Macroeconomic Measurement 1: Values and Prices

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Our first lectures will be devoted to understanding and getting familiar with basic macroeconomic data. In economics, more than in other sciences, the gathering of data is linked with theory. *NIPA*(National Income and Product Accounting) provides a useful framework for organizing macroeconomic data. In this notes we will briefly describe the main ideas and concepts of *NIPA*. For US data, tables and methodology the best source is the Bureau of Economic Analysis (BEA) National Economic Accounts

A model economy

One important distinction we will make throughout the course is between *domestic* and *national*. Domestic pertains to someone or something that is located and operates in a given country. National pertains to something that belongs to that country but it is not necessarily located in the country. For example a Honda factory in Columbus Ohio is a US domestic firm but is a Japanese national firm.

Figure 1 shows the 4 building blocks of the macroeconomy.

1. Households

   Households are the domestic private decision units. They buy goods and services from firms and from abroad, provide labor to domestic firms, exchange assets with foreigners, with domestic firms and with the government.

2. Firms

   Firms are the domestic private and public production units. They produce goods and services , employ capital and labor, purchase investment and intermediate goods from other firms and from abroad.

3. Foreign Sector

   The foreign sector is the collection of non-resident production and decision units. These units exchange goods and services with domestic firms, households and governments and they exchange assets with households and government.

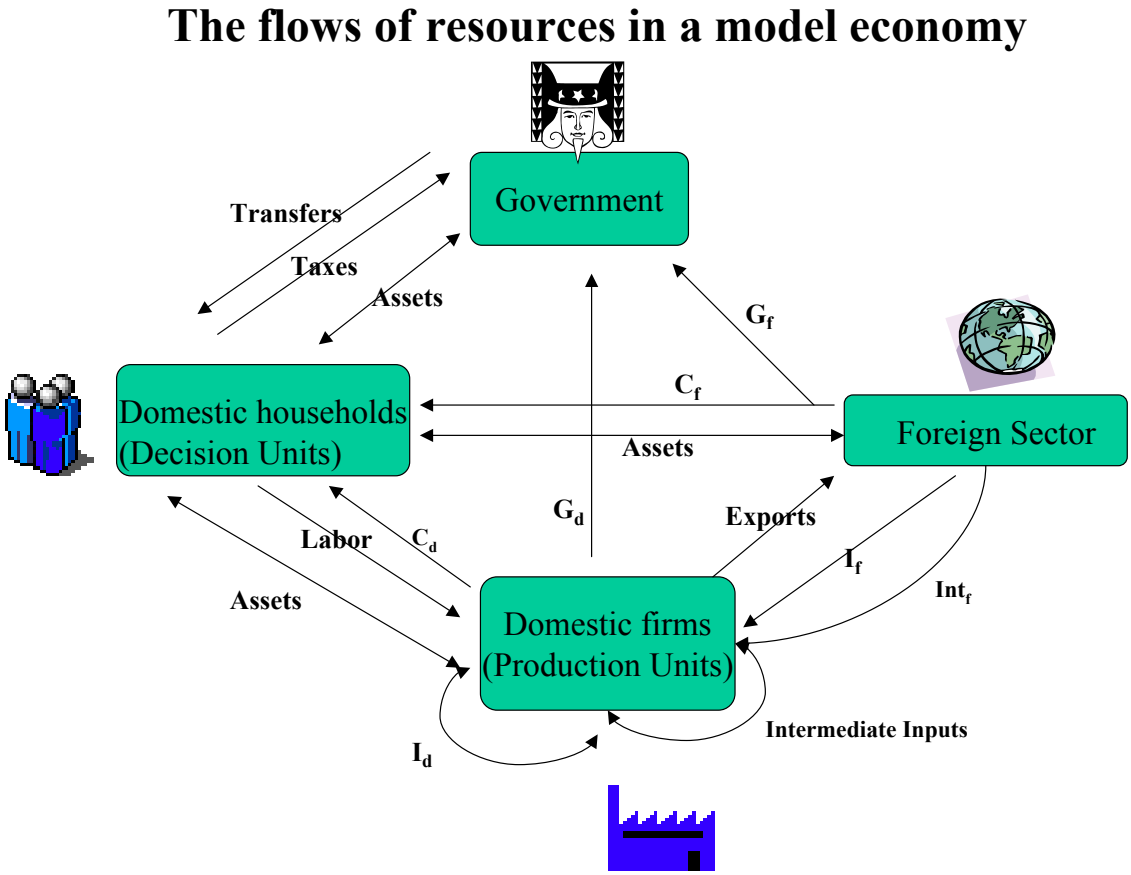

Figure 1: The Building Blocks of the Macroeconomy

4. Government

   The government is the collection of public decision units (the federal government, state and local governments, other government institutions). The government buys goods and services from firms and from abroad, exchange assets, receives tax payments from households, makes transfer payments to them.

Note that this distinction is purely conceptual: in some cases (self employed people, home owners) one person is at the same time household and firm since the person is both a consumer and a producer of goods or services, or an institution (for example a state school) is at the same time part of the government (because it is public) and part of the firms (because it produces a service).

GDP

One key macroeconomic data is how much value is an economy creating in a given period. This measure is often summarized what we call GDP (Gross Domestic Product). We can use this framework to give three ways of measuring GDP.

1) GDP is the sum of **value added** of all domestic firms (*GDP as production*). Value added is just the value of production net of intermediate inputs.

2) GDP is the total value of the expenditure on domestic goods and services by **final users**. (*GDP as expenditure*) net of imported intermediate inputs. Final users are all users that do not use the purchase as an intermediate input for the production of another domestic good or service.

3) GDP is the sum of income earned by domestic factors of production (*GDP as income*).

The three definitions capture the idea that when something is produced, something is also sold[1] and this sale generates revenues.

One clarification is about the role of final and intermediate goods. Suppose Intel produces a chip that is sold to Dell that uses it to produce a computer. This transaction is not recorded in GDP because it would be double counting (the value of the chip is already included in the value of the computer). This is the reason why we sum over value added and not over total production. This is also the reason why we want to

[1] There might be a case that something is produced and it is not sold. In this case the production goes to increase inventories. If we treat inventories as a sale from a firm to itself (or as an investment by the firm) the same principle holds. Clearly from a firm point of view it matters whether something is sold or kept as an inventory but from the the point of view of the economy as whole the two things are equivalent.

subtract foreign intermediate goods from total expenditure by final users. Suppose on the other hand the chip is sold to Toshiba that uses to produce a computer in Japan. In this case the chip will not be counted twice (Toshiba Japan is a final user) so its value should be included in GDP.

To see why all three definitions are equivalent let's make an example. Consider an economy made of only two firms: Supersail (a sail maker) and Fastboat (a sailboat manufacturer) and in which consumers and the government only consume sailboats.

SUPERSAIL		
Production		\$1000
	Sales to Fastboat	\$600
	Sales to foreigners	\$200
	Sales to domestic households	\$100
	Inventories	\$100
Expenditures		\$800
	Parts and materials from abroad	\$500
	Wages	\$300
Net Income		\$200
FASTBOAT.		
Production		\$2000
	Sales to the Government	\$500
	Sales to Foreigners	\$500
	Sales to domestic households	\$1000
Expenditures		\$1400
	Parts and material from abroad	\$500
	Wages	\$300
	Sails from Supersail	\$600
Net Income		\$600

If we measure GDP as the sum of value added we have that value added of Supersail is 1000-500=500 while value added of Fastboat is 2000-500-600=900 so GDP is 500+900=1400.

If we measure GDP as the sum of expenditure net of foreign intermediate we get that the contribution of Supersail is 200+100+100-500=-100, while contribution of Fastboat is 500+500+1000-500=1500 so GDP is 1500-100=1400.

Finally we measure GDP as sum of income we have to add wages and net income across firms. We get 300+200=500 from Supersail and 300+600=900 from Fastboat so GDP is once again 1400.

There are some issues on what to include and what not to include in GDP. For example if you rent your apartment, your rent payments are computed in GDP.

What about if own your place? In this case although you do not pay rent every month you produce housing services for yourself. This is why NIPA includes imputed rent from homeowners in GDP. A big portion of GDP that is not measured on the markets is home production (cooking your own meal, mowing your own lawn) and the underground economy, that can be big in less developed countries especially for fiscal reasons. The size of the underground economy is difficult to measure but there have been attempts, mostly based on the use of cash or the use of electricity. Estimates of the size of the shadow economy range from 10% for US or Switzerland, 20% for Italy, 30% for Brazil to over 70% for Nigeria.

This is especially important when we want to make international comparisons but some times is troublesome when evaluating time series (Italy in 1986 had a big jump in GDP not because there was real growth but just because official statistics started imputing the value created in the underground economy in the GDP statistics). There is also an issue of how to measure services for which we do not observe the price (like government services) and we usually we evaluate them at factor prices. Another issue is the one of used goods. The general principle is always that when the sale is associated to the creation of some value it should enter the GDP. For example if Ford produces a new car and sells it to me this obviously enters GDP. But what if I then sell the used car to someone else? Which part of this transaction should enter GDP? In this case it is useful to distinguish between the value of the car itself and the price paid by the final user. The difference between these two is the value creation that took place in the transaction. The tricky question is how to determine the value of the car. If, for example ,I sell the car for 100$ to a car dealer and the dealer sells it back to a customer for 120$ then 20$ should enter GDP because that is the value generated by the dealer.

Real and Nominal GDP

We mentioned that GDP is an attempt to measure the value of resources created by an economy in a given point in time. How can we aggregate together different goods? that's what dollar prices are for. We can aggregate computers and bread just by summing their total value (price times quantities). This measure is called nominal GDP or GDP at current prices. The problem with that measure is that the general price level is going up, so we might observe our measure of GDP going up even if the stuff produced is not. A better measure is therefore real GDP. Real GDP computed using the base year method is just quantities, multiplied by the price in a fixed year. The ratio between nominal and real GDP is called the GDP deflator and it is a measure of the general price level. Often GDP deflator growth is used as a broad measure of inflation, that is of the change of the general price level. In the example below we compute nominal GDP, real GDP and GDP deflator for an economy that produces only bread and computers.

	P(Br)	**Q(Br)**	**P(Comp)**	**Q(Comp)**
1990	**10**	**100**	**100**	**10**
1995	**20**	**110**	**80**	**20**
2000	**30**	**120**	**50**	**40**

Nom GDP	**Real GDP(Base1990)**	**GDP Deflator**
$\mathbf{10 * 100 + 100 * 10 = 2000}$	$\mathbf{10 * 100 + 100 * 10 = 2000}$	**1**
$\mathbf{20 * 110 + 80 * 20 = 3800}$	$\mathbf{10 * 110 + 100 * 20 = 3100}$	**1.225**
$\mathbf{30 * 120 + 50 * 40 = 5600}$	$\mathbf{10 * 120 + 100 * 40 = 5200}$	**1.077**

	Nom GDP growth	**Real GDP growth**	**GDP Defl Growth**
1990-2000	**180%**	**160%**	**7.7%**

Notice how nominal GDP growth (180%) is equal to real GDP growth (160%) plus GDP deflator growth (7.7%) plus the product of the two.

Chain weighted measures of GDP

The previous example highlights one potential problem of base year measures of GDP (Note how the price of computers is declining over time). If the price of a certain good changes a lot over time in different direction than the general price level, evaluating it at the price in a given year might lead to gross overstatement or understatement of GDP. This is because the relative price change of that good reflects a true change in value of that good and not only a general increase in the price level (that does not reflect a true increase in the value of goods but only a depreciation of dollars). Consider for example the price of a personal computer with average speed and storage (like the one that is now sitting on your desk): in the early 80s its price would have easily exceeded $10,000 while right now its price is below $1000. If we value the current US production of computers at 20 years ago prices, US GDP would be much bigger, but this would not reflect a true increase in total value produced, as the reduction of the price of computers is reflecting a true change in value of computers and it should be taken into account in GDP statistics.

To solve (at least some of) these problems NIPA nowadays uses a different method to compute real GDP. Starting from a base year (year t), it computes the growth rate of real output from one year to the next using the average prices between years, and then chains all the growth rates together to obtain a so called chain weighted series. See the workbook below for how the procedure works with the same numbers we used above:

Chain Weighted Workbook

Calculations	Growth Rates	Real GDP(Base 1990)
$15 * 100 + 90 * 10 = 2400$		2000
$15 * 110 + 90 * 20 = 3450$	$(3450 - 2400)/2400 = 43\%$	$2000 * 1.43 = 2875$
$25 * 110 + 65 * 20 = 4050$		
$25 * 120 + 65 * 40 = 5600$	$(5600 - 4050)/4050 = 38\%$	$2875 * 1.38 = 3975$

Note the 1990-2000 growth rate of chain-weighted real GDP is just below 100% (3975/2000-1) which is much less than the growth rate of base year GDP computed in the previous example. The chain weighted method incorporates into aggregate growth some of the reduction in the price of computers so aggregate growth does not look as strong as the one computed using base year prices.

GDP as expenditure

Combining definition 2 of GDP (GDP as expenditure) and the notation used in figure 1 we have that

$$GDP = Y = C_d + I_d + G_d - Int_f + X \tag{1}$$

Using the following definitions: $C = C_f + C_d$, for total consumption, $I = I_f + I_d$ for total investment, $M = C_f + I_f + G_f + Int_f$ for imports, $NX = X - M$, for net exports and equation 1 we can decompose GDP in four different categories as follows

$$\begin{aligned} Y &= C_d + I_d + G_d + X - Int_f \\ &= C - C_f + I - I_f + G - G_f + X - Int_f \\ &= C + I + G + X - C_f - I_f - G_f - Int_f \\ &= C + I + G + X - M \\ &= C + I + G + NX \end{aligned}$$

By consumption (C) we denote goods and services purchased by households that are not used for production of future goods. Consumption expenditure is divided in durables and non durables and services. Durables include goods that provide services for an extended period of time (cars, electronics). Housing is not included into consumption. By investment we denote goods purchased for use in future production. Investment is divided into structures (buildings), equipment (machines) and inventories. Housing is treated as investment.

Government expenditure is expenditure by the government in consumption (for example gas of police cars) investment (for example federal buildings, highways) and services (for example wages to public employees). Finally net exports is the expenditure by foreigners on our goods and services minus our expenditure on their goods and services.

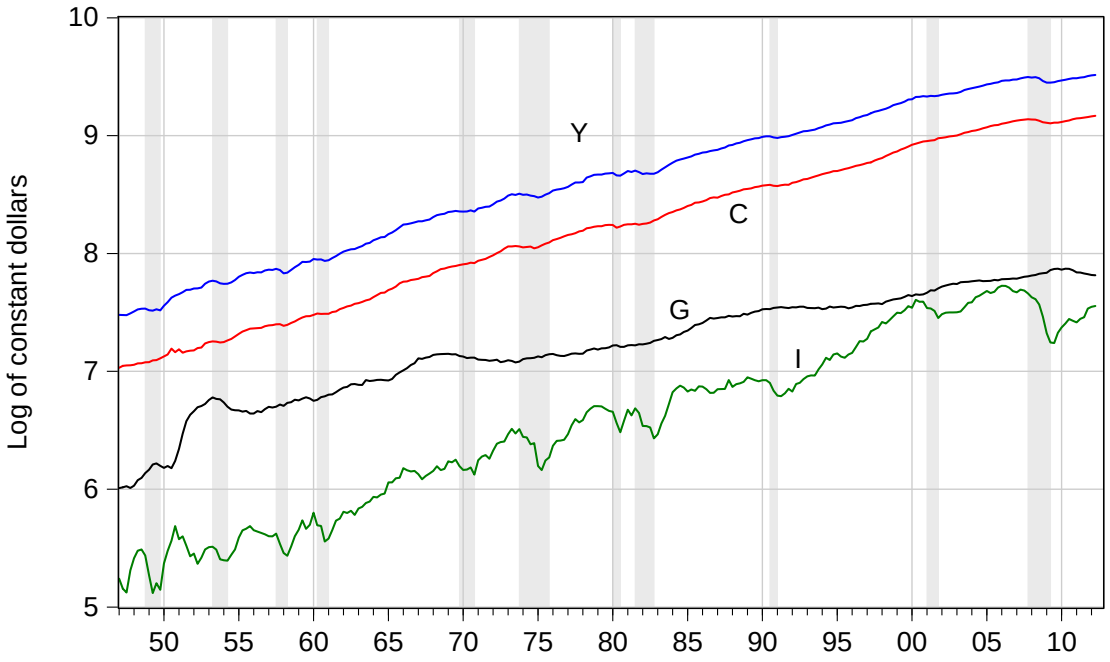

Figure 2: Expenditures Components of GDP

In figure 2 you can see the patterns for Real GDP, Private Investment, Private Consumption, Government expenditure in US for the past 60 years. Some features of these series (the higher volatility of investment) are very similar across countries, others (like the size of government spending) are not. On the right hand side of table A below you can look at the expenditure components of GDP in the US in year 2004 (in real terms). Note that in US data in 2004 private consumption is about 70% of GDP, investment about 17% and government purchases about 18%. (Why do they sum to a number bigger than 1?)

Causality

The equations above are accounting identities and do not tell what is causing what. You might be often reading statement like

> The economy grew at an annual rate of 3.4 percent in the second quarter on the strength of consumer spending (NYTimes, July, 29 2005)

These statements imply that the right side of the identity is causing the left, so they are not simply based on the identity but they also make some theoretical assumptions.

For now, just keep in mind that could easily be the other way around, that is one could write that consumer spending has shown robust growth on the strength of income growth.

GDP as income

The right hand side of account 1 table A breaks down GDP by expenditure while the left hand side breaks it down according to the income paid out to the factors of production. You can see that a large fraction of GDP (about 60%) is earned by workers (compensation to employees), about 7% goes directly to the government (mostly through sales tax, that are labeled are taxes on production) and the rest goes to capital, partly to compensate capital owners (net operating surplus) partly to replace depreciated capital (consumption of fixed capital). Notice also from the table that even though in theory the two concepts (as income or as expenditure) of GDP should be equal, in practice there is a non trivial difference (about 1% of GDP) that we label statistical discrepancy. Accounts 2 and 3 in table A show in more detail how the payments to the factors of production generated by GDP creation, together with government transfers and asset trade with the rest of the world (we will discuss these accounts in lecture 4) generate private enterprise income, personal income and personal outlays.

An important difference between GDP as product and GDP as income is that GDP is only available at a quarterly frequency while certain components of GDP as income or outlays are available at a monthly frequency so they can be used the state of the economy before the official release of the GDP figures. For example in January you might want to know what how the US economy performed in the 4th quarter of the past year. But GDP data for the quarter are not available until the end of February. But personal income data are available monthly so you can easily get information on personal income growth for the first two months of the quarter. Since personal income is a significant part of GDP that information will give you a pretty good information about GDP.

GDP, GNP and NNP

GDP measures the creation of value by domestic firms but does not tell you whether this value goes to nationals. Similarly, national households might get income from non domestic firms. This is why we also measure GNP (Gross national product) that is the income earned by national households. We define GNP to be equal to GDP plus factor payments from foreign firms minus payments of domestic firms to foreign factors. We call the sum of these two terms net factor payments (NFP) so we have

Table A. Summary National Income and Product Accounts, 2004

[Billions of dollars]

Account 1. Domestic Income and Product Account

Line			Line		
1	Compensation of employees, paid	6,693.4	15	Personal consumption expenditures (3–3)	8,214.3
2	Wage and salary accruals	5,395.2	16	Durable goods	987.8
3	Disbursements (3–12 and 5–11)	5,395.2	17	Nondurable goods	2,368.3
4	Wage accruals less disbursements (4–9 and 6–11)	0.0	18	Services	4,858.2
5	Supplements to wages and salaries (3–14)	1,298.1	19	Gross private domestic investment	1,928.1
6	Taxes on production and imports (4–16)	852.8	20	Fixed investment (6–2)	1,872.6
7	*Less:* Subsidies (4–8)	43.5	21	Nonresidential	1,198.8
8	Net operating surplus	2,719.4	22	Structures	298.4
9	Private enterprises (2–19)	2,722.4	23	Equipment and software	900.4
10	Current surplus of government enterprises (4–26)	–3.0	24	Residential	673.8
11	Consumption of fixed capital (6–13)	1,435.3	25	Change in private inventories (6–4)	55.4
			26	Net exports of goods and services	–624.0
12	**Gross domestic income**	**11,657.5**	27	Exports (5–1)	1,173.8
			28	Imports (5–9)	1,797.8
13	Statistical discrepancy (6–19)	76.8	29	Government consumption expenditures and gross investment (4–1 and 6–3)	2,215.9
			30	Federal	827.6
			31	National defense	552.7
			32	Nondefense	274.9
			33	State and local	1,388.3
14	**GROSS DOMESTIC PRODUCT**	**11,734.3**	34	**GROSS DOMESTIC PRODUCT**	**11,734.3**

Account 2. Private Enterprise Income Account

Line			Line		
1	Income payments on assets	2,182.4	19	Net operating surplus (1–9)	2,722.4
2	Interest and miscellaneous payments (3–20 and 4–21)	2,057.8	20	Income receipts on assets	1,736.4
3	Dividend payments to the rest of the world (5–14)	68.4	21	Interest (3–20)	1,426.9
4	Reinvested earnings on foreign direct investment in the United States (5–15)	56.2	22	Dividend receipts from the rest of the world (5–6)	104.3
5	Business current transfer payments (net)	91.1	23	Reinvested earnings on U.S. direct investment abroad (5–7)	205.2
6	To persons (net) (3–24)	33.0			
7	To government (net) (4–24)	51.5			
8	To the rest of the world (net) (5–19)	6.6			
9	Proprietors' income with inventory valuation and capital consumption adjustments (3–17)	889.6			
10	Rental income of persons with capital consumption adjustment (3–18)	134.2			
11	Corporate profits with inventory valuation and capital consumption adjustments	1,161.5			
12	Taxes on corporate income	271.1			
13	To government (4–17)	258.9			
14	To the rest of the world (5–19)	12.3			
15	Profits after tax with inventory valuation and capital consumption adjustments	890.3			
16	Net dividends (3–21 and 4–22)	493.0			
17	Undistributed corporate profits with inventory valuation and capital consumption adjustments (6–10)	397.3			
18	**USES OF PRIVATE ENTERPRISE INCOME**	**4,458.9**	24	**SOURCES OF PRIVATE ENTERPRISE INCOME**	**4,458.9**

Account 3. Personal Income and Outlay Account

Line			Line		
1	Personal current taxes (4–15)	1,049.1	10	Compensation of employees, received	6,687.6
2	Personal outlays	8,512.5	11	Wage and salary disbursements	5,389.4
3	Personal consumption expenditures (1–15)	8,214.3	12	Domestic (1–3 less 5–11)	5,386.4
4	Personal interest payments (3–20)	186.7	13	Rest of the world (5–3)	3.0
5	Personal current transfer payments	111.5	14	Supplements to wages and salaries (1–5)	1,298.1
6	To government (4–25)	68.6	15	Employer contributions for employee pension and insurance funds	895.5
7	To the rest of the world (net) (5–17)	42.9	16	Employer contributions for government social insurance	402.7
8	Personal saving (6–9)	151.8	17	Proprietors' income with inventory valuation and capital consumption adjustments (2–9)	889.6
			18	Rental income of persons with capital consumption adjustment (2–10)	134.2
			19	Personal income receipts on assets	1,396.5
			20	Personal interest income (2–2 and 3–4 and 4–7 and 5–5 less 2–21 less 4–21 less 5–13)	905.9
			21	Personal dividend income (2–16 less 4–22)	490.6
			22	Personal current transfer receipts	1,427.5
			23	Government social benefits (4–4)	1,394.5
			24	From business (net) (2–6)	33.0
			25	*Less:* Contributions for government social insurance (4–19)	822.2
9	**PERSONAL TAXES, OUTLAYS, AND SAVING**	**9,713.3**	26	**PERSONAL INCOME**	**9,713.3**

$$GNP = GDP + NFP$$

For example, capital income from an Intel plant in Costarica enters US GNP but not US GDP, and income earned by an Italian worker in the United States enters US GDP but not US GNP. For the US the difference between GDP and GNP is not very large (less than 1% of GDP) because it is a relatively closed economy, but for some countries it is quite big. Reasons for which this difference can be big are: large stock of domestic capital owned by foreigners (Ireland), nationals owning a lot of foreign capital (Kuwait), large number of national workers working abroad (Bangladesh). For example, in 2000 the ratio of net factor payments to GDP in US was -0.04%, but in Ireland it was -15%, in Kuwait was 15% and in Bangladesh was 5%. Sometimes it is also useful to define the concept of Net National Product (NNP) as

$$NNP = GNP - consumption \quad of \quad fixed \quad capital$$

Usually the difference in growth rates between them is small but some commentators have argued that since a big part of the US boom of the 1900s was the purchase of IT equipment, that depreciates really fast, we should really use measures of NNP to evaluate the performance of the US economy in the 1990s. It turns out that the difference in growth rates between NNP and GNP even in the 1990s is quite small (2.8% for GNP as opposed to 2.68% for NNP over the period 1990-2002).

Measuring Prices

Prices are a measure of the quantity of money needed to obtain a certain good or service. The general price level (i.e the price of economy-wide basket of goods and services) is closely watched because it is a measure of the general value of money. We have already seen a measure of the general price level that is the GDP deflator that is the ratio between the nominal GDP and the real GDP. If nominal GDP goes up relatively to real GDP this means there has been an increase in the general price level rather than in the amount of goods and services produced and so that money is losing value.

Another important measure of the price level is the so called CPI (consumer price index). The CPI measures the price of a fixed basket of goods (the consumption bundle of the typical US household) relative to the price of the same basket in a base year. Since the basket of goods is held constant, increases in the CPI only reflect increases in the prices.

There are three differences between the CPI and GDP deflator:

1. The CPI measures only increases in the price of goods paid by consumers. An increase in the price of thermonuclear reactors will not show up in the CPI but it will in the GDP deflator (as long as they are produced).

2. The CPI includes also goods produced abroad but the GDP deflator does not. An increase in the price of Toyotas will show up in the CPI but it will not in the GDP deflator.

3. In the CPI the basket is held constant in the GDP deflator is not.

The following example is helpful in explaining this last difference between the two. Consider an economy that produces only Gas and Bicycles and in which consumers only care about those two goods. The table reports the prices and quantities consumed and produced in two years.

	P(Bicycles)	P(Gas)	C(Bicycles)	C(Gas)
1970	10	10	10	10
1980	10	20	15	2.5

The GDP deflator is then computed in the usual way as the ratio between nominal and real GDP (base 1970). The CPI is computed as the price of a basket composed by 10 Bicycles and 10 units of Gas. This yields the following prices and inflations

	GDP Deflator	CPI
1970	200/200=1	200
1980	200/175=8/7	300
Inflation	14%	50%

This example describes a situation that is similar to the one that arose in the 70's during the oil shocks. The price of gas went up and this increase was fully reflected in the CPI since the consumption basket of gas and bicycles was kept constant. In reality Americans, in response to an increase in the price of gas, substituted away from gas into cheaper bicycles, so the GDP Deflator inflation is smaller. None of these indices truly reflects the true impact of the price increase and an average of these two (called the ideal price index) sometimes is used. In the figure 3 we see these effects on the CPI and GDP deflator in the 1970s. In recent years the differences between CPI and GDP deflator though have not been as large.

There are some issues in measuring the CPI.

One issue is the change in the quality of the goods and the second is the introduction of new goods. The Bureau of Labor Statistics (BLS) attempts to control for changes in quality when measuring the CPI but sometimes it is hard to disentangle how much of a price change is actually due to quality increase and how much it is due to a pure

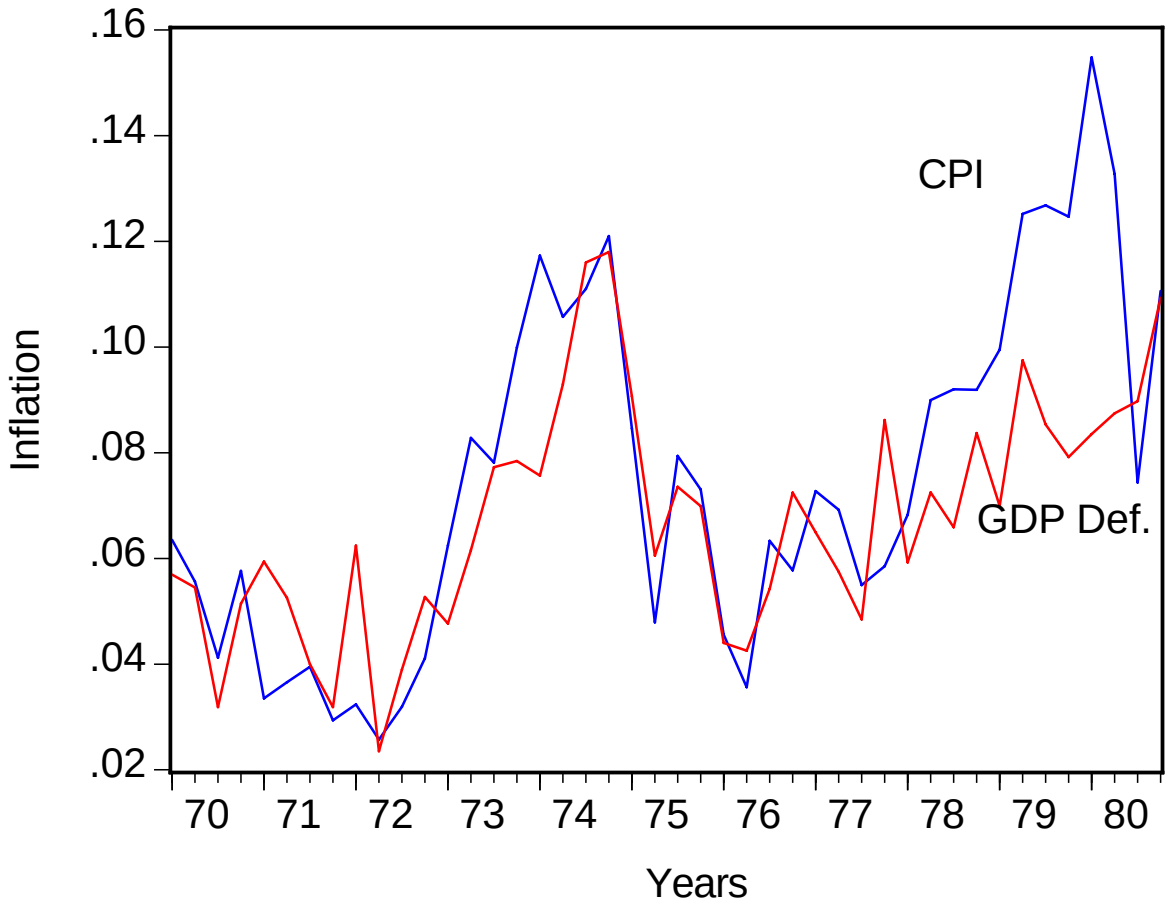

Figure 3: GDP Deflator and CPI Inflation

increase in price. Consider for example the case of a computer. If we simply use the definition of computer in the basket of goods in the CPI we will see that the price of an average computer now is not very different from what it was 5 years ago but the quality of the good is much better.

Another issue is the introduction of new goods. New goods can substantially decrease the cost of living (think about the introduction of VCR that makes me spend less in movie tickets) but they do not show up in CPI directly. A government commission has advanced the idea that, because of new goods and quality increases, CPI overstates true price changes of about 1.1% each year so when we say that current inflation is 2% the true inflation is really 1%.

Another issue is whether to include all the price of all goods in CPI. The prices in some goods like energy goods or food are very volatile and they can cause the CPI to fluctuate widely but for brief periods of time. In order to eliminate this fluctuations people look at the so called CORE CPI which does not include the prices of food and energy. Picture 4 shows that in recent years the difference in volatility between the two measures has been remarkable.

Why do we care about measuring the CPI correctly?

A simple reason is that changing prices reflect changing value of money relative to goods, and thus in times when prices change, Central Banks, which manage money supply, usually take measures to prevent these price changes. One commonly used measure is changes in target interest rates, so if you are a bond trader and are interested in where interest rates are going, you should closely monitor prices. Figure below shows the path for CPI inflation (4 quarters moving average) and for the Federal Funds rate which is a measure of short term interest rate which is controlled by the Federal Reserve Bank. The figure shows clearly that inflation and short term rates move in lock-step and shows that several episodes in which increase in inflation have been accompanied by spikes in the Federal Funds Rate. Incidentally the figure also shows that after the 1990s inflation in US (and in many developed economies) has been remarkably low and stable, rarely exceeding 4%.

A final reason is that a lot of government expenditures and revenues are linked (indexed) to the CPI. If the CPI goes up social security benefits go up, and marginal tax rates go down so the government has a very strong interest in not to overestimate the CPI. Wage setters and negotiators are also very interested in having a right measure of the CPI so they can know exactly the purchasing power of the wages they are bargaining on. If you want to know more about the CPI then you can look at a comprehensive list of CPI FAQ at the Bureau of Labor Statistics (BLS) or you can even call the New York CPI Hotline at +1 (212) 337-2400.

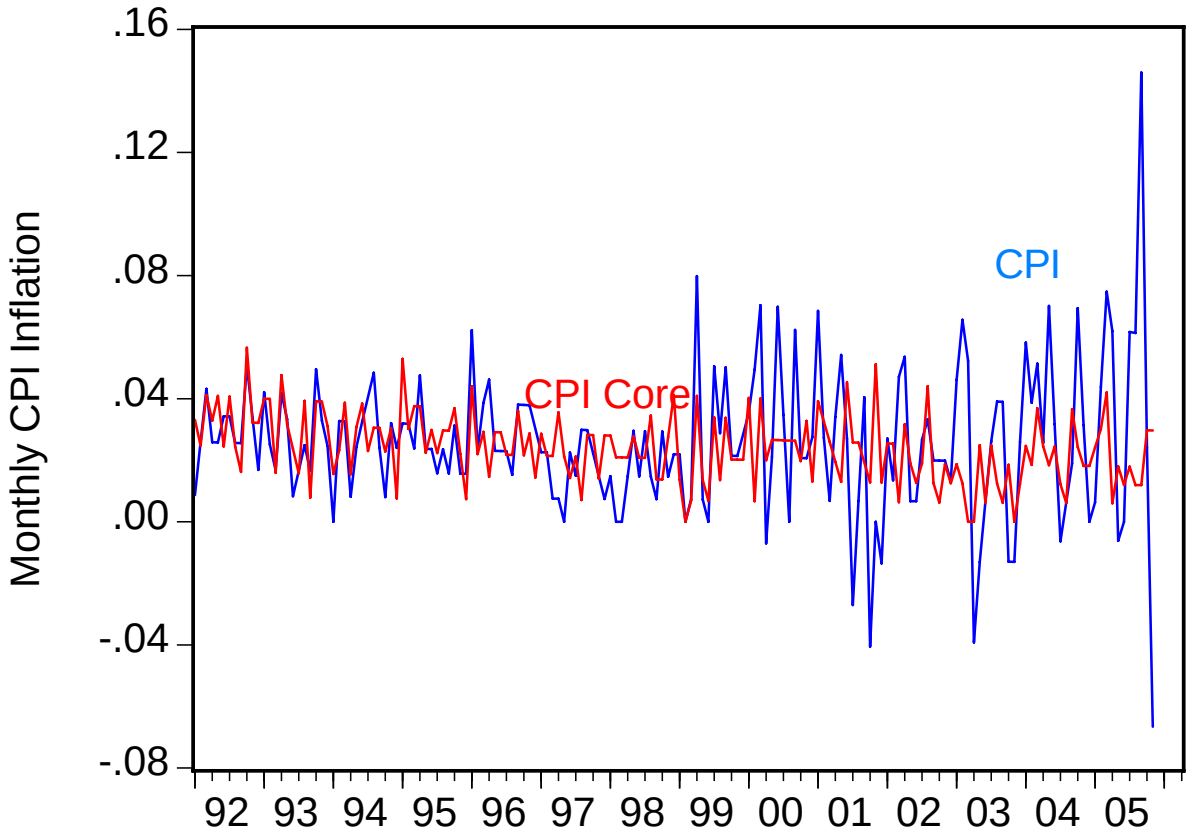

Figure 4: CPI and Core CPI Inflation

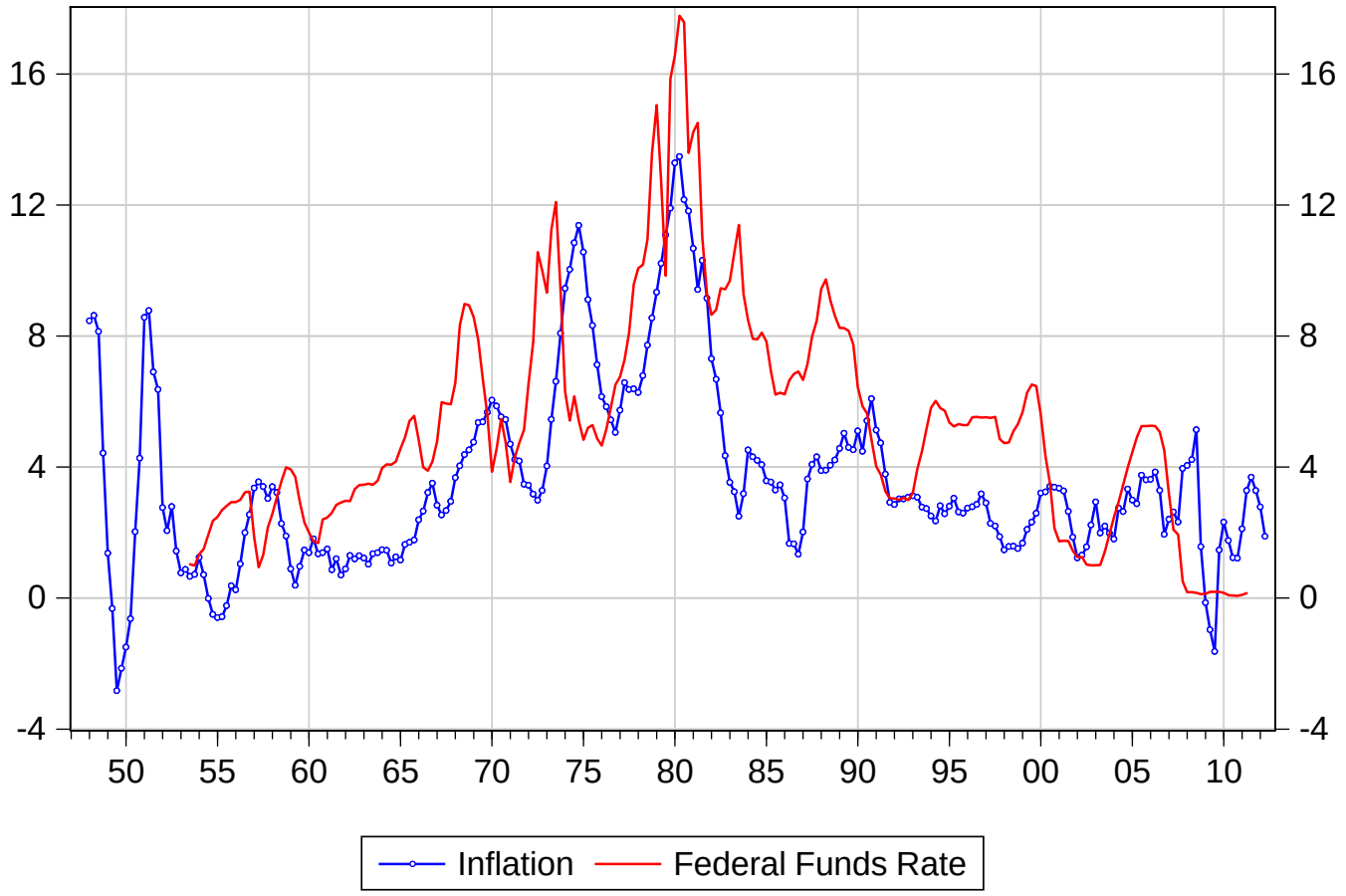

Figure 5: US CPI and Federal Funds Rate

Concepts you should know

1. GDP as expenditure, income or value added
2. Real and Nominal GDP, Chain weighted GDP
3. GNP, NNP
4. GDP Deflator, CPI

Review questions

1. Consider two US located retailers, Chinamart and USmart, which sell the same type of goods. Chinamart though only sells goods produced in China while USmart only sells goods produced in the US. Is it correct to argue that USmart contributes more to US GDP than Chinamart?
2. Company A sells 4 tires to Company X for 400. Company B sells a CD player to Company X for 300. Company X installs both in a car, which it sells for 5000. What is the total contribution to GDP of these transactions?
3. Place each transaction into the appropriate expenditure component of US GDP:
   (a) Boeing sells an airplane to the Air Force
   (b) Boeing sells an airplane to American Airlines
   (c) Boeing sells an airplane to Virgin Atlantic airline
   (d) Boeing sells an airplane to Jennifer Lopez
   (e) Boeing builds an airplane but fails to sell it
4. The following data describe the Bocconi economy:

	Prices			Quantities		
Year	PCs	Pizza	Beer	PCs	Pizza	Beer
2000	100	10	5	25	100	250
2005	50	20	15	50	125	200
2010	25	30	30	100	150	150

   (a) Compute real and nominal GDP and the GDP deflator using 2000 as the base year.
   (b) Compute the CPI using 2000 quantities as your basket.
   (c) How do the indexes differ?

Answers

1. No. Which one contributes more to GDP depends on their value added which in general does not depend on the location of production of the intermediate goods used by the retailers.

2. The contribution to GDP is 5000, 400 from A, 300 from B, and the rest from X.

3. (a) G – It's a government purchase, as the Air Force is part of the Federal Government

   (b) I – It's investment, as American Airlines will use the aircraft as capital good

   (c) NX – It's export, since Virgin Atlantic is incorporated in the United Kingdom

   (d) C – It's consumption (durable consumption), because Jennifer Lopez will use the plane for her personal travel, and not as capital good

   (e) I – It's investment, because the plane will increase Boeing's inventory of unsold products

4. The numbers are

Year	Nominal GDP	Real GDP	Deflator	CPI	Base = 100
2000	4750	4750	100.00	4750	100.00
2005	8000	7250	110.34	7000	147.37
2010	11500	12250	93.88	11125	234.21

   The point is that different methods give different answers. This is most striking if we compare the fourth and last columns. The last one is the CPI, indexed so that it's value is 100 in 2000. Note that the deflator has prices going down in 2010, the CPI has prices rising — a lot! The reason is that the CPI has a fixed basket, and doesn't account for the substitution effect: our tendency to buy more PCs as their price falls.