Trade over distance for New Zealand firms: measurement and implications

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New Zealand Productivity Commission Working Paper 2014/5: Trade over distance for New Zealand firms: Measurement and implications

Abstract

This paper investigates the proximity of firms to their customers to assess the extent to which different industries trade their output over distance within New Zealand. At the sector level, the output of the primary sector is traded across distance to the largest extent, followed by the goods-producing sector and then the services sector. However, these broad results mask considerable variation at the industry level. The paper also tentatively assesses the correlation between tradability and firm productivity. This shows that firms in the goods-producing and service sectors that trade their output over distance tend to have higher labour productivity than firms located closer to their customers and more focused on the local market. The paper investigates three possible reasons for this link between domestic tradability and labour productivity. In short, the potential for firms to agglomerate, along with the scale and competition benefits that large markets allow, may underpin productivity improvements compared to firms that produce output only for the local market.

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1   Introduction

The extent to which firms trade their output over distance is a key determinant of where they locate and the size of the market in which they operate. For example, firms supplying a product that cannot be traded over distance will have to locate in close proximity to their customers and be locked into the local economy. In contrast, firms producing a product that is traded over distance have the option to locate near other firms in the same industry to reap the benefits of geographic proximity. These firms are also likely to have greater potential for increased scale and may face more intense competition from rival producers situated in other domestic and international locations.

Tradability – or the distance between where a product is produced and where it is purchased – is particularly relevant for firms in some services industries. Traditionally, much of the services sector has produced products that are inherently non-tradable, implying that the geographic distribution of firms is tied to the distribution of their downstream customers. More recently, while transportation costs for goods have declined to some extent, the ability to transmit information has grown exponentially because of ICT and other technological advances. As such, some services no longer require face-to-face interactions and the firms supplying these services are increasingly free to choose their geographic location. This has contributed to increased geographic concentration of firms in some service industries.[1]

The extent to which products are tradable over distance within the domestic economy may also be particularly relevant for New Zealand – a long, thin, mountainous and sparsely populated country in which infrastructure provision to link regional economies can be challenging. Compared to other small open economies, the intensity of international trade is also low in New Zealand and domestic firms are generally not well integrated into global value chains (de Serres, Yashiro, & Boulhol, 2014).

These features suggest that New Zealand's domestic markets may be relatively small and isolated in international comparison, which may limit the potential for agglomeration, competition and the extent to which domestic firms are able to exploit opportunities for scale and specialisation. With these being key drivers of productivity, this could be one important reason why New Zealand's productivity performance has been relatively poor for a number of decades (Conway & Meehan, 2013). As such, understanding tradability within the New Zealand economy and its implications for the extent of the market in which firms operate is important in assessing the causes of New Zealand's poor productivity performance and the potential role of policy in improving it.

Against this background, this paper uses a modified version of the methodology developed by Jensen & Kletzer (2005) to estimate the tradability of the output produced by New Zealand firms. This tradability measure – described in Section 2 – uses data on firm-level employment and regional population, in conjunction with input-output tables, to measure the extent to which firms in different industries co-locate with their customers. In essence, this methodology measures differences in the spatial distribution of production on the one hand and intermediate and final use of output on the other at a detailed industry level. It does not measure inter-regional trade flows directly but, instead, estimates them based on the geographic distribution of firms and their downstream customers.

The results – outlined in Section 3 – show that the output of firms in the primary sector is the most easily traded over distance, followed by the output of firms in the goods-producing sector and then the service sector. However, within services there is considerable variation in tradability by industry. For example, firms in person-centred service industries that still require face-to-face contact tend to be widely dispersed across the country in much the same way as their downstream customers. In contrast, customer location has less influence on firms in knowledge-intensive service industries, which are more likely to concentrate in urban areas, particularly Auckland.

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[1] For example, Krugman (1991) notes in the United States context that "Hartford is an insurance city; Chicago the centre of futures trading; Los Angeles the entertainment capital; and so on".

The paper goes on to take a tentative look at the link between domestic tradability and firm productivity in Section 4. This analysis is not based on structural modelling but simply outlines broad trends in the data that may be indicative of the impact of tradability on various firm and market characteristics. This indicates that in the goods-producing and services sectors, firms producing more tradable output tend to be more productive than firms producing output that is less traded across distance within the domestic economy. This link between tradability and labour productivity is not apparent in the primary sector, perhaps reflecting the fact that the location choices of firms in this sector are often determined by an immovable factor of production.

Finally, the paper assesses three potential reasons for the link between tradability and labour productivity – geographic proximity among firms, firm scale and market competition. Reflecting a core-periphery split identified by Grimes & Vaillant (2011), firms supplying tradable market services are more likely to locate in Auckland while firms producing tradable goods are more likely to locate in New Zealand's secondary urban regions. In contrast, firms producing output that tends not to trade over distance within New Zealand are more likely to be distributed throughout the country and are less likely to benefit from close proximity to other firms in the same industry.

The correlation between tradability and labour productivity is apparent in firms outside Auckland, suggesting that close geographic proximity is not the only link between tradability and labour productivity. Indeed, domestic tradability is also correlated with firm size – firms producing highly tradable output tend to employ more people than firms more focused on the local market. This is reinforced by a significant correlation between domestic tradability and exporting, with firms producing low-tradability products for the local market less likely to increase scale and specialisation through exporting.

At the sector level, with services generally less tradable than goods, average firm size is considerably smaller than in the goods-producing sector. Firms in the primary sector are smaller still and with no apparent correlation between employment and tradability, again perhaps reflecting the impact of an immovable factor of production.

The paper also finds tentative evidence of a link between domestic tradability and competition, with price-cost margins relatively high in some sub-industries in the services sector that produce output for the local market. With competition being a key driver of productivity, this may also be a potential explanation for the apparent link between tradability and labour productivity.

2   Data and methodology

2.1   Data

The primary dataset used in the paper is Statistics New Zealand's prototype Longitudinal Business Database (LBD). The LBD is part of Statistics New Zealand's Integrated Data Infrastructure (IDI) and includes tax and survey-based financial data at the firm-level.[2] The core of the LBD dataset is the Longitudinal Business Frame (LBF), which provides longitudinal payroll tax records of businesses in the Statistics New Zealand business frame since 1999.[3]

The main unit of analysis in the LBD is the enterprise, which approximates the economic concept of the firm. An enterprise generally corresponds to legal entities such as a limited liability company, a state-owned enterprise or a trust. Enterprises are made up of geographic units (GEOs), which approximate

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[2] Tax-based data includes Goods and Services Tax (GST) returns, financial accounts (IR10) and aggregated Pay-As-You-Earn (PAYE) returns from the Inland Revenue Department (IRD). Survey-based data cover a wide range of existing business surveys, for example the Annual Enterprise Survey and the Business Operation Survey.

[3] Payroll tax records are only collected for economically significant businesses. An enterprise is said to be economically significant if it meets one or more of the following criteria: 1) annual expenses or sales (subject to GST) of more than $30,000; 2) 12 month rolling mean employee count of greater than three; 3) part of a group of enterprises; 4) registered for GST and involved in agriculture or forestry; and 5) over $40,000 of income recorded in the IR10 annual tax return.

the plant or establishment. Each GEO is a separate operating unit engaged in one of New Zealand's regions in one or predominantly one kind of economic activity.

The spatial unit of analysis used in the paper is the local labour market region (LMR), which is the most appropriate unit of analysis for examining regional economic activity (Stabler, Rose & Greuel, 1996). LMRs represent a functional and relatively self-contained economic area within which the majority of employed people reside and work. The LMRs used in this paper are derived from travel-to-work data at the area unit level from the 2006 Census.[4] This technique identifies 102 labour market catchments in New Zealand, which are aggregated into 23 labour market regions based on cluster analysis of industry composition.[5] These labour market regions are mapped in Appendix 2.

The analysis uses 12-month rolling means of employee numbers at the GEO level from the Linked Employer-Employee Database at March years.

2.2   Geographic concentration

Jensen & Kletzer (2005) propose two empirical approaches to measuring the geographic concentration of firms and the tradability of their output. The first approach is based on Ellison & Glaeser (1997) and the second is based on a Gini coefficient technique. In practise, both approaches return very similar results – in the case of New Zealand, the correlation between the results of the Ellison & Glaeser and the Gini coefficient approachs is 0.87.[6] For ease of exposition, the results presented in the remainder of this paper are based on the Gini approach.

The Gini approach measures the geographic concentration of firms in a given industry based on the distribution of industry employment across space compared to the distribution of total employment (equation 1).

$$Gini_i = 1 - \sum_p \left(\sigma Y_{i,p-1} + \sigma Y_{i,p} \right) * \left(\sigma X_p - \sigma X_{p-1} \right) \tag{1}$$

In this equation, i is industry and p is region. Regions are sorted from largest to smallest on the basis of their share of industry employment. $\sigma Y_{i,p}$ is the cumulative employment share of industry i in region p and $\sigma Y_{i,p-1}$ is the cumulative employment share of industry i in region p-1, which has the next largest share of industry employment relative to region p. Similarly, $\sigma X_{i,p}$ is the cumulative share of total employment in region p, and $\sigma X_{i,p-1}$ is the cumulative share of total employment in region p-1.

This index of geographic concentration measures the difference between the spatial distributions of employment in industry i and in total employment. When the distribution of employment across regions in industry i is identical to the distribution of total employment, then the concentration measure will be equal to zero, indicating a total lack of geographic concentration. Conversely, if the regional distribution of industry employment is more spatially concentrated than the distribution of aggregate employment, then the concentration measure will signal higher industry geographic concentration. The index rages from 0 (not concentrated) to 1 (fully concentrated).

To illustrate the gini coefficient approach to measuring geographic concentration, Figure 1 shows cumulative regional employment shares for New Zealand's real estate services and dairy cattle farming industries, relative to the total employment share. As is apparent from the figure, the real estate services industry is distributed across regions in much the same way as total employment, indicating that it is relatively localised. This results in a small orange shaded area and a low Gini coefficient of 0.1342. In contrast, the dairy cattle farming industry is concentrated in a few rural regions, such as Taranaki Rural and central north of the North Island. This results in a regional employment distribution

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[4] The same methodology from Newell & Papps (2002) is applied to travel-to-work from Census 2006 data.

[5] Regional studies should ideally be conducted at the finest level of labour market disaggregation. However, in the New Zealand context, a number of labour markets are very small – employing less than 1000 workers – and do not cover a range of industries. In this case, the geographic concentration and tradability results become very sensitive to employment patterns in some very small industries. Results are more robust when the analysis is conducted at the level of the labour market regions.

[6] Both of these techniques and the empirical results for New Zealand are outlined in Appendix A.

that is considerably different from total employment, as indicated by the larger orange shaded area and a Gini coefficient of 0.6801.

Figure 1   Geographic concentration, 2000-2010 average

a.   Real estate services   b. Dairy cattle farming
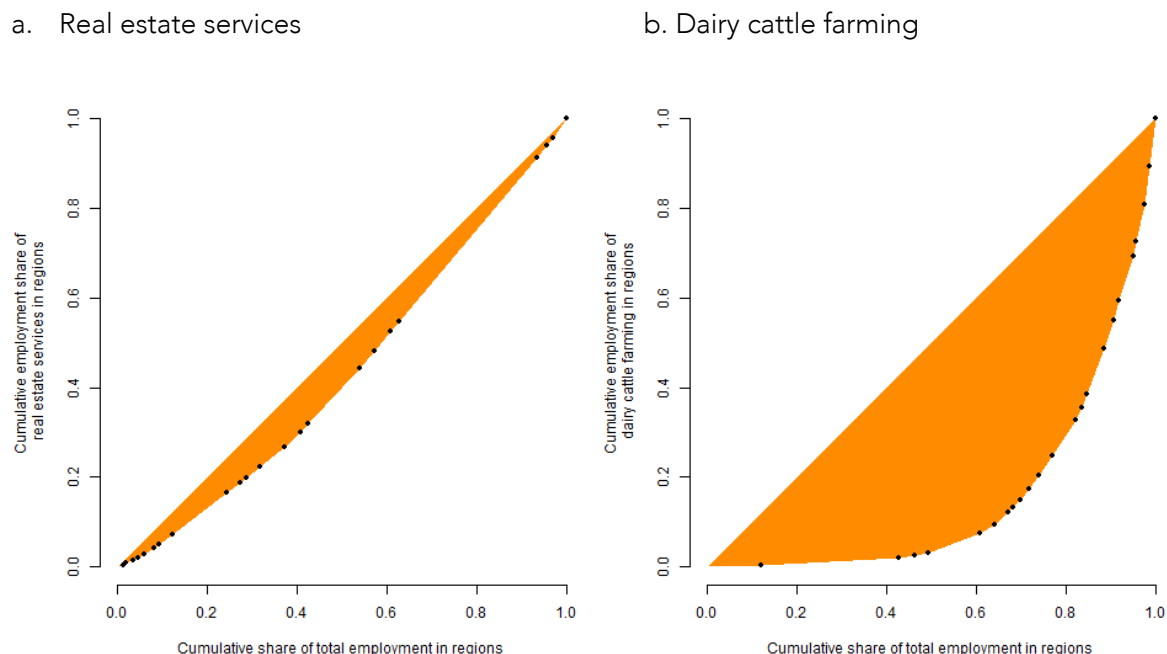
Source: Author's calculations using LBD.

Notes:

1.   Geographic concentration by Gini method is measured in orange shaded areas.

2.   Each dot on the curve represents a local labour market region in New Zealand (sorted by industry employment share).

2.3   Tradability

Jensen & Kletzer (2005) devise a measure of industry tradability that compares firm geographic concentration with the spatial distribution of demand from downstream firms. This builds on the measure of geographic concentration described above to account for differences in the spatial distribution of firms producing output and the distribution of downstream firms that use this output as an intermediate and final input. The general idea is that if an industry is geographically concentrated in one location and sells its output to an industry largely located in other locations, then the output of that industry is assessed as being tradable across distance.

The advantage of this method over measures of employment concentration is that it corrects for the spatial pattern of demand. For instance, if an industry produces output that cannot be traded over distance and is used as an intermediate input by a geographically concentrated downstream industry, then the upstream industry will also be geographically concentrated despite producing a non-tradable product. If a non-tradable industry provides intermediate inputs to a downstream industry, then the geographical distribution of the non-traded intermediate industry should follow the distribution of the downstream industry. So by accounting for input-output relationships, the Jensen & Kletzer (2005) technique corrects for any potential errors in assessing tradability based solely on measures of employment concentration.

To incorporate spatial patterns of demand into the analysis, Jensen & Kletzer (2005) replace the cumulative share of total employment in a region in equation (1) by an "industry demand share" (IDS) that measures the spatial pattern of demand for intermediate inputs by firms in downstream industries. The approach used in this paper augments the Jensen & Kletzer (2005) methodology to also account for the spatial patterns of final demand from households, as well as demand from downstream firms for intermediate inputs. This provides a measure of the "total domestic demand share" (TDDS) faced by

firms that is a more comprehensive estimate of the spatial pattern of demand for their output, particularly for firms that produce a large share of output for final consumption by households.[7]

The TDDS is derived from input-output tables and regional population data and summarises the geographic concentration of intermediate and final domestic demand for the output of firms in industry i (Equation 2).[8]

$$TDDS_{i,p} = \sum_{j=1}^{J-1} (Y_{i,j}/Y_i \times E_{j,p}/E_j) + (Y_{i,j=J}/Y_i \times POP_p/POP) \qquad (2)$$

where i is the upstream industry, j is the downstream industry plus households and p is the labour market region. $Y_{i,j}$ is the output of industry i used by industry j as intermediate inputs and Y_i is the total output of industry i. $E_{j,p}$ is employment of industry j in region p and E_j is total employment in industry j. POP_p is population in region p and POP is total population.[9]

In words, the total demand share of industry i in labour market region p consists of the industry demand share (the first bracket on the right-hand side of equation 2) and household demand share (the second bracket on the right-hand side of the equation). The equation assumes that the regional inter-industry demand for a product produced by upstream industry i is proportional to the regional employment share of downstream industry j. Similarly, regional household demand for final goods produced by firm i is calculated as proportional to the regional population. Combing the industry and household demand shares, the TDDS gives estimates of the spatial pattern of overall domestic demand.

Replacing the total employment term in equation 1 with the TDDS in equation 2 yields an index of industry tradability that measures differences in the distribution of industry employment and TDDS (equation 3).

$$Gini_i^{tradability} = 1 - \sum_p \left(\sigma Y_{i,p-1} + \sigma Y_{i,p}\right) * \left(\sigma TDDS_{i,p} - \sigma TDDS_{i,p-1}\right) \qquad (3)$$

where i is industry and p is region (regions are sorted by the region's share of industry employment). $\sigma Y_{i,p}$ is the cumulative share of industry i in region p. $\sigma Y_{i,p-1}$ is the cumulative share of industry i employment in the region p-1, which has the next lowest share of industry employment. $\sigma TDDS_{i,p}$ is the cumulative TDDS in region p, and $\sigma TDDS_{i,p-1}$ is the cumulative TDDS in the region p-1. The index takes a value from 0 (not tradable) to 1 (highly tradable).

Analogous to Figure 1, Figure 2 depicts tradability in New Zealand's real estate services and dairy cattle farming industries. The real estate services industry tends to trade within local labour market regions, indicating only minor differences between the spatial distribution of industry employment and intermediate and final demand for its product. As such, the measure of domestic tradability is relatively small (0.045). The dairy cattle farming industry is more tradable as the distribution of industry employment is quite different from the distribution of intermediate and final demand. As such, domestic tradability is assessed as being relatively large (0.3133).

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[7] For example, in 2007, almost 70% of the output of the food and beverage services industry was for final consumption. More generally, inter-industry transactions and final consumption expenditure by households make up 46.7% and 21.8% of total industry output respectively.

[8] Input-output table in New Zealand is available for the year-ending March 2007 from Statistics New Zealand. www.stats.govt.nz/browse_for_stats/economic_indicators/NationalAccounts/input-output%20tables.aspx

[9] Population by labour market regions are based on Census 2006.

Figure 2   Domestic tradability in real estate services and dairy cattle farming, 2007
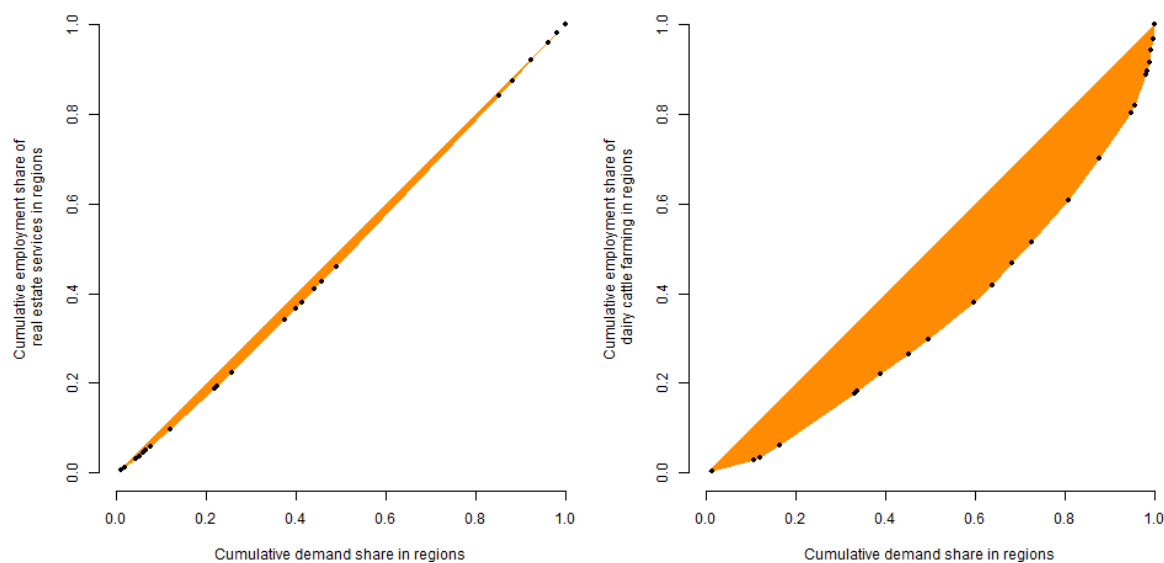
Source: Author's calculations using LBD and input-output table 2007.

Notes:

1.   Tradability by Gini method is measured in orange shaded areas.

2.   Each dot on the curve represents a local labour market region in New Zealand.

3   Industry geographic concentration and tradability

This section presents the results of estimating equations 1 and 3 to calculate geographic concentration and tradability statistics over the period 2000 – 2010. The analysis is conducted at the sub-industry level with the results at the industry and sector level calculated as averages weighted by gross industry production in 2007.[10] Sub-industries are split into groups of "high", "medium" and "low" geographic concentration and tradability. Following Jensen & Kletzer (2005), the boundaries between these groups are simply set at the 33rd and 67th percentiles of the respective distributions.[11]

3.1   Industry geographic concentration

At the broad sector level, the results of estimating equation (1) above indicate that the primary sector is the most geographically concentrated (0.70 on average), followed by the goods-producing (0.37) and service (0.23) sectors (Figure 3). At this very broad level of aggregation, the geographic concentrations of all three sectors are reasonably stable over the sample period.

At the more detailed industry level, there is considerable diversity in the pattern of geographic concentration. The two **primary industries** of mining and agriculture, forestry & fishing are the first and second most spatially concentrated industries in New Zealand (Figure 4). At the sub-industry level, 100% of employment in the 11 sub-industries that make up the primary sector is in highly concentrated sub-industries (Table 1).

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[10] Throughout this paper, "sub-industry" refers to a group of firms that have the same main activity as classified within ANZSIC06 (for example, auxiliary finance & insurance services). "Industry" refers to a group of sub-industries in the same category (for example, manufacturing). A "sector" is based on SNZ's classification that allocates productive activities in the economy into one of three sectors: primary, goods producing and services.

[11] The 33rd and 67th percentiles of geographic concentration and tradability are weighted by gross industry production form the input-output table for 2007. For geographic concentration, the 33rd and 67th percentiles are 0.175 and 0.299 respectively. For tradability, the 33rd and 67th percentiles are 0.161 and 0.328.

Figure 3   Geographic concentrations (Gini) in primary, goods-producing and service sectors, 2000-2010
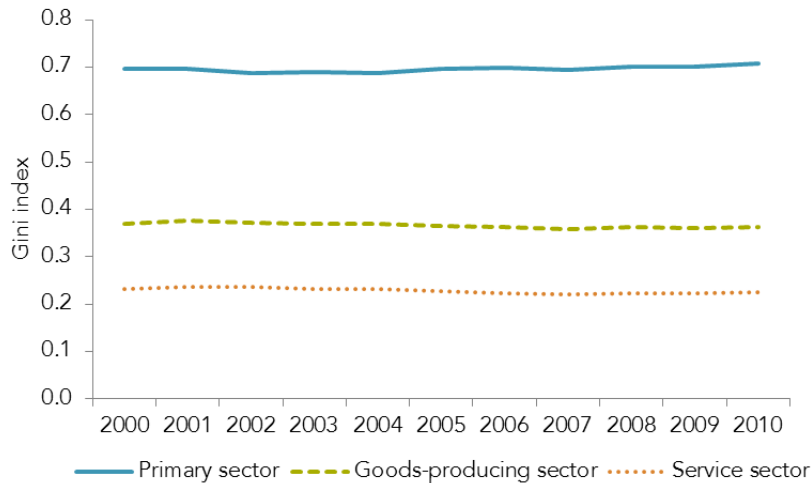
Source: Author's calculations using LBD.

Notes:

1.   Gini concentrations at the sector level are calculated as industry-production-weighted averages of the constituent 1-digit NZSIOC industries. Industry gross production weights are for 2007.

Figure 4   Averaged geographic concentrations (Gini) at 1-digit NZSIOC06, 2000-2010
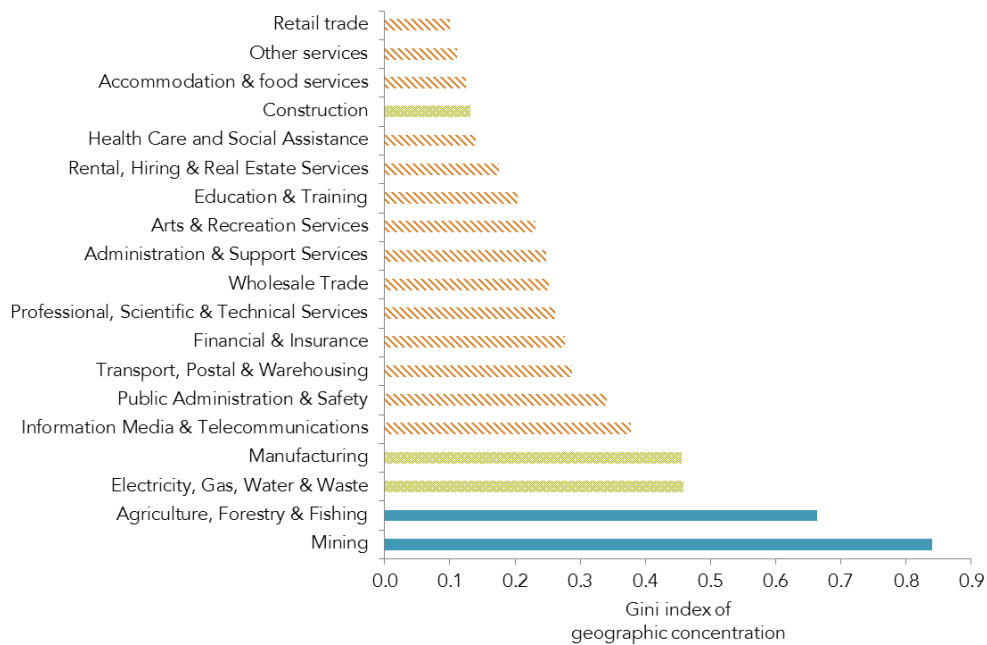
Source: Author's calculations using LBD

Notes:

1.   Blue, green and orange coloured bars represent primary, goods-producing and services sectors respectively.
2.   Geographic concentration at 1-digit NZSIOC level is calculated as production-weighted averages of concentration at the 3-digit NZSIOC industry level.

Table 1   Employment share of geographic concentration classes at the sub-industry level

	Geographic concentration		
NZSIOC industries	Low	Medium	High
Primary sector			
Agriculture, forestry & fishing	0.0%	0.0%	100.0%
Mining	0.0%	0.0%	100.0%
Goods-producing sector			
Manufacturing	25.4%	30.0%	44.6%
Electricity, gas, water & waste services	35.0%	11.8%	53.3%
Construction	100.0%	0.0%	0.0%
Service sector			
Wholesale trade	41.7%	35.9%	22.5%
Retail trade	100.0%	0.0%	0.0%
Accommodation & food services	75.2%	24.8%	0.0%
Transport, postal & warehousing	56.9%	26.2%	16.9%
Information media & telecommunications	44.8%	22.2%	33.0%
Financial & insurance services	42.5%	51.5%	6.0%
Rental, hiring & real estate services	98.8%	1.2%	0.0%
Professional, scientific & technical services	50.7%	36.7%	12.6%
Administrative & support services	30.2%	69.8%	0.0%
Public administration & safety	53.9%	0.0%	46.1%
Education & training	72.3%	23.4%	4.4%
Health care & social assistance	100.0%	0.0%	0.0%
Arts & recreation services	65.4%	30.6%	4.0%
Other services	100.0%	0.0%	0.0%
Total	62.3%	19.5%	18.2%

Source: Author's calculations using LBD,

In the **goods-producing sector**, the electricity, gas, water & waste services and manufacturing industries are ranked as the third and fourth most geographically concentrated in the economy respectively (Figure 4). These two industries are considerably less concentrated than the primary industries, with 75% and 65% of employment respectively classified as being in sub-industries with high or medium geographic concentration (Table 1). In contrast, the construction industry shows very little evidence of geographic concentration, with 100% of employment working in sub-industries classified as having low geographic concentration.

Consistent with the sector results reported above, all **services industries** are less geographically concentrated than primary industries and goods-producing industries, with the exception of construction. However, there is considerable variation in the pattern of geographic concentration across service industries. The information, media & telecommunications industry is the most concentrated service industry, with 55% of employment working in medium or highly concentrated sub-industries. A range of services industries make up the medium concentration category – public administration & safety; transport, postal & warehousing; finance & insurance; professional, scientific & technical services; wholesale trade; administration & support services; arts & recreation services; education & training and rental, hiring & real estate services.

The other four service industries – retail trade; other services; accommodation and food services and health care and social assistance – have low geographic concentration. These are the least geographically concentrated or most geographically dispersed industries in New Zealand and none of the employment at the sub-industry level works in highly concentrated industries.

In aggregate across the New Zealand economy, 62% of workers are employed in industries classified as having low geographic concentration.

3.2   Industry tradability

The tradability statistics show a broadly similar pattern across sub-industries as the estimates of geographic concentration – the correlation between tradability and geographic concentration is 0.86 and highly significant (Figure 5a). This gives some indication that the output of firms in geographically concentrated industries tends to trade across local labour market boundaries whereas the output of firms in geographically dispersed industries tends to trade within the local labour market.

The tradability measures are also highly correlated with a self-reported measure of the importance that firms place on physical proximity to customers, as reported in Statistics New Zealand's Business Operations Survey (Figure 5b). This is a useful corroboration of the tradability data and indicates that proximity to customers is less important for firms that produce output that routinely trades across local labour market boundaries.

Figure 5   Domestic tradability, employment concentration and the importance of proximity

a.   Tradability and concentration

b.   Tradability and the importance of proximity
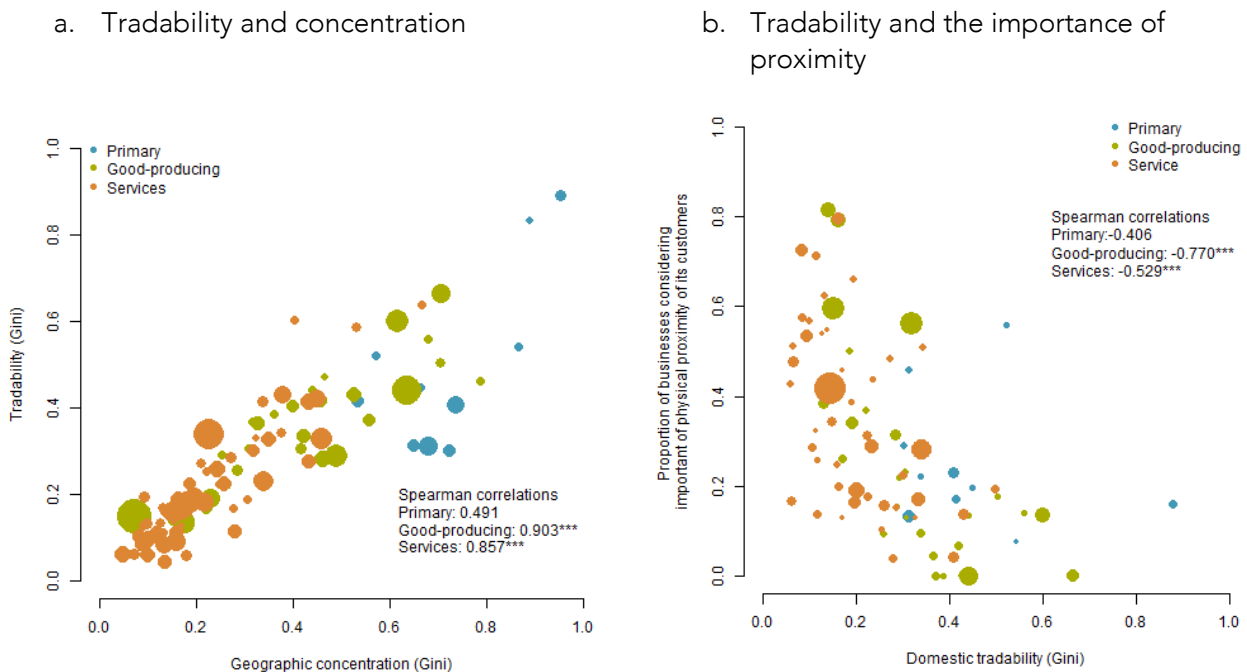
Source: Author's calculation using LBD and business operations survey 2011 from Statistics New Zealand.

Notes:

1.   Size of circle represents industry contribution to New Zealand's GDP in 2007.

2.   Tests of linear correlation are applied across all sectors. ***, ** and * represent statistical significance at 1%, 5% and 10%.

In the **primary sector** the output of the mining industry is the most heavily traded across distance with a tradability score much higher than for other industries (Figure 6). Consistent with high tradability at the industry level, 100% of mining employment works in sub-industries producing output that is highly tradable across labour market regions (Table 2). The agriculture, forestry & fishing industry also produces highly tradable output, although 44% of employment works in sub-industries assessed as having medium tradability.

In the **goods-producing sector**, the output of the manufacturing industry has the second highest tradability score, although some distance behind mining. This industry-level ranking hides considerable diversity, with around half of manufacturing employment in "medium tradable" sub-industries and 10% in low-tradable sub-industries. The electricity, gas and water supply industry is some way further down the ranking and classified at the top end of the medium tradability range with just over half of employment at the sub-industry level in the low and medium tradability categories. The construction industry is in the low tradability category.

Reflecting its diversity of geographic concentration, the **services sector** has a mix of tradability results at the industry level. Public administration & safety is highly tradable. The medium-tradability category is dominated by services industries – finance & insurance; wholesale trade; information media & telecommunication; transport, postal & warehousing; administration & support services; arts & recreation services; professional, scientific & technical services and education & training. The remaining service industries – health care & social assistance; other services; retail trade, accommodation & food service and rental, hiring & real estate – are all in the low-tradability category and assessed as producing output that is the least tradable in the economy.

Within the services sector, there are 36 sub-industries assessed as producing high or medium tradability output. This equates to 60% of the total services sub-industries and 62% of total service-sector employment. The majority of these service sub-industries are in the finance & insurance; wholesale; transport, postal & warehousing; professional, scientific & technical services and public administration & safety industries. This suggests that service firms in these industries do, to some extent, cluster in space and deliver their products over distance to intermediate and final consumers in other regions of New Zealand.

Figure 6   Domestic tradability index (Gini) at 1-digit NZSIOC, 2007
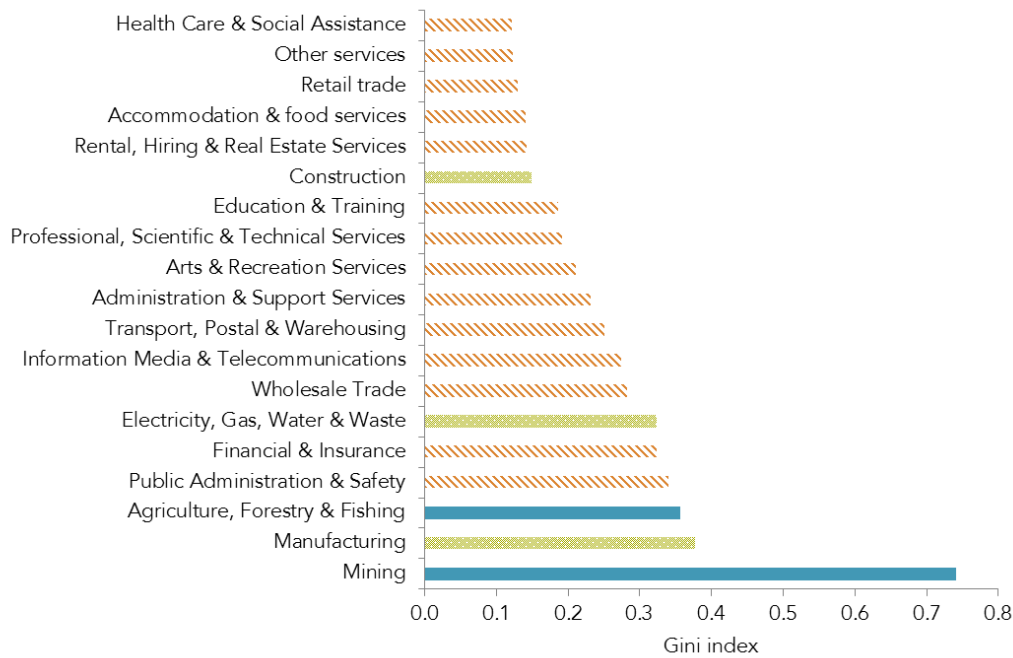
Source: Author's calculations using LBD.

Notes:

1.   Blue, green and orange coloured bars represent primary, goods-producing and services sectors respectively.

2.   Geographic concentrations at 1-digit NZSIOC level are calculated by production-weighted concentrations at 3-digit NZSIOC industry level.

Table 2   Employment share of tradability classes at 1-digit NZSIOC industry level

NZSIOC industries	Domestic tradability		
	Low	Medium	High
Primary sector			
Agriculture, forestry & fishing	0.0%	44.4%	55.6%
Mining	0.0%	0.0%	100.0%
Goods-producing sector			
Manufacturing	9.6%	52.2%	38.1%
Electricity, gas, water & waste services	35.0%	19.6%	45.5%
Construction	86.5%	13.5%	0.0%
Services sector			
Wholesale trade	0.0%	72.9%	27.1%
Retail trade	63.8%	36.2%	0.0%
Accommodation & food services	75.2%	24.8%	0.0%
Transport, postal & warehousing	59.7%	22.8%	17.5%
Information media & telecommunications	38.5%	30.9%	30.6%
Financial & insurance services	24.3%	0.0%	75.7%
Rental, hiring & real estate services	75.4%	24.6%	0.0%
Professional, scientific & technical services	23.0%	77.0%	0.0%
Administrative & support services	0.0%	100.0%	0.0%
Public administration & safety	17.6%	36.3%	46.1%
Education & training	72.3%	0.0%	27.7%
Health care & social assistance	100.0%	0.0%	0.0%
Arts & recreation services	65.4%	23.5%	11.1%
Other services	66.5%	33.5%	0.0%
Total	46.2%	35.4%	18.4%

Source: Author's calculation using LBD.

4   Tradability and productivity

Looking at firm-level labour productivity by sector and tradability class reveals that firms in higher-tradability sub-industries in the goods-producing and service sectors tend to be relatively more productive (Figure 7). Specifically, median labour productivity for firms in highly tradable goods-producing and service sectors are 52% and 35% higher respectively than for firms in low tradability sub-industries in these sectors. In the primary sector, firms in the medium-tradability class have higher median labour productivity than firms in the high-tradability class. In large part, this reflects the inclusion of the high-productivity dairy industry in the medium-tradability category.

Very little work has been done on the impact of trade over distance within the domestic economy on productivity. However, the agglomeration and international trade literature suggest at least three potential interrelated explanations for the positive correlations outlined in Figure 7. First, as touched on in the introduction, producing a tradable product gives firms greater latitude in their location decisions, including co-locating with firms in the same industry to benefit from geographic proximity. Second, as well as the external scale effects associated with geographic proximity, the expansion of markets allowed for by increased trade over distance may also encourage productivity gains from internal scale economies and specialisation. Thirdly, this increase in the extent of the market may also increase the extent of competitive pressures that firms face, which has also been shown to be an important driver of efficiency gains.

Rigorously assessing the importance of each of these potential mechanisms is beyond the scope of the current paper. Instead, the following subsections merely sketch out broad correlations between tradability and geographic proximity, scale and competition. Because the analysis is not based on structural modelling, the results are only indicative of the likely impact of tradability on each of these productivity drivers.

Figure 7   The distribution of labour productivity across firms by sector and tradability class

a. Total economy

b. Primary industries

c. Goods-producing industries

d. Service industries
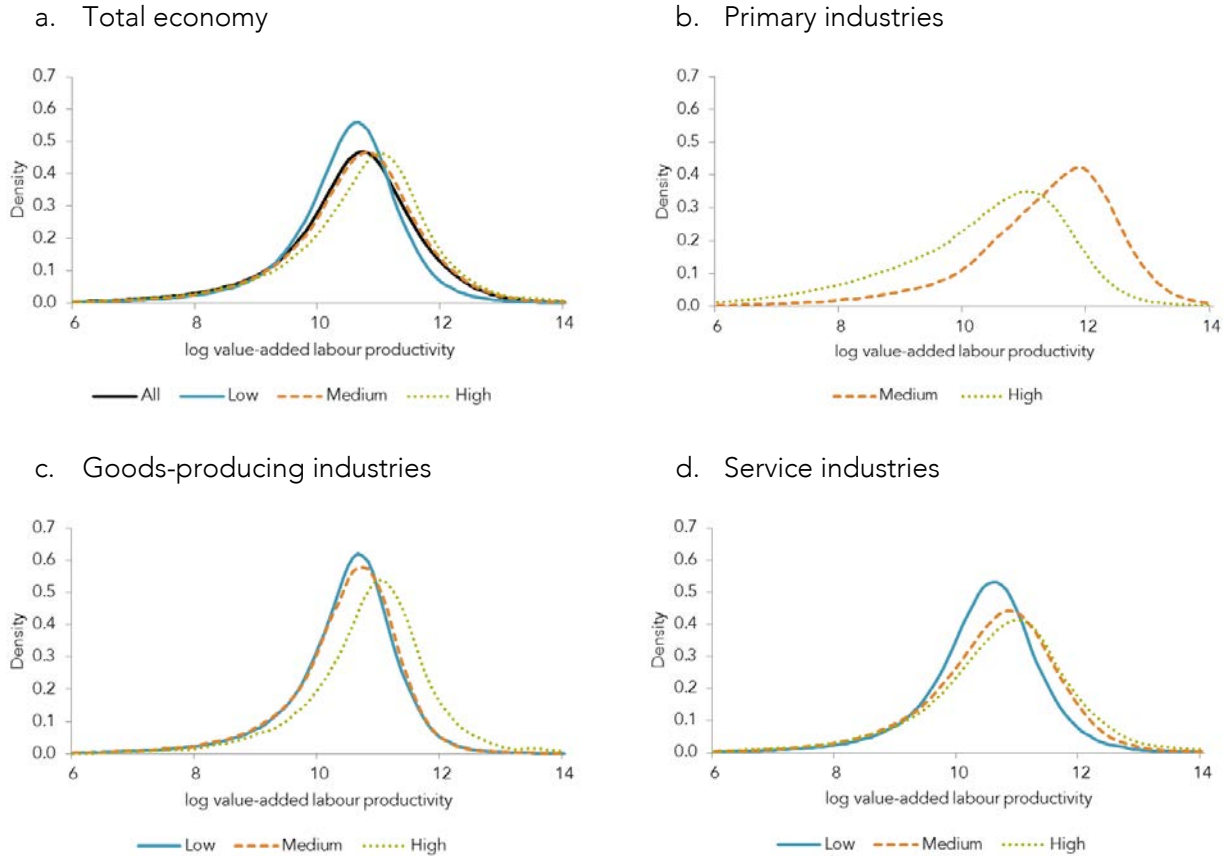
Source: Author's calculation using LBD.

Notes:

1.   Labour productivity is measured as a log difference between value-added and employee count, $\frac{VA}{labour} \approx \ln(va) - \ln(labour)$

2.   Distribution of labour productivity is estimated by kernel density estimation.

3.   Colour-coded lines represent different subsets of tradability classes. Black, green, orange and blue: represent all industries, highly, medium and low tradable industries respectively.

4.1   Geographic proximity

The positive impact of geographic proximity on productivity has been traced to a number of place-specific external scale effects – in short, having firms co-locate promotes interactions that increase productivity. Marshall (1920), for example, argues that firm concentration facilitates knowledge and information spillovers, labour pooling and backward and forward supply-chain linkages. In a more recent contribution, Duranton & Puga (2003) attribute the productivity benefits from urban agglomeration to three general micro-foundations: the sharing of gains from scale and specialisation; improvements in the probability and/or quality of matching between firms and productive inputs; and learning based on the generation, diffusion and accumulation of knowledge.

In New Zealand, firms producing highly tradable services tend to locate in the main urban centres (Figure 8a). Wellington has the highest employment share in high and medium tradable service industries, reflecting the concentration of government in the capital. Market-based services that are tradable over distance tend to concentrate in Auckland – there is a positive and significant correlation between tradability in

market-based service industries and their Auckland-based employment share (Figure 9). As such, around 40% of total employment in market-based service industries in the medium to high tradability category is Auckland-based (Figure 10). For services in the low-tradability category, the share of employment based in Auckland is 32%.

Figure 8   Average regional employment shares by tradability classes, 2000-2010
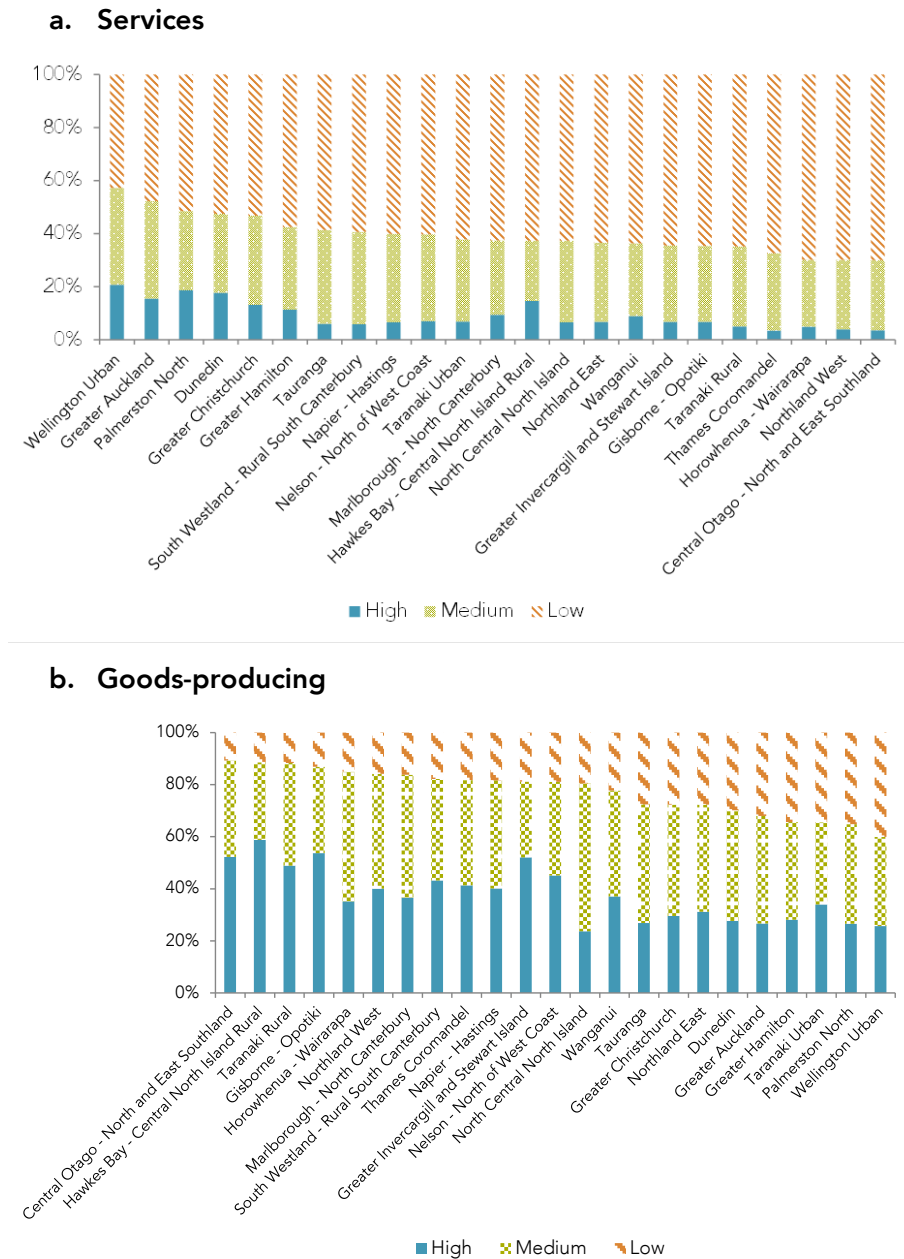
a. Services

b. Goods-producing

Source: Author's calculations using LBD.

Notes:

1.   New Zealand regions are defined as labour market regions: www.mera.co.nz/index.htm.

2.   Employment data are employee counts (excluding employers) based on Linked Employer-Employee Data (LEED).

Figure 9   Tradability and Auckland-based employment share, by industry
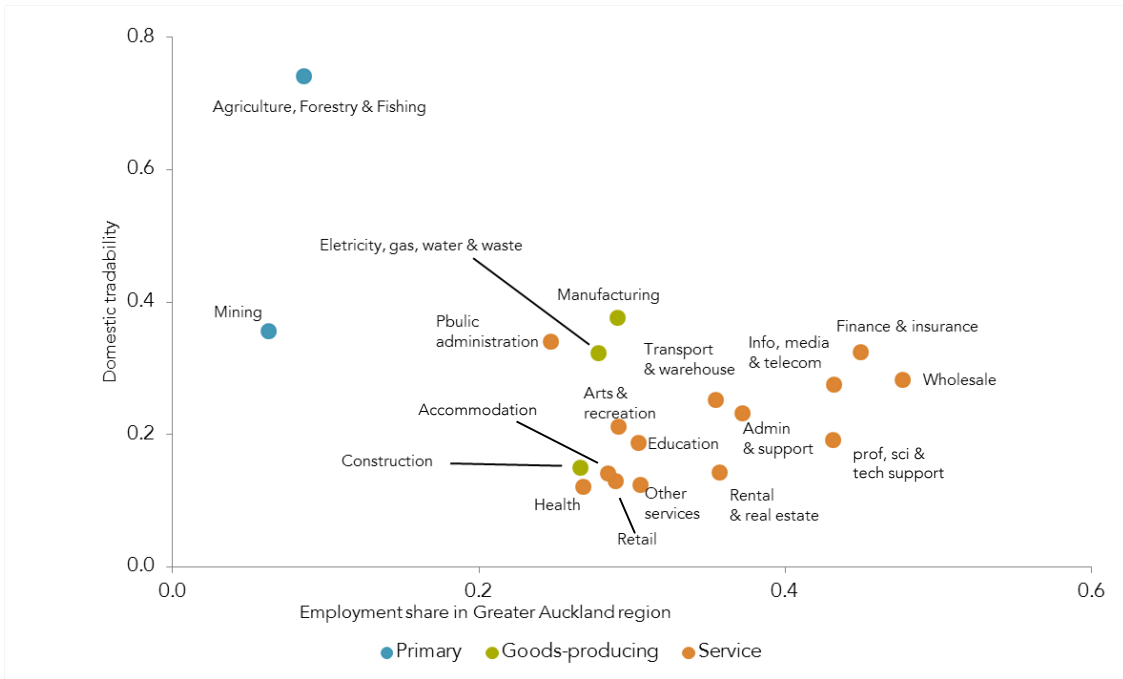
Source: Author's calculations using LBD.

1.   The correlation for market-based services is 0.86 and significant at the 1% level.

Figure 10   Region contributions to employment in service industries, 2000-2010
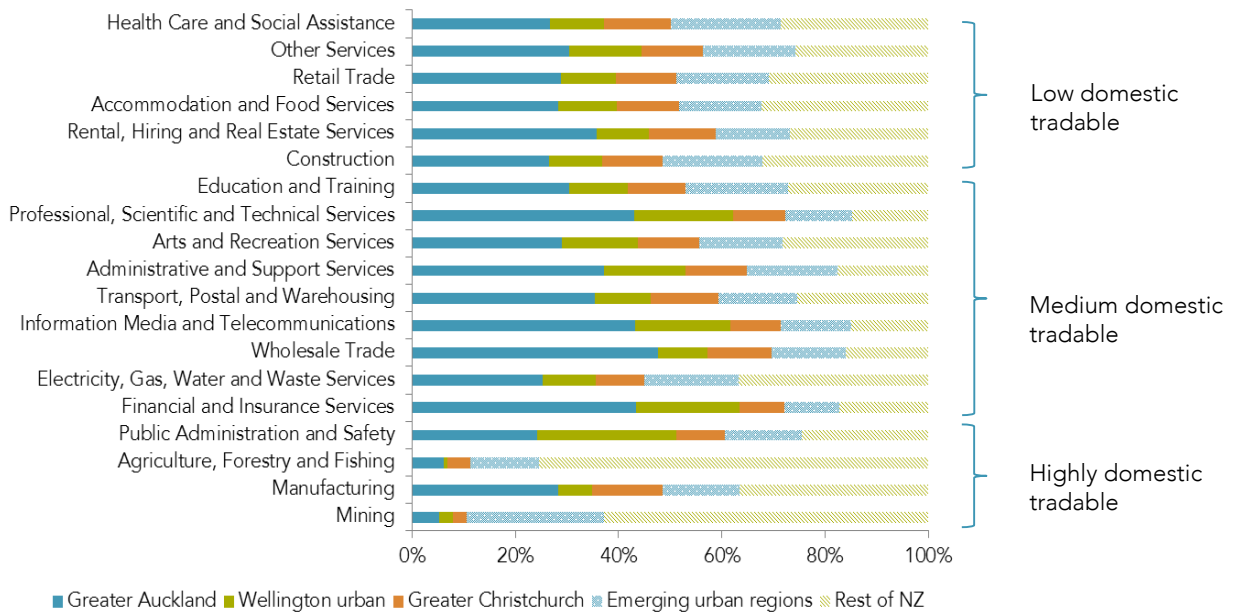
Source: Author's calculations using LBD.

Notes:

1.   New Zealand regions are defined as labour market regions: www.mera.co.nz/index.htm.
2.   Emerging urban regions consist of Greater Hamilton, Taranaki urban, Tauranga, Palmerston North and Dunedin.
3.   Employment data are employee counts (excluding employers) based on Linked Employer-Employee Data (LEED).

These Auckland-centric service industries – information, media & telecommunication; finance & insurance and professional, scientific & technical services – are "knowledge-intensive services" (KIS) that have benefited from new technologies allowing them to operate at a distance from their customer base.[12] In other regions of New Zealand, service sector firms are more focused on the local economy (Figure 8a). For example, the low-tradability service industries of rental, hiring & real estate; health care and social assistance; retail and accommodation industries are more evenly distributed across New Zealand's regions (Figure 10).

In the goods-producing sector, firms producing tradable goods tend to locate in the emerging urban and rural regions (Figure 8b). Within the electricity, gas, water & waste industry, some sub-industries are located near New Zealand's natural resource endowment, reducing the scope for geographic proximity (Figure 10 and Table D.1). In manufacturing, although almost 30% of employment is Auckland-based, this industry is also present in other parts of the country, particularly greater Christchurch. In contrast, reflecting low tradability, the construction industry is widely distributed across the country and trades within, as opposed to across, local labour markets.

In the primary sector, the highly tradable mining industry is predominately located in rural regions where New Zealand's mineral resources are located (Figure 10). For example, most oil and gas extraction takes place in Taranaki while New Zealand's coal mining industry is predominately on the West Coast and around Huntley. The agriculture, forestry and fishing industry is also highly tradable and predominantly located in rural regions.[13]

These location results are consistent with a core-periphery split identified by Grimes & Vaillant, 2011. The core is made up of major centres with high value-added activities associated with knowledge intensive inputs. The periphery is characterised by firms pursuing more routine and potentially less lucrative production tasks. Further, Maré & Graham (2010) find that an area with ten percent higher density in New Zealand equates with an improvement in firm productivity of 0.69 %.[14]

Of course, the tradability of output is only one determinant of firm location choice, which also reflects a range of other influences, including proximity to suppliers, rents and congestion costs. However, the cursory evidence in Figures 8 and 9 suggests that firms producing tradable output are more likely to co-locate with firms in the same industry to benefit from geographic proximity.

The association between tradability and labour productivity extends to firms located outside the greater Auckland region, suggesting that geographic proximity is not the only possible explanation (Figure 11). As such, the following two sub-sections investigate the link between domestic tradability and firm scale and competition.

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[12] Grimes & Vaillant (2011) also find that KIS firms are disproportionally located in Auckland and that Auckland has had the highest growth in KIS intensity across Australian and New Zealand cities.

[13] The high geographic concentration and tradability results for this industry may appear counter-intuitive given that agriculture, forestry & fishing is reasonably ubiquitous across the New Zealand countryside. However, at the sub-industry level, land use is relatively specialised by region with different areas tending to concentrate on different primary products. For example, the sheep, beef cattle & grain farming industry – which is the most concentrated sub-industry in agriculture, forestry & fishing – is largely concentrated in the Hawkes Bay and central North Island rural regions whereas the fishing & aquaculture industry is relatively concentrated in Marlborough and Nelson.

[14] These New Zealand-specific results are consistent with the international literature on the link between agglomeration and productivity. For instance, in a review article, Combes et al (2012) find that estimates of the elasticity of productivity to city size typically range between 0.02 and 0.10. For example, Ciccone & Robert (1996) find that doubling employment density in a United States county increases average labour productivity by six %. This literature is reviewed in Strange & Rosenthal (2003) and Melo & Graham (2009).

Figure 11   Median labour productivity by sector and tradability classes, overall and without Auckland
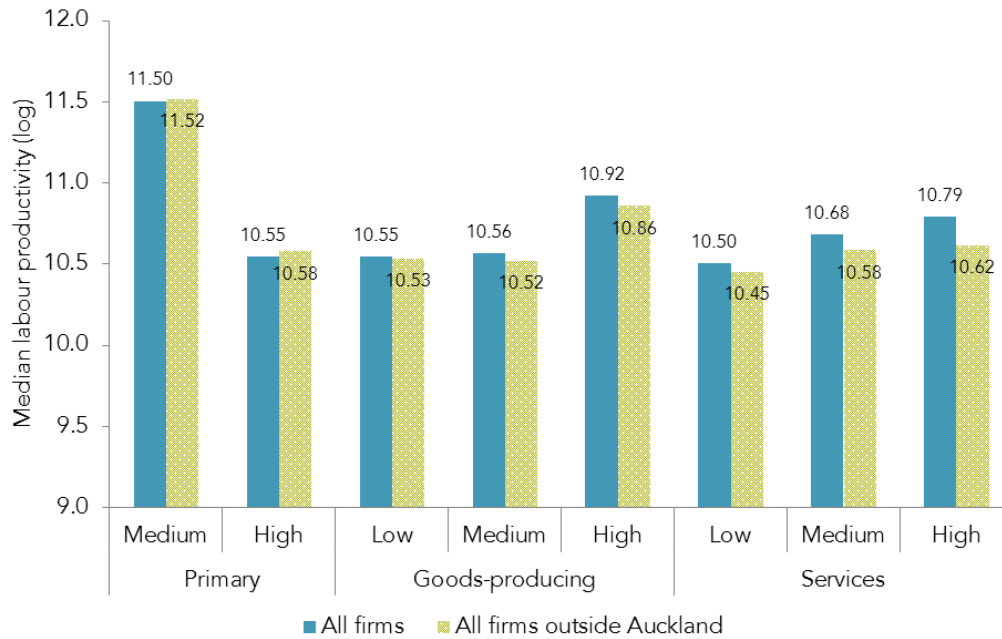
■ All firms   ▨ All firms outside Auckland

Source: Author's calculations using LBD.

Notes:

1.   Labour productivity is measured as a log difference between value-added and employee count, $\frac{VA}{labour} \approx \ln(va) - \ln(labour)$

4.2   Scale and specialisation

Tradability and exporting

Firms supplying the local labour market in which they are located are unlikely to have the same growth opportunities as firms that trade their products at the national level. As well as greater growth potential from the domestic market, firms producing tradable output are also more likely to be able to export. Although a firm's decision to export reflects a great deal more than just the extent to which its products are tradable over distance, the ability to supply customers in different locations is a necessary (but not sufficient) condition for cross-border trade.

A look at domestic tradability and the export share of gross output at the sub-industry level does indeed reveal a significant positive relationship (Figure 12). This correlation is particularly strong for goods-producing industries but weaker across service industries, raising questions about the propensity of service firms to engage in cross-border exporting.[15]

Looking at the different quadrants of Figure 12, sub-industries in the "high tradability-high export intensity" corner furthest from the origin are mostly in the goods-producing or primary sectors. Firms in these sub-industries operate in potentially large markets in which products are traded over distance within New Zealand and across borders into international markets. The goods-producing sub-industries in this quadrant are all in manufacturing whereas the primary sector sub-industries span various parts of mining and agriculture, fishing & forestry.[16] Consistent with transport and storage being a high share of New Zealand's service exports (Meehan, 2014), the rail, air & space & other transport and warehousing & other storage services are the only two services sub-industries in this quadrant of the graph.

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[15] Of course, international services transactions are complex to analyse given that services can be supplied through a number of different modes. As such, trade patterns in some service industries will depend on the feasibility and cost of using alternative methods of international trade. However, services exports are low in New Zealand compared to other countries and cross-border services exports account for 20% of total exports (Meehan, 2014). This indicates at least some potential for improvement. In addition, outward direct investment is also relatively low in New Zealand, indicating that the export of services by New Zealand firms via commercial presence is also low in international comparison.

[16] A full listing of the sub-industries in each quadrant of Figure 13a is given in Appendix C.

The "low tradability-low export quadrant" closest to the origin in Figure 12 is dominated by sub-industries in the services sector. These sub-industries are predominantly associated with retail trade, education, health care and social assistance and recreational services. The three goods-producing sub-industries in this quadrant are all part of the construction industry. Firms in these sub-industries operate in small local markets and have limited opportunities for improvements in scale and specialisation by trading at the national level or exporting into international markets.

Service sub-industries also dominate the "medium tradability-medium export" quadrant. A number of these sub-industries are part of the wholesale and professional, scientific & technical services industries. This quadrant also contains a range of ICT and design sub-industries. Export shares of between 20-34% of total output in these sub-industries suggest that there are no inherent barriers to international trade and that they represent good potential for increasing the low share of services in New Zealand's export mix.

Figure 12   Scatterplot of export intensity and domestic tradability, 2007

Spearman linear correlations

Primary: -0.536
Goods-producing: 0.671***
Services: 0.196***
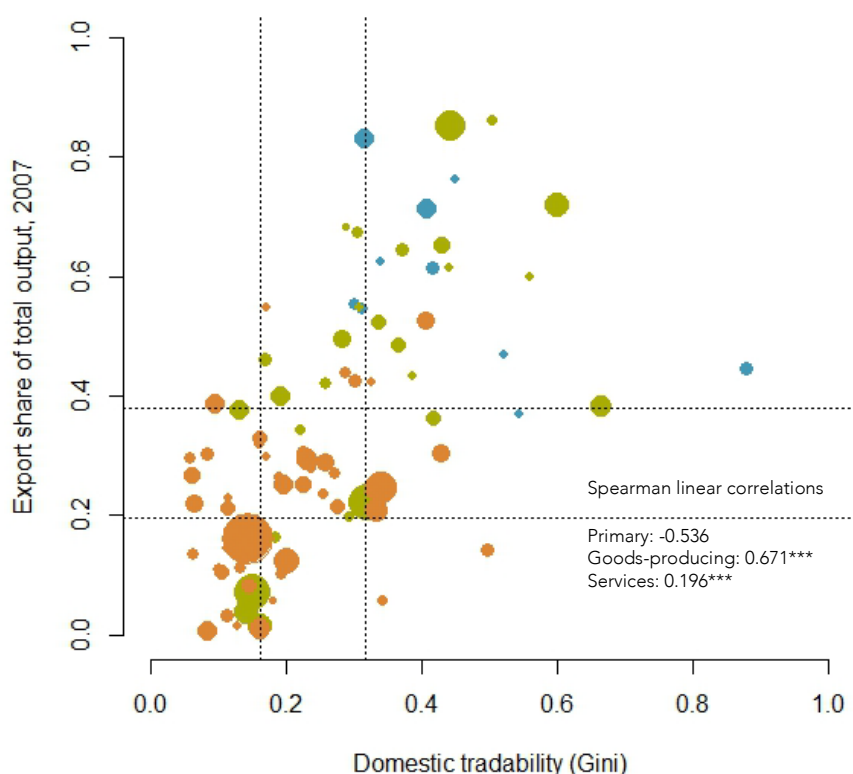
Source: Author's calculation using LBD and input-output table 2007.

Notes:

1.   Size of circle represents industry contribution to New Zealand's GDP in 2007.

2.   Horizontal and vertical lines are respectively production weighted 33rd and 67th percentiles of international trade and tradability Gini index and international engagement question.

3.   Export intensity is expressed as export share of total gross domestic production in 2007.

Given the association between domestic tradability and exporting, it is also interesting to explore the off-diagonal quadrants of Figure 12. Sub-industries assessed as producing output that is highly tradable domestically but with only low or medium export intensity may be indicative of missed exporting opportunities and the existence of other barriers to exporting (Box 1). Service sub-industries dominate this category and include banking & finance; other goods wholesaling; telecommunications services; gambling activities and life & health & general insurance. Conversely, sub-industries assessed as having relatively high export intensity but low to medium domestic tradability are predominantly in the goods-producing sector.

Box 1   **Where are New Zealand's missed export opportunities?**

To give some indication of the possible reasons underlying this pattern, Figure 13 shows the responses of firms in the sub-industries in each of these two groups to a question on barriers to generating overseas income (from the Business Operations Survey 2011). For firms in the low domestic tradability but medium or high exports category, the exchange rate is the most commonly cited barrier to generating overseas income. For firms in the high domestic tradability but low to medium exports, "other" is the most commonly cited barrier to generating overseas income.

There are a number of potential reasons why firms in some service sub-industries that produce output that is traded over distance within New Zealand do not sell their product internationally. For instance, New Zealand's banking & finance industry has a high degree of foreign ownership. Given that the head offices for some of these firms are situated in other countries, they may be more likely to export services from their home location. Additionally, regulatory impediments to trade, including cross-country differences in regulation, may hamper the export ambitions of firms in some of these sub-industries.

Figure 13   Barriers to generating overseas income
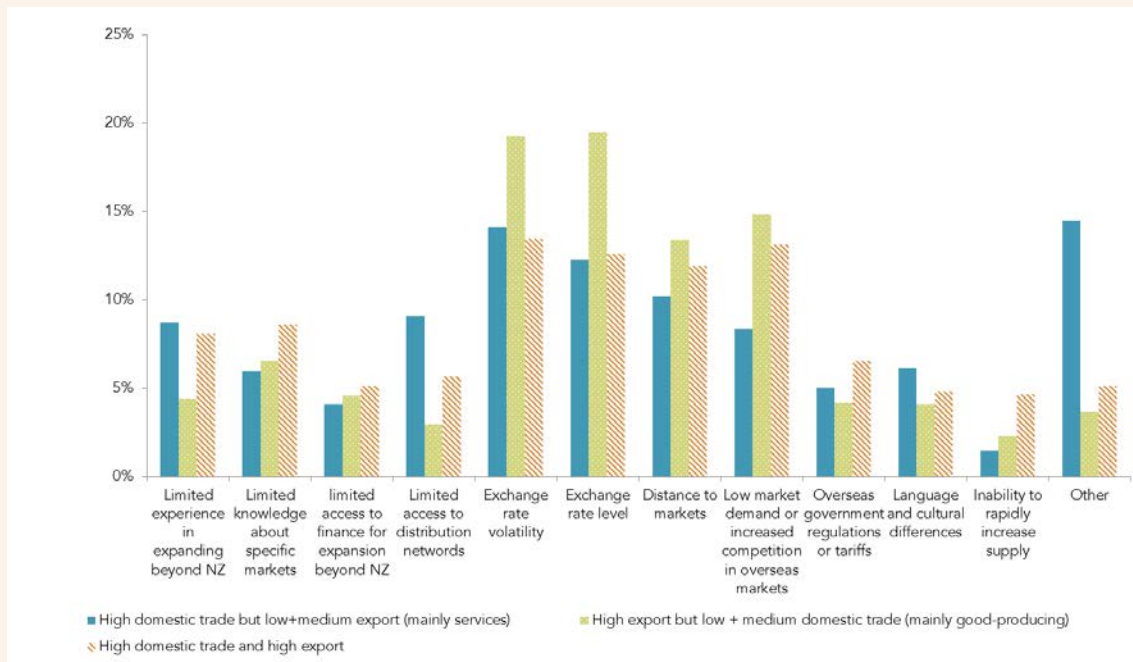
Source: Author's calculations using the Business Operations Survey 2011.

Tradability and firm size

The correlation between domestic tradability and exporting suggests that firms producing low-tradability products for the local labour market are unlikely to increase scale through exporting. This suggests a positive correlation between the tradability of a firm's output and its size.

New Zealand does have a high share of employment in small firms, which may reflect the impact of small domestic markets and limited connection with international markets. A recent study by Criscuolo, Gal, & Carlo (2014), which is based on harmonised international firm data, finds that New Zealand has

the second highest proportion of micro enterprises among the 17 OECD countries included in the study.[17] In 2010, firms with 1 to 19 employees accounted for 92% of firms and 30% of employment in New Zealand (Figure 14). Large firms employing more than 50 people account for only 3% of the number of firms but about 57% of total employment.

Figure 14   Firm and employment share by firm size
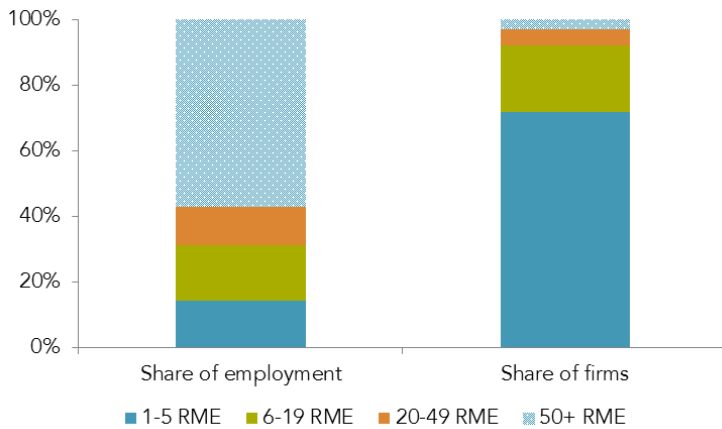
Source: Author's calculations using LBD.

Overlaid on this aggregate picture, there is a clear link between tradability and firm size in the goods-producing and service sectors (Figure 15). In the goods-producing sector, the proportion of employment in firms with between 1-19 employees falls from 94% in low-tradability sub-industries to 71% in high-tradability sub-industries. As a result, average firm size increases by a factor of seven – from eight to around sixty employees – in high-tradability sub-industries compared to low-tradability sub-industries.

Perhaps reflecting lower domestic tradability and export penetration, small firms in the services sector are more prevalent than in the goods-producing sector – the average firm size is smaller and small firms account for a larger share of total firms. Across tradability classes, however, the service sector shows a broadly similar pattern of firm size. That is, average firm size and the share of firms and employment accounted for by relatively large firms increases with the extent to which the products they produce are tradable over distance.

In the primary sector, small firms are particularly prevalent, with firms of less than 20 people accounting for 97% of firms and 68% of total employment. In contrast to the goods-producing and service sectors, the dominance of small firms in the primary sector is invariant to the extent to which the output of sub-industries within the sector is tradable across distance within New Zealand (Figure 15 and Figure 16). This may reflect the impact of an immovable factor of production for firms in this sector.

Figure 15   Share of firm (left) and employment (right) by sector, tradability and size classes, average 2000-2010

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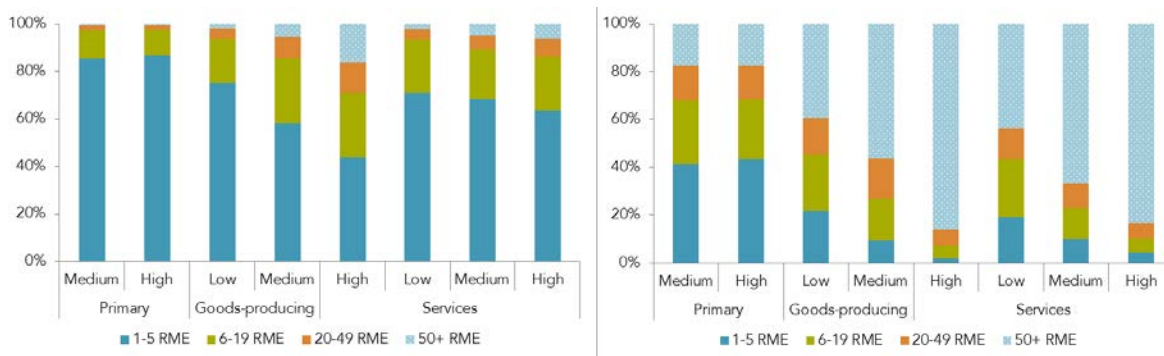
[17] Note that methodological differences can complicate international comparisons of firm size – see Mills & Timmins (2004).

Notes:

1.   RME stands for rolling mean employee counts. It is an average of employee counts in the past 12 months.

Figure 16   Average number of employees by sector and tradability, 2000-2010
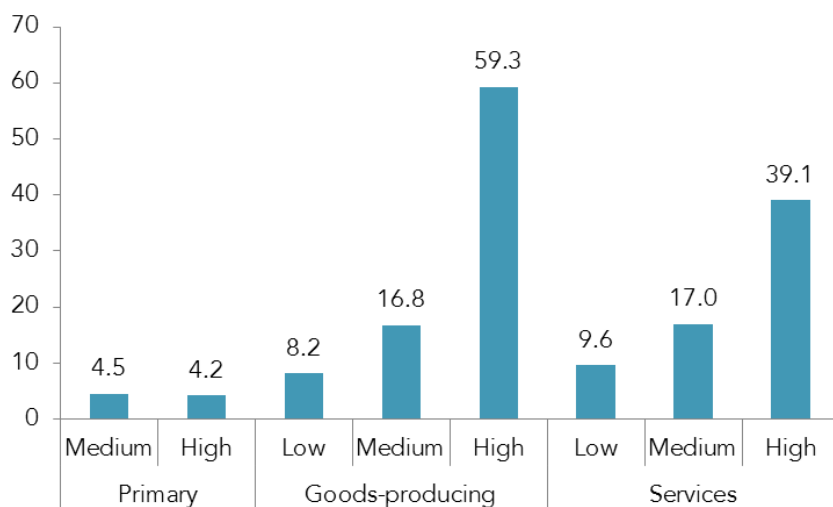
Firm size and productivity

Although relatively little is currently known about the impact of firm size on productivity in New Zealand, a number of international studies indicate that the link is likely to be positive and significant.[18] Indeed, splitting median labour productivity for each sector and tradability class by firm size reveals evidence of scale effects among New Zealand firms in the goods-producing and service sectors (Figure 17). In these sectors, labour productivity increases with firm size across almost all tradability classes. For example, in highly tradable services sub-industries, median labour productivity for firms with 50+ employees is 85% higher than for firms with 1-5 employees. As such, the promotion of internal scale effects may be one of the mechanisms linking tradability and productivity.

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[18] For instance, Leung, Meh, & Terajima (2008) find a significant positive relationship between firm size and productivity in Canada, both manufacturing and non-manufacturing industries. Their study showed firms with more than 500 employees were roughly 30 % more productive than those with 0-100 employees. Yang & Chen (2009) and Serrasqueiro & Maçãs Nunes (2008) found that size is positively related to performance but only for small and medium enterprises (SMEs) in Taiwan and Portuguese respectively. These studies indicate the relationship may not necessarily be linear and firm growth beyond optimal level may deteriorate performance.

Figure 17   Labour productivity vs firm size by sector and tradability, average 2000-2010
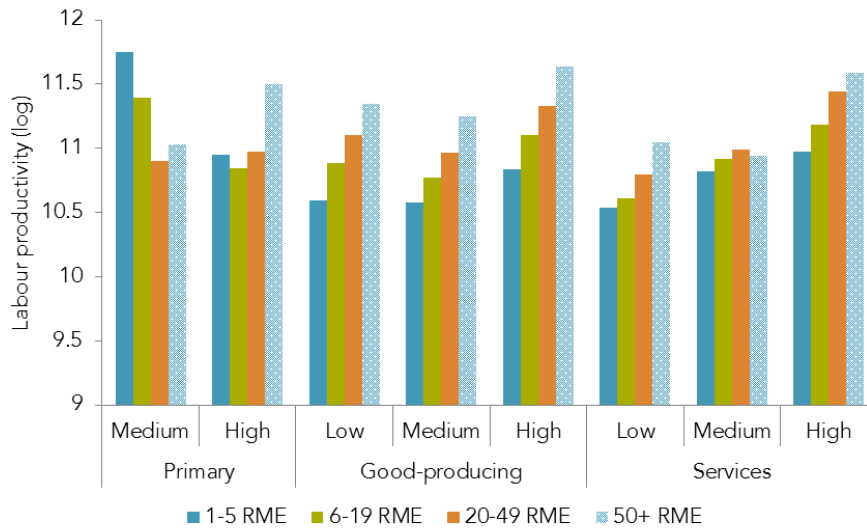
Source: Author's calculations using LBD.

Notes:
1.   Labour productivity is expressed in natural log scale and in 2007 price.

4.3   Tradability and competition

The third reason to expect a positive link between tradability and productivity is that markets for tradable products broaden the extent of competition beyond a firm's location. This increases spatial substitutability in a market – when firms compete with each other over distance it is easier for consumers to switch between rival suppliers. As a result, relatively inefficient producers find it more difficult to operate profitably and are more likely to exit. In principle, this truncates the left-hand tail of the productivity distribution, leading to a tighter dispersion of productivity across firms and a higher minimum and average productivity level in the sub-industry.[19]

At first glance, there is no obvious bi-variate correlation between tradability and competition – as proxied by price-cost mark ups (PCMs) – at the sub-industry level in New Zealand (Figure 18). This is not altogether surprising given that the drivers of competition are complex and PCMs provide only a rough proxy for one aspect of competition.

What is apparent from Figure 18 is that sub-industries in the services sector dominate the upper-left hand quadrant of the figure. On the face of it, this indicates that firms in these sub-industries produce low-tradability products that face relatively little competition (i.e. high PCMs). In addition, import penetration in the services sector is generally much lower than in the rest of the economy – cross-border imports account for 11% of total output in services, compared to 31% and 22% in goods-producing and primary sectors respectively.[20] Taken together, these results suggest that some service-sector firms are insulated from domestic and international competition relative to other parts of the economy.

This pattern of relatively high PCMs in services is consistent with the international evidence. The reasons typically cited for relatively high mark ups in services are lower international competition and various regulations and entry barriers that reduce effective competition and generate rents (Høj et al, 2007).[21] ICT has improved the extent to which services can be traded over distance and has had a

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[19] Syverson (2004) finds that greater competition in the readymade cement industry leads to better firm selection and resource allocation to high-productivity firms in relatively dense employment areas. Although Syverson focuses on the impact of firm density on competition and productivity, the idea that increased substitutability truncates the productivity distribution from below is likely to also hold in the case of greater geographic market coverage. In other words, firms producing tradable products are more likely to compete with rival producers in other parts of the New Zealand and international economies, toughening competition, which, in turn, is beneficial for firm productivity.

[20] Interestingly, the correlation between import penetration and price-cost mark ups in the services sector is around -0.57 and statistically significant.

[21] The cross-country variability of mark-up estimates is also lower in manufacturing than in non-manufacturing sectors, as the disciplining effect from vast internal markets is considerable on manufacturing sectors in large countries, while international competition is strong in small open economies.

significant impact on productivity in some service industries. However, at least in the New Zealand context, services are still not traded across regions to the same extent as goods and tend to be less exposed to competition. Although the literature on the impact of competition on productivity in New Zealand markets is underdeveloped, with competition a key driver of productivity, this may also be suggestive of a link between tradability and productivity.

Figure 18   Tradability and price-cost margin
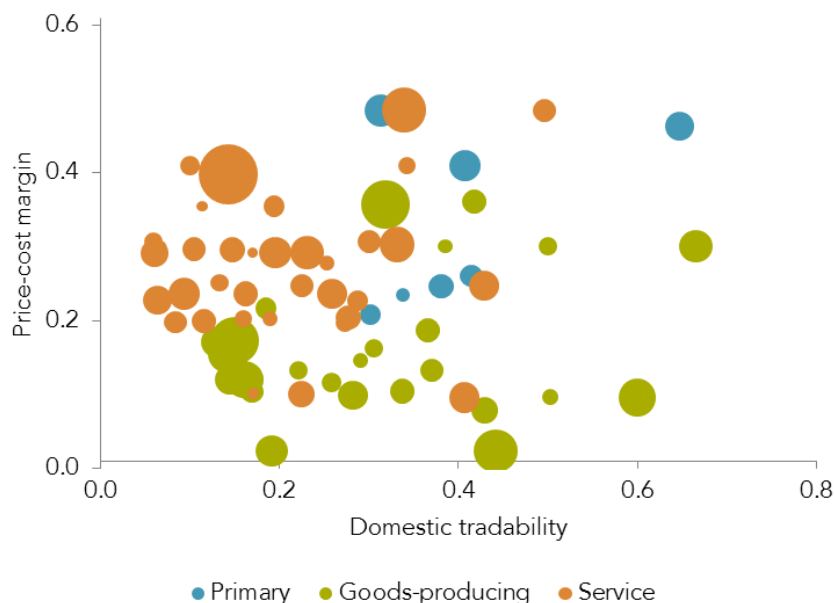
Source: Author's calculations using LBD.

Notes:

1.   Price-cost margins are an indicator of a firm's market power – its ability to raise prices above marginal cost. It is calculated as $\sum_{i\in j}\left[\frac{(y_i - ic_i - w_i)}{y_i}\right]$, where y is gross output, ic is intermediate consumption and w is labour cost.

2.   A lower price-cost margin means higher competition as the firm has less market power to control price over its marginal cost.

5   Concluding remarks

This paper looks at the extent to which output is traded over distance in New Zealand and finds that firms in the primary sector produce output that is the most easily traded over distance, followed by the goods-producing and services sectors.

The paper goes on to link tradability to the level of labour productivity across firms and explores three potential reasons. That is, firms producing tradable output are more likely to benefit from geographic proximity to firms in the same industry, increased scale, specialisation and the tougher domestic and international competition that deeper markets allow. Disentangling the various channels through which tradability might influence productivity is complicated and out of scope for this work. However, it is clear from different aspects of the New Zealand data that producing tradable output confers a productivity advantage on firms.

The findings presented in the paper raise a number of interesting issues for the service sector. As with most advanced economies, services have become a major part of the domestic economy and increasingly contribute value-add into New Zealand's export mix (Meehan, 2014). While ICT has improved the tradability of some services, firms in other parts of the services sector still produce output that is difficult to trade over distance and export to a much smaller extent than firms in other sectors of the economy. As such, the extent of the market for these firms is likely to be relatively small, with negative implications for scale and specialisation. High price-cost margins also indicate that firms in some service sub-industries are relatively under-exposed to domestic and international competition,

which may reflect difficulties in trading their output over distance. All of these influences are likely to weigh on the productivity performance of some parts of New Zealand's services sector.

Although the primary aim of the paper is to measure domestic tradability and assess its implications, it does suggest a number of policy-relevant issues. For instance, the link between tradability and labour productivity highlights the importance of connectivity between the cities and regions of New Zealand. For example, the tradability measures may be useful in evaluating the wider benefits of transport and other infrastructure investments that aim to improve connection between New Zealand's regions. Further, the results also highlight the importance of stimulating competition in sub-industries that produce non-tradable output, which is especially the case in a number of service sub-industries. Doing so would improve the potential for firms to agglomerate and the specialisation and competition benefits that a large market brings are likely to lead to productivity improvements compared to firms that produce for the local market.

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Appendix A Methods to calculate geographic concentration

There are two standard methods for measuring industry geographic concentration and tradability. The first measure, described in Ellison & Glaeser (1997), is:

Equation A.1   Geographic concentration by Ellison & Glaeser method

$$EG_i = \sum_p (s_{i,p} - x_p)^2 \text{ or } EG_i^{tradability} = \sum_p (s_{i,p} - IDS_p)^2$$

where i is industry and p is region.

This index compares a region's share of industry employment ($s_{i,p}$) with the region's share of aggregate employment (x_p) or industry demand share (IDS_p). When a region's employment share in an industry is greater than the region's share of aggregate employment ($s_{i,p} > x_p$)   of the region's industry demand share (($s_{i,p} > IDS_p$), the EG index will indicate a relatively different concentration pattern of employment in an industry compared to that of the aggregate employment and industry demand. The EG index takes a value from 0 (not concentrated) to positive infinity (highly concentrated).

The second measure of geographic concentration is based on a Gini coefficient approach:

Equation A.2   Geographic concentration by Gini coefficient method

$$Gini_i = 1 - \sum_p (\sigma Y_{i,p-1} + \sigma Y_{i,p}) * (\sigma X_{i,p} - \sigma X_{i,p-1}) \text{ or}$$

$$Gini_i^{tradability} = 1 - \sum_p (\sigma Y_{i,p-1} + \sigma Y_{i,p}) * (\sigma IDS_{i,p} - \sigma IDS_{i,p-1})$$

where i is industry and p is region (regions are sorted by the region's share of industry employment). $\sigma Y_{i,p}$ is the cumulative share of industry i in region p. $\sigma Y_{i,p-1}$ is the cumulative share of industry *i* employment in the region *p-1*, next lowest share of industry employment. $\sigma X_{i,p}$ is the cumulative share of total employment in region p, and $\sigma X_{i,p-1}$ is the cumulative share of total employment in the region p-1. For the tradability Gini equation, . $\sigma IDS_{i,p}$ is the cumulative share of industry demand share in region p, and $\sigma IDS_{i,p-1}$ is the cumulative share of industry demand share in the region p-1.

The gini coefficient measures the inequality between the distributions of industry employment and total employment or industry demand share. When the employment distribution of an industry is concentrated relative to that of aggregate employment and industry demand share, then the gini index will signal a relatively large inequality and the industry is classified as concentrated. The index values are from 0 (not concentrated) to 1 (highly concentrated).

In general, EG and gini concentrations return very similar results for both geographic concentration and tradability. The correlations between both measures in geographic concentration and tradability are highly positive, 0.92 and 0.87 respectively[22] (Figure A.1). For ease of exposition, the note focuses on Gini concentrations.

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[22] Correlation estimates are based on production weighted Pearson's linear correlation. Linear assumption may not be appropriate as scatterplots reveal a slight non-linear pattern. When results from Ellison & Glaser are transformed by taking the square root, the correlation becomes linear. In that case, Pearson's linear correlations are 0.96 and 0.94 for geographic concentration and tradability respectively.

Figure A.1   Comparison results between Ellison & Glaser and Gini coefficients: geographic concentration (left) and tradability (right)
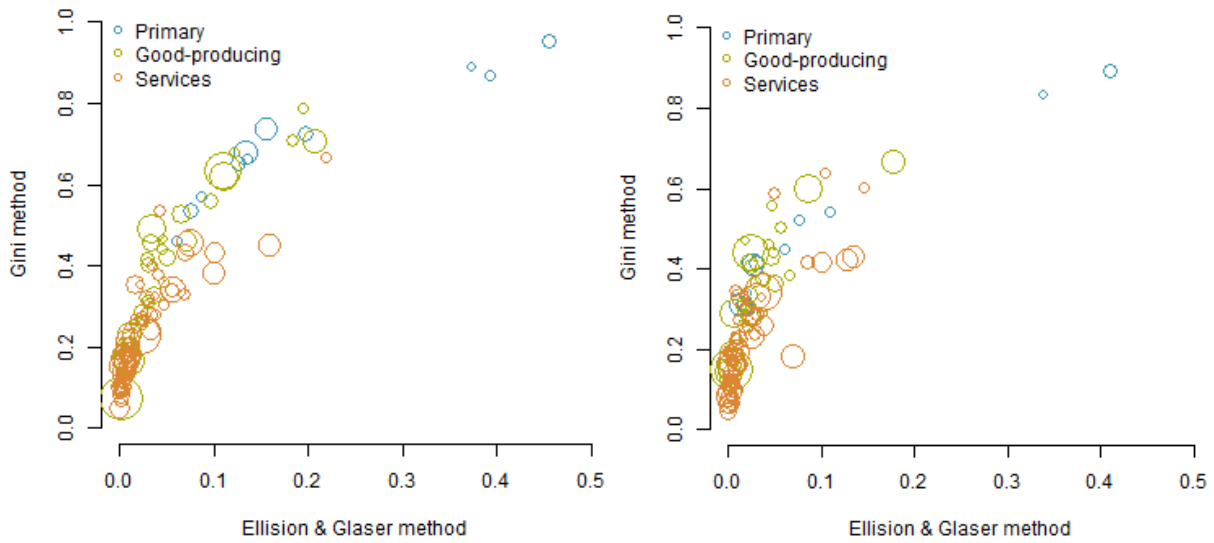
Source: Author's calculations using LBD.

Notes:

1. Each dot represents a unique NZSIOC industry.
2. Geographic concentration results are averaged concentration between 2000 and 2010.
3. Tradability results are derived from input-output table and LEED employments in 2007.

Appendix B   Labour market regions in New Zealand

Labour market regions in North Island

Northland East

Northland west

Greater Auckland

Thames Coromandel

Tauranga

North central North Island

Greater Hamilton

Taranaki Rural

Taranaki Urban

Gisborne - Opotiki

Napier - Hastings

Wanganui

Palmerston North

Hawkes Bay – Central North Island rural

Wellington urban

Horowhenua - Wairarapa

Labour market regions in South Island

Nelson – North of West Coast

Marlborough – North Canterbury

Greater Christchurch

South Westland – Rural South Canterbury

Central Otago - North and East Southland

Dunedin

Greater Invercargill and Steward Island

Source: labour market regions http://www.mera.co.nz/index.htm

Appendix C Tradability and exports

Table C.1   Detailed industries in domestic tradability and export intensity quadrants

	High domestic tradability	Medium domestic tradability	Low domestic tradability
High export share	**Primary sector:** Coal; oil and gas extraction Fishing and aquaculture Horticulture and fruit growing Poultry, deer and other livestock farming Metal ore and non-metallic mineral mining and quarrying Sheep, beef cattle and grain farming **Goods-producing sector:** Basic chemical and basic polymer manufacturing Dairy product manufacturing Electronic and electrical equipment manufacturing Fertiliser and pesticide manufacturing Meat and meat product manufacturing Petroleum and coal product manufacturing Pharmaceutical, cleaning and other chemical manufacturing Polymer product and rubber product manufacturing Primary metal and metal product manufacturing Pulp, paper and converted paper product manufacturing Seafood processing **Service sector:** Rail, Air and space, and other transport Warehousing and storage services	**Primary sector:** Agriculture, forestry and fishing support services Dairy cattle farming Forestry and logging **Goods-producing sector:** Clothing, knitted products and footwear manufacturing Fruit, oil, cereal and other food product manufacturing Machinery manufacturing Other manufacturing Textile and leather manufacturing Transport equipment manufacturing Wood product manufacturing **Services sector:** Accommodation Transport support services Travel agency and tour arrangement services	**Services sector:** Road transport
Medium export share	**Primary sector:** Exploration and other mining support services **Goods-producing sector:** Beverage and tobacco product manufacturing Electricity, gas and water supply **Services sector:** Banking and financing Other goods wholesaling Telecommunications services	**Goods-producing sector:** Furniture manufacturing Printing **Services sector:** Advertising, market research and management services Basic material wholesaling Broadcasting and internet publishing Building cleaning, pest control and other support services Computer system design and related services Employment and other administrative services Grocery, liquor and tobacco product wholesaling Machinery and equipment wholesaling Motion picture and sound recording activities Motor vehicle and motor vehicle parts wholesaling Scientific, architectural and engineering services Veterinary and other professional services	**Services sector:** Adult, community and other education Auxiliary finance and insurance services

	High domestic tradability	**Medium domestic tradability**	**Low domestic tradability**
Low export share	Service sector: Gambling activities Life and health and general insurance	Goods-producing sector: Non-metallic mineral product manufacturing Residential building construction Services sector: School and tertiary education Supermarket and grocery stores	Goods-producing sector: Construction services Heavy and civil engineering construction Non-residential building construction Services sector: Fuel retailing Furniture, electrical and hardware retailing Hospitals Medical and other health care services Motor vehicle and parts retailing Pharmaceutical and other store based retailing Preschool education Recreational, clothing, footwear and personal accessory retailing; department stores Rental, hiring and real estate services Residential care services and social assistance Specialised food retailing Sport and recreation activities

Source: Author's calculations using LBD and input-output table 2007.

Notes:

1.   This table is equivalent to Figure 11 and provides detailed industries within each domestic tradability and export intensity quadrant.

Appendix D Geographic concentration and domestic tradability

Table D.1   Geographic concentration and tradability by 3-digit NZSIOC industries

NZSIOC codes	NZSIOC industries	Geographic concentration (Gini), average 2000-2010	Domestic tradability (Gini), 2007
AA111	Horticulture and fruit growing	0.5348	0.4144
AA121	Sheep, beef cattle and grain farming	0.7362	0.4068
AA131	Dairy cattle farming	0.6801	0.3133
AA141	Poultry, deer and other livestock farming	0.4619	0.3379
AA211	Forestry and logging	0.7232	0.3013
AA311	Fishing and aquaculture	0.6639	0.4483
AA322	Agriculture, forestry and fishing support services	0.6513	0.3129
BB111	Coal mining	0.8905	0.8340
BB112	Oil and gas extraction	0.9514	0.8913
BB113	Metal ore and non-metallic mineral mining and quarrying	0.5710	0.5216
BB114	Exploration and other mining support services	0.8612	0.5425
CC111	Meat and meat product manufacturing	0.6171	0.5998
CC121	Seafood processing	0.7048	0.5028
CC131	Dairy product manufacturing	0.6347	0.4413
CC141	Fruit, oil, cereal and other food product manufacturing	0.2293	0.1914
CC151	Beverage and tobacco product manufacturing	0.4562	0.4179
CC211	Textile and leather manufacturing	0.4159	0.3058
CC212	Clothing, knitted products and footwear manufacturing	0.3092	0.3077
CC311	Wood product manufacturing	0.4600	0.2821
CC321	Pulp, paper and converted paper product manufacturing	0.5579	0.3709
CC411	Printing	0.2640	0.2209
CC511	Petroleum and coal product manufacturing	0.7051	0.6652
CC521	Basic chemical and basic polymer manufacturing	0.4389	0.4409
CC522	Fertiliser and pesticide manufacturing	0.6775	0.5586

CC523	Pharmaceutical, cleaning and other chemical manufacturing	0.3602	0.3853
CC531	Polymer product and rubber product manufacturing	0.3272	0.3652
CC611	Non-metallic mineral product manufacturing	0.2068	0.1849
CC711	Primary metal and metal product manufacturing	0.5263	0.4296
CC721	Fabricated metal product manufacturing	0.1806	0.1295
CC811	Transport equipment manufacturing	0.2854	0.2579
CC821	Electronic and electrical equipment manufacturing	0.4204	0.3373
CC822	Machinery manufacturing	0.2204	0.1692
CC911	Furniture manufacturing	0.2539	0.2908
CC912	Other manufacturing	0.2536	0.2881
DD111	Electricity generation and on-selling	0.4915	0.2892
DD112	Electricity transmission and distribution	0.3998	0.4034
DD113	Gas supply	0.7864	0.4614
DD121	Water supply	0.3153	0.3682
DD122	Sewerage and drainage services	0.4647	0.4709
DD123	Waste collection, treatment and disposal services	0.1750	0.1243
EE112	Residential building construction	0.1668	0.1611
EE113	Non-residential building construction	0.1575	0.1450
EE121	Heavy and civil engineering construction	0.1754	0.1409
EE131	Construction services	0.0722	0.1498
FF111	Basic material wholesaling	0.1398	0.1622
FF112	Machinery and equipment wholesaling	0.2435	0.2588
FF113	Motor vehicle and motor vehicle parts wholesaling	0.2227	0.2535
FF114	Grocery, liquor and tobacco product wholesaling	0.1875	0.2248
FF115	Other goods and commission based wholesaling	0.3800	0.4289
GH111	Motor vehicle and parts retailing	0.1261	0.1330
GH112	Fuel retailing	0.1543	0.1383
GH121	Supermarket and grocery stores	0.0932	0.1939
GH122	Specialised food retailing	0.1311	0.1130
GH131	Furniture, electrical and hardware retailing	0.0815	0.1045

GH132	Recreational, clothing, footwear and personal accessory retailing	0.0967	0.1341
GH133	Department stores	0.1309	0.1687
GH134	Other store based retailing; non-store and commission based retailing	0.0708	0.0637
GH211	Accommodation	0.2715	0.2873
GH212	Food and beverage services	0.0478	0.0643
II111	Road transport	0.1595	0.0935
II121	Rail transport	0.3246	0.3292
II122	Air and space transport	0.4019	0.6029
II123	Other transport	0.4321	0.4150
II131	Postal and courier pick up and delivery services	0.1789	0.0589
II132	Transport support services	0.3195	0.3006
II133	Warehousing and storage services	0.3508	0.3260
JJ111	Publishing (except internet and music publishing)	0.1842	0.1597
JJ112	Motion picture and sound recording activities	0.3049	0.1895
JJ113	Broadcasting and internet publishing	0.3287	0.2353
JJ121	Telecommunications services including internet service providers	0.4590	0.3315
JJ123	Library and other information services	0.1901	0.1799
KK111	Banking and financing; financial asset investing	0.2256	0.3389
KK121	Life insurance	0.6727	0.6389
KK122	Health and general insurance	0.3383	0.4164
KK131	Auxiliary finance and insurance services	0.2783	0.1152
LL111	Rental and hiring services (except real estate); non-financial asset leasing	0.1592	0.1143
LL121	Residential property operation	0.2156	0.1841
LL122	Non-residential property operation	0.1698	0.1665
LL123	Real estate services	0.1342	0.0450
MN111	Scientific, architectural and engineering services	0.1953	0.1957
MN112	Legal and accounting services	0.1005	0.0604
MN113	Advertising, market research and management services	0.3411	0.2312
MN114	Veterinary and other professional services	0.1981	0.1701

MN115	Computer system design and related services	0.4315	0.2772
MN211	Travel agency and tour arrangement services	0.2775	0.1701
MN212	Employment and other administrative services	0.2591	0.2241
MN213	Building cleaning, pest control and other support services	0.2098	0.2726
OO111	Local government administration	0.1536	0.1415
OO211	Central government administration and justice	0.4490	0.4222
OO212	Defence	0.5309	0.5848
OO213	Public order, safety and regulatory services	0.1645	0.1887
PP111	Preschool education	0.1685	0.1268
PP112	School education	0.1005	0.0984
PP113	Tertiary education	0.3499	0.3289
PP114	Adult, community and other education	0.1654	0.1147
QQ111	Hospitals	0.1516	0.1607
QQ112	Medical and other health care services	0.1353	0.0824
QQ113	Residential care services and social assistance	0.1181	0.1117
RS111	Heritage and artistic activities	0.2483	0.2249
RS112	Sport and recreation activities	0.1057	0.1000
RS113	Gambling activities	0.3772	0.3421
RS211	Repair and maintenance	0.0880	0.0840
RS212	Personal services; domestic household staff	0.0934	0.1274
RS213	Religious services; civil, professional and other interest groups	0.1756	0.1964

Source: Author's calculations using LBD and the input-output table 2007