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<b>Authors(s)</b>	Moore, Michael J.
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WAGES AND EMPLOYMENT - REVISITED

The book  
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## Money Wages and Employment--Revisited

### Abstract

The Barro-Grossman/Malinvaud model is extended to include two factors of production: skilled labour with a flexible price and unskilled labour with an exogenously determined money wage. A number of simple diagrams are constructed to examine the possibility that factor substitution could enable wage cuts to restore full employment. However easily interpretable conditions are derived to illustrate the circumstances under which employment of unskilled labour responds perversely to changes in money wages.

## 1. Introduction

The Neo-Classical "equilibrium" argument is that unemployment of labour can be reduced by a downward adjustment in money wages. Thus, unemployment is voluntary in that sufficiently large reductions in wages can restore full employment. Keynes(1936, chap. 19) contested this and argued that unless money wage changes affected the components of aggregate demand there would be no direct impact on output or employment. Keynes's conclusion was that wage cuts were at best slow and unreliable means of restoring full employment. Indeed the possibility was raised that a wage cut could have counter-intuitive effects on output and employment.

The subsequent controversy is well summarised in Tobin(1947) who pointed out that Keynes's conclusion that wage changes have no effects on the supply of output is critically dependent on the assumption that labour is the only variable factor. Tobin argued that even if a wage cut left the level of output unchanged, factor substitution could lead to an increase in employment in accordance with the classical prescription. In his exposition of fix-price theory, Malinvaud(1977) shows that in "Keynesian" temporary equilibrium the effect of a money wage cut is to depress effective demand and thus output and employment. This is the most extreme statement of the Keynesian position and suffers from the same weakness that Tobin drew attention to a generation ago, namely, that labour is modelled as the only variable factor of production.<sup>1</sup>



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The purpose of this paper is to pursue Tobin's reservation in the light of developments in fix-price theory. The basic Barro-Grossman model is adapted to incorporate a second variable factor which is elastically supplied with a flexible price. The effect of changes in the exogenous unskilled wage in the Keynesian state is examined with the aid of simple diagrams and easily interpretable conditions are derived whereby Malinvaud's strong result is preserved.

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1. Malinvaud's result also depends on his assumption that current-period profits are held over in subsequent periods. It is easy to show even for the general case that if profits are instantly distributed money wage changes are neutral in their effect on aggregate demand.

## 2.The Agents

An aggregate firm produces a single good using two factors of production - skilled labour and unskilled labour. There are two distinct aggregate households: one supplies unskilled labour (the "unskilled household") and the other supplies skilled labour (the "skilled household"); the latter also owns all of the shares in the firm. Though a government is implicitly present in this monetary economy its activity can be suppressed without loss of generality. The price of goods ( $p$ ) and the unskilled wage rate ( $w$ ) are exogenous but the skilled wage rate ( $v$ ) is flexible. Only one time period is considered, there is no investment or inventories, expectations are exogenous and there is no foreign trade.

The skilled household purchases goods ( $z$ ), supplies skilled labour ( $s$ ) and accumulates money balances ( $j$ ) according to the budget constraint:

$$(2.1) \quad pz + j = vs + J$$

where  $J$  is lump sum income and includes last period's profits which are paid at the beginning of the current period. Leisure and current goods are normal and gross substitutes and the effect of wages on the supply of labour is assumed positive. Thus:

$$(2.2) \quad e_v^z > 0 \quad e_v^s > 0$$

where  $e_v^z$  is the wage elasticity of the demand for goods and  $e_v^s$  is the own price elasticity for the supply of skilled labour. The unskilled household is quantity constrained in the labour market and chooses its demand for goods ( $k$ ) and its end period money balances ( $m_1$ ) subject to:

$$(2.3) \quad pk + m_1 = wn + m_0$$

where  $n$  is the firm's demand for unskilled labour and is less than full employment<sup>2</sup> and  $m_0$  is initial money balances. Current goods are normal so that from Neary and Roberts(1980):

$$(2.4) \quad e_n^k = e_w^k = b/a$$

where  $e_n^k$  and  $e_w^k$  are the employment and wage elasticities of the demand for goods by the unskilled household, respectively and  $b$  and  $a$  are its marginal and average propensities to consume out of wage income respectively.

The firm is rationed in the goods market and produces the amount of the good ( $y$ ) which is demanded by the two

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2. It is assumed that labour is notionally supplied inelastically by the unskilled household though this does not substantially alter the analysis which follows. The assumption is used in the derivation of (2.4) but it is not essential: a sufficient condition for this result is that leisure is weakly separable from goods and money in the unskilled household's utility function.

aggregate households.

$$(2.5) \quad y = k+z$$

The technology is strictly convex and the amounts of the two inputs are chosen so as to minimise cost.<sup>3</sup> This immediately suggests the behaviour of the firm is best summarised by the cost function:

$$(2.6) \quad c = c(w,v,y)$$

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3. Because the firm is not producing the output level which maximises profit, the marginal product of both factors is greater than their respective factor prices. Though scale efficiency is not possible, cost minimisation implies that the firm equates the marginal rate of (technical) substitution to the factor price ratio.



### 3. The Model

The general equilibrium of the above system of behavioural assumptions can be summarised by equations (3.1) to (3.3):

$$(3.1) \quad y = k(\underset{-}{p}, \underset{+}{w}, \underset{+}{n}, \underset{+}{m_0}) + z(\underset{-}{p}, \underset{+}{v}, \underset{+}{J})$$

$$(3.2) \quad n = c_w(\underset{-}{w}, \underset{+}{v}, \underset{+}{y})$$

$$(3.3) \quad s(\underset{-}{p}, \underset{+}{v}, \underset{-}{J}) = c_v(\underset{+}{w}, \underset{-}{v}, \underset{+}{y})$$

(3.1) states that output is demand determined; (3.2) that the level of employment of unskilled labour is given by the firm's demand for that factor and (3.3) indicates that  $v$  adjusts to clear the skilled labour market. The signs of  $c_{wy}$  and  $c_{vy}$  amount to the additional assumption that both factors are "normal" in production. The three equations solve for the three endogenous variables  $y$ ,  $n$ ,  $v$  given the exogenously determined values of  $w$ ,  $p$ ,  $J$  and  $m_0$ . Since our purpose is to examine how the equilibrium is disturbed when  $w$  changes, it is useful to respecify (3.1) to (3.3) in terms of equations of change following Jones(1965):

$$(3.1a)^4 \quad \hat{y} = \theta_n b(\hat{w} + \hat{n}) + \chi_s e^{z\hat{v}}$$

$$(3.2a) \quad \hat{n} = \theta_s \hat{v}(\hat{v} - \hat{w}) + c_y^n \hat{y}$$

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4. To derive (3.1a),  $\theta_n = \chi_n/a$  is invoked in addition to (2.4).

$$(3.3a) \quad e_v^{\hat{S}\hat{V}} = \theta_n \sigma (\hat{w} - \hat{v}) + c_y^{\hat{S}\hat{Y}}$$

where  $c_y^n$  and  $c_y^s$  are the elasticities of demand for unskilled and skilled labour respectively with respect to output;  $\theta_n$  and  $\theta_s$  are the factor shares of unskilled and skilled labour respectively;  $\chi_n$  and  $\chi_s$  are the shares in consumption of unskilled and skilled labour respectively;  $\sigma = pyc_{wv}/c_v c_w$  is a measure of factor substitutability.<sup>5</sup> A "hat" (^) indicates a proportionate rate of change.

It is useful to examine the equilibrium diagrammatically. In figure 1,  $v$  is measured on the vertical axis and  $y$  on the horizontal. SLM is the skilled labour market equilibrium locus. From (3.3a), it is upward sloping because as  $v$  increases, excess supply tends to increase, while as output increases demand increases: thus  $y$  and  $v$  must move in the same direction to maintain equilibrium. The elasticity of the SLM is:

$$(3.4) \quad c_y^s / (e_v^s + \theta_n \sigma)$$

Above the SLM, incipient excess supply prevails and conversely below the locus.

GMEL is the goods market equilibrium locus. Its slope

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5. The Hicks elasticity of substitution is:

$$(\theta_n + \theta_s)(pyc_{wv}) / c_v c_w$$

Thus, our  $\sigma$  is larger than the elasticity of substitution given that the production set is strictly convex.

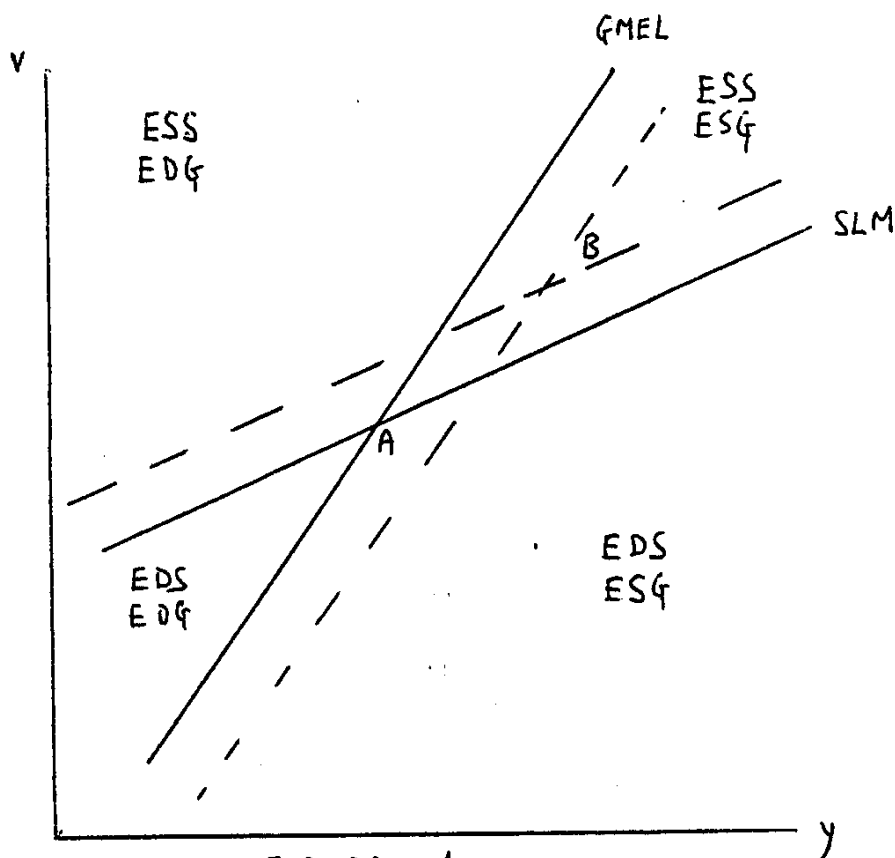


FIGURE 1.

EXAMPLES OF NOTATION:

ESS: "EXCESS SUPPLY OF SKILLED LABOUR"

EDG: "EXCESS DEMAND FOR GOODS"

is not immediately obvious because of variations in the employment of unskilled labour which are not explicitly evident in figure 1. As  $v$  rises the demand for goods by skilled workers increases directly while indirectly employment of unskilled workers expands through factor substitution, reinforcing the direct effect. An increase in output leads to incipient excess supply because the induced increase in demand by unskilled workers is less. Thus  $v$  and  $y$  must move in the same direction to secure equilibrium and the GMEL is upward sloping with elasticity:

$$(3.5)^6 \quad (1 - \theta_n b c_y^n) / (\chi_{se}^z + \theta_s \theta_n b)$$

Incipient excess demand for goods prevails above the locus and conversely below. In figure 1, the GMEL has been drawn intersecting the SLM from below. This follows from the correspondence principle as invoked by Dixit(1978). If  $v$  is considered to adjust to clear the skilled labour market and  $y$ , the goods market, then stability demands that the GMEL cut the SLM from below.

It is easy to see the consequences of changes in  $w$  from figure 1. Consider the SLM: when  $w$  rises, the demand for skilled labour increases so that the SLM shifts upwards. This is the "pure substitution" effect. The effect on the GMEL is ambiguous: an increase in the unskilled wage

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6.  $\theta_{nc_y}^n < 1$  can be seen by totally differentiating the production function and recalling that both  $c_y^n$  and  $c_y^s$  have been assumed to be positive.  $b$ , the marginal propensity to consume is, of course, less than unity.

directly increases the demand for goods but it also depresses employment of unskilled workers through factor substitution which works in the opposite direction. This is the "net income" effect. If factor substitution dominates the net income effect, the rise in  $w$  causes excess supply of goods and the GMEL shifts to the left. However, a necessary and sufficient condition for the net income effect to increase demand and thus shift the GMEL to the right is:

$$(3.6) \quad \theta_s \sigma < 1$$

(3.6) is a sufficient condition for output to increase as a consequence of the increase in the unskilled wage. This is shown in figure 1, and it is clear that the original equilibrium at A has moved to the North-West at B. From (3.2a), (3.6) is equivalent to the requirement that the conditional elasticity of demand for unskilled labour be less than unity.

However, a rise in output is not sufficient for unskilled employment to increase: this also depends on  $v$ . In figure 2,  $v$  is again measured on the vertical axis but, in contrast to figure 1, the horizontal axis shows  $n$ . UU is the unskilled labour market locus. From equation (3.2a) it is clear that as  $v$  rises, the demand for unskilled labour increases because of the substitution effect and this is reinforced by the income effect. When  $n$  rises, the induced rise in demand is less so that "excess supply" emerges. Thus  $v$  and  $n$  must move in the same direction to maintain

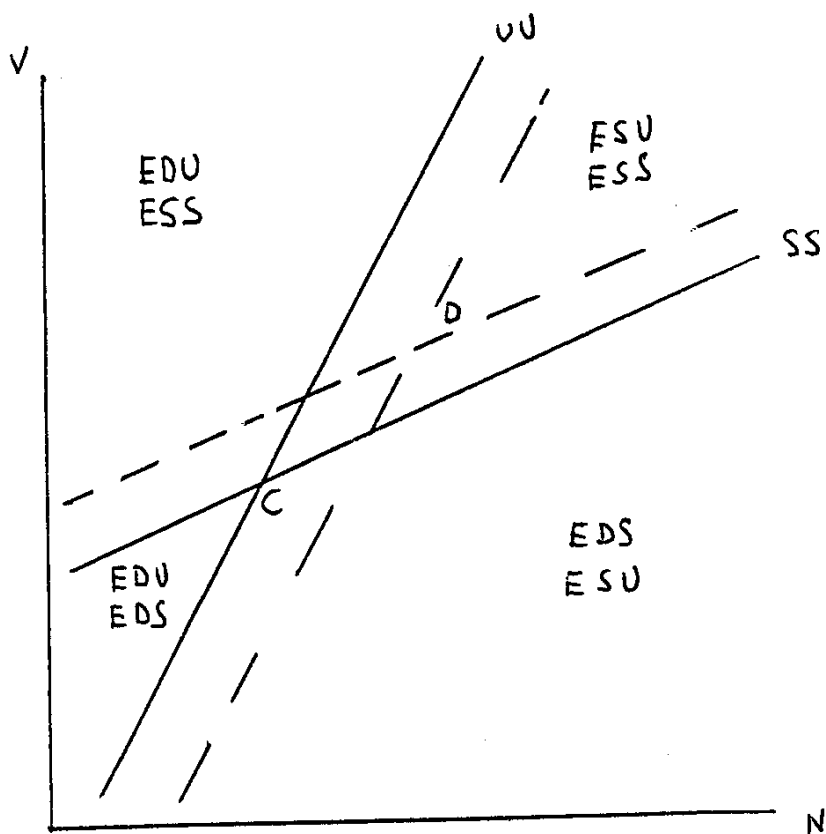


FIGURE 2.

equilibrium in the unskilled labour market and the UU locus is upward sloping with elasticity:

$$(3.7) \quad (1 - \theta_n b c_y^n) / (\theta_s \sigma + c_y^n \chi_s e_v^z)$$

Incipient excess demand prevails above the locus and conversely below.

SS is the skilled labour market locus in figure 2. As  $n$  rises, the effective demand for goods and consequently output increases as is evident from equation (3.3a): this causes incipient excess demand in the skilled labour market. The impact of an increase in  $v$  is ambiguous: demand falls through the factor substitution effect and supply rises both leading to excess supply; however an increase in  $v$  also augments income which acts in the opposite direction. The elasticity is:

$$(3.8) \quad (\theta_n b c_y^s) / (e_v^s + \theta_n \sigma - c_y^s \chi_s e_v^z)$$

However, the same type of stability argument which was invoked in connection with figure 1, indicates that the SS curve should be upward sloping cutting the UU locus from above.<sup>7</sup> Excess supply of skilled labour is incipient to the left of the SS locus and conversely to the right.

It is now possible to read off the effect of changes in

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7. Indeed, it can be shown that the stability condition required for the configuration of figure 1 is equivalent to that required for figure 2.

w on unskilled employment from figure 2. A rise in w unambiguously shifts the SS curve to the left because the demand for the skilled factor increases through both the substitution and income effects. However a rise in w has an ambiguous effect on the UU locus: the substitution effect tends to shift the locus upward but the income effect does the opposite. The necessary and sufficient condition for the UU locus to shift downwards is:

$$(3.9) \quad \theta_s \sigma < \theta_n b c_y^n$$

This position is illustrated in figure 2 where n has increased in moving from C to D. Thus (3.9) is a sufficient condition for employment of unskilled workers to rise following a wage increase. The similarity with (3.6) is obvious: (3.9) places an upper bound on substitution possibilities as summarised by the own-price elasticity of the conditional demand schedule for the unskilled factor.<sup>8</sup> As would be expected, (3.9) is more restrictive as its right-hand side is less than unity (see footnote 6): it is also more intuitive as it directly compares substitution and income effect parameters.

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8. Akerlof (1981) provides a convincing theoretical justification for a low wage elasticity of demand for unskilled labour.



## Conclusion

This study has returned to an old problem for Keynesian economists and shown how it can be approached in the light of the insights of fix-price theory. It has also introduced a necessary sophistication into aggregate fix-price theory: the possibility of factor substitution in production. Though the fix-price factor is "unskilled labour", in contrast to the flexibly priced "skilled labour", the labels need not be taken literally. "Skilled labour", of course, signifies the aggregate of factors which in the short run are both variable in supply and have a flexible price. However, there is a serious intent in the nomenclature to the extent that even the most ardent fix-price theorist must accept that some wage rates, usually in the more mobile professional, managerial and other skilled categories, are best modelled as flexible.

A notable feature of the two conditions derived is that they require no knowledge of the consumption behaviour of the flexibly priced factor. This is not to deny the obvious weaknesses of the model, principal among which is the lack of any serious intertemporal or expectational structure. Nevertheless, the model goes some way to strengthen the Keynesian emphasis on the essential irrationality of wage cuts in conditions of demand-deficient unemployment.

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