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USING OIL PRICE SHOCKS TO TEACH THE AS-AD MODEL IN A BLENDED LEARNING STRATEGY*

Harry Tse
Business School Economics Group,
University of Technology, Sydney

ABSTRACT

This paper reports a pedagogical strategy employed to teach the *AS-AD* model. Dolan & Stevens (2006) stress the importance of teaching macroeconomics with *relevance*, and in this vein the issue of the macroeconomic effect of substantial increases in oil prices was used as a focus for teaching the *AS-AD* model in the first semester of 2006. This strategy also had a substantial blended learning dimension which Fox & MacKeogh (2003) argue can generate deeper student learning than traditional, pure, face to face strategies and which Hughes (2007) suggests can enhance the confidence with which students approach learning tasks, improving what they take away from these experiences. The paper describes the behaviour of oil prices in the years leading up to 2006 and the factors affecting this price. It outlines the structure of the *AS-AD* model presented to students and how oil prices can be incorporated into this model. It then discusses details of the overall strategy used for teaching the model and finally presents some evidence that students reported better and more relevant learning experiences than did students in the three prior semesters which had not used this strategy.

Keywords: Aggregate demand, aggregate supply, macroeconomics, oil prices, blended learning.

JEL Classifications: A22, E1.

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* Correspondence: Harry Tse, Associate Lecturer, Economics Group, UTS Business School, University of Technology, Sydney, P.O. Box 123 Broadway, New South Wales, 2007, Australia. Ph. 61 2 9514-7786; Fax 61 2 9514-7777; E-mail: harry.tse@uts.edu.au.
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1. INTRODUCTION

In two recent papers in this journal, Peter Docherty and I examined a range of Aggregate Supply-Aggregate Demand (*AS-AD*) models typically used to teach intermediate macroeconomics, as well as a number of criticisms of such models advanced over the years (see Docherty & Tse 2009a, 2009b). We argued in the second of those papers that while the neoclassical framework continues to be the dominant paradigm in economics, most of the criticisms of the *AS-AD* model can be overcome so that it can continue to be used as a device for teaching intermediate macroeconomics.

In this paper I report a pedagogical strategy we employed to teach one of the *AS-AD* models examined in our earlier papers. Any *AS-AD* model can be taught with the model itself as the centre of pedagogical attention but such an approach has the potential to be dry and abstract. Students typically respond negatively to such teaching. In contrast, Dolan & Stevens (2006) stress the importance of teaching macroeconomics with *relevance*, and in this vein we gave considerable attention in 2006 as to how we could teach the *AS-AD* model so that students understood it thoroughly but found their learning experience interesting, engaging and connected to the real world.

The prominence of rising oil prices in the media at the time provided a natural real world problem to which the *AS-AD* problem could be applied. Prior to the Global Financial Crisis, central banks in a number of countries were becoming increasingly concerned about the development of inflation after several years of sustained growth in aggregate demand. This concern focused particularly on the price of oil which had been rising significantly and which prompted comparisons with the oil price increases of the 1970s. One consequence of a potential new oil price shock was argued to be the possibility of global recession. Outlining how recession can be caused by high oil prices thus became the main focus of the strategy we used to teach the *AS-AD* model.

This strategy also had a substantial blended learning dimension which Fox & MacKeogh (2003) argue can generate deeper student learning than traditional, pure, face to face strategies. Hughes (2007) also suggests that blended learning approaches can enhance student support and thus improve the confidence with which students approach learning tasks, increasing what they take away from these tasks.

The paper begins with a consideration of oil prices in the years leading up to 2006 and the factors affecting these prices. The structure

of the *AS-AD* model presented to students is then outlined and an approach to incorporating oil prices into the model is explained. The overall strategy for teaching the *AS-AD* model using the effect of rising oil prices as a major theme is then described. Some consideration is given as to how students reacted to our approach, before some concluding remarks are made.

2. THE MACROECONOMIC IMPORTANCE OF OIL PRICES

Hamilton (1983) argues that every major recession from World War II up to the 1970s was preceded by a significant increase in the price of oil and that the balance of evidence suggests a causal link from these increases to the onset of recession. Barsky & Killian (2004) challenge the notion that oil price shocks constitute either a necessary or sufficient condition for the onset of recession but admit that a number of the most serious recessions from the 1970s were associated with large increases in the price of oil.

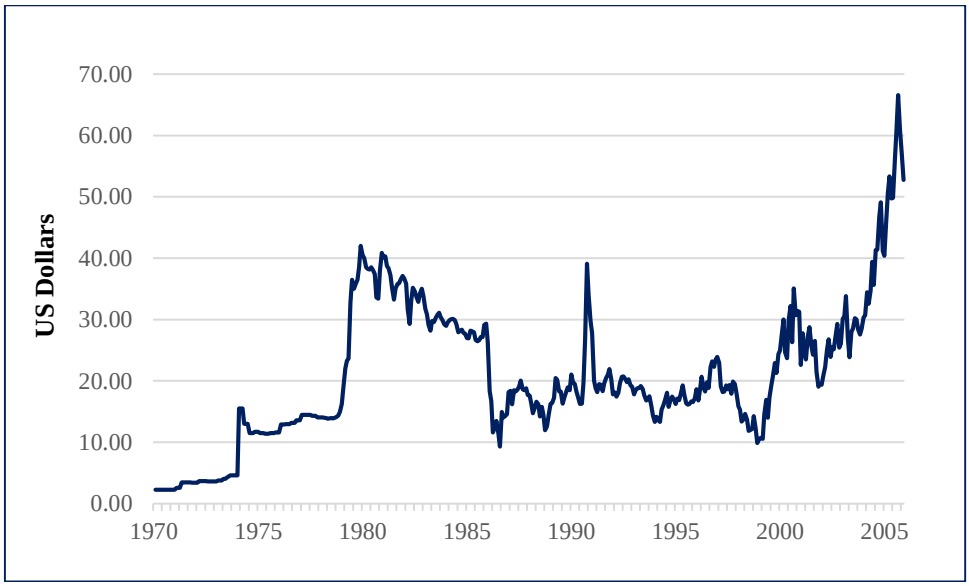

Figure 1: Nominal Price of Brent Crude Oil, 1970-2005
Source: Datastream.

The behaviour of oil prices leading up to 2006 is shown in Figures 1 and 2. Figure 1 shows the nominal price per barrel of Brent Crude Oil in US Dollars. This figure indicates that in the early 2000s oil prices surpassed their levels of the mid 1970s and approached the levels reached during the second oil price shock of 1979-80 (*cf.* Reserve Bank of Australia 2005, p.6). Figure 2 shows the *real* price of Brent Crude, calculated as an index of the nominal price deflated by the producers'

price index and set to be 100 in 1970. This figure indicates that the real price of oil did *not* quite reach the heights of the first or second oil price shocks in the years leading up to 2006. It did, however, reach levels higher than at any point *since* those shocks.

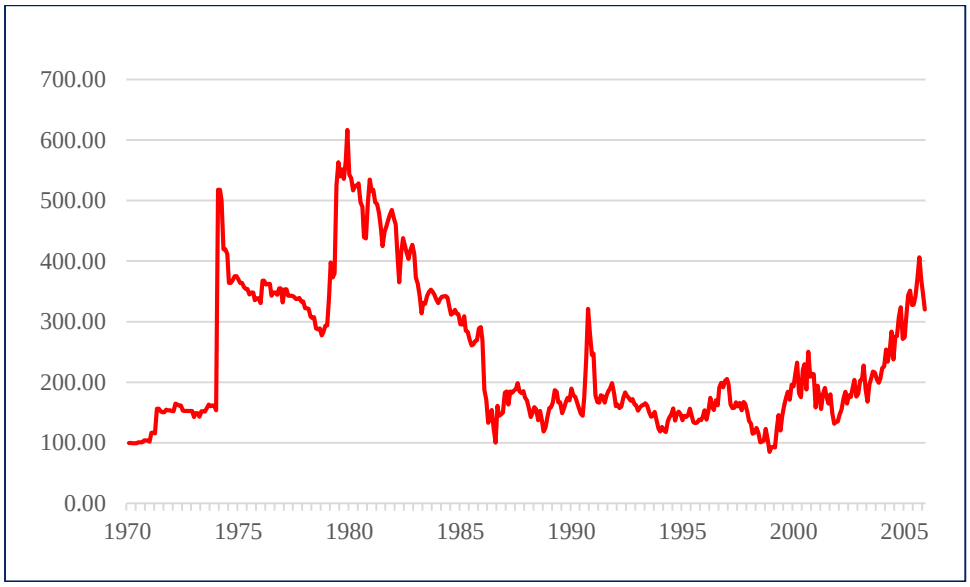

Figure 2: Real Price of Brent Crude Oil, 1970-2005

Source: Datastream and RBA.

A number of commentators in early 2006 raised the possibility that this spike in oil prices might have negative implications for the world economy. These commentators generally pointed out some important differences in the circumstances of the mid 2000s compared with the 1970s focusing mainly on the strength of world demand emanating from the Chinese and Indian economies (see, for example, Dickman & Holloway 2004, pp.4-5; and Woodall 2005, pp.15-16). It is thus worth reflecting on the factors affecting oil prices before looking at the impact of higher oil prices on the macroeconomy. The Reserve Bank of Australia (2005) notes two important things about the *supply* of oil over the period from 1980 to 2005. Firstly, since about 2001, the supply of oil had been *rising* to reach its level in 2005 of about 82 million barrels per day, although subject to sudden but temporary "shocks" downwards. This contrasts with the experience of around 2000 when global supply in general and from OPEC in particular *fell* over the course of a year or so, and was clearly in contrast to the big fall in OPEC supply between 1980 and 1985. Thus the period in which the price of oil had been rising to 2006 was associated with a period in which the

supply of oil had mainly been rising. The production process which determines the supply of oil (the so-called "oil value chain") is made up of four main dimensions: exploration, extraction, transport, and refining. The broad behaviour of oil supply can thus be decomposed into these dimensions which, in the years leading up to 2006, had been the outcome of a variety of factors worth considering in some detail.

Manipulation of OPEC Quotas

The more slowly oil is released from reserves to the market, other things equal, the higher will be the price of oil and the higher will be profits from oil production. Thus, it is in the interests of OPEC countries to release oil slowly enough to keep the price of oil high and maintain their profits but not so slowly as to cause such a high price that the world economy goes into recession and demand for oil drops (see *The Economist* 2005, p.5 where the Saudi Arabia oil minister points out that Saudi Arabia thrives on the economic growth of other countries). It is also in the interests of oil producers for the price of oil to be relatively *stable* because fluctuations in price tend to dampen demand. Thus Saudi Arabia has tended in the past to increase the supply of oil when the price has risen sharply (to dampen price increases) and vice versa (*The Economist* 2005, p.5). This is called "targeting inventories". In 1997 after OPEC decided to increase supply, the Asian Crisis hit, demand dropped as Asian countries went into severe recession and the price of oil fell to $10 per barrel. OPEC then cut production in an attempt to lift the price, and it subsequently rose steadily.

Lack of Investment in Oil-Producing Capacity

As the world economy grows, it demands more oil and oil producers must invest in their ability to produce, deliver and refine oil if they are to keep up with this growing demand and maintain a stable price. This investment takes the form of oil rigs and drills to extract oil, oil tankers to ship oil around the world and oil refineries to turn crude oil into petroleum and other usable forms for cars and industry. Many oil producers, especially OPEC, had cut their spending on investment in this kind of productive capacity over the ten years or so prior to 2006, so that growth in demand was on average bigger than growth in supply (*The Economist* 2005, p.5; Dickman & Holloway 2004, p.2). As OPEC increased its supply to meet growing demand its production levels approached its capacity to supply oil.

Supply Disruptions

When the relationship between supply and demand is tightly balanced due to factors such as those discussed above, any disruption to supply caused by adverse weather conditions knocking out part of the oil value chain, by political unrest or labour disputes closing down wharves or production facilities (such as those in Venezeula or Nigeria in the years immediately prior to 2006) or by wars (the invasion of Iraq, for example), causing demand to run ahead or nearly ahead of supply and the price of oil to rise. In fact, any *hint* that such a disruption might happen can cause the price of oil to rise, this being called the "fear" or "risk" premium (Dickman & Holloway 2004, p.3; *The Economist* 2005, p.4).

Resource Nationalism

This is a less clear factor but worth noting. It involves developing or emerging countries forming companies to access and extract oil themselves rather than allowing one of the big OECD oil-based companies who compete with OPEC to do it. This potentially reduces the supply of oil available globally if these nations decide to stock pile oil rather than to sell it and keep the profits. If they sell, it doesn't reduce the world supply of oil but it does make life tougher for "Big Oil", the big private western oil companies that include Exxon-Mobil, Royal Dutch Shell, Chevron Texaco and BP (the four remaining companies of the so-called "seven sisters" of the 60s, 70s and 80s, the 7 biggest western oil companies who controlled world oil supplies before the formation of OPEC; See *The Economist* 2005, p.5ff).

Hubbert's Peak

This is a background supply issue rather than one that had direct effects on supply over the period up to 2006. The idea is that there is a fixed supply of oil in the ground and that rising demand is using up this supply at a rate sufficient to generate an upward trend in prices. Some argue that reluctance on the part of oil producers to invest in oil-producing capacity is due to their desire to hold back the flow of oil so that it can be released at higher prices.

Impact of Supply on Recent Oil Price Increases

As pointed out above, the price of oil had been rising in the years leading up to 2006 at the same time as the supply of oil had been broadly increasing. This would seem to suggest that changes in supply were not the key factor determining the price of oil in 2006. The implication is

that *demand* had been more important in this respect. Figure 1 indicates how the price has generally risen since 1998. Demand factors affecting the price of oil principally reflect strong growth in world GDP over a number of years since 2001 or so, especially in China and the US. Since oil is a major factor of production, when GDP grows strongly, the demand for oil is higher and this impacts on the price, other things equal. The particularly strong demand from China reflected about 1/3 of the growth in total demand for oil in 2004 (Dickman & Holloway 2004).

This is very different from the oil price shocks of the 1970s when supply was suddenly reduced causing the price to rise. However it should also be remembered that both supply and demand factors contribute to oil price determination. Given that investment in oil producing capacity had been relatively low in 2006, the rate of growth of capacity had been lower than the rate of growth in demand. So it would not be true to say that supply considerations are irrelevant or failed to contribute to oil price movements, even if these considerations were qualitatively different from those of the 1970s.

Future Price Movements

According to some, the world was facing a new "price paradigm" for oil in 2006 prior to the GFC (*The Economist* 2005, p.7). Principally, strong demand was increasingly coming up against a limited supply of oil and prices would never fall back to $30 a barrel but were more likely to exceed $100 per barrel on a permanent basis. Central to this argument was the concept of "Hubbert's Peak" as discussed above. However, the following arguments weigh against the idea that Hubbert's Peak could have inaugurated a new price paradigm:

- Technology is constantly expanding the supply of oil in terms of improving access to existing supplies; in making the discovery of additional supplies more likely; and in widening the definition of "oil" to make associated products more realistic oil substitutes;
- Investment in oil infrastructure by OPEC had been increasing;
- The surge in world GDP growth may not have lasted (as the emergence of the GFC subsequently ensured was the case);
- The unusually high Chinese demand for oil was partly because of a temporary shortage of coal and was unlikely to remain as high.

Thus supply factors could well have had some impact on price over the following few years if demand had remained strong. But a consistently high price of oil was likely to have generated supply responses that either increased the proportion of reserves recovered from existing fields, providing an incentive either for more exploration and the discovery of new oil fields, or for a speeding up of the development of oil substitutes. And these would have increased the effective supply of oil, reducing oil prices in the longer term. It might also have been the case that there were *demand* responses to higher oil prices as people began to run more efficient cars and found ways of reducing their reliance on oil.

An examination of the potential impact of the surge in oil prices in the lead up to 2006 on the macroeconomy thus represented an excellent opportunity to engage the interest of students in real macroeconomic developments in a manner consistent with the recommendations of Dolan & Stevens (2006). It also represented an opportunity to provide students with a challenging variant on a reasonably well documented supply shock that would require and facilitate a good knowledge of the workings of the *AS-AD* model. The following two sections outline the structure of the basic *AS-AD* model dealt with in lectures and tutorials in 2006, and how oil could then be integrated into this model and used to examine the macroeconomic impact of significant increases in oil prices. The teaching strategy used to lead students to an understanding of this material is then outlined.

3. THE STICKY WAGE AS-AD MODEL

The version of the *AS-AD* model we focused upon in 2006 was the so-called "sticky wage" model. This version of the model is not without its problems (see Docherty & Tse 2009b for a discussion of these problems) but it dovetails quite nicely with material treated in microeconomics courses and thus taps into students' existing knowledge, building links across degree content. The sticky wage model was originally characterised as the "downwardly rigid money wages" model and an early textbook treatment of this model may be found in Glahe (1977, pp.25-29). We provided a detailed exposition of this model in Docherty & Tse (2009a) but the structure of the model is summarised here for the convenience of readers.

Most texts distinguish between the long run aggregate supply curve, which is vertical at potential or full employment output and to which

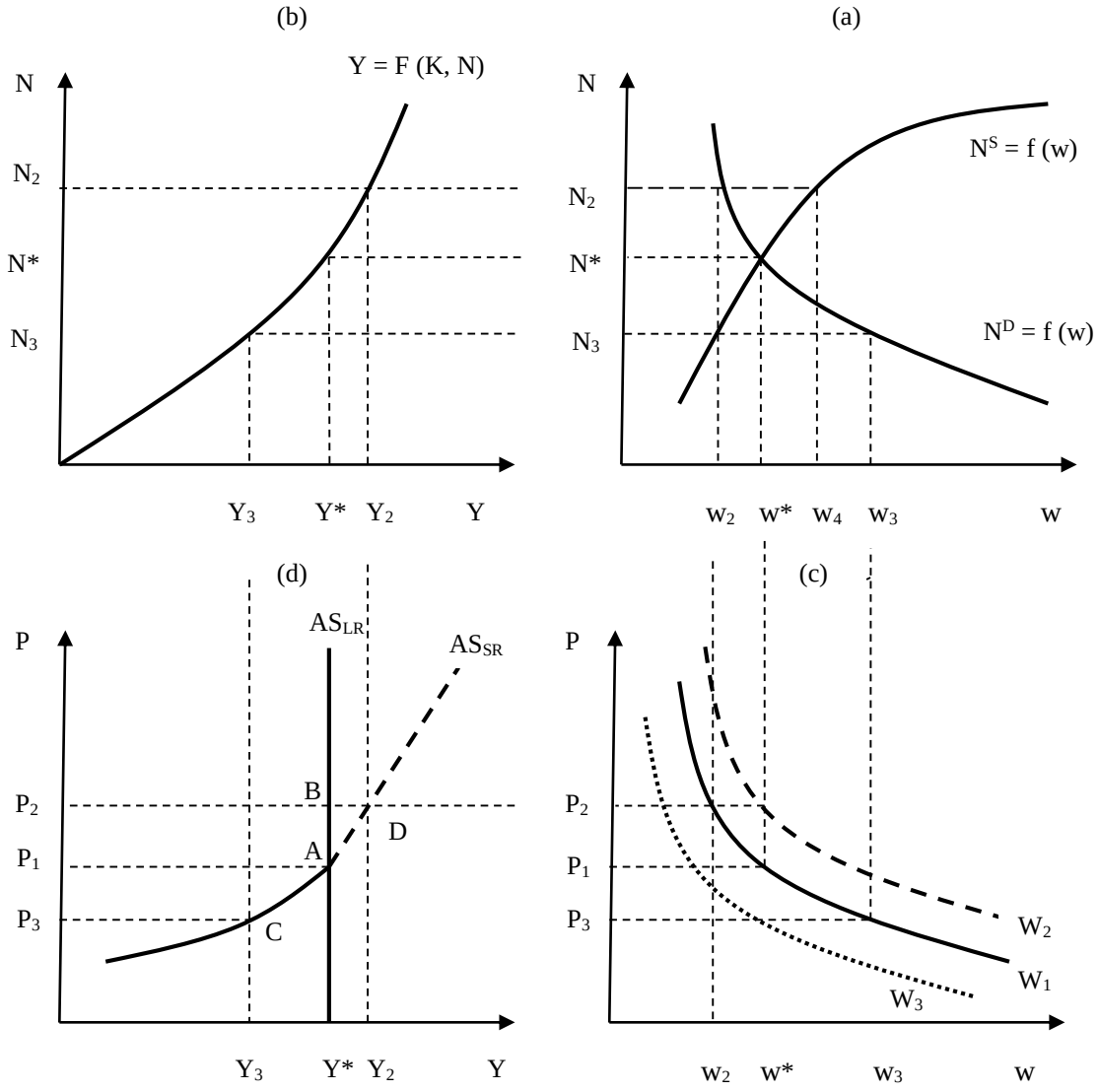

Figure 3: Glahe's (1977) Long Run Aggregate Supply Curve

the economy gravitates with the passage of sufficient time, and the short run aggregate supply curve which is typically characterised by a positive relation between the aggregate price level and output. Since the long run curve defines the position to which the economy eventually returns and around which it fluctuates in the short run, it functions as a benchmark against which the short run relation must be understood. It is, thus, worth discussing first in some detail before the structure of the short run aggregate supply curve is considered in relations to it. In 2006, we thus found that Glahe's (1977) treatment although nearly 30 years old was not "dated" but provided a detailed and useful approach.

Glahe's derivation of the long run aggregate supply curve is shown in Figure 3, where the curve appears in panel (d) and is vertical in

price-output space at the level of potential output, Y^*. Potential output itself is determined jointly from the labour market in panel (a) and a standard aggregate production function in panel (b) where the amount of capital is held constant. Glahe carefully derives the supply curve for labour, N^S, in panel (a), from the work-leisure choice facing workers given the real wage, and the labour demand curve, N^D, from the firm's profit maximising choice of labour inputs. He thus provides detailed micro-foundations for the labour market equilibrium in panel (a) and hence for the level of full employment, N^*. Substitution of N^* into the production function with constant capital gives full employment or potential output, Y^*, from panel (b).

In this long run benchmark framework, firms always supply Y^* because the real cost of labour, the real wage, w, is constant at its equilibrium value, w^*, and prices and wages are perfectly flexible. Given equilibrium in the labour market and its associated real wage, w^*, the price level firms require to supply Y^* is determined by the money wage. For any given level of this wage, the definition of the real wage implies an inverse relation between the real wage and the aggregate price level. A series of such relations, corresponding to various levels of the money wage, is shown in panel (c) of Figure 3. If the money wage is W_1, the equilibrium real wage, w^*, translates into a price level of P_1. Thus the price-output combination (P_1, Y^*) constitutes one point, *A*, on the long run aggregate supply curve in panel (d) when the money wage is W_1 in panel (c). An increase in the money wage to W_2 requires firms to increase the price level to P_2 in order to maintain the equilibrium real wage, w^*, and continue supplying Y^*. The price-output combination (P_2, Y^*) thus constitutes a second point, *B*, on the long run aggregate supply curve in panel (d) when the money wage is W_2, and so on.

When money wages or prices are not perfectly flexible, however, the aggregate supply curve will be upward sloping. This is generally perceived to be a reasonable assumption in the short run but the logic of the resulting upward sloping relation depends on whether it is prices or wages that are assumed to be inflexible or whether imperfect information forces expectations to play an important role in the behaviour of firms and workers. Mankiw (2003, p.348ff) thus identifies three prominent approaches that may be taken to short run aggregate supply: the sticky wage model; the imperfect information model; and

the sticky price model. Docherty & Tse (2009a) consider each of these approaches but I focus here on the sticky wage model.

The sticky wage model adds to the long run framework the assumption that workers resist downward revisions to money wages. If variations in demand lead firms to reduce the price level, this *increases* the real wage firms face, and their demand for labour *falls*. If we assume that the price level is initially P_1 in panel (d) of Figure 3, a reduction of the price level to P_3 in panel (d) would generate a higher real wage of w_3 in panel (c), given that the money wage of W_1 cannot be reduced. This higher real wage would cause firms to reduce their demand for labour to N_3 in panel (a) and to produce output of only Y_3 when this new level of employment is substituted into the production function in panel (b). Thus a positive relation emerges between the price level and output for prices *below* the current price level. For price increases *above* the current price level, the lower real wage implied by such higher prices would lead to excess demand for labour as before and money wages would rise. The aggregate supply curve would then continue to be vertical at Y^* for prices in this range.

Glahe regards the downwardly rigid money wage *AS* curve with an upward sloping portion for prices below P_1 and a vertical portion for prices above P_1, as an alternative *long run* structure to the purely vertical curve presented in Figure 3. Development of the New Keynesian tradition, however, provided a comprehensive theory of nominal rigidities that supported viewing wages as sticky in *both* directions, but only in the *short run*. Mankiw (2003, pp.349-351) provides a treatment of aggregate supply along these lines. In terms of Figure 3, assume that the money wage is fixed at W_1 and is sticky in both directions. We have already explained the upward sloping portion of aggregate supply for prices below the current price P_1 in terms of Glahe's analysis, and a similar argument applies for prices above this level. If the price level rises to P_2, for example, firms face a real wage of w_2 in panel (c) and demand more labour at N_2 in panel (a). Mankiw (2003, p.350) assumes that employment is determined by labour demand which then allows production to expand via panel (b) to Y_2. This approach is somewhat problematic because labour supply at a real wage of w_2 is smaller than labour demand so that demand is unlikely to be satisfied on first consideration. Docherty & Tse (2009a) consider this issue in some detail, but accepting Mankiw's approach for the moment implies that the upward sloping section of the aggregate supply curve

continues beyond Y^* so that the total short run aggregate supply function is now given by both the solid and dashed portions of the upward sloping AS_{SR} curve in panel (d).

This approach can be expressed mathematically in terms of equations (1) to (3) below. Equation (1) is simply the definition of the real wage, w, in terms of a fixed money wage, $\bar{W}$, and the aggregate price level, P. Equation (2) is the labour demand function, N^D, which depends negatively on the real wage. Equation (3) is an aggregate production function according to which output, Y, depends positively on the amount of employment, N, and the stock of capital, K, which we assume to be fixed in this analysis.

$$w = \bar{W}/P \tag{1}$$

$$N^D = f(w) \qquad dN^D/dw < 0 \tag{2}$$

$$Y = F(N, \bar{K}) \qquad \partial F/\partial N \ > 0 \tag{3}$$

We first rearrange equation (1) to express the price level in terms of the fixed money wage divided by the real wage, and we invert equations (2) and (3) to express the real wage as a function of labour demanded, and employment as a function of output. We then substitute (3) into (2), and (2) into (1) to obtain:

$$P = \frac{1}{f^{-1}[F^{-1}(Y)]} \cdot \bar{W}$$

We may, however, write $f^{-1}[F^{-1}(Y)]$ as $g(Y)$ for simplicity, which gives:

$$P = \frac{1}{g(Y)} \cdot \bar{W} \tag{4}$$

Since $g(Y)$ is decreasing in Y, $1/g(Y)$ will be increasing in Y. Equation (4) then represents the aggregate supply curve when money wages are fixed. It slopes upwards in price-output space as indicated in panel (d) of Figure 3 and its vertical location depends on the value of the fixed money wage.

This model was carefully exposited in lectures, followed up with an interactive tutorial in which students were asked to construct the model themselves from scratch, and with detailed notes subsequently posted on the course website. The following section outlines how oil prices can be integrated into this version of the *AS-AD* model.

4. OIL PRICES IN THE STICKY WAGE MODEL

The version of the *AS-AD* model outlined above does not specifically incorporate oil or oil prices into the analysis and so requires modification before the impact of oil prices can be examined. The most obvious way to do this is to incorporate oil explicitly into the production function and to include the cost of oil explicitly in the profit function. Let us, therefore, assume that the production function is given by (5) instead of (3):

$$Y = F(N,K,O) = A \cdot N^{\alpha} \cdot K^{\beta} \cdot O^{\gamma} \tag{5}$$

where O represents the quantity of oil used in production, and A, α, β and γ are all parameters. If we designate the price of oil as P_o, the representative firm's profit function becomes:

$$PROFIT = P \cdot Y - W \cdot N - P_K \cdot K - P_O \cdot O \tag{6}$$

where profit is given by the revenue firms make from producing and selling output (PY), less the costs of production which are made up of the wage bill (WN), capital costs (the price of a capital good, P_K, times the number of capital goods used, K) and the oil bill. The demand for labour curve in panel (a) of Figure 3 is obtained by differentiating expression (6) with respect to the amount of labour, setting the resulting expression equal to zero, and expressing this with the amount of labour on the left hand side. The resulting expression indicates that the optimal amount of labour must satisfy the condition that the real wage paid to labour must equal the marginal product of labour which is a decreasing function of the amount of labour employed. Given the production function in (5), the marginal product of labour is given by:

$$\frac{\partial Y}{\partial N} = A \cdot N^{\alpha-1} \cdot K^{\beta} \cdot O^{\gamma} \tag{7}$$

which is positively related both to the amount of oil used in the production process and to the parameter γ. Thus a change in either of these variables will change the position of the labour demand curve in panel (a) of Figure 3, the point of equilibrium in the labour market, and the location of the vertical, long run aggregate supply curve in panel (d) of these figures. To determine the impact of an increase in the oil price, therefore, we must first determine the impact of this change on oil usage.

This is done in the same way that labour usage is determined. Differentiating equation (6) with respect to the amount of *O*, setting the resulting expression equal to zero, and rearranging, yields the following condition for the optimal usage of oil:

$$\frac{\partial Y}{\partial O} = \frac{P_O}{P} \tag{8}$$

This can be represented in terms of Figure 4 below. Assuming the marginal product of oil declines with the quantity used, if the real price of oil is initially p_{O1}, the optimal amount of oil usage is O_1. If, however, the real price of oil rises to p_{O2}, optimal oil usage falls to O_2. This implies from the production function that overall production will fall depending on the degree of substitutability between oil and other productive inputs (*cf.* Barsky and Killian 2004, p.120). The higher the value of γ, the less substitutable is oil (the higher the degree of complementarity between oil and other productive inputs) and the bigger the impact of the choice to reduce oil usage on the level of output.[1]

The above analysis stresses the analytical importance of the relative or *real* price of oil which was shown in Figure 2 when we initially described the behaviour of oil prices in the years leading up to 2006. While this relative price was briefly explained to students when we introduced this graph in the first lecture of the semester, it was clear that when we reached this more detailed analysis later in the semester, many students experienced a "penny dropping" moment and understood the concept of the real price of oil clearly for the first time. The above analysis also indicates that when the real price of oil rises, optimal oil usage falls. This in turn feeds back into equation (7) and changes the location of the marginal product of labour curve. Since the marginal

[1] There will, of course, be considerable interaction between oil and labour since each of these variables appears in the marginal product expression of the other. The real story will thus be more complicated than suggested above. It can be shown, however, that the equilibrium ratio of the money wage to the nominal price of oil will equal the optimal ratio of oil to labour usage:

$$W/P_O = O^*/N^*.$$

Thus an increase in the nominal price of oil will reduce the relative price of labour to oil and optimal oil to labour usage. Optimal oil usage will thus fall relative to labour and this will lead to a downward shift in the marginal product curve for labour as the above analysis suggests.

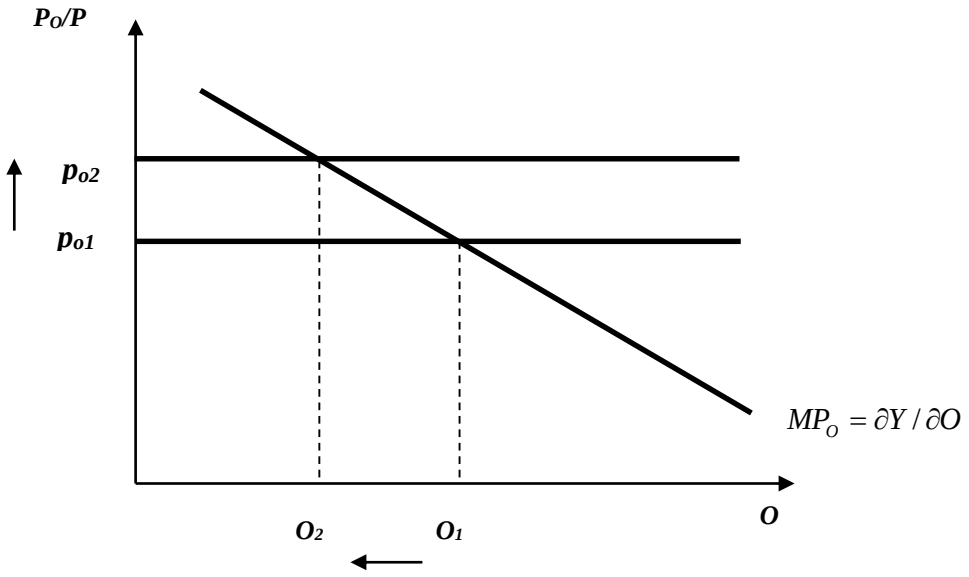

Figure 4: Optimal Usage of Oil in Production

product of labour plays an important role in affecting the location of the vertical AS curve, changes in oil prices and consequently in optimal oil usage have implications for the long run *AS* curve.

These implications are shown in Figure 5. As the real price of oil rises, optimal oil usage falls and the position of the marginal product of labour curve, as outlined in equation (7), moves downwards. This is shown in panel (a) of Figure 5 in the movement of the labour demand curve from N^{D1} to N^{D2}. This shift reduces the equilibrium real wage from w^* to w^{**} and potential output from Y^* to Y^{**} in panel (b). This in turn shifts the vertical, long run aggregate supply curve to the left from AS_1 to AS_2. Given the initial money wage of W_1, the movement of the labour demand curve also shifts the short run aggregate supply curve from AS_{SR1} to AS_{SR2}. If aggregate demand is given by AD_1 in panel (d), the negative supply shock associated with an increase in the price of oil raises the price level from P_1 to P_2 and reduces output from Y^* to Y^{**}.[2]

The case illustrated in panel (d) of Figure 5 explains oil price shocks such as the sudden deliberate increases in oil prices by OPEC in the

[2] The intersection of AD_1 and AS_{SR2} which will determine the position of the economy immediately following the supply shock may occur at a lower price and higher output than (P_2, Y^{**}). However, since this level of Y will exceed Y^{**}, there will be excess demand for labour and the money wage will be forced upwards, shifting the money wage curve in panel (c) upwards and the short run aggregate supply curve in panel (d) upwards as well, until AD_1 and AS_{SR2} intersect on the new long run aggregate supply curve AS_2 at a price level of P_2 as depicted in Figure 5.

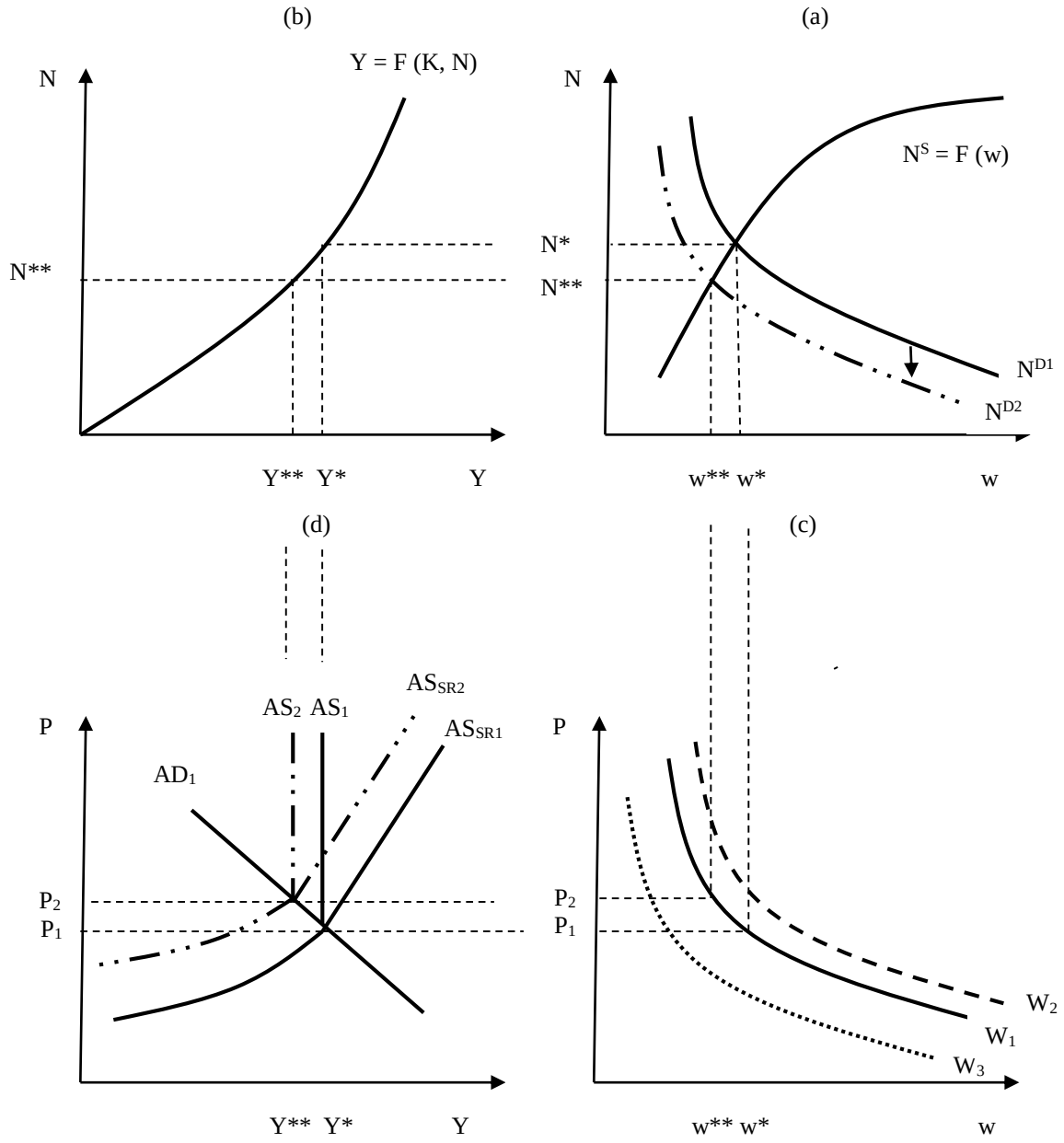

Figure 5: Oil Price Shock in the *Sticky Wage* Aggregate Supply Model

1970s. The price increases of the years leading up to 2006 in contrast, contained a substantial demand side element. Strong world growth, especially in China, led to an increase in demand for oil that, given supply conditions, led to the higher oil prices shown in Figure 1 above. An accurate representation of these increases in oil prices, therefore, should incorporate a rightward shift in the aggregate demand curve first, followed by a leftward shift of the vertical aggregate supply curve as oil prices respond to the higher world demand. This is not shown in the accompanying diagrams but it would result in a higher average price level than that shown in Figure 5 but with an identical level of output.

5. OUTLINE OF THE BLENDED LEARNING STRATEGY

The material described in the previous two sections tends to be challenging for intermediate macroeconomics students. But a good knowledge of this material provides them with a powerful tool to think systematically about the macroeconomy and to be more effective graduate economists. Assisting students to learn this material effectively and to engage seriously with the learning process is thus an important pedagogical challenge for economics instructors. Ramsden (1992, p.165) argues that deep student learning is facilitated when students are active in the learning process and when learning and assessment exercises carefully integrate material from various parts of a course. Fox & MacKeogh (2003) argue that deeper student learning may also be promoted using blended learning environments that combine face to face and online components. Hughes (2007) further argues that blended approaches enhance student support and thus improve the confidence with which students approach learning tasks and thus what they take away from these experiences.

At the time this strategy was deployed for *Macroeconomics: Theory and Applications*, a program to enhance the quality of student writing was also being implemented. This program was aimed at improving the quality of student writing by clearly articulating the characteristics of good writing, exploring these in voluntary writing workshops (which also linked the structuring of good writing to high quality economic analysis) and then providing students with the opportunity to write using their new knowledge from the workshops, to receive feedback on this writing, and to write again drawing upon this feedback. The assessment structure for the course was designed to facilitate this process with students completing a shorter, introductory paper about one third of the way through the semester, and then a longer and more analytically challenging paper towards the end of the semester. More detail about this program can be found in Docherty, Tse, Forman and McKenzie (2010). It was, however, a natural step to set these assignments on material related to oil prices and the impact of oil price increases on the macroeconomy. The course thus integrated the writing project with an attempt to teach students the *AS-AD* framework in a hands-on way with practical relevance.

Additional on-line support was also provided to students via the University's Blackboard platform called *UTS Online* incorporating the kinds of insight suggested by Fox & MacKeogh (2003) and Hughes

(2007). This support focused on assisting students to integrate oil into the *AS-AD* model once the basic model outlined in Section 3 above had been exposited in lectures and followed up with an interactive small class tutorial. A detailed set of notes on the basic model was also made available online after this tutorial.

Once these classes had been conducted and we felt that the students had a good grasp of the basic model, the first of a series of three "notes" was released online which gave students some clues about where to begin with integrating oil into the model. This note dealt with both the psychology and analytics of the integration process. It acknowledged that the task was going to be a challenging one but it suggested what the students should read first in thinking about the issues. It directed them in particular to Barksy & Killian (2004) and Blanchard & Sheen (2004) who use a different version of the *AS-AD* model to explicitly think about the impact that changes in oil prices could have on macroeconomic systems. Students were then directed to the course's online discussion board to ask questions about the readings or float ideas or suggestions about how oil prices might be integrated into the *AS-AD* model used in *Macroeconomics: Theory and Applications*. A number of staff monitored the discussion board so that students received responses to their postings within 24 hours. Responses mainly took the form of affirming suggestions that moved the analysis in the right direction or asking questions which probed the ideas that students were coming up with to think about oil and its impact.

Once the idea emerged in this interaction that oil was a key productive input, students were encouraged to think about the role of the other productive input that had already been included in the *AS-AD* model and discussed in lectures and tutorials: labour. Students were encouraged to think about labour in the production function, how this input affected profit, and how the profit maximising choice of labour use could be made within a neoclassical framework. This was in a sense revision, but it required students to explore in greater depth the structure of the model to which they had already been exposed. Once students interacting online had demonstrated a grasp of these issues, the second "note" was released which summarised this discussion using a formal model. This note finished by suggesting that *oil* could be included in the production function as an additional productive input and treated in a very similar way to labour. Students were then directed back to the discussion board and interaction on these issues continued online.

Eventually, a number of students worked out the analysis shown in the first part of Section 4 above, deriving expressions (7) and (8) and the main idea behind Figure 4. We then released the third "note" which formally summarised this online discussion and students were then left to think about how the impact of oil prices could affect the macro-economy within the resulting *AS-AD* framework. Students were then required to write this up in a 2,500 word essay and the essay was graded. Further questions were answered online but no more formal information was made available.

Our approach can thus be summarised as having four stages. The *first* stage was to orient the students to the issue of oil prices by having them research and write an initial, "shorter" assignment of 1,500 words. This essentially focused on the material considered in Section 2 above and used most of the papers to which we referred in that section. Students thus developed an understanding of the forces driving the increase in oil prices leading up to 2006 quite early in the semester. The *second* stage was to teach the basic *AS-AD* model outlined in Section 3 above via the traditional lecture and tutorial format. The *third* stage was to foster online interaction between students themselves, as well as between students and staff, about the more analytically challenging task of integrating oil into the basic *AD-AS* framework. This involved both online discussion, as described above, and the gradual release of assignment "notes" summarising this online discussion. The *fourth* stage was to have the students use the resulting *AS-AD* model with oil to think about the macroeconomic implications of rising oil prices. They did this by completing a longer 2,500 word essay on this subject. The approach thus integrated traditional learning formats and online interaction with active learning experiences. It thus encompassed the recommendations of Ramsden (1992), Fox & MacKeogh (2003), Dolan & Stevens (2006) and Hughes (2007).

6. EVALUATION

Assessing the effectiveness of new teaching strategies is often a difficult task. Student grades are not determined independently of the staff who are implementing the strategies being assessed, and staff impressions of any improved interaction with students or enhanced student learning is similarly lacking in independence. Student evaluations on the other hand may be "bought" with inflated grades or may reflect teacher popularity rather than genuine learning outcomes and so such evaluations must also be interpreted with care. These are

all common objections to the standard methods of teaching evaluation. It is, however, important to reflect on the effectiveness of new teaching strategies and we can only use the measures which are available to us.

At the level of impressions, we firstly felt that students were more engaged with understanding and exploring the *AS-AD* model than in previous semesters. This was true both in terms of the attention students paid to the basic model and in terms of their online engagement with the integration of oil into the model. More and better questions, for example, seemed to be asked about the basic model in the tutorial dealing with this topic. We had stressed that this model would need to be developed by students themselves later in the semester and that it therefore needed to be understood thoroughly in preparation for that later work. Students also engaged actively online later in the semester in trying to integrate oil into the basic framework. These may have been the better students, but a reasonable number of them were involved in the online discussion rather than simply one or two. There was also discussion clarifying some of the issues raised which clearly involved students not at the forefront of developing the model. This discussion appeared to play an important role in helping the average student to understand the ideas being discussed online. All of this also appeared to be reflected in the higher quality of written papers as perceived by the staff who graded them.

These perceptions were corroborated by data from the standard *Student Feedback Survey* (*SFS*) collected about the course at the end of semester. Figure 6 shows the performance of *Macroeconomics: Theory and Applications* for the following four questions on the survey:

- My learning experiences in this subject were interesting and thought provoking;
- There were appropriate resources available to support this subject;
- Overall I am satisfied with the quality of this subject;
- This subject was relevant to me.

The first of these questions focuses particularly on student perceptions of their learning and while this refers to the course overall, the strategy described above was a major part of the course in the first semester of 2006. One would expect, therefore, to see some change in response to this question if the strategy was effective. Since additional resources were made available as part of the strategy in terms of the more active

discussion board and the assignment notes, one might expect this to show up in response to the second question above. The third question relates to the course overall but one might expect to see a change in the response to this question if the strategy had a significant impact on student learning. Responses to the final question above were included because of the objective of making the course more relevant to real world phenomena as suggested by Dolan & Stevens (2006). While the wording of the question could be interpreted by students at a much more personal level, it is not unreasonable for students to see a subject that

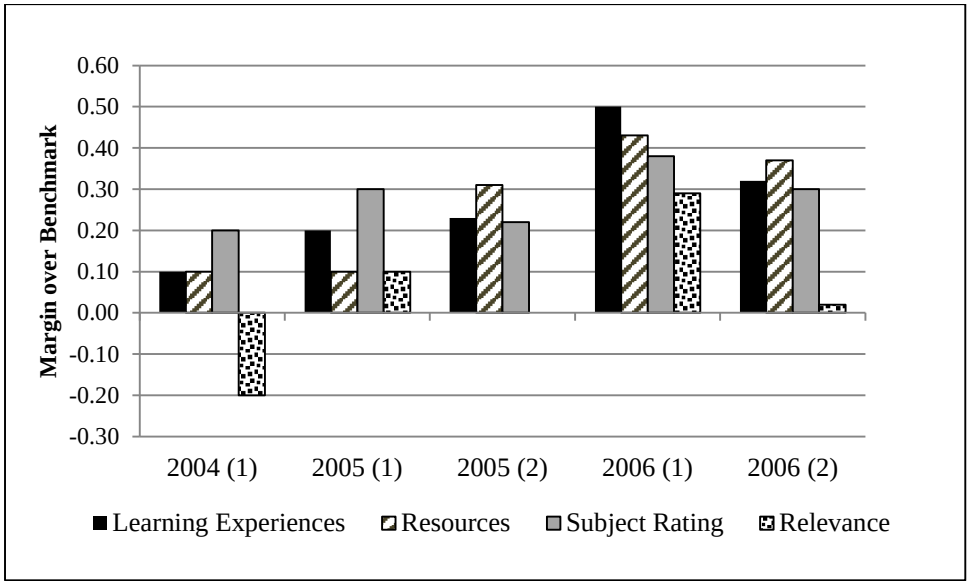

Figure 6: Student Feedback Responses on Key Course Aspects

Note: The margin is over a benchmark measure which was the average of subjects taught in the Business Faculty in the same semester. This benchmark was not available for 2005(2) when average of subjects in the same School of Finance and Economics was used. This was the largest school within the Business Faculty for the whole period covered by the graph. No benchmark measure for *Relevance* was available in that semester.

relates to the real world as relevant, in the sense that it equips them better to work in this world after graduation.

Students responded to these questions by using a five point Likert scale with 5 being "Strongly Agree". The performance of *Macroeconomics: Theory and Applications* shown in Figure 6 is measured as the margin of the score out of 5 received by the course on the four questions over and above the average score for all subjects taught in the Business Faculty for the semester in question. A positive value indicates that *Macroeconomics: Theory and Applications*

performed *better* than average, and vice versa. Measures are shown for five semesters in which the number of survey responses (with enrolments in brackets) were 239 (490), 191 (337), 127 (268), 97 (211) and 121 (194) respectively. This translates into response rates of 48.77%, 56.67%, 47.38%, 45.97% and 62.37% respectively for these semesters.

Figure 6 indicates a noticeably higher margin over benchmark in 2006 (1) for each of the four questions above than for surrounding semesters. On the first question about the quality of learning experiences, the highest margin in the three prior semesters had been about 0.23 above the average for the Business Faculty. In 2006 (1), this margin more than doubled to 0.50. Smaller improvements were observed in the "resources" question and the overall subject rating. Of particular interest is the change in student response to the "relevance" question. The margin on this question had been negative in 2004 (1) and only 0.10 in 2005 (1). In 2006 (1), however, it nearly trebled to 0.30. Since some aspects of the strategy were left in place in the following semester, it is not completely surprising that feedback in 2006 (2) did not simply revert to its longer term mean.

It should be noted that responses to the SFS were at their lowest in 2006 (1) than at any other time in the measurement period in Figure 6. It is thus possible that students who might have rated the course more poorly on each of the four questions became discouraged and failed to respond to the survey. However, given that the highest response rate in the same period was in the following semester, and that the response margins for three of the four questions remained above previous levels with some aspects of the strategy left in place, there is some evidence that the higher rating in 2006 (1) was not influenced by a "discouraged student" effect.

Open-ended student comments from the SFS identified the two-paper assignment structure, the discussion board, and the applied nature of the subject as strengths of the course. The following selection of comments gives some flavour of this positive evaluation:

> [I] [p]articularly like[d] . . . the focus on oil.
>
> [The course] was interesting and the assignments though hard, were relevant to the current economic situation and support was provided …
>
> [I liked] [t]he help provided by UTSOnline and the support provided to do the assignment.
>
> [The course] [r]elates to contemporary issues.

Student comments are often not particularly effusive and are best used to identify those dimensions of a course that students found most useful. The comments above indicate an evaluation consistent with feedback on the "relevance" question in Figure 6 and identify the online dimension of the blended learning strategy used in 2006 (1) as one of the course's strengths.

It is also worth commenting on the resources required to implement the strategy described above. This required considerable effort. Developing two complementary assignment questions with appropriate readings, supporting the online discussion with constant monitoring and providing responses of sufficient detail to guide students in their thinking about developing the *AS-AD* model, and writing up the assignment "notes" to summarise the online discussion for the average student, were all fairly time consuming tasks that were additional to previous delivery of the course. Because we had received a substantial grant from the University's Learning and Teaching Performance Fund allocation to support the writing initiative being implemented in the course, and because the oil price strategy was closely linked with this initiative, we were able to employ a teaching-research assistant to help with management and responses on the discussion board. This support was not available in following semesters and while we tried to maintain the impetus established in 2006 (1), we were not able to manage the same level of student-staff interaction that characterised this initial semester. This partly explains why the student responses were not as high in the following semester.

There is, therefore, some evidence that the oil price shock-focused, blended learning strategy for teaching the *AS-AD* model was effective. Students seemed to engage better than previous semesters with what was fairly demanding material, the quality of responses was perceived as being fairly high by staff who graded the papers, and student feedback was better than previous semesters on questions related to the strategy. The strategy did, however, require considerable staff time so that these benefits came at a non-trivial cost.

7. CONCLUSION

This paper has reported a pedagogical strategy I employed with Peter Docherty to teach the *AS-AD* model. Dolan & Stevens (2006) stress the importance of teaching macroeconomics with *relevance*, and in this vein we used the issue of the macroeconomic effect of substantial increases in oil prices as a focus for teaching the *AS-AD* model in the

first semester of 2006. This strategy also had a substantial blended learning dimension which Fox & MacKeogh (2003) argue can generate deeper student learning than traditional pure face to face strategies and Hughes (2007) suggests can enhance the confidence with which students approach learning tasks, improving what they take away from these experiences.

The paper considered the behavior of oil prices in the years leading up to 2006 and the factors affecting this price. It outlined the structure of the *AS-AD* model presented to students and how oil prices can be incorporated into this model. It then describe the overall strategy we used for teaching the model and finally presented some evidence that students reported better and more relevant learning experiences than did students in the three prior semesters which had not used this strategy.

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