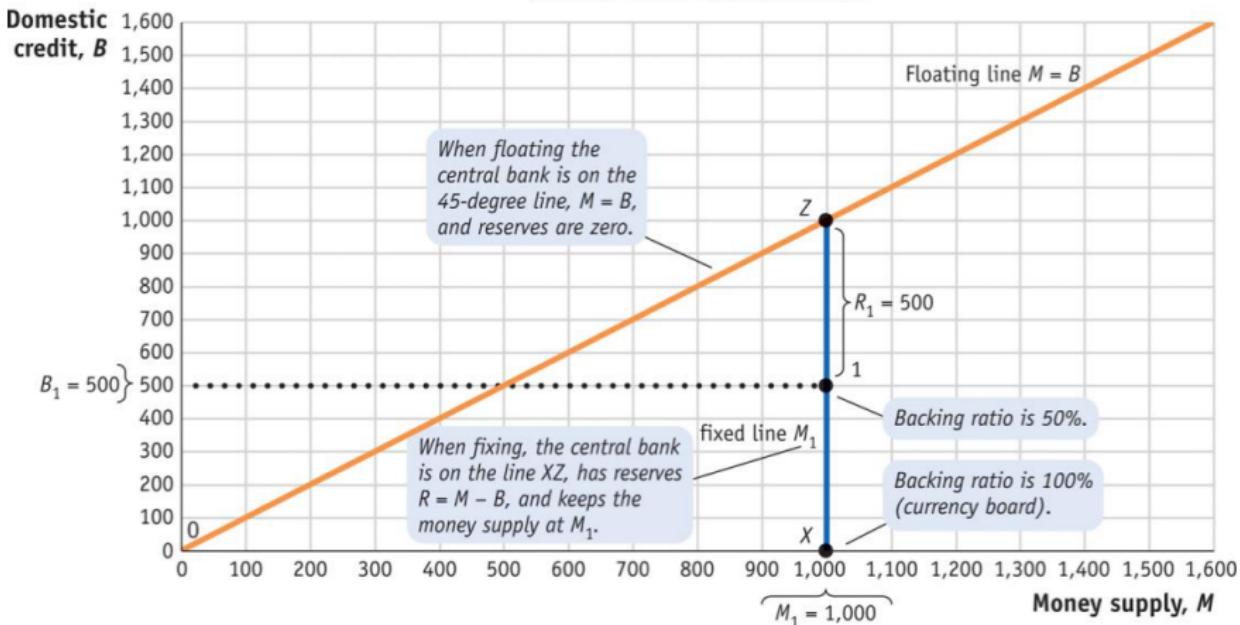
- To peg exchange rates, countries may adjust domestic credit and foreign reserves, but they never try to rely solely on domestic credit adjustments and zero reserves. In developing models, we assume that the exchange rate is fixed if and only if the central bank holds reserves; and the exchange rate is floating when the central bank has no reserves.
- In the very short run, FX market conditions can change rapidly that only direct intervention through reserve trading can maintain the peg. In addition, large adjustments to domestic credit may pose problems in an emerging market by causing instability in the bond market as the central bank buys or sells potentially large amounts of government bonds.
- Countries can also float and yet keep some reserves on hand. They may want reserves on hand for future emergencies, such as war; or as a savings buffer in the event of a sudden stop to financial flows; or so they can peg at some later date.

## Reserve Adjustment: How Peg Works?

- What level of reserves must the central bank have to maintain the peg?  
If the central bank can maintain a level of reserves, the peg will hold.  
Otherwise, the peg breaks.
- Start from central bank money supply equation:  $M = B + R$
- The foreign reserve equation becomes:  $R = M - B$
- In money market equilibrium:  $M_d = L(i)PY = M_s$
- Therefore, foreign reserves  $R = L(i)PY - B$ .
- If the CB bought more reserves than required, home money supply would expand and the home nominal interest rate would fall, domestic currency would depreciate, and the peg would break.
- To prevent this, the CB would need to intervene in the FX market to offset its initial purchase of reserves, to keep the supply of home currency constant, and to keep the exchange rate steady.

# Reserve Adjustment, Money Supply, Exchange Rate

Central Bank Balance Sheet



Source: FT (2017). The figure presents a simplified model of central bank operations.

## Reserve Adjustment Model: How Peg Works?

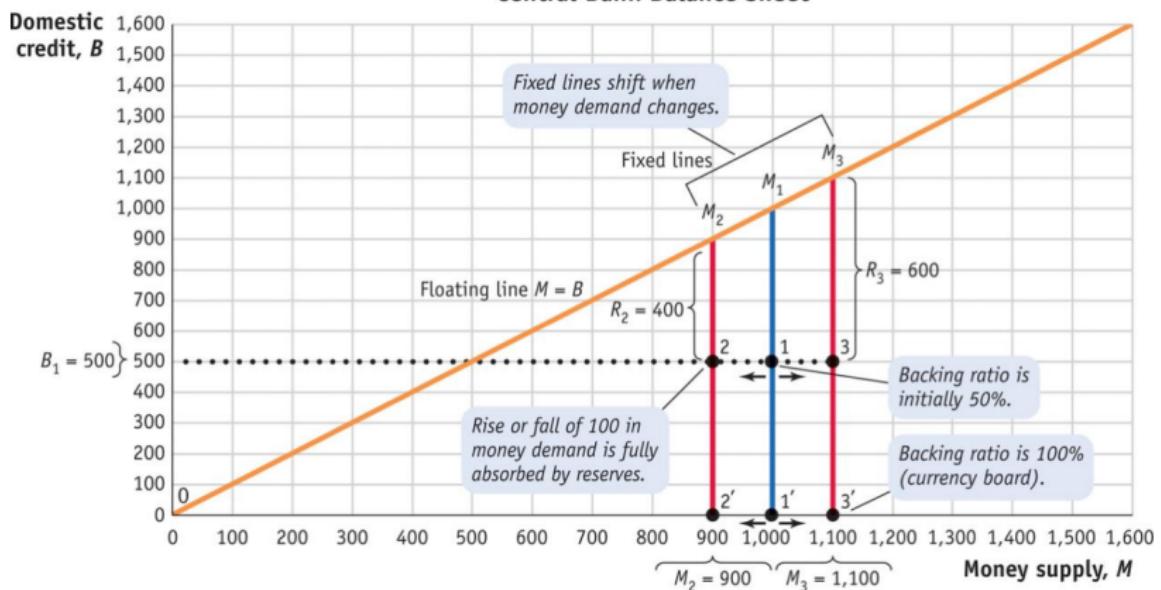
- The figure presents a simplified view of central bank operations. On the 45-degree line, reserves are at zero, and the money supply M equals domestic credit B. Variations in the money supply along this line would cause the exchange rate to float.
- There is a unique level of the money supply M1 (here assumed to be 1,000) that ensures the exchange rate is at its chosen fixed value.
- To fix the money supply at this level, the central bank must choose a mix of assets on its balance sheet that corresponds to points on line XZ, points at which domestic credit B is less than money supply M.
- At point Z, reserves would be at zero; at point X, reserves would be 100% of the money supply. Any point in between on XZ is a feasible choice. At point 1, for example, domestic credit is  $B_1 = 500$ , reserves are  $R_1 = 500$ , and  $B_1 + R_1 = M_1 = 1,000$ .

## Reserve Adjustment Model: Summary and Extensions

- To sum up: If the exchange rate is floating, the central bank balance sheet corresponds to a point on the 45-degree floating line; if the exchange rate is fixed, the central bank balance sheet corresponds to a point on the vertical fixed line.
- The ratio  $R/M$  is called **the backing ratio**, and it indicates the fraction of the money supply that is backed by reserves on the CB balance sheet.
- Highlight: A fixed exchange rate that always operates with reserves equal to 100% of the money supply is known as a **currency board system**.
- If money demand falls, interest rates tend to fall, leading to pressure for an exchange rate to depreciate. To prevent this, the CB must intervene and defend the peg by selling reserves, which lowers the money supply.
- The central bank's objective is to peg, keep the interest rate fixed, and to ensure that money supply equals money demand.

# Money Demand Shocks and Reserve Adjustment

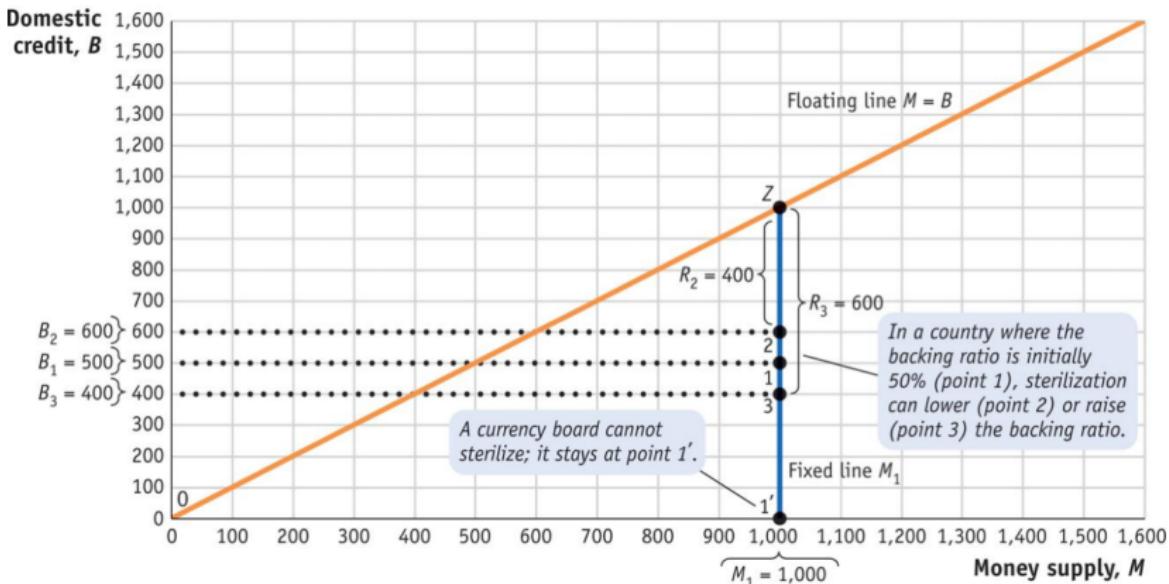
Central Bank Balance Sheet



Source: FT (2017). Defend the peg by selling reserves after a negative  $M_d$  shock ( $M_1 \downarrow \rightarrow M_2$ ). An opposite positive shock is shown by the move from point 1 to 3.

# Central Bank Sterilization and Reserve Adjustment

Central Bank Balance Sheet



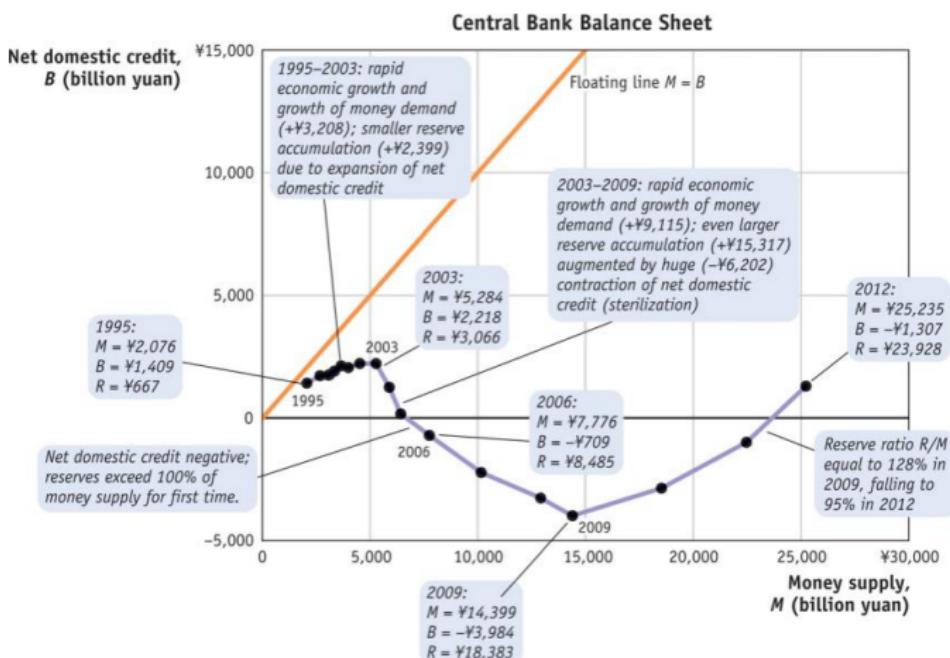
Source: FT (2017). Sterilization: Defend the peg by selling reserves to keep the money supply fixed at  $\bar{M} = 1000$  ( $R_1 \downarrow \rightarrow R_2 \Rightarrow M_s \downarrow < \bar{M}, B_1 \uparrow \rightarrow B_2 \Rightarrow M_s \uparrow \rightarrow \bar{M}$ ).



## Case Study: Sterilization in China 1995-2012 (w)

- With the global economy recovering from the 2008 financial crisis, China's trade surplus began to grow. Moreover, capital inflows increased significantly, owing to real investment opportunities in the high-growth economy and the expectation of renminbi revaluation.
- Strong demand for Yuan causes the rapid growth in foreign exchange reserves, which means an increase in the domestic money supply.
- By issuing sterilization bonds, central banks can borrow from domestic residents to buy more reserves. With sufficient borrowing, the central bank can end up with negative net domestic credit and reserves in excess of the money supply. This has happened in China in recent years.
- What borrowing to buy reserves achieves is not a change in monetary policy (money supply and interest rates are unchanged, given the peg) but an increase in the backing ratio. Sterilization is just a way to change the backing ratio, all else equal.

# Case Study: Sterilization in China 1995-2012



Source: FT (2017). 1995-2003:  $M_d \uparrow \Rightarrow R \uparrow \Rightarrow M_s \uparrow$ . 2003-2009 Sterilization:  $R \uparrow \& B \downarrow \Rightarrow M_s \downarrow$

# Case Study: Argentine after Tequila Crisis

## The Argentine Convertibility Plan Before the Tequila Crisis

- At the fixed exchange rate system in Argentina, the Convertibility Plan began in 1991 and ended in 2002. In this plan, a peg was maintained as one peso per dollar.
- The central bank balance sheet diagram helps us to see how a central bank manages a fixed exchange rate and what adjustments need to be made in response to a shock in money demand.
- Prior to the crisis, domestic credit was essentially unchanged, and reserves grew from \$8 billion to \$11 billion as money demand grew in line with rapid growth in incomes.
- After the crisis hit in December 1994, interest rate spreads widened, money demand fell, but domestic credit stood still and \$1 billion in reserves were lost.

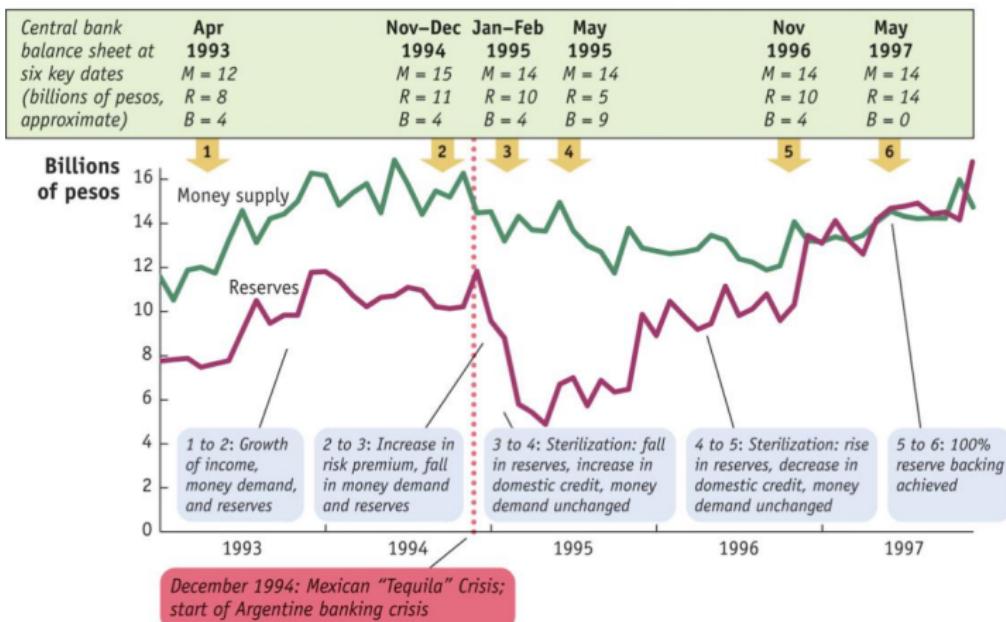
## Case Study: Argentine after Tequila Crisis

### The Argentine Convertibility Plan Before the Tequila Crisis

- In 1995 there was a run on banks and on the currency, and the central bank sterilized by expanding domestic credit by 5 billion pesos and selling \$5 billion of reserves as money demand remained constant. Reserves reached a low level of \$5 billion.
- By 1996 the crisis had passed and the central bank replenished its reserves, reversing the earlier sterilization. Domestic credit fell by 5 billion pesos and reserves increased by \$5 billion. Further sterilized purchases of \$4 billion of reserves brought the backing ratio up to 100% in 1997.

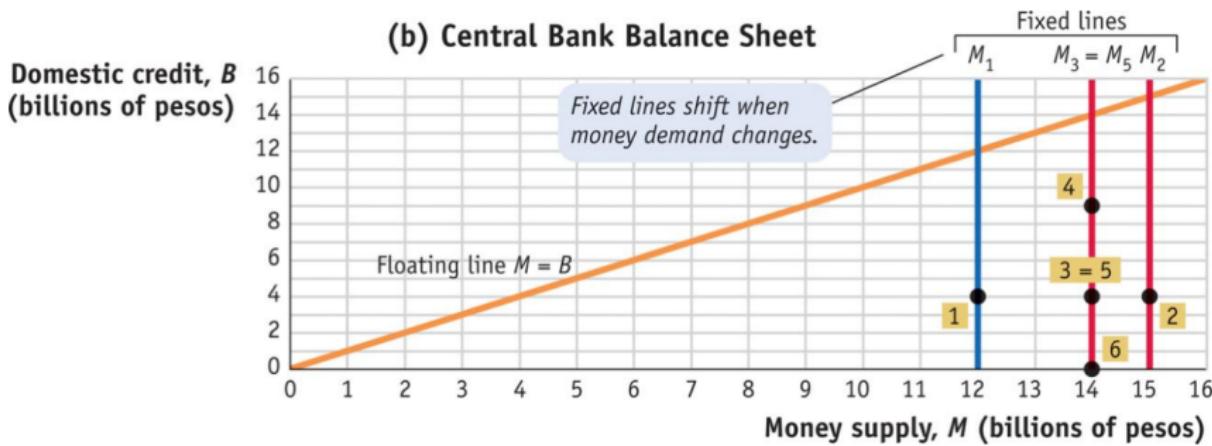
# Argentina's Central Bank Operations, 1993-1997

(a) Approximate Evolution of Money Supply and Reserves



Source: FT (2017). The chart shows six key dates around the Mexican Tequila crisis.

# Argentina's Central Bank Operations, 1993-1997



Source: FT (2017). Prior to the crisis, domestic credit was essentially unchanged, and reserves grew from \$8 billion to \$11 billion as money demand grew from  $M_1$  to  $M_2$  in line with rapid growth in incomes (move from point 1 to 2).



# Outline

- 1 FX Regimes
- 2 FX Intervention
- 3 Policy Trilemma
- 4 IS-LM-FX Model



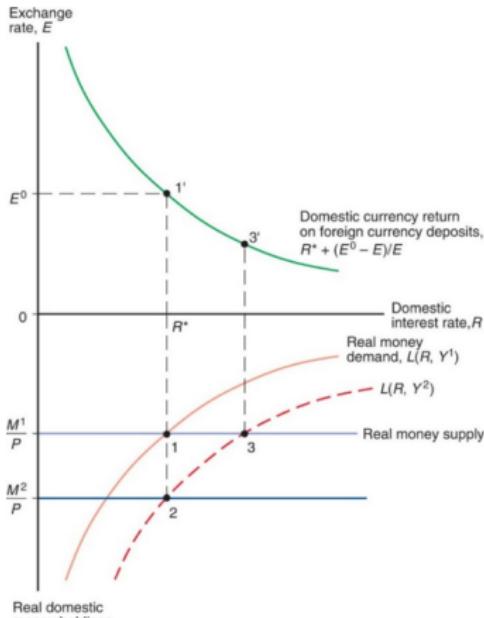
## Fixed Exchange Rate and Interest Rates

- To fix the exchange rate, a central bank influences the quantities supplied and demanded of currency by trading domestic and foreign assets, so that the exchange rate (the price of foreign currency in terms of domestic currency) stays constant.
- Foreign exchange markets are in equilibrium when interest rate parity holds:  $R_H \approx R_F + (E^e - E)/E$ . When the exchange rate is fixed at some level  $E_0$  and the market expects it to stay fixed at that level ( $E^e = E$ ).
- Under a fixed exchange rate system,  $R_H \approx R_F$ . Interest rate parity reduces to interest rate equality. Put differently, to fix the exchange rate, the central bank must trade foreign and domestic assets in the foreign exchange market until  $R_H \approx R_F$ .
- In the money market, the central bank adjusts the quantity of monetary assets until the domestic interest rate equals the foreign interest rate, given the level of average prices and real output:  $M/P = L(R_F, Y)$ .

# Fixed Exchange Rate and Money Market Equilibrium

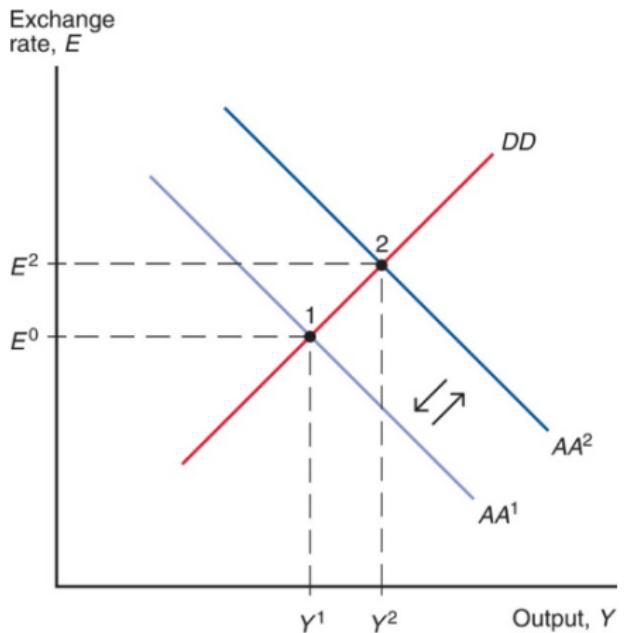
Under a fixed exchange rate, the CB responds to a positive  $M_d$  shock:

- ① Output rises:  $Y_1 \uparrow \rightarrow Y_2$
- ② Money demand rises  $M_d \uparrow$
- ③ Domestic interest rate is under pressure to rise  $R_H \uparrow \Rightarrow E \downarrow$
- ④ CB intervenes to avoid exchange rate appreciation ( $E \approx E_0$ )
- ⑤ CB will purchase foreign asset with home asset/currency  $M_s \uparrow$
- ⑥ Money supply will increase  $M_1 \uparrow \rightarrow M_2 \Rightarrow R_H \downarrow \Rightarrow E \uparrow \rightarrow E_0$



Source: KOM (2018).

# Fixed Exchange Rate and Ineffective Monetary Policy



Monetary expansion is ineffective under a fixed exchange rate: When the central bank buys and sells foreign assets to keep the exchange rate fixed and to maintain domestic interest rates equal to foreign interest rates, it is not able to adjust domestic interest rates to attain other goals. In particular, **monetary policy is ineffective (even counterproductive) in influencing output and employment.**

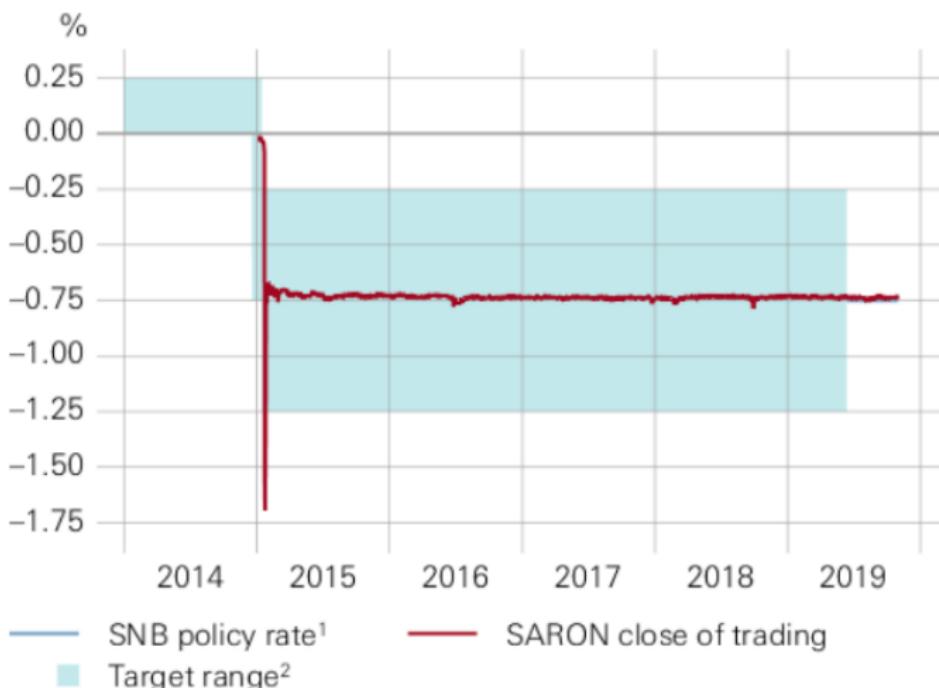
Source: KOM (2018).

## Case Study: Swiss Franc under "Attack" 2008-2015

An interesting case study by KOM (2018) pp. 214-215 : Can markets attack a strong currency? The case of Switzerland.

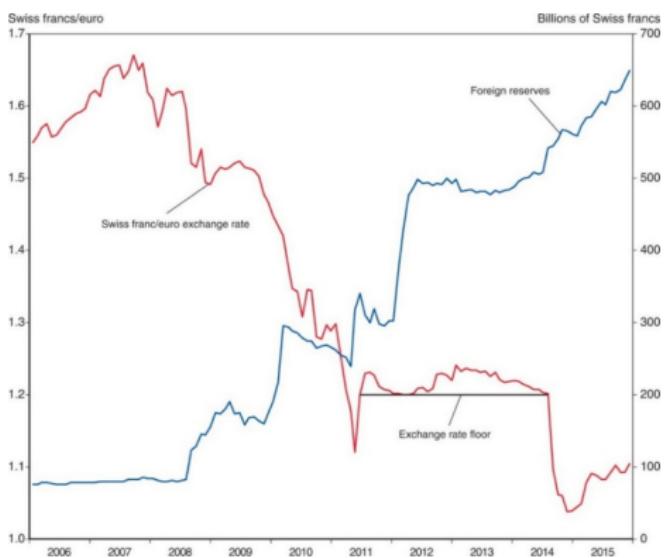
- The Swiss franc has traditionally been a "safe haven" currency: a currency investors buy when they fear instability in the global economy.
- When a simmering global financial crisis intensified in September 2008, the usual pattern repeated itself. Investors rushed to put their money into Switzerland.
- The Swiss franc price of euros fell sharply, while the reserve of the Swiss National Bank (SNB) elevated . Reserves rose because the SNB was intervening in the FX market, buying euros with francs in order to slow the franc's appreciation.
- Meanwhile, Swiss policy interest rates fell to negative values since 2015 and remains negative today.

## Case Study: Swiss Policy Interest Rate (<sub>w</sub>)



Source: SNB.

## Case Study: Swiss Exchange Rate and Foreign Reserves

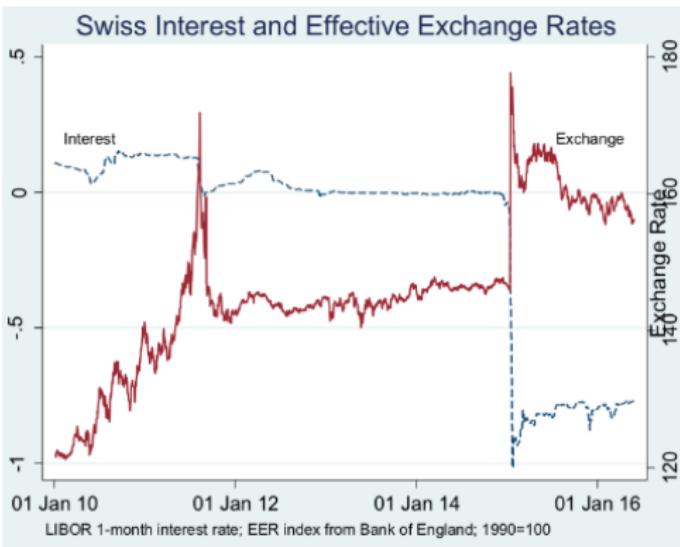


To protect its competitiveness and reduce deflationary pressures, the Swiss National Bank (SNB) intervened heavily to slow the Swiss franc's appreciation against the euro, setting a floor under the price of the euro in September 2011 and abandoning that floor in January 2015.

Source: KOM (2018).

## Case Study: Swiss Exchange Rate and Interest Rate (w)

Through several policy innovations such as quantitative easing, swap transactions, and most radically, the establishment of a floor on the euro/Swiss franc exchange rate on 6 September 2011, Swiss interest rates then fluctuated around zero until the dramatic events of mid-January 2015, when the SNB removed the exchange rate floor, lowered interest rates to substantially negative levels, and allowed the franc to appreciate.



Source: Hameed and Rose (2016).

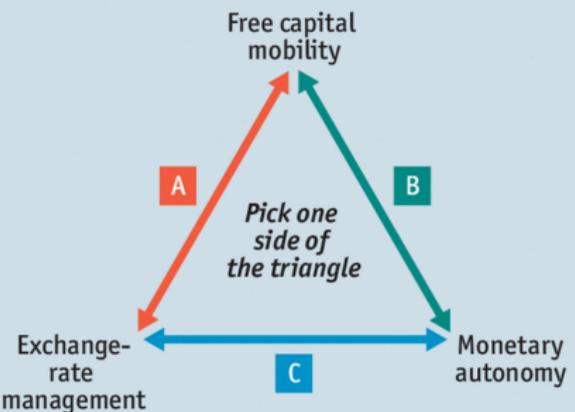


## Open Economy Policy Trilemma (w)

- Imagine a country that fixes its exchange rate against the American dollar and is open to foreign capital. If in order to bring down inflation its central bank sets interest rates above those set by the Federal Reserve, this would attract foreign capital in search of higher returns.
- That would in turn put upward pressure on the local currency. Eventually the peg with the dollar would break. Equally, if interest rates are cut below the federal funds rate, the exchange rate would fall as capital left to seek higher returns in America.
- Many emerging markets find that tying the exchange rate to a stable monetary anchor, such as the dollar, can be useful. It is a speedy way to show a serious intent to control inflation, for instance. Indeed this was also the reason why Britain tied itself to the D-mark in the early 1990s.
- The cost is a loss of monetary independence: interest-rate policy is subordinated to maintaining the peg and so cannot be used flexibly.

## Open-Economy Policy Trilemma (w)

## The policy trilemma



Economist.com

Source: The Economist (2016).

**Impossible Trinity:** A country cannot achieve more than two items from the following list:

- ① Exchange rate stability.
  - ② Monetary policy oriented toward domestic goals.
  - ③ Freedom of international capital movements.

*Three out of three ain't possible,  
but two out of three ain't bad.*

## Policy Trilemma for Open Economies

The vertices of an impossible triangle show three features that policy makers in open economies would prefer their monetary system to achieve. Unfortunately, at most two can coexist. Each of the three policy regime labels along the triangle's edges (floating exchange rate, fixed exchange rate, financial controls) is consistent with the two goals that it lies between in the diagram.

- ① A country that fixes its currency's exchange rate while allowing free capital movements gives up control over domestic monetary policy.
- ② A country that fixes its exchange rate can have control over domestic monetary policy if it restricts international financial flows so that interest parity  $R_H \approx R_F$  need not hold.
- ③ A country can allow international capital to flow freely and have control over domestic monetary policy if it allows the exchange rate to float.



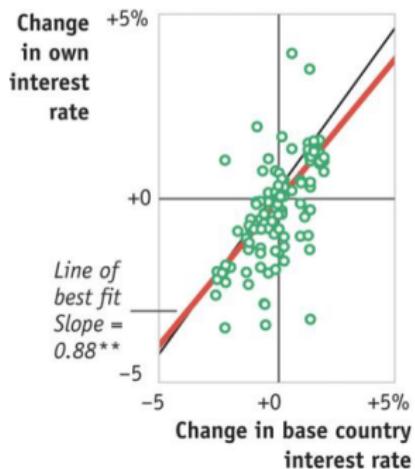
## Open-Economy Impossible Trinity: Cases

Impossible Trinity: A country must choose two among free capital mobility, exchange-rate management and an independent monetary policy.

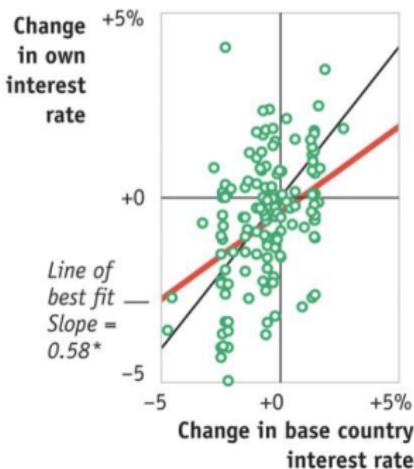
- China's trilemma: A country that wishes to fix the value of its currency and also have an interest-rate policy that is free from outside influence cannot allow capital to flow freely across its borders. China wants eventually to liberalize its capital account as a stepping stone to a modern financial system. To do so, it will have to live with a volatile yuan.
- Britain's trilemma: The exchange rate was fixed to D-mark but the country is open to cross-border capital flows, it cannot have an independent monetary policy. Britain had been forced to abandon its currency peg with Germany, in 1992, because it was in recession even as Germany enjoyed a boom.
- If a nation favors capital mobility and monetary autonomy, it has to allow its currency to float, a combination adopted by most modern economies.

# Open-Economy Policy Trilemma: Empirical Evidence

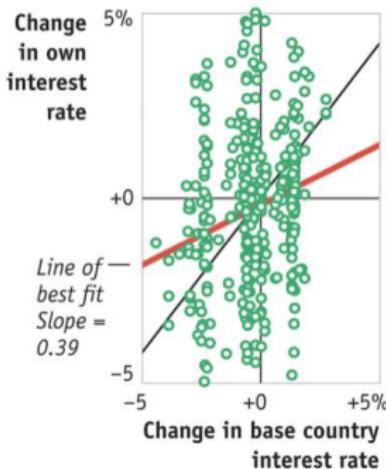
(a) Open and Pegged



(b) Open and Not Pegged



(c) Closed



Source: FT (2017). Panel (a) shows that an open peg must sacrifice monetary policy autonomy. Panels (b) (c) show that either floating exchange rate or capital control permits home interest rates to move more independently of the base country.

## Fixed Exchange Rate: Currency Board System (w)

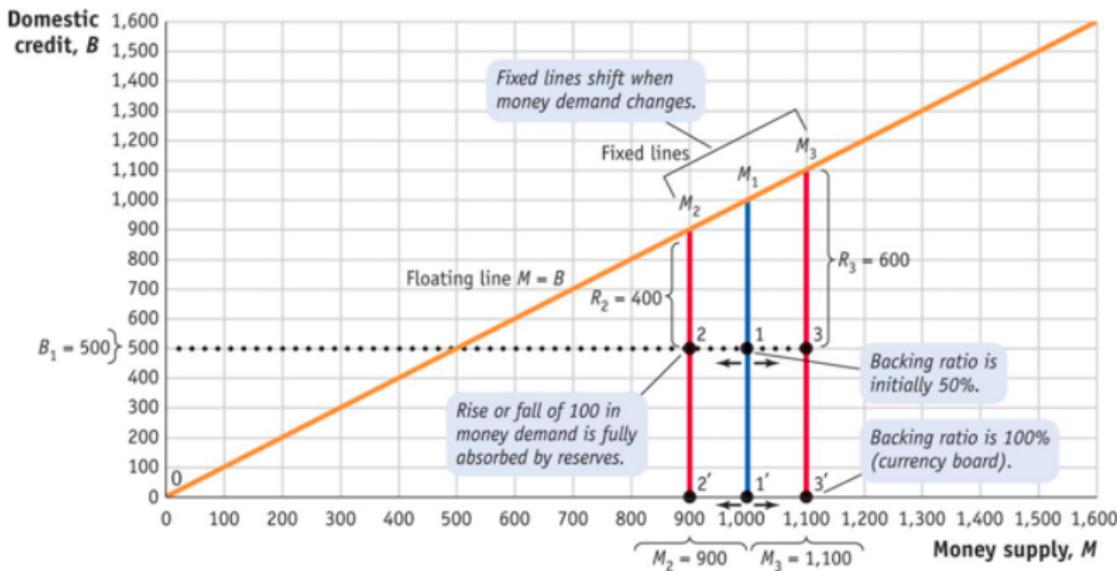
- A currency board is an exchange rate regime based on the full convertibility of a local currency into a reserve one, by a fixed exchange rate and 100 percent coverage of the monetary supply backed up with foreign currency reserves. Therefore, in the currency board system there can be no fiduciary issuing of money.
- For currency boards to work properly, there has to be a long-term commitment to the system and automatic currency convertibility. This includes, but is not limited to, a limitation on printing new money, since this would affect the exchange rate.
- The first currency boards appeared during the nineteenth century in Britain and France's colonies. The principle of the currency board was created in 1844 by the British Bank Charter Act.
- The classical example of currency board system is Hong Kong dollar against the U.S. dollar.



## Fixed Exchange Rate: Currency Board Arrangement

- A fixed exchange rate that always operates with reserves equal to 100% of the money supply ( $M = R$  and  $B = 0$ ) is known as a currency board system. All foreign reserves and no domestic credit. No independent monetary policy at disposal for achieving internal macroeconomic goals.
- A currency board keeps reserves at a maximum 100% of its total asset holding, so the central bank can cope with any shock to money demand without running out of reserves.
- Currency boards are considered a hard peg because their high backing ratio ought to confer on them greater resilience in the face of money demand shocks or speculative attacks.
- A backing ratio ( $R/M$ ) of 100% is maintained at all times by a currency board. The level of reserves are equal to money supply and equal to money demand.

# Fixed Exchange Rate: Currency Board Operation



Source: FT (2017). In a currency board system, a country maintaining 100% reserves  $M=R$  will be on the horizontal axis with zero domestic credit  $B=0$ .

It adjusts to money demand shocks by moving from point 1' to points 2' or 3'.



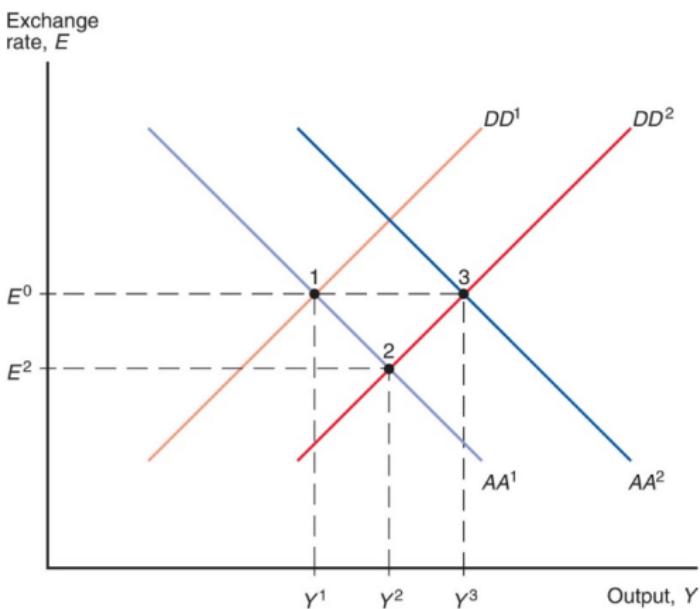
## Fixed Exchange Rate and Fiscal Policy

- Temporary changes in fiscal policy are very effective in influencing output and employment in the short run. The rise in aggregate demand and output due to expansionary fiscal policy raises demand for real monetary assets, putting upward pressure on interest rates and currency value.
- To prevent an appreciation of the domestic currency, the central bank must buy foreign assets, thereby increasing the money supply and decreasing interest rates.
- When the exchange rate is fixed and prices are sticky, there is no real appreciation of the value of domestic products in the short run.
- However, when output is above its potential level, wages and prices tend to rise in the long run. A rising price level makes domestic products more expensive (a real appreciation). Aggregate demand and output decrease as prices rise: Prices tend to rise until employment, aggregate demand, and output fall to their potential or natural levels ( $P \uparrow \Rightarrow AA - \& DD -$ ).

# Fixed Exchange Rate and Fiscal Policy: Short Run Effects

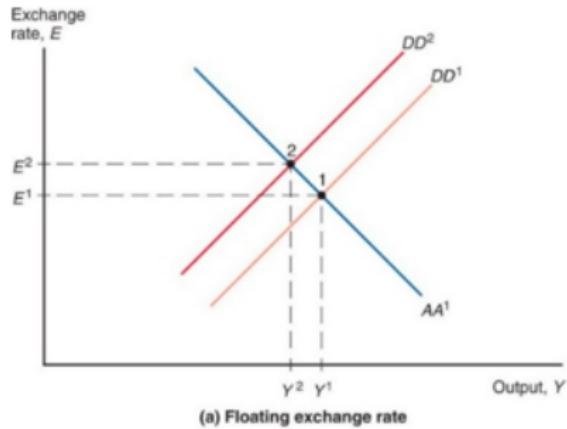
The figure shows the effects of a fiscal expansion under a fixed rate:

- ① Fiscal expansion ( $G \uparrow & T \downarrow$ ):  $AD+ \Rightarrow DD+ \Rightarrow Y_1 \uparrow \rightarrow Y_2$
- ② Money demand rises  $M_d \uparrow$
- ③ Domestic interest rate and currency is under pressure  $R_H \uparrow \Rightarrow E_0 \downarrow \rightarrow E_2$
- ④ CB intervenes to buy foreign asset with home asset  $M_s \uparrow \Rightarrow R_H \downarrow \Rightarrow E_2 \uparrow$
- ⑤ Output will rise further  $Y_2 \uparrow \Rightarrow Y_3 \& E_2 \uparrow \rightarrow E_0$

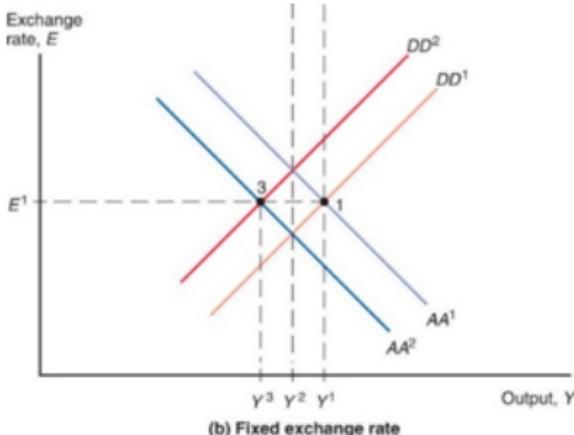


Source: KOM (2018).

# Floating Exchange Rate: Automatic Stabilizer



(a) Floating exchange rate



(b) Fixed exchange rate

Source: KOM (2018). The response to a fall in export demand (a left shift of  $DD_1 \rightarrow DD_2$ ) differs under floating and fixed exchange rates. With a floating rate, output falls only to  $Y_2$  as the currency's depreciation shifts demand back toward domestic goods. With the exchange rate fixed, output falls all the way to  $Y_3$  as the central bank reduces the money supply (a shift of  $AA_1$  to  $AA_2$  is counterproductive).

## Milton Friedman on Fixed Exchange Rate Regime

*Either extreme: a fixed exchange rate through a currency board, but no central bank, or a central bank plus truly floating exchange rates; either of those is a tenable arrangement. But a pegged exchange rate with a central bank is a recipe for trouble.*

Milton Friedman, 1998

*How many more fiascoes will it take before responsible people are finally convinced that a system of pegged exchange rates is not a satisfactory financial arrangement for a group of large countries with independent political systems and independent national policies?*

Milton Friedman, 1992



# Outline

- 1 FX Regimes
- 2 FX Intervention
- 3 Policy Trilemma
- 4 IS-LM-FX Model



## IS-LM: Introduction and Motivation

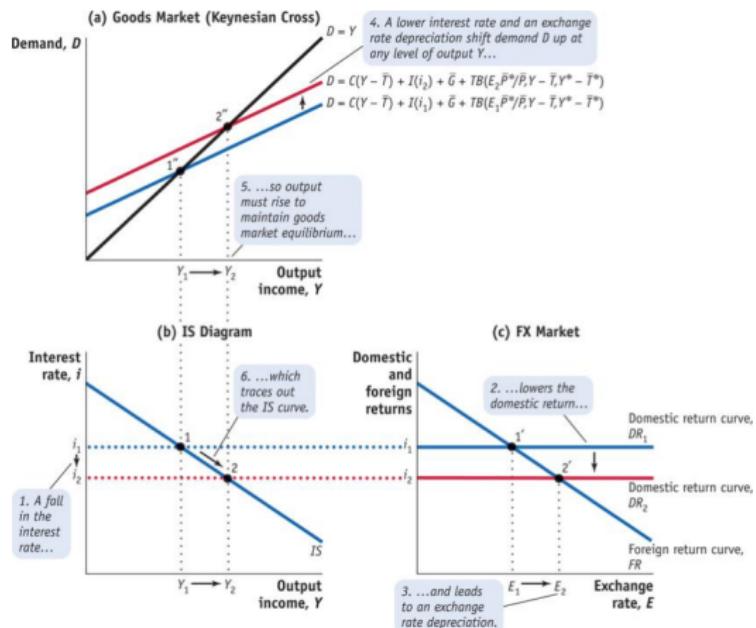
- The IS-LM model is the cornerstone of Keynesian Economics. The model was developed by John Hicks in the 1930s as an interpretation of John Maynard Keynes's seminal work, *The General Theory of Employment, Interest and Money*, and is based on an analysis of equilibrium in the goods and money markets, supposing that the price level is fixed.
- Economists can interpret the IS-LM model in two distinct ways: first, as a theory of national income determination, supposing that the price level is fixed; second, as a theory of aggregate demand and so as part of an aggregate demand-aggregate supply model.
- IS means investment and saving; LM stands for liquidity and money.
- IS characterizes the output market equilibrium and LM features money market equilibrium. **The IS-LM model shows the relation between interest rate and output when two markets are simultaneously in equilibrium.**

# IS-FX Equilibrium: Derivation

The figure derives the IS curve:

- ① Keynesian cross  $AD = AS$
- ② Interest rate:  $i_1 \downarrow \rightarrow i_2$
- ③ Investment:  $I \uparrow \rightarrow AD \uparrow$
- ④  $Y = C + I(i) + G + TB$
- ⑤ Output:  $Y_1 \uparrow \rightarrow Y_2$
- ⑥ Exchange rate:  $E_1 \uparrow \rightarrow E_2$

Source: FT (2017)



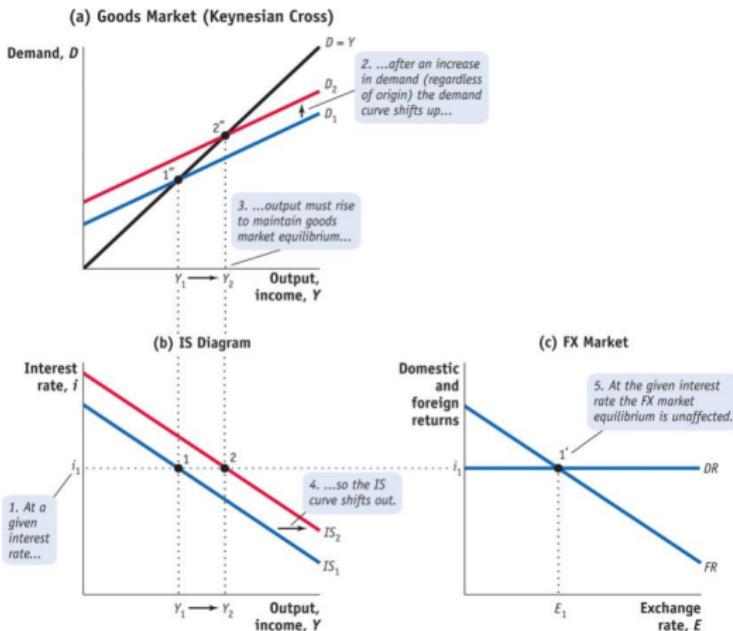
# IS Curve Factors: Summary

For a given home interest rate,  
 $IS(C, I, G, T, i_F, RE) + if$

- ①  $C, I, G, TB \uparrow$  or  $T \downarrow$
- ② Foreign interest rate  $i_F \uparrow$
- ③ Expected future  $E^e \uparrow$
- ④  $RE = E * P_F / P_H \uparrow$

The opposite changes lead to a decrease in demand and shift the demand curve down and the IS curve to the left.

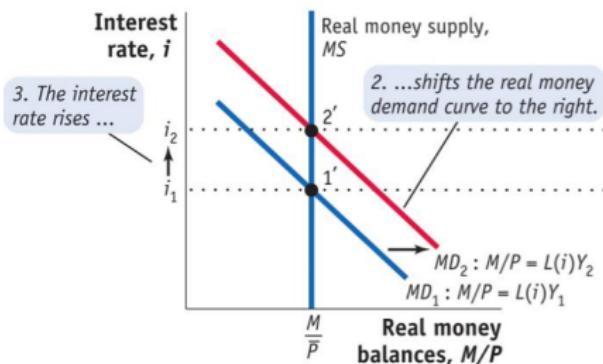
Note: " + " means shifting to the right.



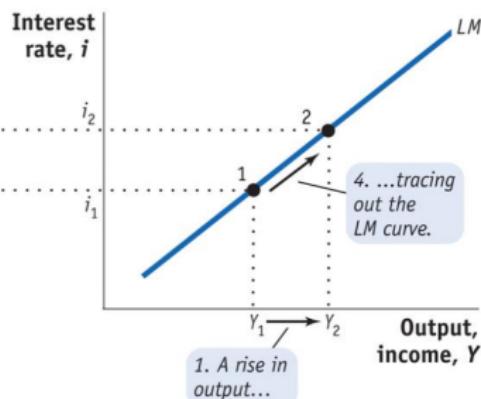
Source: FT (2017)

# LM Derivation: Money Market Equilibrium

(a) Money Market



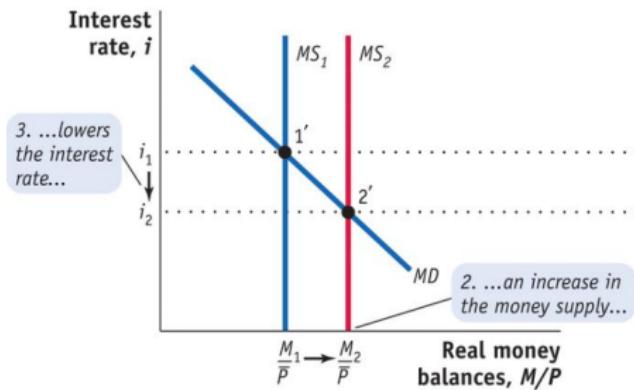
(b) LM Diagram



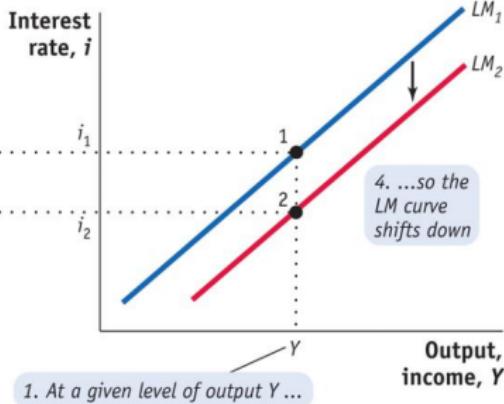
Source: FT (2017). The relationship between the interest rate and income is known as the LM curve and is depicted in panel (b). The LM curve is upward-sloping: When the output level rises from  $Y_1$  to  $Y_2$ , the interest rate rises from  $i_1$  to  $i_2$ . The LM curve describes all combinations of  $i$  and  $Y$  that are consistent with money market equilibrium in panel (a). Contrary to IS, the causal link in LM is from  $Y$  to  $i$ .

## LM Curve Factors: Summary

#### (a) Money Market



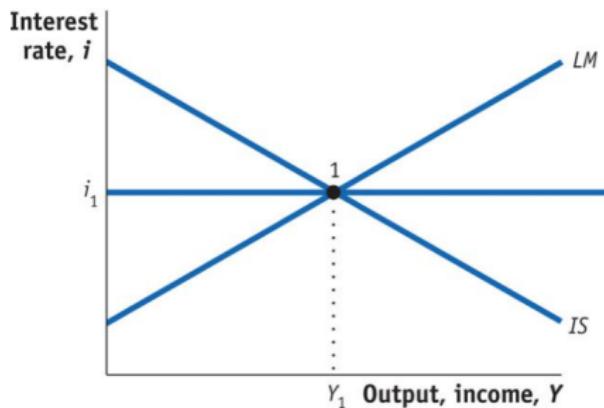
**(b) LM Diagram**



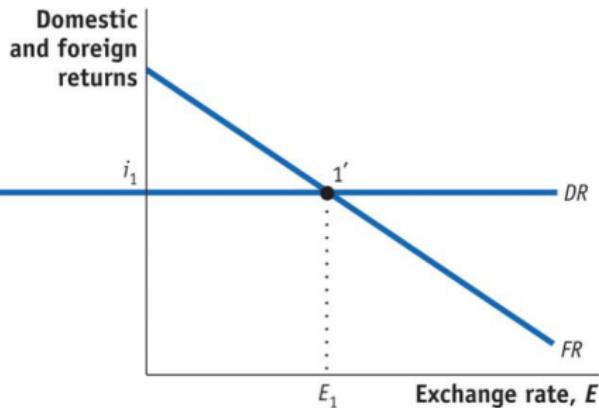
Source: FT (2017). In the money market, shown in panel (a), we hold fixed the level of real income or output,  $Y$ , and hence real money demand  $M_d$ . All else equal, we show the effect of an increase in money supply. This moves the equilibrium from 1' to 2', lowering the interest rate from  $i_1$  to  $i_2$ . All else equal, for a given  $Y$  and  $P$ ,  $M_s \uparrow \rightarrow LM+$  and  $M_d \downarrow \rightarrow LM+$  (money affects interest rate in equilibrium).

# IS-LM-FX Model: Synthesis

(a) IS-LM Diagram



(b) FX Market



Source: FT (2017). In panel (a), the IS and LM curves are both drawn. The output and forex markets are in equilibrium when the economy is on the IS curve. The money market is in equilibrium when the economy is on the LM curve. All markets are in equilibrium if and only if the economy is at point 1. In panel (b), the forex market is in equilibrium at point 1' where the foreign return equals domestic return.



## Exchange Rate Regimes and Policies: Short Run Analysis

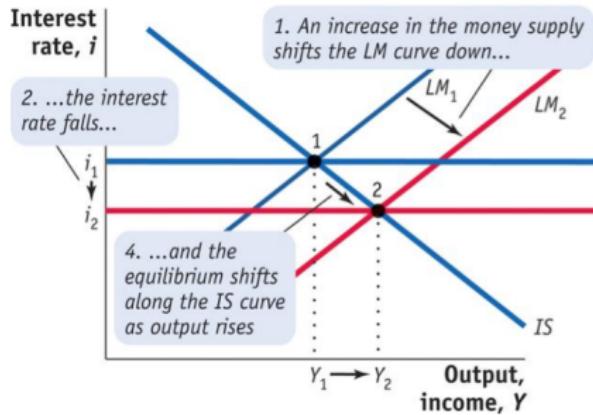
Apply IS-LM-FX to two main policy actions: changes in monetary policy, via changes in the money supply, and changes in fiscal policy, via changes in government spending or taxes. The key assumptions are as follows:

- ① The economy starts in long-run equilibrium. We then consider policy changes in the home economy, assuming that conditions in the foreign economy are unchanged.
- ② The home economy is subject to the usual short-run assumption of a sticky price level at home and abroad.
- ③ Furthermore, we assume that the forex market operates freely and is unrestricted by capital controls and that the exchange rate is determined by market forces.

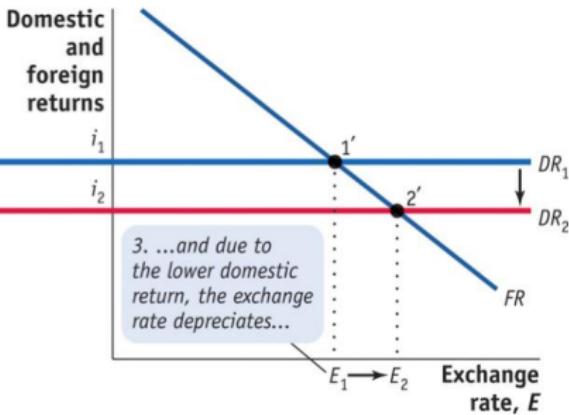
The mechanism behind the IS-LM-FX is identical to the DD-AA Model.

# Monetary Policy under Floating Exchange Rate

(a) IS-LM Diagram



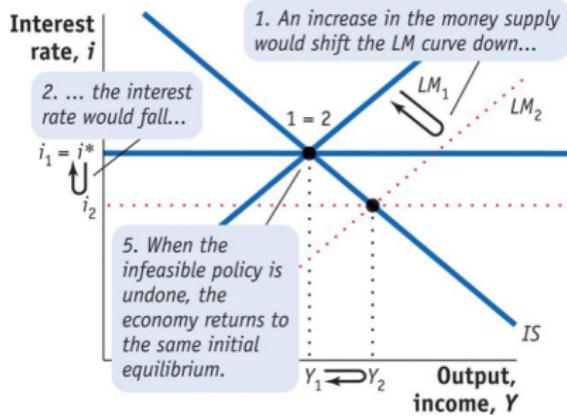
(b) FX Market



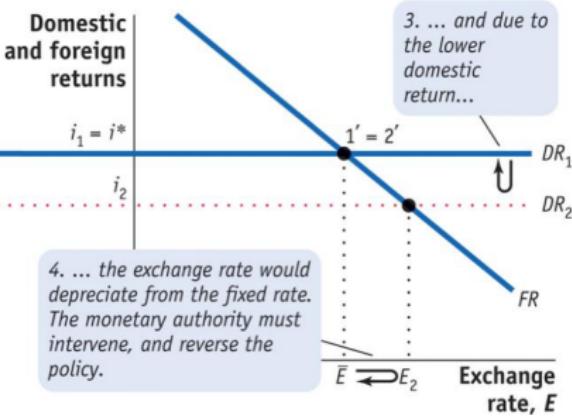
Source: FT (2017). A temporary monetary expansion under floating exchange rates is effective in combating economic downturns by boosting output. It raises output at home, lowers the interest rate, and causes a depreciation of the exchange rate. What happens to the trade balance cannot be predicted with certainty.

# Monetary Policy under Fixed Exchange Rate

(a) IS-LM Diagram

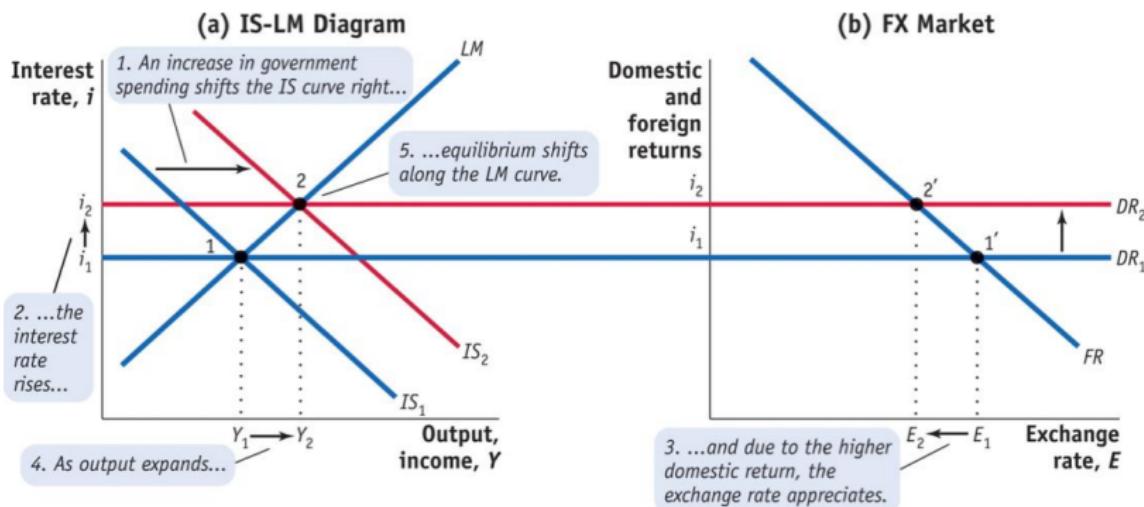


(b) FX Market



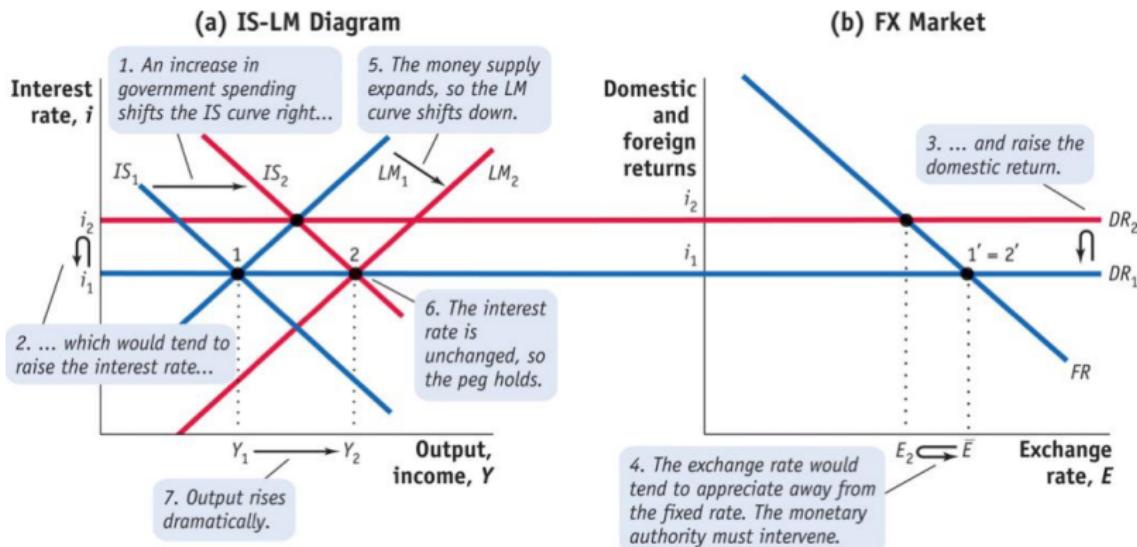
Source: FT (2017). Monetary policy under fixed exchange rates is impossible to undertake. Fixing the exchange rate means giving up monetary policy autonomy. Countries cannot simultaneously allow capital mobility, maintain fixed exchange rates, and pursue an autonomous monetary policy. Open-economy policy trilemma.

# Fiscal Policy under Floating Exchange Rate



Source: FT (2017). An expansion of fiscal policy under floating exchange rates might be temporarily effective. It raises output, raises the interest rate (crowds out investment), and causes a currency appreciation (decreases the trade balance). Hence, it limits the rise in output to less than an increase in government spending.

# Fiscal Policy under Fixed Exchange Rate



Source: FT (2017). A temporary expansion of fiscal policy under fixed exchange rates raises output at home more than the case under floating rates.

# IS-LM-FX Summary: Macro Policy Effects

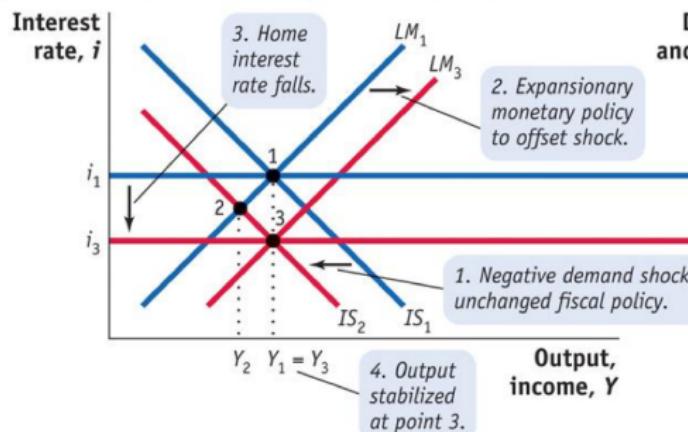
Responses to Policy Shocks in the IS-LM-FX Model

Exchange Rate Regime	Policy	Impact on:				
		$i$	$E$	$I$	$TB$	$Y$
Floating	Monetary expansion	↓	↑	↑	↑?	↑
	Fiscal expansion	↑	↓	↓	↓	↑
Fixed	Monetary expansion	0	0	0	0	0
	Fiscal expansion	0	0	0	↓	↑

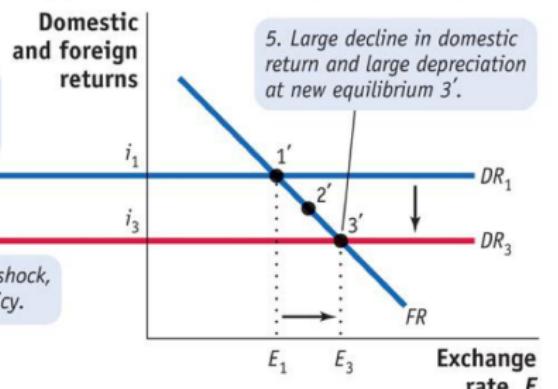
Source: FT (2017). Stabilization policy: Authorities can change policies to try to keep the economy at or near its full-employment level of output. If the economy is hit by a temporary adverse shock, policy makers could use expansionary monetary and fiscal policies to prevent a deep recession. Conversely, if the economy is pushed by a shock above its full employment level, contractionary policies could tame the boom.

# Policy Application: Output Stabilization under Float

(a) IS-LM Diagram: Floating + Monetary Expansion



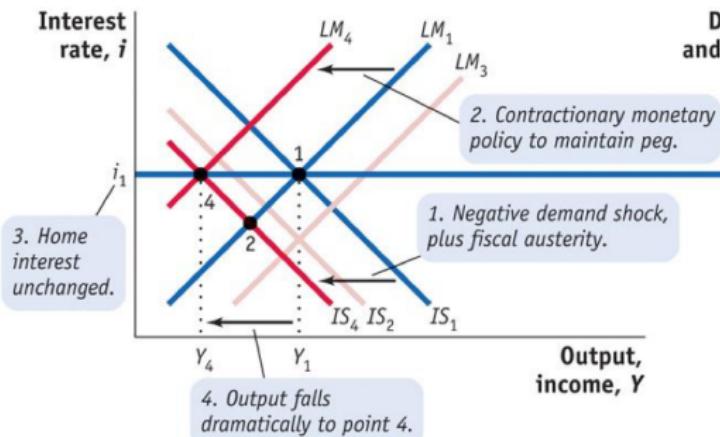
(b) FX Market: Floating + Monetary Expansion



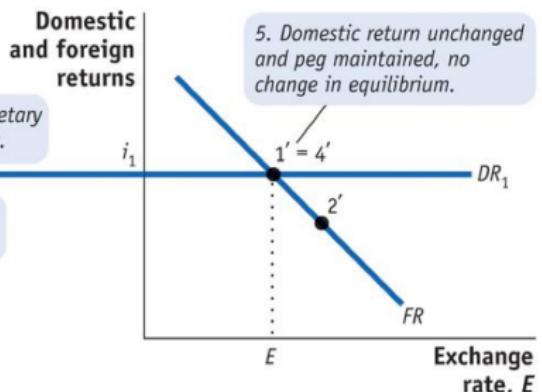
Source: FT (2017). With a floating exchange rate, the central bank can respond to a negative demand shock by stabilizing output at its former level via a monetary policy expansion, increasing the money, lowering interest rate and currency value.

# Policy Application: Austerity under Fixed Rate

(c) IS-LM Diagram: Fixed + Fiscal Contraction



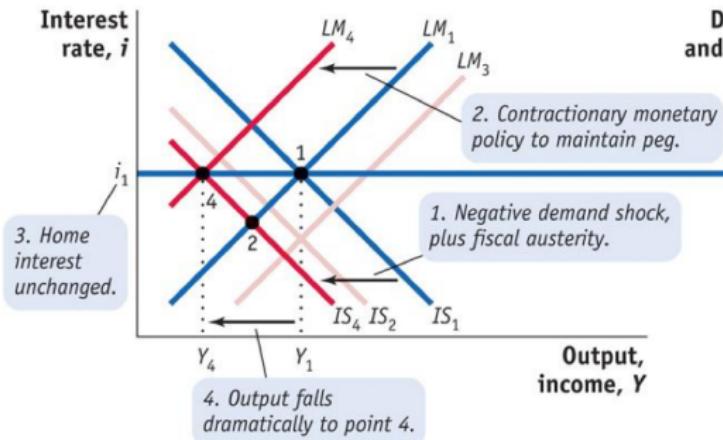
(d) FX Market: Fixed + Fiscal Contraction



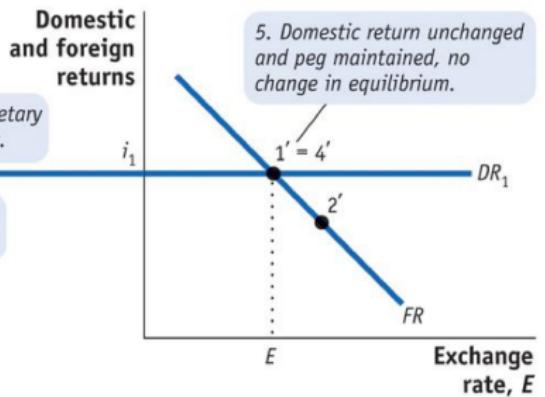
Source: FT (2017). Panels (c) and (d) explore what happens when the exchange rate is fixed and the government pursues austerity. Negative global demand shock causes the  $IS$  curve to shift from  $IS_1 \rightarrow IS_2$ . Without further action, output and interest rates would fall and the exchange rate would tend to depreciate.

# Policy Application: Austerity under Fixed Rate

(c) IS-LM Diagram: Fixed + Fiscal Contraction



(d) FX Market: Fixed + Fiscal Contraction

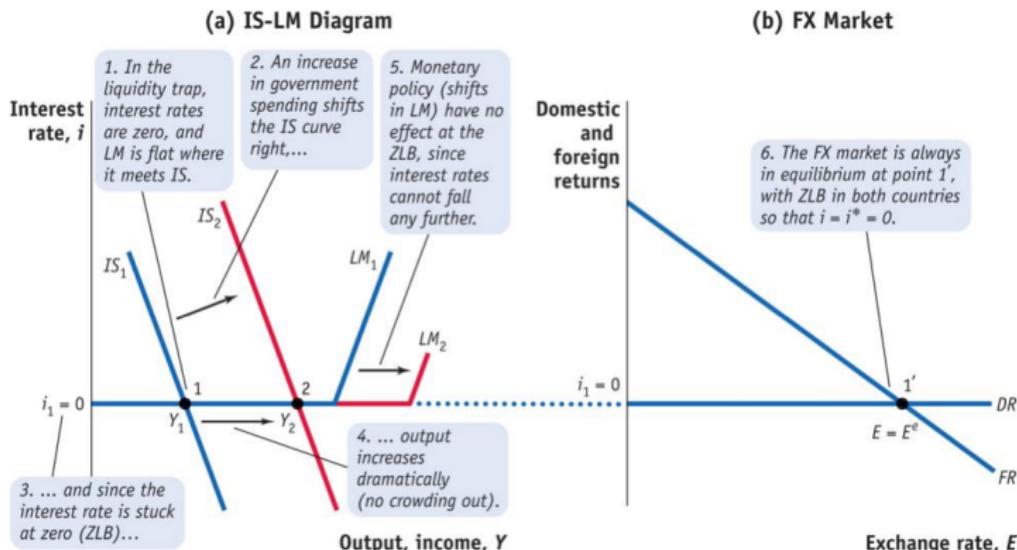


Source: FT (2017). With austerity policy, government cuts spending ( $IS_2 \rightarrow IS_4$ ). If the CB does nothing, the interest rate would fall and the exchange rate would depreciate. To maintain the peg, the CB must engage in contractionary monetary policy ( $M_s \downarrow \rightarrow i \uparrow \& Y \downarrow$ ), causing the  $LM$  shift to point 4 ( $Y_4 < Y_2 < Y_1$ ).

## Liquidity Trap in the IS-LM Model (w)

- A liquidity trap is a situation, described in Keynesian economics, in which, "after the rate of interest has fallen to a certain level, liquidity preference may become virtually absolute in the sense that almost everyone prefers holding cash rather than holding a debt which yields so low a rate of interest."
- A liquidity trap is caused when people hoard cash because they expect an adverse event such as deflation, insufficient aggregate demand, or war. According to mainstream theory, among the characteristics of a liquidity trap are interest rates that are close to zero and changes in the money supply that fail to translate into changes in the price level.
- Investors hoard the increased money instead of spending it because the opportunity cost of holding cash—the forgone earnings from interest—is zero when the nominal interest rate is zero.
- The LM curve becomes horizontal in a liquidity trap.

# Macroeconomic Policies in the Liquidity Trap



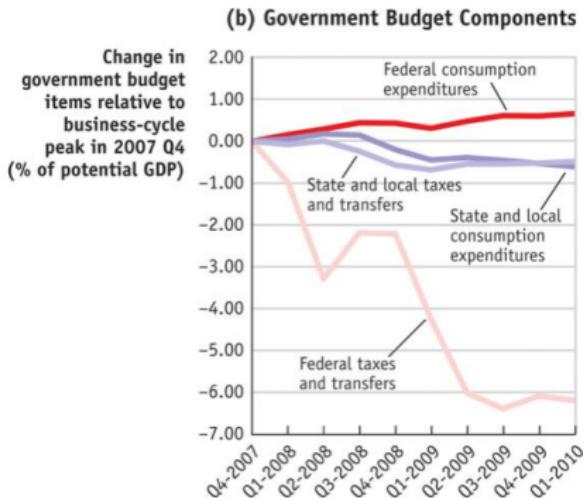
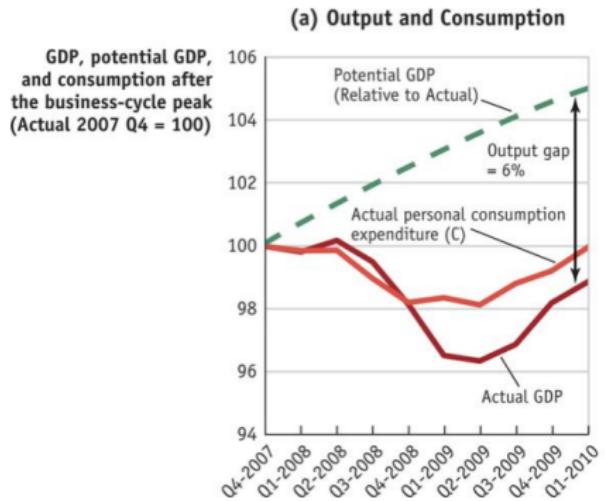
Source: FT (2017). In a liquidity trap, monetary policy is impotent because the interest rate cannot be lowered any further. However, fiscal policy may be very effective: the economy is still at the ZLB with a higher level of output (1 → 2).

## Case Study: U.S. Fiscal Policy in the Great Recession

### U.S. Fiscal Policy in the Great Recession: Didn't Work or Wasn't Tried?

- In the U.S. economic slump of 2008-2010, output had fallen 6% below the estimate of potential level of GDP by the first quarter of 2009. This was the worst U.S. recession since the 1930s. Policy responses included automatic fiscal expansion (increases in spending and reductions in taxes), plus an additional discretionary stimulus.
- The tax part of the stimulus appeared to do very little: Significant reductions in taxes seen were insufficient to prop up consumption expenditure, as consumers saved the extra disposable income.
- And on the government spending side, there was no stimulus at all in the aggregate: Increases in federal government expenditure were fully offset by cuts in state and local government expenditure.

## Case Study: U.S. Fiscal Policy in the Great Recession



Source: FT (2017). Significant reductions in taxes were insufficient to prop up consumption, as consumers saved the extra disposable income. Increases in federal government expenditure were fully offset by cuts in state and local expenditure.



## References

- [1] Feenstra and Taylor (2017), International Economics. 4e. Worth.
- [2] Krugman, Obstfeld and Melitz (2018), International Economics - Theory and Policy. 11e. Pearson.
- [3] IMF Annual Reports on Exchange Arrangements and Exchange Restrictions. 2017-2019. (w)
- [4] Christopher J. Neely (2017), "Chinese Foreign Exchange Reserves, Policy Choices, and the U.S. Economy," Federal Reserve Bank of St. Louis Review, Second Quarter, pp. 207-31. <https://doi.org/10.20955/r.2017.207-231>
- [5] Paul Krugman (2013), Monetary Policy in a Liquidity Trap. NY Times.  
<https://krugman.blogs.nytimes.com/2013/04/11/monetary-policy-in-a-liquidity-trap/>