

# National Accounts

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<sup>1</sup>I wish to acknowledge Battista Severgnini for providing last year's slides to me. His generosity saved me much time, and these slides are partially based on his. Any errors are of course my own.

# Plan for Today

1. Chapter 13:
  - ▶ National income accounts
  - ▶ National saving, investment, and the current account
2. Chapter 14:
  - ▶ Exchange rate
  - ▶ The foreign exchange market
  - ▶ The demand of currency deposits
  - ▶ Interest rate parity
  - ▶ Partial equilibrium ex. rates
3. If time: Quick review of International Trade

## Chapter 13: National Income Accounting and the Balance of Payments

# Goodbye micro foundations

- ▶ Our first trade models
  - ▶ Stark and simple
  - ▶ General equilibrium
  - ▶ A real economy – no money!
- ▶ Models in the remainder of course
  - ▶ Partial equilibrium
  - ▶ Equilibrium conditions:
    1. Interest rate parity
    2. Law of one price
- ▶ Text: Micro vs Macro
  - ▶ A little more complicated than that...

# Why partial equilibrium?

- ▶ Easier to analyze some important topics
- ▶ Our general equilibrium models abstracted from
  1. Unemployment
  2. Saving
  3. Trade imbalances
  4. Money
- ▶ Fiat money very tricky to put in 'microfounded' model!
  - ▶ International finance about exchange rates!
- ▶ Minnesota macro vs. New Keynsian macro

# Chapter 13 split

1. National income accounting
  - ▶ Measuring value of a nation's annual production
2. Balance of payments accounting
  - ▶ Measuring a nation's debt to other countries at a point in time

# National income accounting

- ▶ Focus on *Gross National Product* or GNP
- ▶ Definition from textbook:
  - ▶ The value of all final goods and services produced by the country's factors of production and sold on the market in a given time period
- ▶ Let's parse this

# Gross National Product

- ▶ Definition from textbook:
  - ▶ **The value** of all final goods and services produced by the country's factors of production and sold on the market in a given time period
  - ▶ The value in common terms – often current national currency

# Gross National Product

- ▶ Definition from textbook:
  - ▶ The value of all final goods and services produced by the country's factors of production and sold on the market in a given time period
  - ▶ Only final goods are counted, not intermediates
  - ▶ Count only the sale of the textbook, not the sale of the paper to the bookmaker
  - ▶ Final goods can also be "investment" like production machines

# Gross National Product

- ▶ Definition from textbook:
  - ▶ The value of all final goods and services **produced by the country's factors of production** and sold on the market in a given time period
  - ▶ The final goods must have been produced using factors of production owned by nationals
    1. Land (resources)
    2. Labor (human capital)
    3. Capital (machines, buildings, etc)
  - ▶ Production does not have to take place within the country

# Gross National Product

- ▶ Definition from textbook:
  - ▶ The value of all final goods and services produced by the country's factors of production **and sold on the market in a given time period**
  - ▶ Only count final goods that are sold in the relevant year
  - ▶ Do not count sale of used textbooks!
  - ▶ Sale of previously manufactured stuff is just exchange, not production

# Gross National Product

- ▶ Definition from textbook:
  - ▶ The value of all final goods and services produced by the country's factors of production and sold on the market in a given time period
- ▶ Ex: Fish caught in Oresund and sold in a Nyhavn restaurant
  - ▶ Restaurant buys fish from fisherman – *not* part of GNP
  - ▶ Consumer buys fish from restaurant – part of GNP
- ▶ Ex: Danish company goes public
  - ▶ Investors buy stocks from firm – *not* part of GNP
  - ▶ Investors buy stocks from each other – *not* part of GNP
- ▶ Ex: Danish-owned company opens pharmaceutical factory in Poland
  - ▶ Sales of factory are part of GNP (less the wages paid to Polish labor)

# Gross National Product (GNP)

- ▶ Often separate GNP by ultimate use of production

$$GNP = C + I + G + CA$$

where

- ▶  $C$  is consumption
- ▶  $I$  is investment
- ▶  $G$  is government purchases
- ▶  $CA$  is current account balance (exports minus imports)
- ▶ Let's talk about these categories

# Gross National Product, ultimate use categories

$$GNP = C + I + G + CA$$

- ▶ Consumption
  - ▶ Portion of production expended in satisfying current wants
  - ▶ Examples: Movie tickets, food, dental work, and washing machines
  - ▶ Largest share of production, 60-70%

# Gross National Product, ultimate use categories

$$GNP = C + I + G + CA$$

## ▶ Investment

- ▶ Any good or service which is used for future production
- ▶ Examples: Machinery for a factory, the newest word processor
- ▶ *Does not* include household “investment”, or purchases of bonds or shares
- ▶ If company sells bond and uses cash to buy machinery, it is counted as investment
- ▶ The sale of a bond between two people is just an exchange, not production

# Gross National Product, ultimate use categories

$$GNP = C + I + G + CA$$

- ▶ Government purchases

- ▶ Any good or service ultimately used by the government
- ▶ Examples: new fighter jet, highway repair, basic research
- ▶ Some countries (Denmark) divide this into:
  - ▶ Government consumption (ex: military)
  - ▶ Government investment (ex: highway repair)

## Gross National Product, ultimate use categories

$$GNP = C + I + G + CA$$

- ▶ Current account balance
  - ▶  $CA = EX - IM$
  - ▶  $EX$  = goods and services produced by Danish factors and used abroad
  - ▶  $IM$  = goods and services produced by Foreign factors and used in Denmark

## Gross National Product, ultimate use categories

$$GNP = C + I + G + CA$$

- ▶ Current account balance difference between exports and imports
- ▶  $> 0$  is *current account surplus*,  $< 0$  is *current account deficit*
- ▶ Surplus means a country is lending, deficit means borrowing
- ▶ Current account balance is change in net foreign wealth

## Gross National Product, ultimate use categories

$$GNP = C + I + G + CA$$

- ▶ Takeaway
  - ▶ GNP is (the value of) stuff produced in a country in a year

## Gross National Product, three details

- ▶ Three more details from the textbook
  - 1. National product vs national income
  - 2. Capital depreciation and international transfers
  - 3. GNP vs GDP

## National Product vs. National Income

- ▶ The value of production ultimately reaches owners of a factor
- ▶ Thus national income should equal national product
- ▶ Almost. . .

# National Product vs. National Income

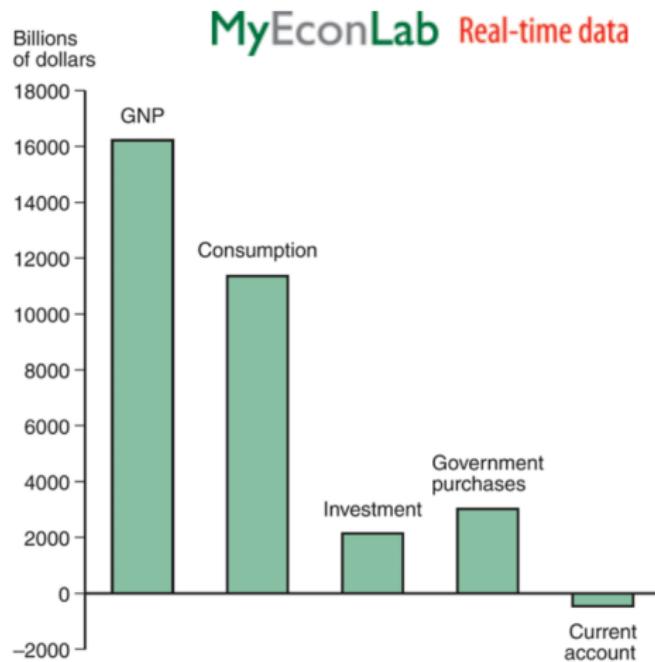
1. Capital depreciation like a reduction in the wealth of owners of capital
  - ▶ Needs to be subtracted from production to get income
  - ▶ GNP net of depreciation is called Net National Product (NNP)
2. Unilateral transfers
  - ▶ Sometimes a country gives goods or services to another country
  - ▶ Needs to be added to production to get national income

# Gross Domestic Product

- ▶ GDP has replaced GNP as the most common headline figure in national accounts
- ▶ Only one difference
  - ▶ GDP is the product of all factors in a country, regardless of the owners
  - ▶ GNP is the product of all factors owned by people from a country, regardless of production location
- ▶ Ex: If a British firm owns a factory in Denmark
  - ▶ The product is part of Denmark's GDP, but not GNP

# U.S. GNP by use

- ▶ How would Denmark be different?



**Source:** U.S. Department of Commerce, Bureau of Economic Analysis. The figure shows 2013:Q1 GNP and its components at an annual rate, seasonally adjusted.

## More on the Current Account

$$CA = EX - IM = Y - (C + I + G)$$

When production > domestic expenditure, exports > imports:  
current account > 0 and trade balance > 0

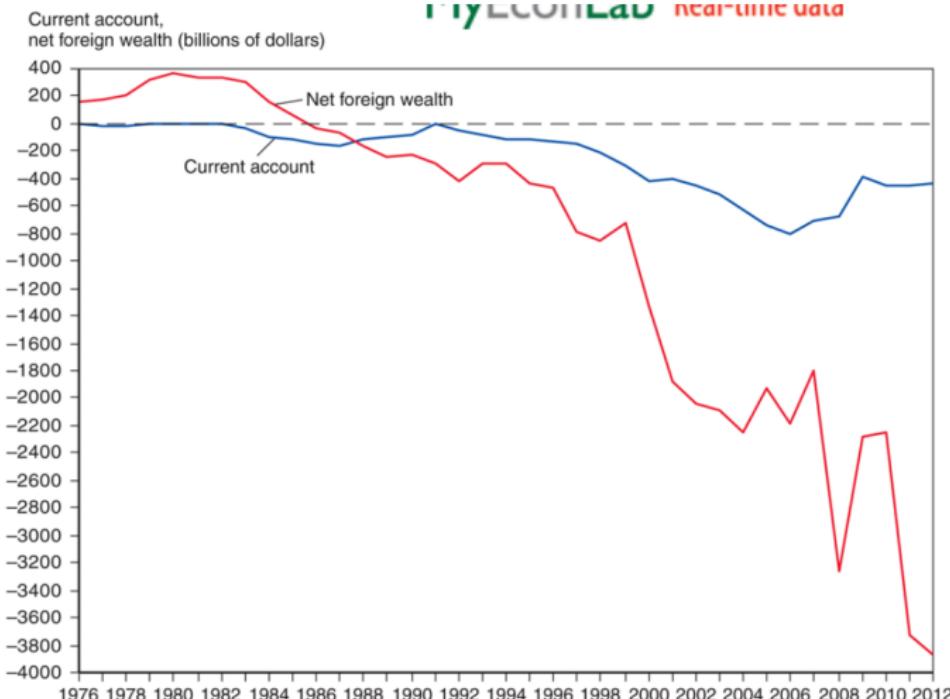
- ▶ if  $Y > (C + I + G) \Rightarrow EX > IM \Rightarrow CA > 0$  (surplus)
- ▶ if  $Y < (C + I + G) \Rightarrow EX < IM \Rightarrow CA < 0$  (deficit)

World production must equal world consumption, investment, and government purchases

- ▶ Globally, deficits and surpluses must balance
- ▶ Some countries often borrowers, others often lenders: **global imbalances**

# International Investment Position

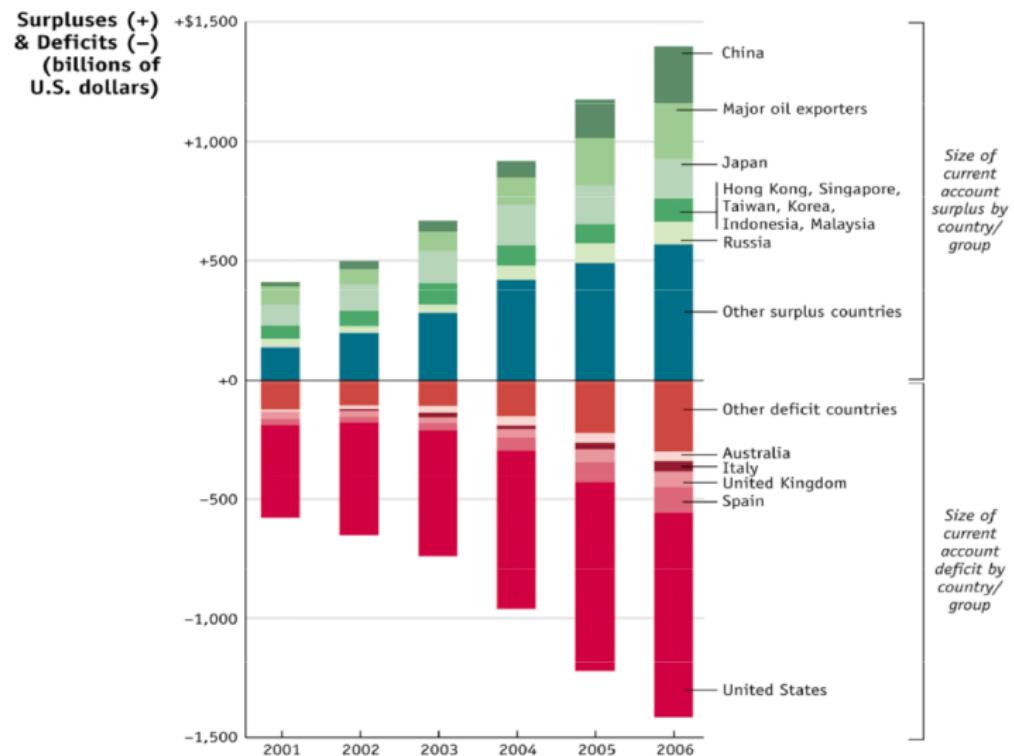
## ► The stock of net foreign wealth



Source: U.S. Department of Commerce, Bureau of Economic Analysis.

## ► Why is net foreign wealth so volatile?

# Figure; Deficits and Surpluses: The Balance of Payments (Source: IMF, International Financial Statistics)



# National Saving

- ▶ Define national savings as:

$$S = Y - C - G$$

- ▶ GNP identity:

$$Y = C + I + G + CA$$

- ▶ Combine the two:

$$\implies S - CA = I$$

- ▶ Investment can be financed by:

1. Putting off consumption (pay today)
2. Borrowing from abroad (pay tomorrow)
3. Current account sometimes called *net foreign investment*

## National Saving: Private vs government

$$S = Y - C - G$$

$$S = (Y - C - T) + (T - G)$$

$$S = S^p + S^g$$

## National Saving: Private vs government

- ▶ Combining our two definitions of saving:

$$S = I + CA = S^P + S^G$$

$$S^P = I + CA - S^G$$

$$S^P = I + CA + (G - T)$$

- ▶ Private saving is used for:
  1. Investment at home
  2. Investment abroad
  3. Purchasing government debt

## Pause

- ▶ National Income Accounts
  - ▶  $GNP : Y = C + I + G + CA$
  - ▶ Only count stuff produced by factors owned by nationals
  - ▶ Investment can be funded by foreign borrowing
- ▶ Next: Balance of Payment Account
  - ▶ Tracks credits and liabilities between countries
  - ▶ Similar to a balance sheet from accounting

# Balance of Payments Accounts

- ▶ Two types of transactions:
  1. Credit if a foreigner pays a native
  2. Debit if a native pays a foreigner
- ▶ A *Financial Asset* holds wealth: stocks, bonds, debt, etc
- ▶ current account + financial account + capital account = 0
  1. **current account**: tracks flows of goods and services (imports and exports)
  2. **financial account**: tracks flows of financial assets (financial capital)
  3. **capital account**: flows of special categories of assets: typically intangible assets like debt forgiveness, copyrights and trademarks.

## Example 1: US imports fax machine

- ▶ US imports fax machine from Italy
- ▶ Italian firm deposits USD in US bank

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Fax machine (*current account, U.S. good import*)

-\$80

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Bank deposit (*financial account, U.S. asset sale*)

+\$80

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## Example 2: US tourist buys French lunch

- ▶ US tourist buys lunch in Paris
- ▶ Pays with US credit card

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Meal purchase (*current account, U.S. service import*)

-\$30

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Sale of credit card claim (*financial account, U.S. asset sale*)

+\$30

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## Example 3: American buys share of British Petroleum

- ▶ American buys a share of BP
  - ▶ BP deposits money in American bank
- 

Stock purchase (*financial account, U.S. asset purchase*)

-\$90

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Bank deposit (*financial account, U.S. asset sale*)

+\$90

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# U.S. Balance of Payments Accounts for 2012 (billions of dollars)

<b>Current Account</b>	
(1) Exports	<b>2,986.9</b>
Of which:	
Goods	1,561.2
Services	649.3
Income receipts (primary income)	776.3
(2) Imports	<b>3,297.7</b>
Of which:	
Goods	2,302.7
Services	442.5
Income payments (primary income)	552.4
(3) Net unilateral transfers (secondary income)	-129.7
Balance on current account	<b>-440.4</b>
[(1) - (2) + (3)]	
<b>Capital Account</b>	
(4)	<b>7.0</b>
<b>Financial Account</b>	
(5) Net U.S. acquisition of financial assets, excluding financial derivatives	<b>97.5</b>
Of which:	
Official reserve assets	4.5
Other assets	93.0
(6) Net U.S. incurrence of liabilities, excluding financial derivatives	<b>543.9</b>
Of which:	
Official reserve assets	393.9
Other assets	150.0
(7) Financial derivatives, net	<b>7.1</b>
Net financial flows	<b>-439.4</b>
[(5) - (6) + (7)]	
Net errors and omissions	-6.0
[Net financial flows less sum of current and capital accounts]	

Source: U.S. Department of Commerce, Bureau of Economic Analysis, June 14, 2013, release. Totals may differ from sums because of rounding.

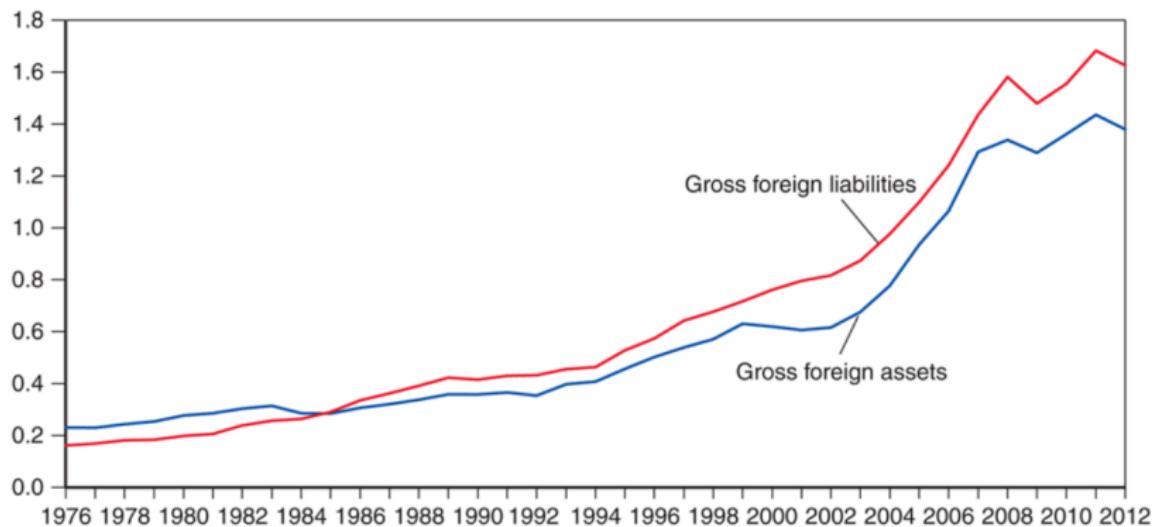
## Official reserve assets

- ▶ Central banks hold foreign currency reserves
  - ▶ Purpose: Insure against macroeconomic fluctuations
- ▶ These are often American Treasury bills (promises that the American government will pay a dollar tomorrow)
- ▶ Buying and selling these bills locally allows central banks to affect money supply

# Expansion of credit end of 20th century

Assets, liabilities  
(ratio to GDP)

MyEconLab Real-time data



Source: U.S. Department of Commerce, Bureau of Economic Analysis, June 2013.

# Pause

- ▶ National Income Accounts
  - ▶  $GNP : Y = C + I + G + CA$
  - ▶ Only count stuff produced by factors owned by nationals
  - ▶ Investment can be funded by foreign borrowing
- ▶ Balance of Payment Account
  - ▶ Tracks credits and liabilities between countries
  - ▶ That is, who consumes now and who in the future

## Chapter 14: Exchange Rates and the Foreign Exchange Market: An Asset Approach

# Exchange Rates

- ▶ *Direct*: The price of the foreign currency in terms of DKK (e.g., 7.45 DKK per Euro):  $E_{DKK/EURO}$
- ▶ *Indirect* : The price of DKK in terms of the foreign currency (e.g., 0.13 Euro per 1 DKK)

Exchange rate regimes:

- ▶ *flexible*: Exchange rate is determined freely by the market
- ▶ *fixed*: Exchange rate is politically determined and market is manipulated

# Fixed Exchange Rate

**1 EUR = 7.4427 DKK +0.00005 (0.001%)**

Sep 29, 5:19PM GMT



# Floating Exchange Rate

**1 USD = 5.8626 DKK -0.01098 (-0.187%)**

Sep 29, 5:20PM GMT



# Exchange Rate Quotations

**CURRENCIES**

**FX - EFFECTIVE INDICES**

	Jun 7	Jun 6	Mth ago	Jun 7	Jun 6	Mth ago	
Australia	105.2	106.0	113.0	Sweden	87.1	87.3	88.6
Canada	111.6	110.5	113.6	Switzerland	143.4	143.7	143.7
Denmark	107.3	107.3	106.9	UK	81.1	81.2	80.9
Japan	145.7	144.3	143.4	USA	85.6	86.1	85.9
New Zealand	114.6	115.9	121.8	Euro	95.03	95.04	94.43
Norway	107.5	107.6	106.8				

Source: Bank of England. New Sterling ERI base Jan 2005 = 100. Other indices base average 1990 = 100. Index rebased 1/2/95; for further information about ERIs see [www.bankofengland.co.uk](http://www.bankofengland.co.uk)

**Bank of England Indices**

Date	Euro	Sterling	US Dollar
Dec 7	~90	~85	~75
2012	~95	~88	~77
2013	~90	~85	~75
Jun 7	~92	~87	~76

**DOLLAR**      **EURO**      **POUND**

	Currency	Closing Mid	Day's Change	Closing Mid	Day's Change	Closing Mid	Day's Change
Argentina	(Peso)	5.3015	0.0077	7.0089	0.0240	8.2378	0.0198
Australia	(A\$)	1.0545	0.0050	1.3941	0.0093	1.6385	0.0092
Bahrain	(Dinar)	0.3770	-	0.4985	0.0010	0.5858	0.0006
Bolivia	(Boliviano)	6.9100	-	9.1354	0.0179	10.7371	0.0100
Brazil	(R\$)	2.1309	0.0027	2.8172	0.0090	3.3111	0.0072
Canada	(C\$)	1.0208	-0.0110	1.3495	-0.0119*	1.5861	0.0047
Chile	(Peso)	500.500	-0.0500	661.686	-5.3619	777.702	-7.1138
China	(Yuan)	6.1335	-0.0027	8.1088	0.0124	9.5306	0.0047
Colombia	(Peso)	1897.17	-13.6300	2508.15	-13.0515	2947.92	-18.4083
Costa Rica	(Colon)	498.980	-0.030	659.677	1.2578	775.341	0.6772
Czech Rep.	(Koruna)	19.3473	-0.1597	25.5780	-0.1605	30.0627	-0.2200
Denmark	(DKr)	5.6394	-0.0115	7.4555	-0.0006	8.7627	-0.0098
Egypt	(Egypt £)	6.9890	-	9.2399	0.0182	10.8598	0.0102
Hong Kong	(HK\$)	7.7626	-	10.2625	0.0202	12.0619	0.0119
Hungary	(Forint)	223.101	-3.1794	294.950	-3.6150	346.665	-4.6122
India	(Rs)	57.0750	0.1850	75.4560	0.3925	88.6860	0.3699
Indonesia	(Rupiah)	9805.00	12.5000	12962.7	41.9865	15235.5	33.6230
Iran	(Rial)	12278.5	-	16232.8	31.9241	19078.9	7.18038
Israel	(Shek)	3.6120	-0.0023	4.7753	0.0064	5.6125	0.0017
Japan	(¥)	97.3850	-0.9900	128.744	-1.0530	151.322	-1.3957
One Month		97.3715	-0.0010	128.750	-0.0008	151.270	-0.0014
Three Month		97.3382	-0.0021	128.751	-0.0037	151.160	-0.0013
One Year		97.0400	-0.0110	128.584	-0.0052	150.509	-0.0041
Kenya	(Shilling)	84.9000	-	112.242	0.2208	131.922	0.1231
Kuwait	(Dinar)	0.2847	-0.0003	0.3764	0.0004	0.4424	-
Malaysia	(RM)	3.0935	0.0105	4.0898	0.0219	4.8068	0.0207
Mexico	(New Peso)	12.7217	-0.1774	16.8187	-0.2009	19.7676	-0.2569
New Zealand	(NZ\$)	1.2652	0.0106	1.6726	0.0173	1.9659	0.0188
Nigeria	(Naira)	159.700	0.8000	211.131	1.4708	248.150	1.4735
Norway	(Nkr)	5.7702	-0.0076	7.6285	0.0050	8.9660	-0.0035
Pakistan	(Rupee)	98.4750	0.0100	130.180	0.2693	153.015	0.1583
Peru	(New Sol)	2.7280	-0.0060	3.6066	-0.0008	4.2389	-0.0054
Philippines	(Peso)	42.2400	0.1000	55.8843	0.2418	65.6347	0.2165

Rates are derived from WM/Reuters at 4pm (London time). \* The closing mid-point rates for the Euro and £ against the \$ are shown in brackets. The other figures in the dollar column of both the Euro and Sterling rows are in the reciprocal form in market convention. Currency re-denominated by 1000. Some values are rounded by the FT. The exchange rates printed in this table are also available on the internet at <http://www.FT.com/marketsdata>

Euro Locking Rates: Austrian Schilling 13.7603, Belgium/Luxembourg Franc 40.3399, Cyprus 0.585274, Finnish Markka 5.94572, French Franc 6.55957, German Mark 1.95583, Greek Drachma 340.75, Irish Punt 0.787564, Italian Lira 1936.27, Malta 0.4293, Netherlands Gulder 2.0371, Portuguese Escudo 200.482, Slovenia Tolar 239.64, Spanish Peseta 166.386

Source: Data from *Financial Times*, June 8, 2013, p. 17.

# Depreciation and Appreciation

We are under **flexible exchange rates**:

1. **Depreciation**  $E_{DKK/EURO} \uparrow$  the Euro becomes more expensive, i.e., DKK becomes less valuable.
2. **Appreciation**  $E_{DKK/EURO} \downarrow$  the Euro becomes less expensive, i.e., DKK becomes more valuable.

# Devaluation and Revaluation

We are under **fixed exchange rates**:

1. **Devaluation**  $E_{DKK/EURO} \uparrow$  the Euro becomes more expensive, i.e., DKK becomes less valuable.
2. **Revaluation**  $E_{DKK/EURO} \downarrow$  the Euro becomes less expensive, i.e., DKK becomes more valuable.

# The Foreign Exchange Market

Main actor:

- ▶ **Commercial banks and other depository institutions**
  - ▶ Suppose I want to buy some books from Amazon UK
  - ▶ Nordea charges me in DKK, and then pays Amazon in GBP
- ▶ Interbank trading is lions share of foreign currency trading
- ▶ *Wholesale* rates in the Financial Times: only trades of 5 million dkk and up
- ▶ *Retail* rates available to you and I are much worse

# The Foreign Exchange Market

Other actors:

1. **Non-financial businesses** directly buy foreign currency transactions to pay foreign employees or suppliers
2. **Non-bank financial institutions** may trade foreign currency for investment clients
3. **Central banks** conduct official international reserves trades (small)

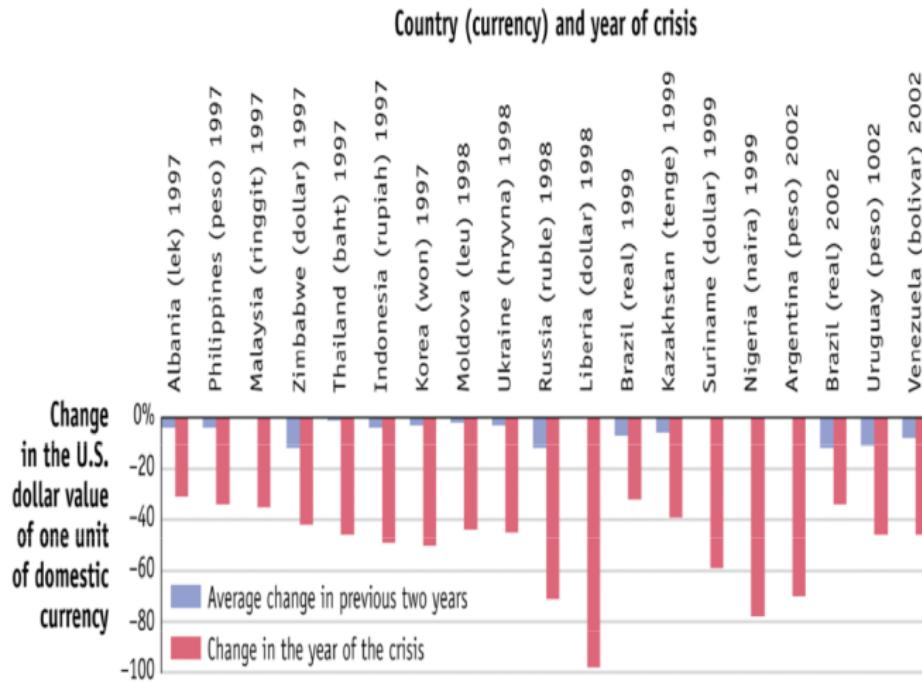
# The Foreign Exchange Market

- ▶ Incredible volume
  - ▶ 4 trillion USD traded a day
  - ▶ The value of everything produced in the world in a year – 70 trillion dollars
- ▶ Tightly connected market
  - ▶ Price cannot be different in different places
  - ▶ No *arbitrage*
  - ▶ That is, can't buy in London, sell in Copenhagen for a profit

# When Exchange Rates Misbehave

- ▶ **Exchange rate crises** occur when a currency experiences a sudden change in value against another world currencies.
  - ▶ Such crises are fairly common, 19 crises 1980-2002
- ▶ Crises can have severe economic consequences.
  - ▶ Government default
  - ▶ Severe changes in lending positions (bank collapse)
  - ▶ Contraction in output and decline in real wages
- ▶ Also politically embarrassing
  - ▶ Countries experiencing crises often seek loans from international development agencies, such as the International Monetary Fund (IMF).
  - ▶ Idea: use foreign currency to change money supply

# When Exchange Rates Misbehave. Source: IMF, International Financial Statistics.



# Case Study: Argentina (2001)

- ▶ Depreciated to 70% in six months!
- ▶ Effect on importers (good? bad?)
- ▶ Effect on exporters (good? bad?)



## Ways to trading currency

- ▶ **Spot rate:** exchange rates for currency exchange "on the spot", or when trading is executed immediately.
- ▶ **Forward rate:** promise to buy or sell in the future

Other methods:

1. **Foreign exchange swap** sell currency on the spot and promise to buy it back in the future
2. **Futures contract** Promise to deliver currency in the future
3. **Options contracts** Option to buy or sell currency for a fixed rate in the future

# Spot and Future Rate

- ▶ Depreciated to 70% in six months!
- ▶ Effect on importers (good? bad?)
- ▶ Effect on exporters (good? bad?)

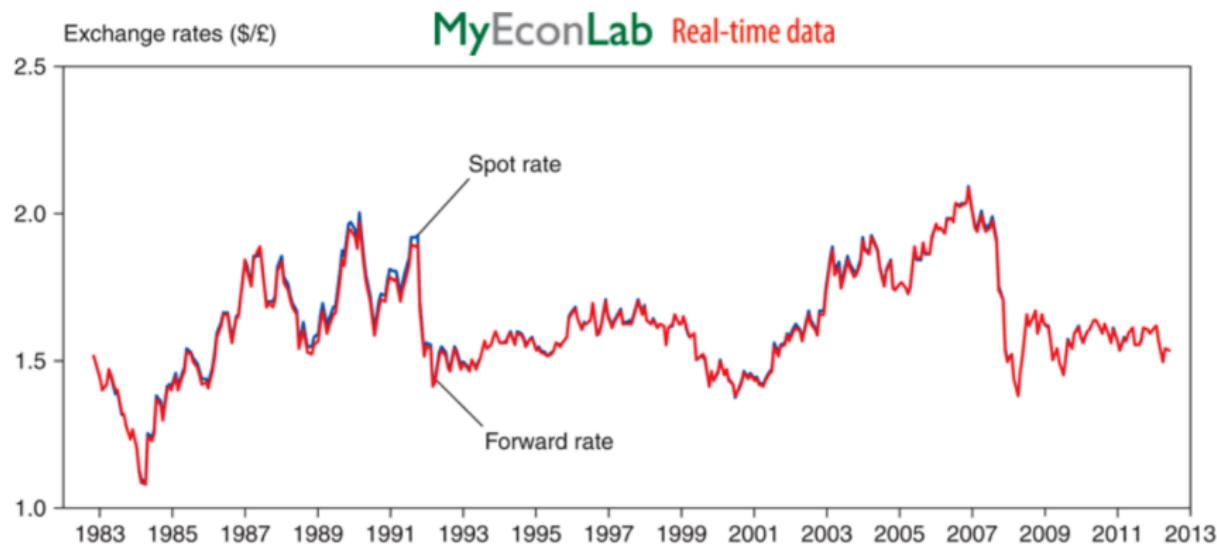
1 USD = 8.4766 ARS +0.00820 (0.097%)

Sep 29, 6:00PM GMT



Fig. 14-1: Dollar/Pound Spot and 90 Day Forward Exchange Rates, 1983-2013

- ▶ Why are they so close?



Source: Datastream. Rates shown are 90-day forward exchange rates and spot exchange rates, at end of month.

## Pause

- ▶ We have seen who trades currency
- ▶ We have seen how currency is traded
- ▶ Now lets talk about what makes people want to trade currency

# The Demand for Currency

- ▶ Most important determinant of demand: belief about future value
  - 1. Expected rate of return
  - 2. Expected future exchange rate
- ▶ Rate of return definitions:
  - ▶ **Rate of return:** the % change in value that an asset offers during a time period
  - ▶ **Real rate of return:** inflation-adjusted rate of return
    - ▶ if  $\text{inflation}=0 \Rightarrow \text{rate of return}=\text{real rate of return}$

## Some other considerations

- ▶ In addition to expected return, investors care about:
  1. *risk*: Uncertainty about future real returns
  2. *liquidity*: Ease of selling currency?
- ▶ For now, we will ignore these considerations
- ▶ Assume certain knowledge of future, and liquid market

## Comparing assets

Example: Should we invest in a Danish bond or a Euro bond?

- ▶ Return of 1 DKK in DK bonds in DKK  
⇒  $R_{DKK,t}$
- ▶ Return of 1 DKK in Euro bonds in DKK:  
⇒  $\left( \frac{E_{DKK/EURO,t+1}^e}{E_{DKK/EURO,t}} \right) (1 + R_{EURO,t}) - 1$

## A convenient approximation

- ▶ Return of 1 DKK in Euro bonds in DKK:

$$\left( \frac{E_{DKK/EURO,t+1}^e}{E_{DKK/EURO,t}} \right) (1 + R_{EURO,t}) - 1$$

- ▶ Some algebra:  $R_{EURO,t} + \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}} +$

$$R_{EURO,t} \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$$

- ▶ Final term is usually small

- ▶ Return of 1 DKK in Euro bonds in DKK is approximately

$$R_{EURO,t} + \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$$

- ▶ Euro interest rate plus the rate of depreciation of the Kroner against the Euro

## Using our approximation

- ▶ Approximation  $R_{EURO,t} + \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$
- ▶ Buy the DKK bond if:

$$R_{DKK,t} - R_{EURO,t} - \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}} > 0$$

## Case studies

- ▶ Replace DKK with USD

Case	Dollar Interest Rate $R_S$	Euro Interest Rate $R_\epsilon$	Expected Rate of Dollar Depreciation against Euro $\frac{E_{S/\epsilon}^e - E_{S/\epsilon}}{E_{S/\epsilon}}$	Rate of Return Difference between Dollar and Euro Deposits $R_S - R_\epsilon - \frac{(E_{S/\epsilon}^e - E_{S/\epsilon})}{E_{S/\epsilon}}$
1	0.10	0.06	0.00	0.04
2	0.10	0.06	0.04	0.00
3	0.10	0.06	0.08	-0.04
4	0.10	0.12	-0.04	0.02

## Pause

- ▶ We have seen who trades currency
- ▶ We have seen how currency is traded
- ▶ We have seen what drives currency demand
- ▶ Now (partial) equilibrium in the financial market

## Before we begin

- ▶ Need to know how people form beliefs about future interest rates
- ▶ This is the concern of the next two chapters (next session)
- ▶ For now future exchange rate taken as given

## Interest rate parity

- ▶ In equilibrium, all assets should give the same expected return
- ▶ Why?
- ▶ Using our approximation:

$$R_{DKK,t} = R_{EURO,t} + \frac{E^e_{DKK/EURO,t+1} - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$$

## Interest rate parity

In other words, arbitrage ensures that the domestic interest rate equals the foreign interest rate plus the expected percentage depreciation of the domestic currency.

- ▶  $E_{DKK/EURO,t+1}^e = E_{DKK/EURO,t} \Rightarrow R_{DKK,t} = R_{EURO,t}$

## Effect of current exchange rates on return

- ▶ All else equal (including future exchange rate)
  - ▶ Current depreciation of *DKK* lowers the *DKK* return on Euro bonds
  - ▶ Appreciation of *DKK* raises the *DKK* return on Euro bonds
- ▶ Intuitive, because depreciation means one can buy less Euros today!

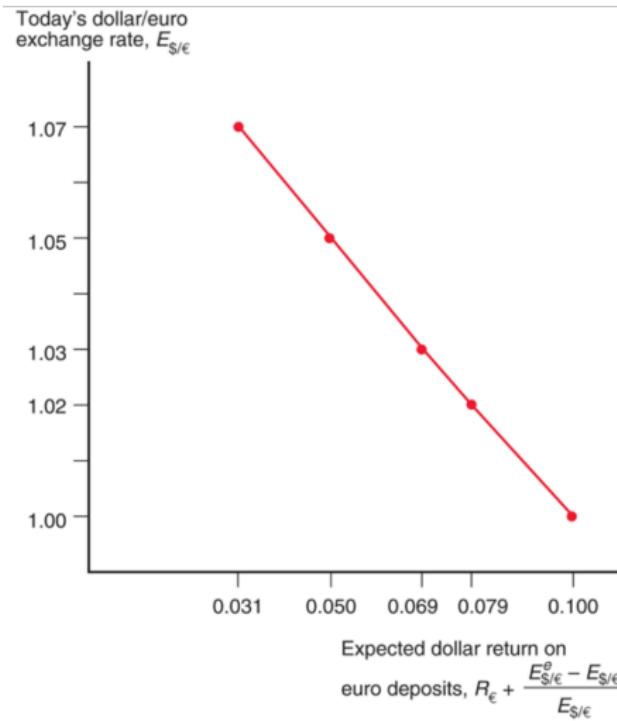
## Effect of current exchange rates on return

- ▶ Replace DKK with USD

Today's Dollar/Euro Exchange Rate $E_{\$/\epsilon}$	Interest Rate on Euro Deposits $R_\epsilon$	Expected Dollar Depreciation Rate against Euro $\frac{1.05 - E_{\$/\epsilon}}{E_{\$/\epsilon}}$	Expected Dollar Return on Euro Deposits $R_\epsilon + \frac{1.05 - E_{\$/\epsilon}}{E_{\$/\epsilon}}$
1.07	0.05	- 0.019	0.031
1.05	0.05	0.00	0.05
1.03	0.05	0.019	0.069
1.02	0.05	0.029	0.079
1.00	0.05	0.05	0.10

Table 14-3: Comparing Dollar Rates of Return on Dollar and Euro Deposits

- ▶ Same thing in a chart rather than a table
- ▶ Remember, keep future exchange rates fixed



# Equilibrium in the Foreign Exchange Market

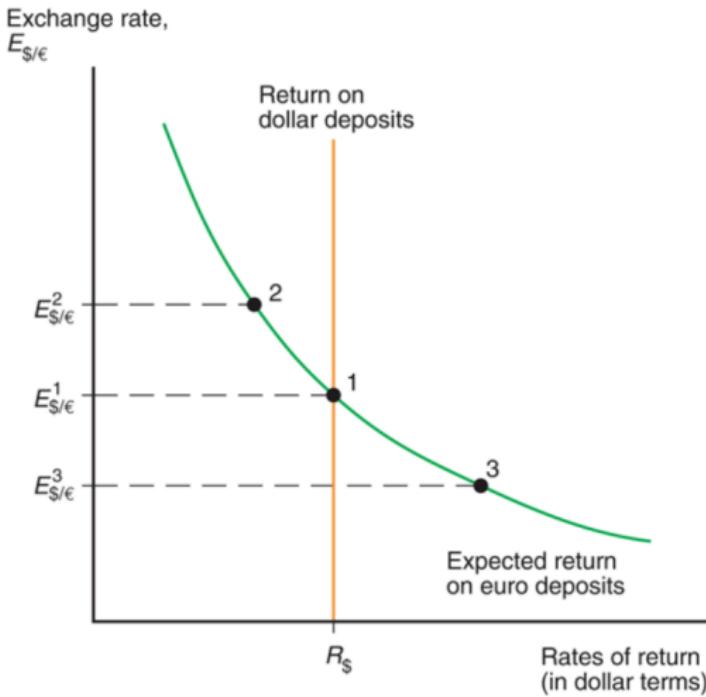
## The 'Equilibrium Exchange Rate'

- ▶ Assume that the DKK interest rate  $R_{DKK}$ , the Euro interest rate  $R_{EURO}$ , and the expected future DKK/EURO exchange rate  $E_e$ , are all given
- ▶ Basically, solve our parity condition for  $E_{DKK/EURO,t}$

$$R_{DKK,t} = R_{EURO,t} + \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$$

## Equilibrium exchange rate

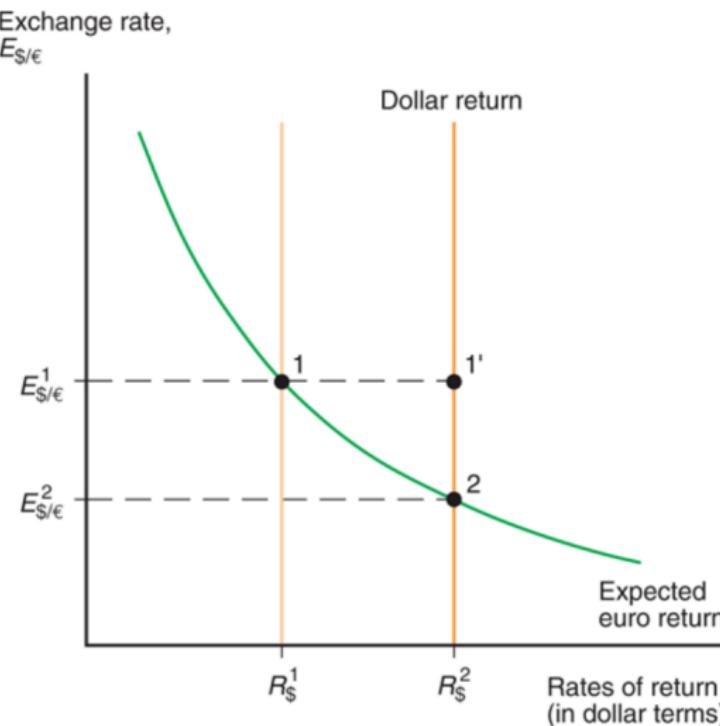
$$R_{DKK,t} = R_{EURO,t} + \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$$



## Changing interest rates and exchange rate

$$R_{DKK,t} = R_{EURO,t} + \frac{E^e_{DKK/EURO,t+1} - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$$

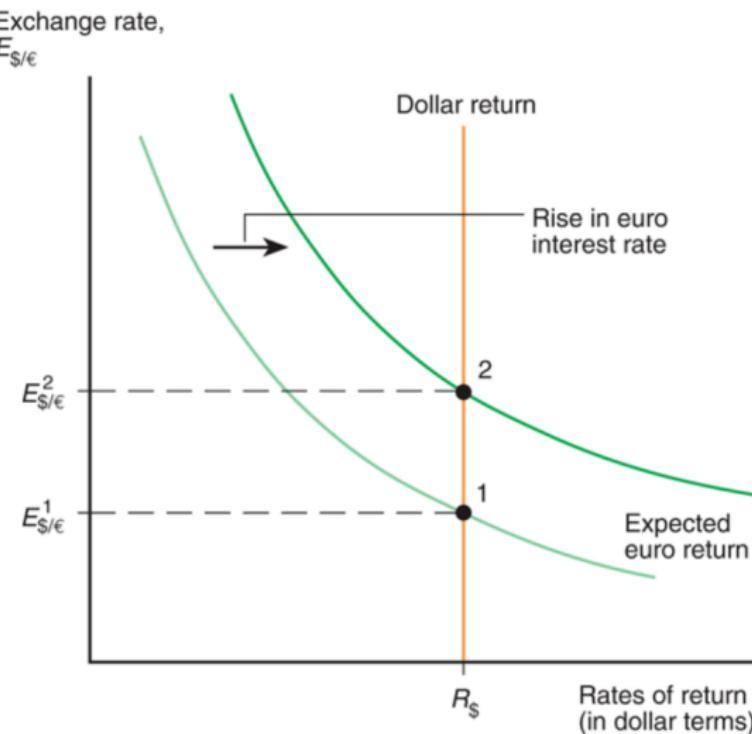
- ▶ Rise in interest rate results in current currency appreciation



## Changing interest rates and exchange rate

$$R_{DKK,t} = R_{EURO,t} + \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$$

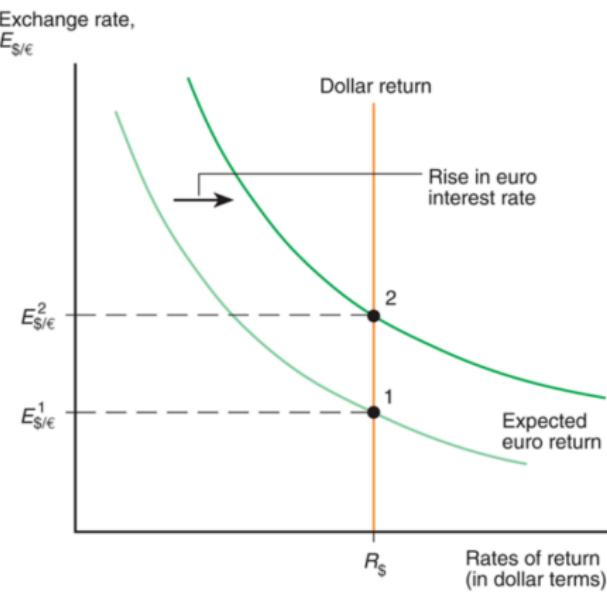
- ▶ Rise in interest rate results in current currency appreciation



## Changing future exchange rate and current exchange rate

$$R_{DKK,t} = R_{EURO,t} + \frac{E_{DKK/EURO,t+1}^e - E_{DKK/EURO,t}}{E_{DKK/EURO,t}}$$

- ▶ Rise in future exchange rate results in current currency appreciation



# Summary

- ▶ Chapter 13:
  - ▶ National income accounting
  - ▶ Measuring value of a nation's annual production
  - ▶ Balance of payments accounting
  - ▶ Measuring a nation's debt to other countries
- ▶ Chapter 14:
  - ▶ Currency markets
  - ▶ Currency demand
  - ▶ Interest rate parity
  - ▶ Partial equilibrium ex. rate determination

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## Next time

- ▶ How are beliefs about exchange rates formed?

# Brief trade review

