

# **Productivity effects of international outsourcing: Evidence from plant level data\***

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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 show that productivity benefits only accrue to affiliates of foreign-owned multinationals and exporters. In particular, for foreign-owned exporting plants increased international outsourcing of both services and materials is associated with higher productivity, whereas this link only exists for domestic exporters' outsourcing of materials.

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## 1 Introduction

International outsourcing has become a growing phenomenon in world trade. Hummels et al. (2001), for example, provide evidence from data 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.<sup>1</sup> Moreover, they find that international outsourcing grew approximately 30 percent between 1970 and 1990. Chen et al. (2005) update this evidence and also show for the US that vertical specialisation of production can account for about two-thirds of the increase in exports over the last three decades. More recently, the attention in many industrialised countries, in particular the US and UK has shifted away from outsourcing of materials to services outsourcing (Amiti and Wei, 2005a). For instance, much media coverage has been given to the outsourcing of services to developing countries such as India.

Given the considerable growth in outsourcing it is not surprising that a sizeable amount of research has now been devoted to attempting to understand the causes and consequences of this disintegration of production.<sup>2</sup> When investigating the impact of international outsourcing most research seems to focus on the implications for domestic labour markets, as reviewed by Feenstra and Hanson (2001). For example, Feenstra and Hanson (1996, 1999) and Hijzen et al. (2005) use aggregate data to estimate the impact of international outsourcing on wages and the relative demand for skills in the US and UK, respectively.<sup>3</sup> Head and Ries (2002) provide a micro level study of the impact of international outsourcing on firm level labour demand, measuring outsourcing using data on employment in Japanese enterprises abroad. Their

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<sup>1</sup> In the international trade literature, international outsourcing is generally seen to be equivalent to vertical specialisation and is measured in terms of trade in intermediate goods.

<sup>2</sup> See, for example, recent special issues on international outsourcing of the *North American Journal of Economics and Finance* (Vol. 16, No. 1, 2005) and the *International Review of Economics and Finance* (Vol. 14, No. 2, 2005).

<sup>3</sup> Similar work has been undertaken for other countries; see, for example, the review by Feenstra and Hanson (2001).

empirical results show changes in skills intensities that are consistent with outsourcing of lower-skill activities abroad.

Another somewhat neglected, but potentially important, aspect of outsourcing is its impact on productivity.<sup>4</sup> In this regard, standard trade theory tells us that increased specialization following international outsourcing is beneficial for the economy as it allows reallocation of resources to their best use. A priori, one would also expect the individual plant to be able to benefit from international outsourcing. In the short run it allows the plant to purchase lower cost or higher quality intermediates abroad. In the medium to longer run, it will also be able to reallocate resources (e.g., outsourcing of low skill intensive part of production may lead to specialization in higher value activities).

The empirical evidence on such link between international outsourcing and productivity is, however, to the best of our knowledge, scarce. The few papers that have investigated productivity effects of outsourcing have used aggregate data. For instance, Egger and Egger (2005) focus on the link between international outsourcing of materials and labour productivity of low skilled labour, using aggregate data for EU member countries. The authors find that the productivity of low skilled workers is adversely affected by cross-border fragmentation in the EU in the short-run, while 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. Another example is Amiti and Wei (2005b) who use industry level data for the US and show that services outsourcing is positively associated with productivity.

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<sup>4</sup> The potential importance of this aspect is highlighted by some recent evidence which casts some doubt on the efficacy of outsourcing for boosting company performance. For example, 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; see Software Development Magazine, January 2004 issue.

In the current paper we, as the aforementioned studies, also investigate whether international outsourcing affects productivity. However, in contrast to these, we do so using plant, rather than industry, level data.<sup>5</sup> Recent empirical studies of firm and plant level productivity have established that there is large and persistent heterogeneity across firms even within narrowly defined industries (see, e.g., Bartelsman and Doms, 2000), hence accounting for this with the use of micro data is important. Additionally, we allow for potential productivity effects to be different for purely domestic plants, exporters, and foreign-owned affiliates in the host country. This latter aspect links our paper in with the recent theoretical and empirical work on plant/firm heterogeneity and international trade, such as Bernard et al. (2003), Helpman et al. (2004) and Yeaple (2005).

Another feature of our paper is that we make the explicit distinction between services and materials outsourcing. That such a categorisation may be important has already been hinted at by the recent studies of Görzig and Stephan (2002) and Görg and Hanley (2004), who using establishment level data for Germany and Ireland, respectively, find that outsourcing of material inputs has positive effects on establishments' returns on sales and profitability, while there are no such positive effects for services outsourcing.<sup>6</sup> Similar to the empirical literature using aggregate industry level data (e.g., Feenstra and Hanson, 1996, 1999), which defines international outsourcing generally as 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.

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<sup>5</sup> Girma and Görg (2004) provide a micro level study of the impact of total outsourcing on productivity, though one limitation of their analysis is that they are unable to distinguish outsourcing across borders from domestic outsourcing. There is also a somewhat related literature using plant level data to look at the productivity effects of reductions in tariffs on inputs, e.g., Fernandes (2003) and Amiti and Konings (2005).

<sup>6</sup> Note that these studies do not distinguish domestic and international outsourcing, however.

Our empirical analysis utilises 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).

Our evidence from econometric estimations controlling for endogeneity of the outsourcing decisions using this data suggests that there are potential positive effects from international outsourcing of both materials and services inputs. However, we find that these benefits only accrue to affiliates of foreign-owned multinationals, or exporters. This suggests that plant level heterogeneity, and in particular contacts in foreign markets, is important in evaluating the productivity effects of international outsourcing.

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. Section 3 sets out the empirical methodology for analysing the link between outsourcing and total factor 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.<sup>7</sup> In this set up, one may expect three different types of effects. In the short run, the plant engaging in international outsourcing has access to internationally traded inputs which may be available at lower costs or at higher quality than those available domestically. Hence, increasing use of internationally traded inputs may result in a direct boost in productivity for the plant, shifting its production function outward.

Secondly, in the longer run, international outsourcing may also lead to changes in factor shares, which may have implications for productivity. Assume, for example, two types of labour, skilled and unskilled, where the former has a higher marginal product than the latter. 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.

Thirdly, 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.

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<sup>7</sup> See, for example, Kohler (2004) and Feenstra and Hanson (1996) for theoretical models assuming such multistage production with a continuum of production stages.

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.

Given the substantial heterogeneity of units in our plant level data, it seems reasonable to expect the plant level productivity effects to differ depending on plant characteristics. We distinguish purely domestic plants from domestic exporters and foreign-owned multinationals. The latter two types of establishments can be expected to face lower costs of searching for suppliers abroad as they are embedded into international production networks with more foreign contacts than purely domestic firms (e.g., Sjöholm, 2003).<sup>8</sup> Also, they are generally more productive, larger and more skill intensive than purely domestic firms (e.g, Girma et al, 2005). Hence, they may be more likely to benefit from outsourcing.

Our data provides us with other valuable information that we exploit in the empirical analysis. Namely, 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). It is not a priori obvious that we should expect similar productivity effects from the outsourcing of different types of inputs and, hence, it seems appropriate to investigate this issue in detail. For example, one reason for expecting different effects is that services outsourcing may, at least to some extent, capture fixed as well as variable costs, while materials more likely only captures the latter.<sup>9</sup>

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<sup>8</sup> Grossman and Helpman (2004) provide a theoretical model which shows the importance of search costs for international outsourcing decisions.

<sup>9</sup> However, given the nature of the data, we are not able to distinguish these two types of cost components. Note also that our data do not allow us to distinguish more than these two types of intermediate inputs.

### 3 Empirical methodology

In order to investigate the effect of international outsourcing on plant level total factor productivity we estimate production functions that include the effect of international outsourcing. Specifically, we assume a general Cobb-Douglas production function

$$Y_{it} = A_{it}^f (K_{it}^a L_{it}^b) \quad (1)$$

where  $Y$  is value added,  $K$  is capital,  $L$  is labour, and  $A$  is a technology parameter (or total factor productivity, TFP). Taking logs yields

$$y_{it} = fa_{it} + ak_{it} + bl_{it} \quad (2)$$

where lower case letters denote natural logs (i.e.,  $y = \ln Y$ ) of the variables.

We investigate whether the use of international outsourcing has any effect on total factor productivity by allowing the intensity of international outsourcing to shift the technology parameter  $a$  of the underlying production function,  $a_{it} = a(outs_{it})$ , i.e., we assume that international outsourcing leads to a shift of the plant's production function. This is, thus, an empirical analysis of the type of short run effect from international outsourcing on productivity, as discussed in Section 2.

In the estimation of the production function we also include the lagged level of value added in order to allow for learning by doing effects and the cumulative effects of continuous production.<sup>10</sup> Hence, the estimation equation is

$$y_{it} = p + ky_{it-1} + douts^{m,s}_{it} + ak_{it} + bl_{it} + gX_{it} + m + e_{it} \quad (3)$$

where  $outs^{m,s}$  is the intensity of international outsourcing for either material inputs  $m$  or services  $s$ , and  $X$  is a vector of other firm characteristics that may impact on TFP.  $m$  captures

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<sup>10</sup> This is similar to the literature on macro level cross country productivity growth, e.g., Islam (1995).

any unobserved time invariant plant specific effects which we do not explicitly account for in the empirical model, and the remaining error term  $\mathbf{e}$  is assumed to be white noise.

The vector  $X$  includes two sets of dummy variables indicating whether a firm is part of a foreign owned multinational and whether it is an exporter as it is frequently argued that both types of firms are more productive than purely domestic plants. While the international evidence generally supports this claim (see, for example, Bernard and Jensen, 1999 and Doms and Jensen, 1998 for the US and Girma et al. 2004 and 2001 for the UK), the evidence for Ireland is less clear-cut. For example, Girma, Görg and Strobl (2004) show using plant level data that labour productivity in multinationals is higher than in domestic plants (either exporters or non-exporters) but that there is no significant difference in productivity levels between domestic exporters and non-exporters.

While the standard explanations for these productivity advantages usually focus on firm specific assets for multinationals and self-selection or learning for exporters,<sup>11</sup> the possibility that outsourcing enhances productivity can also be advanced. 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. In the empirical estimations, we relax the assumption that the effect of outsourcing on productivity is the same across different types of plants by allowing for differential productivity effects of international outsourcing by nationality and export status of the plants.

There are a number of econometric issues to consider with regard to the estimation of (3). First, a commonly used method for purging the plant-specific time invariant effect is to estimate a first-differenced version, or a within transformation, of the equation. However, due to the lagged dependent variable, such a simply transformed estimation using OLS leads to biased and inconsistent estimates (Baltagi, 2001). Second, the relationship between outsourcing and productivity may be endogenous if, there are unobserved variables that are potentially correlated with outsourcing and the error term. For example, plants with high or low productivity levels may be 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. This is the case as the contemporaneous level of TFP may affect the current choice of variable input factors, in which case inputs would be correlated with the error term (e.g., Levinsohn and Petrin, 2003).

In order to take account of these potential endogeneity problems while also controlling for plant specific fixed effects ( $\mu_i$ ), we resort to using the now popular GMM systems estimator developed by Blundell and Bond (1998). Accordingly, one simultaneously estimates first differenced and level versions of the estimating equation, where for the former appropriately lagged values and for the latter appropriately lagged differences of the endogenous variables can serve as valid instruments. The validity of these instruments can be tested using a Sargan-type test. The consistency of our estimates also rests on the assumption that there is no second order correlation of the residuals of the first-differenced equation. The standard procedure to verify this is to use an AR(2) test on the residuals developed by Arellano and Bond (1991), which we also implement for our estimates.

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<sup>11</sup> See, for example, Helpman, Melitz and Yeaple (2004) and Bernard, Eaton, Jensen and Kortum (2003).

#### 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 over the period 1983-1998 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 response rate to this survey is generally estimated to be between 60 and 80 per cent of the targeted plant population. The survey provides plant level information on, *inter alia*, output, value added, exports, employment, capital employed, nationality of ownership, as well as details on plants' expenditure on labour, materials, and services inputs.<sup>12</sup> One should note, however, that information on the capital stock, is only available from 1990 onwards, and hence, since we focus on total factor productivity, our sample period consists of the years 1990-1998.<sup>13</sup> A plant is defined as foreign owned in the data if at least 50 percent of its shares are held by foreign owners.<sup>14</sup>

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

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<sup>12</sup> All nominal values are deflated using a standard consumer price index as there are no official sector level price deflators available for Ireland.

<sup>13</sup> The data actually commences in 1983, but the earlier years contain no suitable proxy for the capital stock of plants.

<sup>14</sup> While this may leave out plants with minority foreign ownership it has been the case in Ireland, certainly over the period covered, that most FDI was in the form of new fully foreign-owned greenfield investment (see, e.g., Barry and Bradley, 1997).

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 break down intermediate inputs into 2 groups: raw materials and components (referred to as materials) and services inputs respectively. Additionally, we have information on the proportion of these factors sourced abroad.<sup>15</sup> We can therefore calculate two disaggregated measures of international outsourcing, namely, the ratio of imported materials over total wages, and the 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 development of international outsourcing over the nine year time period studied, Figure 1 plots the aggregate totals for materials and services outsourcing by year. Two points are worthy of note. Firstly, international outsourcing of materials has consistently been more important than outsourcing of services in terms of aggregate values. Secondly, both types of outsourcing increased, on average, between 1990 and 1998, reflecting the general notion that international outsourcing has become more important over the 1990s.

*[Figure 1 here]*

Table 1 presents some summary statistics on some of the variables of interest. As is common in the literature, we find that foreign-owned plants as well as domestic exporters are

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<sup>15</sup> 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. Also, the data set does not provide information on the source country of the inputs.

larger (in terms of employment) and more productive (in terms of value added per employee) than purely domestic oriented local plants. We also find that foreign-owned plants have the highest intensities of international outsourcing for both services and materials. By contrast there is no statistically significant difference in outsourcing intensities between domestic exporters and non-exporters.

*[Table 1 here]*

In order to get a preliminary idea of the relationship between international outsourcing and productivity (in terms of value added per employee), we decompose the latter variable in two groups: low (below median) and high (above median) labour productivity respectively. Table 2 then 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]*

## **5 Econometric analysis**

While the summary statistics just shown gave some insight into the potential relationship between productivity and outsourcing, they do not, of course, allow us to take adequately into account other covariates that may impact on plant level productivity and may be correlated with outsourcing, or say anything about directions of causality. In order to deal with these issues we now turn to estimating the production functions described in equation (3). Due to the inclusion of the lagged dependent variable the coefficients describe the short run response in total factor productivity due to changes in the variables. 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.<sup>16</sup> In terms of the diagnostics, both the Sargan and AR(2) tests indicate that the specification is sensible. The coefficients on the lagged level of value added and the production factors seem reasonable and as expected. We also find that foreign owned plants are more productive than domestic ones, as is generally found in the literature. However, we do not find any statistically significant productivity premium for exporters. As pointed out above, this is not unexpected as there is, as far as we are aware, no clear cut evidence for Ireland substantiating that exporters are more productive than non-exporters.

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 and materials appear to have roughly the same impact on average plant level productivity. Specifically, the point estimates suggest that an increase in the outsourcing intensity (either services or materials) by one percentage point leads to a roughly 2.5 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 than 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 and as indicated by the summary statistics, 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.

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<sup>16</sup> For comparison we report the equivalent OLS regressions in the appendix.

To allow for this, we split the sample by nationality of ownership, creating two subsamples consisting of foreign and domestic plants, and report results for GMM systems estimations on these in the next two columns of Table 3. It is apparent that the productivity effects of international outsourcing do indeed appear to be different for these two groups of plants. For foreign owned plants we find evidence for productivity enhancing effects of international outsourcing of both services and materials. Again the coefficients are of roughly similar magnitude suggesting that international outsourcing of either type of inputs by one percentage point leads to TFP improvements by about 1.5 percent. For domestic plants we still find positive productivity effects from outsourcing of materials (albeit with a lower marginal effect than for foreign plants), while services outsourcing is associated with reductions in TFP. The finding that foreign plants are better able to benefit from international outsourcing is in line with the idea advanced above that international outsourcing allows foreign affiliates to benefit from being part of an international production network.

In the next set of results, reported in columns (4) and (5) we estimate separate production functions for 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. This conjecture is again borne out by the results. More precisely, we find statistically significant positive effects of international outsourcing of services and materials for exporters. However, for non-exporters, we find statistically significant and strong negative effects of international outsourcing on productivity. This indicates that only exporting plants appear to benefit from international production networks and lower search costs.

*[Table 3 here]*

While most foreign multinationals located in Ireland are exporters there is also a significant majority that only service the local market and do not sell overseas (Barry and Bradley, 1997). Similarly, the majority of domestic plants in our sample are exporters, though domestic non-exporters are far from negligible. To take the analysis a step further we split the sample by nationality, as in columns (2) and (3) of Table 3 but also allow the productivity effects of outsourcing to differ by exporting status within the nationality group. We do so using interaction terms of the outsourcing intensities with exporting dummies, given that further splitting the sample into four separate groups would have left us with too few observations, in particular for the samples of non-exporters. Table 4 reports the results.

A number of interesting findings emerge. From column (1) we find that foreign-owned non-exporters do not benefit from international outsourcing – indeed, there seem to be economically significant negative productivity effects associated with the outsourcing of services. By contrast, we find that foreign-owned exporters benefit from both types of international outsourcing activity.<sup>17</sup> The marginal effects of services and materials outsourcing are roughly similar, with a percentage point increase in the outsourcing intensity leading to an increase in TFP by around 2 percent.

Finally, we find strong negative effects of both types of outsourcing for domestic non-exporters (column 2). In contrast, the interaction terms show for domestic exporters that they reap positive productivity effects from outsourcing of materials inputs, but not from services outsourcing. Also, the magnitude of the negative effect of services outsourcing is substantially less for exporters than for non-exporters.

*[Table 4 here]*

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<sup>17</sup> We can reject the hypothesis that the sum of the coefficient on the outsourcing intensity plus the interaction term adds up to zero, at the one percent level. We have tested this using a Wald test as reported in the Table.

## **6 Conclusions**

This paper presents evidence describing the effect of international outsourcing of materials and services inputs on plant level productivity based on plant level data. Our results suggest that there are positive effects from outsourcing of both types of inputs. However, these results only hold for affiliates of foreign-owned multinationals and exporters. In particular, for foreign-owned exporting plants, increased international outsourcing of both services and materials is associated with higher productivity. The same pattern is only repeated where domestic exporters outsource materials, not services inputs. A possible reason for this 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. 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. Overall, our results suggest that plant level heterogeneity is important in evaluating the productivity effects of international outsourcing.

## **References**

- Amiti, Mary and Jozef Konings (2005), "Trade liberalization, intermediate inputs and productivity: Evidence from Indonesia", CEPR Discussion Paper 5104
- Amiti, Mary and Shang-Jin Wei (2005a), "Fear of services outsourcing: Is it justified?", CEPR Discussion Paper 4719

- Amiti, Mary and Shang-Jin Wei (2005b), "Service outsourcing, productivity and employment: Evidence from the US", mimeo, IMF.
- Arellano, M. and S. Bond (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, Vol. 58, pp. 29-51.
- Baltagi, Badi H. (2001), *Econometric analysis of panel data*, 2nd edition, John Wiley.
- Barry, Frank and John Bradley (1997), "FDI and Trade: The Irish Host-Country Experience", *Economic Journal*, Vol. 107, pp. 1798-1811.
- Bartelsman, E.J. and M. Doms (2000), "Understanding productivity: lessons from longitudinal microdata", *Journal of Economic Literature*, Vol. 38, pp. 569-595.
- Bernard, Andrew B. and J. Bradford Jensen (1999), "Exceptional exporter performance: Cause, effect, or both?", *Journal of International Economics*, Vol. 47, pp. 1-25.
- Bernard A.B., J. Eaton, B. Jensen and S.S. Kortum (2003), "Plants and productivity in international trade", *American Economic Review*, Vol. 93, pp. 1268-1290.
- Blundell, Richard and Stephen Bond (1998), Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, *Journal of Econometrics*, 87, 115-137.
- Chen, Hogan, Matthew Kondratowicz and Kei-Mu Yi (2005), "Vertical specialization and three facts about U.S. international trade", *North American Journal of Economics and Finance*, Vol. 16, pp. 35-59.
- Doms, M.E. and J.B. Jensen (1998), "Comparing wages, skills, and productivity between domestically and foreign-owned manufacturing establishments in the United States", in: R. Baldwin, R. Lipsey and J.D. Richardson, eds., *Geography and Ownership as Bases for Economic Accounting* (Chicago: Chicago University Press), pp. 235-255.
- Egger, Hartmut and Peter Egger (2005), "International outsourcing and the productivity of low-skilled labor in the EU", *Economic Inquiry*, forthcoming.
- Feenstra, Robert C. and Gordon H. Hanson (1996), "Foreign investment, outsourcing, and relative wages", in Feenstra, R.C., Grossman, G.M. and Irwin, D.A. (eds.), *The Political Economy of Trade Policy*, Cambridge MA: MIT Press, pp. 89-127.
- Feenstra, Robert C. and Gordon H. Hanson (1999), "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1990", *Quarterly Journal of Economics*, Vol. 114, pp. 907-941.
- Feenstra, Robert C. and Gordon H. Hanson (2001), "Global production sharing and rising inequality: A survey of trade and wages", NBER Working Paper 8372.
- Fernandes, Ana M. (2003), Trade policy, trade volumes and plant level productivity in Colombian manufacturing industries, World Bank Working Paper 3006.
- Girma, Sourafel and Holger Görg (2004), "Outsourcing, foreign ownership and productivity: Evidence from UK establishment level data", *Review of International Economics*, Vol. 12, pp. 817-832.

Girma, Sourafel, Holger Görg and Eric Strobl (2004), "Exports, international investment, and plant performance: Evidence from a non-parametric test", *Economics Letters*, Vol. 83, pp. 317-324.

Girma, Sourafel, David Greenaway and Richard Kneller (2004), "Does Exporting Lead to Better Performance: A Microeconomic Analysis of Matched Firms", *Review of International Economics*, Vol. 12, pp. 855-866

Girma, S., D. Greenaway and K. Wakelin (2001), "Who benefits from foreign direct investment in the UK?", *Scottish Journal of Political Economy*, Vol. 48, pp. 119-133.

Görg, Holger and Aoife Hanley (2004), "Does outsourcing increase profitability?", *Economic and Social Review*, Vol. 35, pp. 267-288.

Görzig, Bernd and Andreas Stephan (2002), "Outsourcing and firm-level performance", Discussion Paper No. 309, DIW Berlin.

Grossman, Gene M. and Elhanan Helpman (2004), "Outsourcing in a global economy", *Review of Economic Studies*, forthcoming.

Head, Keith and John Ries (2002), "Offshore Production and Skill Upgrading by Japanese Manufacturing Firms", *Journal of International Economics*, Vol. 58, pp. 81-105.

Helpman Elhanan, Marc J. Melitz and Stephen R. Yeaple (2004), "Export versus FDI with heterogeneous firms", *American Economic Review*,

Hijzen, Alexander, Holger Görg and Robert C. Hine (2005), "International outsourcing and the skill structure of labour demand in the United Kingdom", *Economic Journal*, Vol. 115, pp. 861-879.

Hummels, D., J. Ishii and K.-M. Yi (2001), "The nature and growth of vertical specialization in world trade", *Journal of International Economics*, Vol. 54, pp. 75-96.

Islam, Nazrul (1995), "Growth empirics: A panel data approach", *Quarterly Journal of Economics*, Vol. 110, pp. 1127-1170.

Kohler, Wilhelm (2004), "International outsourcing and factor prices with multistage production", *Economic Journal*, Vol. 114, pp. C166-C185.

Markusen, James R. (1995), "The Boundaries of Multinational Enterprises and the Theory of International Trade", *Journal of Economic Perspectives*, Vol. 9(2), pp. 169-189.

Ruane, Frances and Julie Sutherland (2002), "Globalization, Europeanization and Trade in the 1990s: Export Responses of Foreign and Indigenous Manufacturing Companies", in: H. Kierzkowski, ed., *Europe and Globalization* (London, Palgrave Macmillan), pp. 207-228.

Sjöholm, Fredrik (2003), "Which Indonesian firms export? The importance of foreign networks", *Papers in Regional Science*, Vol. 82, pp. 333-350.

Yeaple, Stephen (2005), "A simple model of firm heterogeneity, international trade and wages", *Journal of International Economics*,

**Table 1: Summary Statistics**

	Domestic non-exporters	Domestic exporters	Foreign
Employment	67.7 (140.7)	101.0 (223.7)	180.8 (240.8)
Labour productivity	0.207 (0.197)	0.244 (1.302)	0.658 (2.600)
Services o/s intensity (outs <sup>s</sup> )	0.254 (0.441)	0.235 (0.445)	0.453 (3.072)
Materials o/s intensity (outs <sup>m</sup> )	1.552 (2.882)	1.338 (1.847)	2.193 (4.136)
Observations	2178	7663	6916

**Table 2: Summary Statistics for Low and High Productivity Plant**

	Low Productivity	High Productivity		
	Mean	Std. Deviation	Mean	Std. Deviation
Materials o/s intensity (outs <sup>m</sup> )	1.00	1.15	2.43	4.16
Services o/s intensity (outs <sup>s</sup> )	0.21	1.84	0.44	2.15
Domestic firms	59%		36%	
Foreign firms	41%		64%	

**Table 3: GMM Regression results**

	(1)	(2)	(3)	(4)	(5)
	all	foreign	domestic	exporters	non-exporters
l_log_va	0.425 (0.012)***	0.487 (0.004)***	0.262 (0.009)***	0.418 (0.010)***	0.463 (0.001)***
log_k	0.082 (0.013)***	0.143 (0.005)***	0.107 (0.011)***	0.082 (0.013)***	0.123 (0.001)***
log_l	0.445 (0.018)***	0.368 (0.008)***	0.736 (0.018)***	0.436 (0.017)***	0.437 (0.003)***
expd	-0.083 (0.062)	-0.180 (0.033)***	0.067 (0.027)**		
for	0.525 (0.037)***			0.519 (0.035)***	0.464 (0.015)***
out_s2	0.020 (0.001)***	0.015 (0.001)***	-0.091 (0.009)***	0.020 (0.001)***	-0.076 (0.002)***
out_m2	0.013 (0.002)***	0.016 (0.001)***	0.013 (0.004)***	0.009 (0.002)***	-0.044 (0.000)***
Sargan test (p-value)					
AR(2) test (p-value)					
Observations	8757	3575	5182	7621	1136
Number of plants	1816	661	1155	1580	366

Notes: (1) Standard errors in parentheses, (2) \*\*\* indicates significant at 1%, (3) regressions include time dummies

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

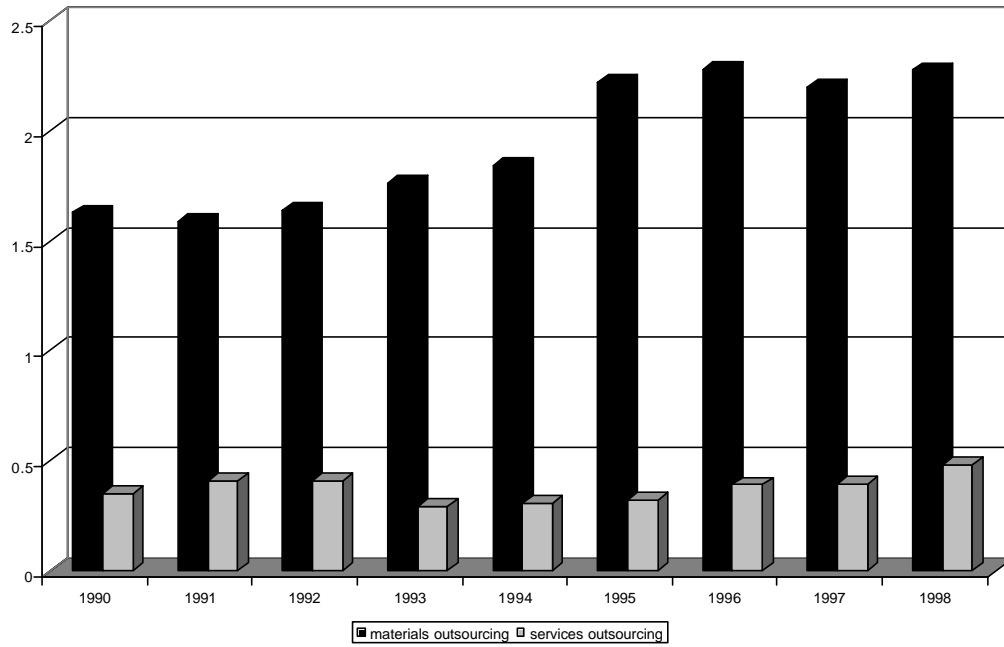
	(1)	(2)
	foreign	domestic
l_log_va	0.662 (0.003)***	0.266 (0.002)***
log_k	0.053 (0.002)***	0.131 (0.003)***
log_l	0.301 (0.004)***	0.690 (0.003)***
out_s2	-0.049 (0.021)**	-0.150 (0.007)***
out_m2	-0.004 (0.000)***	-0.070 (0.002)***
expd	-0.032 (0.006)***	-0.088 (0.005)***
expd_out_s2	0.063 (0.021)***	0.072 (0.006)***
expd_out_m2	0.019 (0.001)***	0.089 (0.002)***
Sargan test (p-value)	1.00	0.47
AR(2) test (p-value)	0.42	0.41
Wald 1 (p-value)	0.00	0.00
Wald 2 (p-value)	0.00	0.00
Observations	3575	5182
Number of plants	661	1155

Notes: (1) Standard errors in parentheses, (2) \* indicates significant at 1%, (3) regressions include time dummies

Wald 1:  $H_0 = out\_s2 + expd\_out\_s2 = 0$

Wald 2:  $H_0 = out\_m2 + expd\_out\_m2 = 0$

**Table 1: Development of international outsourcing**



**Appendix: OLS regressions**

	(1)	(2)	(3)	(4)	(5)
	all	foreign	domestic	exporters	Non-exporters
l_log_va	0.751 (0.019)***	0.799 (0.028)***	0.679 (0.022)***	0.748 (0.022)***	0.758 (0.039)***
log_k	0.072 (0.008)***	0.067 (0.014)***	0.083 (0.009)***	0.075 (0.010)***	0.062 (0.015)***
log_l	0.187 (0.018)***	0.140 (0.025)***	0.255 (0.023)***	0.190 (0.020)***	0.189 (0.043)***
expd	0.002 (0.015)	-0.023 (0.035)	0.011 (0.018)		
for	0.107 (0.013)***			0.102 (0.014)***	0.168 (0.043)***
out_s2	0.017 (0.004)***	0.016 (0.005)***	-0.057 (0.027)**	0.018 (0.004)***	-0.113 (0.049)**
out_m2	0.005 (0.003)*	0.008 (0.003)**	-0.006 (0.005)	0.007 (0.003)**	-0.009 (0.006)
Constant	-0.537 (0.255)**	-0.278 (0.121)**	-0.391 (0.059)***	-0.316 (0.054)***	-0.293 (0.113)**
Observations	8757	3575	5182	7621	1136
R-squared	0.91	0.89	0.88	0.91	0.90

Notes: (1) robust standard errors in parentheses, (2) \*\*\* indicates significant at 1%, (3) regressions include time dummies