Trade and Labour Demand Elasticity in Imperfect Competition: Theory and Evidence

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Abstract

In this article, we extend the Allen (1938)-Hamermesh (1993) theoretical relation of labour demand elasticity to imperfect competition using Dixit's (1990) framework. In oligopoly, we find that the elasticity of labour demand depends on a third 'pro-competitive effect' term that eases labour demand adjustment to a particular shock like openness. Besides, this relationship appears to be directly testable in the data. We use UK firm level data from *OneSource* database and find that the long run derived estimators are consistent with our theoretical framework. The short-run estimators however, show only mixed support to our relation.

In recent years, a growing body of the literature in international trade tried to investigate whether openness has been increasing labour demand elasticities. From a labour theory perspective in partial equilibrium, the Allen-Hamermesh theoretical relation became one of the few general frameworks to refer to[1]. This theory states that labour demand elasticity should be positively affected by its two principal determinants: the elasticity of substitution between labour and other factors and the elasticity of demand for goods to prices. Under the assumption that openness is affecting these factors by increasing the possibility of substitution among factors and goods respectively, that relation could then predict a consecutive increase in the elasticity of demand for labour.

Although some empirical studies in the field were inspired by that relation (i.e. Slaughter (2001), Haskel, Slaughter and Fabbri (2002) among others), two issues remain.

First, Allen (1938) showed that this relation holds in a perfect competition environment at the industry level. While it is now widely recognized

[1]One should also note that Leamer (1996), Wood (1995) and also Panagariya (1999) discussed the effect of trade on labour demand elasticities, but applying HO or specific factor trade theories in General Equilibrium.

that imperfect competition is one of the most influent basis for the rise in trade and multinational activities the Allen-Hamermesh relation constrains the researchers to test the impact of openness on labour demand elasticities assuming perfectly competitive markets. The first question addressed then by this article is how the Allen-Hamermesh (henceforth AH) relation could be extended to an imperfectly competitive setting[2]. Following Dixit's (1990) modelling framework, we show that AH can be generalized to allow for imperfect competition. In particular, under the assumption of oligopoly, the elasticity of labour demand depends on a third term, neglected so far by the AH relation. This term is reducing the burden on labour demand elasticity: the elasticity of prices to wages. Actually, an increase in wages has a pure cost effect, but is reducing at the same time the market share of the firm and thus its mark-up. As a result of this pro-competitive effect, there might be incomplete pass through between prices and wages and the adjustment of labour demand would be then smaller than expected.

The second issue left out by the AH relation is that it does not show *formally* the relationship between trade openness mesures and labour demand elasticities[3]. We try to fill that gap in this article by showing that the average elasticity of labour demand depends, in a formal manner, on the import penetration rates. Also, our model provides an explanation for why the elasticity of demand has not been increasing that much with trade, a result that was pointed out by previous studies. In fact, it predicts that the effect of import penetration would be high, if there is complete pass-through from wages to prices. But in the case of incomplete pass-through, then a small effect of import penetration should prevail.

We use UK firm level data from OneSource database to test for our relationship. Our results tend to support our theoretical framework.

1 The Allen (1938)-Uzawa (1962) relation

Some authors like Slaughter (2001) have been inspired by the following relation, ***at the industry level***, of the elasticity of labour demand (sensitivity of labour demand to wages η_l) proved in Allen (1938), further investigated by Uzawa (1962) and discussed in details by Hamermesh (1993). Consider-

[2]Note that Krishna *et al* (2001) have studied the impact of trade on labour demand elasticities by emphasizing the role of imperfect competition as well. However, the authors design a framework based on monopolistic competition (i.e. they do not consider strategic interaction among firms) and assume a Cobb-Douglas production function.

[3]Jean (2000) could also link trade measures with the elasticity of labour demand but he uses a different framework than that of Allen-Hamermesh. His work is built on a perfect competition world in general equilibrium with an Armington type hypothesis on the demand side and a Leontief production function on the supply side

ing 2 inputs, say labour and capital, the wage elasticity of labour is equal to:

$$\eta_l = -(1 - \alpha_l)\sigma - \alpha_l \eta_Y \quad (1)$$

with $\alpha_l = \frac{wl}{pY}$ is the share of labour cost to revenue in the industry, σ is the absolute value of the elasticity of substitution between labour and capital, and η_Y the absolute value of the elasticity of total demand Y to prices in the sector. Allen (1938) proves this relation by resolving a program of profit maximisation in perfect competition, considering the case of two factors and a constant return to scale technology.

What is the intuition behind this relation? If wages increase, and given a fixed output, employers will want to substitute away labour towards the other factor of production whose price is now relatively lower (the employers change the technique of production along the same isoquant). The extent of this effect depends on α. The higher share of labour cost, the smaller the pass-through from σ to η_L.

However, industry output is not fixed. In fact, for a given technique of production, an increase in wages affect positively commodity prices in the industry which in turn reduce industrial production overall. (The isoquant moves inward.) This affects downward the demand for the two factors and *a fortiori* that for labour. The extent of this decrease in labour demand following the adjustment of production to the new prices, depends on the share of labour cost.

Allen (1938) generalizes this relation to m factors of production ($m > 2$) by proving that:

$$\eta_l = -\alpha_l \sigma_{ll} - \alpha_l \eta_Y \quad (2)$$

Here, σ_{ll}, as Allen (1938) underlines, represents the elasticity of substitution between l and all all the other factors of production in the industry[4]. The positive relation between labour demand elasticity and product demand elasticity (scale effect) is known to form the third Marshall rule (see Slaughter (2001) for further discussion).

[4]The concept of the Allen elasticity of substitution has been called into question not long ago. Blackorby and Russel (1989) highlight that the AH elasticity of substitution is completely uninformative about the easy with which inputs can be substituted (when there are more than two inputs). They stresses as the Morishima (1967) elasticity of substitution is the true elasticity of substitution. However, this argument does not directly apply for the purpose of this paper since what we are interested is the own price labour demand elasticity. Although the σ_{ll} is not the elasticity of substitution of labour it is an intermediate figure whereby computing the wage elasticity of labour.

Notice moreover that the factor of pass-through from substitution to labour demand is now α_L. Hence, the effect of substituting away labour towards all other factors is more harmful on labour demand, the more the share of labour in total cost is important.

Trade could affect the elasticity of labour demand in two fashions. Slaughter (2001) and Haskel *et al* (2002) mention that international commerce could augment σ by increasing the possibilities of substitution between domestic and foreign factors. Moreover, openness could lead to an increase in the elasticity of demand to prices η_Y by increasing competition. Yet, this latter prospect makes the inappropriateness, at firm level, of the AH relation manifest since in perfect competition the product demand is by definition perfectly elastic. This would imply perfectly elastic input demands as well, irrespective of the elasticity of substitution or any other factor that might affect them directly or indirectly.

2 Generalization of the theory to imperfect competition

The same relation is obtained from a more elegant and simpler formal setting by Dixit (1990) who minimizes total costs instead of maximizing profits. We thus follow the same type of formulation than Dixit in what follows but extend the framework to the case of imperfect competition.

Assume a firm that produces with constant returns to scale. Its total cost can be written as follows:[5]

$$C = yc(W) \tag{3}$$

Where $W = (w_1, \dots w_m)$ is the vector of factor prices for m factors of production. Assuming Cournot competition, the first order conditions provides an equality between marginal revenue and marginal costs. Prices could then be represented by:

$$p = \frac{1}{\left(1 - \frac{s}{\eta_Y}\right)} c(W) \tag{4}$$

where p is the equilibrium price, Y represents total demand (or industry production), $s = \frac{y}{Y}$ is the market share and η_Y the absolute value of the elasticity of the product demand to prices faced by the firm. Note in what

[5]We could have supposed an increasing returns to scale technology by assuming an alternative expression that includes fixed costs like $C = yc(W) + F$, but this does not affect the relation to estimate hereafter.

follows that $\frac{1}{\left(1-\frac{s}{\eta_Y}\right)} = \mu$ represents the mark up. By Shephard's Lemma, the demand for labor is the derivative of total costs with respect to the price of labor:

$$l = \frac{\partial C}{\partial w_l} = y\frac{\partial c(W)}{\partial w_l} = yc_w \tag{5}$$

Deriving with respect to w_l we have:

$$\frac{dl}{dw_l} = c_{ww}y + \frac{\partial y}{\partial Y}\frac{\partial Y}{\partial p}\frac{\partial p}{\partial w_l}c_w \tag{6}$$

where $c_{ww} = \frac{\partial c_w}{\partial w}$.

We know from Uzawa (1962) and Hammermesh (1993) that when the cost function is linear and homogenous, the absolute value of the elasticity of substitution σ_{ll} equals $\left|\frac{c(W)c_{ww}}{c_w c_w}\right|$. In addition, let $\eta_p = \frac{\partial p}{\partial w}\frac{w}{p}$ be the elasticity of prices to wages and recall $\eta_Y = \frac{\partial Y}{\partial p}\frac{p}{Y}$ the elasticity of total demand to prices in the industry. Then expressing equation 6 as an elasticity, $\eta_l = \frac{dl}{dw_l}\frac{w_l}{l}$, gives:

$$\eta_l = -\sigma_{ll}\alpha_l - \eta_Y(1/s)\eta_p \tag{7}$$

Relation 7 designates the firm-level elasticity of demand in oligopoly with $\alpha_l = \frac{wl}{C}$ standing as the labour share in total costs. It has some similarities with the traditional relation presented in the prior section. Firstly, the elasticity of substitution of labour with respect to all other factors (σ_{ll}) enters the equation as before and is multiplied by the cost share of labour.

Second, note $\eta_Y(1/s) = \eta_y$. This is, for a typical firm, the perceived elasticity of demand to an increase of its price. Hence, when the firm has a small market share due for example, to a big number of firms in the industry, the firm perceives a price-elasticity of demand for its commodity that is high because it has little market power that enables that firm to set its own price.

Keeping this perceived elasticity in mind, the second term of equation 7 can thus be presented as $-\eta_y\eta_p$. How can our framework compare then to that of AH? To see this, we develop in what follows the expression of the elasticity of prices to wages $\eta_p = \frac{\partial p/p}{\partial w/w}$.

Indeed, from 4, we have

$$\frac{\partial p}{\partial w_l} = \frac{\partial \mu c(W)}{\partial w_l} = c_w\mu + c(W)\frac{\partial \mu}{\partial w_l} \tag{8}$$

The derivative of costs with respect to wages c_w has a positive sign. Besides, it can be easily shown that the derivative of mark-ups is $\frac{\partial \mu}{\partial w_l} =$

$\mu^2(1/\eta_Y)\frac{\partial s}{\partial w_l}$. Under the traditional assumption of downward sloping best response functions, it is well known that market share is decreasing with the marginal cost of the firm: thus, $\frac{\partial s}{\partial w_l}$ is negative and so do the derivative of mark-ups. To sum up, an increase in wage has 2 opposite effects on prices: a pure positive cost effect and a negative pro-competitive effect. From that effect, one can thus observe an incomplete pass-through between a change in wages and a change in prices. One fraction of the higher cost is now supported by the firm in the form of lower mark-ups.

Note that the elasticity of mark-ups to wages can be expressed as: $\eta_\mu = -\frac{\partial \mu}{\partial w_l}\frac{w_l}{\mu}$. Multiplying equation 8 by $\frac{w_l}{p}$, and recalling the relations 3, 4 and 5, we obtain the following expression of η_p after simplification:

$$\eta_p = \frac{\partial p}{\partial w_l}\frac{w_l}{p} = \alpha_l - \eta_\mu \tag{9}$$

Plugging that expression into equation 7 we obtain:

$$\eta_l = -\sigma_{ll}\alpha_l - \eta_Y(1/s)\alpha_l + \eta_Y(1/s)\eta_\mu \tag{10}$$

Here, the additional term $\eta_Y(1/s)\eta_\mu$ enters the equation. This term is *reducing in absolute values* the elasticity of labour demand to wages. It is doing so because of the pro-competitive effect generated by the variation in wages on mark-ups. In order not to loose much of their competitiveness, the firms are constrained to pass a part of the increase in wages on to less mark-ups, making eventually a relatively small adjustment on prices and thus demand. Hence, in an oligopoly world, this incomplete pass through between wages and prices would makes the labour demand less elastic.

Then, from 10 it is possible to see that in a oligopolistic competition, as it is the case in a perfectly competitive market, labour demand is more elastic when the cost share of labour α_l is high but also when substitutions between factors (i.e. σ_{ll}) and goods (η_Y) are high. On the other hand, relation 7 suggests that labour demand of a firm is less elastic the higher its market share.

By comparing the two relations 2 and 10, AH appears as a particular case of the latter equation. Indeed, consider a relatively competitive market where say, s is small but not too small in order to maintain a finite perceived elasticity of product demand $\eta_Y(1/s) \neq \infty$. In that case, the mark-up tends to 1 and its elasticity with respect to wages η_μ and η_s would approximate 0. Hence, the whole increase in wages is passed on prices and the third term of our equation 10 vanishes, thus retrieving the AH relation.

If the market is perfectly competitive though $s \approx 0$, our relationship indicates that the perceived demand elasticity $\eta_Y(1/s)$, would tend to infinity and so does the elasticity of labour demand. Indeed, in that market the firm cannot act neither on the wage it offers nor on the price it sets. It takes them as given from the competitive labour and product markets. Note that this perfect competition type result is different from that provided by the AH relation because our unit of study is the firm, not the industry. In AH, factor and commodity prices should vary evenly across firms and thus affect total demand as a whole at the industry level. In our firm-level configuration, if it happens that a firm decides unilaterally to increase its price, consumers substitute away the product of that firm towards those sold by other firms in the industry at a lower (market) price. Hence, the composition of suppliers changes leaving total demand unchanged.

A second particular case of equation η that is worth noting is that of monopoly with constant elasticity of product demand to prices. In this case, $s = 1$, $\eta_{\mu} = \eta_s = 0$: here again a proportionate increase in wages results in a same proportion of increase in prices. This is also true for the case of perfect differentiation in, say a monopolistic competition structure: a firm producing its own variety faces an elasticity of demand compared to that of a monopolist. In that case, the AH relationship prevails at the firm level.

3 Elasticity of Labour Demand and Trade

How would openness to imports affect labour demand elasticity? So far, the literature noted that trade could affect labour demand elasticity by affecting both the elasticity of substitution and the elasticity of product demand. The first elasticity, could indeed be affected as openness increase the possibility of combining domestic and foreign factors in the production process of a firm.

In addition, international trade may augment or reduce the scale effect due to the perceived elasticity depending on whether it causes an increase or decrease in the market share and in the cost share of labour. These are not obvious questions. The answer hinges on how firms react to increased foreign competition.

The literature concerning international trade and labour demand has amply investigated the effect of trade on the cost share of skilled and unskilled workers Generally, trade has not been found to affect directly the cost share of labour while technology has.The relationship between the market share and trade has not been investigated sufficiently thus far. Consider first that the number of domestic firms is given in the market. An increase in foreign firms' shares due to a larger openness would then reduce mechanically the domestic firms market shares and hence, exacerbate the elasticity of product and labour demand. However, the number of firms might be endogenous to trade. Under this new assumption an increase in foreign competition leads to least productive firms to exit the market thereby resulting in a more concentrated market and hence higher market share for surviving firms.

To sum-up, at the firm level the effect of import penetration on market shares is ambiguous. However, the effect becomes unambiguous at the industry level, irrespective of whether the number of firms is endogenous or not. In order to see this, we relate formally hereafter import penetration to the *mean* labour demand elasticity prevailing in the industry.

From equation 7, we multiply each term by the market share of the firm among its peers in the market ($s_l^d = \frac{y_l}{Y^D}$)[6] and sum over all domestic firms in order to obtain an expression for the weighted mean elasticity of labour demand in the industry, $\overline{\eta} = \sum_l s_l^d \eta_l$. After simplification we obtain:

$$\overline{\eta} = -\sigma_{ll} \sum_l (\alpha_l s_l^d) - \eta_Y \eta_p N \frac{1}{S} \tag{11}$$

with S being the total market share of domestic firms on their market. It is also equal to $1 - MP$ where MP is the import penetration rate in the market. Hence, at the industry level, import penetration is directly affecting market share of domestic firms as a whole. This results in a higher mean elasticity of labour demand in the industry. In this relation, we can thus estimate the pure effect of import penetration via its impact on perceived product demand on average in the industry: $\overline{\eta_y} = \eta_Y \frac{1}{S}$.

4 Data set

UK firm level data were used in this paper. These come from the *One-Source* database from 1993 to 1999. It includes information on all public limited companies, all companies with employees greater than 50, and the top companies based on turnover, net worth, total assets, or shareholders funds (whichever is largest) up to a maximum of 110,000 companies, in both manufacturing and service industries. Companies that are dissolved or in the process of liquidation are excluded from the *OneSource* sample. In this paper we concentrate on manufacturing firms from this data source.

The data set was screened to keep only those firms for which there were a complete set of information about output and inputs. This left an unbalanced panel data of around 36500 observations regarding 11100 firms. This firm level data set was used to obtain data about number of workers, cost shares, and mark-ups.

[6] Y^D is total sales of domestic firms

The relationship under scrutiny requires market shares as well. To compute it the firm level data set was merged by industry and years with the Production Standard Extracts, provided by the British Office of National Statistics. This procedure was necessary to have reliable measures of total industry production.

Further detail about the variables used can be found in Appendix A.

5 Empirical results

Formula 10 can be estimated on firm level data using variables of employment, wages and market shares. Taking discrete approximations, accounting for firm i cross-section and time t variations, equation 10 could be estimated as:

$$\begin{aligned} \Delta \log(l_{it}) &= -\sigma\left[\alpha_{it}\Delta\log(w_{it})\right] - \qquad (12) \\ &- \beta_1\left[(\alpha_l/s_{it})\Delta\log(w_{it})\right] + \beta_2\left[(1/s_{it})\Delta\log(w_{it})\right] \\ &\quad +d_t + d_i + \varepsilon_{it} \qquad (13) \end{aligned}$$

where di and dt represent individual and time effects and ε_{it} is standard error term. The Δ operator expresses here first differences. The parameter β_1 represents the product demand elasticity (i.e. η_Y) whereas β_2 estimates the interaction between the product demand elasticity and the elasticity of the mark-up to wages (viz. $\eta_Y\eta_\mu$). Independent variables, $\Delta\log w$, α_l and $(1/s)$ can be easily computed from our data (see appendix) which would allow us to estimate the above regression.

The relationship in 10 is derived form theory and therefore refers to the long term. It does not allow for any adjustment and dynamics, which in actual facts may be important. Here, we are interested in the long run behaviour of our variables since we want to test the proposition implied by the theory.

It is widely believed that cross-sectional studies tend to yield results concerning the long-run while time series studies conduce to short-run estimates. This association was investigated by Kuh (1959). By the same token, the Between estimator in a panel data set is supposed to generate long term results since it exploits the cross-sectional (i.e. between) variation of the data whereas the Within estimator is thought to yield short-term coefficients because this methodology uses the time series (viz. within) variation of the data (Baltagi 2001).

Various authors have tackled the issue of why the Between and the Within estimates often differ markedly while theoretically they should not.

The culprits have been identified in unobserved individual heterogeneity, dynamic misspecification and measurement errors. The former leads to a source of bias which arises if the individual effect is correlated with the regressors. In this occurrence the Within estimates would be consistent while the Between would not since the former wipes out the individual effect whereas the latter does not. Dynamic misspecification could also be the cause of the discrepancy between the Within and Between estimates as underlined by Baltagi and Griffin (1984). Indeed, long-lags and short panel data, as is the norm in firm level data set, may result in dynamic misidentification. With regards this problem, Pirotte (1999) shows that the static Between estimator converges towards the long-run coefficient even though the true data generating processes is dynamic[7]. Griliches and Hausman (1986) have investigated the bias induced by measurement error. They claim that any transformation that eliminates the individual fixed effect such as the within and first difference transformation is likely to exacerbate the measurement error bias. This point is further analysed by Mairesse (1990) who underlines that, provided the measurement error is not autocorrelated, the Between estimators minimizes the bias induced by measurement errors, because of the averaging, whereas Within estimates magnify it.

In the estimation of regression 13 biases due to the unobserved individual heterogeneity, measurement errors and dynamic misspecification are likely to be encountered. Between the first two, the measurement error seems to be the gravest since the discrete approximation of continuous derivative admittedly cannot be expected to be very precise. Thus, this would favour the Between estimator since, as discussed before, the Within may aggravate the measurement error bias (Griliches and Hausman 1986). Besides, the bias related to the unobserved individual effect is probably lessened by first differencing the data in order to obtain the discrete approximation. In addition the Between estimator has the advantage to be robust to dynamic misspecification as Pirotte (1999) has shown.

Therefore, regression 13 has been estimated by means of the following panel data model

$$y_{it} = \delta_0 + \overline{x}_i \delta_1 + (x_{it} - \overline{x}_i)\, \delta_2 + \mu_t + \varepsilon_{it} \tag{14}$$

This model permits to distinguish the effect of a temporary variation in the independent variables from the impact of a permanent one. Indeed, it assumes that changes in the mean of variables ($\overline{x}_i$) to wit long run changes, affect the dependent variable differently than temporary deviations from it ($x_{it} - \overline{x}_i$).

[7] For the converge it is required that T tends to infinity, N is fixed and the parameters are homogeneous. In addition this result holds irrespectively to the number of autoregressive and distributed lag terms appearing in the true data generating process

It therefore combines the Within and the Between estimator. Indeed, $\overline{x}_i$ is the between transformation ($\overline{x}_i = \sum_t x_{it}$) whereas $x_{it} - \overline{x}_i$ is the within transformation.

It is worth noting that averaging over time it is possible to obtain

$$\overline{y}_i = \delta_0 + \overline{x}_i\delta_1 + \varepsilon_{it} \tag{15}$$

where δ_1 is the Between estimator. Subtracting the last equation from 14 one obtains

$$y_{it} - \overline{y}_i = (x_{it} - \overline{x}_i)\,\delta_2 + \mu_t + \varepsilon_{it} - \overline{\varepsilon}_i \tag{16}$$

where now, the δ_2 is the Within estimator.

The parameters of 13 were estimated according to model 14. To control for the size of the firm the lagged log of employment was included as additional regressor. The results are shown in table 1. Coefficients of variables with the upper bar refer to the effect of permanent variations whereas the others concern the effect of a temporary variation. In other words, the first set of results are the Between estimates whereas the second set are the Within estimates.

With reference to the long run, it is possible to note that the size of the firm seems to increase in absolute value the elasticity of labour demand. This means that other things equal large firms are more inclined than small companies to substitute labour with other inputs when its cost increases. Furthermore, the long run constant output wage elasticity of labour, to wit the AH elasticity of substitution, is negative as expected and the smallest confidence level. It implies that a permanent increase in the cost share of labour will result in a more elastic labour demand.

Finally, the terms concerning the scale effect provide somewhat mixed results . Indeed, the product demand elasticity is estimated to be negative and significant at 5% confidence level whereas the pro-competitive term is positive, as theory predicts, but insignificant.

With regard to the coefficient of the variables concerning a temporary departure from their mean it is possible to note that the size of the firm appears to affect the labour demand elasticity in the same direction as in the long-run. In fact, the two lagged values of employment in log are both negative and significant.

In addition, the elasticity of substitution is estimated to be negative and significant anew. On the contrary the last two terms, which refers to the short-run scale effect are insignificant and with the opposite sign of what the

Table 1: Elasticity of Labour Demand Equation: The following model was estimated:

$$
\begin{aligned}
\Delta \ln l_{it} &= \delta_0 + \delta_1 \overline{\ln l_i} + \sigma_{ll}^B \overline{\alpha_{li} \Delta \ln w_i} + \eta_Y^B \overline{(\alpha_{li}/s_i) \Delta \ln w_i} + \eta_Y^B \eta_\mu^B \overline{(1/s_i) \Delta \ln w_i} \\
&+ \delta_2 (\ln l_{it-1} - \overline{\ln l_i}) + \delta_3 (\ln l_{it-2} - \overline{\ln l_i}) + \sigma_{ll}^W \left[\alpha_{lit} \Delta \ln w_{it} - (\overline{\alpha_{li} \Delta \ln w_i}) \right] \\
&+ \eta_Y^W \left[(\alpha_{lit}/s_{it}) \Delta \ln w_{it} - \overline{(\alpha_{li}/s_i) \Delta \ln w_i} \right] + \\
&+ \eta_Y^W \eta_\mu^W \left[(1/s_{it}) \Delta \ln w_{it} - \overline{(1/s_i) \Delta \ln w_i} \right] + \varepsilon_{it}
\end{aligned}
$$

$\overline{l_i}$	-.018611**
	(.001236)
$\overline{\alpha_{li} \Delta \ln w_i}$	-.842043**
	(.203486)
$\overline{(\alpha_{li}/s_i) \Delta \ln w_i}$	-.000122*
	(.000058)
$\overline{(1/s_i) \Delta \ln w_i}$	.000015
	(.000021)
$\ln l_{it-1} - \overline{\ln l_i}$	-.135285**
	(.02664)
$\ln l_{it-2} - \overline{\ln l_i}$	-.27508**
	(.016242)
$\alpha_{lit} \Delta \ln w_i - (\overline{\alpha_{li} \Delta \ln w_i})$	-.817545**
	(.157535)
$(\alpha_{lit}/s_{it}) \Delta \ln w_{it} - \overline{(\alpha_{li}/s_i) \Delta \ln w_i}$	.000024
	(.000064)
$(1/s_{it}) \Delta \ln w_{it} - \overline{(1/s_i) \Delta \ln w_i}$	-1.00e-07
	(.000018)
cons	.14133**
	(.00729)
Observations	26150
Firms	9897
R^2	.143915

Notes

(i) Robust standard errors in parenthesis

(ii) * significance at 5% confidence level; ** significance at 1%

(iii) Time dummies included

theory posits. Therefore, it seems that whereas the elasticity of substitution have a role both in the short-term and the long-term the scale effect does not have any effect in the short-run.

However, these results should be interpreted keeping in mind the econometric caveat discussed above. More specifically, all the short term coefficients are probably biased because they are in fact Within estimates. These suffer of the likely major sources of bias impairing our estimation, namely measurement error bias (Griliches and Hausman 1986) and dynamic misspecification (Baltagi and Griffin 1984; Pirotte 1999). The estimates derived from permanent variation of independent variables, i.e. the Between estimators, should not be affected by dynamic misspecification (Pirotte 1999) and less affected by measurement errors (Mairesse 1990).

For this reason it appears that the theory is partially corroborated by the data exploiting the between variation. Indeed, only one term of the two comprised in the scale effect is significant. More precisely, the elasticity of the product demand is negative and significant whereas the elasticity of the product demand times the elasticity of mark-up with respect to wages is estimated to be positive, but insignificant.

6 Conclusion

In recent years much effort has been devoted to analyze the effect of international trade on labour demand elasticities (However, the Allen-Hamernesh theoretical framework usually employed has constrained the researcher to do that assuming perfectly competitive markets. This is at odds with recent findings theoretical and empirical findings, which show that imperfectly competitive markets are one of the major causes of international commerce.

In this paper, by following the approach of Dixit (1990) we have provided an extension to the Allen-Hamermesh formulation by allowing for Cournot imperfect type competition. The labour demand elasticity is found to depend not only on the cost share of labour, its elasticity of substitution and the elasticity of the product demand but also on the market share of the firm. More precisely two terms feature in the scale effect. The first one is the analogous of the scale effect of in the Allen-Hamermesh expression with the only difference that the product demand elasticity is divided by the market share yielding to the perceived product demand elasticity. The second term is a novelty. It is the result a the pro-competitive effect whereby firms respond to say, an increase in the price of labour, not only shedding jobs, but also reducing their mark-up and market share.

The empirical investigation conducted partially corroborate the theoretical part of the paper. In the long run, it seems that the elasticity of substitution of labour, its cost share and the firm's market share have the expected effect on labour demand elasticities. However, of the two term characterizing the scale effect only one appears to have an explanatory power.

The fact that the labour demand becomes more elastic the smaller the market share may be one of the causes why international trade has not been found empirically to exert any effect on the elasticity in previous empirical studies. Indeed, the impact of international trade may depend on how it affects the market share of domestic firms. International trade might influence domestic firms and their market shares in divergent fashions thereby resulting in having different effect on their labour demand and its elasticity.

Thus, to investigate how trade with other countries affect the elasticity of the labour demand it seems to be relevant to analyze how the market share of domestic firms is affected by such trade. Further and interesting research is therefore worth pursuing on this topic.

7 Appendix A: Construction of variables

Labour demand (l): This is the total number of workers employed by the firm. Unfortunately, Onesource does not contain information on the number of production and non-production workers so their aggregate measure was used in this exercise.

Wage: The wage of workers in each firm was calculated dividing the total wage bill by the number of workers.

Cost share of labour (α_l): This figure is the ratio between the cost of labor and the total cost of production. The cost of labour is the wage bill whereas the total cost of production is the sum of the cost of labour, cost of materials and the rental price of capital. The cost of materials is present in the data set whilst the cost of capital was computed multiplying the user cost of capital times the stock of capital. The former was calculated using the interest rate set by the Bank of England as the rental price of capital. The latter was computed by means of the perpetual inventory method using an 8% depreciation rate and the GDP deflator of capital formation as the deflator of capital.

Market share (s): The Production Standard Extracts 1993-1999 provide information about the total production of each industry for each year. These figures, were used to compute market shares at two digit level at maximum disaggregation level.

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