ECON 102 - Winter 2016
Instructor: François Geerolf

Last Name: _____

First Name: _____

Student ID (UID): _____

Midterm 2
February 17, 2016

Signature: _____

TA Name: _____

Test A

This exam contains 14 pages (including this cover page). The time limit is 75 minutes. You can earn 100 points.

Instructions:

1. Print your Last name, First Name, Student ID Number, Signature, and TA Name (Flavien Moreau, Giovanni Nicolo, Santiago Justel, or Shuo Liu) at the top right-hand corner of this page.

2. The only items that should be on your desk are pencils and/or pens, **a Scantron 882-E**, and the calculator **Canon LS-100TS**, described in the syllabus. NO other items are allowed. Place any other item ON THE STAGE.

3. Once the exam begins, you are not allowed to leave the room until you hand in your exam.

Good luck. Budget your time wisely. (skip the question or even the exercice if you get stuck)

Grade Table (FOR TEACHER USE ONLY)

Question	Points	Score
A	50	
B	50	
Total:	100	

Multiple Choice (50 points)

A. (50 points) There are 25 **multiple choice** questions. **Multiple responses may be correct, and at least one response is correct**. **Use your scantron (Results not reported on the scantron will not be taken into account).** You get either 0 or 2 points: if multiple answers are correct you get points only if you have them all ticked.

Miscellaneous

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(1) (2 points) If P_t is the price level at time t, then inflation at time $t+1$ is given by:

A. $1/P_{t+1}$
B. $P_{t+1}/P_t - 1$
C. $P_{t+1} - P_t$
D. P_t/P_{t+1}
E. $(P_{t+1} - P_t)/P_t$

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(2) (2 points) Consider the consumption function $C_t/\bar{Y}_t = \bar{a}_c + \bar{x}\tilde{Y}_t$. If $\bar{x} = 0.9$, a 1 percent positive demand shock:

A. raises short-run output by 0.9 percent
B. raises short-run output by 9 percent
C. raises short-run output by 1 percent
D. raises short-run output by 10 percent
E. has no impact on short-run output

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(3) (2 points) With adaptive expectations, the Phillips curve can be written as:

A. $\Delta\pi_t = \bar{\nu}\tilde{Y}_t + \bar{o}$
B. $\Delta\pi_t = \pi_{t-1} + n\bar{u}\tilde{Y}_t$
C. $\pi_t = \pi_{t-1} + \bar{\nu}\tilde{Y}_t + \bar{o}$
D. $\Delta\pi_t = \bar{\nu}u_t$
E. $\pi_t = \pi_{t-1}$

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(4) (2 points) Which of the following best describes why the aggregate demand curve slopes downward ?

A. If the central bank observes a low rate of inflation, the monetary policy rule dictates an increase in the real interest rate. The high interest rate reduces output by reducing investment demand in the economy.
B. If the central bank observes a high rate of inflation, the monetary policy rule dictates a decrease in the real interest rate. The low interest rate increases output by reducing investment demand in the economy.

C. If the central bank observes a low rate of inflation, the monetary policy rule dictates a decrease in the real interest rate. The low interest rate reduces output by reducing investment demand in the economy.

D. If the central bank observes a high rate of inflation, the monetary policy rule dictates an increase in the real interest rate. The high interest rate reduces output by reducing investment demand in the economy.

E. None of these answers is correct.

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(5) (2 points) According to the Fisher equation, if the nominal interest rate is 2% and there is 2% expected deflation, then the expected real interest rate is:

A. 0%

B. 1%

C. 2%

D. 4%

E. None of the above.

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(6) (2 points) Assume that investment responds to interest rates in such a way that $\bar{b} = 0.5$. If $\bar{a}$ rises by 2% and the real interest rate falls by 2%, short-run output:

A. falls by 2 percent

B. rises by 1 percent

C. rises by 3 percent

D. falls by 1 percent

E. does not change

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(7) (2 points) If $\bar{m} = 5$, how much does inflation need to be above target to justify raising interest rates above the marginal product of capital by 0.5%?

A. 0.1%

B. 0.2%

C. 0.25%

D. 2.5%

E. 5%

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(8) (2 points) The (AD) curve can be seen as:

A. A combination of the (IS) curve and the Phillips curve.

B. A combination of the (IS) curve and the (LM) curve.

C. A combination of the demand curve for labor and the demand curve for investment.

D. A combination of the (AS) curve and the monetary policy rule.

E. A combination of the (IS) curve and the monetary policy rule.

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(9) (2 points) What was per capita GDP growth in the United States over 1870-2012?

A. 1%
B. 2%
C. 3%
D. 4%
E. 5%

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(10) (2 points) What was GDP growth in the United States over 1870-2012?

A. 2%
B. 3%
C. 3.5%
D. 4.5%
E. 5.5%

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(11) (2 points) What happens if there is a boom in China, which leads China to import more goods from the US?

A. This does not change anything for the US.
B. The US faces an positive aggregate demand shock.
C. The US faces a negative aggregate demand shock.
D. The (IS) curve shifts right.
E. The (AD) curve shifts right.

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(12) (2 points) What happens in the (AS)/(AD) framework if investment starts to respond more to interest rate changes?

A. $\bar{m}$ increases.
B. $\bar{b}$ increases.
C. The (AS) curve steepens.
D. The (AD) curve flattens.
E. The (AD) curve steepens.

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(13) (2 points) Assume that firms start increasing their prices more when they are faced with a higher demand from consumers. What happens?

A. The (AD) curve shifts right.
B. The (AD) curve steepens.
C. The (AD) curve flattens.
D. The (AS) curve flattens.

E. The (AS) curve steepens.

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(14) (2 points) Assume that the central bank decides to raise its inflation target from 2% to 4%. What happens to the (AD) curve?

A. The (AD) curve does not move.

B. The (AD) curve steepens.

C. The (AD) curve flattens.

D. The (AD) curve shifts right.

E. The (AD) curve shifts left.

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(15) (2 points) Assume that the central bank decides to raise its inflation target from 2% to 4%, and that people have adaptive expectations. What happens to inflation and why?

A. Inflation rises because the central bank said so.

B. Inflation rises because the central bank is now responding less to deviations of inflation from the target inflation.

C. Inflation rises because the central bank now sets a lower interest rate for a given level of inflation.

D. Inflation decreases because aggregate demand is too low at this level of inflation.

E. Inflation decreases because of sticky expectations.

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(16) (2 points) Assume that your first salary coming out of UCLA is \$63,000, that your boss gives you a promotion every year of 2%. Assuming that the interest rate is 6%, how much would your human capital be worth if you were able to live forever?

A. \$1,169,500.

B. \$1,669,500.

C. \$2,169,500.

D. \$2,669,500.

E. \$3,169,500.

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(17) (2 points) Assume that your first salary coming out of UCLA is \$63,000, that your boss gives you a promotion every year of 2%. Assuming that the interest rate is 3%, how much would your human capital be worth if you were able to live forever?

A. \$2,489,000.

B. \$3,489,000.

C. \$4,489,000.

D. \$5,489,000.

E. \$6,489,000.

Effects of Leverage

Consider the following balance sheets for three hypothetical financial institutions, bank A, bank B and bank C. You will need to fill in the missing entries in the balance sheets (denoted ___) to answer the following multiple choice questions.

Bank A's Balance Sheet			
Assets		Liabilities	
Cash	600	Deposits	1400
Loan to bank B	400		
Mortgage-Backed Securities	500		
Total assets	___	Total Liabilities	___
		Equity (net worth)	___
Bank B's Balance Sheet			
Assets		Liabilities	
Cash	1000	Deposits	900
Loan to bank C	500	Loan from Bank A	500
Total assets	___	Total Liabilities	___
		Equity (net worth)	___
Bank C's Balance Sheet			
Mortgage-Backed Securities	800	Deposits	200
		Loan from Bank B	500
Total assets	___	Total liabilities	___
		Equity (net worth)	___

(18) (2 points) What is the leverage ratio in Bank A?

A. 1/7
B. 1/14
C. 7/1
D. 14/1
E. 8/1.

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(19) (2 points) What is the leverage ratio in Bank C?

A. 1/7
B. 1/14
C. 7/1
D. 14/1
E. 1/8.

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(20) (2 points) Suppose housing prices fall sharply and the mortgage-backed securities as a consequence fall in value by 50%. Assume that banks first make good on their deposits, before actually repaying other banks. Calculate bank A's new net worth.

A. -250.

B. -300.

C. -350.

D. -400.

E. -450.

Bathtub Model

In subsequent multiple choice questions, we consider the following "bathtub" model of unemployment. There is a number $\bar{L}$ of people in the labor force. Jobs separate at a rate $\bar{s}$, and the rate at which unemployed people find new jobs is $\bar{f}$. Finally, the number of people unemployed is denoted by U_t and the number of people employed as E_t. The unemployment rate is denoted by u_t.

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(21) (2 points) Which equality (equalities) is (are) verified in this model?

A. $U_{t+1} = \bar{f}U_t - \bar{s}E_t$.
B. $\Delta U_{t+1} = \bar{f}U_t - \bar{s}E_t$.
C. $\Delta U_{t+1} = \bar{s}E_t - \bar{f}U_t$**.**
D. $U_{t+1} - U_t = \bar{f}U_t - \bar{s}E_t$.
E. $U_{t+1} - U_t = \bar{f}U_t - \bar{s}E_t$.

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(22) (2 points) What is the value of the long-run unemployment rate in this model?

A. $u^* = \dfrac{\bar{s}}{\bar{s}+\bar{f}}$**.**
B. $u^* = \dfrac{\bar{s}\bar{L}}{\bar{s}+\bar{f}}$.
C. $u^* = \dfrac{\bar{f}}{\bar{s}+\bar{f}}$.
D. $u^* = \dfrac{\bar{f}\bar{L}}{\bar{s}+\bar{f}}$.
E. None of the above.

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(23) (2 points) Assume that the separation rate is 3%, that the finding rate is 50%, and that unemployment rate is at time 0 equal to $u_0 = 12\%$. What is the long-run unemployment rate?

A. 3%.
B. 3.33%.
C. 5%.
D. 5.66%
E. 7%.

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(24) (2 points) Assume that the separation rate is 3%, that the finding rate is 50%, and that unemployment rate is at time 0 equal to $u_0 = 12\%$. What is the unemployment rate at time 1?

A. 6%.
B. 6.03%.

C. 8.64%.

D. 9%.

E. 11%.

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(25) (2 points) Assume that the separation rate is 3%, that the finding rate is 50%, and that unemployment rate is at time 0 equal to $u_0 = 12\%$. What is the unemployment rate at time 2?

A. 5.06%.

B. 6%.

C. 6.06%.

D. 7.06%.

E. 8%.

An Oil Price Shock in the AS/AD Model (50 points)

B. (50 points) Take the usual AS/AD model, ruling out Aggregate Demand shocks, so with $\bar{a} = 0$, but assuming a one-time, unexpected oil price shock $\bar{o}_0 > 0$. One time means that the oil price shock lasts only for one period, in period $t = 0$, and that $\bar{o}_t = 0$ for all subsequent $t \in \{1, 2, ...\}$. Unexpected means that the economy was originally in steady-state, and in particular that $\pi_0 = \bar{\pi}$. Unless otherwise noted, agents have adaptive expectations about inflation. The economy is described by an AS/AD model. In particular, the AS curve is given by (be careful about the convention on the timing of the oil shock $\bar{o}_{t-1}$!):

$$\pi_t = \pi_t^e + \bar{\nu}\tilde{Y}_t + \bar{o}_{t-1}.$$

The AD curve is the standard one used throughout the course.

(1) (5 points) What are the values of π_1 and $\tilde{Y}_1$ in terms of the parameters of the model? (in particular the size of the oil price shock, $\bar{o}_0$)

Solution: The AS/AD equations are:

$$\pi_1 = \bar{\pi} + \bar{\nu}\tilde{Y}_1 + \bar{o}_0$$
$$\tilde{Y}_1 = -\bar{b}\bar{m}\left(\pi_1 - \bar{\pi}\right).$$

Using the second equation to plug in the first, one gets:

$$\tilde{Y}_1 = -\bar{b}\bar{m}\left[\bar{\nu}\tilde{Y}_1 + \bar{o}_0\right] \quad \Rightarrow \quad \tilde{Y}_1 = -\frac{\bar{b}\bar{m}}{1 + \bar{b}\bar{m}\bar{\nu}}\bar{o}_0.$$

Using this to replace in one or the other equation, one gets:

$$\pi_1 = \bar{\pi} + \frac{1}{1 + \bar{b}\bar{m}\bar{\nu}}\bar{o}_0.$$

(2) (5 points) Show in mathematical terms the effect of a more agressive monetary policy on inflation and short-run output in period 1: do inflation and short-run output increase or decrease with a more agressive monetary policy?

Solution:

$$\frac{\partial \pi_1}{\partial \bar{m}} = -\frac{\bar{b}\bar{\nu}}{(1 + \bar{b}\bar{m}\bar{\nu})^2}\bar{o}_0.$$
$$\frac{\partial \tilde{Y}_1}{\partial \bar{m}} = -\frac{\bar{b}}{(1 + \bar{b}\bar{m}\bar{\nu})^2}\bar{o}_0.$$

Both decrease. Note that you could see directly from the formula for π_1 that it

is decreasing in $\bar{m}$. For $\tilde{Y}_1$, there is a bit more work as:

$$\tilde{Y}_1 = -\frac{\bar{b}\bar{m}}{1+\bar{b}\bar{m}\bar{\nu}}\bar{o}_0 = -\frac{\bar{b}\bar{m}\bar{\nu}}{1+\bar{b}\bar{m}\bar{\nu}}\frac{\bar{o}_0}{\bar{\nu}} = \left(\frac{1}{1+\bar{b}\bar{m}\bar{\nu}} - 1\right)\frac{\bar{o}_0}{\bar{\nu}}.$$

Since inflation was increasing initially, this means there is a more muted response of inflation. To the contrary, since output was already decreasing, this means that the response of short-run output is actually more important. With a more agressive monetary policy, the bulk of the adjustment goes through unemployment, and a decrease in short-run output. (Note: of course, adaptive expectations neglect the fact that if monetary policy was expected to be agressive, then people may anticipate that inflation will be lower in future periods, which on the contrary mitigates the needed adjustment of short-run output).

(3) (5 points) Illustrate this on two graphs with the AS/AD curves: show one AS/AD diagram with a soft monetary policy, and next to it another AS/AD diagram with an agressive monetary policy. Show π_1 and $\tilde{Y}_1$ as well as the long run values of inflation and short-run output on these graphs.

Solution: See TA section.

(4) (5 points) What are the values of $\tilde{Y}_1$ and π_1 when the central bank does not respond at all to changes in inflation?

Solution: When the central bank does not respond at all to changes in inflation, then the parameter in the monetary policy rule is $\bar{m} = 0$. Then, from the previous formula we get:

$$\tilde{Y}_1 = 0, \qquad \pi_1 = \bar{\pi} + \bar{o}_0.$$

(5) (5 points) What are the values of $\tilde{Y}_1$ and π_1 when the central bank responds with a parameter $\bar{m} = +\infty$ in the monetary policy rule?

Solution: When the central bank responds very agressively with $\bar{m} = +\infty$, we get for short-run output:

$$\tilde{Y}_1 = -\frac{\bar{b}\bar{m}}{1+\bar{b}\bar{m}\bar{\nu}}\bar{o}_0 = -\frac{\bar{b}}{\frac{1}{\bar{m}}+\bar{b}\bar{\nu}}\bar{o}_0 = -\frac{\bar{o}_0}{\bar{\nu}},$$

since $1/\bar{m}$ goes to 0 as $\bar{m}$ goes to infinity (i derived this during the class). For inflation we get:

$$\pi_1 = \bar{\pi}.$$

(6) (5 points) What is the intuition behind the result in the previous question?

Solution: When the central bank reponds very aggressively to any change in inflation, all the effect of the oil price shock is accommodated by lower short run output which, through the (AS) curve, can bring inflation to target if it decreases by a sufficient amount. Note that the recession is all the more severe that $\bar{\nu}$ is small: if firms do not respond a lot to variations in short-run output by lowering their prices, then it needs a large recession to bring inflation back to target.

(7) (5 points) Eliminating $\tilde{Y}_t$ from the AS/AD model, find a difference equation for π_t, for $t \in \{2, 3, ...\}$.

Solution: Because people have adaptive expectations, he have the following equations:

$$\pi_t = \pi_{t-1} + \bar{\nu}\tilde{Y}_t + \bar{o}_{t-1}$$
$$\tilde{Y}_t = -\bar{b}\bar{m}\left(\pi_t - \bar{\pi}\right).$$

Solving this system of two equations and two unknowns (where the unknowns are $(\tilde{Y}_t, \pi_t)$), it is easy to show that inflation follows the following difference equation:

$$\pi_t = \frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\pi_{t-1} + \frac{\bar{b}\bar{m}\bar{\nu}}{1+\bar{b}\bar{m}\bar{\nu}}\bar{\pi} + \frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\bar{o}_{t-1}.$$

Moreover we have that $\bar{o}_{t-1} = 0$ for all $t \in \{2, 3, ...\}$, because the shock is a one time shock. So finally:

$$\forall t \in \{2, 3, ...\}, \quad \pi_t = \frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\pi_{t-1} + \frac{\bar{b}\bar{m}\bar{\nu}}{1+\bar{b}\bar{m}\bar{\nu}}\bar{\pi}$$

(8) (5 points) Substracting $\bar{\pi}$ on both sides in the difference equation for π_t, show that $\pi_t - \bar{\pi}$ satisfies a simpler difference equation than π_t. Solve for this difference equation. This should give you an expression for π_t as a function of π_1. Then replace π_1 with the value found in question (1), to get π_t as a function of time and the parameters of the model.

Solution: We have:

$$\pi_t = \frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\pi_{t-1} + \frac{\bar{b}\bar{m}\bar{\nu}}{1+\bar{b}\bar{m}\bar{\nu}}\bar{\pi} \quad \Rightarrow \quad \pi_t - \bar{\pi} = \frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\left(\pi_{t-1} - \bar{\pi}\right).$$

This difference equation iterates (just as those in the Romer model) through:

$$\pi_t - \bar{\pi} = \left(\frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\right)^{t-1}(\pi_1 - \bar{\pi}).$$

Using the expression for π_1 in the previous question:

$$\pi_1 = \bar{\pi} + \frac{\bar{o}_0}{1+\bar{b}\bar{m}\bar{\nu}},$$

This gives:

$$\pi_t = \bar{\pi} + \left(\frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\right)^{t}\bar{o}_0.$$

(9) (5 points) Use the (AD) curve to then calculate $\tilde{Y}_t$ as a function of time and the parameters of the model.

Solution: We use the AD curve which is:

$$\tilde{Y}_t = -\bar{b}\bar{m}\left(\pi_t - \bar{\pi}\right).$$

with the expression found in the previous question:

$$\pi_t = \bar{\pi} + \left(\frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\right)^t \bar{o}_0 \qquad \Rightarrow \qquad \tilde{Y}_t = -\bar{b}\bar{m}\left(\frac{1}{1+\bar{b}\bar{m}\bar{\nu}}\right)^t \bar{o}_0.$$

(10) (5 points) Numerical Application: Suppose the parameters of the (AS) and (AD) curves take the following values: $\bar{o}_0 = 8\%$, $\bar{a} = 0$, $\bar{b} = 2$, $\bar{m} = 2$, $\bar{\nu} = 1$, and $\bar{\pi} = 4\%$. Solve for the value of short-run output and the inflation rate for the first 2 years after the shock. (**give an approximation**)

Solution: Therefore, numerically:

$$\frac{1}{1+\bar{b}\bar{m}\bar{\nu}} = 0.2.$$

Time	**Inflation π_t**	**Short-Run Output $\tilde{Y}_t$**
0	4 %	0 %
1	5.60%	-6.40%
2	4.32%	-1.28%