

Midterm Exam No. 1 - Answers
February 19, 2004

Answer all questions, on these sheets in the spaces provided (use the blank space on page 11 (12) if you need more). In questions where it is appropriate, **show your work**, if you want a chance of partial credit for an incorrect answer. Point values for the questions are shown; there are a total of 79 points possible. *(This answer sheet includes several questions that were removed from the final draft of the exam, so the points here are more than 79. These questions are printed in gray.)*

1. (10 points 1/2 per answer in a, rounded up, and 2 in b)
- a. For each of the following transactions and events, indicate whether or not it contributes to one or more of the U.S. macroeconomic variables, C, I, G, EX, or IM, and if so, which one or ones. Record your answer(s) by writing either “none” or $x=\pm yyy$ in the space provided, where $x=C,I,G,EX,$ or IM and yyy is the dollar amount. For example, to say that a transaction contributes positively to imports (making imports larger than they would otherwise be) by \$760, write $IM=+760$ in the blank. Unless stated otherwise, everything listed happens in the same year and all persons and firms are American.

Abner earns \$500 working for the state government of Nevada.

$G=+500$

Theresa buys 100 shares of stock in a construction firm, at a price of \$12.50 per share

none

The XYZ corporation produces but fails to sell 10 hyperwidgets, worth \$70 each, and adds them to inventories.

$I=+700$

Floyd buys a piano from the Japanese company Yamaha for \$5000. (2 pts)

$IM=+5000$
 $C=+5000$

Greg, a lawyer, visits Canada to advise a client, whom he charges \$420

$EX=+420$

James and Judy pay a day-care center \$300 for taking care of their 3-year old child, Droopy, for one month.

$C=+300$

The next month, James stays home from work and cares for Droopy himself.

none

Judy spends \$180 replacing the curtains destroyed by Droopy and James.

$$C=+180$$

Walmart sells a desk, which it had purchased the year before for \$90 from China, to a UM college student for \$120. (2 pts)

$$I= -90$$

$$C=+120$$

Twilla buys a used 1993 Honda car, made in Japan, from Fiona for \$2200.

none

Hank buys travelers checks worth \$1000 from TCF Bank, paying \$1015 for them.

$$C=+15$$

An elevator, purchased by U of M for \$7,000 in 1934, stops working.

none

U of M (a state university) pays \$1940 for a Sony Viao laptop computer, made in Japan, for use by a professor. (2 pts)

$$IM=+1940$$

$$G=+1940$$

- b. (2 pts) Calculate the total contribution of the above transactions to U.S. Gross Domestic Product.

$$\begin{aligned} \text{Ans: } GDP &= C (+5000+300+180+120+15 = 5615) \\ &+ I (+700-90 = 790) \\ &+ G (+500+1940 = 2440) \\ &+ EX (+420 = 420) \\ &- IM (+5000+1940 = 6940) \\ &= 2325 \end{aligned}$$

2. (10 points) The economy of Boringia produces and consumes only two goods, huhums and yawns. The following table reports the quantities and prices of these two goods in the years 2001 and 2002.

	Quantities		Prices	
	2001	2002	2001	2002
Huhums	10	25	6	8
Yawns	20	15	4	10

- a. Calculate the following, using 2001 as the base year and the quantities listed for 2001 as the consumption basket for the CPI. Use the space at the right and below, if you wish to show your calculations.

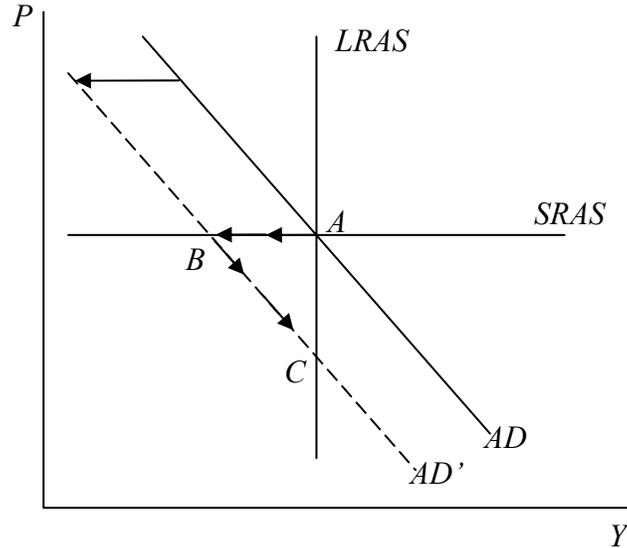
$$\begin{aligned}
 \text{Real GDP in 2002 (2 pts)} & \quad \underline{210} = 6(25) + 4(15) \\
 \text{CPI in 2002 (2 pts)} & \quad \underline{200} = 100[8(10) + 10(20)] / [6(10) + 4(20)] \\
 \text{GDP Deflator in 2002 (2 pts)} & \quad \underline{167} = 100 \text{ Nom GDP} / \text{Real GDP} \\
 \text{\% inflation 2001-2002} & \\
 \text{- based on CPI (1 pt)} & \quad \underline{100} = \text{CPI} - 100 \\
 \text{- based on deflator (1 pt)} & \quad \underline{67} = \text{Deflator} - 100
 \end{aligned}$$

- b. (2 pts) Explain why the CPI and the Deflator yield different results for the rate of inflation here.

Ans: The CPI uses old quantities, while the Deflator uses current quantities. As a result, the CPI includes "substitution bias," in that it ignores the fact that consumers can substitute toward goods whose relative prices fall and away from goods whose relative prices rise. Exactly this sort of substitution can be observed in the numbers where, where the relative price of hohums fell, and the consumption bundle shifted to consuming relatively more of them.

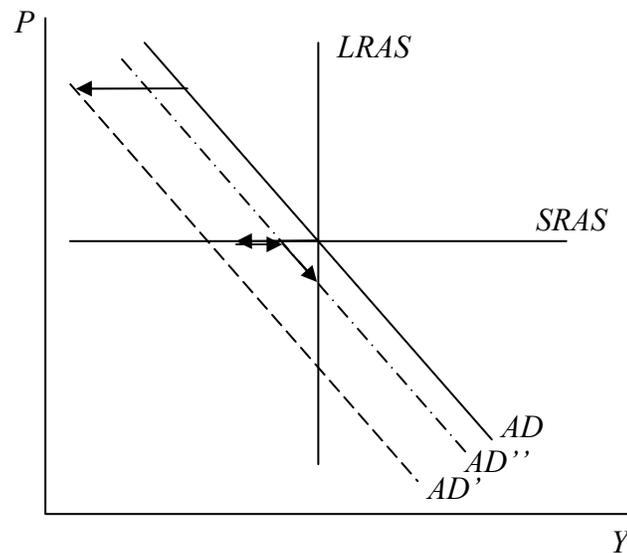
3. (5 points) (10 points) In the year 2000, it appeared to be the case that the United States was in a long-run macroeconomic equilibrium, and thus that it could be represented by the simultaneous intersection of both short- and long-run aggregate supply with aggregate demand, as shown in the diagram below. There then occurred a shock to this equilibrium due to the sudden collapse of prices in the stock market, which reduced the perceived wealth of lots of consumers. A plausible response to this event would be for consumers to reduce their consumption and increase their savings. Suppose that this did happen. Illustrate in the diagram how this would cause income and the price level to change, both in the short run and in the long run, under each of the policy assumptions specified. (The diagram is repeated in part (b) so that you can start fresh with the new policy assumption.) Also, in each case, state in words what happens to these two variables over time.

- a. Assume here that there is **no change** in macroeconomic policy.



Ans: The drop in consumption causes the aggregate demand curve, AD, to shift to the left as shown, to AD'. In the short run, the economy moves from point A to point B, with national income Y falling and no change in the price level. Over time, the economy then moves down along the new AD' curve to point C, with income rising back to its former level and the price level falling.

- b. Assume here that, **after they observe a change in income**, the policymakers use a mix of monetary and fiscal policies that is expansionary if income has fallen or contractionary if income has risen.



Ans: What is shown is just one of several possibilities. The AD curve shifts initially to the left, just as in part (a), and income begins to fall, moving the economy to the left in the picture. As policy makers notice the decline in income, they employ expansionary monetary and/or fiscal policies, either of which cause the AD curve to shift back to the right by some amount. What happens next depends on how quickly they do this, and how expansionary are their policies. The case shown has them acting before much drop in price (along AD') has occurred, and it has them expanding aggregate demand by somewhat less than the initial fall, so that the AD curve, though it shifts to the right, does not reach the position of the original AD. In this case, income rises part way back to its initial level, and then price does begin to fall and income rises further along with the fall in price. The final effect is that income returns to its original level, and the price level falls but not as much as in part (a). Furthermore, the temporary decline in income is smaller than without any policy response, and lasts a shorter time. Had the policy response come later, this would be less true.

Had the policy response been larger, then any fall in the price level might have been prevented, and indeed it is quite possible for the policy response to be large enough to take AD'' to the right of AD, causing income to rise temporarily above its long-run level and causing the price level to rise in the long run rather than fall.

4. (16 points) (20 points) There seems to be disagreement, at least among politicians, as to whether an increased government budget deficit causes a rise in interest rates and a consequent fall in investment. To find out what at least one model of the economy might say about this, use Mankiw's model of Chapter 3 (national income in the long run, closed economy) to answer the questions below. As a reminder, the model consists of the following equations, the properties of which you should know:

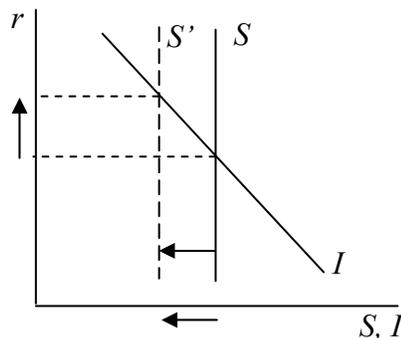
$Y = F(\bar{K}, \bar{L})$	Real income
$W = F_L(\bar{K}, \bar{L})$	Real wage
$C = C(Y - \bar{T})$	Consumption
$I = I(r)$	Investment
$Y = C + I + \bar{G}$	Goods market equilibrium

You may analyze this model using algebra/calculus or using diagrams (or both). Either can be correct, if done right.

- a. (6 pts) Find the effects on savings, S , the interest rate, r , and the level of investment, I , of an increase in government purchases, $\Delta \bar{G}$, without any change in taxes, \bar{T} .

Ans: $S = Y - C - G$. Y is unchanged, and here since T is also unchanged, C is unchanged. Therefore $\Delta S = -\Delta G < 0$. In equilibrium $S = I$, so $\Delta I < 0$. And since $dI/dr < 0$, this requires $\Delta r > 0$.

Graphically:



Or, using differentiation:

$$\begin{aligned}
 dI &= dY - dC - d\bar{G} = dY - C'(dY - d\bar{T}) - d\bar{G} \\
 &= (1 - C')dY + C'd\bar{T} - d\bar{G} = (1 - C')(F_K d\bar{K} + F_L d\bar{L}) + C'd\bar{T} - d\bar{G} \\
 &= -d\bar{G} < 0 \quad \text{as } d\bar{K} = d\bar{L} = d\bar{T} = 0 \\
 dI &= I'dr \Rightarrow dr = (1/I')dI > 0 \quad \text{as } I' < 0
 \end{aligned}$$

- b. (6 pts) In contrast, now find the effects (on the same variables) due to an increase in \bar{G} that does *not* increase the deficit, but rather is accompanied by an equal increase in \bar{T} : $\Delta\bar{T} = \Delta\bar{G} > 0$. How does your answer compare to part (a)?

Ans: Now $\Delta T > 0$, so C does change: $\Delta C = -C' \Delta T = -C' \Delta G$, where C' is the $MPC < 1$. Since $S = Y - C - G$, $\Delta S = C' \Delta G - \Delta G = -(1 - C') \Delta G < 0$. So as in part (a), savings falls and so must investment, while r rises. However, the drop in savings is smaller than in part (a), equal to $(1 - C') \Delta G$ instead of ΔG . Therefore the drop in investment and the rise in the interest rate are also smaller.

The diagram looks the same as in part (a), although the S curve should not shift by as much. In the next-to-last step of the differentiated solution, now $dI = C' d\bar{T} - d\bar{G} = C' d\bar{G} - d\bar{G} = -(1 - C') d\bar{G} < 0$

- b'. (4 pts) Suppose now that, contrary to the model stated above, government purchases are actually a form of investment that is not included in the private investment function $I(r)$. (Government spending on roads, for example, could be viewed as just as much part of the economy's capital stock as a firm's investment in machinery.) Find how the two policies of parts (a) and (b) affect this more comprehensive measure of investment, $\tilde{I} = I + G$.

Ans: In part (a) we found that S falls by exactly the increase in G . Since $I = S$, I must also fall by that amount, leaving $I + G = -\Delta G + \Delta G = 0$, or in other words no change at all. In part (b), with a balanced budget, we had $\Delta S = -(1 - C') \Delta G$. So now, $\Delta(I + G) = -(1 - C') \Delta G + \Delta G = +C' \Delta G > 0$. So if the government spends on what is really investment, then although it crowds out private investment, total investment does not fall. And if the government uses taxes to finance that spending, total investment actually rises.

- b. (4 pts) The equilibrium real wage, W , in this model depends only on \bar{K} and \bar{L} , which so far we have not changed. But suppose now that we assume a change in the capital stock, $\Delta\bar{K} = \Delta I$ (or $\Delta\tilde{I}$ in c). How then do the policies in parts (a) and (b) affect W ?

Ans: Since we are holding L constant, if K rises the marginal product of labor rises and thus so does the real wage. If K falls, the opposite happens. So in parts (a) and (b), where investment falls, W falls. In part (c) however it does not, and if the increased spending on public investment is matched by a tax increase, the real wage rises. (Workers are made more productive by the public capital.)

5. (8 points) (10 points) Suppose that the country of Oopsland has had a history, until the start of this year, of a very stable economy. Real output has grown steadily at a constant rate, and inflation has been moderate for as long as anybody can remember. Suddenly this year, and unexpectedly, the rate of inflation increases to well over 300%. Based on the quantity theory of money as well as other things that you learned about the causes and effects of inflation, put a check mark (✓) next to each of the following statements that seems likely to be true during this year.

The supply of money in this economy is growing much more rapidly than it did in prior years.

Those whose income comes from producing goods and services are experiencing a rapid rise in their real incomes.

The real wage of labor is falling.

People spend more time and effort than they did before, managing their money in order hold less of it.

The nominal interest rate in this economy is higher than it was last year.

The real interest rate in this economy is higher than it was last year.

Those who borrowed money in the past benefit from the new inflation.

Those who lent money in the past benefit from the new inflation.

The increased inflation makes it harder for necessary changes in relative prices to occur.

Inflation raises the costs of certain commodities disproportionately compared to everything else, particularly shoe leather and menus.

6. (3 points) In the last quarter of 2003, as reported in the *Wall Street Journal*, (circle one correct option in each case below):

a. Labor costs: rose fell stayed the same

b. Real hourly wages: rose fell stayed the same

c. These changes were due largely to changes in:

 employment monetary policy productivity

 inflation the budget deficit

7. (14 Points)

- a. (4 pts) Show and explain how the equations and variables of the closed-economy model in question 4 need to be modified or augmented to obtain the open-economy model of Mankiw's Chapter 5.

Ans: Two changes are needed. To include trade, the equilibrium condition now needs to include net exports, NX , which depends negatively on the real exchange rate, ϵ (the relative price of domestic goods compared to foreign goods or, if you prefer, $\epsilon=eP/P^$ where e is the nominal exchange rate – foreign-currency price of domestic currency – and P and P^* are the domestic and foreign price levels respectively). In addition, to reflect perfect international capital mobility, the domestic interest rate, r , should be set equal to the foreign interest rate, r^* .*

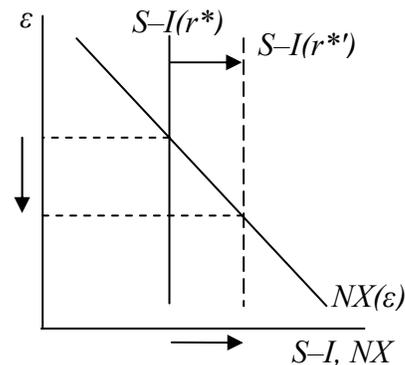
Thus

$$I=I(r^*)$$

$$Y=C+I+G+NX(\epsilon) \text{ where } dNX/d\epsilon < 0$$

- b. (4 pts) Show how a rise in the foreign interest rate, r^* , will affect the equilibrium levels of the real exchange rate and net exports in the open-economy model.

Ans: Equilibrium requires that $S-I(r^)=NX(\epsilon)$, where $S=Y-C-G$ in this case is constant (depending on capital, labor, taxes, and government purchases, all fixed). The rise in r^* reduces I , increasing $S-I$, and requiring an increase therefore in NX . So NX rises. What makes NX rise is, necessarily, a fall in ϵ , so the real exchange rate depreciates.*



- c. (6 pts) Combine Mankiw's open-economy model from part (a) with his model of the natural rate of unemployment (using the latter to determine the level of employment from a given population) to answer the following: Suppose that improved communication between potential employers and employees increases the rate at which the unemployed find jobs, without changing the rate at which employed workers leave jobs. How will this affect the equilibrium level of net exports? (For this problem, you should ignore any effect that a changing employment of labor might have on the incentive to invest in capital.)

Ans: In Mankiw's model of the natural rate of unemployment, $u_n = s/(s+f)$, where s and f are the rates of job separation and job finding respectively. Here we have an increase in f , which will therefore reduce u_n .

From a given population and labor force, this implies that a smaller fraction are unemployed, and therefore a larger fraction are employed. That is, L goes up.

Introducing this increase in L into the open-economy model, since $Y = F(K, L)$ and K is unchanged, this rise in L increases income, Y . That in turn increases both consumption, C , and saving, $S = Y - C - G$, since the marginal propensity to consume is positive but less than one. Returning to the equilibrium condition, $S - I(r^) = NX$, since now r^* and therefore I are unchanged, this rise in S requires a rise in NX .*

8. (3 Points) In the last quarter of the 20th century, as discussed in the assigned Policy Brief by Becky Blank, (circle one correct option in each case below):

- a. Rates of unemployment in Europe: rose fell stayed the same
b. Wage inequality in the U.S.: rose fell stayed the same
c. Which of the following explanations is offered for this difference in labor-market performance between Europe and the U.S.? (Check one.)

_____ Europe's proximity to the formerly communist countries of the Soviet Bloc exposed it to increased low-wage competition from which the U.S. was insulated by distance.

_____ Wage bargaining in the English language is more effective, from the standpoint of management, than bargaining in the diverse languages available in Europe.

_____ Like the sun, jobs arrive later in the U.S. than in Europe.

_____ In the face of global shocks that were common to both Europe and the U.S., legislation and union rules in Europe prevented wages from adjusting as they did in the more flexible labor markets of the U.S.

_____ U.S. workers work longer hours and more days per year than European workers, reflecting their more materialistic orientation.

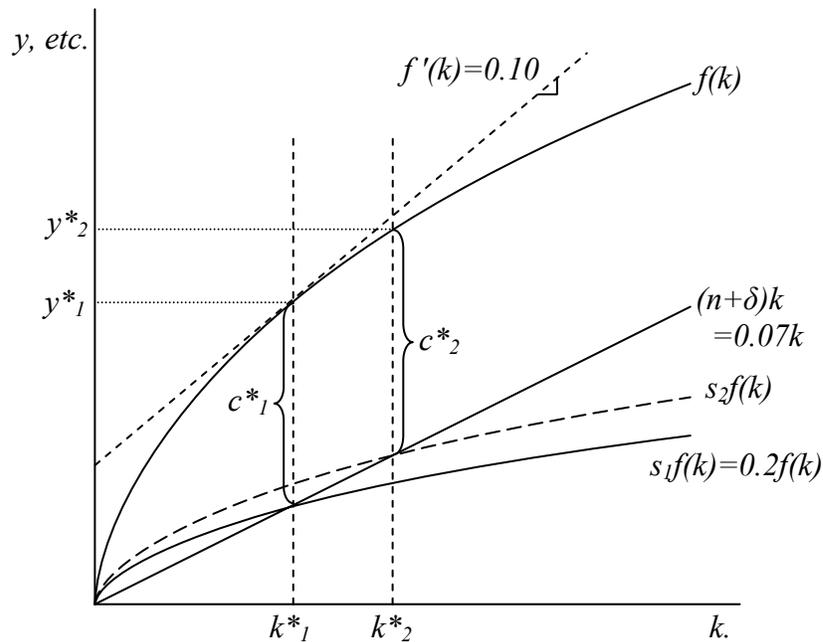
9. (10 points) Consider an economy in the Solow growth model without technical progress which is initially in a steady state with the following properties (not all of which may be relevant):

Population growth rate =	2% per year
Capital depreciation rate =	5% per year
Marginal product of capital =	10% per year
Savings rate =	20%
Income per worker =	20,000 per year

Show graphically the effect (direction only, not size) of a small increase in the rate of savings on

- i. Capital per worker, k
- ii. Income per worker, y
- iii. Consumption per worker, c
- iv. The wage of labor, w

both initially and in the new steady state, as compared to the previous steady state.



The increased savings rate shifts the $sf(k)$ function upward, as shown, moving the steady state to the right. The capital-labor ratio, k , initially does not change at all, but it then grows over time to approach k^*_2 . Output per capita, y , also does not change initially, but it too grows over time to y^*_2 .

Consumption per capita, c , falls initially, since more is saved out of the unchanged per capita output. Over time it then grows, and because the marginal product of capital, f' , is given as 10% and is larger than the 7% sum of the rates of population growth and depreciation $(n+\delta)$, we know that the f function is steeper than the $(n+\delta)k$ line, and thus the new steady state c , c^*_2 , is larger than c^*_1 . [Go to p. 12]

This extra page is to use in case you run out of room on one of the questions. Label clearly which question(s) you are writing about here.

Question 9 (continued):

As for the real wage, it is the marginal product of labor and simply depends on the capital labor ratio, k . Since k is unchanged initially and then rises over time, the wage does the same. (If you are interested, the wage can be found in the figure as the vertical intercept of the straight line tangent to f .)