The Determinants of Firm-Level Export Intensity in New Zealand Agriculture and Forestry[1,2]

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Abstract: This paper investigates the determinants of firm level export intensity in New Zealand's agriculture and forestry over the period 2000-06. Applying a random effects model, it is uncovered that export intensity is driven by firm productivity and export market diversification. Firm size is found to have a negative effect on export intensity. Sector characteristics do not have an empirically discernible influence.

I. INTRODUCTION

Historically, economic growth in New Zealand (NZ) has been underpinned by exports, especially of food and fibre products. In recent times, NZ's economic performance has faltered, relative to the OECD. It is no surprise that this has coincided with NZ's export to GDP ratio remaining static while the rest of the OECD has surged ahead.[3] NZ's exports to GDP ratio has remained at 30 percent since the mid 1980s while the average in the OECD is now well over 40 percent. The need to achieve a step change in exports has been recognised. Indeed, one of the stated goals of the NZ Government is to increase exports to 40 percent of GDP by 2025.

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[2]   Disclaimer: The opinions, findings, recommendations and conclusions expressed in this report are those of the authors. Statistics NZ, the Ministry of Economic Development, NZ and the Ministry of Agriculture and Forestry, NZ take no responsibility for any omissions or errors in the information contained here. Access to the data used in this study was provided by Statistics NZ in accordance with security and confidentiality provisions of the Statistics Act 1975. Only people authorised by the Statistics Act 1975 are allowed to see data about a particular, business or organisation. The results in this paper have been confidentialised to protect individual businesses from identification. Statistics NZ protocols were applied to the data sourced from the New Zealand Customs Service; the Foundation for Research, Science and Technology; New Zealand Trade and Enterprise; and Te Puni Kokiri. Any discussion of data limitations is not related to the data's ability to support these government agencies' core operational requirements. Any table or other material in this report may be reproduced and published without further licence, provided that it does not purport to be published under government authority and that acknowledgement is made of this source.

[3]   Frankel and Romer (1999) estimate that a rise of one percentage point in the ratio of trade to GDP increases income per head by at least one-half of a percent.

While more than 80 percent of NZ exports are accounted for by firms in the manufacturing sector, nearly two-thirds of the exports are based on food, fibre and forestry products.[4] Focus on the export potential and performance of the primary industry goods sectors is, therefore, topical and important.

Recent policy and research interest in firm level analyses of exporting behaviour is, at least in part, motivated by the understanding that while the Government is able to give effect to a broad range of policy measures that will facilitate trade, the real action needed to achieve the exports goal rests with the exporting firms. Two dimensions of firm level export performance have been focused upon: export propensity and export intensity. The former is defined as whether or not a firm is an exporter. The latter is defined as exports as a proportion of sales. Among the two dimensions, export propensity features more prominently in the literature. Hiep and Nishijima (2009), reviewing over ninety micro-data studies of export decision making, find that just about ten percent of them deal with export intensity.[5] Plausibly, this is attributable to researchers considering export intensity as decision that a firm makes simultaneously to export propensity (Hiep and Nishijima 2009). However, recent evidence from Helpman et al. (2008) and Lawless and Whelan (2008) suggests that the two decisions are in fact independent, different and driven by heterogeneous factors. This supports the case for undertaking separate investigations to identify the determinants of export intensity.

Firm specific attributes and sector wide characteristics have been used to model export intensity. Among firm specific attributes, productivity, firm size, firm age, product and export market diversification have been focused upon. At the sector level, measures of concentration or competition have received the maximum attention. Despite an overlap in the vector of determinants across studies, the international evidence on export intensity determinants is mixed. Results from different countries and industries point in different directions. Roberts and Tybout (1997) suggest that different idiosyncratic forces at work determine export behaviours of firms in different countries and industries. The ambiguity across cross-country and industry evidence is, therefore, to be expected. From a policy perspective, this means that findings on export intensity determinants from one country or industry should not be used to inform policy in another.

Addressing the need for country and industry specific evidence, this paper investigates the determinants of firm-level export intensity in NZ, focusing on the agriculture and forestry related industries. Evidence from this paper should inform policy pertaining to NZ's primary goods based exports. A sample of 1140 exporting firms[6] over the period 2000-06 is applied in the analysis. The data is wholly drawn from the prototype Longitudinal Business Database (LBD) which is built primarily around government administered data collections, and is administered by Statistics NZ. In constructing the dataset, a broad definition of the agriculture and forestry is applied; including firms in upstream activities such as manufacturing and services as long as the essential business of the firm pertains to primary goods (producing, processing or selling). The agriculture and forestry industry is classified into eight sector groupings. See Appendix 1 for details on sector groupings.

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[4]   Author's calculations.

[5]   Lawless and Whelan (2008) make a similar observation.

[6]   Random rounded.

The rest of the paper is organised as follows. The next section briefly reviews the literature on the modelling of firm level export intensity. Section III presents the empirical model and discusses the data. The results are presented in Section IV. Section V concludes.

II. LITERATURE REVIEW

In international studies, export intensity has been modelled on a host of firm specific attributes and sector wide factors. There is a certain level of consensus on what the determinants of export intensity might potentially be. As far as firm specific attributes are concerned, productivity is most commonly evaluated as a determinant of export intensity. It is observed that firms with higher productivity are more likely to export and, export more of their output. This is attributable to the variable and fixed trade costs, which productive firms are more capable of footing (see, Hiep and Nishijima 2009). 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 will be able to enter more markets and, thereby, export a larger share of their output. This prediction is confirmed in both Helpman et al. (2008) and Yoshino (2008). However, the empirical evidence on the effects of productivity on export intensity is sobering. For example, Liu et al. (1999) and Castellani (2002) find that labour productivity does not determine export intensity of firms in Taiwan and Italy, respectively. Farinas and Martin-Marcos (2007) observe that the effect of labour productivity on export intensity on Spanish firms is ambiguous; different effects are observed in different industries. In contrast, for a sample of firms from Chile, Alvarez (2002) finds the effect of productivity on export intensity to be positive and significant.

The probability of a firm exporting appears to increase with firm size, although exporters can be found among smaller firms (Wagner 2001). Chetty and Hamilton (1993) in a review of the export performance literature also find significant evidence of a positive relationship between firm size and exports. In a sample of manufacturing firms in Italy, Sterlacchini (2001) reports that firm size is the most significant determinant of export behaviour. In contrast, analyzing a sample of French firms, Pla-Barber and Alegre (2007) find the effects of size to be statistically insignificant. Reviewing the literature, Hiep and Nishijima (2009) observe that the findings are mixed and conclude that re-testing of firm size effects on export intensity is called for. Likewise, the effect of firm age on export intensity has also been found ambiguous. For example, while Majocchi et al. (2005) finds that older firms are more export intensive in Italy, Fryges (2006) observes that newer firms are more export intensive in Germany and UK.

Diversification measures relating to both export markets and products have been used as indicators of export performance in several empirical studies (see, Katsikeas et al. 2000; Sousa et al. 2004). Intuitively, it is straightforward to argue that diversification offers more export opportunities and might, therefore, lead to increase in export intensity. Indeed, the expectation of a positive association between product diversification and international sales is rooted in the new trade theory. Empirical evidence is also readily forthcoming. For example, Beamish et al. (1993) offer evidence that a diversified product portfolio has a positive impact on export performance. Cooper and Kleinschmidt (1985) observe that high performance exporters tend to have diversified export markets. In the NZ context, it has been suggested that the low level of

export market and product diversification has negatively impacted export intensity (Ministry of Economic Development 2007).

Among sector wide factors, competition is often modelled as a determinant of firm level export intensity. Cloughety and Zang (2008) summarize two conflicting view points on the effects of competition. On the one hand, greater industry concentration (low competition) allows firms to garner scale economies, which can be critical while competing in the international market place. On the other, it has been observed that concentration provides little incentive to improve performance, identify new markets or indulge in product diversification. Zhao and Zou (2002) find that the more a firm acts in a concentrated sector, the less the firm will be prone to improve its export performance. Surveying the evidence on the effects of competition on export intensity, Morgan (1999) concludes that the results vary across studies.

If a sector as a whole is characterised by high export intensity, it possibly reflects the competitive advantage of the sector in the international market. Arguably, therefore, the export orientation of the sector could be a determinant of firm level export intensity. Naidu and Prasad (1994) note that firms in export intensive sectors are more likely to learn to become more regular exporters. The argument put forth is that when competing firms are engaged in export activity, there is a significant incentive for a firm to follow suit.

III. EMPIRICAL MODEL AND DATA

3.1 The Model

Equation (1) specifies the baseline model estimated.

$$EXINT_{ijt} = \beta_0 + \beta_1 LP_{ijt-1} + \beta_2 MKTS_{ijt-1} + \beta_3 PDTS_{ijt-1} + \beta_4 MKTSHARE_{ijt-1} + \beta_5 SIZE_{ijt-1} + \beta_6 AGE_{ijt} + \beta_7 SECTEXINT_{jt} + \beta_8 SECTSIZE_{jt} + \beta_9 FFCR_{jt} + YearDummies + SectorDummies + \varepsilon_{ijt} \tag{1}$$

where,

$EXINT_{ijt}$:	Exports over sales ratio of firm i in sector j at time t
LP_{ijt-1}:	Labour productivity (in natural logarithms) of firm i in sector j at time t-1
$MKTS_{ijt-1}$:	Number of export markets of firm i in sector j at time t-1
$PDTS_{ijt-1}$:	Number of products exported by firm i in sector j at time t-1
$MKTSHARE_{ijt-1}$:	Market share of firm i measured relative to sector j at time t-1
$SIZE_{ijt-1}$:	Employment (in natural logarithms) of firm i in sector j at time t-1
AGE_{ijt}:	Years of existence of firm i in sector j at time t
$SECTEXINT_{jt}$:	Exports over sales ratio for all firms in sector j at time t
$SECTSIZE_{jt}$:	Number of exporting firms in sector j at time t
$FFCR_{jt}$:	Five firm concentration ratio of sector j at time t

The dependent variable in the model, export intensity, is defined as the ratio of exports over sales. There exists substantial international evidence that productive firms self-select to exporting (see, Bernard and Jensen 2004, Wagner 2007). Even in the specific case of NZ, there is emerging evidence that productivity has a causal effect on exporting activity (Fabling et al. 2008). The coefficient of labour productivity in Equation (1) above does not represent the casual

link running from productivity to exports per se. Instead, the coefficient informs on whether exporting firms with higher productivity export a greater share of their output.[7] Consistent with the export intensity modelling literature, firm diversification variables relating to both number of export markets and products are included in the vector of explanatory variables. The firm's market share calculated at a sector level is also used as a regressor (see Appendix 1 for sector composition). A dominant position in the market should result in higher export intensity. Other firm specific variables in the model include size and age. Size, measured by labour count, also serves as a control variable to ensure that size effects are not attributed to other factors.

Sector wide characteristics in the regression model include competition, sector export intensity and sector size. Competition is measured by the five firm concentration ratio (FFCR). A higher ratio is indicative of a few firms garnering much of the market. Sector export intensity is included to proxy for the sector's competitive advantage in international markets. The sign of sector size variables cannot be determined *apriori*. On the one hand, a larger sector size, as measured by the number of firms, may reflect the strength of the sector at large, internationally. On the other, it may mean reduced export opportunities per firm.

3.2 Data and Summary Statistics

The data for the study comes from a variety of sources within the prototype Longitudinal Business Database (LBD). The LBD data are described in Statistics NZ (2007) and Fabling et al. (2008). The panel extracted for this study was unbalanced containing data on 1140 exporting firms over the period 2000-06. At the least, there was one observation per firm and some firms had six time observations (one time observation is invariably lost by taking the first lag). The average number of time observations per firm was 3.2. *Table 1* lists the source of data, briefly explains their construction and presents the summary statistics.

It is apparent that exporting firms have a clear productivity advantage over purely domestic firms. The average labour productivity for exporters in the agriculture and forestry sectors is nearly $237,000 per worker. The corresponding statistics for the economy at large has been worked to be $88,000 per worker. On average, exporters sell close to 30 percent of their output overseas. Summary statistics on export markets and product diversification are sobering. On average, an exporter has access only to 3 countries and has a mix of only 9 products.[8] It is known that bulk of NZ exports come from the agriculture and forestry activities and that this is an area of competitive advantage for the country. Still, the export intensity of 'exporting' firms in this sector stands at only 37 percent.[9] The sector per se is concentrated with the five largest firms garnering close to 50 percent of the market share, on average.

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[7]　The productivity measure applied is that of labour productivity. Ideally, a multifactor productivity (MFP) measure should have been used. Firm level capital stocks are not available at present, pre-empting the computation of MFP. However, the main import of the results is not confounded by the use of the labour productivity measure. Furthermore, modelling of export intensity on labour productivity is a common practice. See, for instance, Liu et al. (1999), Castellani (2002) and Farinas and Martin-Marcos (2007).

[8]　The products are coded on HS10, which is a narrow definition. Resorting to a broader HS code, the number of products per firm will reduce even further.

[9]　The sector export intensity value obtained was significantly lower that the *apriori* expectation, considering the share of physical production in diary and meat industries being exported. However, it appears that this value is driven by some large firms that predominantly service the local market but also export agriculture and forestry products.

Table 1: Variables, Data Sources and Construction

Explanatory Variables	Acronym	Data Source and Construction	Mean	Std. Dev.
Export Intensity	EXINT	Exports / Sales; Exports from CUSTOMS and sales from Business Activity Indicator (BAI).	0.2934	0.3241
Labour Productivity	LP	Value Added / Labour Count; value added derived from BAI and labour count is the Rolling Mean Employment (RME) derived from Linked Employer-Employee Database (LEED).	236,577	2,031,477
Number of Export Markets	MKTS	Derived from CUSTOMS database based on the destination market as specified by the exporter.	3	9
Number of Products Exported	PDTS	Derived using the HS code specified in the CUSTOMS database.	9	21
Market Share	MSHARE	Sales of the firm /Sales of exporting firms in the sector both derived from BAI.	0.0085	0.0374
Employment (Firm Size)	LAB	Labour count (RME from LEED)	69	300
Years of Existence	AGE	Based on date of birth taken from the Longitudinal business frame.	15	15
Sector Export Intensity	SECTEXINT	Sector exports over sales of exporting firms in the sector. Exports from CUSTOMS and sales from BAI.	0.3715	0.1996
Sector Size	SECTSIZE	Number of exporting firms in the sector, derived using CUSTOMS.	258	123
Five Firm Concentration Ratio	FFCR	Ratio of sales accounted for the top five firms over the sales of the sector – both derived from BAI.	0.5065	0.1638

Notes: minimum and maximum values cannot be reported due to confidentiality constraints; reported numbers, when counts, are random rounded and when magnitudes are grad random rounded.

IV. RESULTS AND DISCUSSION

Results from three alternative model specifications are presented in *Table 2* below. Examining alternative specifications serves two purposes. First, it enhances the interpretation of the results and two, it tests for sensitivity. The models were estimated using the random effects method. A fixed effect model was overwhelmingly rejected by the Hausman test (at less than 1 percent level of significance).[10] In accordance with the specification in Equation (1), full sets of time and sector dummies are included. These additional variables control for un-observables which might be related to time or sector specific.

All model specifications required regression of micro units on variables aggregated at the sector level. Moulton (1990) has demonstrated that such regressions produce standard errors that are biased downwards, thereby giving raise to the possibility of spurious significance. To address this issue, robust, i.e., clustered standard errors are used.

The findings from the study are reasonably intuitive. It is observed that the lag of labour productivity is positive and significant across all three estimated models. While this is consistent with the hypothesis that productive firms self select to exporting, the result really means that more productive exporters in the agriculture and forestry domain tend to export a larger share of their output. From a policy perspective, this implies that cherry picking productive firms for Government assistance will contribute to improving export performance at the economy-wide level. To the extent increases in export intensity lead to productivity growth, a mutually reinforcing relationship may be in place.

There is a clear association between market diversification and export intensity; more the number of destination markets for a firm, higher its export intensity. Specifically, an addition of one new market marks a 1.3 per cent increase in an average firm's export intensity. The size of the coefficient is robust across specifications. It can be postulated that the decline in the rate of market diversification observed in NZ since the mid 1980s[11] might have limited possible increases in export intensity. It appears that Government initiatives to identify new markets and facilitate exporter entry in them should result in export growth for firms in the agriculture and forestry sectors. Product diversification is significant at 10 percent in Model 2. Presumably, the effect of product diversification on export intensity is confounded by the presence of the market diversification variable (Models 1 and 3). A similar observation is made for the market share variable, which is significant only in the model that excludes the market diversification variable.

The size of the firm, measured by employment, is found to be negatively correlated with export intensity. On average, a one percent increase in employment count results in export intensity decreasing by roughly 0.04 percent. Although unusual, this result is backed by a reasonable explanation. Larger exporting firms may have a large domestic market as well, pulling down the export intensity. Certainly, the result does not mean that larger firms export less in an absolute sense. Across all models, it is found that the age of firm does not explain export intensity.

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[10] Results of the fixed effect model and pooled OLS model available on request.
[11] See, Economic Development Indicators (2007), Ministry of Economic Development.

Table 2: Random Effects Regression Models of Firm Export Intensity

Variables	Model 1	Model 2	Model 3
Ln Labour Productivity (First Lag)	0.0071** (0.0035)	0.0141*** (0.0047)	0.0072** (0.0033)
Number of Export Markets (First Lag)	0.0129*** (0.0015)	---	0.0131*** (0.0016)
Number of Products Exported (First Lag)	0.0003 (0.0004)	0.0015* (0.0008)	0.0003 (0.0004)
Market Share	-0.3361 (0.3699)	0.4029* (0.2385)	-0.3547 (0.3608)
Ln Employment	-0.0385*** (0.0107)	-0.0252** (0.0106)	-0.0408*** (0.0104)
Years of Existence	-0.0007 (0.0005)	-0.0003 (0.0005)	-0.0006 (0.0005)
Sector Export Intensity	0.1005 (0.0720)	0.0793 (0.0770)	0.1732*** (0.0312)
Sector size	-0.0001 (0.0002)	-0.0002 (0.0003)	0.0000 (0.0001)
FFCR	-0.0119 (0.0472)	-0.0102 (0.0393)	0.0456 (0.0686)
Intercept	0.3075*** (0.0911)	0.2569*** (0.0865)	0.1978*** (0.0621)
Year Dummy 1	0.0128** (0.0055)	-0.0137** (0.0062)	---
Year Dummy 2	0.0080 (0.0121)	-0.0058 (0.0078)	---
Year Dummy 3	0.0084 (0.0176)	-0.0055 (0.0158)	---
Year Dummy 4	0.0256 (0.0205)	0.0148 (0.0207)	---
Year Dummy 5	0.0173 (0.0197)	0.0079 (0.0200)	---
Sector 2 Dummy	-0.0571** (0.0250)	-0.0717*** (0.0239)	---
Sector 3 Dummy	-0.0194 (0.0427)	-0.0042 (0.0387)	---
Sector 4 Dummy	-0.1143** (0.0540)	-0.0292 (0.0670)	---
Sector 5 Dummy	-0.0530 (0.0710)	-0.1041 (0.0877)	---
Sector 6 Dummy	-0.0541* (0.0303)	-0.0762* (0.0463)	---
Sector 7 Dummy	-0.0094 (0.0567)	-0.0172 (0.0646)	---
Sector 8 Dummy	0.0471 (0.0454)	0.0955** (0.0480)	---
R-Squared	0.2492	0.1593	0.2443

Notes: Robust standard errors are presented in parentheses;*, **, *** Significant at the 10-percent, 5-percent and 1 percent level, respectively.

Evidence from the model suggests that the export intensity of a firm is not a function of the export intensity of the exporters in the sector. In model 3, sector export intensity is significant at less than one percent, but that result is driven plausibly due to omission of sector dummies. Perhaps, the nature of the sector does matter even if its average export intensity does not. Measures of competition – sector size and FFCR – have no explanatory power. It is worth noting that none of the sector wide characteristics are found to determine firm level export intensity.

V. CONCLUSION

Increasing firm level exports underpins export success at the economy wide level. This recognition has led to increased policy and research interest in firm level analyses of export performance. Export Intensity is an important dimension of export performance. International evidence on the determinants of export intensity has been mixed; different results have been identified for different countries and industries. This underlines the importance of using country and industry specific evidence to inform policy. This paper investigated the determinants of export intensity in NZ agriculture and forestry, which is defined to include related upstream manufacturing and service activities. An unbalanced panel dataset of 1140 firms over the 2000-06 period was compiled from the LBD for the empirical analysis.

Results from random effects regression models reveal that more productive exporters export a larger share of their output. From a policy perspective, cherry picking the more productive firms for export assistance should lead to greater exports, than what would otherwise have been the case. It appears that firm size should not be a criterion for the cherry picking, given that size is negatively associated with export intensity. This is not to suggest discrimination against large firms per se since they might be exporting more in an absolute sense. The export intensity of a firm is positively influenced by the number of export market serviced and possibly, by product diversification. This finding is in accordance with the new trade theory. Government intervention at the firm level, through delivery agencies with ground level knowledge of foreign markets, is likely to be effective. More generally, Government action to facilitate exporter entry to new overseas markets would lead to a greater share of output being exported.

APPENDIX 1: AGRICULTURE AND FORESTRY ACTIVITIES

Group	ANZSIC Codes	Description
1	A011, A012, A013, A014, A015, A016, A017, A019, C2130, F4715	Plant nurseries; flowers, vegetables fruits growing; fruit and vegetables processing; fruit and vegetables wholesaling.
2	A0121, A0122, A0169, C2140, C2151, C2152, C2161, C2162, C2163, C2171, C2172, C2174, C2179, F4512, F4519	Grain growing; crop and plant growing nec; manufacturing of: oil and fat; flour mill products, cereal and foods, bread, cake and pastry, biscuits, sugar, confectionaries, animal and bird feeds, food nec; wholesaling of: cereal and grain; farm produce and supplies.
3	A0123, A0124, A0125, A0141, A0142, A0152, A0153, A0159, C2111, C2112, C2113, F4711	Farming of: sheep; beef; beef cattle; poultry; eggs; pig; horse; deer; livestock nec, processing of: meat; poultry; bacon, ham and small goods; wholesaling of meat and poultry.
4	A0130, C2121, C2122, C2129, F4713	Dairy cattle farming, processing of: milk and cream; ice cream, dairy products nec, dairy produce wholesaling
5	A0213, A0219	Aerial agricultural services, services to agriculture nec.
6	A0301, A0302, A0303, C2311, C2313, C2321, C2322, C2323, C2329, C2331, C2332, C2333, C2334, C2339, C2411, F4531	Forestry, logging and services to forestry, log sawmilling, wood chipping, timber resawing and dressing, manufacturing of: plywood and veneer; fabricated wood, wooden structural components, wood products nec, pulp, paper and paper board, solid paperboard container, corrugated paper board, paper bag and sack, paper products nec, wholesaling of timber.
7	C2261, C2262	Leather tanning and fur dressing, leather and leather substitute product manufacturing.
8	F4511	Wool wholesaling.

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