

Econ 101b - Answer Key to Problem Set 1

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■ Question 1

In 1979 the (short-term) nominal interest rate on three-month Treasury bills averaged 10.0%, and the GDP deflator rose from 50.88 to 55.22. What was the annual rate of inflation in 1979? What was the real interest rate in 1979?

Inflation is nothing else than the growth rate of prices over a period of time. In our case:

$$\text{Inflation}_{79} = (55.22 - 50.88) / 50.88$$

$$0.0852987$$

Thus inflation averaged 8.5 % in 1979. (We usually use π as a symbol for inflation.)

$$i_{79} = 0.1$$

i is the symbol used for the nominal interest rate.

$$r_{79} = i_{79} - \text{Inflation}_{79}$$

r stands for the real interest rate. $i = r + \pi$ is called the Fisher equation. It obviously implies the previous formula for the real interest rate. The intuition is that inflation erodes the value of a dollar to be received tomorrow. You therefore have to subtract it from the nominal interest rate to see what is the real rate of return on lended liquidity.

$$0.0147013$$

Thus the real interest rate averaged 1.4 % in 1979.

a. Were real interest rates higher in 1979, or in 1998 (when the (short-term) nominal interest rate on three-month Treasury bills was 4.8%, and the inflation rate was 2.6%?)

$$\text{Inflation}_{98} = 0.026$$

$$i_{98} = 0.048$$

$$r_{98} = i_{98} - \text{Inflation}_{98}$$

$$0.022$$

The real interest rate averaged 2.2 % in 1998. The real interest rate was thus higher in 1998 than in 1979.

b. Which interest rate concept--the nominal interest rate or the real interest rate--do lenders and borrowers care more about? Why?

Both lenders and borrowers care more about the real interest rate. Lenders care mostly about the real rate of return on their loans because it tells them how much they will earn in real terms, similarly borrowers care mostly about the real interest rate because it tells them how expensive is liquidity in real terms, i.e. in terms of forgone (real) consumption.

■ Question 2

In 1992 the components of nominal (and real) GDP were as follows:

\$4.2198 trillion: consumption spending
 \$0.7904 trillion: gross investment spending
 \$0.6394 trillion: exports
 \$0.6690 trillion: imports
 \$1.2638 trillion: government purchases.

By 1993 these four components of spending had risen:

\$4.4592 trillion: consumption spending,
 \$0.8762 trillion: gross investment spending
 \$0.6586 trillion: exports
 \$0.7193 trillion: imports
 \$1.2834 trillion: government purchases.

Moreover, prices had also risen: the price index for consumption rose from 100 to 102.8; the price index for investment rose from 100 to 107.6; the price index for government purchases fell from 100 to 99.1; the price index for exports rose from 100 to 102.9; and the price index for imports rose from 100 to 108.9.

a. What was real GDP (measured at 1992 prices) in 1993? How much was real GDP growth between 1992 and 1993?

Let me denote the real value of expenditure components with a twiddle.

Real consumption in 1993 is equal to:

$$\tilde{C}_{93} = \frac{4.4592}{102.8 / 100}$$

4.33774

Real investment in 1993 is equal to:

$$\tilde{I}_{93} = \frac{0.8762}{107.6 / 100}$$

0.814312

Real government expenditure in 1993 is equal to:

$$\tilde{G}_{93} = \frac{1.2834}{99.1 / 100}$$

1.29506

Real exports in 1993 are equal to:

$$\tilde{X}_{93} = \frac{0.6586}{102.9 / 100}$$

0.640039

Real imports in 1993 are equal to:

$$\tilde{M}_{93} = \frac{0.7193}{108.9 / 100}$$

0.660514

From the expenditure approach, real GDP is the sum of real consumption spending, real gross investment spending, real government purchases and real net exports, i.e.:

$$\tilde{GDP}_{93} = \tilde{C}_{93} + \tilde{I}_{93} + \tilde{G}_{93} + \tilde{X}_{93} - \tilde{M}_{93}$$

6.42664

trillion dollars whereas real GDP in 1992 was equal to:

$$\tilde{GDP}_{92} = 4.2198 + 0.7904 + 1.2638 + 0.6394 - 0.6690$$

6.2444

trillion dollars. The real GDP growth rate between 1992 and 1993 was thus:

$$\dot{\tilde{GDP}} = \frac{\tilde{GDP}_{93} - \tilde{GDP}_{92}}{\tilde{GDP}_{92}}$$

0.0291838

i.e. approximately 3%.

b. Which is the more important measure for assessing an economy's performance, real GDP or nominal GDP? Why?

The economy's performance is best measured by real GDP since what we care about is the increase in the real productive power of the economy (and thus real income and real expenditure.) To picture this, assume that real production was unchanged, if the price level doubled, nominal GDP would double. Obviously, nominal GDP would mislead you and make you conclude that the economy's performance has doubled whereas actually it is unchanged.

■ Question 3

- a. Are capital goods--large turbine generators, jet airliners, bay-spanning bridges--intermediate goods or final goods?

These are final goods purchases by businesses in the form of physical investment.

- b. How are they included in GDP?

Referring to the Flow Diagram of the economy, these are the goods that businesses typically buy when they borrow households' savings. In the expenditure approach they are thus counted in big I. In the value-added approach, they are accounted for when the value-added by firms that produce them is taken into account. In the income approach, they are accounted for when the payments to the factor of productions (wages, rents, interests and profits) used to produce them are taken into account.

- c. Why are so-called "intermediate" goods treated differently than "final" goods in the National Income and Product Accounts [NIPA]?

They are different in that intermediate goods are goods used to produce other goods. Take a Starbucks® cup of coffee for instance. You wouldn't want to count in expenditure by the coffee shop on raw coffee because its value has actually been accounted for when you took into account the purchase of the cup of coffee itself. What we absolutely want to avoid in national accounting is double counting value-added for the same good.

- d. By what means does the labor and other factors of production that go into producing intermediate goods get ultimately counted in GDP?

In the expenditure approach, it gets accounted for in the value of the final good(s) it contributed to produce. [In the income approach, they are accounted for when the payments to the factor of productions (wages, rents, interests and profits) used to produce them are taken into account.]

■ Question 4

In 1997 nominal GDP was equal to \$8.1109 trillion; consumption spending was \$5.4937 trillion; gross investment spending was \$1.256 trillion; and government purchases were \$1.4546 trillion.

- a. What was the level of net exports?

$$GDP_{97} = 8.1109$$

$$C_{97} = 5.4937$$

$$I_{97} = 1.256$$

$$G_{97} = 1.4546$$

$$GDP_{97} = C_{97} + I_{97} + G_{97} + NX_{97}$$

`Solve [% , NX97]`

`{ {NX97 → -0.0934 } }`

Thus net exports amounted in nominal terms to minus 8.2043 trillion \$'s, which mean that the US was importing in net terms 8.2043 trillion \$'s worth of goods and services from the Rest of the World.

b. Why are imports subtracted from the sum of consumption, government purchases, investment, and exports to get to GDP?

Because they correspond to value-added for the Rest of the World and not for the US. When national income is spent on imports, it actually contributes to reducing domestic production of goods and thus national value-added and income. Conversely exports to the Rest of the World contributed to national income by generating value-added, and income for the factors of production that contributed to their production.

■ Question 5

Suppose that the appliance store buys a refrigerator from the manufacturer on December 15, 2003 for \$600, and that you then buy that refrigerator on January 15, 2004 for \$750.

a. What is the contribution to GDP in 2003?

In 2003, the production of the refrigerator has generated value-added and thus income for the workers and owners of the firm that produced it. Yet, no final expenditure has been generated yet since you only buy the refrigerator in 2004. So long as it's not sold to anyone, this refrigerator is as good as if it had not been produced. Its true contribution to GDP in 2003 is null.

b. How is the refrigerator accounted for in the NIPA in 2003?

To avoid discrepancies between the income and expenditure approaches, the NIPA will account for the refrigerator's value added by counting it in inventories, which is considered as a form of investment. Thus, the refrigerator's contribution to GDP in 2003 as measured by the NIPA is \$600.

c. What is the contribution to GDP in 2004?

In 2004, the refrigerator is bought by a consumer and thus starts generating a flow of utility for that consumer. GDP in 2004 thus rises by the retail price of the refrigerator, *i.e.* \$750.

d. How is the refrigerator accounted for in the NIPA in 2004?

In 2004, the refrigerator is sold, thus private consumption goes up by \$750. However, simultaneously, the refrigerator goes out of the appliance store's inventories. Thus this kind of investment goes down by \$600. The net result is that the NIPA consider that expenditure has gone up by \$150, which is indeed by how much national income has gone up in 2004. These \$150 helped to pay the factors of production which were needed to sell this final good to you. Again, the NIPA make sure that all three approaches to National Income / Product coincide.

■ Question 6

Explain whether or not and why the following items are included in the calculation of GDP:

a. Increases in business inventories

Yes, increases in business inventories are included in the calculation of GDP as a form of investment. See question 5 for more details.

b. Sales of existing homes

No. Sales of existing home are not included in the calculation of GDP. They represent trade of an existing good (the house) for money. They do not correspond to the creation of income or value-added. If we did account for this kind of trade, by simply reallocating assets in an economy, it would look like national income increased.

c. The fees earned by real estate agents on selling existing homes

Yes, they are included because they represent the sale of a final service to consumers.

d. Income earned by Americans living and working abroad

No, gross *domestic* product accounts for payments of factors of production which, regardless of their nationality, are located on the US territory.

e. Purchases of IBM stock by your brother

No, again this correspond to an exchange of assets and not to the creation of any value-added.

f. Purchase of a new tank by the Department of Defense

Yes, the NIPA account for all expenditure by the government. However, it is debatable whether or not it should be so. Indeed, one may consider tanks as intermediate goods necessary to the "peaceful" creation of value-added in the rest of the economy.

g. Rent that you pay to your landlord

Yes, these are considered as a payment for a service. Furthermore, in order for GDP not to artificially go down when a family buys the home they had been living in from their landlady, fictive rents are imputed for people who own the house in which they are living. (And these imputed rents are actually one of the worst measured elements of the NIPA.)

■ Question 7

Consider an economy made out of a single consumer (or a "representative agents" as economists like to say.) There only two goods in this economy (good 1 and good 2). You are given the following partial information about expenditure:

	Year 1		Year 2	
	Quantity	Price	Quantity	Price
Good 1	100	100	120	100
Good 2	100	100	Q	80

where Q is an unknown (and potentially variable) quantity.

Microeconomists will say that what a bundle of goods consumed in year 2 is "revealed preferred" to the bundle consumed in year 1 if the consumer has chosen for a different bundle in both years although the bundle chosen in year 1 was affordable in year 2.

Over what range of quantities of good 2 consumed in year 2 would you conclude that the following assertions are correct:

a. The bundle consumed in the first period is revealed preferred to the one consumed in the second period, in other words, our representative agent was better off in year 1.

This will be the case when if the year two bundle was affordable in period 1. Thus iff:

$$100 * 100 + 100 * 100 > 120 * 100 + Q * 100$$

or

$$20000 > 12000 + 100 Q$$

that is:

$$Q < 80$$

b. The bundle consumed in second period is revealed preferred to the one consumed in the first period, in other words, our representative agent was better off in year 2.

This will be the case when if the year one bundle was affordable in period 2. Thus iff:

$$100 * 100 + 100 * 80 < 120 * 100 + Q * 80$$

or

$$18000 < 12000 + 80 Q$$

that is

$$Q > 75$$

c. Our representative consumer is acting inconsistently.

Our representative agent is acting inconsistently if bundle 1 is revealed strictly preferred to bundle 2 in year 1 and bundle 2 is revealed strictly preferred to bundle 1 in year 2, so if both:

$$Q < 80$$

and

$$Q > 75$$

that is:

$$75 < Q < 80$$

In other words our representative consumer does not have well defined preferences. Indeed when 2 bundles are available - and everything else being equal - sometimes she chooses the first and sometimes the other...

Now, let's form three index measures of the quantities consumed in this economy:

A "Laspeyres quantity index" computes the change in quantity using year 1 prices as weights, thus $L_Q =$ value of expenditure in year 2 using year 1 prices / value of expenditure in year 1 using year 1 prices.

On the other hand a "Paasche quantity index" uses year 2 prices as weights, thus $P_Q =$ value of expenditure in year 2 using year 2 prices / value of expenditure in year 1 using year 2 prices.

Finally, we could use the consumer's expenditure change, i.e. $E_Q =$ value of expenditure in year 2 using year 2 prices / value of expenditure in year 1 using year 1 prices.

Without any further reference to the above table (i.e. in general), answer the following questions:

d. Explain why if $L_Q < 1$ the consumer is worse off in year 2. What about the case where $L_Q > 1$?

$$L_Q < 1 \Leftrightarrow P_1^1 Q_1^2 + P_2^1 Q_2^2 < P_1^1 Q_1^1 + P_2^1 Q_2^1$$

notice that this means that in year 1, quantities of good 1 and 2 which were purchased in year 2, Q_1^2 and Q_2^2 , were available and yet our representative agent chose Q_1^1 and Q_2^1 . In other words Q_1^1 and Q_2^1 are revealed preferred to Q_1^2 and Q_2^2 and our agent is actually worse off in period 2 than in period 1.

$$L_Q > 1 \Leftrightarrow P_1^1 Q_1^2 + P_2^1 Q_2^2 > P_1^1 Q_1^1 + P_2^1 Q_2^1$$

this does not allow to say much. All we know from the preceding inequality is that Q_1^2 and Q_2^2 were not affordable in period 1. But the mere fact that a bundle is more expensive than another does not make it preferable of course.

e. Explain why if $P_Q > 1$ the consumer is better off in year 2. What about the case where $P_Q < 1$?

$$P_Q > 1 \Leftrightarrow P_1^2 Q_1^2 + P_2^2 Q_2^2 > P_1^2 Q_1^1 + P_2^2 Q_2^1$$

notice that this means that in year 2, quantities of good 1 and 2 which were purchased in year 1, Q_1^1 and Q_2^1 , were available and yet our representative agent chose Q_1^2 and Q_2^2 . In other words Q_1^2 and Q_2^2 are revealed preferred to Q_1^1 and Q_2^1 and our agent is better off in period 2 than in period 1.

$$P_Q < 1 \Leftrightarrow P_1^2 Q_1^2 + P_2^2 Q_2^2 < P_1^2 Q_1^1 + P_2^2 Q_2^1$$

this does not allow to say much. All we

know from the preceding inequality is that Q_1^1 and Q_2^1 were not affordable in period 2. But again, the mere fact that a bundle is more expensive than another does not make it preferable, of course.

f. Explain why we cannot say anything when $E_Q < 1$ or $E_Q > 1$.

$$P_Q > 1 \iff P_1^2 Q_1^2 + P_2^2 Q_2^2 > P_1^1 Q_1^1 + P_2^1 Q_2^1$$

All we know from the preceding inequality is that the agent's chosen bundle is more expensive in period 2 than in period 1.

$$P_Q < 1 \iff P_1^2 Q_1^2 + P_2^2 Q_2^2 < P_1^1 Q_1^1 + P_2^1 Q_2^1$$

All we know from the preceding inequality is that the agent's chosen bundle is more expensive in period 1 than in period 2.

g. What kind of macroeconomic indicator that is often used without caveats in newspapers does E_Q make you think of?

Look at E_Q is like looking at the change in nominal expenditure and thus nominal national income to try to say something about how much better (or in recessions, sometimes worse) off we are from one year to another. But the fact that expenditure is getting more pricy throughout time does not allow us to draw any conclusion in terms of welfare.