

Practice Final Examination 1

Revised: April 23, 2012

You have 120 minutes to complete this exam. Please answer each question in the space provided. You may consult one page of notes and a calculator, but devices capable of wireless transmission are prohibited.

I understand that the honor code applies: I will not lie, cheat, or steal to gain an academic advantage, or tolerate those who do.

(Name and Signature)

Note: These questions come from old exams, so the topics and numbers may be out of date. But be assured: good analysis lasts forever.

1. *US monetary policy (25 points)*. When the US Federal Open Market Committee (FOMC) met in April 2007, inflation was close to 3% and GDP growth was about 2%. After the meeting, their statement said, in part:

Recent indicators have been mixed. ... Nevertheless, the economy seems likely to continue to expand at a moderate pace over coming quarters. Recent readings on core inflation have been somewhat elevated. Although inflation pressures seem likely to moderate over time, the high level of resource utilization has the potential to sustain those pressures. In these circumstances, the Committee's predominant policy concern remains the risk that inflation will fail to moderate as expected. Future policy adjustments will depend on the evolution of the outlook for both inflation and economic growth, as implied by incoming information.

Comment: this is a time when it's helpful to see the AS/AD model lurking behind the words. The following questions should help you work your way through this process.

- (a) How would you interpret the Fed's statement in terms of its goals of low inflation and full employment? Do you agree that the evidence, as presented, suggests that inflation is the "predominant policy concern"? (10 points)

- (b) Use the aggregate supply and demand framework to illustrate how the FOMC might think about monetary policy. Consider each of the following questions in turn: (i) How would an increase in the money supply affect output and prices in the short run? (ii) In the long run? (10 points)
- (c) Given the Fed's assessment of current economic conditions, how would you expect it to respond? Would you expect interest rates to rise or fall? (10 points)

Solution:

- (a) The statement suggests that inflation is above target ("core inflation elevated") and output is at the target ("high level of resource utilization") or possibly beyond it. With output at or above target, inflation is the appropriate focus. GDP growth points the other way, so there's a question about this assessment.
- (b) Draw a diagram with AS, AD, and AS^* . Assume for the time being that we start at a long-run equilibrium (where AS crosses AD and AS^* at the same time). (i) Short-run impact of an increase in the money supply. AD shifts right/up, and we move to where AS and AD cross (and ignore AS^*). This raises output and prices (inflation). (ii) In the long-run, AS also shifts, sending us to the point where AD and AS^* cross. Why? Because the sticky wages that give AS its slope eventually adjust. The result: prices rise, but output stays the same, relative to our starting point. This illustrates the difference between the short-run and long-run effects of monetary policy: In the long run, all we get is inflation. In the short run, we get a combination of higher prices and higher output. Which sends us back to (a): one of the questions the Fed must address is how large the short-run increase in output is. That, in turn, depends on how steep the AS curve is: the steeper the curve, the smaller the increase in output. [For practice, contrast this analysis with one where we start to the left of AS^* .]
- (c) The comment about utilization tells you that the FOMC sees output as at or beyond the long-run supply curve AS^* . To reduce inflation, the Fed would reduce the money supply, shifting aggregate demand left. In practice, they would do this by raising the interest rate. The short-run impact is to lower inflation and output. If output is above target, that's ok on both fronts. If it's at target, the Fed will have to decide whether output or inflation is more important. In this case, we have the Fed's own statement that inflation is the "predominant policy concern," so this is the policy they have in mind. We would therefore expect the Fed to raise the Fed funds rate.

	2002	2003	2004	2005	2006	2007	2008	2009
Real GDP growth	4.3	3.0	3.8	2.8	2.8	4.0	2.1	-1.6
Inflation	3.0	2.8	2.3	2.7	3.5	2.3	4.4	1.2
Interest rate: short	4.6	4.8	5.3	5.5	5.8	6.4	6.7	2.8
Interest rate: long	5.8	5.4	5.6	5.3	5.6	6.0	5.8	3.3
Investment rate	24.1	25.2	25.5	26.5	26.8	27.8	28.7	
Saving rate	20.1	20.4	20.0	21.3	21.2	21.9	24.3	
Current account	-3.8	-5.5	-6.1	-5.8	-5.5	-6.4	-4.2	-3.5
Govt budget: total	1.3	1.8	1.1	1.5	1.5	1.6	1.8	-3.3
Govt budget: primary	2.9	3.2	2.4	2.7	2.6	2.6	2.7	-2.6
Govt debt	20.1	18.5	17.5	17.0	16.4	15.4	13.9	
Exchange rate	1.84	1.54	1.36	1.31	1.33	1.20	1.19	
Real exchange rate	100	113	121	125	125	133	132	
FX reserves (USD)	21	32	36	42	53	25	31	
FX reserves (months)	2.9	3.7	3.3	3.4	4.0	1.6	1.7	

Economic indicators for Australia. Notes: (i) Investment, saving, current account, government budget, government debt, and net foreign assets are expressed as percentages of GDP (ratios multiplied by 100). (ii) The exchange rate is the Aussie dollar (AUD) price of one US dollar; high numbers indicate that foreign currency is expensive. The real exchange rate is a weighted average across trading partners. The convention is the inverse of the exchange rate: high numbers indicate that local goods are expensive relative to foreign goods. (iii) Foreign exchange reserves are expressed, first, in billions of USD, second, as a ratio to monthly imports. Thus the number 2.9 means that reserves are 2.9 times one month's imports. (iv) 2009 numbers are estimates.

2. *Deficits down under (40 points)*. As a European investor in short-term Australian securities, you have made a fair amount of money over the last decade betting that Australia's high interest rates would not be offset by declines in the value of its currency. You wonder, however, whether it's time to take your money and run.

Having some experience with such situations, you check the Economist Intelligence Unit's Country Data, summarized above, and Country Risk Service, which reports:

- The exchange rate is flexible, and could move either way against the euro.
- Australia's large net foreign liability position reflects a combination of direct investment in Australian businesses, notably mining, and the carry trade, in which investors purchase AUD-denominated assets in order to benefit from relatively high local interest rates.
- The banking system is stable.
- Australian political institutions are widely regarded to be of high quality and stable.

With this information in hand, you go through your checklist:

- (a) Fiscal policy 1. Why are the total and primary government balances different? (10 points)
- (b) Fiscal policy 2. What would you estimate for the debt-to-GDP ratio at the end of 2009? (20 points)
- (c) Considering fiscal policy and other risk factors, how do you see the risks to the Australian economy over the next two years or so? (10 points)

Solution:

- (a) The difference is interest on government debt. The government budget looks like (you'll have to look up the notation)

$$D_t = B_t - (1 + i)B_{t-1}.$$

The expression on the left is the primary deficit. On the right, interest in the debt is part of the second term: iB_{t-1} . The numbers tell us this is expected to be 0.7% of GDP (the difference between the primary and total deficits). Since debt at the end of the last year was 13.9% of GDP, the interest rate was about 3.0%.

- (b) The debt-to-GDP ratio evolves like this:

$$\Delta(B_t/Y_t) = (i - \pi)(B_{t-1}/Y_{t-1}) - g(B_{t-1}/Y_{t-1}) + D_t/Y_t.$$

The numbers we're given suggest $r = i - \pi = 1.8\%$. That gives us

$$\Delta(B_t/Y_t) = 0.3 + 0.2 + 2.6 = 3.1,$$

so the debt-to-GDP ratio rises to 17.0%.

- (c) You have some flexibility here, but I would expect you to go through the checklist: fiscal policy (done), exchange rate (overvalued but flexible, with limited reserves), banking system (EIU says ok), and politics/institutions.

Two points seem essential: the debt to GDP ratio is very low, and Australia is a developed country with good institutions. This suggests no particular cause for concern.

[In hindsight, some of the same might have been said about the US, with somewhat higher debt and deficits, but disaster struck anyway. It's a good reminder: these things are hard to predict. Nevertheless, it's helpful to survey the territory, see if there are any obvious landmines lying around.]

3. *Miscellany (50 points).*

- (a) *Chinese crisis?* An analyst suggested that China may suffer a currency crisis along the lines of Mexico in 1994-95, in which the peso fell sharply when the Banco de Mexico ran out of foreign currency reserves. Do you find this scenario likely or unlikely? Why? (10 points)
- (b) *Government deficits.* Can a country run a fiscal (government) deficit forever? Why or why not? (10 points)
- (c) *Canadian inflation.* In Canada over the last year, inflation has been 2.3% and money growth has been 11.8%. Do you find the difference between the two numbers surprising? Why or why not? (10 points)
- (d) *Leading indicators.* Explain what a leading indicator is and give an example for the US. (10 points)
- (e) *Monetary policy mechanics.* Use the central bank's balance sheet to describe how it maintains the short-term interest rate at a specific level. (10 points)

Solution:

- (a) (i) China has enormous foreign exchange reserves: they won't run out any time soon. (ii) The renminbi seems to be undervalued: people want to buy it, not sell it, which results in the central bank accumulating reserves, not losing them.
- (b) The present value of future primary surpluses has to equal the current debt. Thus past deficits must be balanced by future surpluses — you can't run a primary deficit forever. The key word is primary: you can run a primary surplus and an overall deficit at the same time, as we see in (for example) Turkey.
- (c) Under the quantity theory, inflation equals money growth minus real GDP growth. Unless real GDP growth is 9%, something's wrong. What's wrong is that this relation is well known not to work in the short run. Over periods of several years, however, it typically works pretty well.
- (d) A leading indicator (of the economy) is an observable economic variable whose ups and downs precede those in (say) real GDP. You can see this in the cross-correlation function, for example. Common examples: housing starts, stock market indexes, interest rate spread (long minus short).
- (e) Central banks manage short-term interest rates through "open market operations": buying and selling government securities. Selling securities, for example, reduces the amount of currency in private circulation, which generally increases short-term interest rates. [Insert T-accounts here.]

The story we tell is that this reduces the liquidity of capital markets by reducing the quantity of currency in circulation.

Practice Final Examination 2

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Most of these questions come from old exams and may include old data as a result.

1. *Chinese foreign exchange intervention (30 points).* Joseph Yam, Chief Executive of the Hong Kong Monetary Authority, wrote about the foreign exchange activities of the People's Bank of China (PBOC) in January 2007:

The accumulation of foreign exchange reserves involves the PBOC buying foreign assets through creating renminbi. As a result, the monetary base is increased, creating a need to “sterilise.” This is done by issuing paper [short-term notes] to the banks. The PBOC obviously has to pay interest on the money borrowed. Currently the yield of, for example, three-month paper issued by the PBOC is about 2.5%. This is lower than the yield on foreign assets held as reserves — the yield on US treasuries is about 4 to 5% — so theoretically reserve accumulation can be profitable. The problem, however, is the continuing appreciation of the renminbi, which gradually reduces the value of those foreign assets in renminbi terms.

- (a) Use the central bank's balance sheet to show how purchases of foreign currency increase the monetary base (think: supply of currency). (10 points)
- (b) Show how sterilization can be used to reverse the impact on the supply of currency. (10 points)
- (c) You may note that interest rates have now flipped, with Chinese interest rates above US interest rates. What does this imply for the returns on the PBOC's balance sheet? How might it avoid this outcome? (10 points)

Solution:

- (a) A typical central bank balance sheet looks something like this:

Assets		Liabilities	
FX Reserves	100	Monetary Base	200
Bonds	100		

Monetary base is (roughly) another term for currency. Suppose, now, that the PBOC has to purchase another 100 worth of foreign currency (or foreign-currency denominated bonds) and issues currency in return. Then the balance sheet becomes

Assets		Liabilities	
FX Reserves	200	Monetary Base	300
Bonds	100		

This is the impact of the accumulation of reserves on the monetary base described by Yam.

- (b) To undo the increase in the monetary base, the PBOC will issue 100 worth of bonds and accept money in return:

Assets		Liabilities	
FX Reserves	200	Monetary Base	200
Bonds	0		

This operation is referred to as sterilization. For the PBOC, this process has continued to the extent that they have had to issue bonds as liabilities, so that their balance sheet now looks something like this:

Assets		Liabilities	
FX Reserves	800	Monetary Base	200
Bonds	0	Bonds	600

The bond liabilities (so-called “sterilization bonds”) are issued primarily to Chinese commercial banks, as outlined above. Note, as Yam does, that assets and liabilities are equal.

- (c) The PBOC is now likely losing money on its portfolio for two reasons: (i) because the rate it’s paying on liabilities is greater than the rate received on assets and (ii) continued increases in the value of the renminbi raise the value of its liabilities relative to its assets. In a sense, they have the wrong side of the carry trade.

How could it avoid this outcome? Let the currency float and stop buying foreign currency. This is entirely the byproduct of managing the exchange rate: that leads them to buy foreign currency, with the results we’ve just seen.

2. *Globalization and inflation (20 points)*. Fed Chairman Bernanke said recently (March 2007):

As national markets become increasingly integrated and open, sellers of goods, services, and labor may face more competition and have less market power than in the past. These linkages suggest that, at least in the short run, globalization and trade may affect the course of domestic inflation.

- (a) Use aggregate supply and demand to describe how expansionary monetary policy affects output and inflation in the short run. (10 points)
- (b) Back to Bernanke: What do you see as the impact of globalization (think: imports from China) on domestic inflation? How would you represent this in the aggregate supply and demand diagram? How does globalization change the impact of expansionary monetary policy in this model? Do you find the model persuasive in this respect? (10 points)

Solution:

- (a) This would increase both output and prices (inflation, loosely speaking). Your answer should show a diagram with AS, AD, and AS*. AD shifts out, with the stated result.
- (b) The typical argument is that AS has become flatter, since attempts to raise prices will meet with strong foreign competition. As a result, expansionary monetary policy has a smaller impact on inflation and larger impact on output.

3. *Miscellany (50 points)*.

- (a) *Exchange rates*. *The Economist* reports that a Big Mac costs \$2.90 in the US, \$3.28 in the eurozone, and \$2.33 in Japan. (These prices are averages for the various regional markets, expressed in US dollars using current spot exchange rates.) What does this suggest about the likely change in value of the euro and yen v. the dollar over the coming 6 months? 6 years? (10 points)
- (b) *Inflation*. Milton Friedman once said: inflation is always and everywhere a monetary phenomenon. Do you agree or disagree? Why or why not? (10 points)
- (c) *Employment report*. At 8:30 am on April 6, 2006, the US Bureau of Labor Statistics released its closely-watched employment report, *The Employment Situation*. Firms reported an increase of 180,000 jobs in March, well above the consensus of 135,000. Treasury yields immediately rose 5-10 basis points for maturities from 2 to 30 years. Why? (10 points)

- (d) *ECB policy*. The European Central Bank has kept short-term interest rates in the Euro Zone well above those in the US. Why? (10 points)
- (e) *Cross-correlation function*. Describe the cross-correlation function and show how it can be used to identify promising leading indicators. (10 points)

Solution:

- (a) PPP suggests that exchange rates will adjust to make prices the same across countries. In this case, that means the dollar will rise against the euro, fall against the yen. Is this right? Over short periods of time, exchange rates are close to unpredictable by any means, PPP included. Over longer periods of time (5-20 years) PPP is a reasonable indicator.
- (b) It has lots of truth in it, but I'd disagree for two reasons. First, it's an incomplete statement for high inflations: it's true, but high money growth itself typically stems from a government deficit. Second, over short periods of time, the quantity theory doesn't work that well. It's entirely possible, as our AS/AD analysis implies, that money can have only a modest short-run impact on inflation, and that other demand and supply factors play a role, too.
- (c) I'd start with the Taylor rule: indicators of high output lead to high interest rates. The deeper question is why this shows up in long yields. Certainly it will take some time to affect the Fed's choice of target interest rate, but the impact on the very long end is a typical, if somewhat mysterious, result.
- (d) One reason is that the ECB, by design, places greater weight on inflation: its primary goal is price stability. Another is that they have not had the kind of financial turmoil that has afflicted US markets and driven the Fed to largely abandon its own devotion to stable prices.
- (e) The cross-correlation function is a plot of the correlation of the correlation of two variables at different leads and lags against the lead or lag. Formally, the ccf for two variables x and y is a plot of

$$\text{ccf}(k) = \text{corr}(x_t, y_{t-k}).$$

against k .