Multi-Product Exporters and Product Turnover Behaviour of New Zealand Exporters

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Abstract

Using a unique dataset that covers all exporting firms in New Zealand from 1996 to 2007, this paper analyses the patterns of their product mix, how it changes over time and how this relates to firm characteristics. We suggest that looking at the relative importance of added and dropped products is as important as firm entry/exit in reallocation of resources.

We find that in the cross section, multi-product firms are more productive than single product ones. Changes to product mix by New Zealand exporters occur frequently, suggesting that New Zealand exporters are dynamic and there is "creative destruction" at the product level.

It is also shown that dropping products is more likely to happen than adding products, suggesting the difficulty of entering new markets and products. We also show that products with a smaller share of total exports and products that have been exported for a short period of time are more likely to be dropped by a firm.

The results make a good case for product-firm characteristics being an important part of export decisions and suggest that more work should be done on this link.

JEL CLASSIFICATION D21, E23, L11, L60

KEYWORDS Product churning; product market entry and exit; volatility of earnings; multi product firms; creative destruction

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Multi-Product Exporters and Product Turnover Behaviour of New Zealand Exporters

1 Introduction

Empirical micro studies have found heterogeneity in firm performance across industries.[1] Both theoretical and empirical literature has shown that a reallocation of resources from low to high productivity firms within industries has led to gains in aggregate output.[2] Such a reallocation generally occurs through policy reforms (mostly trade) or changes in market fundamentals.[3] In these studies, the discussions of allocation of resources to their most efficient use generally focus on dynamics of firm entry and exit, i.e., whether newly created firms are more productive than exiting ones. Some exceptions are Bernard et al. (2006a, 2008), Nocke and Yeaple (2006), Baldwin and Gu (2006) and Goldberg et al. (2008). Another way of reallocating resources can occur within firms, as firms add and drop products or alter their product mix. According to Bernard et al. (2006a), changes in product mix account for a larger proportion of output growth than firm entry and exit in the U.S. Product churning accounts for a third of the increase in U.S. output between 1972 and 1997. Goldberg et al. (2008) find that in India, changes in product mix contribute about 25% to the aggregate growth in output.

The prototype Longitudinal Business Database (LBD), which is discussed in detail in Section 2, enables us to approach this issue empirically for New Zealand. The existence of comparable studies for a developed economy such as the U.S. (Bernard et al. (2008)) and a developing economy such as India (Goldberg et al. (2008)) helps us put the results for New Zealand in perspective. Compared with these two countries, New Zealand is a smaller but more open economy. For New Zealand, we observe the full set of products each firm exports in each month and analyse how different firms' product mix changes over the period from 1996 to 2007.

We begin by documenting the characteristics of single and multiple product exporters. New Zealand multi-product exporters are similar to U.S. and Indian firms. Overall, multi-product firms perform better, on average, they have larger sales and value added and higher employment and wages.

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1 Firm level studies have also found that exporters represent a small proportion of all firms and that they have better economic performance compared to non-exporters such as larger size, greater capital intensity and higher productivity.

2 Dunne et al. (1989a, 1989b), Baily et al. (1992),Hopenhayn (1996), Roberts and Tybout (1996).

3 Pavcnik (2002), Melitz (2003), Bernard et al. (2003), Tybout (2003), Bernard et al. (2006), Melitz and Ottaviano (2008).

An analysis of product mix of exporters shows that changes to the product mix are frequent, widespread and affect both aggregate and firm outcomes. The results show that changes in product mix contributed, on net, for 97% of the increase in the value of exports in New Zealand. Looking at the gross changes show that 94% of firms change their product mix.[4] Decomposing the change in the product mix shows that New Zealand exporters are more likely to drop than add products, which is in contrast to results from Indian firms that are much more likely to add products. These findings suggest that "creative destruction" along the product dimension is prevalent among New Zealand exporters. This might be a reflection that there are no regulatory barriers to such actions by firms. Alternatively, lower trade costs lead to rationalization of extensive margins (production due to existing products) by firms through dropping products with higher marginal costs of production. Theories emphasising the role of "creative destruction" in growth predict that product-dropping behaviour by firms is a part of adjustment to changes in the economy. Furthermore, a majority of firms (79%) simultaneously add and drop products, suggesting that New Zealand exporters are quite dynamic and react to changes in economic conditions.

Recent theoretical models of international trade predict that firms drop products as an adjustment to decline in trade costs. Bernard et al. (2006b) extend the heterogeneous firm model of Melitz (2003) from self-selection of more productive firms into production to selection of products within firms. Their model posits a positive correlation between a firms' extensive (number of products) and intensive margin (output per product), which is observed in the data for New Zealand.

In the analysis of firm behaviour, diversification is considered good as it creates a buffer against different types of shocks. Most studies on diversification focus on the financial portfolio of the firm and its effect on productivity or the value of the firm. For example, Ghironi and Melitz (2005) look at firm entry and exit to explain the U.S. business cycle. Product diversification has largely been ignored due to lack of data. The choice of product mix can be thought as a channel through which price volatility feeds into productivity. On the one hand, if firms choose to have a more varied product mix due to volatility of prices, this leads to a diversification in their production, and increases their resilience to price shocks. On the other hand, such a diversification may lead to a decline in productivity as firms are unable to capture the benefits of comparative advantage and economies of scale. This creates a typical risk vs. return trade-off that can be analysed using firm level data.

This paper analyses the product mix of New Zealand, following closely the work by Bernard et al. (2006a, 2008) for US manufacturing firms. Section 2 describes the data, and Section 3 compares the characteristics of single-product and multi-product exporters. Section 4 extends the analysis to the relative share of new, continuing and exiting firms as well as dropped, added and continued products in the value of exports. Patterns of changes to the product mix as well as impact of product mix changes on firm characteristics are also considered.[5] Section 5 discusses why firms might be engaging in product-switching behaviour. Section 6 concludes.

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[4] This is much higher than results showing that 50% of U.S. firms and 30% of Indian firms change their product mix.

[5] Since the analysis for this paper was completed, I have been alerted to the fact that there is a discrepancy in the coding of firm identities in the data that overstates the magnitude of the changes to the product mix presented in this section. At this point, I am unable to quantify the size of the overstatement in the results although I believe that the main conclusions remain valid. Firms are coded with a unique identifier and some changes to a firm, such as a change in name or structure, may trigger a new identifier to be applied to the firm and therefore a false birth and death to appear. This might lead to a larger percentage of aggregate trade being attributed to a change in product mix. Fabling and Sanderson (2008b) correct for this discrepancy to address a similar but more aggregate question. They analyze the contribution of new goods and destinations to aggregate trade growth between the periods 1996-1999 and 2004-2006.

2 Data Description

The dataset used in this paper is the prototype Longitudinal Business Database (LBD), developed by Statistics New Zealand (SNZ).[6] This dataset is a combination of several resources which are shown in Appendix A and includes longitudinal data on all economically active firms in New Zealand.

Economically active enterprises included in the dataset are defined as enterprises that met at least one of the following criteria in a particular year:

- LEED rolling mean employment (RME) greater than zero
- GST sales greater than zero
- GST purchases greater than zero
- IR 10 total income greater than zero
- IR 10 total expenditure greater than zero
- IR 10 total fixed assets greater than zero.

Most important sources in the prototype LBD are:[7]

GST Returns

Definition: Goods and services tax (GST) is a tax on most goods and services in New Zealand, most imported goods, and certain imported services.

Eligibility: Businesses need to register for GST if their annual turnover is more than $40,000. Below this threshold they may, but not have to, register for GST.

Collection: GST data is collected on a monthly, bi-monthly or six-monthly basis by IRD, depending on the annual turnover of the business.

Variables: GST data include information on sales/income & purchases/expenses.

IR10 Accounts Information

Definition: IR10 data is essentially a general summary of information relating to the customer's business and operations.

Variables: This form contains information on sales and other income, purchases, a breakdown of expenses including but not limited to depreciation, research and development, and salaries and wages. Balance sheet items also include: current assets, fixed assets (broken down into vehicles; plant and machinery; furniture and fittings; land & buildings; and other), other assets, liabilities (broken down into current and term), and shareholders funds.

Eligibility: IR10 is designed to collect information for statistical purposes and is not a compulsory form.

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6 For more information, see Statistics New Zealand (2007), Fabling and Sanderson (2008a).

7 Most of this information was provided by Statistics New Zealand. See Appendix 1 for more details about the dataset.

IR4 Income Tax Return for Companies

Eligibility: All active New Zealand resident companies must file an income tax return every year by completing IR4.

Variables: This form includes variables on New Zealand and overseas income (including interest, dividends and income from "business or rental activities") and losses. They also contain a binary foreign-ownership indicator.

LEED

Definition: LEED data is constructed by Statistics NZ from IRD tax data, notably Pay-As-You-Earn (PAYE) returns for employees. To protect the confidentiality of individuals, LEED variables available in the LBD dataset have been aggregated to the enterprise-level (allowing the data to be accessed through the Data Lab).

Variables: LEED data includes counts of employers (on an annual basis) and employees (on a monthly basis) with matching data on income. Summary characteristics of individuals also include gender and banded age breakdowns, tenure distributions of employees, and summary measures of the dispersion of wages within the firm.

Customs Data

The Customs data is recorded monthly at the shipment level and contains information on products at the 10 digit Harmonised System classification, value, volume and currency of the transaction, whether it has been hedged, means of transport and the country of destination and origin.

The definitions of "sector", "industry" and "product" are based on New Zealand Harmonised system classifications.[8] The international HS follows a hierarchical structure, comprising 21 sections, 98 chapters (2 digit), 1228 headings (4 digit), and 5,059 sub–headings (6 digit). This structure is further broken down into approximately 13,500 statistical keys (10 digit) for New Zealand's purposes. Throughout the paper, sections are referred to as sectors, chapters as industries and 10 digit codes as products.

In the sample period from 1996 to 2007, there have been various revisions to these 10 digit classifications such as introduction of new goods and changes in the tariff system. Since the analysis is based on the product mix of firms, it is crucial to get a consistent definition of products, so the dataset is manipulated such that if two or more products have been merged or if a single product has split into several products, these have been aggregated into a single product.[9]

Summary Statistics

Table 1 provides an indication of the relative level of details between sectors and industries. The table lists industries in Sector 15, "Base Metals and Articles of Base Metal" and aims to show the amount of variation in terms of products. The frequencies are reported to show that there is variation across industries, although some are much more important than others. A list of sector classifications is provided in Appendix 2.

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[8] More information can be found at http://www.stats.govt.nz/statistical-methods/classifications-and-related-statistical-standards/harmonised-system/default.htm.

[9] The code to do this analysis was kindly provided by Ministry of Economic Development researchers.

Table 1 – Example of Industries in Sectors

Sector: Base Metals and Articles of Base Metal

Industry	*Description*	*Frequency*	*Percent*
72	Iron and steel	19,600	11
73	Articles of iron or steel	68,700	38
74	Copper and articles thereof	8,900	5
75	Nickel and articles thereof	40	0
76	Aluminium and articles thereof	27,000	15
78	Lead and articles thereof	1,200	1
79	Zinc and articles thereof	840	0
80	Tin and articles thereof	380	0
81	Other base metals, cermets	170	0
82	Tools, implements, cutlery, spoons and forks, of base metal, parts thereof of base metal	33,400	18
83	Miscellaneous articles of base metal	22,500	12
	Total	182,900	100

Note: On average, a sector has 5 industries and 494 products. This table shows that Sector 15 has 11 industries and the percentage of those industries in the whole sample.

Appendix 3 shows that on average a sector will have 5 industries and 494 products. The number of products ranges from a low of 9 in Sector 21 (works of arts, collector pieces) to a high of 1600 in Sector 16 (machinery).[10] On average, firms are not concentrated in one sector or industry—the average industry per firm is 6, most firms are multi product/sector/industry in terms of numbers (Sector 9 – wood - is the lowest) and in terms of value (Sector 5 - mineral products - is the lowest). The last three columns of Appendix 3 show that multi-product firms are more diverse.

[10] In results not reported here, the mean and standard deviation of total sales in each sector were calculated to see sectoral differences, and there is a lot of variation across sectors.

3 Characteristics of Multi-Product Firms

The extent and the variability provided by the data allows us to test the predictions of the models in Bernard et al. (2006b) and Nocke and Yeaple (2006) about the characteristics of multi-product firms and firms' extensive margins. We find that firms exporting multiple products, industries and sectors dominate New Zealand exporters. This dominance is shown in Table 2, which shows the number of firms that export a single product, which is 6663 and their share of all exporting firms, which is 28 percent. The number of firms producing more than one good is 17412, which refers to 72 percent of all exporting firms. Multi product firms also account for 99 percent of total value of exports. The last column of Table 2 shows that multi-product exporters export on average 22 products, compared to 3.5 (3) produced by U.S. (Indian) manufacturing firms. One potential reason the mean number of products per firm is so much higher in New Zealand is that the data used in this study is much more disaggregated (HS10 codes) than the other two studies (SIC5).

Table 2 – Prevalence of Firms Producing Multiple Products, Industries and Sectors

	Number of Firms	Percentage of Firms	Percent of Exports	Mean Product per Firm
Single Product	6663	28	0.55	1
Multiple Product	17412	72	99.45	22
Multiple Industry	14640	61	97.43	7
Multiple Sector	13584	56	96.16	5

Note: Breakdown of firms according to whether they produce multiple products or in multiple sectors or industries. Pooled sample. Numbers rounded for confidentiality reasons.

Firms which export in multiple industries make up 61 percent of all exporters, whereas the percentage for multiple sectors is 56 percent. In comparison, a similar study that analyses US manufacturing firms finds that single-product firms are 59 percent of all firms and multiple industry firms are 29 percent and multiple sectors are 13 percent. This suggests that New Zealand multi-product firms are more diverse than U.S. firms. This higher degree of diversification could be a response to lack of well-functioning capital markets.

One potential cause is that New Zealand firms try to diversify by exporting more than one product as a way of hedging against uncertainty in export markets. In this case, one would expect the percentage of multi-product exporters to increase when the exchange rate is more volatile. Another reason could be that due to the small size of New Zealand exporters in world markets, firms are forced to export a variety of products. In this case, the percentage of multi-product firms should not vary as the market share of New Zealand exporters does not change significantly over time.

In summary, multi-product exporters dominate exports in New Zealand and they exhibit considerable differences from single-product ones.

3.1 Multi-product firms are stronger performers than single-product firms

Theory predicts that due to the presence of fixed costs "better" firms in terms of productivity are expected to self-select into being multi-product exporters. Firms with higher productivity are able to cover the fixed costs of a larger number of products due to their higher revenues per product. Table 3 compares the characteristics of firms that export multiple products (industries and sectors) with those exporting only single ones.

Table 3 – Characteristics of Multi-Product Firms

	(1)	(2)	(3)	(4)	(5)	(6)
	Sales	**Employment**	**Wages**	**Value Added**	**Productivity**	**Exports**
Product2	1.989	1.783	2.072	2.001	-0.037	2.628
	(6.81)**	(6.19)**	(7.12)**	(7.35)**	(0.11)	(5.96)**
Product4	2.198	1.529	1.894	2.103	0.378	2.879
	(6.46)**	(5.22)**	(5.19)**	(6.43)**	(5.15)**	(5.88)**
Product10	2.940	2.019	2.468	2.780	0.516	4.567
	(15.94)**	(12.87)**	(13.21)**	(12.39)**	(6.43)**	(14.57)**
Observations	197490	188000	180875	183555	167040	225205
Number of Industries	100	100	100	100	100	100

Note: Table shows results from OLS regressions of log of firm characteristics on a dummy indicating firm status. *Product 2* is equal to 1 if the firm exports in multiple sectors, *Product 4* is equal to 1 if the firm exports in multiple industries and *Product 10* is equal to 1 if the firm exports multiple products. All regressions include industry fixed effects and standard errors clustered at the industry level. Number of observations rounded to nearest five for confidentiality reasons. ** represents significance at 1%.

The logs of firm characteristics in 2005 are regressed on a dummy variable indicating the firm's status as a single or a multiple product/industry/sector exporter. The dummies are constructed as follows: *Product10* is equal to 1 if a firm exports more than one product at the ten digit code and 0 if only a single product is exported. Likewise, *Product4* is equal to 1 if a firm exports products in more than one industry, and *Product2* is equal to 1 if a firm exports products in more than one sector. The firm characteristics considered are sales, employment, wages, value added (defined as the difference of their sales and purchases), productivity (defined as the ratio of value added to employment) and value of exports. These regressions use industry-fixed effects, and the standard errors are clustered at the industry level as well.[11]

Multi-product firms on average have larger sales, higher employment, wages, value of exports and value added than single product ones. The coefficient on the multi-product dummy in column 1 shows that multi-product firms have on average 17% ($e^{2.94}$-1) higher value of sales than single product ones.

According to Bernard et al. (2006b), multi-product firms are more productive since they are able to cover the fixed costs of producing a larger range of products. On the other hand, Nocke and Yeaple (2006) assume that marginal costs for each product are increasing in the total number of products, implying that in equilibrium, multi-product firms have lower productivity for their marginal products and lower overall productivity than single product ones, although they are *ex-ante* better. At the industry and product level, productivity for

[11] Using product fixed effects as a robustness check does not alter the results.

multi-product exporters is statistically significant and higher than single product exporters. The coefficient for productivity is negative at the sector level although it is insignificant. This is the same result as for the US, suggesting that measuring productivity in firms with products that span several sectors is difficult.

An interesting point to note is that the coefficients are larger than the results reported for U.S. firms, suggesting the differences between multi- and single-product exporters in New Zealand are larger than those in the US.

Another way of comparing multi-product and single-product firms is to analyse i) the prior performance of single product firms that switch to multi-product firms to those that do not switch and ii) the performance of multi-product firms that add products to those that do not add. In order to do so, firms' log sales and log value of exports in 2000 are regressed against a dummy that equals 1 if the firm added a product between 2001 and 2006. Initial industry fixed effects are included and the standard errors are clustered at the industry level. The results in Table 4 show that there is indeed selection among exporters. Firms that added products were stronger performers even before they added products. The difference is larger than that for Indian firms.

Table 4 – Characteristics of Firms that Add Products

	(1)	(2)	(3)	(4)
	Sales	**Sales, MP Only**	**Exports**	**Exports, MP Only**
Add	1.083	1.064	0.342	0.290
	(5.33)**	(4.11)**	(2.85)**	(2.44)*
Observations	770	705	905	830
Number of industries	70	70	70	70
R-squared	0.06	0.05	0.01	0.00

Note: Regression of log sales and exports in 2000 on a dummy *Add* which is equal to 1 if the firm added at least one product between 2000 and 2006. Initial industry fixed effects included. Standard errors are clustered at the industry level. Columns 2 and 4 include only multi-product firms.

3.2 Product Sales Distribution within Firms

Theoretical models have different predictions about the distribution of product sales across products within firms. According to Nocke and Yeaple, output is evenly distributed across products since firms do not have different product-specific expertise. Bernard et al. (2006b), on the other hand, assume that output will be highly skewed towards products for which firms have particular expertise.

Table 5 shows the distribution of products within New Zealand exporters by reporting the average share of a product in the total value of exports of a multi-product firm. The results show that output is not evenly distributed across products. Each row refers to the within-firm ranking of a product by the product's contribution to total exports of the firm. Each column denotes the firms producing the number of products shown at the top. Only firms producing 10 or fewer products are considered. Exports are highly skewed towards the main product. The share of the largest product declines as the number of products exported by a firm increases. The share of the main product declines from 75% for 2 product exporters to 59% and 52% for 5 and 10 product exporters , respectively. For the US, the numbers are 80%, 58% and 46% for 2, 5 and 10 product firms, respectively. These results give support to the predictions of the model by Bernard et al. (2006) which assumes that output will be skewed towards those products for which firms have a comparative advantage in.

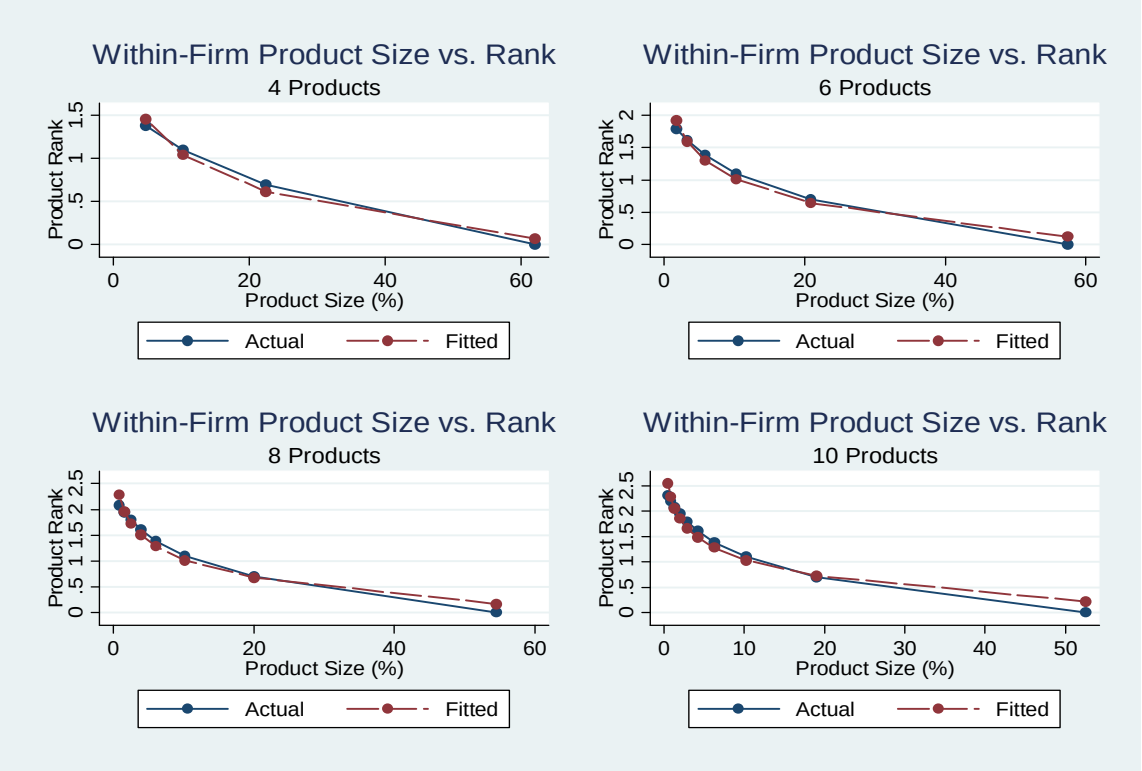
Table 5 – Distribution of Products Within the Firm

Average Share of Product in Firm Exports	Number of Products Produced by the Firm									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	100.00	75.90	67.14	62.01	59.62	57.38	55.38	54.53	52.97	52.55
2		23.87	23.22	22.42	21.33	20.91	20.26	20.02	19.68	19.01
3			9.35	10.21	10.37	10.32	10.33	10.24	10.11	10.24
4				4.75	5.46	5.90	6.17	6.06	6.24	6.27
5					2.83	3.35	3.85	3.91	4.17	4.16
6						1.80	2.33	2.55	2.90	2.90
7							1.29	1.58	1.87	1.97
8								0.85	1.20	1.30
9									0.67	0.83
10										0.49

Note: Columns indicate the number of products produced by the firm. Rows indicate the share of the product, in decreasing order of size. Each cell is the average across the relevant firm-products in the sample (1996-2005).

Firm size distribution literature uses a Pareto distribution, which predicts a log linear regression of log rank of firm shipments on log firm shipments, as a benchmark. Similarly, to assess the product-size distribution within firms producing the same number of products, we estimate an OLS regression of log rank of firm-product size on the log of their share of exports (derived in Table 5). The fitted and actual values for product rank and size are shown in Figure 1. We observe that the actual values lie above the fitted values in the middle of the distribution and below the fitted values in the tails, implying thinner tails than the Pareto distribution. This suggests that heterogeneity across products within firms is analogous to heterogeneity across firms in the firm-size distribution literature.

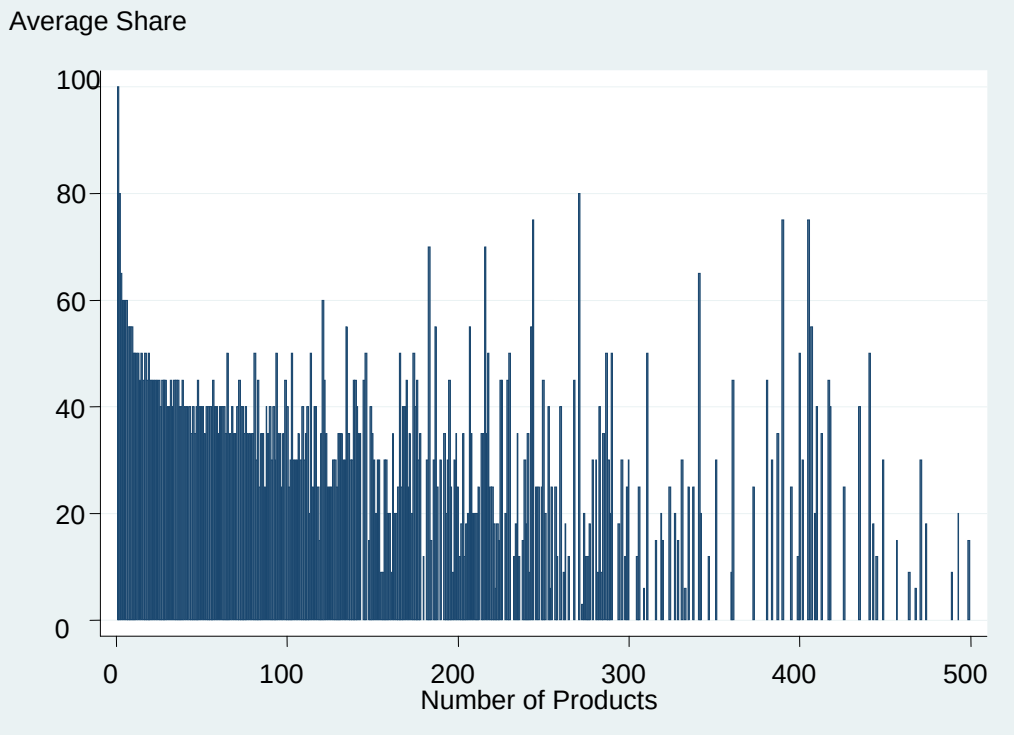
Figure 1 – Within-Firm Product Size and Rank



Note: The solid line plots within-firm product rank against within-firm product size (from Table 5). Each panel is for the set of firms with the noted number of products. Fitted lines are the result of an OLS regression of log product rank on log product size.

Figure 2 extends the analysis to all firms, that is, firms exporting more than 10 products, to show that the value of exports across products is not symmetric. As the number of products increase, the share of the largest product decreases, but the relationship is not perfect. This suggests that for firms with multiple products, they will have at least one major product that they export, and a number of smaller products that they export on the side.

Figure 2 – Average Share of the Largest Product



Note: The export value share of the largest product is plotted against the number of products.

3.3 Correlation between Intensive and Extensive Product Margins

There is a large literature on whether the size differences across firms are mostly due to extensive (number of products) or intensive margins (output per product).

In order to address this, log number of products is regressed on the log of total sales. The upper panel of Table 6 shows two sets of results. The first two columns show results from a cross-section regression in one year, 2005, and include industry fixed effects, whereas the last two columns are pooled results and include industry and time fixed effects. All the coefficients are positive and significant. The results show that about 16 to 28% of variation in output across firms is due to variations in the extensive margin.

Table 6 – Extensive and Intensive Margins

	(1)	(2)	(3)	(4)
	Log Number of Products			
	2005	**MP firms, 2005**	**all years**	**MP firms, all years**
Log Sales	0.215	0.165	0.280	0.231
	(16.17)**	(12.02)**	(75.16)**	(61.67)**
Fixed Effects	Industry	Industry	Industry, Year	Industry, Year
Observations	2545	1715	24075	17410
R-squared	0.02	0.02	0.05	0.04
	(5)	**(6)**	**(7)**	**(8)**
	Log Average Sales			
	2005	**MP firms, 2005**	**all years**	**MP firms, all years**
Log Number of Products	0.275	0.163	0.259	0.201
	(6.25)**	(2.46)*	(12.91)**	(6.73)**
Fixed Effects	Industry	Industry	Industry, Year	Industry, Year
Observations	2545	1715	24075	17410
R-squared	0.10	0.08	0.24	0.23

Note: Table summarizes OLS regressions of log number of products on log sales in the upper panel and log sales on log number of products in the lower panel. First two columns are run on 2005 data only, while columns 3 and 4 pool across all years. Columns 2 and 4 include only multi-product exporters.

According to the theoretical model in Bernard et al. (2006b), there is a positive correlation between extensive and intensive margins. The ratio of output attributed to a firm's extensive vs. intensive margin is of interest to firms and policymakers since it is important to determine whether a firm is large due to manufacturing of a large number of products or production of more output per product.

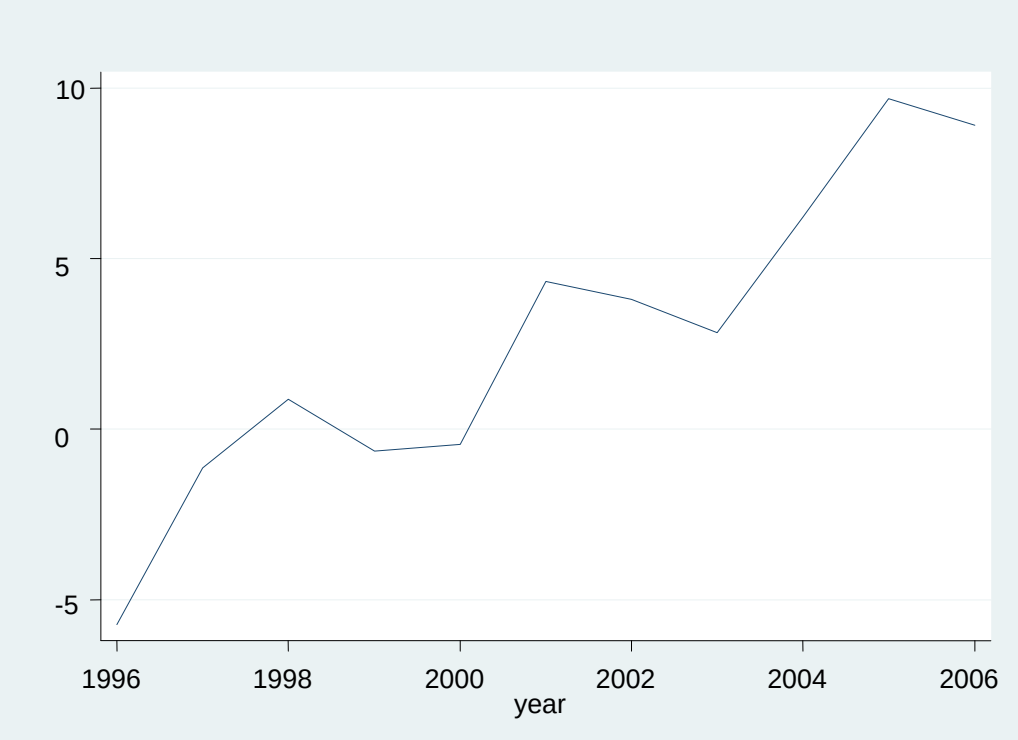
To test this theory, the log average sales per product are regressed on the log number of products. The first two columns in the lower panel of Table 6 present cross section results for all firms and multi-product firms, and the last two columns are pooled results for all and multi-product firms. A positive correlation is observed between multi-product firms' extensive and intensive margins in 2005. The pooled results are also positive.

The results show that bigger New Zealand exporters produce on average more products and firms that produce more products on average have larger sales per product. These patterns are similar to Indian and U.S. firms and provide further support to the theoretical prediction of a positive correlation between extensive and intensive margins.

4 Changes in Product Mix Over Time

This section looks at changes in product mix of firms over time. In their analysis of U.S. firms, Bernard et al. (2008) find a high degree of product churning within firms. As a starting point, Figure 3 plots the coefficients on the year dummies obtained by regressing the number of products exported by a firm on firm and year fixed effects. The results for India show a steady increase in their graph, suggesting an increase in their extensive margin. For New Zealand, there is more fluctuation observed over time, but the increase is not monotonic.

Figure 3 – Products per Firm



Note: Coefficients of the year dummies from the regression of product per firm on year and firm fixed effects.

4.1 Relative Share of Firms in the Aggregate Value of Exports

Product alteration behaviour is investigated further by calculating the relative share of export value contributions by entering, exiting and continuing firms. In order to do so, the change in export value from one year to the next is calculated for several categories.[12]

[12] Initially, quarterly data was used, but this does not adequately capture seasonal changes, so annual results are reported.

The aggregate change in the value of exports, ΔY_t can be decomposed into the sum of the changes due to new (N), exiting (X), and continuing (C) firms,

$$\Delta Y_t = \sum_{j \in N} \Delta Y_{jt} + \sum_{j \in X} \Delta Y_{jt} + \sum_{j \in C} \Delta Y_{jt} \quad (1)$$

where *j* indexes firms. At each continuing firm, the change in the value of exports can be further decomposed into the sum of the changes due to added (A), dropped (D), and continuing (B) products,

$$\Delta Y_{jt} = \sum_{i \in A} \Delta Y_{ijt} + \sum_{i \in D} \Delta Y_{ijt} + \sum_{i \in B} \Delta Y_{ijt} \quad (2)$$

where *i* indexes products. Finally, the value of exports of continued products can be broken into products that grow (G) and shrink (S),

$$\sum_{i \in B} \Delta Y_{ijt} = \sum_{i \in G} \Delta Y_{ijt} + \sum_{i \in S} \Delta Y_{ijt} \quad (3)$$

Substituting, the aggregate change in the value of exports can be written as

$$\Delta Y_t = \sum_{j \in N} \Delta Y_{jt} + \sum_{j \in X} \Delta Y_{jt} + [\sum_{i \in A} \Delta Y_{ijt} + \sum_{i \in D} \Delta Y_{ijt} + \sum_{i \in G} \Delta Y_{ijt} + \sum_{i \in S} \Delta Y_{ijt}] \quad (4)$$

The first two terms reflect the contribution of firm entry and exit. The third and fourth terms represent changes due to product adding and dropping by surviving firms, i.e. adjustments to firms' so-called extensive margins. The last two terms account for the growth and decline of continuing firms' continuing products, i.e., their intensive margins.

Table 7 decomposes value of exports according to these contributions for each year. The first column presents the changes in the aggregate value of exports. The remaining columns show changes due to the new firms, continuing firms and exiting firms (columns two to four) and changes due to product switching behaviour (columns five to seven).

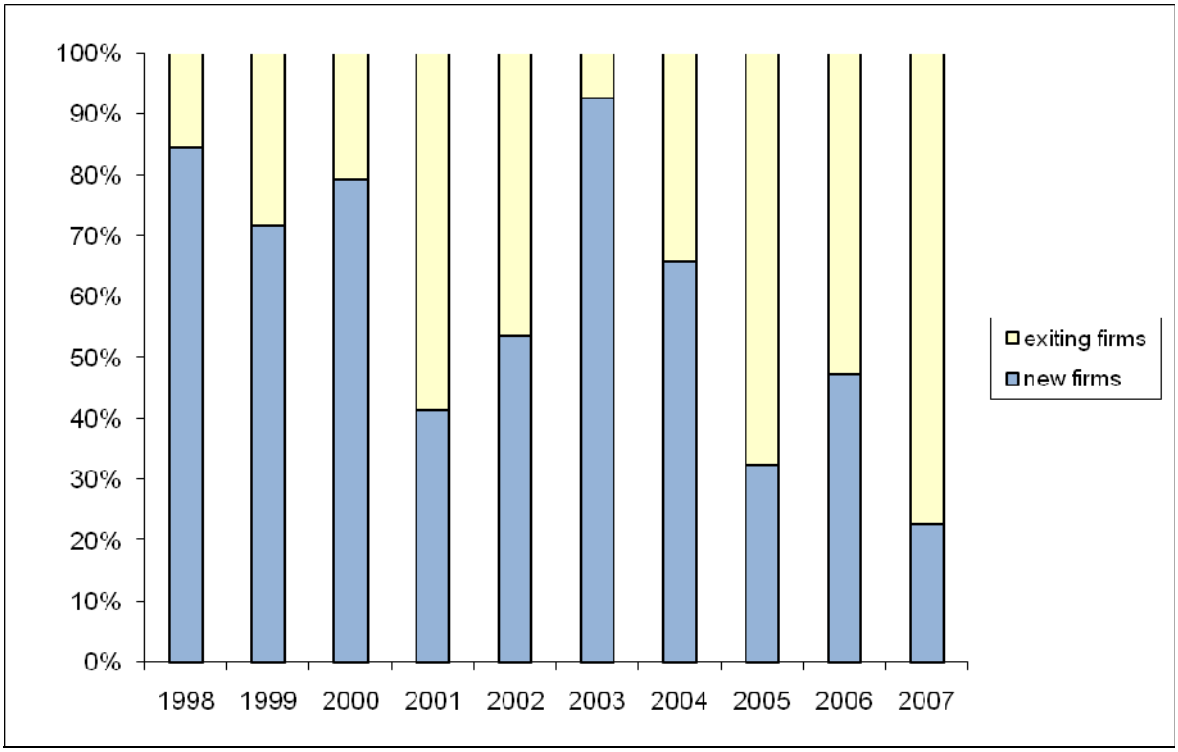
Table 7 – Decomposition of Exports

Year	Total	New Firms	Exiting Firms	Cont. Firms	Added Products	Dropped Products	Cont. Products
1998	20000	1276	235	18500	565	410	17500
1999	21200	267	104	20800	406	184	20200
2000	23500	308	80	23100	369	250	22500
2001	29300	266	378	28700	386	356	27900
2002	30400	486	420	29500	381	453	28700
2003	28200	959	77	27100	366	375	26400
2004	27300	247	129	27000	428	532	26000
2005	28900	271	564	28100	607	465	27000
2006	29600	269	298	29100	411	661	28000
2007	30700	154	522	30000	209	1249	28500
2008	8890	4		8886	194		8692

Note: Table reports aggregate change in the value of exports (in millions of dollars) according to firm type—whether the firm is an entering, existing or exiting firm---and product type—whether the product is a newly added, existing or dropped product. See also Figures 4 and 5.

As in the U.S. and India, intensive margin accounts for the majority of growth in exports. The results show that between 1997 and 2007, continuing firms are the biggest contributors as expected. Looking at the relative share of entering and exiting firms (excluding continuing firms) in Figure 4 shows a variation across time. Until 2004, new firms make up a larger proportion of exports than exiting firms, which suggests that new entrants to export markets are likely to be larger firms. It is expected that exiting firms are generally those that are not doing so well, thus the smaller contribution to the aggregate change in the value of exports. However, this trend reverses after 2004.

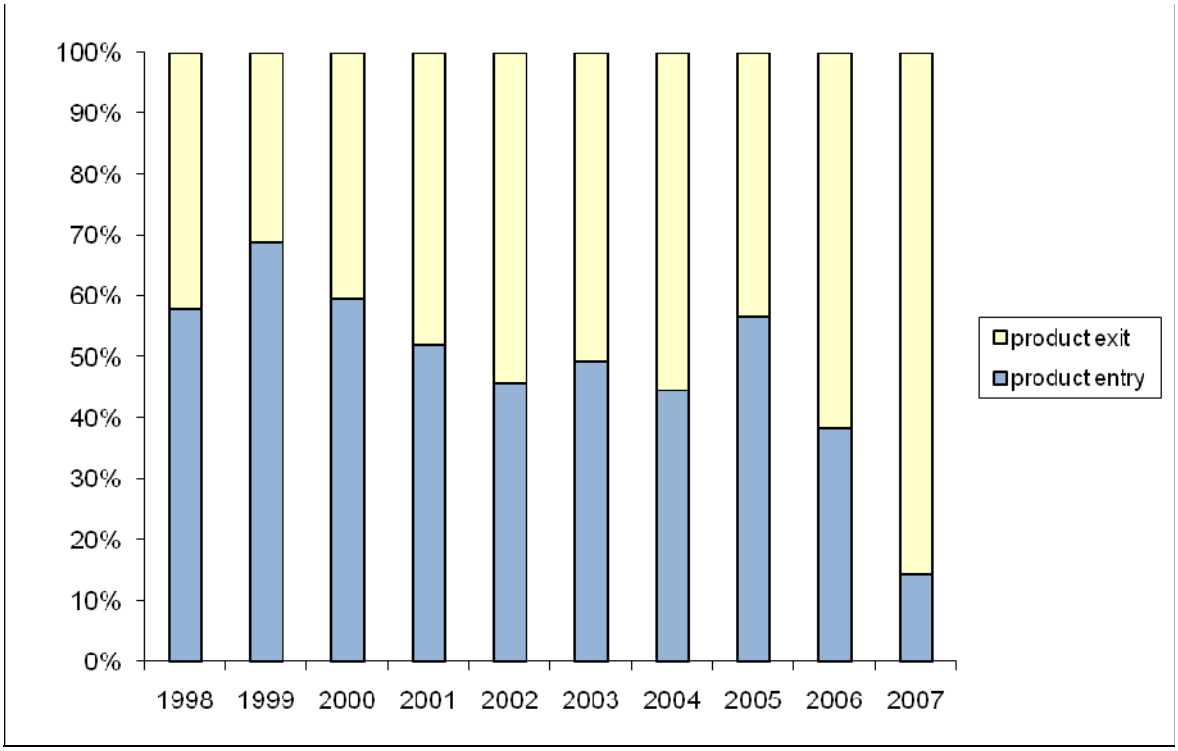
Figure 4 – Relative Share of New vs. Exiting Firms in the Total Value of Exports (excluding continuing firms)



Note: Numbers from Table 7.

Looking at the extensive margin shows that continuing products are the biggest source of growth/decline, suggesting that perhaps adding and dropping of products does not alter firm behaviour or profits drastically. This issue is further investigated in the next section. Figure 5 looks at the relative shares of added and dropped products in the value of exports of continuing firms (excluding continuing products). A similar pattern as new and exiting firms is observed. Although product entry dominates most of the sample, this is not the case in the last two years of the sample.

Figure 5 – Relative Share of Added vs. Dropped Products in the Value of Exports of Continuing Firms (excluding continuing products)—Extensive Margin



Note: Numbers from Table 7.

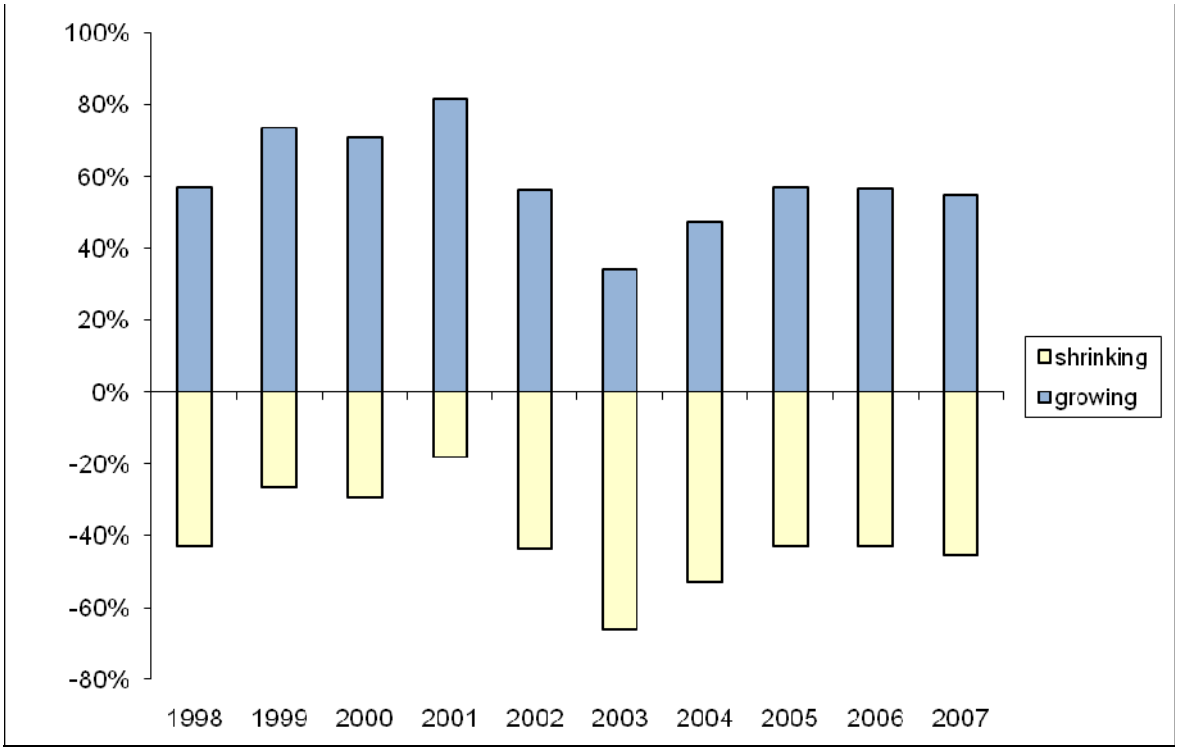
Finally, Table 8 shows the aggregate contributions through the whole sample of whether continuing products have been growing or shrinking. Analysis of the intensive margin in Figure 6 indicates that growing products make up a bigger share of continuing products in terms of value, except for 2003.

Table 8 – Decomposition of Continuing Products

Year	Growing Products	Shrinking Products	Net
1998	2710	-2050	660
1999	4120	-1500	2620
2000	3790	-1580	2210
2001	7110	-1600	5510
2002	3630	-2840	790
2003	2520	-4870	-2350
2004	3280	-3700	-420
2005	4320	-3270	1050
2006	4070	-3110	960
2007	4350	-3650	700

Note: Table reports aggregate change (in millions of dollars) in the value of exports for products that are not added or dropped, i.e., continuing, whether they are growing or shrinking products. See also Figure 6.

Figure 6 – Relative Share of Shrinking vs. Growing Products in the Value of Exports of Continuing Products—Intensive Margin



Note: Numbers from Table 8.

4.2 Patterns of Change in Product Mix

This section examines more in depth the nature of the product mix changes. Specifically, product mix altering behaviour is compared across firms that produce single vs. multiple products/industries/sectors. Continuing firms, i.e., not entering or exiting, are split into groups according to their behaviour of (1) *Neither*—the firm does not change its product mix (2) *Add*-the firm only adds products and (3) *Drop*—the firm only drops products. (4) *Both*—the firm both adds and drops products. A product is dropped if it is exported in period *t* but not in period *t+1* and added if it is exported in period *t* but not in period *t-1.*

Table 9 reports average percentage of continuing firms engaged in each activity over the whole sample, conditional on firm survival. It should be pointed out that Bernard et al. (2006a) find that among firms, exporters are more likely to change their product mix. Since we have product level data only for exporters, there might be a positive bias towards changing product mix in the sample, and this might not reflect the behaviour of all firms in the economy.

It is shown that 94% of all firms alter their product mix by either dropping or adding products or both. These results are much higher than the ones for U.S., where 54% of firms change their product mix. However, in the U.S., adding and dropping contribute almost equally to this behaviour (15% each), whereas in New Zealand, dropping with 10% is more common than adding which is 5%. The majority of firms (79%) both add and drop products.

Table 9 – Product Mix Changes

	All	Single	Multiple Product	All Industry	All Sector
Drop	0.10		0.10	0.02	0.01
Add	0.05	0.02	0.05	0.40	0.45
Neither	0.07	0.97	0.04	0.09	0.10
Both	0.79		0.81	0.49	0.45

Note: Table reports average proportion of firms that drop a product, add a product; both add and drop or do not alter their product mix at all according to their production behaviour.

The second and third columns show product mix altering patterns by single and multiple good exporters. For multiple product exporters, the pattern is the same as with all firms, with dropping being more prominent than adding. For single product exporters, the likelihood of adding or dropping a new product is very low (97%), suggesting that there are strong reasons why firms choose not to export more than one product. A comparison of column 2 (single product firms) and column 3 (multiple product firms) shows that single product firms are more likely to leave their product mix unchanged.

The next two columns show similar figures at the industry and sector levels. Main patterns remain the same. Observing similar behaviour at industry and sector levels, which are more easily identified than 10 digit product level, makes us more comfortable about our results due to potential product category mismeasurement problems. In the US, product switching is more likely than industry switching, which is more likely than sector switching, whereas the differences are not so great for New Zealand.

Table 10 shows adding and dropping by single and multiple product exporters, weighted by their value of export share. This shows that at the product level, product mix alteration constitutes a large portion of firms' business, suggesting perhaps that adding new products is more difficult.[13] Theory predicts that large firms are more likely to add or drop products since more productive firms produce more of each product and have larger total output, and span more industries and sectors that make them more likely to add and drop products. As a result, firms that switch products are likely to account for a larger share of output.

Table 10 – Product Mix Changes, Weighted by the Value of Exports

	All Firms Product	Multiple Product	All Firms Industry	All Firms Sector
Add	0.000	0.000	0.003	
Drop	0.017	0.017	0.131	0.158
Both	0.973	0.976	0.857	0.830
None	0.017	0.017	0.141	0.170

Note: Table reports average percent of firms that drop a product or add a product, weighted by the value of their exports according to whether they are single or multiple product exporters.

[13] See Fabling, Grimes and Sanderson (2008) for a detailed analysis of the export market choice of New Zealand firms.

4.3 Impact of Changing Product Mix on Firm Characteristics

Analysis in previous sections has shown that product adding pushes firms into new industries and sectors; newly added and dropped products make up a large portion of firm activity; and there exist significant relationships between changes in firm performance and product mix.

To analyze the relationship between changing product mix and firm behaviour, simple OLS regressions of changes in firm characteristics on dummy variables capturing contemporaneous product switching behaviour is used.

$$\Delta Z_{jt} = \alpha + \beta Drop_{jt} + \delta Add_{jt} + \varepsilon_{jt}$$

where Z represents firm characteristics, and *Drop* and *Add* are as defined above. These regressions include industry and time fixed effects and the standard errors are clustered at the industry level as well. The firm characteristics that we consider are sales, employment, wages, productivity, value of exports and value added.

Regressions reported in Table 11 include all continuing firms in the sample. The results show that dropping products is associated with lower sales, employment, wages, exports, productivity and value added. Adding products leads to higher sales and employment, i.e., an increase in firm size. Adding products is also associated with higher wages, value of exports and value added. The results for productivity are not significant.

Table 11 – Changes in Firm Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Sales	**Employment**	**Wages**	**Productivity**	**Exports**	**Value Added**
Dropped	-0.088	-0.051	-0.055	0.014	-0.317	-0.068
	(7.07)**	(5.72)**	(5.77)**	(0.97)	(20.94)**	(4.32)**
Added	0.081	0.051	0.060	-0.007	0.526	0.065
	(6.67)**	(5.87)**	(6.47)**	(0.52)	(35.23)**	(4.21)**
Constant	-0.072	-0.101	-0.244	-0.214	0.178	-0.108
	(1.22)	(2.22)*	(4.36)**	(2.32)*	(13.26)**	(1.30)
Observations	22150	18330	18695	15995	51240	18710
Number of Industries	95	95	95	95	95	95
R-squared	0.01	0.01	0.01	0.00	0.03	0.01

Note: Table reports OLS regressions of change in log firm characteristics on dummy variables indicating product switching behaviour. Standard errors are adjusted for clustering at the industry level, and regressions include industry and time fixed effects. Number of observations rounded to nearest five for confidentiality reasons.

It should be noted that these results provide descriptive statistics on the correlation between firm characteristics and the decision to add or drop products. They show that changes to the product mix are associated with changes in observed firm outcomes. Determination of the product mix is endogenous, so the coefficients of the regression capture the correlation between changes in firm characteristics and the decision to change product mix as well as the impact of changes to product mix on firm characteristics conditional on the decision to alter the product mix.

5 Why do Firms Alter Their Product Mix?

The previous section has shown that changes in product mix are frequent, span a variety of industries and make up a significant portion of a firm's exports. Given these results, we consider different explanations for this behaviour that is observed among New Zealand firms.

First, product-specific factors that are common across firms are considered. For example, demand shocks can lead to firms adding 'hot' products for which demand is rising and drop 'cold' ones for which it is falling. Likewise, supply shocks due to technological progress or international trade might lead to dropping of uncompetitive products in line with the theory of comparative advantage. If this indeed is the main cause of the product switching behaviour, we should observe a negative correlation between add and drop rates.

Figure 7 shows the annual mean rate at which product are added and dropped by New Zealand exporters. The add rate in year *t* is the number of firms that added the product between years *t-5* and *t* divided by the average number of firms producing the product in both years. Drop rates are calculated similarly. Our results indicate that there is a slight positive correlation between adding and dropping rates. This suggests that the patterns of product mix change are not solely a result of reallocation of resources from one group of products to another due to say a demand shock, which would have implied a negative relationship between add and drop rates.

Figure 7 – Average Product Add and Drop Rates

Note: Figure shows average rates at which products are added and dropped by year.

Second potential explanation focuses on factors that specific to firms but common to all products. For example, a decrease in trade costs might increase the profitability of all the products and lead the firm to add a marginal product that it did not previously export. However, the evidence presented in Section 4 that shows that firms simultaneously add and drop products does not support this explanation. This suggests that firm specific shocks may affect products differently.

Third potential explanation considered is firm-product factors that focus on product sunk costs of entry and producer heterogeneity within and across product markets. This can be thought of an extension of the existing models of industry dynamics (Jovanovic 1982, Hopenhayn 1992, Ericson and Pakes 1995 and Melitz 2003) that are supported by empirical studies such as Baily et al (1992) and Foster et al (2001, 2006) from firm entry and exit to extensive margin of firms, i.e., product entry and exit. Continuing firms face *ex ante* uncertainty about their productivity in new product markets. For each new product, the firm incurs a product-specific sunk cost. Theoretically, in equilibrium, the flow of firms that add a product each period must equal the flow of firms that drop the product such that equilibrium add and drop rates are positively correlated. Add and drop rates depend on the costs of entry of products: products with low sunk costs of entry exhibit high entry and exit rates and vice versa.

A plausible interpretation then is that firm-product characteristics are important in explaining product switching behaviour of firms. To analyze this, we go back to theories of sunk costs of entry models that suggest that exiting firms should have a relatively low output and should have produced for a short period of time compared to other firms. Extending this to product entry and exit analysis implies that firms which are dropping a product should have relatively low market share of that product and should have exported the product for a short time compared with other firms which continue to export it.

Table 12 reports OLS regressions of a dummy variable indicating that a firm drops a product between 1999Q3 and 2004Q4 on firms' 1999Q3 product size and age (relative to all the other firms exporting the same product) as well as firm size and age (relative to the average size and age of other firms) and the number of products the firm produces,

$$Drop_{jit} = \alpha + \beta_1 Size_{jit} + \beta_2 Tenure_{jit} + \beta_3 Size\_firm_{ji} + \beta_4 Age_{jt} + \beta Products_{jt} + \varepsilon_{jt}$$

where *j* and *i* index firms and products, respectively.[14]

Several specifications are considered. The first column reports industry fixed effects, second column has firm fixed effects (these are firm characteristics that are common across products, such as total exports of the firm, age of the firm, whether it is a multiple product exporter) and the third column reports product fixed effects (these are product characteristics that are common to all firms, such as aggregate demand supply for that product). These fixed effects control for unobserved firm and product specific effects that influence the probability of a product being dropped. Note that firm specific variables are dropped when firm fixed effects are included. The results are robust to inclusion of different fixed effects.

Table 12 shows that firm-product relative size and age are negatively correlated with product dropping. The negative coefficients on relative firm-product size and age are in line with the predictions of sunk cost models and suggest that firm-based explanations by themselves are incomplete. Furthermore, these variables are constructed relative to the average of all firms in that product market, making product-based explanations incomplete as well. The significance of product variables, after controlling for the characteristics of the firm, provides support to the third potential explanation discussed above.

[14] Experimenting with other periods yields similar results.

Table 12 – Firm Product Drop Regressions

	(1)	(2)	(3)
	Drop	**Drop**	**Drop**
Product Size	-0.010	-0.008	-0.011
	(5.24)**	(3.62)**	(5.39)**
Product Age	-0.136	-0.101	-0.174
	(23.20)**	(13.61)**	(23.02)**
Firm Size	-0.010		-0.011
	(8.17)**		(7.09)**
Firm Age	-0.012		-0.008
	(3.79)**		(1.97)*
Number of products	-0.000		-0.000
	(0.49)		(2.53)*
Constant	0.931	0.911	0.958
	(76.86)**	(215.44)**	(160.72)**
Observations	11135	11135	11135
Number of industries	90		
Number of firms		3325	
Number of products			3700
R-squared	0.04	0.03	0.09

Note: Table reports OLS regression results of a dummy variable indicating product dropping on firm-product and firm attributes. Attributes are relative to the whole sample of firms. Standard errors are clustered at the product level. Industry, firm and product fixed effects are used in different specifications. Number of observations rounded to nearest five for confidentiality reasons.

We have shown in the previous section that firms' product-mix alterations are an important part of aggregate exports. Here, it is shown that firm-product drops exhibit lower relative product size and tenure. If we assume that relative product size and age are positively correlated with firm-product productivity, we can potentially say that systemic reallocation of resources towards high productivity sectors occurs across products within firms as well as across firms.

Likewise, firm relative size and age are negatively correlated with product dropping, suggesting that large and old firms are less likely to alter their product mix, so it is the new and small firms who engage in such behaviour. This is consistent with the literature on firm entry and exit that finds these variables to be negatively correlated with firm exit. This is in line with our theory stated at the beginning of the paper that changes to the product mix might be used as a hedging mechanism for firms who are more prone to fluctuations in export markets.

6 Conclusions and Further Work

How resources are allocated to their most efficient use is an important concern in economics. Almost all of the empirical research on this topic concentrates on entry and exit of firms. This paper suggests that looking at the relative importance of added and dropped products is also important. Using a unique dataset that covers products at 10 digit codes for all exporting firms in New Zealand from 1997 to 2007, the patterns of their product mix, how it changes over time and how this relates to firm characteristics are analyzed.

The main results can be summarized as follows:

Multi-product exporters make up of 72% of all firms, and 99% of total value of exports. On average, they export 22 products, i.e., they are quite diverse. Multi-product firms have higher sales, employment and wages than single product ones. They are also more productive than single-product ones, supporting the theory that suggests that high productivity firms are able to cover fixed costs of producing a larger number of products.

It is also shown that for multi-product exporters, the share of exports is not evenly distributed across products. Exports are mainly skewed towards the main product, which is possibly the product they have a comparative advantage in.

An analysis of extensive and intensive margins shows that 16-28% of variation in sales is due to variations in extensive margins. Furthermore, there is a positive correlation between extensive and intensive margins. Bigger New Zealand exporters produce on average more products and firms that produce more products on average have larger sales per product.

Alteration of product mix is frequent and widespread across different sectors. This is a result of shocks to consumer tastes and firm productivity leading to adding and dropping of products. Dropping a product is more likely than adding a product.

Patterns of product switching are correlated with contemporaneous changes in firm outcomes. Adding products are associated with higher wages, value added, sales and exports, whereas dropping products are associated with lower values for these variables.

There is a positive correlation between product add and drop rates. This suggests that some firms receiving positive demand shocks add products, whereas firms receiving negative shocks drop them and patterns are not solely a result of reallocation of resources across products. Product-switching behaviour is not explained solely by firm or product characteristics, but a combination of firm-product factors. The probability of dropping a product decreases with firm age and size as well as product scale and tenure.

The results show that New Zealand exporters are dominated by multi-product firms, which tend to be higher performing and dynamic in response to changing economic conditions, i.e., they add and drop products. This suggests an economy that is not restricted by tight regulations or bound by high sunk costs. This is similar to US firms and in contrast to Indian firms where regulations are much tighter. This might be an indication that the structural reforms of the 1980s were successful in creating a business environment that allows firms to be dynamic.

The analysis also shows that dropped products tend to have smaller size and age, suggesting that there is a systemic reallocation of resources towards high productivity sectors, and across products within firms and across firms. In this sense, dropped products are not an indication of firms in trouble, but their move towards more productive activities.

In light of these results, the most important question to consider is why exporters choose to span several products and sectors. If this is due to their need to hedge and diversify in order to better handle volatilities in overseas markets and in the domestic economy, such as movements in the exchange rate or capital markets that are not functioning well, then there is room for improvement in the economic environment that exporters operate in. On the other hand, if firms choose to be multi-product exporters because they are able to cover fixed costs for a large range of products, this could be a sign that firms find operating across products and sectors more profitable, i.e. diversifying product mix not only reduces variability of revenue but also increases total revenue. The results show that multi-product exporters "select" themselves into being multi-product exporters and are better performing *ex ante* as well as *ex post,* giving support to the second explanation. However, further work that controls for changes in the macroeconomic variables is necessary to draw stronger conclusions.

It would be worth further investigating questions such as: Do different product mixes affect the profitability of firms? Does the product mix of a firm affect the volatility of its earnings? If so, does this affect the volatility of the economy as a whole? Do firms choose to export multiple products to hedge against exchange rate volatility?

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Appendix

Appendix Table 1 – Components of IBULDD

Table 2.01 – Integrated components of IBULDD

Component	Years	Description
The backbone of IBULDD		
Longitudinal Business Frame (LBF)	2000–2006	Contains longitudinally linked data for most enterprises operating in New Zealand. It includes information on employment, location, industrial activity, and firm ownership relationships. The LBF enables individual business units to be tracked over time.
Administrative data linked to the LBF		
Business Activity Indicator (BAI)	1992–2006	The BAI is a monthly series based on the supply of administrative data from Inland Revenue. The main source of this data is the GST (Goods and Services Tax) 101 form. GST is a tax based on the sale of goods and services.
Financial accounts (IR 10)	2000–2006	The Accounts information form (IR 10) collects a general summary of information relating to the business and its operations (profit and loss statement and balance sheet). Inland Revenue supplies IR 10 data to Statistics NZ where it is transformed and linked to IBULDD.
Company tax returns (IR 4)	2000–2006	The IR 4 income tax return is compulsory for businesses that are registered as companies. It includes income, tax calculation, refunds and/or transfers, provisional tax, and disclosures. IR 4 data is supplied to Statistics NZ by Inland Revenue and is then linked to IBULDD.
Linked Employer-Employee Database (LEED)	2000–2006	A Statistics NZ integrated database that provides an insight into the operation of New Zealand's labour market, such as job and worker flows. Created by linking a longitudinal employer series from the Business Frame to a longitudinal series of Employer Monthly Schedule (EMS) payroll data from Inland Revenue.
Overseas Merchandise Trade data	1988–2007	A monthly series based on administrative data supplied by the New Zealand Customs Service. It provides information on the importing and exporting of merchandise goods between New Zealand and other countries.
Government assistance data	2000–2006	Provides information on the assistance provided directly to businesses by the Foundation for Research, Science and Technology, New Zealand Trade and Enterprise, and Te Puni Kōkiri.
Survey data linked to the LBF		
Annual Enterprise Survey (AES)	2000–2006	Provides annual financial performance and financial position information about industry groups operating within New Zealand. AES is the basis of the national accounts (produced by Statistics NZ).
Business Operations Survey (BOS)	2005–2006	Collects measures of business performance and a range of practices and behaviours which may have some impact on that performance, including innovation and business use of information and communication technology.
Innovation Survey	2003	Collected information on the characteristics of innovation in New Zealand private-sector businesses.
Research & Development Survey (R&D)	Biennially 1996–2006	Collects information on business, government and higher education (university) spending on R&D.
Business Practices Survey (BPS)	2001	Collected information on business and management practices.
Business Finance Survey (BFS)	2004	Collected information on the capital structure of businesses in New Zealand, the sources of finance they use and their recent financing experiences.

Source: Potential Outputs from the Longitudinal Business Database

Appendix Table 2 – Sector Classification

1	Live animals; animal products
2	Vegetable products
3	Animal or vegetable fats or oils and their cleavage products; prepared edible fats; animal or vegetable waxes
4	Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes
5	Mineral products
6	Products of the chemical or allied industries
7	Plastics and articles thereof; rubber and articles thereof
8	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (except silk-worm gut)
9	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork
10	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper of paperboard; paper and paperboard and articles thereof
11	Textiles and textile products
12	Footwear, headgear, umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding–crops and parts thereof; prepared feathers and articles made thereof; article flowers; articles of human hair
13	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware
14	Natural or cultured pearls, precious or semi–precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin
15	Base metals and articles of base metal
16	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
17	Vehicles, aircraft, vessels and associated transport equipment
18	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof
19	Arms and ammunition; parts and accessories thereof
20	Miscellaneous manufactured articles
21	Works or art, collectors' pieces and antiques; miscellaneous New Zealand provisions; non-merchandise trade

Appendix Table 3 – Products and Multi-Product Firms by Sector

Sector	Products	Industries	Products per Industry	Product per Firm	Industry per Firm	Multi Product Firm Share	Multiple Industry Firm Share	Multiple Sector Firm Share	MP Share of Exports	Multiple Industry Share of Exports	Multiple Sector Share of Exports	Products per MP Firm	Industries per MP Firm	Sectors per MP Firm
1	800	6	133.3	30.06	5.07	1.00	0.98	0.96	1.00	0.99	0.99	36.55	7.18	4.66
2	520	9	57.8	22.20	5.25	0.99	0.97	0.94	1.00	0.96	0.94	27.08	7.28	4.68
3	80	0		11.00	5.70	1.00	0.99	0.99	1.00	1.00	1.00	58.34	9.62	5.38
4	680	9	75.6	21.14	5.99	1.00	0.95	0.94	0.99	0.98	0.98	21.68	8.24	5.08
5	180	3	60.0	32.68	7.44	0.99	0.96	0.96	0.97	0.44	0.44	41.63	12.19	6.90
6	1000	12	83.3	27.72	8.37	1.00	0.99	0.99	1.00	1.00	1.00	27.73	9.15	5.66
7	500	3	166.7	36.06	8.71	1.00	1.00	0.99	1.00	1.00	1.00	33.91	9.61	5.88
8	130	3	43.3	22.81	7.03	1.00	0.98	0.97	1.00	0.97	0.97	18.89	7.39	4.96
9	220	3	73.3	13.64	4.19	0.99	0.81	0.81	0.99	0.85	0.85	20.27	7.15	4.79
10	340	3	113.3	18.84	5.68	0.99	0.98	0.96	1.00	1.00	0.98	20.74	7.38	5.06
11	1400	15	93.3	35.80	7.57	1.00	0.98	0.95	1.00	0.93	0.84	39.05	8.46	5.07
12	290	3	96.7	27.60	7.76	1.00	0.99	0.99	1.00	1.00	1.00	27.04	8.46	5.47
13	330	3	110.0	20.57	6.70	1.00	0.98	0.97	1.00	0.99	0.99	20.57	7.33	5.05
14	80	0		7.13	3.02	0.99	0.91	0.91	1.00	0.93	0.93	9.21	5.02	4.23
15	1300	9	144.4	35.26	8.53	1.00	1.00	0.99	0.99	0.90	0.89	34.46	8.90	5.40
16	1600	0		25.95	6.07	1.00	0.99	0.98	1.00	1.00	0.99	28.15	7.18	4.89
17	280	3	93.3	16.95	5.37	0.99	0.98	0.98	0.99	0.98	0.98	19.67	6.78	4.81
18	270	3	90.0	18.77	5.69	1.00	0.99	0.99	1.00	1.00	1.00	18.93	6.19	4.57
19	45	3	15.0	6.19	3.35	0.95	0.93	0.93	0.96	0.93	0.93	7.13	4.14	3.81
20	330	3	110.0	20.03	6.26	1.00	0.98	0.98	1.00	0.99	0.99	24.26	7.87	5.17
21	9	3	3.0	6.71	3.61	0.95	0.92	0.92	0.95	0.94	0.94	8.74	5.10	4.15
Total	10384	96.00	86.80	26.98	6.42	1.00	0.98	0.97	1.00	0.97	0.96	29.66	7.87	5.05

Note: Table reports summary statistics by sector. Some numbers rounded for confidentiality reasons.