Alan Kohler in *The Australian* of July 11–12, 1992

"Employment growth is still far too weak despite thirteen reductions in interest rates on the trot and the fact that real, short-term, after-tax borrowing costs for businesses are now close to zero. ... " Kohler argues that the successive lowering of interest rates has not had any great effect on the economy because after the "decade of debt" of the post-deregulation 1980s businesses are wary of debt, of borrowing, and where possible many will reduce debt by raising equity before thinking about expansion, the only way employment will grow fast enough to reduce unemployment. With in the framework of our model, how can we include Kohler's conclusions?

Basically, he's saying that real autonomous planned expenditure has become less sensitive to falls in the interest rate. In our model, that means that b is closer to zero. In the limit a zero b (no effect on A_p as r falls) means the *impotent monetary policy* of Gordon's Figure 4-7 (top), when higher money supply and lower interest rates don't stimulate expenditures, the IS curve is zero, and real income (determined by A_0) is stuck at $k \times A_0$, as in the simple Keynesian cross model.

Since the AD curve (the relationship between the price level P and the real income Y) arises as the LM curve shifts along the IS curve with changing P as real money supply (M^s/P) changes, a vertical IS curve means a vertical AD curve, and so no influence from price level (P) to real income (Y).

One point I haven't emphasised in lectures is that the IS-LM model describes the *equilibrium* point. What the model doesn't do is discuss *how long* convergence to this combination of real income (Y) and real interest rate (r) takes. This question is significant in Australia today, while the GDP is slowly rising, but unemployment (U) is showing no signs of responding, yet.

2. Shifting the Aggregate Demand Curve AD with Monetary and Fiscal Policy

To follow this, it's convenient to rewrite the equation for the AD curve in terms of output (Y), planned real autonomous expenditure at zero interest rate (A_0), money supply (M^s), and the two multipliers — one for autonomous spending (k_1) and one for real money supply (k_2):

$$P = \frac{k_2\, M^s}{Y - k_1\, A_0}$$

2.1 A change in nominal money supply (M^s)

(Shifting the LM curve.) Why does an increase in M^s shift the AD curve to the right? A higher M^s requires a higher Y for any given level of prices (P). In more detail, a higher M^s at constant P shifts the LM curve to the right, and the economy's general equilibrium moves down the IS curve to a higher Y.

Equivalently, why does an increase in M^s shift the AD curve up? A higher M^s requires a higher P (or constant real supply of money M^s/P) for any given level of output (Y). The aggregate demand curve AD moves up by exactly the same proportion as the nominal money supply (M^s) because a doubling of money and a doubling of prices lead to the same real money supply, the same LM curve, the same interest rate, and the same GDP.[1]

2.2 A change in autonomous spending (A_0)

(Shifting the IS curve.) Why does an increase in A_0 shift the AD curve to the right? A higher A_0 requires a higher Y for any given level of prices (P). In more detail, a higher A_0 shifts the IS curve to the right, and with constant real money supply the economy's general equilibrium moves up the LM curve to a higher Y.

Will a reduction in autonomous spending (A_0) reduce real income (Y) and leave the price level (P) unchanged? Or will it reduce the price level and leave real income unchanged? Or some combination of both? To answer this we need to know the shape of the aggregate supply schedule SAS.

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1. Gordon points out that this requires that all forms of real wealth double when the money supply doubles, which is tricky with government bonds as wealth.

3. The Aggregate Supply Schedule SAS

The aggregate supply curve enables us to incorporate economic phenomena of the supply side, including firms' employment of labour, that the IS-LM approach subsumes.

3.1 The firm's supply curve

The profit-maximising firm will produce more output so long as the marginal revenue (*MR*) is greater than the marginal cost (*MC*) of doing so.

3.1.1 The firm's production function: The *production function* is a relationship that shows how much output can be produced by a given quantity of factor inputs, such as labour, capital, land, energy, and technology. In the short run, we assume that only labour is variable, which means that as the number of workers is increased, the extra output that a firm can produce by adding an extra unit of labour (*the marginal product of labour*) falls, and we observe diminishing marginal product of labour (*MPN*).

When we plot the relationship between the number of workers hired (*N*) and the total output (*Y*) — the firm's short-run production function — we see a curve with positive but diminishing slope (the marginal product of labour, *MPN*).

3.1.2 Marginal cost equals price: For a price-taking firm, the marginal revenue equals the price of output (*P*). What of the marginal cost of an extra unit of output? With only one variable input, labour, the marginal cost is the nominal wage (*W*) in dollars per worker divided by that

worker's marginal product (MPN), since $1/MNP$ is the labour necessary to produce the extra unit of output, and this will cost W dollars.

A profit-maximising, price-taking firm hires until its marginal cost equals the price of output:

$$MC = \frac{W}{MPN} = P$$

This can be rewritten as the real wage rate (W/P) will equal the marginal product of labour:

$$\frac{W}{P} = MPN$$

Such a firm only has control over the number of workers it hires, so the necessary condition for profit-maximising becomes: *the quantity of labour demanded by the firm depends on the real wage rate that is set for the firm by the market.*

3.2 The aggregate supply curve

If our profit-maximising, price-taking firm is representative, then we can use the last relationship to derive the economy-wide aggregate supply curve:

3.2.1 The labour demand curve: This is the "marginal product of labour" line horizontally summed across all firms. All firms choose their level of employment by looking along the labour demand curve to the point where the real wage (W/P) equals labour's marginal product (MPN).

What if the price level (P) rose (fell) while the nominal wage rate (W) remained unchanged? The real wage would fall (rise) and workers would be

cheaper (dearer) to hire and so firms would raise (reduce) employment and hire more (fewer) workers.

The labour demand curve (N_0^d) simply states that a fall in the real wage will induce firms to hire more workers, and vice versa. Its position depends on the slope of the production function: if something happened to raise the *MPN*, then it would shift up, and vice versa. Anything that shifts the production function will shift the labour demand curve.

3.2.2 The production function and the aggregate supply curve: From the labour demand curve, as the price level (P) changes, so does the real wage (W_0/P), and so does the level of employment (N). From the production function, as the level of employment (N) changes in response to changes in the price level (P), so does the real output (Y). The aggregate supply curve (SAS) is just the relationship between the price level (P) and the real GDP (Y).

The SAS curve slopes up for the same reason as the individual firm's did. It is drawn for a constant level of nominal wage (W_0).

3.3 Distinguishing features of the SAS curve.

1. The SAS curve shows the profit-maximising level of real GDP for different levels of an aggregate price index such as the GDP deflator. Everywhere along the curve firms are content to continue production without change: *equilibria.*

2. Since for a given nominal wage (W) a higher price index (P) reduces the real wage and so induces an increase in production (and in employment), the SAS curve slopes upwards. The steeper the economy's labour demand curve — that is, the more steeply the marginal product of labour falls as additional workers are hired — the steeper the positively sloped SAS curve.

3. The position of the SAS curve depends on the level of the nominal wage (W). A higher nominal wage would result in a shift up of the SAS curve, since a given level of real wage (W/P) would now occur at a higher price level (P).

4. The position of the SAS curve also depends on the productivity of labour, as reflected in the labour demand (N_0^d): if any of the non-labour inputs (previously assumed fixed in the short run) were to increase, so would the marginal product of labour, and the labour demand curve would shift up. The production function would shift up as well, and the aggregate supply curve SAS would shift to the right. An adverse shock, such as the oil shocks of the 1970s, will work in the opposit direction: the labour demand curve would shift down, as would the production function, and the aggregate supply curve would shift leftwards.

4. How is the Wage Rate Set?

If the nominal wage rate (W) increases, then the SAS curve will shift up, and its intersection with the economy's aggregate demand curve AD (along which the output market and money market are in equilibrium) will shift as well.

Thus the determinants of the actual wage rate paid have a crucial effect on the nature of the economy's response to a change in aggregate demand.

4.1 The equilibrium real wage rate

The *equilibrium real wage rate* is the real wage rate at which the labour supply and demand curves intersect, so there is no pressure for change. The *labour supply curve* is assumed to slope upwards, as a higher real wage induces a higher supply of labour.

The labour supply curve can shift if anything occurs that makes people more or less willing to work at a given real wage rate. Two things that will shift the labour supply curve to the right are:

- a rise in the working-age population, from immigration or natural increase

- a fall in unemployment benefits ("the dole")

From any equilibrium combination of real wage and employment in the labour market, for firms to employ more will require a lower level of real wage, but this will not induce a higher level of labour supply, on the contrary.

Employers need to find some factor that will make workers willing to provide more work than shown

by the labour supply curve. Otherwise, we would never observe changes in employment (N), or changes in real GDP (Y), over the business cycle.

Let's consider the effects of an increase in aggregate demand: the price level (P) rises, reducing the real wage (W/P), and increasing the demand for labour; but workers are unhappy about being asked to work more when they are paid less in real terms. They demand real wage increases, via a higher nominal wage (W), which returns the real wage to its original level, but with a higher nominal wage and a higher price level.

5. Short-Run Output and Price Effects of Fiscal and Monetary Expansion

We now relax our assumption (of the open IS-LM model above) that the price level is fixed. We find that a fiscal stimulus causes both output (Y) and the price level (P) to increase simultaneously in the short run.

5.1 Initial short-run effect of a fiscal expansion

Consider a fiscal stimulus which raises autonomous planned spending from A_{00} to A_{01}. If there were no change in the price level, then the new equilibrium would occur immediately to the right of the initial equilibrium, B, as in the open IS-LM curve. But with increasing marginal costs of additional production, firms will not be willing to produce at L, which is off the short-run supply curve SAS; instead there will be a price increase, to point C, which shows the combination of price level (P) and real output (Y) compatible with profit-maximising firms. Higher aggregate demand[2] has raised prices, stimulating firms to produce more, so long as there has been a fall in *real* wages (nominal wages (W) have not adjusted in full proportion to the increased price level).

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2. From any factor that increases aggregate demand — increases in G, in net exports (NX), in money supply, in business and consumer confidence, in transfer payments, or falls in taxes. So long as AD slopes upwards.