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Working Paper

Monopolistic Competition, Efficiency Wages and Perverse Effects of Demand Shock

CESifo Working Paper, No. 475

Provided in Cooperation with:
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Suggested Citation: Malley, Jim; Molana, Hassan (2001) : Monopolistic Competition, Efficiency Wages and Perverse Effects of Demand Shock, CESifo Working Paper, No. 475, Center for Economic Studies and ifo Institute (CESifo), Munich

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A joint Initiative of Ludwig-Maximilians-Universität and Ifo Institute for Economic Research

CESifo Working Papers

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May 2001

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CESifo *Working Paper No. 475*
May 2001

MONOPOLISTIC COMPETITION, EFFICIENCY WAGES AND PERVERSE EFFECTS OF DEMAND SHOCK

Abstract

In this paper we construct a stylised general equilibrium macromodel to show that demand led expansions may have unexpected effects when market imperfections lead to changes in labour productivity. We find some empirical support, from a number of European countries, for the main predictions of this model that unemployment and output are positively related when unemployment is low and inversely related when unemployment is high. An important policy insight that emerges from this study is that an exogenous stimulation of aggregate demand can only raise output and reduce unemployment provided the economy is operating relatively efficiently. However, when an economy is trapped in an inefficient equilibrium, positive demand shocks can lead, perversely, to an increase in unemployment.

JEL Classification: E62, J41, H3.

Keywords: Efficiency wages, effort supply, monopolistic competition, multiple equilibria, stability, fiscal multiplier.

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1. Introduction

In the last few decades, the industrialised nations of Europe have been subjected to a variety of external and policy-induced demand shocks while simultaneously experiencing significant changes in their labour productivity and employment. Meanwhile, it has been recognised that persistent involuntary unemployment gives rise to externalities that could be exploited by economic agents. For example, price-setting firms could use rising unemployment as device to deter shirking. In this setting, macroeconomic policy interventions can produce unexpected consequences. For example, as Lindbeck (1992) points out: "*In the context of a nonmarket-clearing labour market, it is certainly reasonable to regard unemployment, in particular highly persistent unemployment, as a major macroeconomic distortion. There is therefore a potential case for policy actions, provided such actions do not create more problems than they solve. Experience in many countries suggests that the latter reservation is not trivial*." To more fully explore the extent to which these concerns are warranted, we construct a stylised general equilibrium model to show the conditions under which demand led expansions, which lead to changes in labour productivity, may have perverse effects on unemployment. Additionally, we provide some evidence, for a number of European countries, which suggests that Lindbeck's concerns are, indeed, not without empirical foundation.

Recent examples of related theoretical research, which examines the link between European unemployment and productivity, include Malley and Moutos (2001), Leith and Li (2000), Daveri and Tabellini (2000), Blanchard (1998), Caballero and Hammour (1998a,b), Gordon (1997) and Manning (1992)). However, none of these studies explores the general equilibrium implications for unemployment of demand shocks in the presence of both labour and product market imperfections. On the empirical side, a large number of studies have

examined the behaviour of labour productivity in the industrialised countries and provide indisputable evidence regarding the way in which labour productivity has changed over the last few decades. Recent examples include Disney, *et al*. (2000), Barnes and Haskel (2000), Marini and Scaramozzino (2000), Bart van Ark *et al*. (2000) and Sala-i-Martin (1996). The evidence provided in these studies is usually interpreted using one of the micro-based explanations underlying the behaviour of labour productivity. These may, in general, be divided into two categories. The first concentrates on the productivity gains that can be realised through: i) increased skill due to training; ii) increased efficiency due to progress in management and restructuring; and iii) increased physical productivity of other factors of production due to R&D, etc.. The second category emphasises market forces and sees competition and market selection as the main motivation behind the rise in efficiency. The separating line between these two accounts is not very clear in the sense that the latter will have to be achieved through the former when the economy is operating efficiently. However, if the economy happens to be in an inefficient phase, market forces can act directly without having to induce any of the factors in the first category. The efficiency wage hypothesis is a typical example of this case and will be used in this paper to illustrate the point.

To provide the intuition for the role of efficiency wages in this context, consider an equilibrium that sustains involuntary unemployment and further suppose that the existence of the latter persuades the employed to work harder. In this case, because there is a causal relationship between the level of unemployment and the productivity of the employed, a total change in output can be decomposed into changes due to employment and productivity. As a result, a sufficient condition for an expansionary demand shock to raise both output and employment is that the resulting fall in unemployment does not induce a fall in productivity of the employed to such an extent that it eliminates the effect of the rise in employment.

Defining aggregate labour productivity as $q=Y/L$ where Y, L and q respectively denote output, employment and productivity, and noting that $dq=(dY-qdL)/L$, it is clear that any of the six cases outlined in Table 1 could, in principle, occur in the aggregate (see Barnes and Haskel, 2000, for evidence at plant level).

Table 1. Simultaneous Changes in Labour Productivity, Output and Employment

Change in Labour Productivity	Change in Employment	Change in Output	Change in Unemployment Rate
Rising Productivity $dq>0$	$dL<0$	$dY>0$	$du>0$
	$dL>0$	$dY>0$	$du<0$
	$dL<0$	$dY<0$	$du>0$
Falling Productivity $dq<0$	$dL>0$	$dY<0$	$du<0$
	$dL<0$	$dY<0$	$du>0$
	$dL>0$	$dY>0$	$du<0$

The last column of Table 1 shows the implied changes in the unemployment rate (based on the approximation that the labour force is constant). This discussion clearly suggests that it is a distinct possibility that output and unemployment can both fall or rise simultaneously. While the cases in which changes in output and unemployment have opposite signs can be easily explained by a variety of standard theories, a convincing macroeconomic theory capable of predicting why these variables both fall or rise simultaneously is more elusive[1]. To obtain a more realistic indication of whether output and unemployment simultaneously move in the same direction, in Table 2 we examine quarterly data for a cross section of 10 European countries, chosen to reflect a wide range industrial structures as well as macroeconomic and labour market experiences over the last few decades.

[1] Note that theories of creative destruction (see e.g. Aghion and Howitt, 1992, 1994) are also capable of predicting that output and unemployment simultaneously move in the same direction. However, if the periods in which output and unemployment are positively related occur on a systematic basis, these theories are lacking since the impulse mechanisms which ignite the creative destruction process are either product or process innovation and by their very nature these are random occurrences.

Table 2. Directions of Quarterly Changes in Output, *Y*, & Unemployment Rate, *u*; (occurrences as percentage of the sample size, *n*)

Country	Sample	$dY_{t+4}<0$ & $du_t<0$ and $dY_{t+4}>0$ & $du_t>0$	$dY_{t+2}<0$ & $du_t<0$ and $dY_{t+2}>0$ & $du_t>0$	$dY_t<0$ & $du_t<0$ and $dY_t>0$ & $du_t>0$	$dY_{t+2}<0$ & $du_t<0$ and $dY_{t+2}>0$ & $du_t>0$	$dY_{t+4}<0$ & $du_t<0$ and $dY_{t+4}>0$ & $du_t>0$
BEL	60:2-97:4 (*n*=151)	0.456	0.423	0.417	0.423	0.463
DEU	60:2-89:4 (*n*=119)	0.461	0.385	0.345	0.402	0.461
ESP	61:1-98:4 (*n*=152)	0.493	0.500	0.480	0.473	0.493
FRA	65:1-97:4 (*n*=132)	0.609	0.592	0.553	0.638	0.656
GBR	60:2-98:3 (*n*=154)	0.433	0.414	0.370	0.461	0.547
IRE	60:2-97:4 (*n*=151)	0.497	0.463	0.430	0.450	0.456
ITA	60:2-98:3 (*n*=154)	0.487	0.559	0.513	0.546	0.560
NLD	69:2-97:4 (*n*=115)	0.414	0.416	0.400	0.416	0.414
PRT	60:2-97:4 (*n*=151)	0.578	0.597	0.629	0.671	0.694
SWE	60:2-98:3 (*n*=154)	0.473	0.342	0.357	0.467	0.460

The number of observations, *n*, and the sample period correspond to the contemporaneous changes in the natural logarithm of real GDP (market prices), *Y*, and the unemployment rate, *u*. Based on a one-sample 2-tailed *t*-test the mean number occurrences of ($dY_t\pm_s>0$ & $du_t>0$) and ($dY_t\pm_s<0$ & $du_t<0$) are significantly different from zero at the 0.01 level of significance. This result also holds across all leads and lags. Belgium (BEL), West Germany (DEU), Spain (ESP), France (FRA), UK (GBR), Ireland (IRE), Italy (ITA), Netherlands (NLD), Portugal (PRT), Sweden (SWE); *Y* and *u* are obtained from the OECD Business Sector Database.

Table 2 shows the directions of quarterly changes as a proportion of the entire sample for which changes in output and unemployment have the same sign, i.e. $[\,dY_{t\pm s} > 0 \;\&\; du_t > 0\,]$ and $[\,dY_{t\pm s} < 0 \;\&\; du_t < 0\,]$ for $s=0,2,4$. These results indicate that for a substantial and statistically significant proportion of the sample (i.e. at least 35% of the sample for all countries) the sign combinations show output and unemployment moving in the same direction. It is also clear from Table 2 that these findings hold not only for

contemporaneous changes but also for lagged and led changes[2]. Regarding the latter, the proportion of periods where Y and u are positively related increases for virtually all other cases considered[3]. Given the results in Table 2, it seems fair to conclude that theories disregarding this possibility – by employing models with market structures which are only capable of generating the prediction that Y and u are negatively related – can only be of limited use when analysing the potential effects of macroeconomic policy.

There are already a number of studies that analyse the macroeconomic effects of labour market imperfections. The interested reader may consult, for instance, Danthine and Donaldson (1990), Dixon (1990), Moutos (1991), Hoon and Phelps (1992), Fender and Yip (1993), Phelps (1994) and Dixon and Rankin (1995) where the latter also provides a survey. This paper diverges from the these studies by focusing on deriving an equilibrium relationship between output and unemployment, which is consistent with the evidence presented in Table 2, and examining the effect of demand shocks in a model that embodies such a relationship. An important policy insight that emerges from this paper is that an exogenous stimulation of aggregate demand can only raise output and reduce unemployment provided the economy is operating relatively efficiently. The intuition for this lies in the supply side nonlinearities, which could give rise to multiple equilibria in the long run. We show that when an economy is trapped in an inefficient equilibrium, positive demand shocks can lead, perversely, to an increase in unemployment.

The rest of the paper proceeds as follows. Section 2 describes the production side – consisting of monopolistically competitive firms setting prices and offering efficiency wages

[2] We have also examined ($dY_{t \pm s}$, du_t) for $s = 2, 4$, to allow for cyclical changes.

[3] In the empirical analysis, which follows in Section 2, we will concentrate on the contemporaneous case only since this case clearly does not over-record the proportion of periods when Y and u are moving in the same direction.

to maximise profits – and derives a nonlinear equilibrium relationship between output and unemployment which is consistent with the evidence reported above. We also provide further evidence to show that the main predictions of the model hold for a number of European countries (i.e. unemployment and output are positively related when unemployment is low and inversely related when unemployment is high). Section 3 outlines the demand side – comprising a representative household and a government, as in the typical models of imperfect competition – and obtains a conventional aggregate demand function. Section 4 shows that, given the aggregate demand and supply functions, in principle different types of equilibria could emerge, which do not exclude multiple equilibria. The main distinction between these equilibria, apart from their stability properties, is related to the level of labour productivity. This enables us to rank them as 'efficient' and 'inefficient'. Section 5 concludes the paper.

2. Production and Aggregate Supply

The supply side is assumed to be populated by N monopolistically competitive firms each producing a distinct variety of a horizontally differentiated good. The demand function facing firm j is

$$y_j = \left(\frac{P_j}{P}\right)^{-s}\left(\frac{Y}{N}\right), \tag{1}$$

where j is the index denoting firms/products, $j \hat{I} [0,N]$, $s>1$ is the (constant) elasticity of substitution between any two varieties, P and Y are the aggregate price and quantity CES indices, P_j is price of variety j and y_j is the corresponding quantity demanded and consist of the private and public demand for the variety produced by firm j. Denoting the latter by c_j and g_j, respectively, we have $y_j = c_j + g_j$ at the firm level and $Y = C + G$ in the aggregate.

Following the existing literature on monopolistic competition[4], we assume that public and private goods are similar CES bundles and that the government pays the same price as private consumers. Hence,

$$X = \left(N^{-1/s} \int_{j \in N} (x_j)^{1-(1/s)} dj \right)^{1/[1-(1/s)]}, \tag{2}$$

where $x_j = c_j$, g_j and $X = C, G$. As a result, total expenditure satisfies the following

$$\int_{j \in N} (P_j y_j) dj = PY, \tag{3}$$

and

$$P = \left(\frac{1}{N} \int_{j \in N} (P_j)^{1-s} dj \right)^{1/(1-s)}. \tag{4}$$

Labour is assumed to be the only factor of production, and to be perfectly mobile between firms. Each firm j uses an increasing returns technology

$$y_j = e_j L_j - f, \tag{5}$$

where L_j is the variable labour input, e_j is labour productivity and f is a constant parameter reflecting the fixed cost of production[5]. We assume that e_j is determined by the workers' attitude towards shirking and represents their optimal effort supply function which depends on: *i)* the real wage paid by the firm $w_j = W_j/P$; *ii)* the extent of unemployment in the economy captured by the unemployment rate[6] u; and *iii)* the real value of the reservation wage $b = B/P$. The latter is determined by the unemployment benefit, which the government would

[4] We follow the existing studies in assuming that *G* and *C* are similar CES bundles. See Startz (1989), Dixon and Lawler (1996), Heijdra and Van der Ploeg (1996) and Heijdra, *et al*. (1998) for further details.

[5] The falling average cost therefore gives rise to the incentive for full specialisation from which a one-to-one correspondence between the number of varieties and the number of firms in the market will result.

[6] Given that the number of households is normalised to 1, *u* is simply the proportion of unemployed households.

pay an unemployed worker. Thus, we postulate the following effort supply function for a worker employed by firm j

$$e_j = e(w_j, u, b), \tag{6}$$

which is assumed to satisfy $e'_{jw} = \frac{\partial e_j}{\partial w_j} > 0$, $e'_{ju} = \frac{\partial e_j}{\partial u} > 0$, $e'_{jb} = \frac{\partial e_j}{\partial b} < 0$, and to have plausible second and cross partial derivatives. In particular, we shall assume $e''_{jww} = \frac{\partial^2 e_j}{\partial w^2_j} < 0$, $e''_{juw} = \frac{\partial^2 e_j}{\partial u \partial w_j} < 0$ and $e''_{jbw} = \frac{\partial^2 e_j}{\partial b \partial w_j} > 0$. An example of this type of the effort function is explicitly derived in the appendix.

Each firm j takes u, B, and the price level P, as given and chooses its 'efficiency wage' W_j and its price P_j so as to maximise its profit

$$p_j = P_j y_j - W_j L_j, \tag{7}$$

subject to the demand function in (1) and the production function in (5) as well as taking account of its workers' reaction to the choice of W_j which is given by the effort function in (6). The first order conditions are $\partial p_j / \partial W_j = 0$ and $\partial p_j / \partial P_j = 0$ whose solution imply the following wage and price setting rules

$$W_j = \frac{e_j}{\frac{\partial e_j}{\partial W_j}}, \tag{8}$$

$$P_j = \left(\frac{s}{s-1}\right)\frac{W_j}{e_j}. \tag{9}$$

Equation (8) is the well-known result – in the efficiency wage hypothesis literature – that implies a firm raises its efficiency wage and moves up the effort function until its elasticity with respect to wage becomes unity. Equation (9) is the usual mark-up pricing rule for a monoplistically competitive firm.

In a symmetric equilibrium where all firms are identical these equations can be written as $e'_w \cdot w = e$ and $e = sw$, where $s = s/(s-1)$ and the subscript j is dropped. To see the implication of these, we first note that together these yield $e'_w(w,u,b) = s > 1$. Totally differentiating $e(w,u,b) = sw$ and taking account of $e'_w = s$ implies

$$\frac{du}{db} = -\frac{e'_b}{e'_u} > 0, \tag{10}$$

which shows that an increase in the benefit rate raises the unemployment rate. Totally differentiating $e'_w(w,u,b) = s$ and using (10) to eliminate db yields

$$\frac{dw}{du} = \left(\frac{e''_{bw}}{e''_{ww}}\right) \cdot \left(\frac{e'_u}{e'_b} - \left(\frac{e''_{uw}}{e''_{bw}}\right)\right),$$

which can be re-written as

$$\frac{dw}{du} = \left(-\frac{e'_u}{w \cdot e''_{ww}}\right) \cdot \left(-\frac{e''_{bw}}{e'_b / w} - \left(-\frac{e''_{uw}}{e'_u / w}\right)\right). \tag{11}$$

Under the assumptions made, $-\frac{e'_u}{w \cdot e''_{ww}}$, $-\frac{e''_{uw}}{e'_u / w}$ and $-\frac{e''_{bw}}{e'_b / w}$ are all positive and the latter two ratios are the real wage elasticities of e'_u and e'_b, respectively. Thus *i)* a rise in the unemployment rate will correspond to a fall (rise) in the real wage rate if e'_u is more (less) elastic than e'_b with respect *w*; and *ii)* a change in the unemployment rate will have no impact on the wage rate if e'_u and e'_b show the same relative response with respect to a change in *w*.

We can use the above results to examine the way equilibrium output and unemployment are related to each other on the supply side. The symmetric long-run equilibrium of the industry is obtained when entry eliminates profits, $P = \int_{j \in N} p_j dj = PY - WL$

where $L = \int_{j \in N} L_j dj$ is total employment. Thus, through free entry and exit process N adjusts to ensure $P=0$, which can be solved to obtain $Y = wL$, which, given that $e = sw$, in turn implies

$$Y = \frac{1}{s} eL . \tag{12}$$

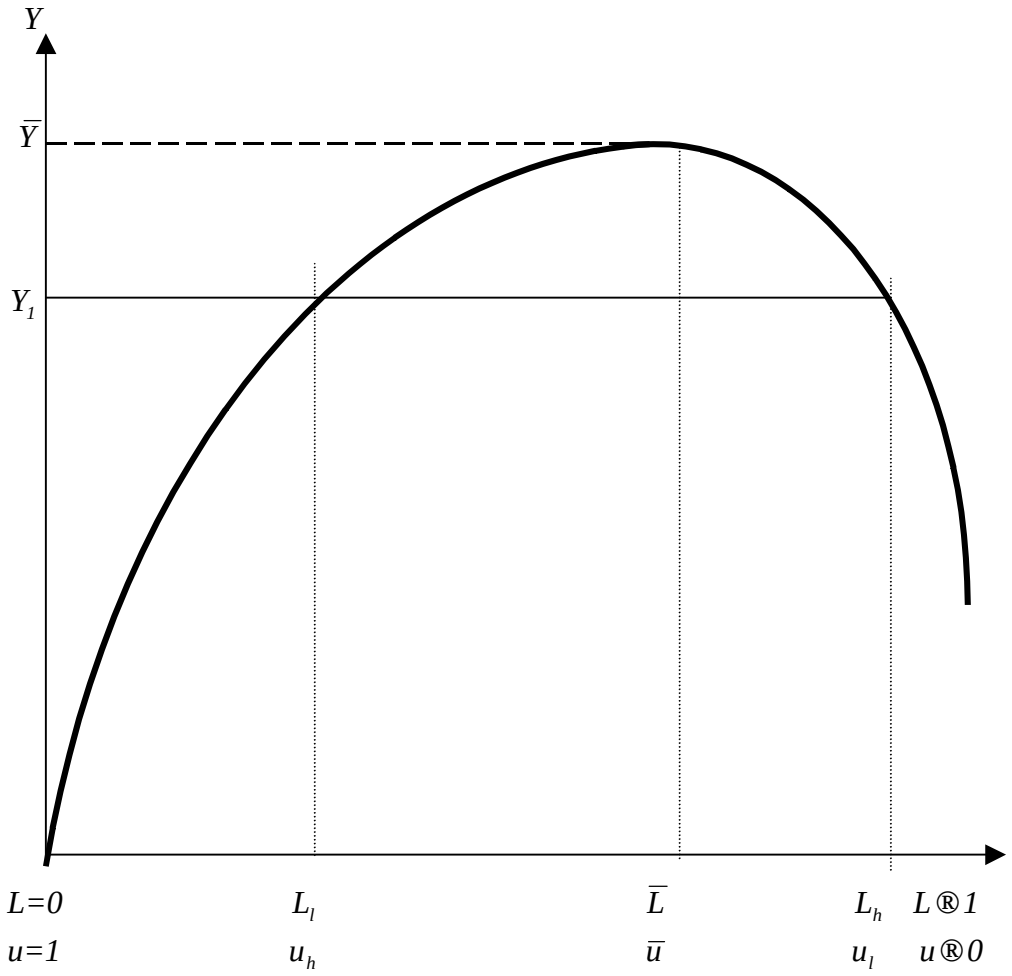
Equation (12) may be interpreted as a *'quasi-aggregate'* production function. It traces the combinations of aggregate employment and output *(L,Y)* which satisfy the supply side equilibrium in which labour productivity is determined by an effort supply function and firms pay wages to induces workers to supply the effort level that maximises their profit. Or, put differently, these combinations give the equilibrium locus that describes how Y changes as firms respond to changes in u while adjusting wages to ensure the resulting effort supply maximises their profit.

Normalising labour force to unity implies $L+u=1$. Taking account of this and recalling that $e = sw$ and hence $de = s\, dw$, total differentiation of (12) can be used to obtain

$$\frac{dY}{dL} = w\left(1 - \left(\frac{1-u}{u}\right)\left(\frac{u}{w}\frac{dw}{du}\right)\right), \tag{13}$$

which can be used to determine the shape of (12) in *(L,Y)* space. Provided that dw/du is finite as $u \to 1$, we would expect the right-hand-side of (13) to be positive for sufficiently large levels of u. Conversely, starting from very low levels of u, we would expect the right-hand-side of (13) to be negative as long as dw/du is positive and w is sufficiently elastic with respect to u (see discussion under (11)). Given these and assuming that dw/du is continuous in u, the equilibrium locus in *(L,Y)* space may be depicted as in Figure 1.

Figure 1. The equilibrium relationship between aggregate output and employment with efficiency wages and monopolistic competition



The shape in Figure 1 is capable of generating all the combinations outlined in Table 1 regarding the possible signs of *dY* and *du*. A clear prediction from Figure 1 is that unemployment and output, in the aggregate, are positively related when unemployment is low, and are inversely related when unemployment is high. Provided that observed, or measured, output is supply determined, we can use data in Table 2 to check whether evidence is consistent with this prediction. To do so, we first test to see if the occurrences of $[\,dY_t > 0 \,\&\, du_t > 0\,]$ and $[\,dY_t < 0 \,\&\, du_t < 0\,]$ reported in that table occur randomly or systematically throughout the sample. At the very least, for the relationship between *Y* and *u*

described above to be consistent with the data, we will have to find that the above sign combinations for the change output and unemployment occur systematically throughout the sample. Random occurrences of $[\,dY_t > 0 \,\&\, du_t > 0\,]$ and $[\,dY_t < 0 \,\&\, du_t < 0\,]$ on the other hand might be consistent with a number of alternative explanations, e.g. creative destruction, exogenous increase the labour force participation, or the net result of simultaneous exogenous shocks to aggregate supply and demand. However, none of these alternatives are capable of explaining systematic occurrences of the above phenomena. We conduct this check statistically using a 'runs test', which is a one-sample nonparametric test for randomness in a dichotomous variable[7].

Table 3: Runs Tests for the occurrences of $[dY_t>0 \,\&\, du_t>0]$ and $[dY_t<0 \,\&\, du_t<0]$ Cases

Country	T.V.	Cases < T.V.	Cases ³T.V.	Total Cases	No. of Runs	T.S.V.	A .S.
BEL	0.417	88	63	151	25	-8.301	0.000
DEU	0.345	78	41	119	43	-2.397	0.017
ESP	0.480	79	73	152	47	-4.871	0.000
FRA	0.553	59	73	132	50	-2.874	0.004
GBR	0.370	97	57	154	58	-2.568	0.010
IRE	0.430	86	65	151	29	-7.668	0.000
ITA	**0.513**	**75**	**79**	**154**	**76**	**-0.315**	**0.753**
NLD	0.400	69	46	115	35	-4.138	0.000
PRT	0.629	56	95	151	42	-5.158	0.000
SWE	**0.357**	**99**	**55**	**154**	**62**	**-1.711**	**0.087**

T.V. is the Test value (mean cut point); **T.S.V.** is the value of the test statistic; **A.S.** is the 2-tailed asymptotic significance level.

The bolded rows in Table 3 indicate the countries (i.e. Italy and Sweden) for which we are unable to reject the null hypothesis of randomness in the runs. Accordingly, these

[7] In this test we assign 1 to those periods where $[dY_t>0 \,\&\, du_t>0]$ and $[dY_t<0 \,\&\, du_t<0]$ and 0 to all other periods. A run is defined as any sequence of cases having the same value. The total number of runs in a sample is a measure of randomness in the order of the cases. Too many or too few runs can suggest a non-random or dependent ordering.

countries are excluded from further analysis which will focus on the specific prediction arising from Figure 1, i.e. unemployment and output are positively related when unemployment is low and inversely related when unemployment is high. Given that it is impossible to robustly estimate the underlying structural model generating the relationship in Figure 1 – since, for example, the model contains a number of unobservable variables – and because of the well-known specification and identification problems associated with estimating the simple bi-variate reduced form depicted in Figure 1, we opt to simply compare summary measures of central tendency of the unemployment rate across the two different states set out in Table 2. According to Figure 1, *u* should be low in state 1 and high in state 0, recalling that these states correspond, to $[dY_t > 0 \,\&\, du_t > 0]$ and $[dY_t < 0 \,\&\, du_t < 0]$, and $[dY_t > 0 \,\&\, du_t < 0]$ and $[dY_t < 0 \,\&\, du_t > 0]$, respectively. These simple comparisons are reported in Table 4.

Table 4: Comparing Mean and Median Unemployment Rates for the Periods when *Y* and *u* are positively and negatively related

Country	Mean for State 1 Periods	Mean for State 0 Periods	Difference Between Means	Median for State 1 Periods	Median for State 0 Periods	Difference between Medians
BEL	6.655	7.345	-0.689	7.066	8.847	-1.781
DEU	**3.503**	**3.267**	**0.236**	**3.246**	**2.909**	**0.337**
ESP	10.436	11.684	-1.248	7.603	15.351	-7.748
FRA	6.285	7.609	-1.323	5.661	9.002	-3.341
GBR	5.615	5.803	-0.187	4.419	5.914	-1.495
IRE	9.350	9.611	-0.261	7.765	8.310	-0.545
NLD	4.911	5.965	-1.054	4.071	5.856	-1.785
PRT	5.962	6.789	-0.828	5.593	7.106	-1.513

The results in Table 4 provide clear support for the prediction that states 0 and 1 are likely to occur at high and low levels of unemployment, respectively; with the exception of German data, the evidence shows a clear tendency for unemployment to be lower when output and unemployment are positively related and higher when they are negatively related.

Thus, of the 10 European countries examined only Italy, Sweden and Germany do not match this prediction, even though as seen in Table 2 that they have a significant number of occurrences of output and unemployment moving in the same direction[8].

To construct the aggregate supply locus in *(Y,P)* space, we next examine how output responds to changes in the price level. To this end, we can first use *L=1–-u* to re-write (13) as follows

$$dY = -w\left(1-\left(\frac{1-u}{u}\right)\left(\frac{u}{w}\frac{dw}{du}\right)\right)du\ . \tag{13'}$$

Using (10) and recalling that *b=B/P* and hence $db = -\left(\frac{B}{P^2}\right)dP$, we obtain

$$du = -\left(\frac{B}{P^2}\right)\left(-\frac{e_b'}{e_u'}\right)dP\,, \tag{14}$$

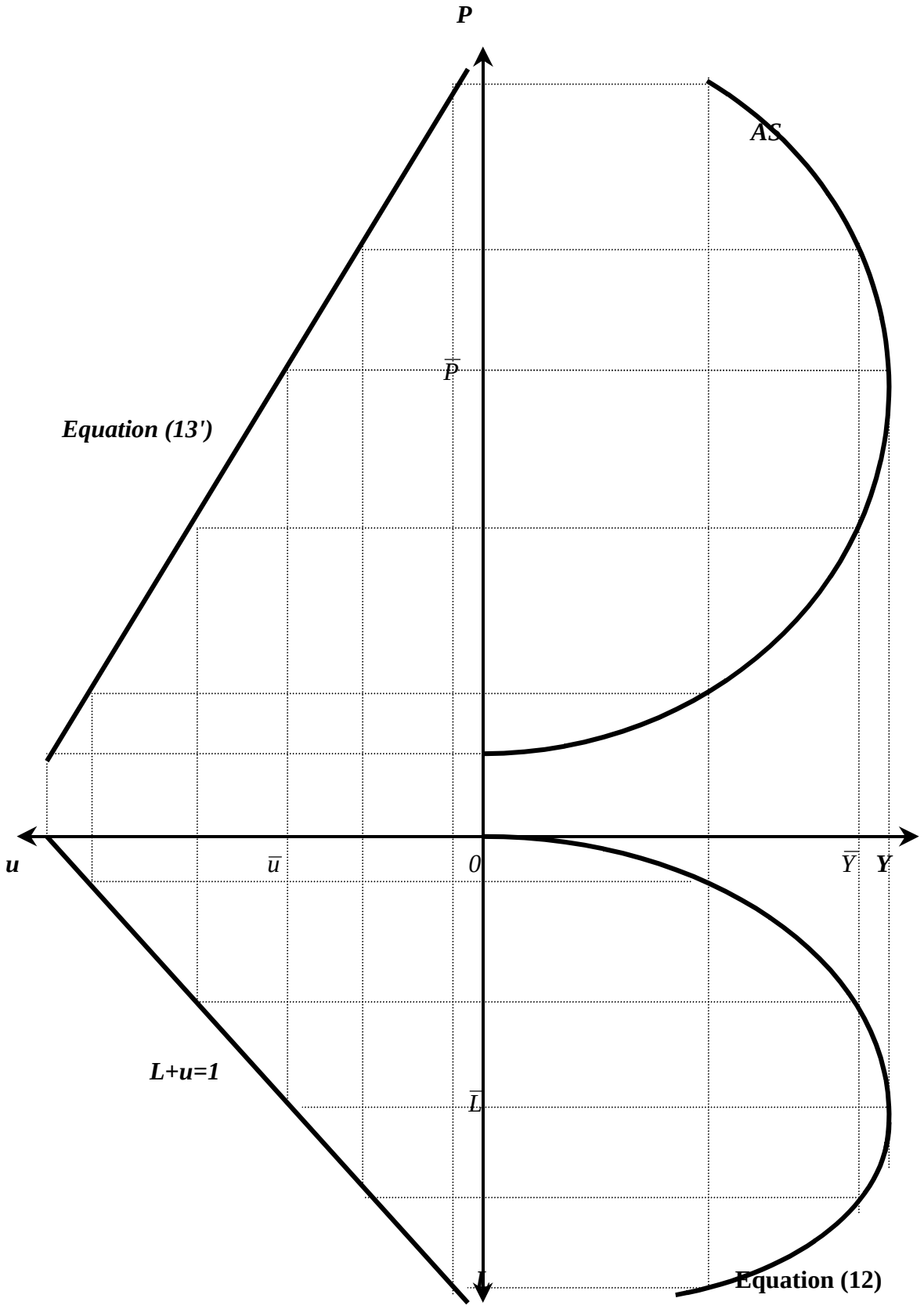
which shows the trade-off between the price level and unemployment rate that results from firms' optimising behaviour in the presence of an exogenously determined reservation wage, *B*. Upon substitution for *du* from (14) in (13') we have

$$\frac{dY}{dP} = \left(\frac{wB}{P^2}\right)\left(-\frac{e_b'}{e_u'}\right)\left(1-\left(\frac{1-u}{u}\right)\left(\frac{u}{w}\frac{dw}{du}\right)\right). \tag{15}$$

Given the discussion above regarding the sign of *dY/dL*, the right-hand-side of equation (15) implies that the sign of *dY/dP* changes from positive to negative as the level of

[8] This discrepancy may be due to the differences in the way labour markets function in these countries, e.g. use of guest labour, style of unionisation etc.. However, further investigation of these results is beyond the scope of this paper since we are not attempting to empirically establish the general validity of the theory. In contrast, our primary purpose is to determine the theoretical conditions under which market imperfections pose serious obstacles to welfare-improving stabilization policies and secondarily to check if any of the countries in our sample have cause for concern. Based on the simple data analysis presented in Section 2 we conclude that Lindbeck's reservations regarding the effectiveness of policy interventions have at least *prima facia* empirical support for a number of European countries.

Figure 2. The Backward-Bending Aggregate Supply Curve



output reaches $Y = \overline{Y}$, which is the level corresponding to the maximum supply that the economy can reach as illustrated in Figure 1. Thus, the aggregate supply, ***AS***, locus in *(Y, P)* is upward sloping initially as *Y* rises, but then bends backward and output supply falls as price rises. This is shown in Figure 2 where we sketch the derivation of ***AS*** by combining: *i)* the equilibrium relationship in (12) depicted in Figure 1 which is now drawn in the bottom right quarter; *ii)* the trade-off between the price level and unemployment rate in (13') which, for convenience, is approximated by a straight line in the top left quarter; and the labour force restriction $L+u=1$ which is drawn in the bottom left quarter. Those combinations of *P* and *Y* which satisfy these three relationships are then traced by dotted lines to the *(Y, P)* space in the top right quarter of Figure 2 to construct the aggregate supply curve which bends back at $\overline{Y}$ where output reaches its maximum as unemployment rate approaches $\overline{u}$.

3. Government, Households and Aggregate Demand

Government consumption consists of a CES bundle of the differentiated varieties produced in the economy as explained in (2), and the corresponding expenditure is

$$\int_{j \in N} \left(P_j g_j \right) dj = PG \,. \tag{16}$$

The government expenditure consists of (16) and the unemployment benefit payments *B* per unemployed. This expenditure is financed by a lump sum tax[9], *T*, which, together with the normalisation of the number of households to unity – on the assumption that each household is endowed with one unit of labour – gives rise to the following budget constraint

$$PG + uB = T. \tag{17}$$

[9] The use of a lump-sum tax is a common simplification in the literature. For further explanations see Molana and Moutos (1992), Heijdra and Van der Ploeg (1996) and Heijdra, *et al*. (1998) among others.

Each household supplies, inelastically, its unit of labour and at any point in time it can either be employed or be unemployed. When employed, a typical household works for a firm *j*, supplying the effort level $e_j>0$ and earning nominal wage W_j. If unemployed, it receives from the government the nominal unemployment benefit *B* at no effort. Dropping the distinction between firms and recalling that: *i)* the normalisation of the number of households to unity implies $L+u=1$; *ii)* profits are eliminated through a free entry and exit process, the 'expected' household income is given by $(1-u)W+uB$ and its budget constraint is

$$PC + M = (1-u)W + uB + \overline{M} - T \,, \tag{18}$$

where *M* is the desired stock of money, $\overline{M}$ is the existing money stock, *T* is the lump-sum tax, and *C* and *P* are the CES quantity and price indices described by equations (2) and (3), respectively[10]. Household's utility[11] is defined as a Cobb-Douglas function of *C* and $\frac{M}{P}$

$$u\left(C, \frac{M}{P}\right) = C^{a}\left(\frac{M}{P}\right)^{1-a} \,, \tag{19}$$

implying the following consumption and money demand equations,

$$C = a\left(\frac{(1-u)W + uB + \overline{M} - T}{P}\right), \tag{20}$$

and

$$\frac{M}{P} = (1-a)\left(\frac{(1-u)W + uB + \overline{M} - T}{P}\right). \tag{21}$$

---

[10] Note that $PC = \int_{j\in N}(P_j c_j)dj$ where P_j is price of the *j*th variety, the demand for which is $c_j = \left(\frac{P_j}{P}\right)^{-e}\left(\frac{C}{n}\right)$.

[11] For simplicity, like most studies we assume complete separation between households' and government's consumption. Therefore, government consumption does not appear in household's utility function. For some exceptions see, for example, Molana and Moutos (1989), Heijdra *et al* (1998) and Reinhorn (1998) who extend the original results by allowing for some substitution between the public and private consumption.

Given the above, the aggregate demand, ***AD***, can be derived as follows. Imposing the money market equilibrium by setting $M = \overline{M}$, (20) and (21) imply $C = \left(\frac{a}{1-a}\right)\frac{\overline{M}}{P}$, which can be substituted into the aggregate demand $Y = C+G$ to yield

$$Y = G + \left(\frac{a}{1-a}\right)\frac{\overline{M}}{P}. \tag{22}$$

4. Goods Market in General Equilibrium

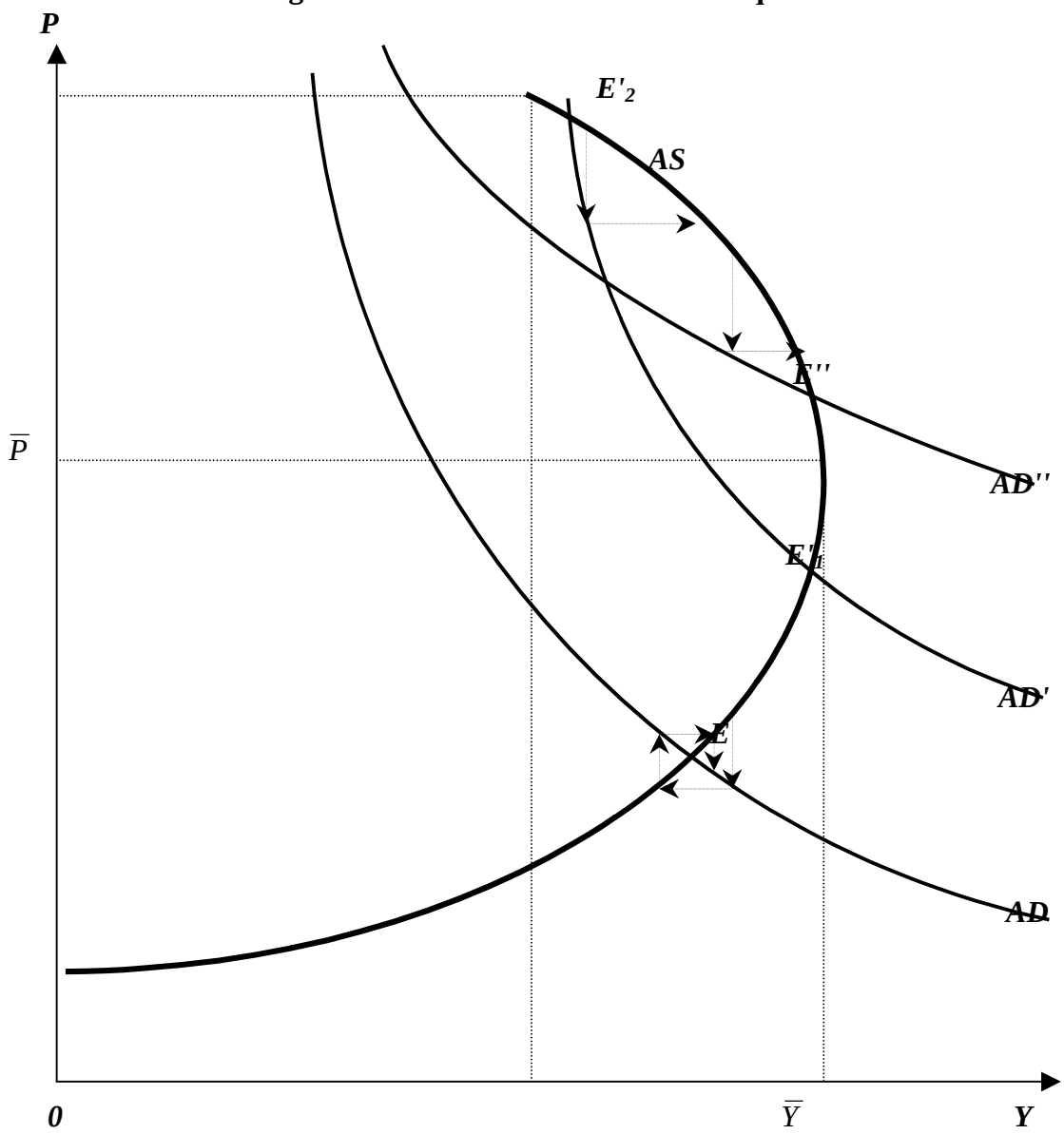
We can now study the general equilibrium properties of the economy described above by focusing on the goods market equilibrium and examining how the ***AD*** and ***AS*** curves interact in *(Y, P)* space. This is shown in Figure 3 in which ***AS*** is re-plotted as derived in Figure 2 and the curves labelled ***AD, AD'*** and ***AD''*** show three possible graphs of (22).

First, consider ***AD,*** which captures the familiar situation since a unique and stable equilibrium labelled ***E*** emerges where ***AS*** is upward sloping. A small expansionary demand shock will shift ***AD*** to the right and the new equilibrium will therefore be associated with higher levels of output, employment and price. It can be easily verified that the balanced budget fiscal multiplier in this situation is positive but less than unity (see below).

Next consider ***AD'*** which gives rise to two equilibria labelled $\boldsymbol{E'_1}$ and $\boldsymbol{E'_2}$. While $\boldsymbol{E'_1}$ has the conventional attributes as ***E*** above, $\boldsymbol{E'_2}$ is unstable and occurs where ***AS*** is downward sloping. Compared to $\boldsymbol{E'_1}$, $\boldsymbol{E'_2}$ corresponds to a lower level of output, a higher price level, and a considerably lower level of unemployment. Clearly, $\boldsymbol{E'_2}$ is not an equilibrium that will ever be selected by efficient market forces. Nevertheless, its existence suggests that, given suitable policy instruments, the pursuit of full employment policies could in fact entrap the economy in such an inefficient and unstable equilibrium. It is also interesting to note that,

disregarding the instability problem, the balanced budget fiscal output multiplier in this situation exceeds unity; output rises more than proportionally but employment falls! This apparently counter-intuitive result occurs because the economy at E'_2 is inefficient and suffers from what one may call hidden unemployment where labour is rather unproductive.

Figure 3. Goods Market in General Equilibrium



Now, consider the situation portrayed by ***AD''*** which has a unique intersection with ***AS*** at ***E''*** that occurs where ***AS*** is downward sloping. While the slopes of ***AD''*** and ***AS*** are

such that ***E''*** is stable, it is nevertheless important to note that this is an inefficient equilibrium since the same level of output could be produced at a considerably lower level of employment. Moreover, in this situation an expansionary fiscal shock which shifts ***AD''*** to the right raises the price level and employment but reduces output! This outcome could be explained as follows. The exogenous increase in demand initially raises prices and results in positive profits, which induces new entry that continues until profits are wiped out. But as the new entrants' hire workers the falling unemployment begins to show its impact on labour productivity, which results in losses and induces the loss making firms to exit. The process continues until a new equilibrium is achieved in which a smaller number of firms operate in a relatively inefficient environment where labour productivity is relatively low.

Finally, the fiscal multiplier mentioned above can be expressed as *1/(1-R)* where *R* is the ratio of slope of ***AD*** to that of ***AS*** at the initial equilibrium point. To see this, use the above explanation underlying the ***AS*** and ***AD*** to write

AS: $Y = Y^s(P)$

AD: $Y = G + Y^d(P)$

Totally differentiating these and eliminating *dP* yields

$$\frac{dY}{dG} = \frac{1}{1 - \frac{Y^{d\prime}(P)}{Y^{s\prime}(P)}}. \tag{23}$$

Equation (23) clearly shows how the size and sign of the multiplier is determined by the relative slopes of the ***AS*** and ***AD*** curves.

6. Summary and Conclusions

The main purpose of this paper has been to determine the theoretical conditions under which market imperfections pose serious obstacles to welfare-improving stabilization policies. To this end we have constructed a stylised general equilibrium model, consisting of price setting monopolistically competitive firms which offer efficiency wages, to show that demand led expansions may have a variety of expected and unexpected effects when market imperfections lead to changes in labour productivity. The interaction of the aggregate demand and supply functions derived in this model clearly show that, in principle, different types of equilibria could emerge including multiple equilibria. The main distinction between these equilibria, apart from their stability properties, relates to the level of labour productivity. This delineation has enabled us to rank the equilibria as 'efficient' and 'inefficient' and using these rankings we have shown that an exogenous stimulation of aggregate demand can only raise output and reduce unemployment provided the economy is operating relatively efficiently. However, when an economy is trapped in an inefficient equilibrium, we have shown that positive demand shocks can lead, perversely, to an increase in unemployment.

Additionally, based on the stylised facts regarding the co-movement of output and unemployment changes from a number of European countries, we have also shown that – in contrast to most of the current theoretical literature – the model developed in this paper is capable of reproducing the observed movements in the data (i.e. unemployment changes and output changes can be either positively or negatively related). Moreover, our simple data analysis suggested that, for most of the European countries in our sample, there was a clear tendency for unemployment to be lower when output and unemployment were positively related and higher when they were negatively related.

In conclusion, we hope that the analysis and empirical evidence provided in this paper have shed light on the importance of having reservations about the effectiveness of policy interventions in the face of market imperfections and lend support to the concerns expressed in Lindbeck (1992).

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Appendix: Derivation of the Effort Supply Function *e(w,u,b)*

This appendix explains how a specific effort supply function such as that in equation (6) can be derived within the framework of the Efficiency Wage Hypothesis. As explained in Section 2, equation (6) could in fact be derived by maximising a suitably constructed function which describes a household's preferences for employment and effort. We denote this by *v(e)* and assumed that: *i)* agents associate a positive level of utility with being employed; *ii)* the level of utility attached to employement is higher, the larger is the unemployment rate in the economy; and *iii)* while agents dislike effort and would like to reduce it as much as possible, doing so will raise the probability of losing their job due to shirking. Using these, we explain our derivation of an effort supply function such as equation (6) in a number of stages.

In stage 1, we define the probabilities associated with moving from one state to another:

f: probability associated with being fired when shirking.
We assume that shirking is the only reason for being fired. Therefore, *ceteris paribus*, *f* is a monotonic function of the effort level, *e*. Thus, $f = f(e)$; $f(0) = 1$; $f(1) = 0$; and $f' < 0$. For simplicity, we let $f(e) = 1 - e$.

h: probability associated with finding a job, or being hired, when unemployed.
We assume that the labour force is homogeneous and, *ceteris paribus*, *h* is a monotonic function of the unemployment rate, *u*. Thus, $h = h(u)$, $h(0) \leq 1$, $h(1) = 0$, $h' < 0$. For simplicity we let $h(u) = 1 - u$.

In stage 2, we define the utility indices corresponding to being in each state:

V^H: utility of being hired (or finding a job)
V^E: utility of being in employment (or working)
V^F: utility of being fired (or losing one's job)
V^U: utility of being unemployed

In stage 3, we explain how the above utility indices are determined, and use them to construct the subutility *v(e)*.

i) We use V^U as our benchmark and let $V^U = b$, where *b* is the real value of the reservation wage, or in our model the unemployment benefit, $b=B/P$.

ii) We assume that a potential worker prefers finding a job (or being hired) to remaining unemployed. The simplest way to implement this assumption is to let $V^H = bV^U$, $b>1$. Adding a further assumption that the relative satisfaction of finding a job is higher the larger is the extent of unemployment, implies $b = b(u)$, $b(0) > 1$, $b' > 0$, $b'' < 0$.

iii) We construct V^E using the standard idea that the utility from working is proportional to the real wage $w=W/P$ earned which ought to be adjusted for the

disutility of effort. Thus, we let $V^E = gw - ke^2$ where $g \geq 1$ is a factor scaling income from work, $k>0$ is a constant parameter and the disutilty of effort is assumed to rise at an increasing rate. Now, adding a further assumption that the marginal utility of income from employment is higher the larger is the extent of unemployment, implies $g = g(u),\ \ g(0) = 1,\ \ g' > 0,\ \ g'' < 0$. To keep notation simple we adopt the normalisation $b = 1 + g$.

iv) Given that a 'fired' worker can either be hired or remain unemployed, we let V^F be a weighted average of V^H and V^U. Thus, $V^F = hV^H + (1-h)V^U$.

v) Finally, given that $v(e)$ is, by definition, the 'expected utility' of remaining in employment, we let $v(e) = (1-f)V^E + fV^F$.

Based on the above explanations, we obtain,

$$v(e) = e\left(gw - ke^2\right) + (1-e)\left((1-u)(1+g)b + ub\right).$$

The agent takes (w,u,b) as given and chooses e to maximise $v(e)$, the first order condition for which is

$$-3ke^2 + gw - \left((1-u)(1+g)b + ub\right) = 0.$$

Letting $d \quad 1 + (1-u)g$ and using normalisation $k=1/3$, we obtain an explicit functional form for equation (6), namely $e = \left(gw - db\right)^{1/2}$. While it is clear that $e'_w > 0$ and $e'_b < 0$ always hold, the sign of $e'_u = \left(\frac{1}{2e}\right)\left(b[w-(1-u)b]g' + gb\right)$ is not readily determined. But it can be seen that $e'_u > 0$ is also satisfied since $g' > 0$ and $w > (1-u)b$ holds. It is also easy to verify that $e''_{ww} = \frac{\partial^2 e}{\partial w^2} < 0$, $e''_{wb} = \frac{\partial^2 e}{\partial w \partial b} > 0$ and $e''_{wu} = \frac{\partial^2 e}{\partial w \partial u} < 0$ hold and the condition $\frac{e'_u}{e'_b} - \frac{e''_{wu}}{e''_{wb}} < 0$ is satisfied which implies dw/du obtained in (11) is positive, as required.