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*Outsourcing, foreign ownership, exporting and productivity:
An empirical investigation with plant level data*

by

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Abstract

We investigate the impact of international outsourcing on productivity using plant level data for Irish manufacturing. Specifically, we distinguish the effect of outsourcing of materials from services inputs. Moreover, we examine whether the impact on productivity is different for plants being more embedded in international markets through exporting or being part of a multinational. Our results demonstrate that these distinctions can in general be important and are line with implications from the recent theoretical literature.

JEL classification: F14, F23, L23

Keywords: International outsourcing, productivity, exporting, multinational production

Outline

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Non-Technical Summary

A recent survey of UK companies found that 68 percent of firms outsource at least some services and that the main rationale cited by respondents was cost reduction. However, the recent trend from the traditional pattern of outsourcing non-core activities, is the offshoring of “high abstraction”, i.e., highly intellectual, and potentially core activities. In the popular press one appears to have arrived at a point where experts begin to question the validity of outsourcing as a long-term strategy or even short term as a cost reduction exercise. In fact, 56 percent of survey respondents to an IT specialists’ journal claimed that outsourced IT work was at least worse than that produced in-house. More worryingly, 11 percent reported that the outsourced work induced a setback in the firm’s production.

Only a small number of econometric studies have thus far looked at the effect of outsourcing on company performance. The purpose of this paper is to focus on the international dimension of outsourcing (fragmentation of production) and its effects on productivity at the level of the outsourcing plant. We define international outsourcing as the value of imported intermediates at the level of the plant.

This paper contributes to the literature in a number of ways. To begin with, our paper is, to the best of our knowledge, the first that uses plant level data to investigate the impact of international outsourcing (i.e. imports of intermediate inputs) on plant level productivity. Secondly, our data set enables us to separate the outsourcing of services from that of materials inputs. Furthermore, we investigate whether these productivity effects are different for purely domestic plants, exporters and foreign-owned affiliates located in the host country. These distinctions are motivated by referring to the recent theoretical model by Grossman and Helpman (2002), which shows the importance of factors such as search costs and the ‘thickness’ of supplier markets for international outsourcing.

We investigate these issues empirically using plant level data for manufacturing industries in the Republic of Ireland. Ireland may be considered as an interesting case study since it is a small open economy that is likely to rely heavily on fragmentation of its production processes. Furthermore, Ireland has over the last few decades been an important host country for affiliates of multinational companies, and many plants, both foreign and domestic owned, engage in exporting.

The most unambiguous result obtained is the positive productivity gains accruing to exporting firms which engage in the offshoring of intermediates. In other words, exporting firms enjoy some advantage over non-exporters which allow them to convert this advantage into a productivity gain. A possible reason for this gain is that firms that are members of international production networks possess extensive knowledge on where to procure competitively priced inputs and, hence, face lower costs of searching for potential suppliers abroad, in line with the theoretical model by Grossman and Helpman (2002).

The evidence for benefits to services offshoring is less clear-cut. According to our empirical work, the rewards to services procurement might well be non-existent. This links in with the recent evidence from IT practitioners that a majority of those surveyed regarded procured services to be of inferior quality to those produced in-house. In a minority of cases, procurement of services, including “high abstraction” activities were actually harmful to production flows.

1 Introduction

International outsourcing has become a growing phenomenon in world trade (Feenstra, 1998). Hummels et al. (2001), for example, provide evidence from data collected for 10 OECD and four emerging market countries, that trade in outsourced components in the vertical chain accounts for 21 percent of these countries' exports. Moreover, international outsourcing grew approximately 30 percent between 1970 and 1990. Much research has endeavoured to measure the impact of this disintegration of production on domestic labour markets (see Feenstra and Hanson, 2001 for a review).

A recent survey of UK companies on outsourced services by Manpower, a UK based recruitment and employment agency, found that 68 percent of firms outsource at least some services and that the main rationale cited by respondents was cost reduction. However, the recent trend from the traditional pattern of outsourcing non-core activities, is the offshoring of “high abstraction”, i.e., highly intellectual, and potentially core activities.¹ Hence, in the popular press one appears to have arrived at a point where experts begin to question the validity of outsourcing as a long-term strategy or even short term as a cost reduction exercise. In fact, 56 percent of survey respondents to an IT specialists' journal claimed that outsourced IT work was at least worse than that produced in-house. More worryingly, 11 percent reported that the outsourced work induced a setback in the firm's production.²

Only a small number of econometric studies have thus far looked at the effect of outsourcing on company performance. Gözrig and Stephan (2002) and Görg and Hanley (2003) use establishment level data for Germany and Ireland, respectively, and find that outsourcing of material inputs can positively affect establishment performance in terms of its returns on sales and profitability. However, these positive effects cannot be found when examining the effect of services outsourcing on performance. Unfortunately, the data used in both studies do not distinguish domestic outsourcing from international outsourcing.

The purpose of this paper is to focus on the international dimension of outsourcing (fragmentation of production) and its effects on productivity at the level of the outsourcing plant. Similar to the empirical literature using aggregate industry level data (e.g., Feenstra and Hanson, 1996, 1999, Yeats, 2001), which defines international outsourcing generally as

¹ <http://www.manpower.co.uk/news/OutsourcingSurvey.pdf>

² Software Development Magazine, January 2004 issue.

“imported intermediate inputs” we examine input sourcing behaviour at the level of the plant. Hence, we define international outsourcing as the value of imported intermediates at the level of the plant.

This paper contributes to the literature in a number of ways. To begin with, our paper is, to the best of our knowledge, the first that uses plant level data to investigate the impact of international outsourcing (i.e., imports of intermediate inputs) on plant level productivity. Secondly, our data set enables us to separate the outsourcing of services from that of materials inputs. Furthermore, we investigate whether these productivity effects are different for purely domestic plants, exporters and foreign-owned affiliates located in the host country. These distinctions are motivated by referring to the recent theoretical model by Grossman and Helpman (2002), which shows the importance of factors such as search costs and the ‘thickness’ of supplier markets for international outsourcing.

We investigate these issues empirically using plant level data for manufacturing industries in the Republic of Ireland. Ireland may be considered as an interesting case study given that Hummels et al. (2001) argue that a small open economy is most likely to rely heavily on fragmentation of its production processes. Furthermore, Ireland has over the last few decades been an important host country for affiliates of multinational companies, and many plants, both foreign and domestic owned, engage in exporting (see, for example, Barry and Bradley, 1997, and Ruane and Sutherland, 2002).

Motivated by the current discussion about the benefits of international outsourcing, and the recent theoretical literature, we aim to establish whether international outsourcing does indeed give rise to productivity gains. We find some evidence that establishments that outsource inputs internationally, earn significant productivity gains. This effect is different for the outsourcing of materials and services inputs. Moreover, the positive productivity effects of internationally outsourced inputs depend on the type of establishment that is engaged in outsourcing. Plants that are linked into international production networks, i.e., foreign-owned plants as well as domestic exporters, benefit while no such effects are found for non-exporting establishments. We rationalise these results in terms of the arguments provided by Grossman and Helpman (2002).

The structure of our paper is as follows. In the next section we discuss the theoretical rationale for our hypothesis that international outsourcing affects productivity, and review the related empirical literature. Section 3 sets out the empirical methodology for analysing the link

between outsourcing and productivity at the plant level. Then follows a description of the data along with some descriptive statistics in Section 4. We subsequently present the results of our estimations in Section 5 before concluding in the final section.

2 International outsourcing and productivity

The theoretical rationale for expecting an effect from international outsourcing on plant level productivity is fairly straightforward. Assume that goods are produced in a multistage production process, which for each good involves different stages from basic upstream production to the eventual completion of the final good in the downstream stages.³ With two types of labour, skilled and unskilled, where the former has a higher marginal product than the latter, outsourcing of production stages abroad can lead to changes in overall labour productivity within the plant.

One may expect two types of effects. Firstly, there are direct effects at the level of the outsourcing plant, due to the reallocation of production activities. As an example, assume that the less skill intensive upstream production stages are produced with only unskilled labour, while more skill intensive downstream stages use only skilled labour. If the plant outsources some or all of the upstream production abroad (due to, for example, lower factor prices for unskilled labour in the foreign country) there will be a reallocation of production in the plant towards more skill intensive downstream production. This, *ceteris paribus*, will lead to a rise in average labour productivity in the plant (given that wage rates for high skill workers exceed those for low skilled workers). The opposite effect can be expected if for some reason the plant outsources more skill intensive downstream stages of the production process.

Secondly, there will be general equilibrium effects associated with the plant level outsourcing activity. International outsourcing changes the relative demand for factors of production in the domestic economy, which will affect relative factor prices in the economy. We focus on the first plant level effect for two reasons. First, our data are at the plant level which is ideal for studying that type of effect. Second, given the nature of our econometric approach (which is described in Section 3) our results should be interpreted as short run results, which is in line with the first type of effect described above.

³ See, for example, Kohler (2004) and Feenstra and Hanson (1996) for theoretical models assuming such multistage production with a continuum of production stages.

Given the substantial heterogeneity of units in our plant level data, it seems reasonable to expect the plant level productivity effects of outsourcing to depend on a number of things. In particular, these effects may differ depending on the type of firm that engages in outsourcing, as well as the characteristics of suppliers. To put this idea in context we refer to the recent theoretical discussion of international outsourcing decisions in a global economy by Grossman and Helpman (2002). In their model, firms decide about where to outsource, and this decision invariably involves a costly search for suitable suppliers in two countries. Search costs increase with the extent of search. *Inter alia*, Grossman and Helpman (2002) argue that firms are more able to find suitable suppliers in “thicker markets”, i.e., where there is a larger number of potential suppliers.

The analysis we carry out in this paper can be linked in with these theoretical priors. Firstly, we are able to distinguish purely domestic plants from domestic exporters and foreign-owned multinationals. The latter two types of establishments can be expected to face lower search costs as they are embedded into international production networks with more foreign contacts than purely domestic firms (e.g., Sjöholm, 2003). Hence, they may be more likely to benefit from outsourcing. Secondly, we can distinguish international outsourcing of tangible inputs, i.e., materials and components, from services inputs (the exact definition of which will be given in the data section below). Arguably, one may expect different degrees of market thickness for both types of broadly defined input categories. For example, in Ireland the services sector appears to be fairly uncompetitive, in particular for transport, the professions, retail banking or service provision over networks (such as telecommunications) (see Fingleton, 1996). This is not the case for tradable goods which, of course, includes materials and components. Similarly, it is likely that the international market for outsourcing differs from that of suppliers at the local level. Hence one may expect different productivity effects following the outsourcing of materials or services inputs.^{4,5}

The empirical evidence on the link between international outsourcing and productivity is, to the best of our knowledge, scarce. It appears that to date most of the empirical work has

⁴ The evidence provided by Görg and Hanley (2003) is in line with this argument. Using a much more limited data set than used herein they find that total outsourcing (not distinguishing domestic and international outsourcing) of services reduces plants’ profitability, while materials outsourcing has positive effects on profitability.

⁵ Another reason for expecting different effects is that services outsourcing may, at least to some extent, capture fixed as well as variable costs, while materials only captures the latter. However, given the nature of the data, we are not able to distinguish these two types of cost components.

focused on the labour market – wage effects of outsourcing. For example, Feenstra and Hanson (1999) and Hijzen (2003) use aggregate data to estimate the impact of international outsourcing on wages in the US and UK, respectively, implementing the so-called “mandated wage regression” approach. Similar work has been undertaken for other countries; see, for example, the review by Feenstra and Hanson (2001).

Egger and Egger (2001) present one of the few papers that focuses on the link between international outsourcing and labour productivity, specifically, productivity of low skilled labour. They use aggregate data for EU member countries and a measure of outsourcing similar to Feenstra and Hanson’s (1999) narrow measure of cross-border fragmentation. They find that the productivity of low skilled workers is adversely affected by cross-border fragmentation in the EU, albeit only in the short-run. In the long run, low-skill worker productivity rises. They argue that this result is consistent with labour market rigidities in the short run, but in the long run factor mobility will lead to the predicted result of rising labour productivity.

Given the increasing number of studies concerning themselves with international fragmentation of production, it is perhaps surprising to note that there is a dearth of papers using micro level data, although this is possibly due to the unavailability of data sources that give information at the company or plant level on the establishment’s input sourcing behaviour. One notable exception is a recent paper by Head and Ries (2002) which conducts a micro level study of international outsourcing in Japan on firm level labour demand. They measure outsourcing using data on employment in Japanese enterprises abroad. They hypothesise that skill intensity (proxied by the non-production worker share of the wage bill) will differ with offshore production, only in the case where vertical investment characteristics characterise their data. In other words, they expect changes in wage differentials between skilled and unskilled workers to be predicated on the amount of fragmentation that Japanese firms undertake. Their empirical results show changes in skills intensities that are consistent with fragmentation of lower-skill activities abroad. However, when considering the small number of micro level studies of international outsourcing, none seem to have investigated the link between outsourcing and plant productivity.⁶

⁶ While Girma and Görg (2004) provide a micro level study of the impact of total outsourcing on productivity, one limitation of their analysis is that they are unable to distinguish outsourcing across borders from domestic outsourcing.

3 Empirical methodology

The purpose of this paper is to investigate the effect of international outsourcing on plant level productivity. In order to do so we propose to estimate production functions which can internalise the effect of international outsourcing. Specifically, we assume a general Cobb-Douglas production function

$$Y_{it} = A^\phi (K^\alpha L^\beta M^\gamma S^\kappa) \quad (1)$$

where Y is output, K is capital, L is labour, M is material inputs, S is services inputs and A is a technology parameter. Taking logs, subtracting $\ln L$ from both sides and allowing for a dynamic specification yields the following expression

$$(y - l)_{it} = \phi a + \eta(y - l)_{it-1} + \alpha(k - l)_{it} + \gamma(m - l)_{it} + \kappa(s - l)_{it} + \lambda l_{it} \quad (2)$$

where lower case letters denote natural logs (i.e., $y = \ln Y$) and $\lambda = \alpha + \beta + \gamma + \kappa - 1$ allows for non-constant returns to scale in the production function. The dynamic specification is adopted in order to allow for possible correlation of plant level productivity over time.

It is not straightforward to incorporate the effects of international outsourcing (or outsourcing in general) in such a production function framework. Outsourcing in its very general form simply means a change in the use of intermediate inputs M and S . Of course, a higher use of M and S is expected to increase output via the production function, hence, an interpretation of the coefficients γ and κ as telling us anything about the effects of outsourcing on productivity does not appear sensible.

We investigate whether the use of international outsourcing has any further positive effect over and above the expected positive effect via increasing the volume of total intermediates. In other words, we want to check whether, when we control for total inputs, the source of the inputs matters - i.e., whether imported intermediates confer a productivity advantage to plants. We do so by allowing the intensity of international outsourcing to shift the technology parameter A of the underlying production function, i.e., we assume that the reallocation of production within the plant that is due to international outsourcing leads to a shift of the plant's production function.

Doing so yields the following estimable form of the production function

$$(y - l)_{it} = \pi + \eta(y - l)_{it-1} + \delta outs^{m,s}_{it} + \alpha(k - l)_{it} + \gamma(m - l)_{it} + \kappa(s - l)_{it} + \lambda l_{it} + \mu_i + \varepsilon_{it} \quad (3)$$

where $outs^{ms}$ is the intensity of international outsourcing for either material inputs m or services s , μ_i captures any unobserved time invariant plant specific effects which we do not explicitly account for in the empirical model, and the remaining error term ε is assumed to be white noise.

There are three econometric issues to consider with regard to the estimation of (3). First, in order to purge the plant-specific time invariant effect we estimate a first-differenced version of the equation, as is common in the literature. However, due to the lagged dependent variable, estimation of the equation in first-differences using OLS leads to biased and inconsistent estimates (Baltagi, 2001). Second, the relationship between outsourcing and productivity may be endogenous if, for example, plants with high or low productivity levels are more likely to engage in outsourcing than other plants. Third, factor inputs should also be considered potentially endogenous in the estimation of the production function.

In order to deal with these issues, equation (3) is estimated with the linear generalised methods of moments (GMM) estimator as proposed by Arellano and Bond (1991). This estimator allows us to treat all independent variables as potentially endogenous and uses appropriate lagged levels of the dependent variable and of the independent variables as instruments for the equation in first differences.

Equation (3) constrains the effect of outsourcing on productivity to be the same across different types of firms. In the empirical estimations we relax this assumption, allowing for differential productivity effects of international outsourcing by nationality and export status of the plants. The rationale for this is as follows. It is by now a stylised fact that both foreign multinationals and exporters are more productive than purely domestic plants (see, for example, Bernard and Jensen, 1999 and Doms and Jensen, 1998 for the US and Girma, Görg and Strobl, 2004 for Ireland). While the standard explanations for these productivity advantages usually focus on firm specific assets for multinationals and self-selection or learning for exporters,⁷ productivity enhancing outsourcing may have a role to play, also. Being part of an international production network, either as an affiliate of an MNE or an exporter, allows firms to reap the advantages of international specialisation of production activities. This arguably allows such establishments to lower the costs of searching for new intermediate good suppliers from which to outsource inputs. Hence, due to the lower cost associated with

establishing an outsourcing relationship, such firms may reap greater gains from international outsourcing than firms with production facilities and sales only on the domestic market.

4 Description of the data

In order to investigate the relationship between international outsourcing and productivity we use plant level data for manufacturing industries in the Republic of Ireland. The data are taken from the *Irish Economy Expenditure Survey*, undertaken annually by Forfás, the government agency with responsibility for enterprise development, science and technology. This is an annual survey of larger plants in Irish manufacturing with at least 20 employees, although a plant, once it is included, is generally still surveyed even if its employment level falls below the 20 employee cut-off point. The survey provides plant level information on, *inter alia*, output, exports, employment, capital employed, as well as details on plants' expenditure on labour, materials, and services inputs.⁸ The response rate to this survey is generally estimated to be between 60 and 80 per cent of the targeted plant population. The data covers the period 1990-1998.⁹

The main variable of interest is international outsourcing. This can arguably be seen as a substitute for in-house production and may therefore, at least in the short run, lead to a reduction in the total wage bill. In some sense the cost of outsourcing is therefore equal to the opportunity wage that may have accrued to in-house employees if the service had not been contracted out. We therefore, similar to Girma and Görg (2004), calculate an indicator of an establishment's propensity to outsource as the expenditure on outsourcing, i.e., on either services or material inputs, relative to the plant's total wage bill.

An advantage of our data set is that we can distinguish intermediate inputs into raw materials and components (referred to as materials) and services inputs, and the proportion of these factors sourced abroad.¹⁰ We can therefore calculate two disaggregated measures of international outsourcing, namely, the ratio of imported materials over total wages, and the

⁷ See, for example, Helpman, Melitz and Yeaple (2004), Bernard, Eaton, Jensen and Kortum (2003), Clerides, Lach and Tybout (1998).

⁸ All nominal values are deflated using a standard consumer price index as there are no official sector level price deflators available for Ireland.

⁹ The data actually commences in 1983, but the earlier years contain no suitable proxy for the capital stock of plants.

ratio of imported services inputs over total wages. With regard to the latter measure, services inputs are defined as other direct and indirect cost, excluding materials, wages, rent, interest payments and depreciation. This includes contracted out services, such as consultancy, maintenance, security, cleaning, catering etc.

To illustrate the data, we provide some summary statistics for the main variables in our data set. Because our response variable in subsequent regressions is labour productivity (see equation 3), we first examine the productivity distributions of plants in the *Irish Economy Expenditure Survey*. Table 1 describes the distribution of plants' labour productivity levels for the 16 year time window while Figure 1 depicts the same data graphically. We observe a long tailed positively skewed distribution (confirmed by the difference between average and median values).

[Table 1 and Figure 1 here]

In order to get a preliminary idea of the relationship between outsourcing and labour productivity, we first decompose the latter variable in two groups: low (below median) and high (above median) labour productivity respectively. Table 2 describes average outsourcing intensities for these low and high productivity establishments. One can see that high productivity plants exhibit higher average outsourcing intensities of both materials and services. We also find that a greater proportion of foreign owned establishments are located in the higher productivity category.

[Table 2 here]

Given the positive link between productivity and outsourcing intensity manifested in Table 2, it is fruitful to explore this relationship in more depth. Because foreign owned plants tend to be more productive, we need to examine the productivity / outsourcing relationship while controlling for the nationality of the establishment. Figures 2 to 5 illustrate these relationships in more detail, with the background data used to generate the profiles located in Appendix 1.

[Figures 2-5 here]

Figures 2 and 3 which describe the intensities with which domestic and foreign plants outsource materials inputs, respectively, show a similar profile for both types of

¹⁰ One should note that materials and services not sourced abroad may have been purchased from foreign affiliates of multinationals located in Ireland rather than just from purely domestic firms. Unfortunately, the data set does not allow us to distinguish these two sources for domestically purchased inputs.

establishments. The gap between more productive plants and their lower productivity counterparts is widest not at the lowest outsourcing intensity (first quartile), where the differences are blurred. The gap between firms is most pronounced for Q2, Q3, and Q4 with plants in the uppermost quartile also denoted by higher productivity levels. For foreign owned affiliates this gap is very pronounced - foreign plants engaged most intensively in importing manufactured components from sub-suppliers are comparatively more productive than their counterparts.

When we examine the profile of productivity across international outsourcing for plants importing services as opposed to materials components, the pattern in labour productivity gaps that we observed above breaks down (Figures 4 and 5). The productivity gap pattern depends on whether the plant is domestic or foreign. In Figure 4, describing the outsourcing intensities of services inputs for domestic plants only, establishments with the lowest outsourcing quartile are more likely to manifest low productivity with a percentage gap of 34 percent. The most unambiguous finding when examining the profiles of productivity over internationally outsourced services arises when looking at the productivity gap for foreign owned establishments. They appear to exploit services outsourcing where those with the highest outsourcing intensities are also the most likely to belong to the high-productivity group.

While the obvious drawback of examining such outsourcing profiles is that other potentially useful variables which might influence labour productivity levels are not simultaneously taken into account, we nevertheless develop a rough picture of how the outsourcing / productivity relationship can vary. In particular, we find differences according to whether the components are tangibles or intangibles and depending on the nationality of the establishment that carries out the outsourcing. This can be interpreted in the light of the framework proposed by Grossman and Helpman (2002) and discussed in Section 2 above, as the thickness of markets can be expected to be different for international outsourcing of material (tangible) compared to services (intangible) intermediates. Also, foreign owned establishments are linked into international production networks which may reduce search costs for such plants.

5 Econometric analysis

The summary statistics in the previous section do, of course, not allow us to take adequately into account other covariates that may impact on plant level productivity and may be correlated with outsourcing. In order to do so we now turn to estimating the production functions described in equation (3). Note that when applying the GMM estimator one has the choice of using both a one step and a two step procedure to arrive at estimates of the model in question. Arellano and Bond (1991) show that the asymptotic standard errors from two step estimations may be a poor guide for hypothesis testing. However, the two step estimations are preferred for inference on model specification, specifically, the Sargan test for instrument validity and the test for second-order autocorrelation.¹¹ Hence, we present coefficients and standard errors from the one step estimations, while the Sargan and AR(2) tests are calculated based on the two step estimates.

The results of the estimation of the baseline specification of equation (3) using data for all manufacturing plants are reported in column (1) of Table 3. Note, firstly, that the coefficients on the production factors seem reasonable and as expected, and that we cannot reject the null hypothesis of constant returns, as indicated by the statistically insignificant coefficient on total employment (l) in the equation. In terms of the diagnostics, both the Sargan and AR(2) tests indicate that the specification is sensible.

The variable we are most interested in, is of course, international outsourcing. Examination of the results in the table shows that international outsourcing of services does not appear to have an impact on plant level productivity. Outsourcing of materials, on the other hand, has a positive and statistically significant coefficient in the estimations. These results, hence, suggest that outsourcing of materials can increase productivity – an increase in the outsourcing intensity by one percentage point leading to a 1.2 percent increase in productivity at the level of the plant.

The estimations in column (1) assume that foreign multinationals and domestic firms share the same production function. This might not be a reasonable assumption, given that multinationals are usually presumed to employ superior technologies to domestic firms (e.g., Markusen, 1995). Additionally, we are aware from our review of the summary statistics that the productivity profiles between domestic and foreign owned firms appear to differ.

Furthermore, as we argued in Section 2, multinationals might have an advantage over domestic firms in terms of their international links, which would allow them to have lower search costs and, hence, reap higher benefits from international outsourcing.

To allow for this we split the sample by nationality of ownership, creating two subsamples consisting of foreign and domestic plants. In the next two columns of Table 3 we then report results for GMM estimations on the two separate samples. It is apparent that, even though the coefficients are generally similar in sign, the actual size of the coefficients turns out to be different in most cases. In particular, the productivity enhancing effect of international outsourcing of materials seems to be stronger for foreign than for domestic firms (0.017 compared to 0.009), which is in line with the idea advanced above that international outsourcing allows foreign affiliates to benefit from being part of an international production network.¹² However, the effect of international outsourcing of services is still statistically insignificant for both groups of plants.

[Table 3 here]

In the next set of results, reported in Table 4, we take this a step further and estimate separate production functions for foreign and domestic plants by exporting status. Similar to the nationality distinction, we expect that exporters face lower search costs due to having international exposure and better knowledge about foreign supply sources. Hence, we would expect exporters to benefit more from international outsourcing. In line with this expectation, we find substantial heterogeneity in the coefficients across the different types of plants in Table 4. Most interestingly, international outsourcing of materials exhibits productivity enhancing effects for domestic and foreign exporters, with a coefficient of similar magnitude, while there are no such effects of materials outsourcing for non-exporters. This indicates that only exporting plants appear to benefit from international production networks and lower search costs. However, the same is not true for non-exporting plants that have multinational status.¹³

[Table 4 here]

¹¹ Note that the consistency of the estimates rests on the assumption that there is no second order correlation of the residuals of the first-differenced equation (Arellano and Bond, 1991).

¹² However, a simple t-test based on the assumption of independence of samples indicates that we can only reject the null hypothesis of equality of coefficients at the 10 percent level.

¹³ We also now find a positive coefficient on outsourcing of services for foreign non-exporters. However, one needs to be cautious about this result as this subsample only includes 35 plants. Also, the coefficient is only statistically significant at the 5 percent level.

6 Conclusions

This paper presents, to the best of our knowledge, unique evidence describing the effect of international inputs outsourcing on plant level productivity based on plant level data. The most unambiguous result obtained is the positive productivity gains accruing to exporting firms which engage in the offshoring of intermediates. In other words, exporting firms enjoy some advantage over non-exporters which allow them to convert this advantage into a productivity gain. A possible reason for this gain is that firms that are members of international production networks possess extensive knowledge on where to procure competitively priced inputs and, hence, face lower costs of searching for potential suppliers abroad, in line with the theoretical model by Grossman and Helpman (2002). Another reason why these firms are able to uniquely benefit may be driven by output scale economies which result in lower unit costs for the purchase of intermediates abroad. An exporter might also enjoy non-pecuniary scale economies in negotiation with suppliers, which further bid down the price of intermediates.

The evidence for benefits to services offshoring is less clear-cut. According to our empirical work, the rewards to services procurement might well be non-existent. As noted earlier, there is also recent evidence from IT practitioners that a majority of those surveyed regarded procured services to be of inferior quality to those produced in-house. In a minority of cases, procurement of services, including “high abstraction” activities were actually harmful to production flows.

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Table 1: Productivity Levels for Irish Economy Expenditure Survey firms 1983 - 1998

year	1983	1984	1985	1986	1987	1988	1989	1990
Mean	0.86	0.97	1.00	0.93	0.93	1.01	1.01	0.97
median	0.50	0.55	0.60	0.57	0.60	0.64	0.61	0.57
Std. Dev.	1.00	1.22	1.20	1.11	1.06	1.24	1.40	1.68
Obs	731	654	719	710	753	799	867	923
year	1991	1992	1993	1994	1995	1996	1997	1998
Mean	0.94	0.97	1.08	1.30	1.27	1.25	1.40	1.38
median	0.56	0.57	0.59	0.64	0.63	0.65	0.67	0.69
Std. Dev.	1.51	1.50	2.57	3.35	3.18	2.93	4.06	3.40
Obs	1277	1298	1262	1193	1311	1394	1414	1384

Table 2: Summary Statistics for Low and High Productivity Firms

	Low Productivity		High Productivity	
	Mean	Std. Deviation	Mean	Std. Deviation
Materials o/s intensity ($outs^m$)	1.00	1.15	2.43	4.16
Services o/s intensity ($outs^s$)	0.21	1.84	0.44	2.15
Domestic firms	5828 (59%)		2497 (36%)	
Foreign firms	4005 (41%)		4359 (64%)	

Table 3: GMM Regression results

	(1)	(2)	(3)
	All	Foreign	Domestic
$outs^s$	-0.001 (0.003)	-0.004 (0.003)	0.009 (0.009)
$outs^m$	0.012 (0.002)*	0.017 (0.002)*	0.009 (0.004)*
$(y-l)$ lagged	0.102 (0.012)*	0.077 (0.014)*	0.158 (0.019)*
$(k-l)$	0.025 (0.009)*	0.045 (0.010)*	0.021 (0.011)
$(m-l)$	0.385 (0.019)*	0.301 (0.021)*	0.411 (0.019)*
$(s-l)$	0.066 (0.013)*	0.087 (0.015)*	0.076 (0.015)*
l	-0.033 (0.017)	-0.039 (0.022)	-0.113 (0.022)*
Sargan (p-value)	1.00	1.00	1.00
M2 (p-value)	0.59	0.90	0.49
Observations	6177	2686	3491
Plants	1420	531	889

Notes: (1) Standard errors in parentheses, (2) * indicates significant at 1%, (3) regressions include time trend, (4) coefficients reported are one-step estimates, (5) Sargan and M2 are from two step estimation.

Table 4: GMM regression results, by nationality and export status

	(1)	(2)	(3)	(4)
	foreign exporters	foreign non-exporters	domestic exporters	domestic non-exporters
$outs^s$	-0.003	0.052	-0.003	-0.005
	(0.003)	(0.024)	(0.009)	(0.022)
$outs^m$	0.017	-0.015	0.014	-0.001
	(0.002)*	(0.008)	(0.004)*	(0.009)
$(y-l)$ lagged	0.074	0.113	0.151	0.091
	(0.014)*	(0.026)*	(0.019)*	(0.027)*
$(k-l)$	0.046	0.016	0.057	-0.015
	(0.010)*	(0.018)	(0.012)*	(0.011)
$(m-l)$	0.297	0.729	0.374	0.538
	(0.021)*	(0.024)*	(0.019)*	(0.030)*
$(s-l)$	0.075	0.073	0.092	0.126
	(0.015)*	(0.024)*	(0.015)*	(0.020)*
l	-0.036	-0.120	-0.110	-0.126
	(0.022)	(0.038)*	(0.022)*	(0.036)*
Sargan (p-value)	1.00	1.00	1.00	1.00
M2 (p-value)	0.88	0.45	0.83	0.08
Observations	2572	114	2944	547
Plants	515	35	742	205

Notes: (1) Standard errors in parentheses, (2) * indicates significant at 1%, (3) regressions include time trend, (4) coefficients reported are one-step estimates, (5) Sargan and M2 are from two step estimation.

Figure 1 Labour Productivity

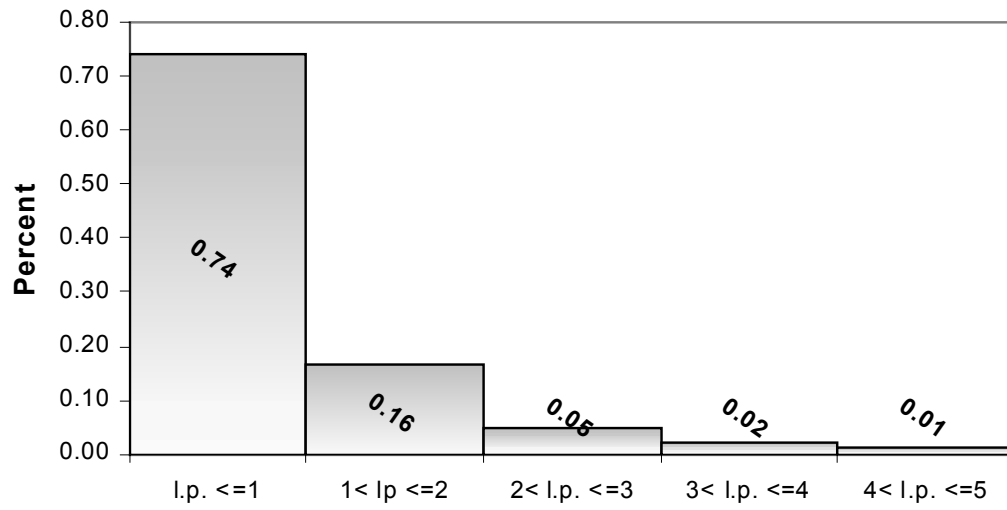


Figure 2 Domestic Firm Materials O/S by Labour Productivity

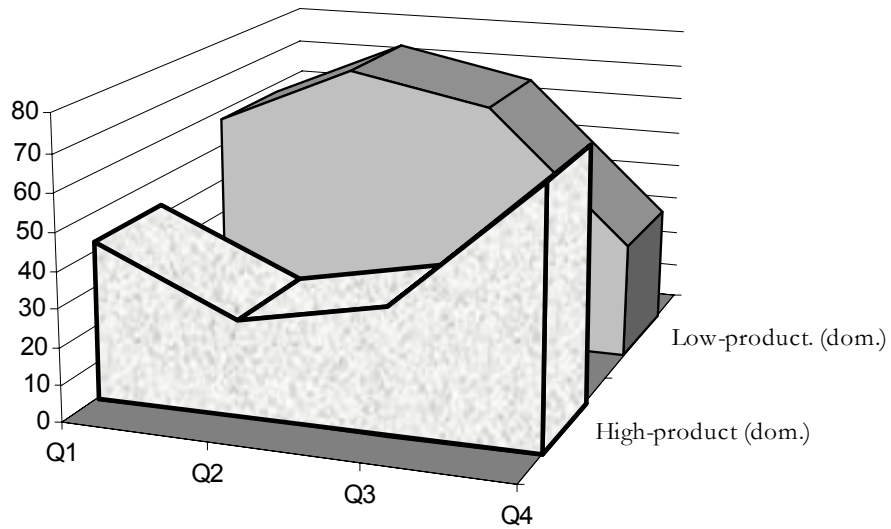


Figure 3 Foreign Firms Materials O/S by Labour Productivity

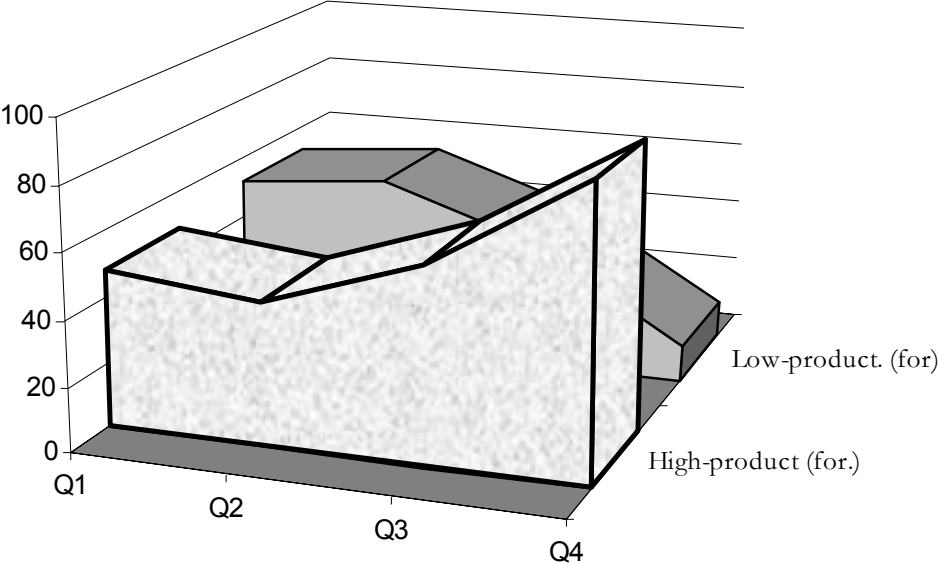


Figure 4 Domestic Firm Services O/S by Labour Productivity

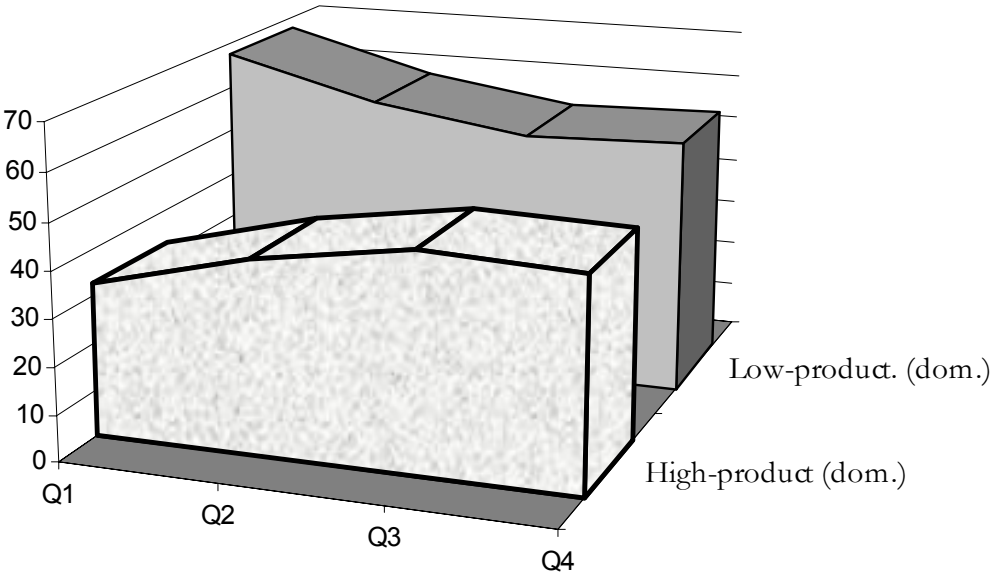
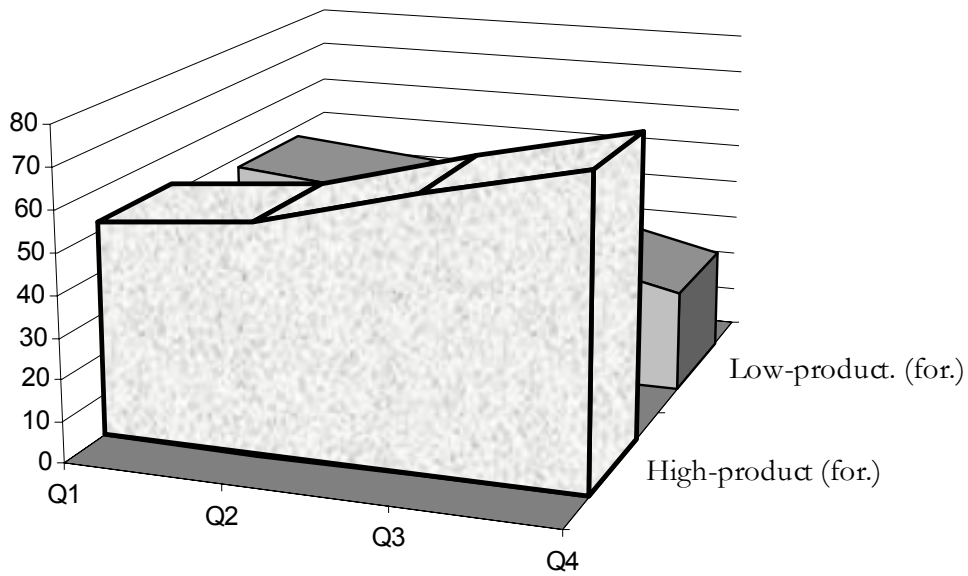


Figure 5 Foreign Firm Services O/S by Labour Productivity



Appendix 1: Distribution of O/S Intensity over High and Low Productivity Firms

	Domestic			Foreign		
<i>Materials outsourcing</i>						
	Low-productivity	High-productivity	Total	Low-productivity	High-productivity	Total
Quantile 1	58	42	100	52	48	100
Quantile 2	75	25	100	56	44	100
Quantile 3	67	33	100	40	60	100
Quantile 4	31	69	100	11	89	100
<i>Services outsourcing</i>						
	Low-productivity	High-productivity	Total	Low-productivity	High-productivity	Total
Quantile 1	67	33	100	47	53	100
Quantile 2	59	41	100	44	56	100
Quantile 3	54	46	100	34	66	100
Quantile 4	55	45	100	25	75	100