Exchange Rates and Open Economy Macroeconomics

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This lesson should teach you:

- What is ER
- Types of ER
- How it is determined
- How its movements affect economies

What is an Exchange Rate?

- Value of one currency expressed in terms of another

- It is customary to use foreign currency in terms of the domestic currency. i.e.: 1EUR = 25.24CZK
  - When speaking about the movement of the Exchange Rates, it is necessary to be careful about increases and declines because the meaning will be opposite depending on from what country one looks at it

Exchange Rate Chart

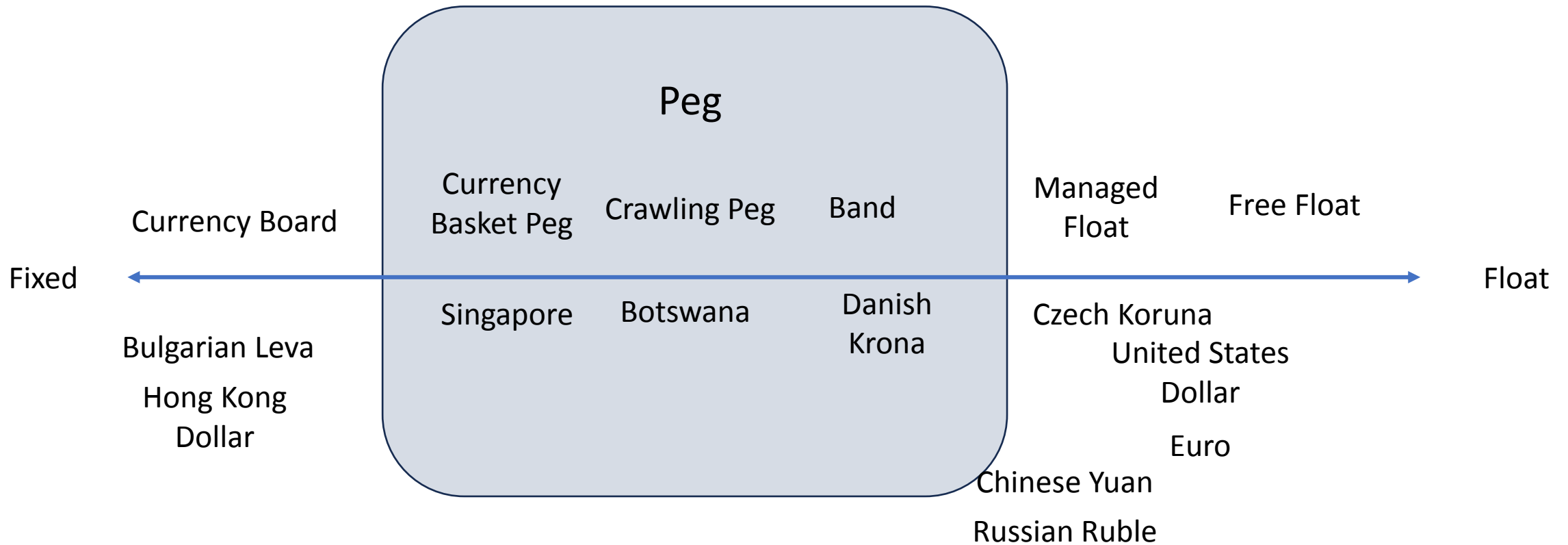| Currency			Spot	Chart
🇺🇸 USD	US dollar	↑	1.0522	⬚
🇯🇵 JPY	Japanese yen	↓	161.13	⬚
🇧🇬 BGN	Bulgarian lev	=	1.9558	⬚
🇨🇿 CZK	Czech koruna	↓	25.294	⬚
🇩🇰 DKK	Danish krone	↓	7.4585	⬚
🇬🇧 GBP	Pound sterling	↑	0.83480	⬚
🇭🇺 HUF	Hungarian forint	↑	410.98	⬚
🇵🇱 PLN	Polish zloty	↓	4.3105	⬚
🇷🇴 RON	Romanian leu	↑	4.9771	⬚
🇸🇪 SEK	Swedish krona	↑	11.5230	⬚
🇨🇭 CHF	Swiss franc	↓	0.9314	⬚

Foreign eXchange (FX) Market

- Worldwide

- The most traded currency is USD
  - Also functions as intermediary currency

- Retail clients, commercial banks, FX Brokers and central banks

- FX arbitrage: financial centers/cross currency arbitrage

- The spot vs forward

Types of ER

- Nominal

  - The value displayed in exchange rate charts

- Real

  - Adjusted for inflation

- Effective

  - An index that describes the strength of a currency relative to a basket of other currencies.

Types of ER regimes

Peg

Currency Board

Currency Basket Peg   Crawling Peg   Band

Managed Float   Free Float

Fixed   ←————————————————————————————→   Float

Bulgarian Leva

Hong Kong Dollar

Singapore   Botswana   Danish Krona

Czech Koruna

United States Dollar

Euro

Chinese Yuan

Russian Ruble

Determination of the spot ER

- Many theories
- The most simple model is here:
  - Demand for domestic currency is derived from demand for the Export
  - Supply domestic currency is derived from demand for the Import

EUR/CZK

S_{czk}

D_{czk}

Quantity of CZK
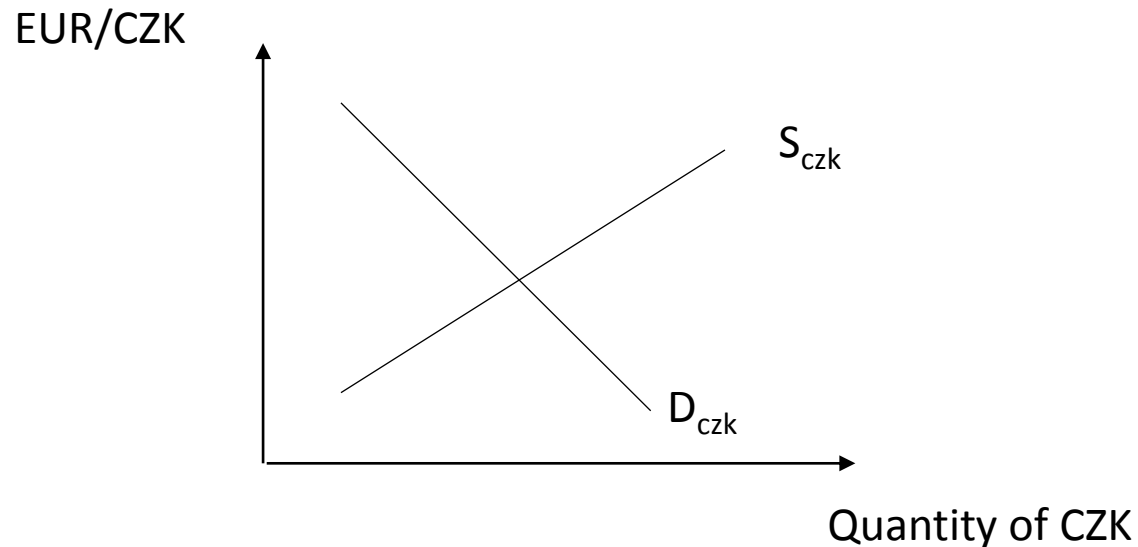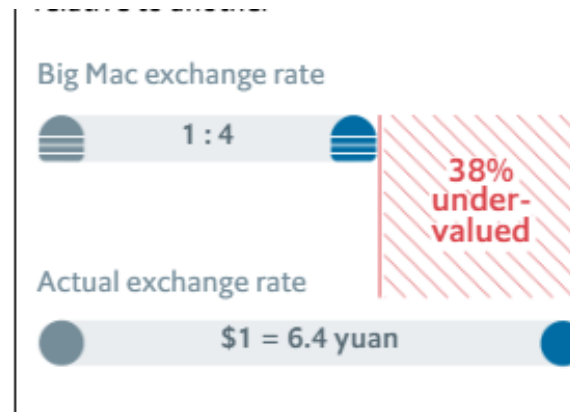
Power Purchasing Parity

- **Absolute**
  - **Prices ratio of the same baskets of goods in two countries**
  - $E_{CZK/EUR} = \dfrac{P_{czk}}{P_{eur}}$
- **Relative**
  - $\Delta E_{CZK} = \pi_{czk} - \pi_{eur}$

Big Mac exchange rate

1 : 4

38% under-valued

Actual exchange rate

$1 = 6.4 yuan

Interest Rate Parity

- Parity in price of money

- $F_0 = S_0 * \dfrac{1+IR_{czk}}{1+IR_{eur}}$; F_0 –forward rate, S_0 - spot rate

Determination of forward ER

- The exchange rate at which a bank agrees to exchange one currency for another at a future date when it enters into a forward contract with an investor.

- Parity relationship among the spot exchange rate

- Differences in interest rates between two countries

Central Banking

What to expect in this lesson

- Brief history od central banks
- Goals of central banks
- Main theories underlying the central banks' policies
- Their operational regimes
- Monetary policy implementation

Central Banking

- Prior to Central Banking
- Coin sorting and storing
- Banknote Issuance
- Banker to the government
- Banker to the banks
- Lender of last resort
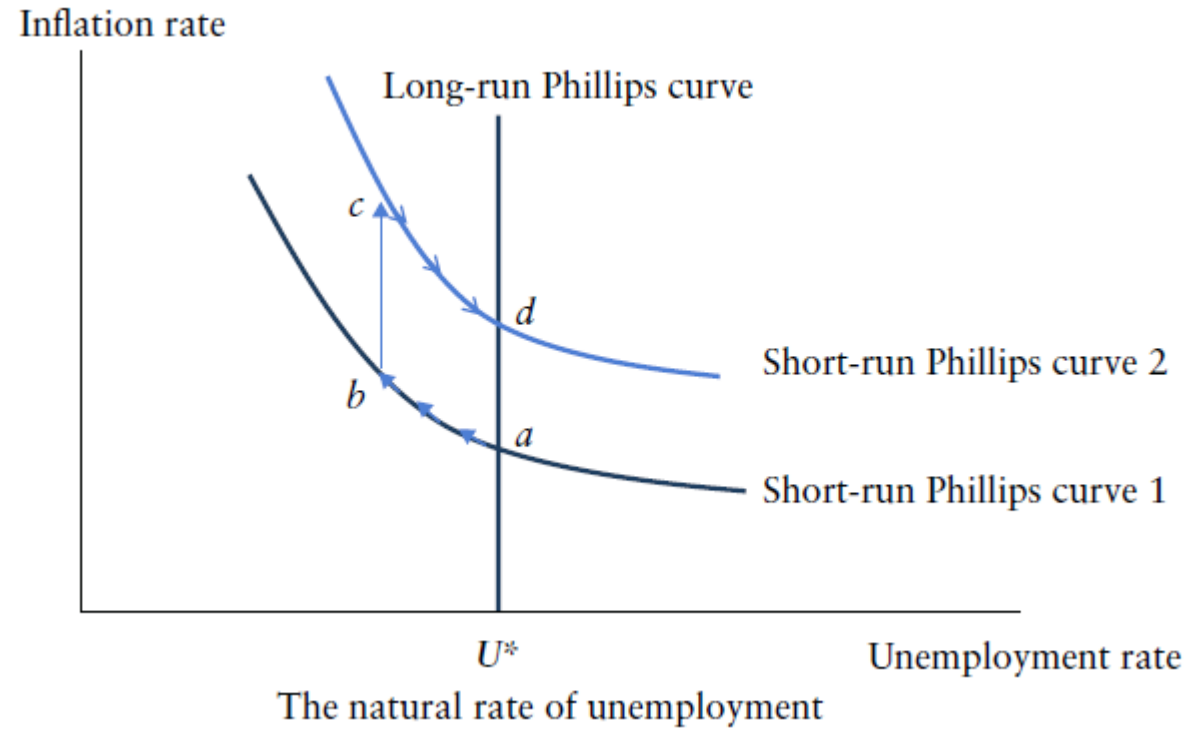- Banks supervisor
- Monetary policy conductor

Central Banks goals

- Monetary and price stability

- Financial Stability

- Full employment

Central Banks - Theory

- The Quantity Theory of Money

- $M \times V = P \times Q$

The Phillips Curve and NAIRU

The Rational Expectation Theory

- It assumes that individuals' actions are based on the best available economic theory and information.

- Departure from Adaptive Expectation Theory
  - Under adaptive expectations, expectations of the future value of an economic variable are based on past values
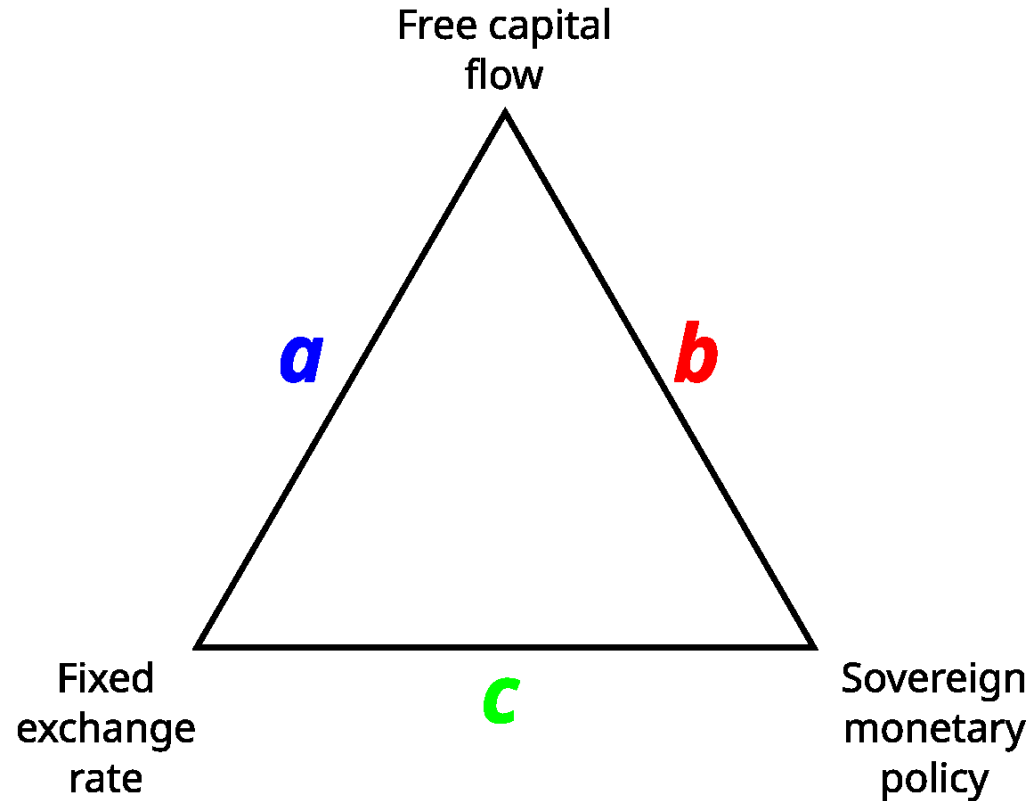
The impossibility trinity aka Trilemma

Why:

a?

b?

c?

Free capital
flow

a

b

Fixed
exchange
rate

c

Sovereign
monetary
policy

Oxelheim, L. (1990)

Monetary policy regimes

Monetary policy regimes

- To follow a particular monetary policy rule is to adopt a monetary policy regime

- Since the demise of Bretton-Wood system (1971), these monetary rules were pursued:

  1. Exchange Rate Targeting
  2. Money Supply Growth Targeting
  3. Risk Management Approach
  4. Inflation Targeting
  5. Unconventional Monetary Policy

Exchange Rate Targeting

- CBs influence the supply curve at FX market to adjust for changes in the demand
- Thus influencing also supply of the currency at the domestic market
- In small open economy, international capital movements may easily overwhelm the CB's ability to keep the ER target
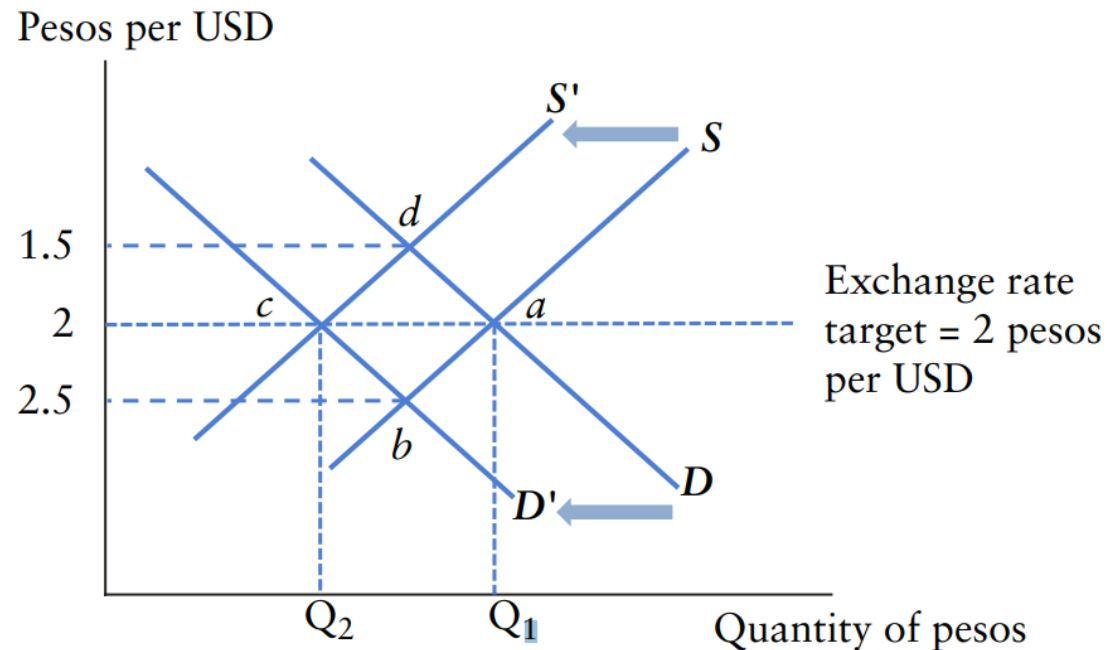
Money supply growth targeting

- Coming from quantitative theory of money

- $M \times V = P \times Q$

- The relationship does not always hold as V happens to be unstable (1980's FED experience)

Risk Management Approach

- no announced specific targets for money supply growth or the inflation rate
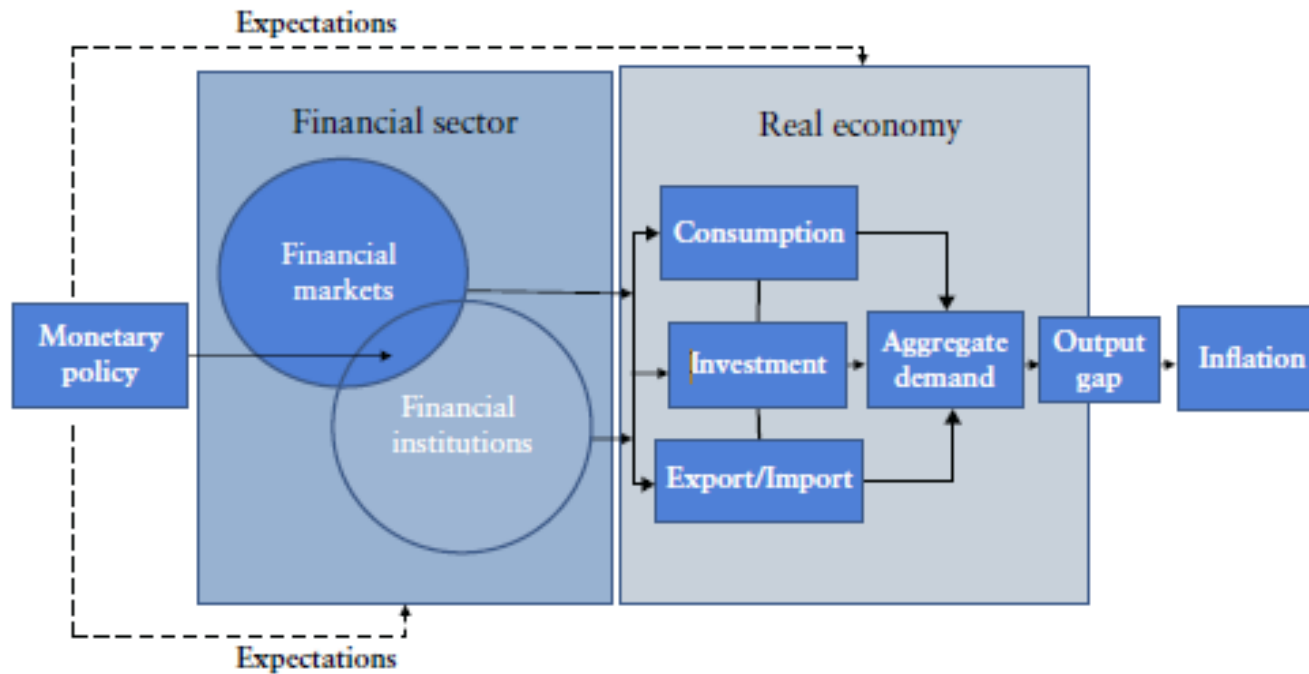- **Taylor' s rule:**

$$ i_t = r_t^* + \pi_t + a_\pi (\pi_t - \pi_t^*) + a_y (y_t - y_t^*) $$

- I_t.... Policy interest rate at time t
- π_t... Inflation at time t
- π_t^*... Desired inflation at time t
- r_t^*... Equilibrium interest rate at time t
- y_t ... The actual GDP growth rate at time t
- y_t^*... GDP growth rate at full potential at time t
- a_y , a_π ... Relative weights given to GDP growth and inflation growth rate

Inflation Targeting
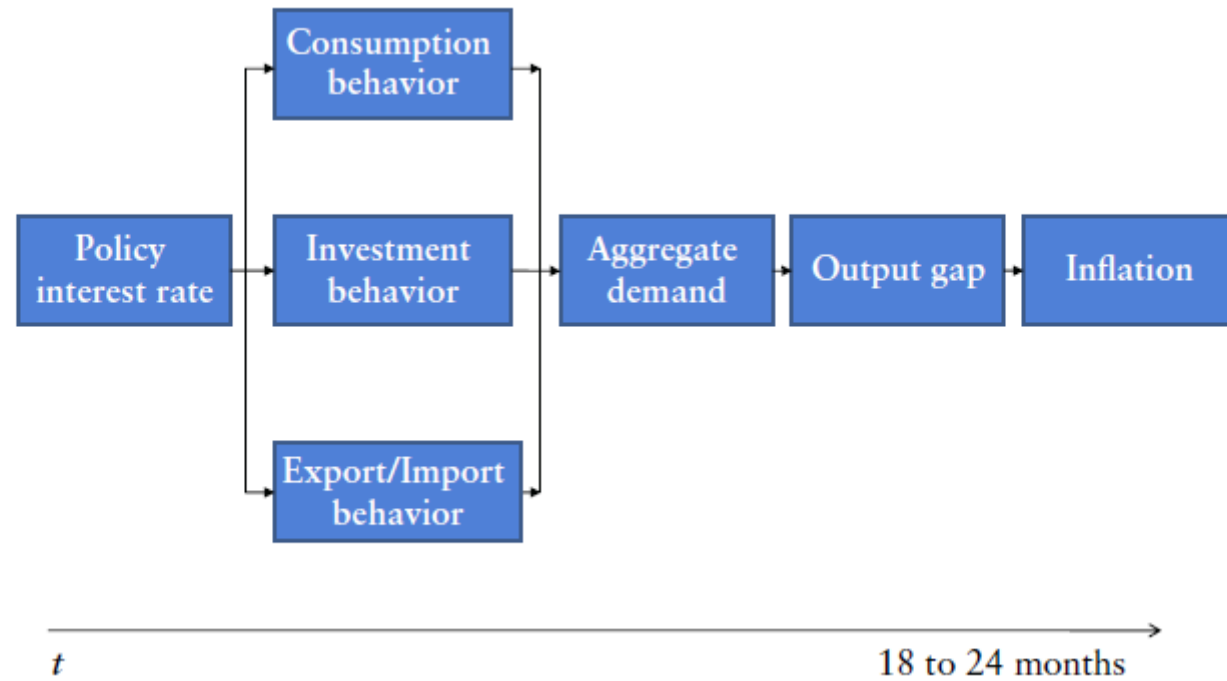
Monetary Policy Implementation

Types of Financial markets

| Type of Financial Market	Transactions Handled	Central Bank Operations or Involvement
Money market	Short-term (less than one year) liquidity funding	Operations in the money market are done to manage the policy interest rate, which is a key reference rate for other short-term interest rates.
Foreign exchange market	Foreign exchange funding	Foreign exchange interventions are done to smooth out excess exchange rate volatility, or to keep the exchange rate within target.
Government securities market	Government funding	Transactions in the (secondary) government securities market are done to inject or absorb liquidity in the longer term.
Credit market	Corporate funding, housing market funding	Part of unconventional monetary policy used in the United States, under which the central bank targets specific liquidity shortages in the system.

Monetary policy through money market 1

- Borrowing and lending funds with short maturity (<1 year)
- At the core is interbank lending
  - Commercial banks lend and borrow among themselves
  - CBs affect the accessibility of the funds by changing the interest rates
  - Commercial banks wat to hold as little cash as possible since it does not yield interest, unlike loans. Although they need to hold minimum reserves.
  - Commercial banks demand the funds for example if unexpectedly high settlement occurs. Also government, and other financial institution might demand funds on this market
  - On the other hand, if commercial banks find out, that they have too much cash, they supply it to the market
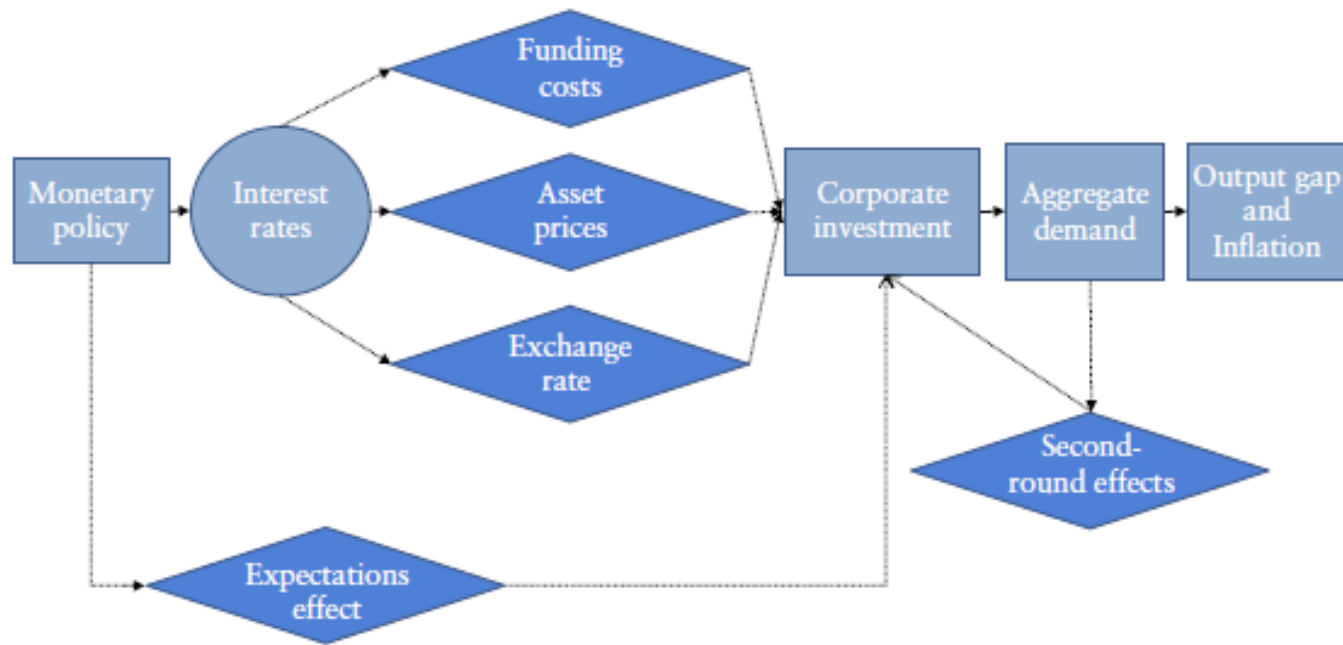 - EURIBOR, LIBOR, SOFR, PRIBOR….

Monetary policy through money market 2

- Policy Interest Rates
- Open market operations
- Reserve requirements

Monetary Policy Transmission - Households
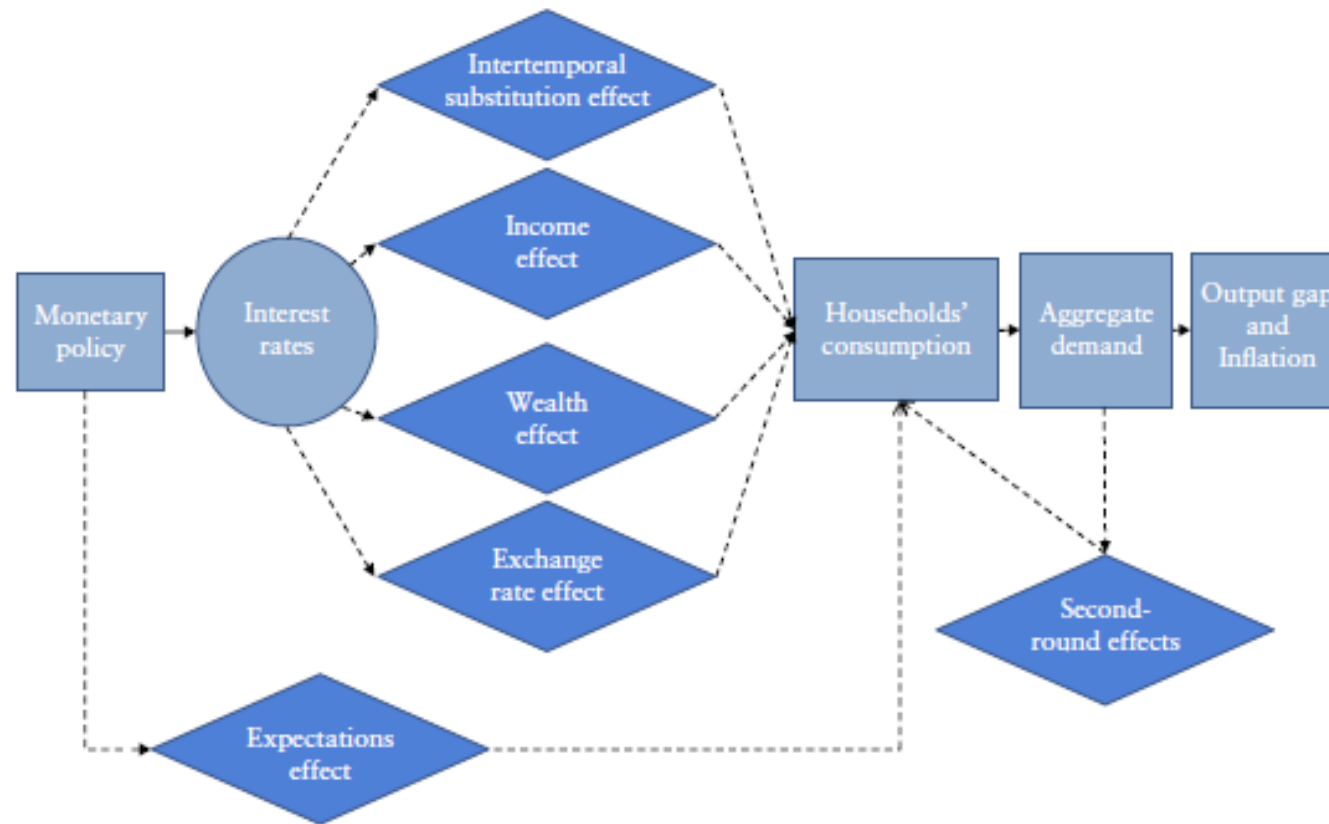
Monetary Policy Transmission- Firms

Central Bank's Balance Sheet

Assets	Liabilities
Foreign Reserves	Currency in Circulation
Domestic Government Bonds	Reserves of Commercial Banks
Loans to Commercial Banks	Government Deposits
Other Financial Assets	Other Liabilities
	Capital (Equity)

Balance of Payments

- One of the most important macroeconomics indicator
- Difference between all money flowing into the country in a particular period of time and the outflow of money to the rest of the world.

$$\text{current account} + \text{broadly defined capital account} + \text{balancing item} = 0.$$

Current Account	Capital and Financial Account
Trade in goods and services	Direct Investment (inflows/outflows)
Income from abroad	Portfolio Investment (stocks, bonds)
Current transfers (e.g., aid)	Loans, reserves, other financial flows
	Capital Transfers (e.g., grants, patents)

Current Account

- Trade Balance
- Income from abroad

Capital Account

- Direct Investments
- Portfolio Investments
- Loans

BoP examples… assuming ER 2USD/1GBP

Example 1 Boeing of the United States exports a $100 million aircraft to the United Kingdom which is paid for by British Airways debiting its US bank deposit account by a like amount.

US balance of payments		UK balance of payments	
current account		current account	
Exports of goods	+$100m	Import of goods	−£50m
Capital account		**Capital account**	
Reduced US bank liabilities to UK residents	−$100m	Reduction in US bank deposit assets	+£50m

Example 2 The US exports $2,000 of goods to the UK in exchange for $2,000 of services.

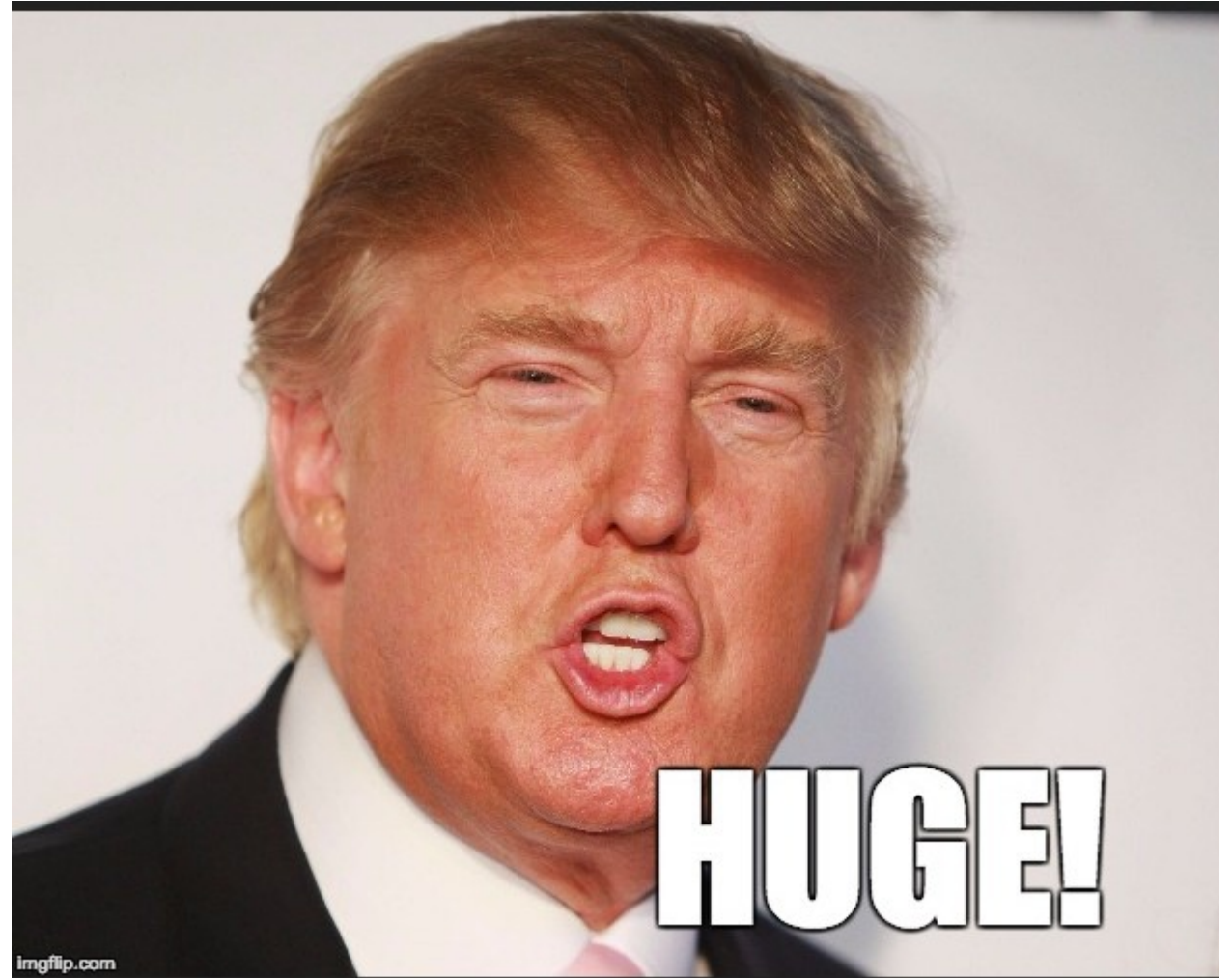| US balance of payments		UK balance of payments	
current account		current account	
Merchandise exports	$2,000	Exports of services	£1,000
Imports of services	−$2,000	Imports of goods	−£1,000

Example 3 A US investor decides to buy £500 of UK Treasury bonds and to pay for them by debiting his US bank account and crediting the account of the UK Treasury held in New York.

US balance of payments		UK balance of payments	
capital account		capital account	
Increase in UK treasury bond holdings	−$1000	Increased bond liabilities to US residents	£500
Increased in US bank liabilities	+$1000	Increased US bank deposit	−£500

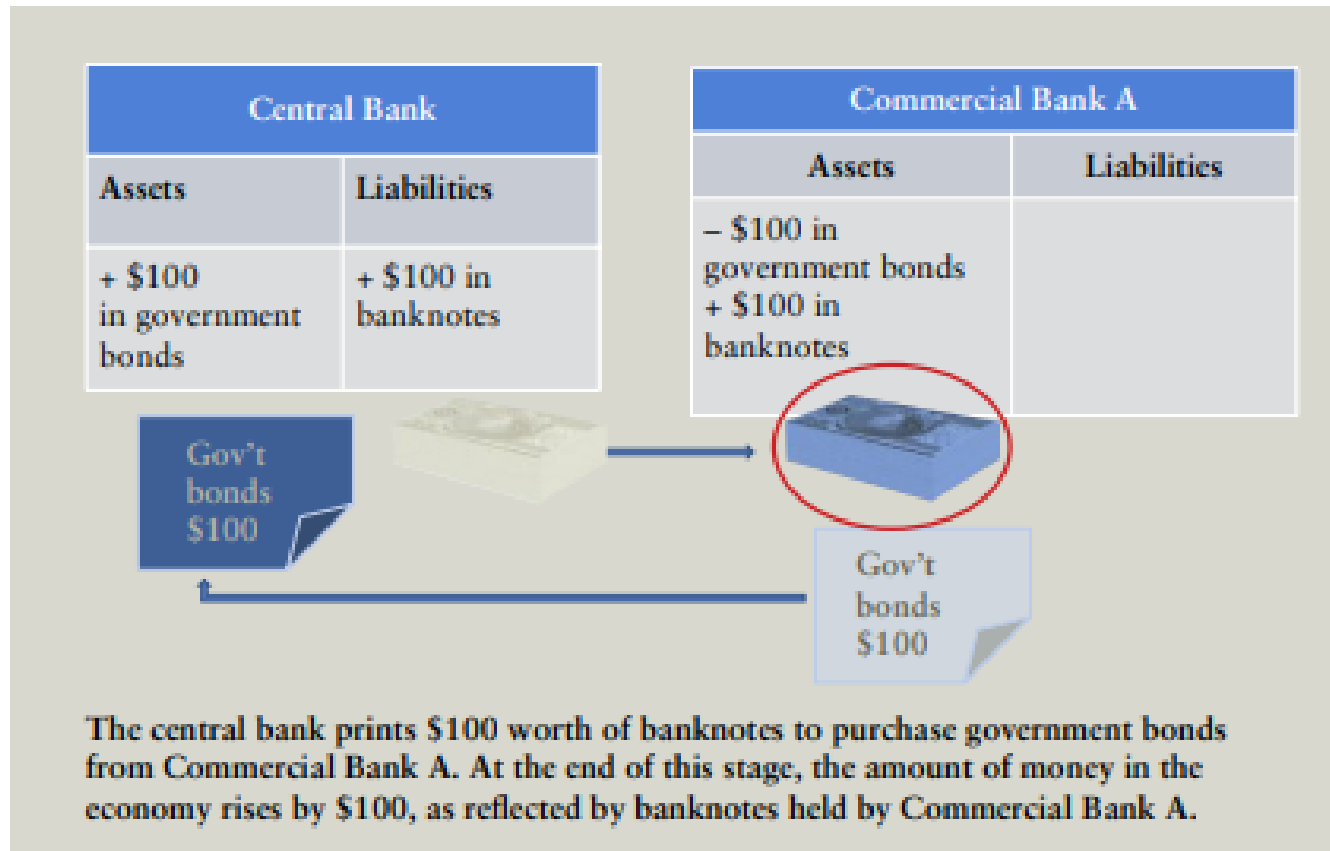# Current Account Imbalances…Do they matter?

- Obviously it does to

Some Macroeconomics Identities with CA

Money Creation 1

The central bank prints $100 worth of banknotes to purchase government bonds from Commercial Bank A. At the end of this stage, the amount of money in the economy rises by $100, as reflected by banknotes held by Commercial Bank A.
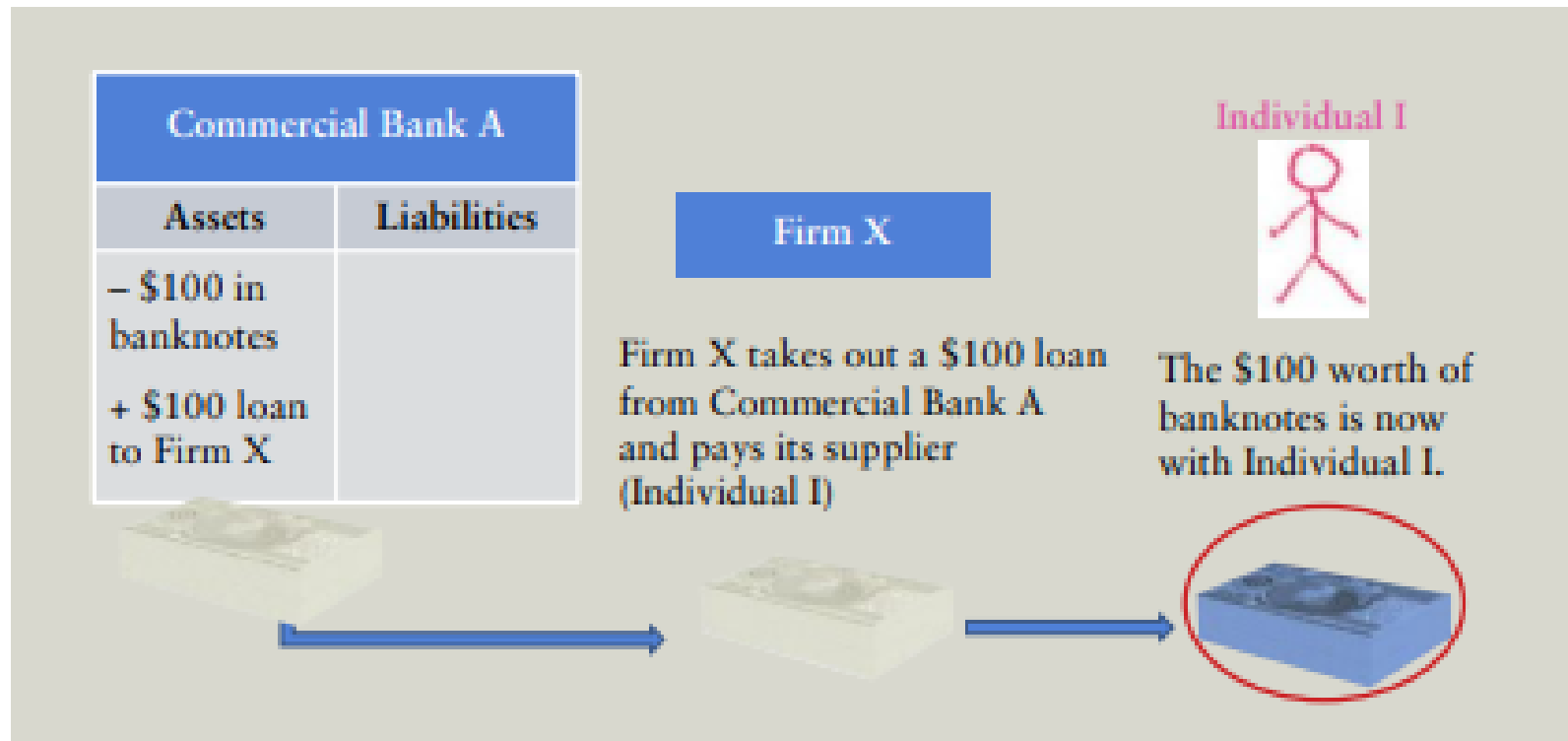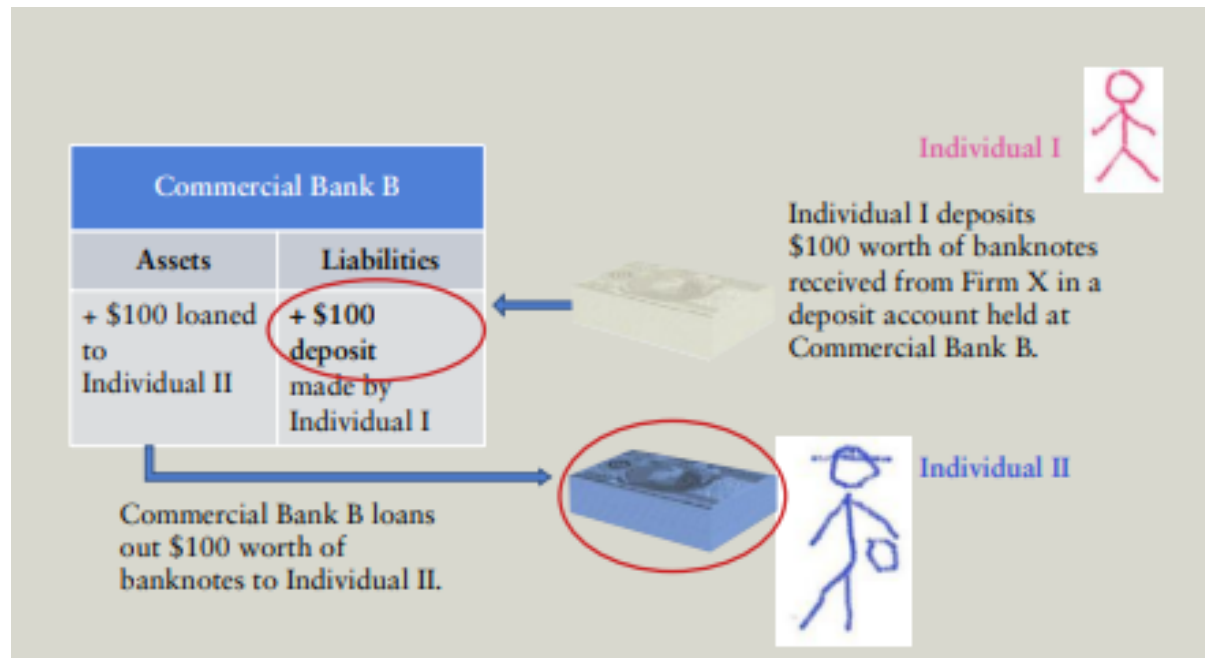
Money Creation 2

Money Creation 3

Money Creation 4
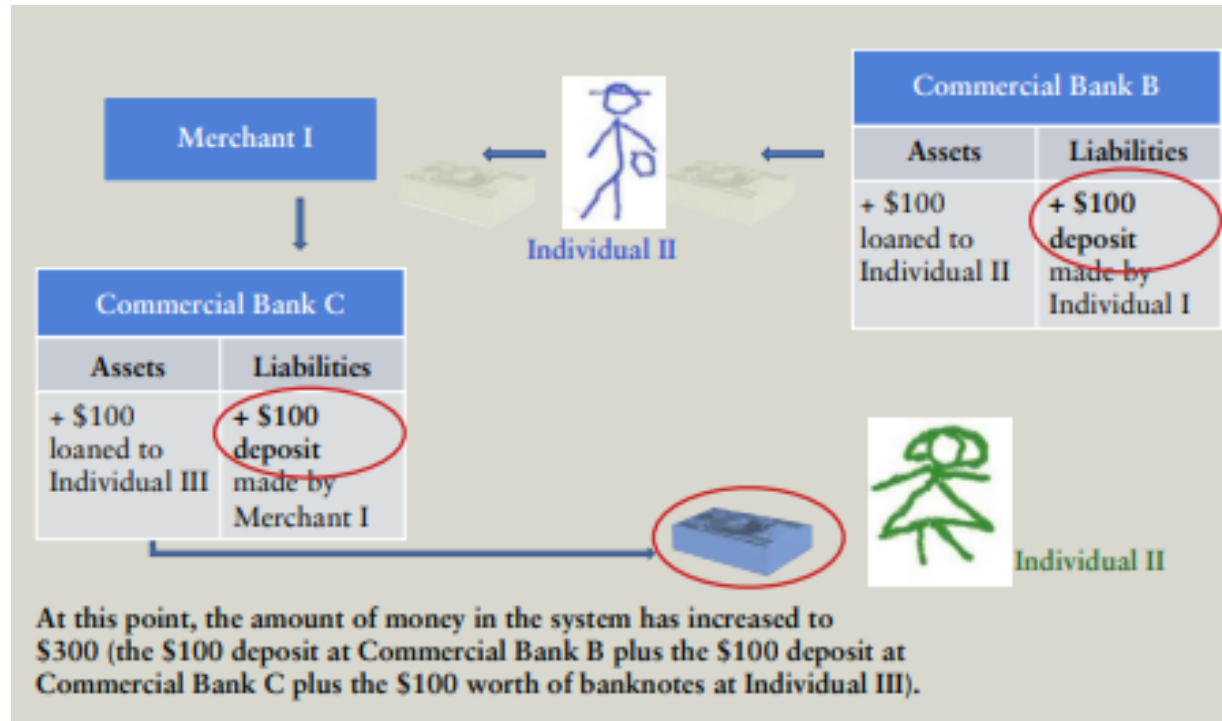
However, this is not how it is done in real world…

- CBs mostly do not set targets on money supply, but rather on inflation
- Reserve requirements(RR) are mostly not used to affect the economy
  - For example: In case of hike in RR, it would be very costly for banks and economy to call in the loans from the banks customers
- Therefore the CBs prefer to impact conditions on money market by changing interest rates and direct market operations

- Oxelheim, L. (1990), International Financial Integration, Heidelberg: Springer Verlag. ISBN 3-540-52629-3

The Swan Diagram
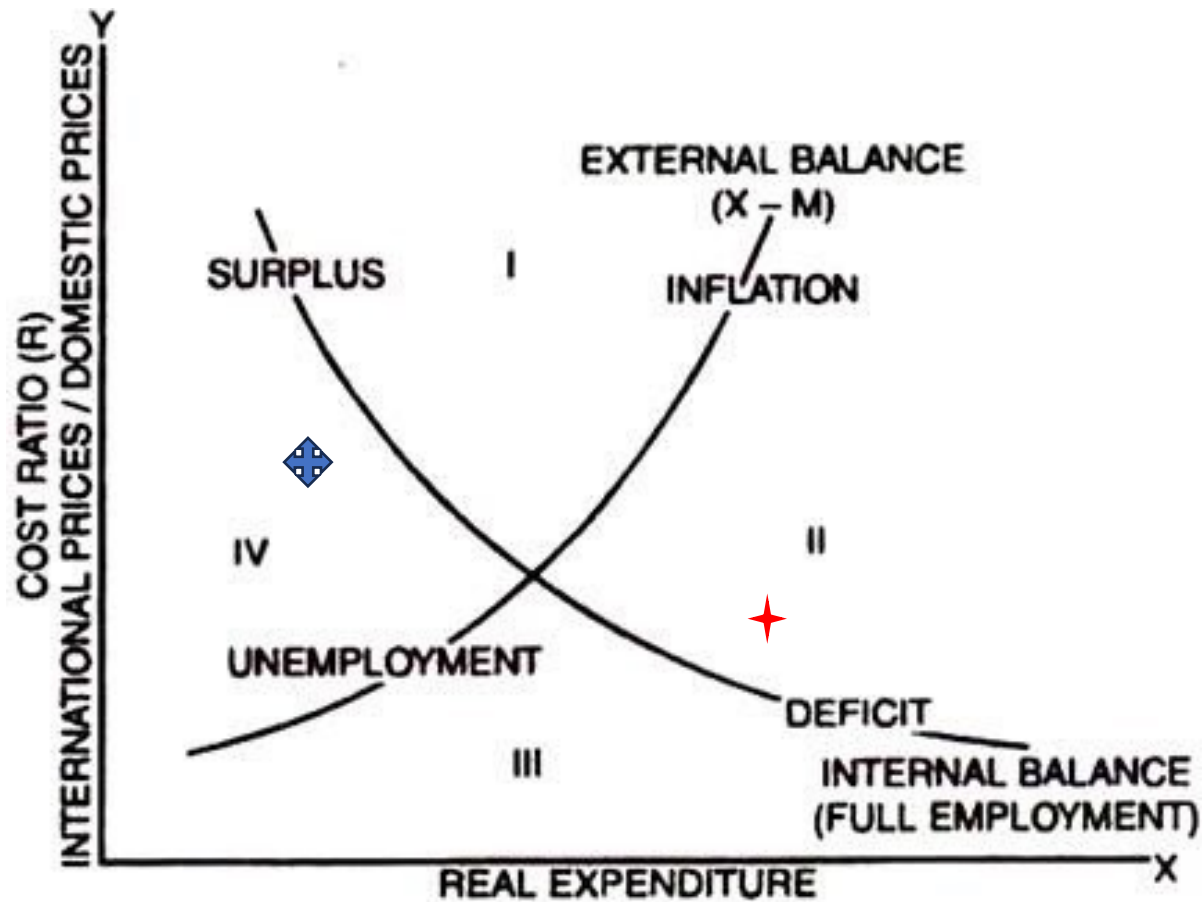
Fig. 25.2

Zone 1: BoP surplus and inflationary pressures
Zone 2: BoP deficit and inflationary pressures
Zone 3: BoP deficit and unemployment
Zone 4: BoP surplus and unemployment

Jan Tinbergen:
We need (at least) as many tools as targets

IS-LM model
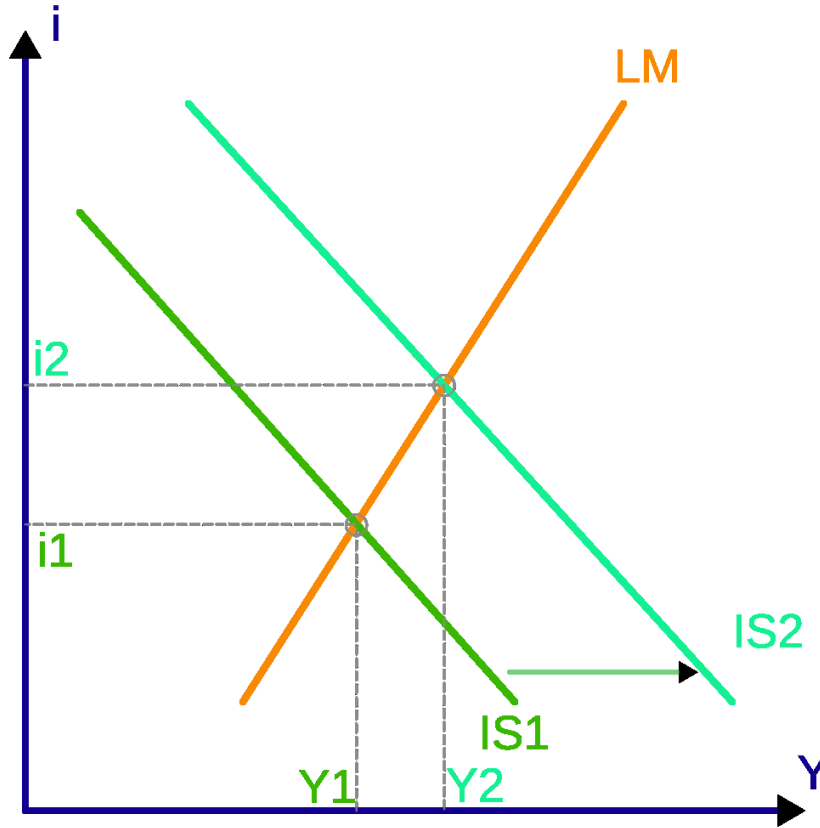
IS: Investment-Saving: goods market
Y = C+I+G+X-M
Since Y = C+S => **S+M = I+G+X**
 - for simplicity assuming linear function of the identities : S = Sa +sY and M= Ma +mY
Also: i ⬇ I⬆   Y⬆   and Y ⬆ S ⬆ i⬇

LM: Liquidity preference- money supply
Money market
The higher the income the higher demand for money

Mundell – Fleming Model aka IS-LM-BP
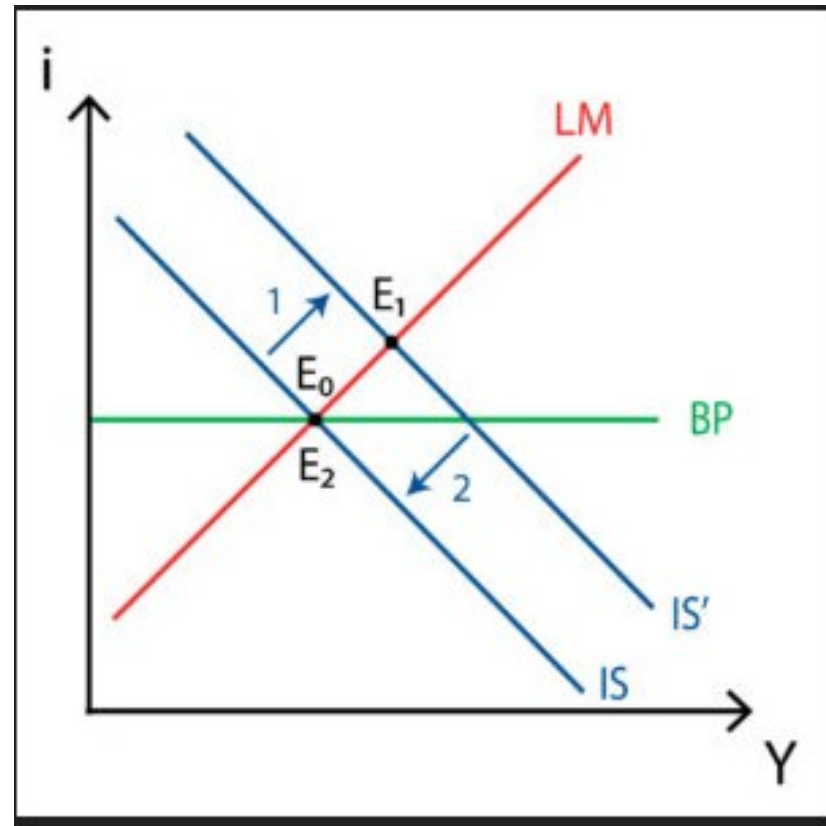
IS-LM-BP fixed ER

- Monetary policy case
- Fiscal policy case
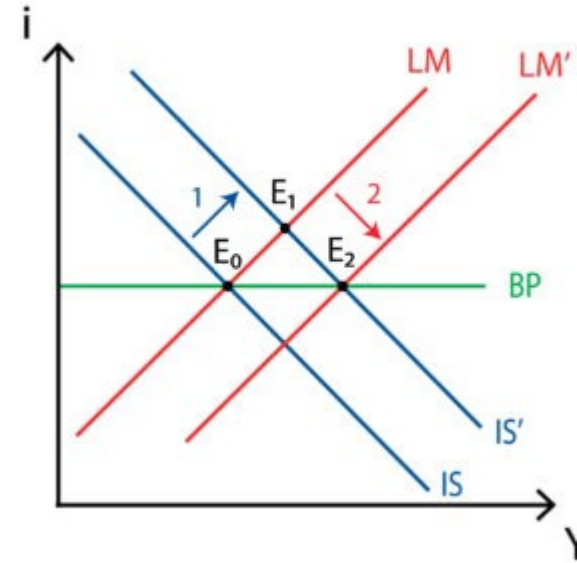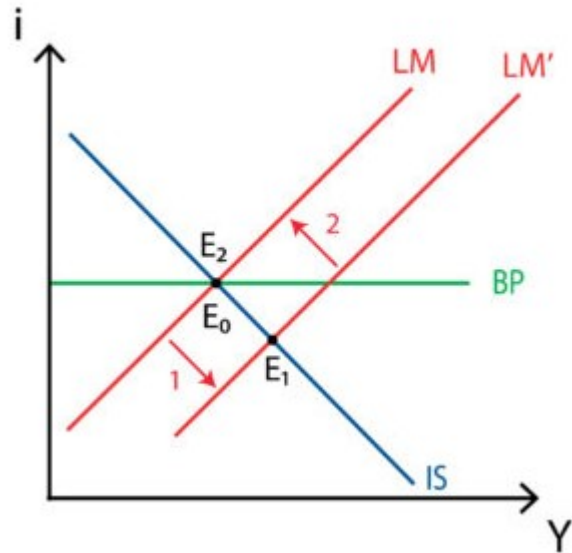
IS-LM-BP under floating Exchange rate
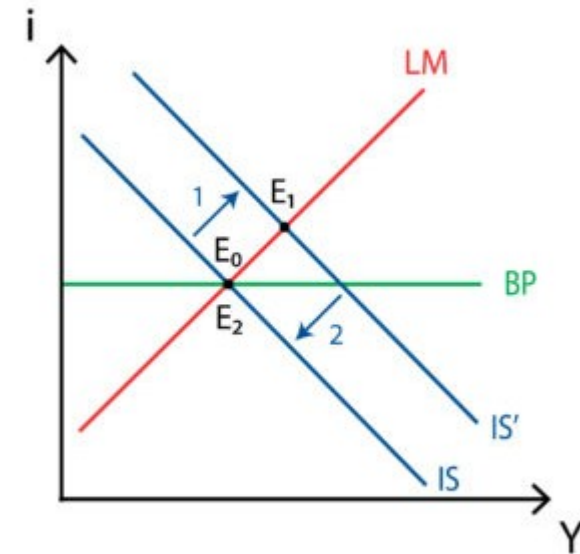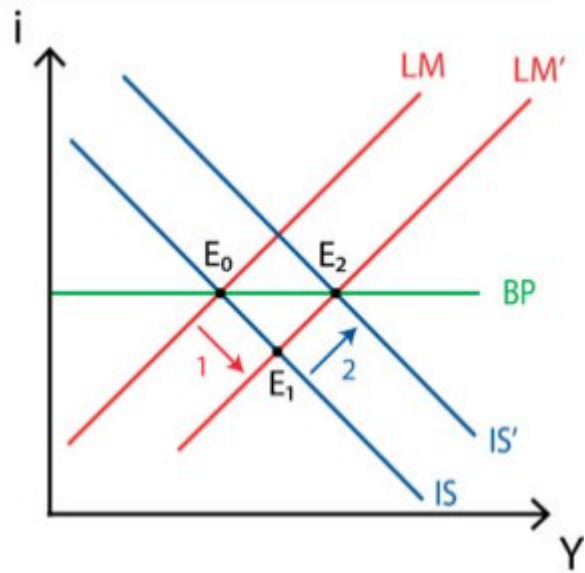
Selected topics in finance

- Concept of present value & compound interest
- Company finances –Balance sheet
- Methods of company valuations
- Multiples

Present value

- Time value of money: Rational investor always prefers MORE money SOONER, therefore: money obtained later has to be discounted

$$PV = \frac{FV}{(1+r)^n}$$

- OK, but how do I get the discount rate (r)?
  - CAPM
  - WACC
  - Or a rule of thump for rough quick calculation

Company's statements

Statement	What It Shows	Key Components
Income Statement	Profitability over a period	Revenue, Expenses, Net Income
Balance Sheet	Financial position at a specific date	Assets = Liabilities + Equity
Cash Flow Statement	Cash inflows/outflows	Operating, Investing, Financing Activities

BALANCE SHEET
(Unaudited)

In millions of USD	31-Dec-23	31-Mar-24	30-Jun-24	30-Sep-24	31-Dec-24
ASSETS					
Current assets					
Cash, cash equivalents and investments	29,094	26,863	30,720	33,648	36,563
Accounts receivable, net	3,508	3,887	3,737	3,313	4,418
Inventory	13,626	16,033	14,195	14,530	12,017
Prepaid expenses and other current assets	3,388	3,752	4,325	4,888	5,362
Total current assets	49,616	50,535	52,977	56,379	58,360
Operating lease vehicles, net	5,989	5,736	5,541	5,380	5,581
Solar energy systems, net	5,229	5,162	5,102	5,040	4,924
Property, plant and equipment, net	29,725	31,436	32,902	36,116	35,836
Operating lease right-of-use assets	4,180	4,367	4,563	4,867	5,160
Digital assets, net	184	184	184	184	1,076
Goodwill and intangible assets, net	431	421	413	411	394
Deferred tax assets	6,733	6,769	6,692	6,486	6,524
Other non-current assets	4,531	4,616	4,458	4,989	4,215
Total assets	**106,618**	**109,226**	**112,832**	**119,852**	**122,070**
LIABILITIES AND EQUITY					
Current liabilities					
Accounts payable	14,431	14,725	13,056	14,654	12,474
Accrued liabilities and other	9,080	9,243	9,616	10,601	10,723
Deferred revenue	2,864	3,024	2,793	3,031	3,168
Current portion of debt and finance leases (1)	2,373	2,461	2,264	2,291	2,456
Total current liabilities	28,748	29,453	27,729	30,577	28,821
Debt and finance leases, net of current portion (1)	2,857	2,899	5,481	5,405	5,757
Deferred revenue, net of current portion	3,251	3,214	3,357	3,350	3,317
Other long-term liabilities	8,153	8,480	9,002	9,810	10,495
Total liabilities	**43,009**	**44,046**	**45,569**	**49,142**	**48,390**
Redeemable noncontrolling interests in subsidiaries	242	73	72	70	63
Total stockholders' equity	62,634	64,378	66,468	69,931	72,913
Noncontrolling interests in subsidiaries	733	729	723	709	704
Total liabilities and equity	**106,618**	**109,226**	**112,832**	**119,852**	**122,070**
(1) Breakdown of our debt is as follows:					
Non-recourse debt	4,613	4,820	7,355	7,379	7,871
Recourse debt	44	54	7	11	7
Days sales outstanding	11	16	14	13	14
Days payable outstanding	63	75	60	63	58

STATEMENT OF CASH FLOWS
(Unaudited)

In millions of USD	Q4-2023	Q1-2024	Q2-2024	Q3-2024	Q4-2024
CASH FLOWS FROM OPERATING ACTIVITIES					
Net income	7,943	1,144	1,494	2,183	2,332
Adjustments to reconcile net income to net cash provided by operating activities:					
Depreciation, amortization and impairment	1,232	1,246	1,278	1,348	1,496
Stock-based compensation	484	524	439	457	579
Deferred income taxes	(6,033)	(11)	144	285	59
Digital assets gain, net	—	—	—	—	(589)
Other	262	—	119	408	(93)
Changes in operating assets and liabilities	482	(2,661)	138	1,574	1030
Net cash provided by operating activities	**4,370**	**242**	**3,612**	**6,255**	**4,814**
CASH FLOWS FROM INVESTING ACTIVITIES					
Capital expenditures	(2,306)	(2,773)	(2,270)	(3,513)	(2,783)
Purchases of solar energy systems, net of sales	(1)	(4)	(2)	—	3
Purchases of investments	(5,891)	(6,622)	(8,143)	(6,032)	(15,158)
Proceeds from maturities of investments	3,394	4,315	6,990	6,670	10,335
Proceeds from sales of investments	—	—	200	—	—
Net cash used in investing activities	**(4,804)**	**(5,084)**	**(3,225)**	**(2,875)**	**(7,603)**
CASH FLOWS FROM FINANCING ACTIVITIES					
Net cash flows from other debt activities	(141)	(140)	2,598	(75)	(108)
Net borrowings (repayments) under vehicle and energy product financing	952	216	(212)	(107)	677
Net cash flows from noncontrolling interests – Solar	(76)	(131)	(43)	(26)	(37)
Other	152	251	197	340	453
Net cash provided by financing activities	**887**	**196**	**2,540**	**132**	**985**
Effect of exchange rate changes on cash and cash equivalents and restricted cash	146	(79)	(37)	108	(133)
Net increase (decrease) in cash and cash equivalents and restricted cash	599	(4,725)	2,890	3,620	(1,937)
Cash and cash equivalents and restricted cash at beginning of period	16,590	17,189	12,464	15,354	18,974
Cash and cash equivalents and restricted cash at end of period	17,189	12,464	15,354	18,974	17,037

STATEMENT OF OPERATIONS
(Unaudited)

In millions of USD or shares as applicable, except per share data	Q4-2023	Q1-2024	Q2-2024	Q3-2024	Q4-2024
REVENUES					
Automotive sales	20,630	16,460	18,530	18,831	18,659
Automotive regulatory credits	433	442	890	739	692
Automotive leasing	500	476	458	446	447
Total automotive revenues	21,563	17,378	19,878	20,016	19,798
Energy generation and storage	1,438	1,635	3,014	2,376	3,061
Services and other	2,166	2,288	2,608	2,790	2,848
Total revenues	**25,167**	**21,301**	**25,500**	**25,182**	**25,707**
COST OF REVENUES					
Automotive sales	17,202	13,897	15,962	15,743	16,268
Automotive leasing	296	269	245	247	242
Total automotive cost of revenues	17,498	14,166	16,207	15,990	16,510
Energy generation and storage	1,124	1,232	2,274	1,651	2,289
Services and other	2,107	2,207	2,441	2,544	2,729
Total cost of revenues	20,729	17,605	20,922	20,185	21,528
Gross profit	**4,438**	**3,696**	**4,578**	**4,997**	**4,179**
OPERATING EXPENSES					
Research and development	1,094	1,151	1,074	1,039	1,276
Selling, general and administrative	1,280	1,374	1,277	1,186	1,313
Restructuring and other	-	-	622	55	7
Total operating expenses	2,374	2,525	2,973	2,280	2,596
INCOME FROM OPERATIONS	**2,064**	**1,171**	**1,605**	**2,717**	**1,583**
Interest income	333	350	348	429	442
Interest expense	(61)	(76)	(86)	(92)	(96)
Other (expense) income, net	(145)	108	20	(270)	837
INCOME BEFORE INCOME TAXES	2,191	1,553	1,887	2,784	2,766
(Benefit from) provision for income taxes	(5,752)	409	393	601	434
NET INCOME	7,943	1,144	1,494	2,183	2,332
Net income attributable to noncontrolling interests and redeemable noncontrolling interests in subsidiaries	15	15	16	16	15
NET INCOME ATTRIBUTABLE TO COMMON STOCKHOLDERS	**7,928**	**1,129**	**1,478**	**2,167**	**2,317**
Net income per share of common stock attributable to common stockholders					
Basic	$ 2.49	$ 0.37	$ 0.46	$ 0.68	$ 0.72
Diluted	$ 2.27	$ 0.34	$ 0.42	$ 0.62	$ 0.66
Weighted average shares used in computing net income per share of common stock					
Basic	3,181	3,186	3,191	3,198	3,213
Diluted	3,492	3,484	3,481	3,497	3,517

Financial metrics and multiples

- EV/EBITDA
- P/E
- P/B
- Enterprise value vs Market Cap
- EBITDA vs Earnings
- ROI, ROE