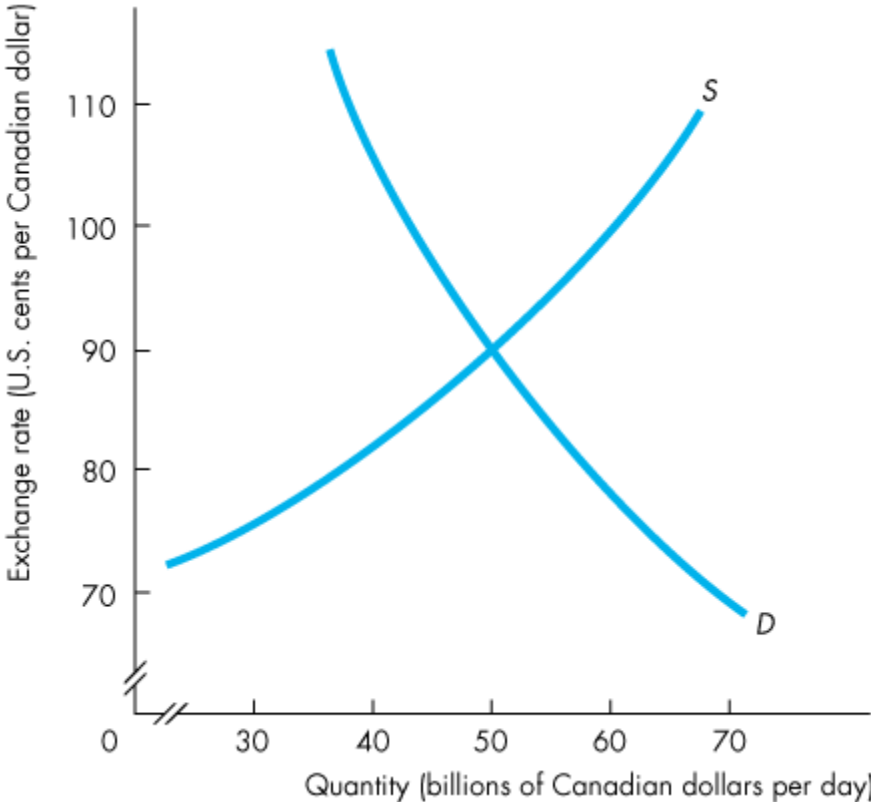


**Recall:**  
**Shifts in the demand and supply curves**



## Fundamentals, Expectations, and Arbitrage

The exchange rate changes when it is *expected to change*.

But, what causes this change in expectation?

**Arbitrage** is the practice of buying in one market and selling for a higher price in another market.

Arbitrage activities can lead to:

- Law of one price
- Interest rate parity
- Purchasing power parity (PPP)

## The Law of One Price

states that if an item is traded in more than one place, the price will be the same in all locations.

## Interest Rate Parity

Suppose that bank deposit earns 1% a year in Tokyo and 3% a year in Toronto.

Why are there differences in rates of return across countries?

- .

For Japanese investors to earn 3% in Toronto, they must first convert their Yen (¥) to C\$.

One year later, convert C\$ back to Yen.

Today's exchange rate:  $¥100 = \text{C\$}1$ .

¥100 gives C\$1, deposit this in Toronto and obtain C\$1.03 one year later.

But 1-year later exchange rate:  $¥98 = \text{C\$}1$ .                      so C\$1.03 gives ¥101

Thus, rate of return that you get in Toronto, after accounting for the depreciation of C\$, is 1% .

Rate of return in Tokyo = [Rate of return in Toronto] + [expected depreciation or appreciation of C\$]

Rate of return in Tokyo = 3% + [-2%]

**Interest rate parity** means *equal interest rates* when exchange rate changes are taken into account.

Market forces achieve interest rate parity very quickly.

## Purchasing Power Parity (PPP)

Suppose a camera costs ¥10,000 in Tokyo and \$100 in Toronto.

If the ex rate is ¥100=C\$1, the two monies have the same value.

You can buy the camera in either Tokyo or Toronto for the same price. You can express that price as either ¥10,000 or \$100, but the price is the same in the two currencies.

- This situation is called PPP which means *equal value of money*.
- In this example, ¥100=C\$1 is the PPP exchange rate.

PPP: One dollar should be able to buy the SAME quantity of goods in all countries.

If PPP does not prevail, powerful arbitrage forces go to work (buy in the market where it is low and sell in the market where it is high, and profit the difference). How?

Suppose the ex rate remains at ¥100 per C\$1. The price of camera in Tokyo is still ¥10000 but in Toronto, suppose that it costs C\$120.

- Buy camera in Tokyo or Toronto?

Another example:

Magazine cost: C\$10 in Canada or US\$8 in the United States.

Suppose the exchange rate is US\$0.80=C\$1.

• .

## Example: Big Mac around the World

The Big Mac Index July 2011: <http://www.economist.com/blogs/dailychart/2011/07/big-mac-index>

The Hamburger Standard						
Country		Big Mac Prices in local currency		Implied PPP Exchange Rate		Actual Exchange Rate on July 25th
USA		US\$ 4.07				
Canada		C\$ 4.73		US\$ 0.86 / C\$1		US\$ 1.05 / C\$1
Japan		Yen 320				
Euro Area		€ 3.44				
China		Yuan 14.7				
Britian		Pounds 2.39				

# The hamburger standard

Country	Big Mac prices		Implied PPP† of the dollar	Actual dollar exchange rate July 25th	Under(-)/over(+) valuation against the dollar, %	
	in local currency	in dollars*			raw index	adjusted for GDP per person
United States‡	\$4.07	4.07	—	—	—	—
Argentina	Peso 20.0	4.84	4.92	4.13	19	101
Australia	A\$4.56	4.94	1.12	0.92	22	12
Brazil	Real 9.50	6.16	2.34	1.54	52	149
Britain	£2.39	3.89	1.70§	1.63§	-4	9
Canada	C\$4.73	5.00	1.16	0.95	23	24
Chile	Peso 1,850	4.00	455	463	-2	58
China	Yuan 14.7	2.27	3.60	6.45	-44	3
Colombia	Peso 8,400	4.74	2,066	1,771	17	108
Czech Republic	Koruna 69.3	4.07	17.1	17.0	nil	45
Denmark	DK 28.5	5.48	7.01	5.20	35	23
Egypt	Pound 14.1	2.36	3.47	5.96	-42	11
Euro area**	€3.44	4.93	1.18††	1.43††	21	36
Hong Kong	HK\$15.1	1.94	3.71	7.79	-52	-43
Hungary	Forint 760	4.04	187	188	-1	57
India§§	Rupee 84.0	1.89	20.7	44.4	-53	-8
Indonesia	Rupiah 22,534	2.64	5,543	8,523	-35	24
Israel	Shekel 15.9	4.67	3.91	3.40	15	43
Japan	¥320	4.08	78.7	78.4	nil	5
Malaysia	Ringgit 7.20	2.42	1.77	2.97	-40	2
Mexico	Peso 32.0	2.74	7.87	11.7	-33	13
New Zealand	NZ\$5.10	4.41	1.25	1.16	9	29
Norway	Kroner 45.0	8.31	11.1	5.41	104	46
Pakistan	Rupee 205	2.38	50.5	86.3	-42	16
Peru	Sol 10.0	3.65	2.46	2.74	-10	63
Philippines	Peso 118	2.78	29.0	42.4	-32	33
Poland	Zloty 8.63	3.09	2.12	2.80	-24	21
Russia	Rouble 75.0	2.70	18.5	27.8	-34	10
Saudi Arabia	Riyal 10.0	2.67	2.46	3.75	-34	-3
Singapore	S\$4.41	3.65	1.08	1.21	-10	-6
South Africa	Rand 19.45	2.87	4.78	6.77	-29	24
South Korea	Won 3,700	3.50	910	1,056	-14	21



## The Real Exchange Rate (RER)

**RER** is the relative price of Canadian-produced goods and services to foreign-produced goods and services.

Example: Suppose a bushel of Canadian wheat sells for \$100, and a bushel of Mexican wheat sells for 500 pesos.

What is the Real Exchange Rate between Canadian and Mexican wheat?

- ⇒ Use the nominal ex rate for covert the prices into a common currency.
- ⇒ Suppose the ex rate is 10 pesos per dollar.
- ⇒ The price of Canadian wheat of \$100 per bushel is equivalent to 1000 pesos per bushel.
- ⇒ Therefore,

The equation that links the nominal exchange rate ( $E$ ) and real exchange rate ( $RER$ ) is

$$RER = (E \times P) / P^*$$

where  $P$  is the Canadian price level and  $P^*$  is the Mexican (or foreign) price level.

If both countries produce identical goods, then the price levels expressed in the same currency would be the same and  $RER$  would equal 1.

## The Short Run

In the short run, the equation determines  $RER$ .

$$RER = (E \times P)/P^*$$

In the short run, if the nominal exchange rate changes,  $P$  and  $P^*$  do not change and the change in  $E$  brings an equivalent change in  $RER$ .

## The Long Run

In the long run,  $RER$  is determined by the real forces of demand and supply in the markets for goods and services.

So in the long run,  $E$  is determined by  $RER$  and the price levels. That is,

$$E = RER \times (P^*/P)$$

A rise in the Japanese price level  $P^*$  brings an appreciation of the Canadian dollar in the long run.

A rise in the Canadian price level  $P$  brings a depreciation of the Canadian dollar in the long run.

## Exchange Rate Policy

Three possible exchange rate policies are

- Flexible exchange rate
- Fixed exchange rate
- Crawling peg

A **flexible exchange rate** policy is one that permits the exchange rate to be determined by demand and supply with *no* direct intervention in the foreign exchange market by the central bank.

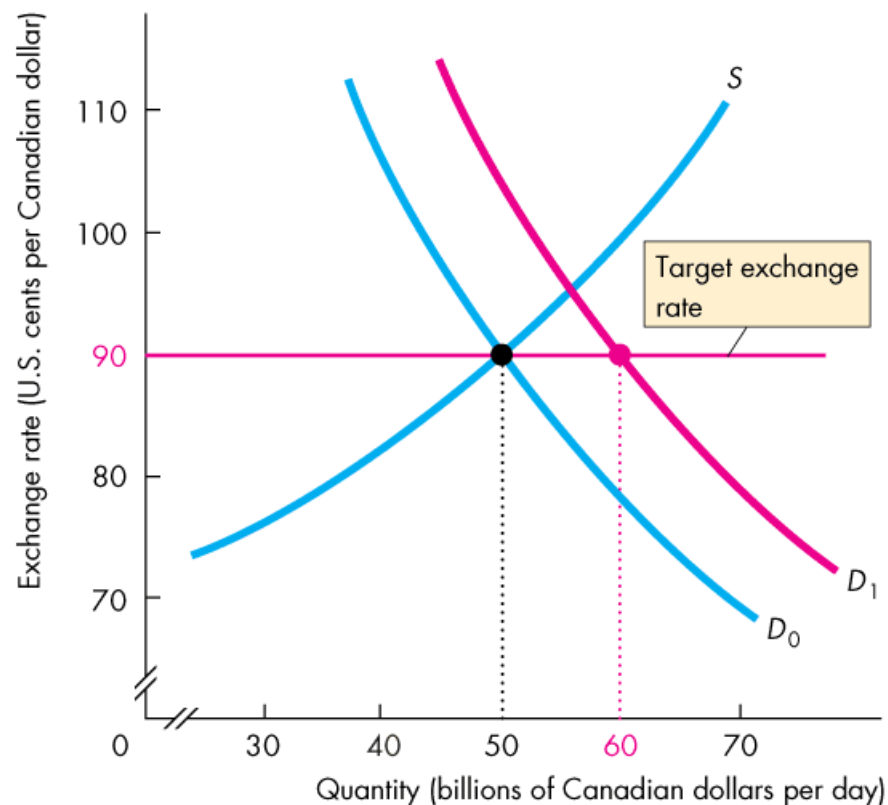
A **fixed exchange rate** policy is one that pegs the exchange rate at a value decided by the government or central bank and is achieved by direct intervention in the foreign exchange market to block unregulated forces of demand and supply.

A fixed exchange rate requires active intervention in the foreign exchange market.

How the BOC can intervene in the foreign exchange market to keep the exchange rate close to a target rate.

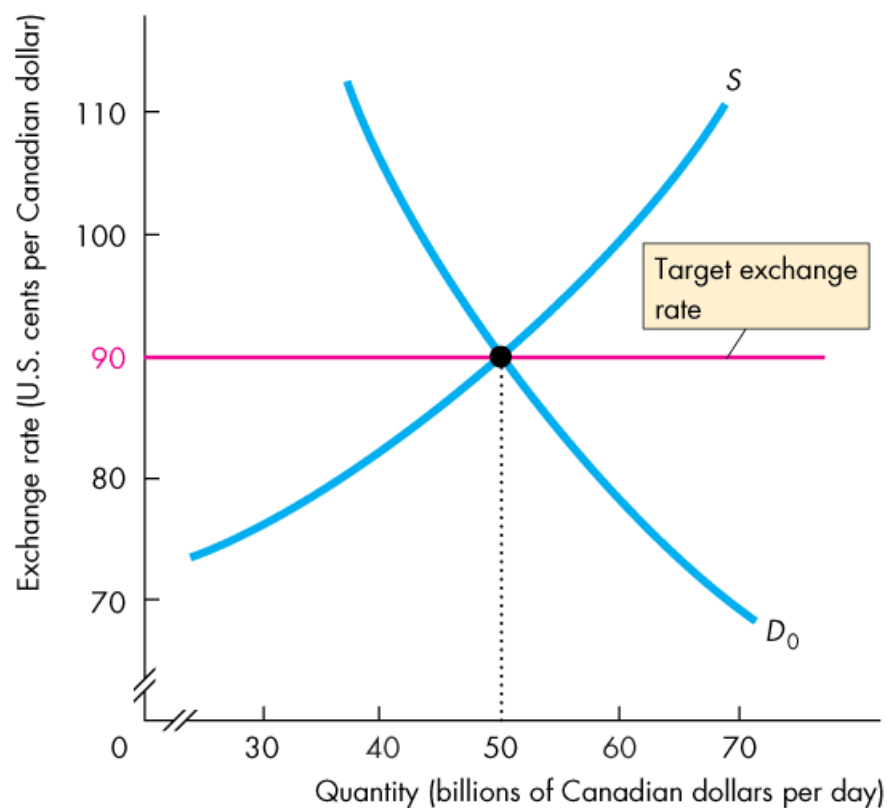
Suppose that the target is 90 yen per Canadian dollar.

If the demand for Canadian dollars increases,  
the BOC sells Canadian dollars to increase supply.



If demand for Canadian dollars decreases, ...

... the Bank of Canada buys Canadian dollars to decrease supply.



A **crawling peg** is an exchange rate that follows a path determined by a decision of the government or the central bank and is achieved by active intervention in the market.

China is a country that operates a crawling peg.

A crawling peg works like a fixed exchange rate except that the target value changes.

The idea behind a crawling peg is to avoid wild swings in the exchange rate that might happen if expectations became volatile and to avoid the problem of running out of reserves, which can happen with a fixed exchange rate.