HOW ARE PRODUCT DEMAND CHANGES TRANSMITTED TO THE LABOUR MARKET?

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In the traditional Keynesian and classical models, the transmission of product demand changes to the labour market generally involves wage-price sluggishness or counter-cyclical real wage movements. In practice, however, real wages are often acyclical or procyclical, and wages and prices are flexible over periods of several years. This paper examines the main channels whereby product demand can affect employment under these conditions. The analysis suggests that the effectiveness of demand management policies under wage-price flexibility depends significantly on the availability of a limited number of supply-side transmission channels.

The question of how product demand changes are transmitted to the labour market has been the focus of unremitting interest in macroeconomics. In the Keynesian literature, there are two main channels of transmission: First, if prices are assumed to be more responsive than nominal wages to product demand changes, then a rise in demand reduces the real wage and thereby raises employment. Secondly, if prices are sluggish, a product demand shock has a direct effect on labour demand without requiring any change in the real wage. In the natural rate models and intertemporal substitution models, a rise in product demand may lead to a temporary outward shift of the labour supply curve, reducing the real wage and raising employment.

The Keynesian and New Classical channels of transmission that work via the real wage imply counter-cyclical real wage movements, namely, the real product wage and employment move in opposite directions. In practice, however, real wage movements are often acyclical or even pro-cyclical (particularly in the United States). Moreover, all the transmission channels above – those operating through the real wage and price inertia – are relevant primarily to the short run; they tell us little about how product demand changes can affect employment once wages and prices have responded fully, and intertemporal substitution effects and errors in price expectations have disappeared. This is a serious handicap if demand variations are to be seen as an explanation of prolonged periods of low unemployment (as in the 1960s) or high unemployment (as in Europe during the 1980s). For aggregate product demand to have a significant role in explaining such prominent unemployment movements, the influence must extend beyond the short run.

In response to these deficiencies, this paper aims to identify channels whereby product demand changes are transmitted to employment, without (a) assuming wage-price inertia or (b) implying counter-cyclical movements of the real wage. The underlying motivation is to provide a plausible account of how demand management policies and other demand changes can affect employment over a period long enough for prices to be flexible and for price surprises and intertemporal substitution to be insignificant. This issue is controversial and important: some economists believe demand-side policies to
be effective only in the short run, while others assert that there are longer-term effects without explaining the various channels whereby these may occur. This paper focuses on both the medium run, when capital is roughly constant and there are diminishing returns to labour, and the long run, over which the capital stock adjusts fully.

To fix ideas, let the labour market equilibrium be depicted by the intersection between a labour demand curve and a wage setting curve, as shown in Fig. 1a. Under diminishing returns to labour, when the labour demand curve slopes downwards, it is clear that if changes in product demand do not shift the labour demand curve, then any employment effect must involve counter-cyclical real wage movements.

Thus, in order to explain how a change in product demand could affect employment without counter-cyclical real wage movements, we need to show how it could shift the labour demand curve, as illustrated in Fig. 1a.

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1 The labour demand curve (LD) may be interpreted as a relation between the real wage and labour demand that emerges when imperfectly competitive firms set prices and employment at predetermined wages. The wage setting curve (WS) could be either a labour supply curve (in a market-clearing model) or a relation between the real wage and employment that emerges from union bargaining, efficiency wage minimisation, and insider-outsider mechanisms.

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Alternatively, we need to show why, in the presence of diminishing returns to labour, the labour demand curve may be flat or upward-sloping. Then a product demand shock that shifts the wage setting curve could generate acyclical or pro-cyclical movements in the real wage, as illustrated in Fig. 1b.

These are clearly necessary, but not sufficient, conditions for the transmission of product demand changes to employment in the absence of counter-cyclical real wage responses. By confining itself to these necessary conditions, this paper becomes manageable in scope, since it restricts our analysis to the position and slope of the labour demand curve. However, it is worth emphasizing that the paper thereby leaves out a number of conceivable interactions between imperfectly competitive product and labour markets, e.g. income effects on labour supply, increasing returns, and search with strategic complementarities. It also does not consider what adjustment costs, labour immobilities, and aggregation across heterogeneous labour markets imply for the transmission of product demand shocks, since these have been covered in detail elsewhere. Dixon and Rankin (1993) contains an excellent survey of these issues.

It is common in many strands of macroeconomics to assume that the transmission of product demand changes to employment is automatic, in the sense that any type of product demand increase (whether it takes the form of road building, income tax reduction, or anything else) will invariably raise the demand for labour, so that the level of product demand may be used as a shift parameter in the labour demand curve. Our analysis takes issue with this presumption. Furthermore, we show that the ability of any given type of product demand to shift the labour demand curve depends on whether a limited number of transmission channels are open. We argue that certain supply-side channels — operating through the degree of capital utilisation, entry and exit of firms, and the productivity-enhancing effects of infrastructure investment — are particularly important in this regard. As we shall see, these results have potentially important policy implications.

If a downward-sloping labour demand curve shifts outwards in response to a product demand rise, it is of course possible that the wage setting curve may shift further outwards, so that the real wage would still move counter-cyclically. And even if the labour demand curve is upward sloping, the real wage will not move pro-cyclically unless the wage setting curve shifts outwards. See, for example, Dixon (1987), Mankiw (1988), and Startz (1989). These effects are relevant to the influence of product demand on the wage setting curve.

See, for example, Cooper and John (1988) and Chatterjee and Cooper (1989). See, for example, Howitt (1985) and Pissarides (1985).

For example, in Dixon (1988) unions reduce the degree of labour mobility, and thus the allocation of government spending across sectors influences the employment level. In Lindbeck and Snower (1988), an increase in product demand that temporarily reduces the real wage (on account of, say, a nominal wage rigidity) will raise employment even after the real wage returns to its initial equilibrium, because of unemployment persistence mechanisms.

Here are some examples: '...insert a parameter B (for business cycle) [into the labour demand function], with the convention that an increase in B increases the demand for labor at any wage.' (McDonald and Solow (1981), p. 899). 'In the standard short-run case when labor is the only variable input, the demand for labor is \( F^{-1}(AD(P(i)/P)) \), where \( Y(i) = F(N(i)) \) is the short-run production function. (..) The employment offered by the representative firm is simply \( N[w, AD(1)] \) [where \( AD \) is aggregate demand].' (Solow (1986), p. 526). 'In this case [i.e. when the goods markets are imperfectly competitive] a firm's labor demand depends on real aggregate demand as well as the real wage, because changes in aggregate demand shifts the firm's labour demand.' (Ball et al. (1988)).
The paper investigates the channels of transmission under three different sets of circumstances. Section I considers the case in which the stock of capital is given and there is full capital capacity utilisation. Section II extends the analysis by including the possibility of excess capital capacity. Section III deals with the long run, when the capital stock is endogenous. Finally, Section IV concludes by providing a brief overview and evaluation of the various transmission channels.

I. Channels of Transmission Under Fixed, Full Capital Capacity

Consider a sector containing a fixed number \( F \) of identical firms producing a homogeneous, nondurable product in the absence of risk and making their pricing, employment, and production decisions simultaneously. Let the sectoral and product demand function be

\[
Q = Q\left(\frac{P}{\Pi}, \frac{X}{\Pi}, A\right),
\]

where \( P \) is the product price, \( \Pi \) is an aggregate price index, \( X \) stands for nominal endowments (e.g. money balances carried forward from the past), and \( A \) is a shift parameter representing the various other exogenous determinants of product demand (e.g. government product demand). If all sectors are identical, the economy-wide product demand function may be captured by the special case where \( P = \Pi \).

Each firm is an imperfect competitor in the product market. To consider a broad spectrum of imperfectly competitive behaviour, extending from monopoly to perfect competition, we depict the firm's interactions with its rivals through the simple assumption that, when it increases its production \( (q) \) by one unit, it expects its rivals to increase their production by \( c - 1 \) units:

\[
\frac{d(Q^e - q)}{dq} = c - 1,
\]

where \( Q^e \) is expected aggregate output, \( (Q^e - q) \) is expected output of the firm's rivals and \( c \) is a constant.\(^8\)

The firm's production function is

\[
q = h(n), \quad h_n > 0, \quad h_{nn} < 0
\]

where \( n \) is its employment, and we implicitly assume that the firm is operating under fixed, full capital capacity. The firm makes its employment \( (n) \), production \( (q) \), and pricing \( (P) \) decisions so as to maximise its profit, \( z = Pq - Wn \), subject to the product demand function \((1)\), the conjecture function

\(^8\) This formulation has the advantage of simplicity, without removing our analysis from the domain of conventional bargaining games, on account of the following special cases: (a) Under Cartel behaviour \( (c = F) \), the firm expects each of its rivals to make the same production decision as it does itself, and thus all firms behave as if they were joint profit maximisers; (b) under Cournot behaviour \( (c = 1) \), the firm expects its production decision to have no effect on the production decisions of its rivals; and (c) under perfectly competitive behaviour \( (c = 0) \), the firm expects its production decision to have no effect on aggregate output.

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(2), the production function (3), and a predetermined wage \(^9\) \((W)\). For this problem, we obtain the standard first-order condition in which the real marginal value product of labour is set equal to the real wage:

\[(1 - m) h_n = W/P = w, \]

where \(w\) is the real wage and \(m = c/(\eta F)\) is the Lerner index of monopoly power\(^10\), with \(\eta\) being the price elasticity of product demand.\(^11\) Inverting this function and letting aggregate (sectoral or economy-wide) employment be \(N = nF\), we obtain the aggregate labour demand curve:

\[N = FL\left(\frac{w}{1 - m}\right), \]

where \(L = (h_n)^{-1}\). Under diminishing returns to labour, this curve is downward sloping \((L' < 0, \text{since } h_n < 0)\).

While this labour demand curve is commonplace in microeconomics, note that it has important implications for the transmission of product demand changes to the labour market and that these implications have largely been neglected in macroeconomics:

**Proposition 1.** For the downward-sloping aggregate labour demand curve (5), an increase in product demand can raise employment without necessarily generating a countercyclical real wage movement only if the labour demand curve shifts outwards. This occurs if and only if

(i) the price elasticity of product demand \((\eta)\) increases,

(ii) the imperfectly competitive interactions among firms, described by \(c\), become more competitive,

(iii) the number of firms \((F)\) increases, or

(iv) the marginal product of labour \((h_n)\) increases.

Observe that since the shift parameter \(A\) of the product demand function is not an argument of the labour demand curve (5), the position of the aggregate labour demand curve does not depend on product demand independently of the transmission channels above. This insight is not compatible with a common macroeconomic formulation of the labour demand curve: \(N = AL(w), L' < 0\) (see footnote 7).

The intuition underlying Proposition 1 is quite straightforward. Suppose that there is an outward shift in the product demand function (1), as illustrated in Fig. 2, but that the firm's individual price elasticity of product demand, \(\eta_f = (\eta F)/c = 1/m\), remains unchanged. As result, the marginal revenue curve, \(MR = P[1 - (1/\eta_f)]\), shifts out from \(MR\) to \(MR'\). In the absence of a change in

\(^9\) This clearly does not imply that it is rigid. It could, for example, be the outcome of a bargain that takes place prior to the employment decision. Alternatively, it could be set simultaneously with employment, as in the efficiency wage models, where the optimal wage and employment decisions are determined by separate first-order conditions.

\(^10\) In particular, \(m\) is the proportional price-cost margin: \(m = (P - MC)/P\), where \(MC = W/h_n\) is the marginal cost.

\(^11\) Under perfect competition, the number of firms \((F)\) is infinite, so that \(m = 0\); hence the real wage is brought into equality with the marginal product of labour: \(w = h\). Under monopoly, \(F = v = 1\), so that condition (4) reduces to the well-known condition that the markup of the price \(P\) over the marginal cost \(W/h_n\) is \([1 - (1/\eta)]\).

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the marginal cost curve \((MC = W/h_n)\), the firm's output would rise from \(q^*\) to \(q'\) in the figure, corresponding to the intersection of the new marginal revenue curve \((MR')\) with the old marginal cost curve \((MC)\). Yet then, of course, the real wage moves countercyclically, since the price \(P\) rises while the nominal wage \(W\) remains constant. But since we are concerned with how an outward shift in the product demand curve affects the firm's level of production and employment at any given real wage, we must ask what happens to \(q\) when the nominal wage \(W\) rises proportionately with the price \(P\), shifting the marginal cost curve upwards. What the labour demand curve (5) implies is that if the elasticity \(\eta_f = 1/m\) is constant, then the marginal revenue curve \((MR = P[1 - (1/\eta_f)]\) must rise by the same amount as the marginal cost curve \((MC = W/h_n)\), and thus production remains unchanged at \(q^*\). Given the production function, employment also remains unchanged, so that there is no shift in the labour demand curve.

The results above turn out to be surprisingly robust. Lindbeck and Snower (1993) show that the transmission channels identified in Proposition 1 continue to hold for a very wide class of models, covering differentiated products, firms of different sizes, stochastic product demand, durable goods, efficiency wages, and simultaneous bargaining over wages and employment (so that a 'labour demand curve' does not exist).12

II. CHANNELS OF TRANSMISSION UNDER EXCESS CAPITAL CAPACITY

We now give this standard model a new twist by incorporating the possibility of excess capital capacity. This permits us to show why the labour demand curve may be flat or even upward-sloping despite the presence of diminishing

12 The underlying reason is that all these models, except the last, yield a first-order condition for employment that is analogous to equation (4). The last model, in which the real wage and employment are the outcome of an efficient bargain between the firm and its employees, employment is given by the intersection of the efficiency and equity loci, whose position depends on the channels above but not directly on the demand parameter \(A\).
returns to labour, and thus why changes in product demand that shift the wage setting curve can influence employment without pushing the real wage in the opposite direction.

We rationalise existence of excess capacity by assuming firms to make capital capacity and technological decisions prior to gaining full information about their product demands. Thus when product demand is low relative to expectations, a firm may find itself with more capital than it is willing to use. Specifically, let the firm’s decision making proceed in two stages. In the first stage, the firm makes its capital capacity and technological decisions, knowing the density, \(g(A)\), of the demand parameter \(A\). In the second stage, the realised value of \(A\) is revealed and the firm makes its employment, production, and pricing decisions, taking the parameter \(A\), the capital capacity and technological decisions as given.

The firm’s first-stage capital capacity decision involves choosing its capital stock \((k = k^*)\) so as to maximise its expected profit. Its technological decision involves choosing a limited range of technologies from the full range available in the first stage of decision making. In particular, given the first-stage production opportunities

\[ q \leq h(n, k), \quad h_n, h_k > 0; \quad h_{nn}, h_{kk} < 0 \quad (3') \]

then the technological decision is specified as the choice of a capital-labour ratio \(v^*\) such that, in the second stage, the firm’s feasible range of capital-labour ratios becomes

\[ [v, \bar{v}] = [v^* - \beta, v^* + \beta], \quad (6) \]

where \(\beta\) is a non-negative constant. (When \(\beta = 0\), the technology reduces to putty-clay.)

Figure 3 illustrates this technological decision for the case in which the first-stage production opportunities are bounded by a Cobb–Douglas production function so that the curve labelled \(q = h(n, k^*) = n^\alpha(k^*)^{1-\alpha}\) in the Fig. stands for the firm’s ex ante production function, given the capital capacity decision \(k = k^*\). For the upper and lower bounds on the capital-labour ratio \((v \text{ and } \bar{v})\), the area \(OABC\) in the Fig. describes the firm’s second-stage production opportunities.

In the second stage,\(^{13}\) the firm sets its employment \((n)\), production \((q)\), and pricing \((P)\) decisions so as to maximise its expected profit \(z = Pq - Wn - Rk^*\), subject to the product demand function \((1)\), the conjecture function \((2)\), the production function \((3')\), its first-stage capacity decision \((k = k^*)\), the constraint that \((k^*/\bar{v}) \leq n \leq (k^*/v)\), the nominal wage \((W)\), and the nominal user cost of capital \((R)\).

Now define \(\underline{n} \equiv (k^*/v)\) and \(\bar{n} \equiv (k^*/\bar{v})\) as the minimum and maximum levels of employment, respectively, compatible with full utilisation of the capital stock \(k = k^*\). Similarly, define \(\underline{w} = h_n(\underline{n}, k^*)\) and \(\bar{w} = h_n(\bar{n}, k^*)\) as the corresponding maximum and minimum levels of the real wage. Now suppose that the demand parameter \(A\) turns out to be sufficiently low so that, at the given nominal wage,
the profit-maximising price is such that \( w > \bar{w} \) (i.e. the real wage is ‘high’). Then, even if the firm were to set the minimum level \( \bar{n} \) of employment compatible with full utilisation of the capital stock, the profit generated by a marginal employee would still be negative \( ([\partial z(n)/\partial n] < 0) \). Thus it employs less than \( \bar{n} \) and holds excess capital capacity, so that the binding portion of its second-stage production function is \( q = h(n, \bar{m}) \). The associated first-order condition for profit maximisation is

\[
\frac{dz}{dn} = P(1 - m)(h_n + \bar{v}h_k) - W = 0
\]  

(7)

evaluated at \( h_n = h_n(n, \bar{m}), h_k = h_k(n, \bar{m}) \), and \( P = \Pi \Psi[Fh(n, \bar{m}), X/\Pi, A] \), where \( \Psi \) is the inverse of the product demand function \( Y \). In other words, employment is set so that the marginal value product of labour (under excess capital capacity) is equal to the nominal wage \( W \).

When the demand parameter is such that \( w < \bar{w} \) (the real wage is in the ‘intermediate’ range), the firm utilises its capital stock fully and sets employment so that the marginal employee generates zero profit \( ([\partial z(n)/\partial n] = 0) \). Thus the binding portion of its second-stage production function is \( q = h(n, k^*) \) and its first-order condition reduces to (4), evaluated at \( P = \Pi \Psi[Fh(n, k^*), X/\Pi, A] \) and \( h_n = h_n(n, k^*) \).

Finally, when the demand parameter is such that \( w < \bar{w} \) (the real wage is ‘low’), then even if the firm were to set the maximum level \( \bar{n} \) of employment compatible with full utilisation of the capital stock, the profit generated by a marginal employee would still be positive \( ([\partial z(n)/\partial n] > 0) \). Then the firm faces ‘over-full capacity’; the binding portion of its second-stage production function is \( q = h(\bar{n}, \bar{v} \bar{m}) \), and its employment is simply \( n = \bar{n} \).

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The value added of this extension of our model lies in the possibility of excess capital capacity. The slope of the labour demand curve under excess capacity is

$$(dw/dN)_{(w>\omega)} = F(1-m) (h_{nn} + \bar{v}h_{kn})$$

which, under imperfect competition, could be downward-sloping, flat, or even upward-sloping.\(^\dagger\)

Under excess capacity, an increase in employment is accompanied by an increase in capital utilisation, and thus the slope of the labour demand curve depends not only on the response of the marginal product of labour to a rise in employment (as under full capacity), but also on the response of the marginal product of capital. Under diminishing returns to labour, the former response is negative; but when labour and capital are Edgeworth complements ($h_{kn} > 0$), the latter response is positive. In practice, the excess capital that is brought back into use at the end of a recession—when workers are recalled to man vacant machines and to bring existing assembly lines back in operation—tends to be highly complementary with labour. Then the latter response ($\bar{v}h_{kn}$) may well be as large as, or even dominate, the former ($h_{nn}$), so that the labour demand curve be flat or even slope upwards.\(^\ddagger\)

Moreover, the excess capital capacity decision (7) yields a new channel of transmission, namely, an increase in product demand shifts the labour demand curve outwards if it raises the marginal product of capital ($h_k$).

In sum,

**Proposition 2.** For the model of excess capital capacity underlying (7),

(a) when the degree of Edgeworth complementarity between labour and capital is sufficiently large, $h_{kn} \geq -h_{nn}/\bar{v}$, the labour demand curve is not downward-sloping, even in the presence of diminishing returns to labour;

(b) an increase in product demand shifts the aggregate labour demand curve outwards only if channels (i)–(iv) in Proposition 1 are operative or if the marginal product of capital ($h_k$) increases.

Under conditions (a) or (b), an increase in product demand can raise employment without necessarily implying a counter-cyclical real wage movement.

### III. LONG-RUN CHANNELS OF TRANSMISSION

We now turn to the 'long run', in which capital capacity is assumed flexible. For simplicity, consider the standard problem in which the firm maximises the present value of its profits, $PV = \sum_t \beta^t (P_t q_t - W_t n_t - R_t k_t)$ subject to the

\(^\dagger\) The second-order conditions for profit maximisation are $(\partial^2 z/\partial n^2) = (1-m) [(dP/dn) (h_n + \bar{v}h_{kn}) + P(h_{nn} + \bar{v}h_{kn})] < 0$. Under perfect competition, $(dP/dn) = 0$, so that this condition reduces to $(h_{nn} + \bar{v}h_{kn}) < 0$. By (8), the labour demand curve must be downward-sloping. Thus a flat or upward-sloping labour demand curve under excess capital capacity is possible only when competition is imperfect.

\(^\ddagger\) The existence of an upward-sloping labour demand curve certainly does not imply that wage moderation in collective bargaining no longer has a role to play in stimulating employment. First, an upward movement along such a labour demand curve can only be achieved by a reduction in the nominal wage, which leads to an even larger reduction in the price level. Secondly, as shown in Fig. 1 b, a rise in employment requires a fall in the wage setting curve, i.e. a reduction in the real wage emerging from the wage-setting process at any given level of employment.

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product demand function (1), the conjecture function (2), and the production function (3'). The first-order conditions are

\[(1 - m) h_n(n_t, k_t) = w_t, \]  
\[(1 - m) h_k(n_t, k_t) = r_t \]  

for each period \( t \), where \( r_t = (R_t/P_t) \) is the real user cost of capital. Letting \( N_t = F_{n_t} \) be aggregate labour demand and \( K_t = F_{k_t} \) be aggregate capital demand, and totally differentiating (9a) and (9b), we obtain

\[ h_{nn} dN_t + h_{nk} dK_t = \frac{F}{(1 - m)} dw_t, \]  
\[ h_{nk} dN_t + h_{kk} dK_t = \frac{F}{(1 - m)} dr_t. \]

Holding the real user cost of capital constant, the slope of the aggregate labour demand curve is

\[ (dw_t / dN_t) = F(I - m) \left[ h_{nn} - \left( \frac{h_{nk}}{h_{kk}} \right) \right] \]  

where \( [h_{nn} - \left( \frac{h_{nk}}{h_{kk}} \right)] < 0 \) by the second-order conditions for optimality, so that the slope of the unconditional aggregate labour demand curve is negative. Then, in the absence of the four transmission channels of Proposition 1 and in the absence of an effect of product demand on the real user cost of capital, a change in product demand cannot affect employment without generating counter-cyclical real wage movements.

Note that the magnitude of these counter-cyclical real wage movements depends on the degree of factor independence, measured by \( h_{nk} \). Equation (11) indicates that the labour demand curve is flatter, the greater is this degree of factor interdependence, regardless of whether the factors are complements or substitutes. The intuitive rational of this perhaps surprising result is straightforward. When \( n_t \) and \( k_t \) are Edgeworth complements \( (h_{nk} > 0) \), a rise in labour demand is associated with a rise in the demand for capital \( (\partial k_t / \partial n_t) = - (h_{nk} / h_{nn}) > 0) \), which, in turn, raises the marginal product of labour \( (\text{since } h_{nk} > 0) \). Thus, the greater the degree of complementarity, the flatter the slope of the labour demand relation. On the other hand, when \( n_t \) and \( k_t \) are Edgeworth substitutes \( (h_{nk} < 0) \), a rise in labour demand is associated with a fall in the demand for capital \( (\partial k_t / \partial n_t) = - (h_{nk} / h_{nn}) < 0) \) which, in turn, raises the marginal product of labour \( (\text{since } h_{nk} < 0) \). Thus, the greater degree of substitutability, the flatter the slope of the labour demand relation.

All this assumes, of course, that the real user cost of capital is constant. However, changes in product demand may affect the real user cost of capital via the real interest rate. The effect of an increase in the real user cost of capital on labour demand, for any given real wage \( \langle w_t \rangle \), is

\[ \frac{dN_t}{dr_t} = - \frac{h_{nk}}{[h_{nn} h_{kk} - (h_{nk})^2]} (1 - m) \]  

by (10a) and (10b). When the second-order conditions for profit maximisation are satisfied \( (\text{so that } [h_{nn} h_{kk} - (h_{nk})^2] > 0) \), we find that \( \text{sgn}(dN/dr) = \)

We assume full information, taking the product demand parameter \( A \) as a known constant.

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-sgn($h_{nk}$). This means that, for the standard case in which labour and capital are Edgeworth complements ($h_{nk} > 0$), an increase in product demand that raises (lowers) the user cost of capital will shift the labour demand curve inwards (outwards). An obvious implication of this result is that, insofar as the interest rate is an empirically significant channel of transmission, monetary and fiscal policies pull the labour demand curve in opposite directions. When expansionary monetary policy depresses the real interest rate, it shifts the labour demand curve outwards; whereas when expansionary fiscal policy raises the real interest rate, the labour demand curve shifts inwards.

In sum,

**Proposition 3.** (a) For the flexible capital capacity model underlying (10a) and (10b), an increase in product demand shifts the labour demand curve outwards only if (1) channels (i)-(iv) in Proposition 1 are operative, or (2) the user cost of capital falls while labour and capital are Edgeworth complements, or (3) the user cost of capital rises while labour and capital are Edgeworth substitutes. Then an increase in product demand can raise employment without necessarily generating a counter-cyclical real wage movement.

(b) The greater is the degree of factor interdependence, the flatter is the labour demand curve. Hence, in the absence of the above transmission channels, the less pronounced will be the long-run counter-cyclical real wage variations associated with a given variation in employment.

**IV. AN OVERVIEW OF TRANSMISSION CHANNELS**

The analysis above provides a unified framework for identifying a broad spectrum of possible channels whereby product demand changes can affect employment without assuming wage-price stickiness or necessarily implying counter-cyclical real wage responses. To give choice theoretic rationales for each of these channels would lie beyond the scope of this paper; in any case, many of these channels have already been rationalised elsewhere, albeit in a fragmented way. What remains to be done here is to provide a very selective overview and evaluation of the various channels, drawing on the existing literature.

*Transmission via the Price Elasticity of Product Demand ($\eta$):* Various authors (surveyed by Dixon and Rankin (1993)) have shown that when public- and private-sector expenditures have different price elasticities, the aggregate elasticity will move in response to changes in the composition of demand. However, this is unlikely to be a reliable channel for the transmission of product demand variations to the labour market since the relative magnitudes of the public and private-sector price elasticities vary across sectors and through time. Furthermore, if the private-sector elasticity is plausibly assumed to exceed the public-sector one, an exogenous increase in government spending shifts the labour demand curve inwards. Finally, government spending increases and tax

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17 Greenwald and Stiglitz (1988) argue that an exogenous rise in spending may shift the labour demand curve outwards by reducing the risk premium on investment. Yet it is not clear that this effect dominates the inward shift of the labour demand curve resulting from the interest rate effect of, say, expansionary fiscal policy.

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reductions that raise private consumption would, through this channel, pull the labour demand curve in opposite directions! Changes in the composition of domestic versus foreign expenditures produce no plausible transmission channel either: indeed, for the plausible case when the foreign price elasticity exceeds the domestic one, an increase in domestic demand reduces the aggregate elasticity and thereby shifts the labour demand curve inwards.

Transmission via Imperfectly Competitive Interactions (v): Pigou (1927), Kalecki (1938), and Keynes (1939) asserted that firms' market power may vary counter-cyclically, but provided no choice-theoretic rationale. More recently Rotemberg and Saloner (1986) have constructed a model in which implicitly colluding oligopolists behave more competitively as product demand rises. The effectiveness of this transmission mechanism depends on special circumstances and thus seems to be a week reed on which to hang a theory of how product demand affects employment.

Transmission via Changes in the number of firms (F): Pagano (1990), Snower (1983), and others have developed models in which an increase in product demand induces entry of new firms, which increases the degree of competition in the product market and thereby shifts the labour demand curve outwards. On a different tack, Lindbeck and Snower (1989) argue that, if nominal wages are sluggish relative to prices in the short run, then a rise in product demand (associated with a rise in the product price) will lead to a temporary fall in the real wage and a rise in profits, thereby encouraging the entry of firms. In the longer run, wages and profits fall to their original level and the entry of firms ceases. Some recently entered firms, however, remain operative, and the long-run increase in the number of firms sustains the outward shift of the aggregate labour demand curve.

Transmission via Changes in the Marginal Product of Labour and Capital (h, and h_e): Clearly, if an exogenous increase in government spending takes the form of industrial infrastructure investment, the marginal product of labour may rise, thereby shifting the labour demand curve outwards. Over a shorter time span, our analysis of Section II has shown that the existence of excess capital capacity may make the labour demand curve flat or upward-sloping and thus product demand variations that shift the wage setting curve may affect employment without counter-cyclical real wage movements.

Transmission via the real user cost of capital (r): For the common case where labour and capital are complements, our analysis of Section III indicates that an increase in product demand which raises (lowers) the real interest rate will shift the labour demand curve inwards (outwards). (See also Phelps, 1994.)

To sum up, the transmission channels operating via the price elasticity of product demand, the imperfectly competitive interactions among firms, and the user cost of capital do not appear to represent consistently reliable ways in which product demand variations get transmitted to the labour market. That leaves us with three potentially significant channels: in the short run, the existence of excess capital capacity may make it possible for a rise in product demand to stimulate employment without reducing the real wage; in the medium run, transmission via changes in the number of firms may have an
important role to play; and in the long run, transmission via the supply-side effects of infrastructure investment may be significant as well.

The policy implications of this evaluation are clear-cut and potentially important: Supply-side policies (such as the removal of barriers to the entry and exit of firms) which open a limited number of transmission channels may be expected to strengthen the longer-term impact of the demand-side policies on employment. Furthermore, government spending in the form of infrastructure investment may have a bigger impact on employment than tax reductions or increased transfer payments.


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