Economics 102
Fall 2015
Answers to Homework #3
Due Monday, October 26, 2015

Directions:

- The homework will be collected in a box **before** the large lecture.
- Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade.
- Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

Please realize that you are essentially creating "your brand" when you submit this homework. Do you want your homework to convey that you are competent, careful, professional? Or, do you want to convey the image that you are careless, sloppy, and less than professional. For the rest of your life you will be creating your brand: please think about what you are saying about yourself when you do any work for someone else!

You may use a calculator to do all of the calculations. Round all decimals to the nearest hundredth if necessary.

GDP Measurement

1. Suppose that Republic of Economists produces three goods: books, magazines and papers. The following table provides information about the prices and output for these three goods for the years 2013, 2014 and 2015.

	Price per book	Quantity of books	Price per magazine	Quantity of magazines	Price per paper	Quantity of papers
2013	$100	10	$50	100	$10	200
2014	$100	12	$52	108	$10	205
2015	$110	12	$54	115	$10	212

a. Using the provided information, fill in the following table.

Answer:

Year	Nominal GDP
2013	(100*10) + (50*100) + (10*200) = $8,000
2014	(100*12) + (52*108) + (10*205) = $8,866
2015	(110*12) + (54*115) + (10*212) = $9,650

b. What is the percentage change in nominal GDP from 2013 to 2014? Provide any formulas you use and show your work in calculating this answer.

Answer:

Percentage change in a variable = {[New value of variable - Previous value of variable]/(Previous value of variable)}* (100%)
Percentage change in nominal GDP from 2013 to 2014 = {[(Nominal GDP in 2014) - (Nominal GDP in 2013)]/(Nominal GDP in 2013)}*(100%)
Percentage change in nominal GDP from 2013 to 2014 = [(8866-8000)/8000]*100 = 10.83%

c. What was the percentage change in nominal GDP from 2014 to 2015?

Answer:

Percentage change in nominal GDP from 2014 to 2015 = [(9650-8866)/8866]*100 = 8.84%

d. Using 2013 as the base year, fill in the following table.

Answer:

Year	Real GDP
2013	(100*10) + (50*100) + (10*200) = $8,000
2014	(100*12) + (50*108) + (10*205) = $8,650
2015	(100*12) + (50*115) + (10*212) = $9,070

e. What was the percentage change in real GDP from 2013 to 2014?

Answer:

Percentage change in real GDP from 2013 to 2014 = [(8650-8000)/8000]*100 = 8.13%

f. What was the percentage change in real GDP from 2014 to 2015?

Answer:

Percentage change in real GDP from 2014 to 2015 = [(9070-8650)/8650]*100 = 4.86%

g. Using 2013 as the base year, fill in the following table.

Answer:

Year	GDP deflator measured on a 100-point scale with 2013 as the base year
2013	(8000/8000)*100 = 100
2014	(8866/8650)*100 = 102.50
2015	(9650/9070)*100 = 106.39

2. The Organization for Economic Co-operation and Development (OECD) annually publishes **National Accounts of OECD Countries**. This annual publication consists of two issues, the first covering main aggregates and the second detailed tables. These publications cover: expenditure-based GDP (what we called Method 2 or the Expenditure Approach when discussing GDP measurement), output-based GDP (what we called Method 1 when discussing GDP measurement), income-based GDP (what we called Method 3 or the Income Approach when discussing GDP measurement), disposable income, saving and net lending, population, employment, and final consumption expenditure of households by purpose. The publications also include simplified accounts for the three main sectors of an country's economy: general government, corporations and households. The publications also include comparative tables based on purchasing power parities and exchange rates for different countries. Data are shown for 34 OECD countries and the Euro area. Figures provided in the country tables are expressed in the country's national currency.

   Use the link below to answer the following set of questions:

   http://www.oecd-ilibrary.org/economics/national-accounts-of-oecd-countries_2221433x

   (You have a free access to the link since UW-Madison has a subscription for its students and researchers. HOWEVER, you must be on campus when downloading the reports and this IMPLIES THAT YOU WILL NEED TO PLAN AHEAD!)

   The expenditure approach tells us that

   GDP = Consumption + Investment + Government Spending + Net Exports or, symbolically:
   GDP = C + I + G + (X - IM)

   Let's verify whether the above identity or equation is true for South Korea's (in the tables and henceforth in this problem we will simply refer to "Korea") national accounts.

a. Fill the blanks of the table below (in billion KRW & at **current** prices):

Answer:

	2010 (Reference Year)	2012	2014
Consumption (including government spending)	819,821	911,938	972,952
Capital Investment	405,188	427,029	433,069
Net Exports	40,299	38,490	79,240
Statistical Discrepancy	0	0	-182
Nominal GDP	1,265,308	1,377,457	1,485,078

Table 1. on page 173 has sufficient information for answering the question above. (See attached page for "Gross domestic product, expenditure approach: Korea")

b. Fill the blanks of the table below (in billion KRW & at **constant** prices with 2010 the base year or reference year):

Answer:

	2010 (Reference Year)	2012	2014
Consumption (including government spending)	819,821	861,259	898,014
Capital Investment	405,188	409,640	429,715
Net Exports	40,299	71,549	99,286
Statistical Discrepancy	0	-481	-475
Real GDP	1,265,308	1,341,967	1,426,540

Table 1. on page 173 has sufficient information for answering the question above. (See attached page for "Gross domestic product, expenditure approach: Korea")

c. Calculate Korea's GDP deflators for the year of 2010, 2012 and 2014 (using a 100-point scale and with 2010 the base year or reference year):

Answer:

	2010 (Reference Year)	2012	2014
GDP Deflator	(Nominal GDP ÷ Real GDP) × 100 = (1,265,308 ÷ 1,265,308) × 100 = 100	(1,377,457 ÷ 1,341,967) × 100 = 102.64	(1,485,078 ÷ 1,426,540) × 100 = 104.10

d. Calculate the biannual growth rates (biannual is every two years) of Korea's real GDP (in percentage):

Answer:

	2010	2012	2014
Growth Rate of Real GDP	-	{(Real GDP in 2012 – Real GDP in 2010) / Real GDP in 2010} × 100 = {(1,341,967 – 1,265,308) / 1,265,308} × 100 = 6.06%	{(1,426,540 – 1,341,967) / 1,341,967} × 100 = 6.30%

Real GDP vs. Nominal GDP

3. The following table includes data showing US GDP and inflation for the past ten years. The nominal and real GDP series in this table are taken from the US Bureau of Economic Analysis (http://www.bea.gov/national/index.htm#gdp), while the last column in the table is calculated from CPI data provided at the US Bureau of Labor Statistics (http://data.bls.gov/cgi-bin/surveymost?bls, CPI for All Urban Consumers (CPI-U) 1982-84=100 (Unadjusted) - CUUR0000SA0). You are encouraged to use excel or other software to do the following calculations.

Year	Nominal GDP in billions	Real GDP in billions	GDP deflator1	GDP deflator2	Inflation (%)	Inflation from CPI (%)
2005	13,093.7	14,234.2		100	-	-
2006	13,855.9	14,613.8				3.23%
2007	14,477.6	14,873.7				2.85%
2008	14,718.6	14,830.4				3.84%

2009	14,418.7	14,418.7				-0.36%
2010	14,964.4	14,783.8				1.64%
2011	15,517.9	15,020.6				3.16%
2012	16,155.3	15,354.6				2.07%
2013	16,663.2	15,583.3				1.46%
2014	17,348.1	15,961.7				1.62%

a. According to the table above, which year is used as the base year in calculating real GDP? Explain your answer.

Answer:

The base year is 2009. We know this because in the base year the nominal GDP is always equal to the real GDP.

b. Using the formula for the GDP deflator given in class, calculate the GDP deflator for the last ten years and fill out the column labeled GDP deflator1. Calculate this GDP deflator using a one-point scale.

Answer:

GDP deflator = (nominal GDP)/(real GDP). See table below for results.

c. Now we want to redefine the base year and make 2005 the new base year. When we do this the GDP deflator in 2005 will have a value of 100 on a 100 point scale. Use your answers from part (b), GDP deflator 1, to fill out the column labeled as GDP deflator 2. Note: not only do we want you to change the base year, we also want you to change the scale from a one-point scale to a 100-point scale.

Answer:

GDP deflator1 in 2005 is 0.92. In order to change it to 100, we need to divide it by 0.92 and then multiply 100. Do the same manipulations to GDP deflator1 for all the other years: that is, divide each GDP deflator 1 by .92 and then multiple this figure by 100 in order to get GDP deflator 2. For example, GDP deflator2 in 2006 = (0.95/0.92)*100 = 103.06. See the table below for the other results.

d. Define inflation as the % change in the general price level; review your class notes for the general formula for the % change in the general price level. Calculate the annual inflation rate for the last ten years based upon the GDP deflator2 and fill out the column labeled inflation. Compare your calculation of the inflation rate using the GDP deflator2 to the measure of inflation provided by the CPI (see the column labeled "inflation from CPI"). Are these two measures of inflation equal? Why or why not?

Answer:

Inflation in 2006 = 100*(GDP deflator2 in 2006 – GDP deflator2 in 2005)/(GDP deflator2 in 2005) = 3.06 (%). Results for other years can be calculated similarly and are given in the table below.

Inflation calculated using the GDP deflator2 as the index is not equal to inflation calculated using the CPI as the index. The GDP deflator is different from the CPI in at least two aspects. (i) The calculation of the GDP deflator and the CPI involves different goods and services. For example, goods and services like exports that are produced but not consumed domestically are used in the calculation of the GDP deflator but not in that of the CPI. The goods and services like imports that are consumed but are not produced domestically are used in the calculation of the CPI but not in that of the GDP deflator. (ii) In the calculation of the CPI, the category and the quantity of the goods and services (the market basket) is fixed over time. In the calculation of the GDP deflator, however, both the category and the quantity of the goods and services may change over time depending on the level of production of these goods and services each year.

Answer:

Here's the completed table for (a), (b), (c) and (d):

Year	Nominal GDP in billions	Real GDP in billions	GDP deflator1	GDP deflator2	Inflation (%)	Inflation from CPI (%)
2005	13,093.7	14,234.2	0.92	100	-	-
2006	13,855.9	14,613.8	0.95	103.06	3.06%	3.23%
2007	14,477.6	14,873.7	0.97	105.80	2.66%	2.85%
2008	14,718.6	14,830.4	0.99	107.88	1.96%	3.84%
2009	14,418.7	14,418.7	1	108.70	0.76%	-0.36%
2010	14,964.4	14,783.8	1.01	110.02	1.22%	1.64%
2011	15,517.9	15,020.6	1.03	112.29	2.06%	3.16%
2012	16,155.3	15,354.6	1.05	114.36	1.84%	2.07%
2013	16,663.2	15,583.3	1.07	116.23	1.63%	1.46%
2014	17,348.1	15,961.7	1.09	118.14	1.64%	1.62%

Unemployment Measurement

4. The table below provides data on US employment taken from US Bureau of Labor Statistics (in thousands).

   Answer:

Year	Month	Labor Force	Employment	Unemployment	Unemployment Rate
2014	Jan	155486	145206	10280	6.6
2014	Feb	155688	145301	10387	6.7
2014	Mar	156180	145796	10384	6.6
2014	Apr	155420	145724	9696	6.2
2014	May	155629	145868	9761	6.3
2014	Jun	155700	146247	9453	6.1
2014	Jul	156048	146401	9648	6.2
2014	Aug	156018	146451	9568	6.1
2014	Sep	155845	146607	9237	5.9
2014	Oct	156243	147260	8983	5.7
2014	Nov	156402	147331	9071	5.8
2014	Dec	156129	147442	8688	5.6
2015	Jan	157180	148201	8979	5.7
2015	Feb	157002	148297	8705	5.5
2015	Mar	156906	148331	8575	5.5
2015	Apr	157072	148523	8549	5.4
2015	May	157469	148795	8674	5.5
2015	Jun	157037	148739	8299	5.3
2015	Jul	157106	148840	8266	5.3
2015	Aug	157065	149036	8029	5.1
2015	Sep	156715	148800	7915	5.1

a. Fill in the missing numbers in the table. Provide any formulas you need to use in filling out the missing values as well.

   Answer:

   Labor force = employment + unemployment
   Unemployment rate = (unemployment/Labor force)*100
   Answers are given in the table above.

b. According to the US Census Bureau, the US has a population of about 320 million people. Why is the labor force in the above table only about 160 million people? Which groups of people are not included in the labor force? List at least four groups of people that are excluded from the labor force.

Answer:

Children, retired persons, students, homemakers, people in prison or similar institutions as well as discouraged workers who cannot find work are excluded from the labor force.

Suppose that the Republic of Economists (ROE) is a country which has exactly the same values for their labor force, their employment and their unemployment as the US in September 2015. Among those 7915 unemployed workers in the ROE, 2000 of these unemployed workers are temporarily laid-off workers and newly graduated students who expect to find a new job soon, while 1800 of these unemployed workers are searching for jobs in the market where there are few vacancies due to the type of job that is being sought.

c. Given this information, what is the structural unemployment rate in ROE? What is the frictional unemployment rate in ROE? What is the cyclical unemployment rate in ROE? What is the natural unemployment rate in ROE? For each answer show the formula you use and the numeric values you entered in that formula when computing your answer (don't just provide a final number!).

Answer:

Structural unemployment = 1800 unemployed workers
Structural unemployment rate = (number of structurally unemployed/labor force) * 100 = (1800/156715) * 100 = 1.15%
Frictional unemployment = 2000 unemployed workers
Frictional unemployment rate = (number of frictionally unemployed/labor force) * 100 = (2000/156715) * 100 = 1.28%
Natural unemployment = Structural unemployment + Frictional unemployment = 3800 unemployed workers
Natural unemployment rate = (natural unemployment/labor force) * 100 = (3800/156715) * 100 = 2.42%
Cyclical unemployment = Actual unemployment – natural unemployment = 7915 – 3800 = 4115 unemployed workers
Cyclical unemployment rate = (cyclical unemployment/labor force) * 100 = (4115/156715) * 100 = 2.63%

If you read the information as 2000 that are temporarily unemployed and another 2000 that are newly graduated students:

Frictional unemployment = 4000 unemployed workers
Frictional unemployment rate = 2.55%
Natural unemployment = 5800 unemployed workers
Natural unemployment rate = 3.70%
Cyclical unemployment = 2115 unemployed workers
Cyclical unemployment rate = 1.35%

CPI

5. Suppose that the market basket for purposes of computing the consumer price index (the CPI) in Madison contains 2 books, 10 steaks, 20 potatoes, 5 cookies, and 2 bags of charcoal. You are given the following price data for the years 2005 through 2010 in Madison.

Item	Price in 2010	Price in 2011	Price in 2012	Price in 2013	Price in 2014	Price in 2015
1 Book	$5.00	$5.00	$5.00	$6.00	$6.00	$7.00
1 Steak	$4.00	$5.00	$4.00	$6.00	$5.00	$7.00
1 Potato	$.50	$.60	$.60	$.40	$.50	$.80
1 Cookie	$1.00	$1.00	$2.00	$2.00	$1.00	$2.00
1 Bag of Charcoal	$5.00	$5.00	$5.00	$6.00	$7.00	$5.00

a. Using the above data compute the cost of each market basket. Put your answers in the following table.

Answer:

Cost of Basket in 2010	(2)(5) + (10)(4) + (20)(.5) + (5)(1) + (2)(5) = $75
Cost of Basket in 2011	(2)(5) + (10)(5) + (20)(.6) + (5)(1) + (2)(5) = $87
Cost of Basket in 2012	(2)(5) + (10)(4) + (20)(.6) + (5)(2) + (2)(5) = $82
Cost of Basket in 2013	(2)(6) + (10)(6) + (20)(.4) + (5)(2) + (2)(6) = $102
Coat of Basket in 2014	(2)(6) + (10)(5) + (20)(.5) + (5)(1) + (2)(7) = $91
Cost of Basket in 2015	(2)(7) + (10)(7) + (20)(.8) + (5)(2) + (2)(5) = $120

b. Now, calculate the CPI for 2010 through 2015 using 2010 as the base year. Enter your results in the following table. Use a 100-point scale for the CPI. Carry your answer out to two places past the decimal.

Answer:

Year	CPI
2010	(75/75)*100 = 100
2011	(87/75)*100 = 116
2012	(82/75)*100 = 109.33
2013	(102/75)*100 = 136
2014	(91/75)*100 = 121.33
2015	(120/75)*100 = 160

c. Now, using the answers you got in part (b) calculate the annual rate of inflation in this economy from 2011 through 2015. Enter your answers in the table provided. Carry your answer out to two places past the decimal.

Answer:

Year	Rate of Inflation
2011	[(116 - 100)/100]*100 = 16%
2012	[(109.33 – 116)/116]*100 = -5.75%
2013	[(136 – 109.33)/109.33]*100 = 24.39%
2014	[(121.33 – 136)/136]*100 = -10.78%
2015	[(160 – 121.33)/121.33]*100 = 31.87%

d. Now, redo the CPI you found in part (b) with 2015 as the base year. Enter your results in the following table. Use a 100-point scale for the CPI. Carry your answer out to two places past the decimal.

Answer:

Year	CPI
2010	(75/120)*100 = 62.50
2011	(87/120)*100 = 72.50
2012	(82/120)*100 = 68.33
2013	(102/120)*100 = 85.00
2014	(91/120)*100 = 75.83
2015	(120/120)*100 = 100

e. Now, using the answers you got in part (d) calculate the annual rate of inflation in this economy from 2011 through 2015. Enter your answers in the table provided. Carry your answer out to two places past the decimal.

Answer:

Year	Rate of Inflation
2011	[(72.50 – 62.50)/62.50]*100 =16%
2012	[(68.33– 72.50)/72.50]*100 = -5.75%
2013	[(85.00 – 68.33)/68.33]*100 = 24.39%
2014	[(75.83 – 85.00)/85.00]*100 = -10.78%
2015	[(100 – 75.83)/75.83]*100 = 31.87%

f. Compare the annual rates of inflation in part (c) and (e). Are they the same or different? Explain your answer.

Answer:

The annual rates of inflation are the same. Changing the base year does not affect the annual rate of inflation when using the CPI to calculate these annual rates of inflation (this is in contrast to the GDP deflator where the choice of base year does impact the annual rate of inflation).

KOREA

Table 1. Gross domestic product, expenditure approach

Billion KRW

		2007	2008	2009	2010	2011	2012	2013	2014
	AT CURRENT PRICES								
1	**Final consumption expenditure**	**691 740**	**740 805**	**769 589**	**819 821**	**873 523**	**911 938**	**942 267**	**972 952**
2	Household	529 759	560 688	574 794	615 228	655 109	678 097	693 861	712 727
3	NPISH's	16 670	18 366	20 089	21 485	24 032	29 518	33 939	36 180
4	Government	145 311	161 751	174 706	183 109	194 381	204 324	214 467	224 045
5	Individual	70 706	78 941	86 434	89 548	98 284	103 464	109 270	115 897
6	Collective	74 605	82 811	88 272	93 561	96 097	100 860	105 197	108 148
7	***of which:*** *Actual individual consumption*	617 135	657 994	681 316	726 261	777 425	811 078	837 070	864 803
8	**Gross capital formation**	**339 889**	**364 687**	**327 841**	**405 188**	**439 236**	**427 029**	**416 000**	**433 069**
9	Gross fixed capital formation, total	318 339	346 612	360 697	385 924	403 045	407 307	418 289	432 247
10	Dwellings	51 314	51 056	50 753	46 010	44 828	44 649	55 442	61 526
11	Other buildings and structures	124 285	139 070	149 399	154 609	160 840	157 051	157 664	156 901
12	Transport equipment	24 637	29 459	31 473	34 066	35 781	35 603	36 125	39 244
13	ICT equipment	..	..	..	..	..	..	..	..
14	Other machinery and equipment and weapons systems[1]	69 308	73 507	72 035	87 556	91 930	92 682	86 874	87 710
15	Cultivated assets	..	..	..	..	..	..	..	..
16	Intangible fixed assets[1]	48 795	53 521	57 036	63 684	69 666	77 323	82 183	86 866
17	Changes in inventories, acquisitions less disposals of valuables	21 550	18 075	-32 856	19 264	36 191	19 722	-2 288	822
18	Changes in inventories	18 841	16 682	-33 269	18 333	35 301	18 781	-2 389	..
19	Acquisitions less disposals of valuables	2 709	1 393	413	931	890	941	101	..
20	**External balance of goods and services**	**11 751**	**-119**	**53 979**	**40 299**	**19 922**	**38 490**	**71 178**	**79 240**
21	Exports of goods and services	408 797	551 820	547 634	625 309	742 936	776 062	770 115	752 062
22	Exports of goods	354 932	474 703	479 528	549 897	666 725	690 755	687 279	665 549
23	Exports of services	53 865	77 117	68 107	75 412	76 211	85 308	82 836	86 512
24	Imports of goods and services	397 047	551 939	493 655	585 010	723 014	737 572	698 937	672 822
25	Imports of goods	323 631	453 707	397 129	480 813	618 071	624 344	588 411	559 435
26	Imports of services	73 416	98 231	96 526	104 197	104 942	113 229	110 526	113 387
27	**Statistical discrepancy**	**-122**	**-880**	**299**	**0**	**0**	**0**	**0**	**-182**
28	**Gross domestic product**	**1 043 258**	**1 104 492**	**1 151 708**	**1 265 308**	**1 332 681**	**1 377 457**	**1 429 445**	**1 485 078**
	AT CONSTANT PRICES, REFERENCE YEAR 2010								
29	**Final consumption expenditure**	**760 101**	**776 459**	**786 332**	**819 821**	**842 339**	**861 259**	**880 130**	**898 014**
30	Household	582 365	589 705	589 467	615 228	631 984	639 782	648 429	658 979
31	NPISH's	18 392	19 302	20 530	21 485	23 197	28 002	31 942	33 644
32	Government	159 440	167 543	176 323	183 109	187 158	193 474	199 783	205 418
33	Individual	..	..	..	..	..	..	..	..
34	Collective	..	..	..	..	..	..	..	..
35	***of which:*** *Actual individual consumption*	678 123 e	689 662 e	696 139 e	726 261 e	749 673 e	766 004 e	781 870 e	798 196 e
36	**Gross capital formation**	**386 391**	**382 654**	**343 840**	**405 188**	**419 283**	**409 640**	**409 154**	**429 715**
37	Gross fixed capital formation, total	367 792	364 663	365 746	385 924	389 124	387 240	400 026	412 588
38	Dwellings	59 195	53 614	52 298	46 010	42 311	41 091	50 701	55 233
39	Other buildings and structures	147 415	147 461	155 885	154 609	151 441	145 018	145 606	143 094
40	Transport equipment	27 802	30 189	31 197	34 066	35 907	35 780	36 893	39 723
41	ICT equipment	..	..	..	..	..	..	..	..
42	Other machinery and equipment and weapons systems[1]	80 743	78 095	68 641	87 556	91 378	91 663	89 569	94 070
43	Cultivated assets	..	..	..	..	..	..	..	..
44	Intangible fixed assets[1]	54 165	56 660	59 045	63 684	68 087	73 954	77 186	80 720
45	Changes in inventories, acquisitions less disposals of valuables	..	..	..	..	..	..	..	..
46	Changes in inventories	..	..	..	..	..	..	..	..
47	Acquisitions less disposals of valuables	..	..	..	..	..	..	..	..
48	**External balance of goods and services**	**-650**	**21 602**	**55 939**	**40 299**	**51 012**	**71 549**	**92 063**	**99 286**
49	Exports of goods and services	517 849	556 668	554 856	625 309	719 943	756 558	788 788	810 723
50	Exports of goods	455 185	482 595	484 518	549 897	643 816	672 052	702 111	718 509
51	Exports of services	63 094	73 954	70 418	75 412	76 128	84 662	86 811	92 432
52	Imports of goods and services	518 499	535 066	498 917	585 010	668 932	685 009	696 725	711 437
53	Imports of goods	421 627	434 315	403 688	480 813	565 289	576 060	583 653	590 842
54	Imports of services	96 565	100 442	95 029	104 197	103 643	109 174	113 402	121 109
55	**Statistical discrepancy (including chaining residual)**	**1 470**	**-943**	**2 007**	**0**	**-741**	**-481**	**-515**	**-475**
56	**Gross domestic product**	**1 147 311**	**1 179 771**	**1 188 118**	**1 265 308**	**1 311 893**	**1 341 967**	**1 380 833**	**1 426 540**

Note: Detailed metadata: http://metalinks.oecd.org/naii/20150812/0a1da

1. Including *ICT Equipment*.