

## **2** Aggregate Demand, Aggregate Supply, and Business Cycles

Solutions to questions set in the textbook

Please email [w.carlin@ucl.ac.uk](mailto:w.carlin@ucl.ac.uk) with any comments about the questions and answers. We would also be pleased to receive suggestions for additional questions (along with outline solutions), which can be added to the website resources.

# 1 Chapter 2. Aggregate demand, aggregate supply and business cycles

## 1.1 Checklist questions

1. What is the  $IS$  curve? Why does it slope downward? Why does an increase in government spending shift it to the right? What happens to the  $IS$  curve when the marginal propensity to consume rises? [Explain using words and either diagrams or equations; see the Appendix for the equations.]

ANSWER: The  $IS$  curve represents the locus of points where the goods market is in equilibrium. It shows the combinations of the real interest rate and output at which planned real expenditure equals real output i.e. where the goods market is in equilibrium. It is downward sloping since when the interest rate is high, investment is low and, via the multiplier, so is output. Conversely, there is an equilibrium when the interest rate is low and output is high. A change in marginal propensity to consume ( $MPC$ ) will change the slope of the  $IS$  curve, making it flatter if the  $MPC$  rises. See also the Appendix to Chapter 2.

2. Assume that the interest rate is constant. Explain in words what happens when there is an increase in government spending. In so doing, explain the concept of the multiplier.

ANSWER: At a given interest rate an increase in government spending will increase output in equilibrium by the amount of the rise in government expenditure magnified by exactly the multiplier. This is because in this case with a constant interest rate there is no crowding out of private investment. The initial increase in government expenditure initially raises aggregate demand, output and income by the same amount; a proportion of this income is spent on consumption (as indicated by the marginal propensity to consume), which in turn raises output and incomes. The process continues. The multiplier refers to the process by which the initial boost to aggregate demand generates higher output in the economy (or the converse for a fall in exogenous demand).

3. What is the  $LM$  curve and why does it slope upward? What happens to the  $LM$  curve when (a) there is an increase in the demand for money (at a given level of income and interest rate); (b) the interest elasticity of the demand for money rises?

ANSWER: The  $LM$  curve shows the combinations of output level and nominal interest rate at which the demand for money equals the supply of money. It slopes upwards since at a high level of output and income, the transactions demand for money is high. With a fixed supply of money, the opportunity cost of holding money (the interest rate) has to be high so as to dampen the asset demand for money and ensure that the money market clears. When output is low, the transactions

demand for money is low. Hence equilibrium in the money market will require a low interest rate in order to boost the asset demand for money. (a) An increase in money demand will shift the  $LM$  to the left. The nominal interest rate will have to be higher for money demand to equal the given money supply. (b) For any change in the interest rate, equilibrium requires a greater change in output. Therefore the  $LM$  curve will be flatter. See also the Appendix to Chapter 2.

4. Briefly explain why it is the real interest rate that is relevant for the  $IS$  curve and the nominal interest rate for the  $LM$  curve.

ANSWER: In the  $IS$  curve, the interest sensitive component is investment ( $I$ ): the agents are comparing the cost of borrowing with what they would have to repay in terms of goods tomorrow (i.e. taking inflation into account). For the  $LM$  curve, the interest rate is the opportunity cost of holding money therefore the comparison is between holding money receiving zero interest and bonds paying a nominal interest rate of  $i$ .

5. Provide two different explanations for why the  $PS$  curve may be flat.

ANSWER: 1) The  $PS$  curve is flat if the production function if the marginal product of labour is constant and the mark up is constant as well. 2) If the marginal product is declining but this is offset by a fall in the mark-up as output rises. 3) If firms set prices using a rule of thumb based on 'normal' average costs.

6. Why is the  $WS$  curve upward sloping (a) when wages are set by unions and (b) when wages are set by firms?

ANSWER: a) The labour supply curve is upward sloping and the presence of unions means that there is a union mark-up, which raises the real wage on the  $WS$  curve above that on the labour supply curve. Hence the  $WS$  curve is upward sloping. More generally, when unemployment is lower, workers are in a stronger position in the labour market and can negotiate a higher wage. b) With efficiency wages, as unemployment falls, the firm must raise the wage because the worker can more easily find work elsewhere. In both cases, the key is to see that the  $WS$  curve lies above the competitive labour supply curve and that it is positively sloped because the labour supply curve is positively sloped.

7. What is being assumed about the timing of wage-setting and price-setting that enables us to say that the economy is always on the  $PS$  curve but only on the  $WS$  curve in a medium-run equilibrium? What timing assumptions would deliver the result that the economy is always on the  $WS$  curve but only on the  $PS$  curve in a medium-run equilibrium?

ANSWER: Firms can adjust prices faster than wage setters: this lies behind the assumption that prices are set immediately after wages. Therefore while workers based their wage claims on a given expected price level, firms are able to change the actual price level. Only when the actual and expected price level are the same, i.e. in a medium-run equilibrium will the economy be on the  $PS$  curve and on the  $WS$  curve. When the opposite assumption about the speed of adjustment is made, i.e. wage setters are able to set money wages after prices have been set, the economy is on  $WS$  curve but not always on the  $PS$  curve. By assuming that neither can adjust immediately, we would typically observe the economy in between the  $WS$  and the  $PS$  curves.

8. Discuss the plausibility of the assumptions in the previous question. Discuss the implications of the timing assumptions for the way real wages move in response to fluctuations in aggregate demand.

ANSWER: Firms have more information (they know the wage they are paying and the price they are setting) and can unilaterally set their price. Wage setters need to gather information about the aggregate price index and they have to negotiate and bargain over wages, which takes time. Using the standard assumption, a change in aggregate demand would result in a different real wage in the short run only if the  $PS$  curve is not flat. Otherwise real wages are acyclical. If, however, there is a lag before price-setters adjust prices, then given that the  $WS$  curve is positively sloped and assuming a flat  $PS$  curve, real wages are pro-cyclical.

9. What are the similarities and differences between the characteristics of labour market equilibrium under perfect as compared with imperfect competition?

ANSWER: The answer should centre around a discussion of Fig. 2.12.

10. Show the likely effects on price- and/or wage-setting behaviour as reflected in the  $WS/PS$  diagram of the following:

- (a) workers become more worried about losing their jobs at any given level of employment
- (b) the government intervenes to protect domestic firms from foreign competition
- (c) higher social security contributions paid by employers
- (d) a reduction in the proportion of employees covered by union wage agreements (e.g. as the result of a decline in industries in the economy that are heavily unionized).

ANSWER: a)  $WS$  curve shifts downwards: workers will bargain for a lower wage ceteris paribus and therefore the wage-setting curve shifts down. b)  $PS$  curve shifts downwards, the mark up rises. c)  $PS$  curve shifts downwards; the tax wedge rises, reducing the real

wage for workers (see also Chapter 4). d)  $WS$  curve shifts downwards. Lower bargaining power of unions.

11. In the context of tripartite negotiations between unions, employers' associations and the government, union bosses strike a deal whereby they agree to make lower wage demands. Show the effect in the  $WS/PS$  diagram if they do so in return for:

- (a) a reduction in the length of the working week so that workers finish at lunch-time on Fridays (assume that wages and productivity on the vertical axis are measured per week.)
- (b) statutory improvements in working conditions that boost morale.

ANSWER: In each case,  $WS$  curve shifts downwards. a)  $PS$  curve shifts downwards as productivity falls. b) If workers work more effectively, the  $PS$  curve may shift upwards.

12. Does the aggregate demand curve for the whole economy slope down for the same reason as does the demand curve for DVDs?

ANSWER: No. The  $AD$  curve is the locus of points where the goods and money market are in equilibrium. The reason why it slopes down is that an increase in prices corresponds to a reduction in real money supply and therefore to an increase of the interest rate that brings a fall in investment and ultimately in output in the new short-run equilibrium. (Discuss the case of a vertical  $AD$  curve (flat  $LM$ ) to highlight this).

13. Explain why the long-run aggregate supply curve is vertical but the short-run one is not.

ANSWER: In the long run expectations are realised, the labour market is in equilibrium and therefore production/supply is fixed at that level. In the short run prices and expected prices differ, employment can fluctuate and a higher price level is associated with larger supply.

## 1.2 Problems and questions for discussion

QUESTION A: In an  $IS/LM$  model of the economy, why does the slope of the  $IS$  curve matter for macroeconomic policy analysis? Choose a policy instrument that will change the slope of the  $IS$  and explain why. What can you conclude from this example about how fiscal and monetary policy may interact?

QUESTION A: ANSWER. The slope of the  $IS$  curve depends on the interest-sensitivity of investment and on the multiplier. A higher tax rate,  $t_y$ , reduces the size of the multiplier, steepening the  $IS$  curve (can easily be shown using the diagram Fig. 2.1). The steeper is the  $IS$  curve, the smaller

is the effect of a given change in the interest rate on output. Hence monetary policy or a change in the price level has less effect on output (show using  $LM$  curve).

QUESTION B: Suppose that there is a large temporary fall in private sector investment. What would you expect the effect of this to be? What would you expect to determine how long the effect lasts?

QUESTION B: ANSWER. The immediate effect will be a fall in aggregate demand: The  $IS$  curve shifts to the left. As a consequence output falls: explain the transmission via the multiplier. The duration depends on what sorts of investment have been cut, on the temporary nature of the fall, on whether the policy maker responds and on how quickly wages and prices adjust.

QUESTION C: Use the  $IS/LM$  model and compare the short-run implications of the use of two different monetary policies. Policy 1 is to keep the interest rate constant and Policy 2 is to keep the money supply constant. Choose a private sector ' $IS$ ' shock that depresses the level of equilibrium output. Compare the implications for output of the use of Policies 1 and 2. Now choose a private sector ' $LM$ ' shock that lowers equilibrium output and complete the same exercise as above. If the authorities are interested in stabilizing the economy, would you recommend that they adopt Policy 1 or Policy 2?

QUESTION C: ANSWER: If shocks are mainly  $LM$  shocks, then Policy 1 is preferable: a constant interest rate policy entails that money demand or price level shocks are offset. However, if shocks are mainly  $IS$  shocks, then Policy 2 is preferable because a constant interest rate amplifies the effect on output of an  $IS$  shock.

QUESTION D: Real wages are mildly procyclical in most industrial economies. Explore which models of wage and price formation and which sources of fluctuations in economic activity are consistent with this observation.

QUESTION D: ANSWER: (See also Checklist questions 7 and 8 above.) Begin with cycles being driven by shifts in aggregate demand, which feed through to output because of nominal rigidities. Nominal wages and prices respond with a lag to the change in output. What happens to real wages depends on (i) lags in wage and price setting; (ii) the production function – specifically whether the marginal product of labour is constant, increasing or decreasing and (iii) the cyclical behaviour of the mark-up. In the standard case where money wages are set relative to last period's price level; prices are marked up immediately after wages are set; and where productivity and mark-ups are constant real wages are acyclical. Holding everything else constant, if there is an adjustment lag in price-setting, then the real wage will lie between the  $WS$  and the  $PS$  curve so

real wages might be pro-cyclical. Holding everything else constant but with decreasing marginal productivity, real wages will be counter-cyclical (i.e. the real wage will be on the downward-sloping *PS* curve). By contrast, in the real business cycle approach, it is shifts in the production function and hence in the *MPL* or *PS* that drive the business cycle. Hence, the economy moves along the labour supply (or *WS*) curve, with the implication that real wages are pro-cyclical.

QUESTION E: Keynes emphasizes the weakness of the self-equilibrating forces in a capitalist economy and highlights the role of government in stabilization. Milton Friedman argues that Keynes' influence on public policy was enormous:

Keynes believed that economists (and others) could best contribute to the improvement of society by investigating how to manipulate the levers actually or potentially under control of the political authorities so as to achieve desirable ends, and then persuading benevolent civil servants and elected officials to follow their advice. The role of voters is to elect persons with the right moral values to office and then let them run the country.<sup>1</sup>

Think about Friedman's argument and consider what it suggests is the proper role for economists in policy-making. Do you agree with him?

ANSWER: Left to the reader. Issues to raise include the way the government is modelled — interested students could be encouraged to look at how this is done in political economy models in Chapter 16. Keynes and Friedman differ in their views about the self-stabilizing properties of the economy, as well as about the benevolence of policy makers.

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<sup>1</sup>Friedman, M. (1997). 'John Maynard Keynes'. Federal Reserve Bank of Richmond, Economic Quarterly, 83/2: 1-23.