Intra-industry Productivity Spillovers from Exporting in New Zealand[1]

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Preliminary version: Results subject to revision.

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Abstract

Utilising a panel dataset of 440,829 firms over the period 2000-08, this paper investigates intra-industry productivity spillovers from domestic and foreign owned exporters in New Zealand. Three types of exporters are distinguished: goods exporters, services exporters and goods and services exporters. There is no evidence of spillovers from services exporters and goods and services exporters. In the case of goods exporters, there is evidence of positive spillovers, but the spillovers accrue only to other exporters in the same industry. There is no marked difference in the evidence obtained when spillovers generated by foreign owned exporters and domestically owned exporters are distinguished. Our sober findings are consistent with the broader evidence reported in the international literature.

JEL Classification: F10, F23, O56

Key words: exporting; productivity; spillovers, New Zealand.

I. Introduction

Recently, the New Zealand (NZ) government has emphasised two important economic growth objectives: raising per capita incomes and increasing the exports share of GDP. Although specified distinctly, it is widely acknowledged that the two objectives are intertwined. The policy focus on these two objectives has motivated several recent studies exploring the linkages between productivity[3] and exporting.

The debate on the direction of causality between exporting and productivity is unsettled. While the NZ evidence appears to favour the view that productive firms self-select into exporting (Fabling & Sanderson, 2010), the international evidence is mixed (e.g., Bernard & Jensen, 1999; Clerides, Lach, & Tybout, 1998). However, there is reasonable consensus both among NZ studies and in the international literature that irrespective of the direction of causality, exporters are, on average, more productive than non-exporters (Baldwin & Gu, 2003; Bernard & Jensen, 1999; Fabling, Grimes, Sanderson, & Stevens, 2008; Fabling & Sanderson, 2009; Iyer, Stevens, & Austin, 2010; Saravanaperumal & Charteris, 2010).

The higher productivity of exporters has a direct effect on national economic growth through the associated income streams, employment opportunities, more efficient resource reallocation, as well as possible "learning by exporting" benefits. But could there also be indirect gains to the NZ economy from exporters via spillovers to local non-exporting firms? The potential for such spillovers has been a key factor underpinning the intervention logic of publicly funded export promotion

[3] Underpinning the emphasis on productivity (rather than per capita income) is the reasonable assumption that per capita income is predominantly a function of productivity (e.g., Hall & Jones, 1999; Prescott, 1998; Solow, 1957).

programmes around the world. As observed in Alvarez and Lopez (2006), from a policy perspective, the more important question in considering government intervention is not whether exporters are individually able to gain from exporting; rather it is whether exporting generates positive effects on other non-exporting firms. These positive effects might involve creating export opportunities for non-exporters and/or enhancing the productivity of the non-exporters. In this paper, we examine if there are productivity spillovers from exporters in the NZ economy to other domestically owned exporting and non-exporting firms.[4]

The hypothesis that exporting generates productivity spillovers is reasonable, although it has been argued that there is not robust evidence of spillovers emanating from exporting activities (Panigariya, 2000; Rodrik, 1999). A pre-condition for spillovers to occur is that the exporters should be more productive than non-exporters. The NZ empirical evidence supports this view. For instance, Iyer, Stevens and Tang (2011a) find that exporters, on average, are 51% more productive than non-exporters. The expectation that exporters will be more productive than non-exporters is underpinned by sound theoretical models. These suggest that it is necessary for a firm to be a highly productive in order to be successful in exporting (e.g., Bernard, Eaton, Jensen, & Kortum, 2003; Melitz, 2003). The literature also notes that knowledge spillovers accruing to exporters in the international market place are significant (Grossman & Helpman, 1991). In theory, non-exporters might be able to appropriate this knowledge from the exporting firm and apply it in their operations. Moreover, faced with more intensive competition in offshore markets,

[4] We do not examine if existing exporters play a role in creating export opportunities for non-exporters. The main reason for this is that in NZ, there is evidence to suggest that productive firms self-select into exporting (Fabling & Sanderson, 2010). As such, productivity is the first order question and export opportunities are only of the second order.

exporters may have to adopt more efficient and competitive management styles (including the training of employees). These firm specific advantages could also potentially spillover to non-exporters and other exporters in the domestic economy. These spillovers may be effected through a variety of conduits such as movement of labour, imitation and observational learning (e.g., Edwards, 1993; Feder 1982; Keesing 1967). This paper seeks to test the hypothesis that:

- spillovers are generated by exporters; and
- other domestically owned exporting and non-exporting firms able to successfully appropriate these spillovers.

International studies examining this hypothesis have commonly found the evidence sobering (Panigariya, 2000; Rodrik, 1999).

The data for the study is taken from the prototype Longitudinal Business Database (LBD) administered by Statistics NZ. The LBD contains a broad range of variables from a number of tax, administrative and survey sources. We derive the data from the following sources from within the LBD: the Annual Enterprise Survey (AES), Business Activity Indicator (smoothed GST returns), financial accounts (IR10), company tax returns (IR4), Pay as you earn (PAYE) returns, shipment level merchandise trade data (CUSTOMS) and the International Trade in Services and Royalties Survey (ITSS). Further, we retrieve demographic information pertaining to firms from the Longitudinal Business Frame (LBF) which has been defined as the "spine" of the LBD (Fabling, 2009).[5] An unbalanced panel dataset of 440,829 firms spanning the years 2000-08 is applied. All the firms in the LBF were included in the

[5] A detailed discussion of the LBD is available in Fabling (2009) and Statistics NZ (2007).

original dataset[6], thereby giving confidence that the study comprehensively captures the NZ business economy.

This paper's primary contribution is that it offers the first evidence on spillovers from exporters to non-exporting local firms in the NZ economy. It provides direction for future research that needs to be undertaken in this area. The paper also contributes to the wider literature on export led spillovers in three important ways as detailed below.

First, so far, the empirical literature on export led spillovers has only considered spillovers from goods exporters. An important contribution of this paper is the analysis of intra-industry spillover by type of exporter i.e. goods only exporters (GE), service only exporters (SE), and, goods and service exporters (GSE). In doing so, the analysis is the paper recognises that the dynamics of spillovers could potentially be different for the GE, SE and GSE groups.

Second, this paper distinguishes between spillovers from domestically and foreign owned exporters. There is evidence that foreign owned firms in NZ, under certain conditions, might be an important source of productivity spillovers for domestic firms in NZ (e.g., Iyer et al., 2011a). It is, therefore, important that the spillovers of exporting are disentangled from those that can be attributed to foreign ownership. In fact, several studies on exporting spillovers suggest that only foreign

[6] The final dataset was "filtered". Firms with no or negative turnover/intermediate consumption/value added/capital/employment were dropped. Econometric analyses of the nature undertaken would not have been possible without filtering the data.

owned exporters are able to generate spillovers (e.g., Aitken, Harrison, & Lipsey, 1997; Greenaway, Sousa, & Wakelin, 2004; Ruane & Sutherland, 2004).

Third, the coverage of our dataset is unprecedented in terms of both scope and depth for a national economy. The extensive coverage, as described above, means that the analysis is truly representative and potentially very useful in guiding policy discussions.

The remainder of the paper is organised as follows. The next section reviews the literature on productivity spillovers from exporting. Section 3 discuses the econometric methodology and presents the model specification. Section 4 describes the data. The results are reported in Section 5. The last section concludes.

II. Review of the Literature

An extensive literature exists which examines the relationship between exporting and productivity at the macro-level (e.g. Balassa, 1978; Buffie, 1992; McKinnon, 1964; Marin, 1992). In recent times, with the increased availability of firm level information, as well as an understanding of the importance of disaggregated analyses, the exporting-productivity relationship has elicited the attention of micro-economists and econometricians. Micro-level studies using NZ and international data commonly find that exporters outperform non-exporters in productivity (e.g., Baldwin & Gu, 2003; Bernard & Jensen, 1999; Fabling et al., 2008; Fabling & Sanderson, 2009; Iyer et al., 2010; Saravanaperumal & Charteris, 2010); this finding has been referred to in the literature as the productivity premium associated with exporting.

Recent evidence points to the existence of a productivity premium among not only GE but also SE (e.g., Breinlich & Criscuolo 2010; Saravanaperumal & Charteris, 2010; Vogel 2009).

Two competing theories explain the correlation between exporting and productivity. The first one, the "learning by exporting" theory, suggests that exporters learn by exposure to international best practice and that the knowledge spillovers accruing to exporters in the international market place are significant (Grossman & Helpman, 1991). Grossman and Helpman (1991) argue that as sellers transmit technology to the buyers, they (i.e., the exporters) also gain from the knowledge base of their buyers.[7] Moreover, exports increase the price of failing to improve and thus enhance competitive pressure, which in turn encourages the exporters to aggressively pursue technology enhancements (Funk, 2001). Some firm-level analyses have found evidence that exporting enhances productivity (e.g., Clerides at al., 1998; De Loecker, 2007; Greenaway & Kneller, 2004; Van Biesebroeck, 2005).

The second theory is that productive firms self-select to exporting. This has robust support in the recent empirical literature (see, Wagner, 2007). The theoretical foundation for the self-selection hypothesis is formalized in Melitz (2003) and Bernard et al. (2003). The Melitz model derives that in the presence of fixed costs associated with exporting, only productive firms venture into exporting. In the absence of fixed costs, this model predicts that all firms will participate in exporting.

[7] For example, spillovers from buyers may occur where the buyers offer advice on potential technology enhancements. Further, exporting requires the producer to be familiar with the demands of foreign buyers, including requirements on product specifications and quality. The knowledge acquired by examining customer demands may also enhance the exporter's technology.

Bernard et al. (2003), observe that potential export markets have different conditions that determine the threshold level of productivity for export entry in each market. They predict that productive firms are more likely to enter export markets. Empirical evidence in favour of the self-selection hypothesis has been recorded in several international studies (e.g., Aw, Chung, & Roberts, 2000; Bernard & Jensen, 1999) and in NZ (e.g. Fabling & Sanderson, 2010).

Regardless of the direction of causality, the existence of a productivity premium among exporters contributes positively to aggregate productivity growth as resources are reallocated from less productive firms to more productive ones (Greenway & Kneller, 2007). Furthermore, productivity gains might also materialise if there are intra-industry and inter-industry spillovers from exporters to the local non-exporting firms. In this paper, the focus, due to data limitations, is restricted to intra-industry spillovers.

There are several theoretical arguments that explain why exporters might generate productivity spillovers within their own industry. For an exporting firm to enter and succeed in the overseas market, it should either, already have some firm-specific advantages, or it should have invested significant resources towards acquiring the competitive advantage that enables it to succeed in overseas markets. Where the exporter is not able to completely plug “knowledge leaks” within the local economy, the possibility of knowledge spillovers to other domestically owned exporters and non-exporters arises.

The knowledge leaks might occur via either labour mobility or observational learning/demonstration effects. In order to achieve a competitive edge, exporters might train their employees (Alvarez & Lopez, 2006). The relocation of the exporting firm trained workers to the currently non-exporting firms, either by changing jobs or starting new ventures, can potentially enhance productivity in two ways:

- The workers may carry with them knowledge of new technology or management techniques, becoming direct agents of technology transfer (Görg & Greenaway, 2004[8]);
- the relocated workers may raise the productivity of co-workers in the non-exporting firms, simply by association.

Observational learning and demonstration effects could be other important conduits of productivity spillovers. Non-exporters might observe and imitate successful exporters and even resort to reverse engineering to acquire new technology.

Despite the seemingly intuitive arguments above, the empirical evidence on intra-industry spillovers from exporting is sobering (Panigariya, 2000; Rodrik, 1999). Focusing on domestically owned exporters in Colombia, Clerides et al. (1998) did not find evidence of intra-industry productivity spillovers to non-exporters. More recently, Alvarez and Lopez (2006), using data on Chilean manufacturing plants, found some evidence of intra-industry productivity spillovers from domestically owned exporters to non-exporters. However, this evidence was sensitive to the choice of empirical

[8] Görg and Greenaway (2004) make this point in the context of spillovers from foreign owned firms, but the argument is equally applicable in the present setting.

methods; moreover, even where statistically significant results were obtained, these were only at the 10% level.[9]

Alvarez and Lopez (2006) offer two theoretical arguments to explain why intra-industry spillovers from exporting may not exist or may not be empirically discernible. First, firms have no reason to allow the diffusion of proprietary know-how to their competitors; if anything, firms have an incentive to "plug the leak" of knowledge to the competitors. Second, export expansion in some industries may increase the cost of labour or of other specialized inputs. In such cases, the net spillover effect may not be empirically discernible. The net spillover effect would then depend on whether the positive effect provided by technological transfer (if it exists) dominates or the negative effect of increased competition on input prices and the scale of production dominates (Alvarez & Lopez, 2006; Dumont, Merlevede, Peitte, & Rayp, 2010). In addition to the arguments in Alvarez and Lopez, it might also be that the exporter's technologies are too different from or superior to those applied in local non-exporter firms for spillovers to take place. In this context, the incorporation of the absorptive capacity (AC) argument becomes important. AC is defined as the ability of firms to identify, assimilate and exploit new technology (Cohen & Levinthal, 1990). Non-exporters with adequate AC might be better placed to appropriate spillovers from exporters. AC is typically modelled using variables such as human capital, R&D and exporting. In this paper, due to data availability considerations, we are able to use exporter status and R&D (but not human capital) to proxy for AC.

[9] Alvarez and Lopez do report robust evidence suggesting that domestic exporters may be important sources of inter-industry productivity spillovers. However, inter-industry spillovers are beyond the scope of our current paper.

Several empirical studies on export led spillovers differentiate between foreign owned and domestically owned exporters and investigate each separately as sources of spillovers. These studies have found that foreign owned exporters do confer spillover benefits to domestically owned non-exporters (e.g., Aitken et al., 1997; Greenaway et al., 2004; Ruane & Sutherland, 2004). However, it is debatable whether this owes to the exporting effect of the foreign owned effect. In NZ, there is evidence of spillovers from foreign owned firms to the domestic sector, under certain conditions (e.g., Iyer et al., 2011). To provide a better basis for policy discussion, empirical modelling of spillovers from exporting should therefore disentangle the effects of foreign ownership from exporting.

III. Model Specification and Econometric Method

The modelling of spillovers from exporting to non-exporting firms in this paper is discussed in two phases. First, estimating the production function to derive estimates of multi-factor productivity (MFP) and second, regressing MFP on spillovers and other control variables. For econometric reasons (i.e., errors are iid) both phases are estimated in a single step.

Phase 1: Computing Multi-factor Productivity (MFP)

MFP is estimated as the residual of a Cobb-Douglas production function and is specified as:

$$\ln(MFP_{it}) = \ln(Y_{it}) - \hat{\theta}_k \ln(K_{it}) - \hat{\theta}_l \ln(L_{it}) \quad (1)$$

where Y_{it} is the value added of firm *i* at time *t*, and $\hat{\theta}_k$ and $\hat{\theta}_l$ are the estimated coefficients of capital and labour.[10]

Phase 2: MFP Regressions

The following baseline model is considered:

$$\ln(MFP_{ijt}) = \phi_0 + \phi_1(EXG_{ijt} + EXS_{ijt} + EXGS_{ijt}) + \phi_4 FDI_{ijt} + \phi_5 R\&D_{ijt} + \phi_6 HI_{jt} + \phi_7 SCALE_{ijt} + \beta_1 SPGE_{jt} + \beta_2 SPSE_{jt} + \beta_3 SPGSE_{jt} + \delta_t + \delta_{ij} + \varepsilon_{ijt} \quad (2)$$

where,

MFP_{ijt} : Multi-factor productivity of firm *i* from industry *j* at time *t*.

EXG_{ijt} : A dummy variable capturing if the firm is a goods exporter (but not a service exporter) at time *t*, and zero otherwise.

EXS_{ijt} : A dummy variable capturing if the firm is a services exporter (but not a goods exporter).

$EXGS_{ijt}$: A dummy variable capturing if the firm is a goods and services exporter. *EXGS* is constructed to be mutually exclusive with respect to *EXG* and *EXS*.

FDI_{ijt} : A dummy variable capturing if the firm is foreign owned.

$R\&D_{ijt}$: A dummy variable capturing if the firm is an R&D performer.

[10] The estimation in equation (1) could potentially suffer from an endogeneity bias if a part of the MFP was observed by the firm early enough to influence the factor input decision. To account for the endogeneity, some studies model MFP using the Olley and Pakes (1992) or Levinsohn and Petrin (2003) (LP) approach. Using the same data source as this paper, Iyer et al., (2011a,b) estimate the production function using both a fixed effect (FE) model and the LP approach. In both papers, they find that the results from the LP approach are qualitative identical and quantitatively similar to those obtained using the FE method.

$SPGE_{ijt}$: Intra-industry spillovers from GE to non-exporting/exporting firm *i* in industry *j* at time *t*, constructed as $LKGE_{jt-1}(1-[EXG_{ijt}+EXS_{ijt}+EXGS_{ijt}])$. $LKGE_{jt}$ is the measure of intra-industry linkage with GE, and following the FDI spillover literature (Javorcik, 2004), is constructed as the output share of GE in industry *j*, i.e. $LKGE_{jt}=(\sum_i y_{ijt}EXG_{ijt})/\sum_i y_{ijt}$, where y_{ijt} is the value added of firm *i* in industry *j* at time *t*. The lag value of $LKGE_{jt}$ is used in constructing $SPGE_{ijt}$ to mitigate potential reverse causality.

$SPSE_{ijt}$: Intra-industry spillovers from SE to non-exporting/exporting firm *i* in industry *j* at time *t*, constructed as $LKSE_{jt-1}(1-[EXG_{ijt}+EXS_{ijt}+EXGS_{ijt}])$. $LKSE_{jt}$ is the measure of intra-industry linkage with SE, and is equal to the output share of SE in industry *j*, i.e. $LKSE_{jt}=(\sum_i y_{ijt}EXS_{ijt})/\sum_i y_{ijt}$, where y_{ijt} is the value added of firm *i* in industry *j* at time *t*.

$SPGSE_{ijt}$: Intra-industry spillovers from GSE to non-exporting/exporting firm *i* in industry *j* at time *t*, constructed as $LKGSE_{jt-1}(1-[EXG_{ijt}+EXS_{ijt}+EXGS_{ijt}])$. $LKGSE_{jt}$ is the measure of intra-industry linkage with goods and services exporting firms, and is equal to the output share of GSE in industry *j*, i.e. $LKGSE_{jt}=(\sum_i y_{ijt}EXGS_{ijt})/\sum_i y_{ijt}$, where y_{ijt} is the value added of firm *i* in industry *j* at time *t*.

HI_{jt} : The Herfindahl index for industry *j* at time *t*, constructed as $\sum_s \left(sales_{sjt}/sales_{jt}\right)^2$. HI_{jt} is bound between 0 and 1, and a higher value indicates greater market concentration or less competition.

$SCALE_{ijt}$: Sales of firm *i* relative to average firm sales of industry *j* at time *t*.

δ_t : Year dummies.

δ_{ij} : Firm dummies.

Firm fixed effects (FE) are to control for firm-specific factors not known to econometricians. However, because FEs are applied, there is an issue with time invariant and nearly time invariant dummies. To deal with this, we remove the dummy time invariant and nearly time invariant variables from the model. To compensate for this, we estimate the model for different subsets of the sample, each subset representing a unique value that a dummy variable might take. For example, one subset includes only observations that are non-exporters, do not undertake R&D and are domestically owned. Another subset includes only observations that are exporters, undertake R&D and are domestically owned. Following the reasoning above, equation (1) becomes:

$$\begin{aligned}\ln(MFP_{ijt}) &= \phi_0 + \phi_1 HI_{jt} + \phi_2 SCALE_{ijt} \\ &+ \beta_1 SPGE_{jt} + \beta_2 SPSE_{jt} + \beta_3 SPGSE_{jt} + \delta_t + \delta_{ij} + \varepsilon_{ijt}\end{aligned} \tag{3}$$

This paper seeks to distinguish between domestic exporters and foreign owned exporters as a source of spillovers. Therefore, a variant of equation (3) is considered:

$$\begin{aligned}\ln(MFP_{ijt}) &= \phi_0 + \phi_1 HI_{jt} + \phi_2 SCALE_{ijt} \\ &+ \beta_1 SPGE_{jt} + \beta_2 SPSE_{jt} + \beta_3 SPGSE_{jt} \\ &+ \beta_4 FSPGE_{jt} + \beta_5 FSPSE_{jt} + \beta_6 FSPGSE_{jt} + \delta_t + \delta_{ij} + \varepsilon_{ijt}\end{aligned} \tag{4}$$

where,

$FSPGE_{ijt}$: $FDI_{ijt} \cdot SPGE_{ijt}$

$FSPSE_{ijt}$: $FDI_{ijt} \cdot SPSE_{ijt}$

$FSPGSE_{ijt}$: $FDI_{ijt} \cdot SPGSE_{ijt}$

The estimated equations have a firm level variable on the LHS and industry level variables on the RHS. Moulton (1990) demonstrates that regressions of micro units on variables aggregated at the industry level produce standard errors that are biased downwards, giving raise to the possibility of spurious significance. To address this issue, we correct the standard errors to allow for intra-industry correlation, relaxing the usual requirement that the observations be independent. That is, the observations are independent across industries but not necessarily within industries.

It is recalled that the two phases are estimated in a single step. As an illustration equation (3) and (4) in practice are estimated as:

$$\begin{aligned}\ln(Y_{ijt}) &= \phi_0 + \theta_k \ln K_{ijt} + \theta_l \ln L_{ijt} + \phi_1 HI_{jt} + \phi_2 SCALE_{ijt} \\ &+ \beta_1 SPGE_{jt} + \beta_2 SPSE_{jt} + \beta_3 SPGSE_{jt} + \delta_t + \delta_{ij} + \varepsilon_{ijt}\end{aligned} \tag{5}$$

$$\begin{aligned}\ln(Y_{ijt}) &= \phi_0 + \theta_k \ln K_{ijt} + \theta_l \ln L_{ijt} + \phi_1 HI_{jt} + \phi_2 SCALE_{ijt} \\ &+ \beta_1 SPGE_{jt} + \beta_2 SPSE_{jt} + \beta_3 SPGSE_{jt} \\ &+ \gamma_1 FSPGE_{jt} + \gamma_2 FSPSE_{jt} + \gamma_3 FSPGSE_{jt} + \delta_t + \delta_{ij} + \varepsilon_{ijt}\end{aligned} \tag{6}$$

IV. Data

The dataset is drawn from the LBD. Generally speaking, the LBD has been built primarily around government administered data collections and stands out for both its comprehensive coverage of firms and the variety of variables captured. The breadth of data in the LBD enables significant advances to be made in many areas of microeconomic analysis, including export spillovers. For the present analysis, an unbalanced panel dataset of 440,829 firms spanning the years 2000-08 is extracted from the LBD.

Understanding which firms are categorized as exporters is of critical importance. Fabling and Sanderson (2008) report that there is considerable degree of intermittent exporting among NZ merchandise exporters; 80% of trade relationships are observed to end after the first year. It is not clear whether this was due to select "non-exporters" taking advantage of specific export opportunities or whether this reflects unsuccessful attempts at exporting. In order to identify authentic and relatively more enduring exporters the following filters were applied:

- An export threshold of NZ$30,000[11] is imposed on all firms. Furthermore, a firm is required to meet this criterion for at least 2 of the 9 observed years to be tagged as an exporter for all future years.
- An exporting firm is considered a goods and services exporter only if annual export earnings from services and goods each exceeds 10% of total export receipts for at least two years; otherwise, the firm is considered a goods exporter or a service exporter whichever is the dominant activity.

[11] An absolute rather than a relative to sales threshold is considered since many exporters also dominant in the domestic market. Results may be sensitive to relative thresholds. An absolute threshold of $30,000 was arbitrarily set to capture "serious exporters", but the results are not sensitive to minor changes of the threshold.

One might argue that these criteria are somewhat stringent. But with the dataset being populated with several intermittent and one-off exporters, this stringency is a requirement to identify true export spillovers.

Likewise, some refinements are applied to the FDI and R&D variables. Firms that first become foreign owned at time *t* are treated as domestically owned in all previous years and as foreign owned in all future years. Similarly, firms that first perform R&D at time *t* are treated as non-performers in all previous years and as performers in all future years.

For the purposes of this paper, a firm represents a group of firms that belong to a common group structure, that is, there is some form of a parent-subsidiary relationship in place, rather than a single legal entity. Other papers using the LBD have not always merged firms in this manner (e.g., Fabling et al., 2008; Iyer et al., 2011a; Iyer et al., 2011b). However, since services export data is available only at the group level, this merging of firms is a requirement.[12]

In our dataset only about 2.2% of the firms in the sample are exporters, yet, on average, they are significantly larger than non-exporters and economically very important. For instance, the average number of employees in a non-exporter is about 4.3, the corresponding statistics for GE, SE, and, GSE are 83.3, 160.3and 950.6 respectively. In terms of value added, firms in the GE and SE groups, on average, generate 41 times and 82 times respectively the value added of a non-exporter. The

[12] This is an important observation given that firms within groups account for a substantial proportion of total employment and value added in NZ (Fabling & Sanderson, 2008).

value added of a firm in the GSE group is several hundred times more than that of a non-exporter.

Table 1: Summary Statistics by Type of Firm

Type of firm	Statistic	Labour Count	Value Added	Gross Output	Capital	Labour productivity
Non exporters	Firms[1]	1,705,017				
	Mean	4.35	255,138	669,416	48,281	70,645
	SD	22.84	1,772,702	4,376,642	713,881	1,102,001
	Median	2.00	74,956	179,802	10,023	35,937
Goods only exporters	Firms[1]	35,214				
	Mean	83.30	10,400,000	32,500,000	2,226,543	175,258
	SD	613.12	88,900,000	379,000,000	29,100,000	2,162,369
	Median	13.17	1,152,291	3,767,590	72,643	78,832
Service only exporters	Firms[1]	1,998				
	Mean	160.25	20,900,000	36,900,000	2,712,141	201,645
	SD	529.92	88,500,000	136,000,000	18,900,000	404,643
	Median	20.87	2,863,416	5,574,296	108,358	123,079
Goods and services exporters	Firms[1]	951				
	Mean	950.63	140,000,000	312,000,000	33,300,000	575,773
	SD	4265.44	762,000,000	1,460,000,000	182,000,000	6,306,519
	Median	91.08	11,900,000	30,100,000	786,768	122,679
All firms	Firms[1]	1,743,180				
	Mean	6.64	559,207	1,524,925	113,477	73,185
	SD	137.80	22,400,000	64,600,000	6,072,070	1,142,160
	Median	2.00	77,495	186,796	10,372	36,583

[1]. Firm counts have been randomly rounded.

Sales data support this picture. The difference between the relative contributions of non-exporters and the three exporter groups are presented in Table 1. Recognising the differences in firm size, the size effect is controlled for in

the regression models. It is straightforward to work out that despite constituting a small fraction of firms in the NZ economy, exporting firms effectively dominate the business landscape.

Saravanaperumal and Charteris (2010) observe that there is a significant wedge between firms in the exporting group and non-exporting firms in terms of labour productivity. Specifically, they find that, on average, GSE firms are most productive followed by SE and then GE firms. Non-exporters were least productive. This paper finds similar results. The labour productivity of an average GSE firm is over half a million dollars per worker, while the corresponding statistic for SE and GE firms are slightly over $200,000 per worker and $175,000 per worker respectively. Non-exporters, on average, are found to generate value added of slightly over $71,000 per worker.[13] We augment labour productivity findings with estimates of MFP. Unlike labour productivity, the magnitudes of MFP are not straightforward to comprehend because MFP represents value added per unit factor input combination. But the variable is monotonous; a higher MFP indicates that the firm is more efficient. The findings with respect to MFP are consistent with labour productivity i.e. GSE firms are most productive followed by SE firms, GE firms and non-exporters (See, Table 2).

However, the difference in the median MFP across the four groups of firms is not as large as observed in case of labour productivity. The smaller differences in MFP simply reflect that exporters are much more capital intensive than non-exporters, which can be deduced from Table 1. It is an important observation that

[13] The reported estimates of labour productivity are likely to be biased upwards because zero and negative value added firms have been filtered from the sample. This upward revision is more likely to impact non-exporters than exporters.

MFPs of non-exporters are negative at least up to the 25th percentile. For firms in the GE group, MFPs are negative until the 10th percentile. For the SE and the GSE groups, very few firms report negative MFPs. This may well mean that a large number of non-exporters do not have the absorptive capacity to gain from spillovers that may be generated by the exporting firms.

Table 2: MFP Distribution

Type of firm	p1	p5	p10	p25	p50	p75	p90	p95	p99	Mean	SD
Non Exporters	-3.89	-2.20	-1.48	-0.57	0.13	0.69	1.21	1.59	2.62	-0.02	1.20
GE	-1.92	-0.58	-0.10	0.50	1.01	1.54	2.11	2.53	3.56	1.00	0.99
SE	-1.45	-0.11	0.37	0.93	1.43	1.94	2.60	3.09	4.07	1.44	0.98
GSE	-0.44	0.45	0.82	1.30	1.73	2.41	3.31	3.75	4.61	1.87	1.03

Percentiles are denoted by"p".

V. Econometric Results and Discussion

Results

As discussed before, the regressions were conducted in one step although for exposition the derivation of MFP and the association of export led spillovers with MFP were shown separately.[14]

The paper now turns to the MFP regression results based on equations (5) and (6). We start with equation (5) which excludes the interaction between FDI and the export led spillover terms. The results are reported in Table 3. Year dummies are suppressed for brevity. There are four sets of results, depending on the exporter and

[14] As in Iyer et al., (2011a, 2011b), we also attempted a two-staged approach. In stage 1, we estimated MFP separately for each industry and in stage 2, we pooled the MFP estimates and ran a regression with spillovers variables in the explanatory vector. The results obtained were very similar to that reported here.

R&D status of the firms that are potential recipients of spillovers. To clarify, spillover variables are calculated for the entire data set, but regressions are carried out for four sub-samples:

1. Domestically owned non-exporters.
2. Domestically owned exporters.
3. Domestically owned non-exporters who undertake R&D.
4) Domestically owned exporters who undertake R&D.

The sub-sample approach is taken because the exporter status and R&D variables are binary and nearly time invariant and the estimation method is FE.

With respect to the coefficients on the conventional production function inputs, the labour coefficients are reasonable, but those of capital seem lower than expected. Using a sub-set of the data in this paper and applying the same estimation method, Iyer et al., (2011a) report more typical factor input coefficients. We believe that the differences in the input coefficients reflect the fact that we account for all firms in the business frame (i.e., essentially the population) while Iyer et al. consider only firms in the AES[15]. Indeed, the large, positive, and significant coefficient on the AES dummy (see, Table 3) further reinforces this view.

Table 3: Regression Model Results

[15] The target population for AES is restricted to economically significant businesses. To be considered economically significant, the firm should satisfy at least one of the following criteria:

1. has greater than $30,000 annual goods and services tax (GST) expenses or sales
2. has rolling mean employment (loosely number of employees) greater than three
3. is in a GST-exempt industry (except residential property leasing and rental)
4. is part of a group of enterprises
5. is a new GST registration that is compulsory, special or forced
6. is registered for GST and involved in agriculture or forestry.

	Non-Exporters	Exporters	Non-Exporters, with R&D	Exporters, with R&D	Non-Exporters	Exporters	Non-Exporters, with R&D	Exporters, with R&D
Ln K	0.1002***	0.1054***	0.0874***	0.1203***	0.1003***	0.1054***	0.0874***	0.1201***
	[0.0106]	[0.0103]	[0.0119]	[0.0203]	[0.0106]	[0.0104]	[0.0118]	[0.0204]
Ln L	0.5426***	0.5858***	0.5302***	0.6576***	0.5423***	0.5860***	0.5303***	0.6574***
	[0.0465]	[0.0424]	[0.0525]	[0.0402]	[0.0465]	[0.0424]	[0.0526]	[0.0404]
AES Dummy	0.2215***	0.1055**	0.2185***	0.062	0.2227***	0.1049**	0.2180***	0.062
	[0.0496]	[0.0458]	[0.0524]	[0.0435]	[0.0495]	[0.0456]	[0.0523]	[0.0446]
SPGE	0.0192	0.5277*	0.1543	1.7027**	-0.1058	0.6220*	0.2084	1.7508**
	[0.2384]	[0.2807]	[0.3882]	[0.6654]	[0.2568]	[0.3447]	[0.3311]	[0.6485]
SPSE	0.5402	-0.3676	-0.258	-0.6591	-0.3981	-0.1071	-0.1498	0.3075
	[0.4098]	[0.5809]	[0.4371]	[0.8783]	[0.4718]	[2.0725]	[0.6764]	[4.1111]
SPGSE	-0.0695	-0.0532	-0.1046	0.6309	-0.4657	1.0201	0.3219	1.4139
	[0.3127]	[0.3534]	[0.2526]	[0.8492]	[0.7936]	[1.0122]	[0.5332]	[3.3221]
HI	-0.3184	-0.4326	0.8126	-1.8751*	-0.3913	-0.393	0.8719	-1.8492*
	[0.4713]	[0.8601]	[1.0634]	[0.9678]	[0.4228]	[0.8850]	[1.0951]	[0.9662]
SCALE	0.1249***	0.0090**	0.0727***	0.0062**	0.1248***	0.0090**	0.0727***	0.0062**
	[0.0305]	[0.0036]	[0.0264]	[0.0029]	[0.0305]	[0.0036]	[0.0264]	[0.0030]
FSPGE					0.2059	-0.1648	-0.1069	-0.0498
					[0.1363]	[0.2199]	[0.1836]	[0.1870]
FSPSE					1.1978**	-0.2306	-0.0818	-1.101
					[0.5371]	[2.0653]	[0.9877]	[4.0532]
FSPGSE					0.4138	-1.1767	-0.5159	-0.8014
					[0.6668]	[0.9779]	[0.5447]	[3.5698]
Constant	9.6514***	10.7598***	10.0027***	9.9671***	9.6614***	10.7555***	9.9968***	9.9478***
	[0.1016]	[0.1775]	[0.1470]	[0.4213]	[0.1059]	[0.1823]	[0.1494]	[0.4101]
No. of Obs.	1,691,529	28,989	53,370	5,835	1,691,529	28,989	53,370	5,835
No. of firms	440,829	5,169	16,005	1,191	440,829	5,169	16,005	1,191
R-squared	0.1	0.14	0.09	0.19	0.1	0.14	0.09	0.19

*** Significant at the 1% significance level.

** Significant at the 5% significance level.

* Significant at the 10% significance level.

Intra-industry spillovers from goods exporters (SPGE) are the only spillover terms that have statistical significance in any of the estimated models. Moreover, even these spillovers accrue only to other exporters. For firms that are exporters, a

one percentage point increase in exporter concentration in the industry, on average, increases the productivity by 0.53% (column 3, table 3). This coefficient is significant only at the 10% level. However, when the sample is further restricted to include only exporters undertaking R&D, the magnitude of the SPGE coefficient increases over three times to 1.70. This means that a one percentage point increase in the share of exporting firms in an industry's value added is associated with a 1.7% increase in the productivity of exporters who also invest in R&D. The SPGE coefficient in the R&D performing exporters sub-sample is significant at the conventional 5% level. This supports the findings in Iyer et al. 2011.

In equation (6), three additional spillover variables are incorporated, each modelling the interaction of foreign ownership with the three types of exporter spillover variables. The coefficients on the SPGE variable remain roughly the same and retain the same level of statistical significance. The interactions of foreign ownership with the spillover variables are however, statistically insignificant. This suggests that non-exporters don't appropriate any spillovers from foreign owned exporters.

Similarly, there is no evidence of intra-industry spillovers from services exporters (SPSE) and goods and services exporters (SPGSE). The coefficient of the spillover variables SPSE and SPGSE are insignificant in almost all of the examined models. In one of the sub-samples, which represent non-exporting firms irrespective of R&D status, the interaction of foreign ownership with services spillovers is statistically significant; however this result is not robust. For example, when the

sample is further restricted to R&D performing exporters, the coefficient is no longer statistically significant.

Regarding the other variables in the explanatory vector, the effect of scale (SCALE) is expectedly significant and positive. A one percentage point increase in scale relative to the industry average increases the productivity of an average non-exporter who does not undertake R&D by about 0.0013% (column 2, table 3). This magnitude is quite large. The median observation for the scale variable is 0.22. That is, the sales volume of the firm at the 50th percentile is roughly equal to 22% of the average firm's sales in the industry. If this firm reaches the average sales figure of the industry it is domiciled in, the firms' productivity would go up by 9.75%.[16] If R&D performance is imposed as addition requirement in determining the sample, we find that the effect of scale on productivity drops to 0.07% (column 4, table 3), relative to 0.13% without the R&D restriction. As expected, the magnitude of the scale coefficient is markedly lower for sub-samples that are restricted to exporters (columns 3 and 5, table 3). This finding mirrors the relative size difference between exporters and non-exporters which is apparent from table 1.

The coefficient on HI (Herfindahl Index) which can be interpreted as both a measure of concentration and competition is not statistically significant in most of the regressions. An explanation of this could be that the HI variable is not able to adequately capture the concept of competition. Indeed, forthcoming research on competition in NZ suggests that concentration indices do not accurately model competition (Devine, Doan, Iyer, Mok, & Stevens, 2011a, 2011b).

[16] 0.125 (scale coefficient) x (1-0.22). One should be aware that scale is measured relative the industry average so that an increase in one firm's scale will increase the industry average and thus reduce all other firms' scales. Therefore, large linear projection of the estimation will be misleading.

Discussion

The high degree of consistency of the results from the eight regressions gives us confidence in discussing their implications.

Firstly, it is reasonable to conclude that exporters in NZ firms have a sizeable productivity premium. This is consistent with what is found elsewhere in the NZ literature (Fabling et al. 2008). It is clarified that this is evidence of correlation as opposed to causation, although the latter might be true as well. Saravanaperumal and Charteris (2010), using measures of labour productivity, reported that among exporters, GSE firms were the most productive followed by the SE and, then the GE firms. We observe the same productivity status applying both labour productivity and MFP; with MFP however, the differences are smaller. This underlines the importance of accounting for capital intensity in computing productivity.

Secondly, there is evidence of positive intra-industry spillovers from goods exporting in NZ, even though such spillovers are observed to accrue only to other exporters. Exactly what gives rise to these spillovers is an interesting question. Perhaps, exporters closely track the activities of other exporters in the same industry and, via observational learning and/or labour mobility, are able to appropriate spillovers from their competitors. That the non-exporters are not able to appropriate similar spillovers is a discouraging finding. Nonetheless, the pattern of results is consistent with the observations in Cohen and Levinthal (1989, 1990) that the ability to utilize new technology is largely a function of prior related knowledge. This view is supported by the finding that even among exporters those that undertake R&D gain

more. Based on the above, it is our view that it is the broader concept of absorptive capacity that this driving this result rather than exporting per se. It therefore gives support to the common practice in the literature to model exporting as measure of absorptive capacity (e.g., Iyer et al., 2011a).

In this paper due to relatively small numbers of SE and GSE, it was not feasible to map spillovers from one type of exporters to each of the other types. So as recipients of spillovers, all exporters were clubbed as one group.

Thirdly, there is no evidence of spillovers from services exporters and goods and services exporters. This could suggest that intra-industry spillover varies by type of exporter and that there are service-specific factors which are somehow preventing the productivity spillovers.[17] That said, it is possible this finding is being driven by data issues which require further exploration. For instance, there could be a greater degree of homogeneity among goods exporters within an industry group that allows easier appropriation of productivity spillovers.

Lastly, we find that scale is a critical determinant of productivity and while exporters have scale advantage, non-exporters do not. Policy practitioners are well aware of the scale challenges of NZ firms and, indeed, exporting has been identified as one way to surmount this challenge.

VI. Conclusion

[17] For example, one firm might be able to buy a good and then reverse engineer it to extract the embodied technology; the same is not possible in the case of services.

This paper evaluated whether productivity benefits accrue to domestically-owned exporting and non-exporting firms as a result of increased exporter presence in the NZ economy. The analysis is carried out using a panel dataset of 440,829 firms spanning the years 2000-2008, making the sample comprehensive and representative of the NZ business population. The source of the data was the prototype Longitudinal Business Database administered by Statistics NZ.

Extending the existing literature, the study distinguished between spillovers from goods exporters (GE), services exporters (SE) and goods and services exporters (GSE). Since the nature of goods producing and service delivering activities are different, it was considered unreasonable to treat GE, SE, and GSE firms as homogenous. Eight regressions were estimated based on different sub-samples and different model specifications. By and large the results are very consistent across all estimations.

There is a sizable productivity premium associated with exporting. Specifically, GSE firms are observed to be most productive followed by SE firms and then GE firms. Intra-industry spillovers are negligible. There is evidence of positive intra-industry spillovers from goods exporting; but, these spillovers accrue only to other exporters, especially to those who undertake R&D. This means that most of the non-exporting local firms are not able to benefit from goods exporters in the same industry. We attribute this not to exporting per se, but to absorptive capacity.

At the same time, an important caveat is that only intra-industry spillovers are modelled. In the context of spillovers from foreign owned firms, a recent and critical

observation is that spillovers are more likely to be inter-industry than intra-industry in nature (Javorcik, 2004). This observation might be equally true in the context of spillovers from exporting. Due to data constraints, it was not straightforward to model inter-industry spillovers; however future research examining inter-industry spillovers is planned.

There is no evidence of spillovers from SE and GSE firms. This is again a disappointing finding. All the same, it underlines the importance of distinguishing exporters by type while evaluating spillovers from them. There is a need for some introspection on whether it is possible to generate spillovers from SE and GE firms, especially given their much higher rates of productivity. Of course, the caveat that inter-industry spillovers have not been considered as yet is equally applicable in the case of SE and GSE spillovers.

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Data Appendix: Variables and Data Sources

Variable Acronym	Variable Name	Data Sources
Firms		Economically active enterprise are defined as enterprises that meet at least one of the following criteria in a particular year: • Linked Employer Employee Data (LEED) rolling mean employment (RME) greater than zero • GST sales greater than zero • GST purchases greater than zero • IR10 total income greater than zero • IR10 total expenditure greater than zero • IR10 total fixed assets greater than zero. As mentioned in the text, firms are not always single legal entities. Where firms are components of a group, the group aggregates are used to measure the variables rather than the firm (i.e., legal entity) specific data.
Y	Value Added	Value added variable derived from the Annual Enterprise Survey (AES). Adjusted to constant 2009Q1 dollars using industry sub-division specific deflators. Where value added was not available in the AES or was based on tax data, it was replaced with a derived value added from the Business Activity Indicator (BAI). The derivation is simply sales (from BAI) less purchases (from BAI) adjusted for stocks (IR10, i.e., financial returns). The production function includes a level dummy to capture the difference in sources. It has been worked out that the difference in the two sources is essentially one of levels.
K	Capital	Derived as the summation of depreciation and cost of capital charge for owned assets. Data from AES and BAI (depending on the source of data for value added). Adjusted to constant 2009Q1 dollars using asset specific deflators.
L	Labour	Rolling mean employment from LBF
FDI	FDI Dummy	Constructed as a binary variable: foreign owned and non-foreign owned; data from LBF and IR4 (company tax returns).
EX	Goods Exporter Dummy Services Exporter Dummy Goods and Services Exporter Dummy	Constructed as a binary variable: Exporter of goods and Non-Exporter of goods; data from Customs. Constructed as a binary variable: Exporter of services and Non-Exporter of services; data from International Trade in Services and Royalties Survey. Constructed as a binary variable: Exporter of goods and services and Non-Exporter of goods and services; Constructed using Goods Exporter and Services Exporter data.
R&D	R&D Dummy	Constructed as a binary variable: R&D performers and R&D non-performers; data from IR10.
SPILL	Intra-industry Spillovers	Constructed using Exporter dummies and value added. See text for formula.

EX	Exports Dummy	Constructed as a binary variable: Exporter and Non-Exporter; data from Customs.
HI	Herfindahl Index	Constructed using data on firm and industry sales (either gross output from AES and sales from BAI). See text for formula.
Scale	Scale	Constructed using data on firm and industry sales (either gross output from AES and sales from BAI). See text for formula.

*Intermediate consumption is used as a proxy variable for unobserved productivity shocks based on the Levinsohn Petrin approach. Data comes from AES and the BAI. Adjusted to constant 2009Q1 dollars using industry group specific producer price indices.