The Variables of Interest to Macroeconomists

- A *stock* variable is a variable measurable at one particular time and represents a quantity accumulated in the past (ex: wealth); whereas,
- A *flow* variable is measured over an interval of time (ex: income)

- Gross Domestic Product (GDP) is one of the national accounts (which measures the economic activity of a nation).
- GDP is a flow variable and it measures the (before tax) market value of economic output produced within the borders of a country in a year (or quarter)
- What do we understand from *economic output*?
  - It is (physical) goods and (intangible) services
- GDP per capita (person) is obtained when total GDP is divided by the resident population, and it is an important indicator for the well being of an economy

- How is GDP calculated?
  - *Production (output) approach:* The summation of the price of goods and services times their amounts
  - *Expenditure approach:* Things are produced for sale. Thus, the GDP can also be calculated as the total amount of expenditure on these goods and services
  - *Income approach:* When people buy goods, the money spent on these goods is distributed among the factors of production as salary for workers, rent for capital owners, and as corporate income. Therefore, GDP is also equal to the total income within the economy

- Q: The role of government?
  - A: To meet its expenditures, the governments use taxes
    - If governments put taxes on capital or labor, it affects people's decisions on how much capital to rent or how much to work. This tax lowers people's incentive to work or accumulate capital. The amount of factors of production changes, so does the GDP. This way a government can distort the economy
  - *We assume government does not involve in production activities

- Q: Suppose some goods are not sold in the year they are produced. How can we calculate GDP in this case?
  - A: We treat those goods as if they are bought by the company itself. The company puts these goods in its inventories to be sold in the coming years. This transaction enters the company's account both as an income and an expenditure. GDP increases. However, if that good is not a durable one (e.g., bread), it is not included in the GDP. In such a case labor earns wage income, but the amount is reduced from producer income

- Q: What is value added way of calculating GDP by production approach?
  - Production of many outputs requires the use of inputs, for instance tires are necessary to produce cars. In calculating GDP, we either count the value of car (f*inal goods approach*), or take the value of tires, and combine it the value of car without the tires (*value added approach*). Thus, value added is the amount by which the value of goods or services are increased in each stage of its production

- In calculating the GDP, three approaches are nearly substitutable (although there can be small statistical discrepancies). But in economic analysis, each gives us different insights:
  - If we are interested in how total income is distributed among the factors of production—that is, income shares (in GDP) of labor and capital—, we may be interested in the *Income Approach*.
  - If we are interested in questions related to the supply side of the economy (What are the contribution of sectors to the GDP?), we may use the *Production Approach*.

– If we are interested in the demand side of the economy (e.g. how much governments and consumers save and how much they consume?), we may refer to the *Expenditure Approach (Demand side)*

- Expenditure Approach: GDP is usually decomposed into
  - *Consumption (C):* Private consumption of all (non-)durable goods and services
  - *Investment (I):* (Non-)residential investment plus change in Inventories
    - Investment does NOT mean individuals' purchases of financial product as we would normally think. Under national accounts buying financial products is classified as 'saving', NOT investment.)
  - *Government Purchases (G)*: Government's expenditure on goods and services, plus expenditure for infrastruc-

ture investment or research spending (called government investment,or gross fixed capital formation)

– *Net Exports (NX)*: Exports (X) minus Imports (I)
  * In a closed economy, Exports, Imports, and Net Exports are all equal to 0.

– National Income Accounts Identity

$$Y = C + I + G + NX$$

– National Income Accounts Identity in a Closed Economy

$$Y = C + I + G$$

- *A Numerical Example:* Suppose there are two producers in an economy: one produces tomatoes and the other produces ketchup. Given the information in Table 1, calculate the GDP of this economy by the approaches outlined above

	Tomate Company ($)	Ketchup Company
Sales Revenue	6000	4000
Productions Costs		
Wage Payments	1500	1000
Input Costs	0	2000
Profits	4500	1000

- *(Final Good Approach)* GDP=(6000-2000)+4000=8000$
- *(Value Added Approach)* GDP=(6000-0)+(4000-2000)=8000$
- *Expenditure Approach* classifies the goods according to by whom expenditure is made (C=8000$)
- *(Income Aproach)* GDP=(1500+1000)+(4500+1000)=8000$

table 2-1

GDP and the Components of Expenditure: 2000

	Total (billions of dollars)	Per Person (dollars)
Gross Domestic Product	**9,963.1**	**36,174**
Consumption	**6,757.3**	**24,534**
Nondurable goods	2,010.0	7,298
Durable goods	820.3	2,978
Services	3,927.0	14,258
Investment	**1,832.7**	**6,654**
Nonresidential fixed investment	1,362.2	4,946
Residential fixed investment	416.0	1,510
Inventory investment	54.5	198
Government Purchases	**1,743.7**	**6,331**
Federal	595.2	2,161
Defense	377.0	1,369
Nondefense	218.2	792
State and local	1,148.6	4,170
Net Exports	**−370.7**	**−1,346**
Exports	1,097.3	3,984
Imports	1,468.0	5,330

Source: U.S. Department of Commerce.

- Note: Housing initially enters as residential investment. Then enters as consumption spending, as people pay rent to live in them. This is expenditure for renters, income for the landlord. If landlord lives in the house by himself, it is treated as he pays rent to itself

- *Case Study:* What would be the effect of the Japanese Earthquake on this country's GDP?
  - In good times, GDP (per capita) is a good to measure of the average well being of the citizens in an economy. However, in bad times, it is not necessarily so

– The quake damaged Japan's existing stock of facilities; hence, Japanese stock of wealth eroded. However, GDP is a flow concept

  * The quake hit an area where considerable production takes place. Hence, GDP would decline due to a possible fall in production
  * But Japanese economy was going through stagnation for decades. Hence, GDP was already below what it would have been under full employment of resources. This is to say there was a large excess supply capacity in Japan. This spare capacity in other parts of the country offset the fall in production in the area hit

by the quake. Hence, in the short run we do not necessarily observe a decline in GDP

* Reconstruction costs will be borne by local governments and mostly by the central government, which can collect the money from financial markets. Thus, national saving goes to government instead of investment. This, in the long run, would decrease the GDP growth rate
  - This public debt will eventually be reflected as higher taxes, leading to decline in the well being of citizens

Money Supply and Prices: Quantity Theory of Money

- Suppose 10 identical goods are produced in the economy, and the price of each good is 10 TL. The GDP of this economy is 100 TL
- Q: How much money do we need in this economy?
  - If the production and sale of the goods occurs at the same point in time, we need 100TL. In this case we say the money in the economy circulates once
  - However, this is not the case in reality. Production of goods in a year does occur in different time spans.

Hence, even a money supply of 20TL in the economy would be enough if there are 5 stages of transactions

– This gives us the *Quantity Theory of Money*: If Q is number of goods in the economy, P is the price of goods, M is the money supply, and V is the velocity of money, the following equation always needs to be satisfied

$$Q * P = M * V$$

The Increase in the Money Supply: Inflation

- Assume that there are 10 identical good are produced, and the price of each good is 10 TL. The GDP of this economy is 100 TL
- Assume Central Bank is not independent and the government orders the Central Bank to print 100 TL more. If the number of goods produced is the same, according to the Quantity Theory of Money, the price of each good should increase to 20 TL
- Since the new money is owned by the government, consumers can now afford to buy only 5 goods, and the rest

of the goods are consumed by the government

- We arrive at two conclusions

  1. Inflation, which is %100 here, is a hidden tax (called seigniorage) that enables government to increase its expenditure share without levying direct taxes on consumers
  2. Just because GDP increases from 100 TL to 200TL, the economy's well being does not change: there are still 10 goods in the economy to be consumed. Hence, nominal GDP (also called *GDP in current prices*) is not an appropriate tool to measure the well being of countries. We need create a *Quantity Index*, which measures the number of goods and services produced in the economy

Formulas for Calculating Quantity Index

- We can keep prices *fixed* at a *base year* (1999 below) and use those prices to weight the quantities produced in different years
- Real GDP (1999) = (1999 Price of Apples * 1999 Quantity of Apples)
  + (1999 Price of Computers * 1999 Quantity of Computers)
  - Note that in 1999 Real GDP=Nominal GDP
- Real GDP (2000) = (1999 Price of Apples * 2000 Quantity of Apples)

+ (1999 Price of Computers * 2000 Quantity of Computers)

- ...
- This is a quantity index and is called *GDP in constant (1999) prices*
- You may compute the same type of index by taking 2000 as the base year. Hence, the level of the Real GDP computed this way is not informative. That is why we compose an index from it. In this example we set it equal to 100 in 1999

- Changes in quantity indexes give us the *Growth in Real GDP*
  - It can be calculated in a way that

$$Q_t = \frac{\sum p_b q_t}{\sum p_b q_b}$$

    where b denotes base prices (1999 in the example above)

- *However, there is a problem with this method.* As an example, in 2009 computers are cheaper and much more available than in 1999. Hence, using their 1999 prices would overestimate the value of computers in year 2009

- Accordingly, we develop another quantity index and a step-wise procedure, which we call the *Chain-Rule*

Formulas for Calculating Chain-Type Quantity Index

- The chain-type annual change in Real GDP (Fisher index) takes the geometric mean of two indexes, each measures the change in Real GDP at time t in two adjacent years, one keeps prices fixed at $t-1$, and the other at t

$$Q_t^F = \sqrt{\frac{\sum p_{t-1}q_t}{\sum p_{t-1}q_{t-1}} * \frac{\sum p_t q_t}{\sum p_t q_{t-1}}}$$

Price Indexes

- Price indexes are used to measure changes in prices. The chain-type price index is

$$P_t^F = \sqrt{\frac{\sum p_t q_{t-1}}{\sum p_{t-1} q_{t-1}} * \frac{\sum p_t q_t}{\sum p_{t-1} q_t}}$$

- Consumer Price Index (CPI) (whether it is chain-type or not) measures changes in the price level of consumer goods and services *purchased by households*

- GDP price deflator (may be called implicit price deflator) gives us the price changes from base year to time t. Unlike CPI, it takes into account all the goods and services in the economy, and it is the ratio nominal gross domestic product to real gross domestic product

$$GDP\ Deflator_t^F = \frac{\sum p_t q_t}{\sum p_b q_t} * 100$$

  - The numerator is the nominal GDP at time t. The denominator is the real GDP

- *"In practice, the difference between the deflator and a price index like the Consumer price index (CPI) is often relatively small. On the other hand, governments increasing utilize of price indexes for everything from fiscal and monetary planning to payments to social program recipients, even small differences between inflation measures can change budget revenues and expenses by a considerable amount."*

- *Example:*

Prices and Quantities

Year	Price of Hot Dogs	Quantity of Hot Dogs	Price of Hamburgers	Quantity of Hamburgers
2013	$1	100	$2	50
2014	$2	150	$3	100
2015	$3	200	$4	150

Calculating Nominal GDP

2013	($1 per hot dog × 100 hot dogs) + ($2 per hamburger × 50 hamburgers) = $200
2014	($2 per hot dog × 150 hot dogs) + ($3 per hamburger × 100 hamburgers) = $600
2015	($3 per hot dog × 200 hot dogs) + ($4 per hamburger × 150 hamburgers) = $1,200

Calculating Real GDP (base year 2013)

2013	($1 per hot dog × 100 hot dogs) + ($2 per hamburger × 50 hamburgers) = $200
2014	($1 per hot dog × 150 hot dogs) + ($2 per hamburger × 100 hamburgers) = $350
2015	($1 per hot dog × 200 hot dogs) + ($2 per hamburger × 150 hamburgers) = $500

Calculating the GDP Deflator

2013	($200 / $200) × 100 = 100
2014	($600 / $350) × 100 = 171
2015	($1,200 / $500) × 100 = 240

- *Case Study:* Turkish GDP and Inflation Data

	2002	*2010*	*Average Yearly Growth Rate*
Real GDP	73	106	%4.7
Real GDP per capita			%3.4
GDP in billion TL	350	1.105	%15
GDP in billion USD	231	736	%15
			Average Yearly Changes in Prices
Consumer Price Index			%8
GDP Deflator			%10.2

Notes

- GDP per capita is obtained by dividing total GDP to the resident population, and it is the mean (first moment) of the income distribution of individuals. If one is interested in how the total income (GDP) is distributed among citizens, she needs to refer to the variance (second moment) of the income distribution, which is a measure of Income Inequality
- GDP data is collected quarterly. Annual GDP is the sum of quarterly GDPs

- There is a seasonality effect on the quarterly GDP data. We do not expect the production to be the same for instance, in winter and summer (for instance heating oil production rises in before the winter heating season). Hence, to calculate GDP growth rate using quarterly data, we should look for 4-quarter growth rates, i.e. compare the Real GDP in any quarter with the corresponding quarter of the previous year. To create an index (which is a level variable) from quarterly data, we should correct the seasonality effect

- *Recessions*: Periods of falling Real GDP, severe ones called *Depressions*
- Gross National Product (GNP) = GDP + Factor Payments From Abroad - Factor Payments to Abroad
- Net National Product (NNP) = GNP - Depreciation

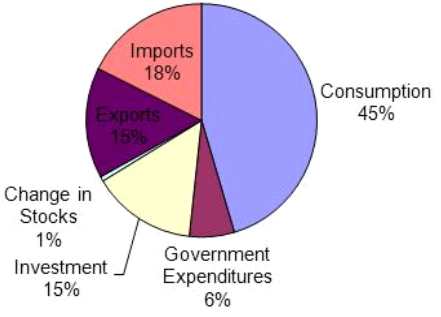
Data Management

- Turkish Data
  - Go to TCMB web site: http://www.tcmb.gov.tr, choose: English; Data; Statistical Data
- The US data
  - US Bureau of Economic Analysis: http://www.bea.gov, choose: National; National Income and Product Accounts Tables; from a list of All NIPA Tables,...

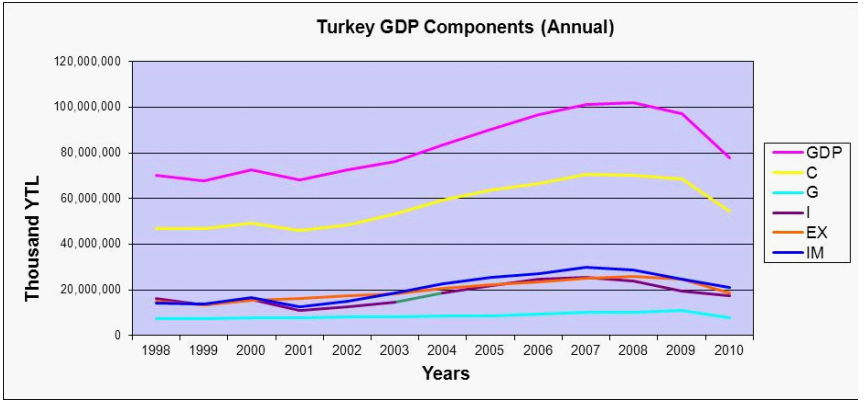
Extracts from the TCMB

Gross Domestic Product	**Gayri Safi Yurtici Hasila**
Final Consumption Expenditure of Resident Households	**Yerlesik Hanehalklarinin Tuketimi**
Final Consumption Expenditure of Resident and Non-Resident Household	Yerlesik ve Yerlesik Olmayan Hanehalklarinin Yurtici Tuketimi
(Less) Final Consumption Expenditure of Non-Resident Households on	(Eksi) Yerlesik Olmayan Hanehalklarinin Yurtici Tuketimi
Final Consumption Expenditure of Resident Households in the Rest of	Yerlesik Hanehalklarinin Yurtdisi Tuketimi
Government Final Consumption Expenditure	**Devletin Nihai Tuketim Harcamalari**
Compensation of Employees	Maas, Ucret
Purchases of Goods and Services	Mal ve Hizmet Alimlari
Gross Fixed Capital Formation	**Gayri Safi Sabit Sermaye Olusumu**
Public Sector	Kamu Sektoru
Machinery-Equipment	Makine-Techizat
Construction	Insaat
Private Sector	Ozel Sektor
Machinery-Equipment	Makine- Techizat
Construction	Insaat
Change in Stocks	**Stok Degismeleri**
Exports of Goods and Services	**Mal ve Hizmet Ihracati**
(Less) Imports of Goods and Services	**(Eksi) Mal ve Hizmet Ithalati**

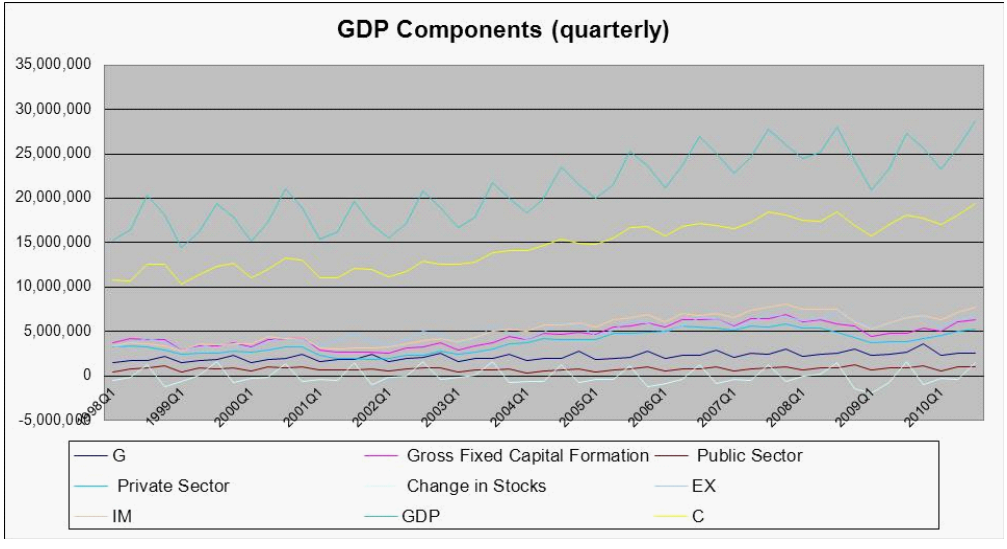
GSYIH Components:
(Cross-Sectional Data)
(2010)



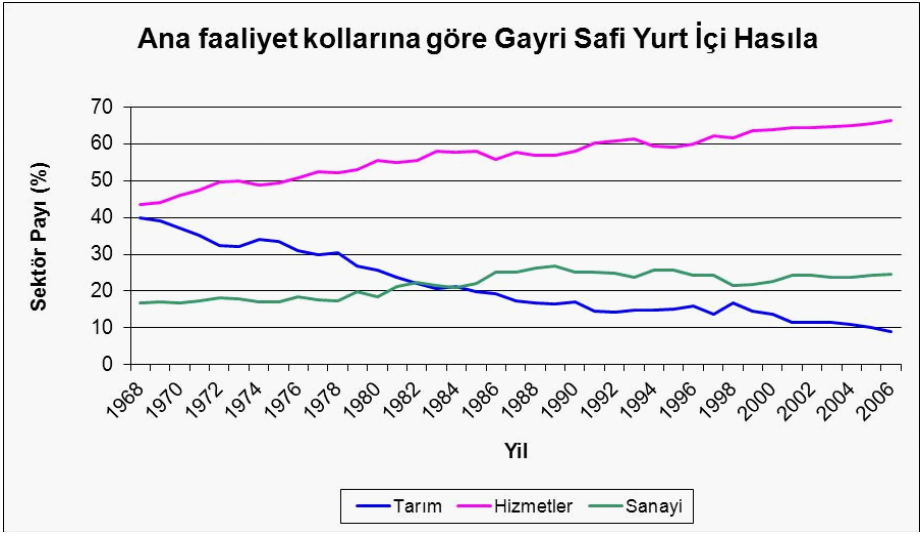
GSYIH Components:
(Time Series Data)



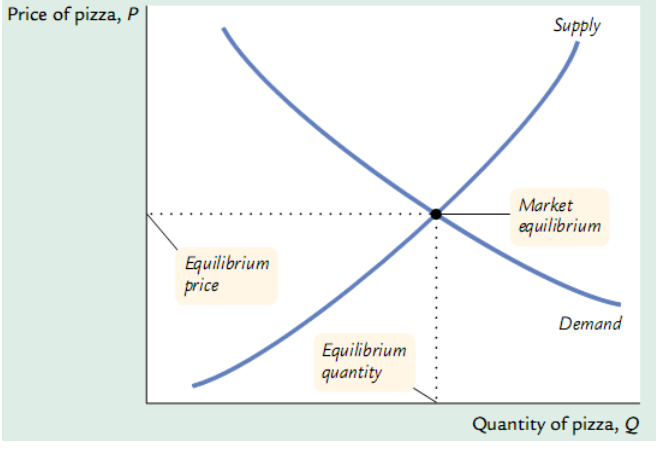
- The importance of seasonal adjustment (see the spikes on the quarterly GDP data shown with the top line)



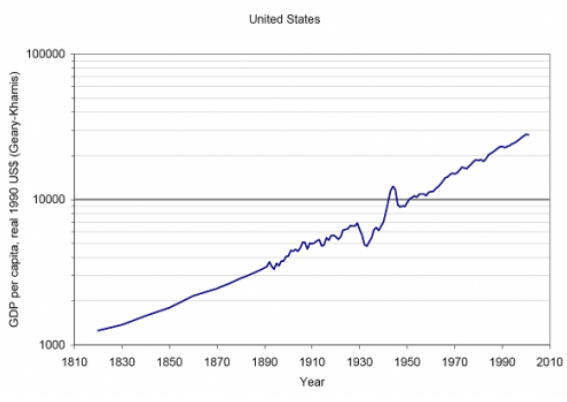
- Sectoral Decomposition of GDP

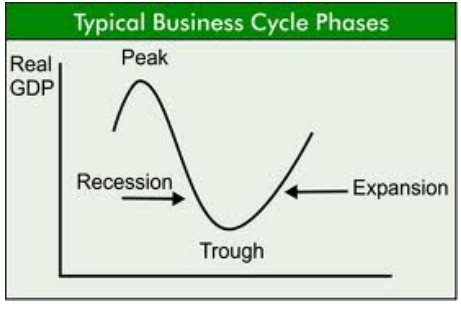


- In Economics, we use theoretical models to explain economic processes in the real world.
- Ex: The model of supply and demand



- Changes in Real GDP are explained in two parts: The (very) long-run (growth) component, and short-run (business cycle) component





- *Theory of Economic Growth* explains increases in national income decades.
- *Business Cycle Theory* explains the fluctuations in the data within a period of three months to a couple of years.

- *Unemployment*: Needless to say, it is one of the most important indicators of well being in the economy. If; Number of Employed: E, Number of Unemployed: U, Number of Home Sitting: HS
  - Labor Force: E+U
  - Unemployment Rate: $\frac{\text{U}}{\text{E+U}}$ *100
  - Labor-Force Participation Rate: $\frac{\text{E+U}}{\text{E+U+HS}}$ *100

- Other important variables
  - Interest Rate (Real Interest Rate= Nominal Interest Rate - Inflation)
  - Exchange Rate ($A_{\$/TL} = 1/A_{TL/\$}$): Real-Nominal, PPP (Purchasing Power Parity)

- *Microeconomics* is the study of how households and firms make decisions and how these decision makers interact in the marketplace
- Because economy-wide events arise from the interaction of many households and many firms, macroeconomics and microeconomics are inextricably linked
- For example, we examine the households' decisions regarding how much to consume and how much money to save and the firms' decision regarding how much to invest. These individual decisions together form the larger

macroeconomic picture. The goal of studying these micro-economic decisions in detail is to refine our understanding of the aggregate economy

- Sometimes a representative consumer may be all we need to model the economy, but sometimes we use heterogenous agents