FACULTY OF ECONOMICS STUDY AIDS 2019

ECT1 Paper 2 Macroeconomics

The Faculty Board has agreed to release outline solutions to the 2019 examinations as a study aid for exam revision. They are abridged solutions, and not 'definitive', and should therefore not be considered as an exemplar for 'complete' answers.

Note that the Faculty will not respond to any queries regarding these solutions.

SECTION A

1. How does the job separation rate s and the job finding rate f affect the natural rate of unemployment? Explain what happens to s and f, and consequently to the natural rate of unemployment in the following cases:
   NRU: $s/(s+f)$. Higher s and lower f both increase the NRU
   (a) Minimum wages in UK increase from £7.83 to £7.93 per hour.
   Increases in minimum wage imply labour market rigidities which lower the job finding rate. In principle, NRU should increase, but the increase is so small that it will probably have no effect, even for unskilled workers.
   (b) The industrial sector shifts from using manual labour to using robots and IT.
   This increases the separation rate, and therefore increases NRU.

2. Consider the Solow model of growth and set $A = 1$ without loss of generality. The production function is $Y = F(K, L) = K^{1/3}L^{2/3}$. Suppose that the savings rate s equals 40%, depreciation δ is 10%, and the population growth rate n is 1%. Is this economy dynamically efficient or inefficient? Explain.
   The economy is in golden rule if $MPK = \delta + n$, equivalently if $s = \alpha$. If $s > \alpha$ as here is the case since $s = 0.4$ and $\alpha = 0.33$, the economy is oversaving and thus is dynamically inefficient.

3. Consider two countries in the long-run, Humland and Funland, both of which have real GDP that has been growing on average at the same yearly rate. However, the annual rate at which money grows in Funland is twice as much as the rate of money growth in Humland.
   (a) Which of the two countries has higher inflation in the long run?
   We expect Funland to have higher long run inflation rates. From QTM we have that $\pi^F = g_m^F - g_y^F = 2g_m^H - g_y^H = g_m^H + g_m^H - g_y^H = g_m^H + \pi^H$
   (b) Assuming that the law of one price holds, does the Hum dollar appreciate of depreciate against the Fun dollar? And by how much?
   If LOP holds, $\varepsilon = 1$ and then $\%\Delta e = \pi_F - \pi_H = g_m^H > 0$. The Hum dollar appreciates at an annual rate that is the same as the growth rate of money in Humland.

4. Using aggregate supply-aggregate demand analysis, explain the short-run and long-run implications of a decision by the central bank to reduce its inflation target.
   Via IS-MP, this gives a fall in Y for any given π. AD thus shifts left, and SRAS down in the long run as expectations adjust. Some candidates may also add ZLB analysis (lower target reduces inflation expectations, potentially worsening a trap...), and should get credit for this.

5. Explain why it is easier to use capital controls to sustain an undervalued rather than an overvalued exchange rate.
'Undervalued' corresponds to NX surplus. This can be recycled by official-sector capital flows. NX deficit must be funded by borrowing from abroad. Official-sector inflows are not so easily engineered as outflows.

6. Using the IS-MP model, analyse the effects of:
   (a) Increased business uncertainty
   Reduction in I, and potentially a steeper slope $\rightarrow$ same for IS
   (b) A reduction in inflation expectations
   Only impact if/when ZLB matters, in which case this should shift up the floor on the MP curve in (r, Y) space.

SECTION B

7. You are given the following data from Eurostat: First, the GDPs at current prices in millions of euros for Ireland, Greece and Finland in 1995 were 52,944.6, 104,662.1, and 102,650.9 respectively. You also know that this measure of GDP for the three countries has been growing at an average rate of about 8.5% (Ireland), 2.7% (Greece) and 3.7% (Finland) per year during the period 1985-2017. Finally, during the same period, prices have been growing at an average rate of 2.4% (Ireland), 1.8% (Greece) and 1.4 (Finland) per year.

   (a) What are (approximately) the GDPs at current prices in millions of euros for Ireland, Greece and Finland in 2017?
   We use the formula $y_t = y_0 (1+g)^t$*, where* g *is the growth of the country, to calculate and approximate GDP (current prices).*
   Ireland: $y_{2017} = 52944.6 \times (1+0.085)^{22} = 318622$ million euros
   Greece: $y_{2017} = 104662.1 \times (1+0.027)^{22} = 188078$ million euros
   Finland: $y_{2017} = 102650.9 \times (1+0.037)^{22} = 228294$ million euros

   (b) What is approximately the average annual growth rate of real GDP of the three countries, for the period 1995-2017?
   Ireland: 8.5% - 2.4% = 6.1%
   Greece: 2.6% - 1.8% = 0.8 %
   Finland: 3.7% - 1.4% = 2.3%

   (c) Using the data given, rank the three economies in 1995 and 2017. Discuss how the three economies compare and suggest explanations for the ranking and their economic performance in these three decades.
   Ranking by nominal GDP (lowest to highest) in 1995: Ireland; Finland; Greece
   Ranking by nominal GDP (lowest to highest) in 2017: Greece; Finland; Ireland
   The ranking by real GDP at the end of the period are the same as above, because inflation rates have not been extremely different. The three countries are not very different in terms of demographics and characteristics such as geographic and population size (Greece has more population than the other two but they are all relative small countries, with low population growth). Growth in nominal GDP comes broadly from growth in (a) prices, (b) population, (c) productivity, and (d) capital stock. Since behaviour of prices and population is similar across the three different countries, growth in Ireland may be due to increased productivity and/or capital stock. Greece at the other end experienced a very bad recession and low productivity for the past 10 years. Good students may highlight that all these are small open economies, and of course capital flows and openness matter here. In fact, Ireland's recent growth success is often attributed to the large number of multinationals that operate from there and the intangible capital associated with it, which of course contributes

to production and thus the GDP measurement.

8. Consider the following variant of the model of money supply. Money supply M consists of currency C held by the public and demand deposits D. Let B be the monetary base, composed of currency and the part of deposits that the banks hold as reserves TR. Let $cr = C/D$ be the fraction of currency the public holds relative to their deposits and $tr = TR/D$ be the fraction of deposits banks hold as reserves.

   (a) Which variable(s) in this model is/are exogenous? Which is/are endogenous?
   By construction, the model assumes that C (decided by public), D (decided by public), TR (decided by banks/regulator) and B (determined by central bank) are exogenous. Then money supply is the endogenous variable.

   (b) Show that money supply is proportional to the monetary base, i.e. that $M = mB$ and derive an expression for the money multiplier m as a function of exogenous variables and parameters of the model. Is the money multiplier larger or smaller than 1?

$$M = \frac{C+D}{C+TR} = \left(\frac{cr+1}{cr+tr}\right) B = mB$$

   The multiplier is larger than one.

Next, let us decompose reserves TR into required reserves RR (reflecting the reserves that banks must hold as instructed by the central bank) and excess reserves ER (reflecting any additional reserves banks hold, over and above required reserves), and define $rr = RR/D$ and $er = ER/D$ to be the required-reserves ratio and excess reserve ratio respectively.

   (c) What is the relationship between tr , rr and er? Do you generally expect er to be large or small relative to rr? Why, and in what situations?
   Now

$$M = \frac{C+D}{C+RR+ER} = \left(\frac{cr+1}{cr+rr+er}\right) B = mB$$

   therefore

$$tr = rr + er.$$

   We generally expect er to be small to almost zero in good times, since banks want to lend out as much as possible and the CB would be giving them low interest rate for any excess reserves. It would be larger if the CB offers high interest rate. Also, it can be large, even when the bank rate is low, because the commercial banks may be worried about the economic conditions (e.g. during the great recession).

   (d) In light of your answer to (c), discuss to what extent it is reasonable to treat the money multiplier m as exogenous. Explain your reasoning.
   It may be thought of as "exogenous" in this model in the sense that commercial banks decide how much excess reserves to hold. However, it is

understood that commercial banks respond to monetary policy (e.g. if CB offers high rate, er would be higher). This is a general equilibrium effect that is not taken into account in the standard textbook model.

9. The money market in a small open economy with fixed nominal prices is described by the following pair of equations:

$$\begin{aligned}\left(\frac{M}{P}\right)^d &= \alpha Y - \beta r^* \\ \left(\frac{M}{P}\right)^s &= \gamma + \delta\left(e - e^*\right)\end{aligned}$$

where $\left(\frac{M}{P}\right)^d$ and $\left(\frac{M}{P}\right)^s$ are the demand and supply of real money balances respectively, Y is real income, r^* is the exogenous world real interest rate, and e is the nominal exchange rate. α, β, γ and δ are positive parameters, and e^* is an exogenous constant. The expected inflation rate is zero.

(a) Discuss intuitively why the money supply schedule might plausibly take this form.
CB responds to appreciation by expanding money supply. This mitigates appreciation to some degree in MF model. Can also note that this nests 'fixed M' and 'fixed e' versions of model as special cases.

(b) Explain diagramatically the equilibrium relationship between income and the nominal exchange rate implied by this money market, given r^*. How does this relationship depend on the parameter δ?
An upward-sloping relationship: higher Y raises money demand. This can only be met with higher supply if e.r. appreciates. δ controls slope, with vertical relationship (fixed Y) when $\delta = 0$ and horizontal (fixed e) when $\delta \to \infty$.

The components of aggregate expenditure in the economy are described by the following equations:

$$\begin{aligned}C &= \bar{C} + cY \\ I &= a - br^* \\ NX &= \overline{N} - \eta e\end{aligned}$$

where C is consumption, I is investment and NX is net exports. There is no government spending. $\bar{C}$ and $\overline{N}$ are exogenous, and a, b, c and η are positive parameters, with $c < 1$.

(c) Derive the equilibrium response of income in this economy to a reduction in the world real interest rate r^*. Comment intuitively on the role of δ in this.
Solving gives:

$$Y = \frac{1}{1 - c + \frac{\eta\alpha}{\delta}}\left[\overline{C} + a + N - \eta e^* + \frac{\eta\gamma}{\delta} + \left(\frac{\eta\beta}{\delta} - b\right) r^*\right]$$

Thus the response to the real interest rate will be positive iff $\left(\frac{\eta\beta}{\delta} - b\right) > 0$, *or* $\delta < \frac{\eta\beta}{b}$. *Students know that in the MF model with fixed* M, *the response is positive, and with fixed* e *the response is negative. These correspond to the cases with* $\delta = 0$ *and* $\delta \to \infty$ *respectively.*

10. Consider an economy where firms and workers bargain in advance over a nominal wage $\overline{W}$, which is then fixed irrespective of changes to the nominal price level. During the bargaining process, firms and workers believe that the price level will equal a value P^e. Workers have market power in the bargaining process, and demand a real wage $\frac{\overline{W}}{P^e}$ that satisfies:

$$\frac{\overline{W}}{P^e} = \frac{1+\mu}{\eta} L$$

where L is the anticipated level of employment, and μ and η are positive parameters. Larger values for μ correspond to greater worker bargaining power. Firms would like to set the real wage equal to the marginal product of labour (MPL), which implies the following condition:

$$\frac{\overline{W}}{P^e} = (1-\alpha)\, L^{-\alpha} \overline{K}^{\alpha}$$

where $\overline{K}$ is a fixed capital stock and α is a parameter between 0 and 1.

(a) Show that the bargained nominal wage is given by:

$$\overline{W} = (1-\alpha)^{\frac{1}{1+\alpha}} \left(\frac{1+\mu}{\eta} \bar{K}\right)^{\frac{\alpha}{1+\alpha}} P^e$$

This follows by combining the two conditions and using standard algebra.

After the bargaining process is over, prices take a value P, which may differ from P^e. Firms would now like to employ until the MPL equals $\frac{\overline{W}}{P}$. Workers are willing to supply labour L^s according to the condition:

$$L^s = \eta \frac{\overline{W}}{P}$$

(b) Show that if $P = P^e$ there will be involuntary unemployment, and express its magnitude in terms of η, μ and $\frac{\overline{W}}{P^e}$.

i. *Taking the difference between labour supply and the equilibrium employment level that corresponds to the real wage above, we have:*

$$U = L^s - L = \eta \frac{\overline{W}}{P^e} \left(\frac{\mu}{1+\mu}\right)$$

(c) Does worker bargaining power improve the plausibility of the sticky-wage model for aggregate supply?

i. *This is the main point of the question, and students cannot score highly unless they answer it well. The key insight is that involuntary unemployment makes the assumption of demand-determined employment more plausible, so long as deviations of P from P^e remain small. A good answer could make this point algebraically, or diagramatically using a labour market diagram. The best answers should identify that the usefulness of this story ultimately hinges on the size of μ. If μ is small then only very small unexpected increases in prices should raise output – thereafter employment should become supply-determined, and fall with further price rises.*

END OF PAPER