Concentration, Specialisation and Agglomeration of firms in New Zealand

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Abstract

To what extent do New Zealand firms choose to locate close to each other, and why? This paper summarises patterns of geographic concentration of firms in New Zealand between 1987 and 2003. We present a range of summary measures of own-industry concentration, and examine between-industry colocation. Overall, New Zealand employment is relatively highly concentrated, although only around 30 percent of employment is in highly concentrated industries. Around 60 percent of employment is in industries that are spread more or less in proportion to total employment. Geographic concentration across 58 Labour Market Areas (LMAs) has increased over the past 18 years, although industries have become more dispersed within LMAs.

We find little evidence of a causal effect of geographic concentration of industries, or of diversity of local industry structure on employment growth or job flow rates. Rates of job creation, job destruction, and net employment growth are higher for industries that are more geographically concentrated, but the relationship disappears when we control for area and industry fixed effects. This suggests that it is not the concentration *per se* that is driving the high flows and employment growth, but other unobserved characteristics of areas and industries.

JEL classification
R12 - Size and Spatial Distributions of Regional Economic Activity;
R3 - Production Analysis and Firm Location

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Geographic concentration; agglomeration; business demography

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1 Introduction

Current New Zealand policy interest in 'sustainable cities', regional development, cluster development, and 'Regional Centres of Excellence' reflects an acceptance that local factors matter for firm performance. It is plausible that location is important for growth, innovation, and productivity, although determining how and why it matters is far more difficult. The existence of cities, and of geographically uneven patterns of activity can be seen as *prima facie* evidence that there are advantages to locating where others locate. In a recent survey of relevant theories of economic geography and agglomeration, Ottaviano and Thisse (2003) note that "peaks and troughs in the spatial distributions of population, employment and wealth are a universal phenomenon in search of a general theory".

The lack of such a general theory is particularly problematic for policy-makers, whose attempts to reinforce the benefits of agglomeration will be hampered by an inability to identify the nature of those benefits. In a separate review of agglomeration theories, with a particular emphasis on cities, Duranton and Puga (2003), summarise the challenges as follow:

> "different microeconomic mechanisms may be used to justify the existence of cities. These mechanisms generate final outcomes that are observationally equivalent in most (but not all) respects. This 'Marshallian' equivalence is partly good news in the sense that the concept of urban agglomeration economies is robust to many different specifications and microeconomic mechanisms. But this equivalence is also partly bad news because empirically identifying and separating these mechanisms becomes very difficult." [p. 40]

Rosenthal and Strange (2003) and Crawford (2004) summarise the empirical literature on the nature, sources and effects of agglomeration economies, which is similarly inconclusive. Both surveys document evidence for a wide range of potential mechanisms, and both point to the difficulties of linking empirical studies to specific agglomeration mechanisms.

The current paper is an initial study of patterns of agglomeration in New Zealand. It documents the extent of geographic agglomeration of employment,

identifies which industries are most geographically concentrated using summary measures that are now fairly standard in the international literature, and examines patterns of colocation of firms from different industries. Colocation measures are used to group industries, and as a basis for summarizing patterns. We use both boundary-based and distance based indicators of concentration to show different aspects of concentration patterns. Finally, we consider the relationship between industry concentration and measures of firm and employment turnover.

2 Measuring agglomeration

2.1 Concentration

As a starting point for our analysis of agglomeration patterns, we need a summary measure of own-industry agglomeration - the degree to which industry employment is geographically concentrated. The most commonly used indices in the recent economics literature are the area-based indices developed by Ellison and Glaeser (1994) and Maurel and Sedillot (1999), although other indices such as the 'relative locational Gini' are also widely reported. An alternative to the area-based measures is a distance-based measure such as that proposed by Duranton and Overman (2002), and discussed in section 2.1.2. In this section we will introduce the area-based measures and provide some guidance on interpretation.

Both Maurel and Sedillot (1999) (*MS*) and Ellison and Glaeser (1994) (*EG*) propose indices that arise from a statistical model as estimators of the correlation between location decisions of two firms. The presentation that follows is based closely on Maurel and Sedillot (1999).

2.1.1 Area-based measures – comparing the *MS* and *EG* measures

In the *MS* model, there are N plants in an industry, with industry employment shares $z_1 \ldots z_N$. These are located across M geographic areas, and $x_1 \ldots x_M$ are the area shares of total employment. The fraction of the industry's employment that is in area i is

$$s_i = \sum_{j=1}^{N} z_j u_{ji} \tag{1}$$

where $u_{ji} = 1$ if firm j locates in area i, and zero otherwise. The u_{ji} are non-independent binomial variables for which $P(u_{ji} = 1) = x_i$ so that firm location decisions are expected to aggregate to the observed distribution of total employment. The *MS* index of concentration (γ) is an estimate of the correlation of u_{ji} and u_{ki} for two firms, j and k. The probability that two firms j and k locate in the same area (*i) is:*

$$P(i,i) = E(u_{ji}, u_{ki}) = Cov(u_{ji}, u_{ki}) + E(u_{ji})E(u_{ki}) = \gamma x_i(1 - x_i) + x_i^2 \tag{2}$$

which suggests an estimator for γ of:

$$\hat{\gamma} = \frac{\hat{p} - \sum_i x_i^2}{1 - \sum_i x_i^2} \tag{3}$$

Maurel and Sedillot (1999) suggest a natural frequency-based estimator for $\hat{p}$, the probability that two firms from within the same industry locate together:[1]

$$\hat{p} = \frac{\sum_{\substack{j,k \in i \\ j \neq k}} z_j z_k}{\sum_{\substack{j,k \\ j \neq k}} z_j z_k} = \frac{\sum_i s_i^2 - \sum_j z_j^2}{1 - \sum_j z_j^2} = \frac{\sum_i s_i^2 - H}{1 - H} \tag{4}$$

where H is the familiar Herfindahl index of industrial (employment) concentration, being the sum of squared plant shares in industry employment. Substituting equation (4) into (3) yields the *MS* concentration index:

$$MS = \hat{\gamma} = \frac{\frac{\sum_i s_i^2 - \sum_i x_i^2}{1 - \sum_i x_i^2} - H}{1 - H} = \frac{G - H}{1 - H} \tag{5}$$

The adjustment for the Herfindahl index has a natural interpretation. An industry with a single plant will necessarily be located in a single location, even if the choice of location were totally random. We do not want to classify an industry as concentrated just because employment is concentrated in a small number of plants.

The *MS* index is closely related to the earlier *EG* index, the only difference being in the form of *G*, which Ellison and Glaeser (1994) derive based on an *a priori* reasoning. The formula for the *EG* index is

$$EG = \hat{\gamma}_{EG} = \frac{\dfrac{\sum_i (s_i - x_i)^2}{1 - \sum_i x_i^2} - H}{1 - H} = \frac{G_{EG} - H}{1 - H} \qquad (6)$$

Both indices are unbiased estimators of the correlation of u_{ji} and u_{ki}. The slight difference in formula can, however, lead to quite different inferences about whether an industry is geographically concentrated or not. The difference between the two indices reflects the difference between the terms $(s_i - x_i)^2$ in the numerator of G_{EG} and $(s_i^2 - x_i^2)$ from the numerator of *G*. The difference is $x_i(s_i - x_i)$, which is positive when the industry is over-represented in areas where total employment is concentrated, and negative when it is over-represented where the total employment share is small.

The G_{EG} measure is always positive, and can take on values from 0 to ∞. The *G* measure takes on values from -∞ to 1. The two measures are equivalent in the special case where total employment is uniformly distributed across locations ($x_i = 1/M$ for each area *i* where i=1,2, . . M; => $\Sigma x_i^2 = 1/M$). In this case, both measures lie in the [0,1] range. G=G_{EG}=0 when industry employment is also uniformly distributed (s_i=$1/M$ $\forall i$), and G=G_{EG}=1 when industry employment is concentrated within a single area. Apart from this special case, the two measures will differ.

When all of an industry's employment is concentrated in a single area, G equals 1. The value of the G_{EG} measure in this case depends also on the distribution of total employment (x_i). As noted above, when total employment is uniformly distributed, G_{EG} = G = 1. As total employment becomes concentrated in a single area,

[1] The Appendix to Maurel and Sedillot (1999) contains a more detailed derivation.

G_{EG} approaches ∞, with the exception that if industry and total employment are concentrated entirely within the *same* single area, $G_{EG} = 0$.[2]

When industry employment is uniformly distributed across areas, the value of *G* is equal to the value of the G_{EG} measure, but with opposite sign. In this case, if total employment is concentrated almost entirely within a single area, the measures take on extreme values. The G measure tends to -∞, whereas G_{EG} tends to ∞.

In practice, the feasible range of values for each of the measures will depend in large part on the baseline distribution of *total* employment (x_i). In much of the empirical analysis that follows, the degree of concentration of total employment across areas is not extreme. When all employment is in a single area, $\Sigma x_i^2 = 1$. For the period 1987-2003, employment in New Zealand is distributed across 58 Labour Market Areas in a way that generates values of Σx_i^2 between 0.083 and 0.093. With $\Sigma x_i^2 = 0.09$, *G* could potentially take on a minimum value of –0.08 when industry employment is uniformly distributed, and a maximum value of 1 when industry employment is concentrated in a single area. Similarly, G_{EG} would take on a minimum value of zero if an industry were distributed identically to total employment, would take a value of 0.08 if industry employment were uniformly distributed, and a maximum value of 1.20 if industry employment were concentrated entirely within an area where total employment was close to zero.[3] Actual values across all industries lie in the range (-0.06 , 0.82) for G and (0 , 0.75) for G_{EG}.

[2] Strictly speaking, it is not possible for total employment to be entirely concentrated in a single area while employment for a given industry is concentrated in a different area (since industry employment is included in total employment. However, for industries that are a small proportion of total employment, it is possible that 100% of industry employment is in an area where there is close to zero percent of total employment.

[3] The general formulae used for deriving the values in Table 1 are as follows: Let $\Sigma x_i^2 = k$, and the number of areas = *N*. When industry employment is uniformly distributed, $G = \left(1/N - k\right)/\left(1 - k\right)$ and $G = -G_{EG}$. When industry employment is concentrated in a single area, $G = 1$ and the value of G_{EG} depends on the proportion of total employment in that area, denoted x_j: $G_{EG} = \left(1 + k + 2x_j\right)/\left(1 - k\right)$. Bounds for G_{EG} are derived using $x_j = 0$ and $x_j = 0.21$, which are the minimum and maximum in our data.

Table 1 summarises the range of potential values of the two measures, and shows also, in the middle row, the potential values when total employment is distributed similarly to the way it is in our data, with $\Sigma x_i^2 = 0.09$.

Table 1 Possible values of Maurel-Sedillot (G) and Ellison-Glaeser (GEG) raw concentration indices

As shown in equations (5) and (6), the *MS* and *EG* indices adjust also for the degree of industry concentration (*H*). When $H = 0$, the *MS* and *EG* indices are equal to *G* and G_{EG} respectively. When *H* is positive, the potential range for *MS* is $(-\infty, 1)$ and G_{EG} can take on any value. In our data, the industry Herfindahl (*H*) ranges between zero and around 0.6. Observed values for *MS* are between –0.09 and 0.68, and for *EG* are between –0.27 and 0.68.

Some examples help to illustrate the nature of concentration that the different measures are capturing. Figure 1 shows hypothetical examples of industry distributions across four LMAs. The employment shares (x_i) of the LMAs are set to be roughly equivalent to the shares of employment across Auckland (40%), South Auckland (25%), Christchurch (20%) and Wellington (15%) LMAs. For ease of exposition, in the discussion that follows, *H* is assumed to be zero for all industries.

Figure 1 Concentration Indices for hypothetical industries

The rightmost bars show the distribution of total employment. If an industry were distributed proportionately to total employment, and thus had a profile identical to that shown by the rightmost bars, both the *EG* and *MS* indices would register zero concentration.

Industry C has the same set of area shares as total employment (40, 25, 20, 15) but it is distributed differently across the four LMAs. The *MS* index shows zero correlation between firms' location decisions, since the degree of 'bunching' (summarised by Σs_i^2) matches the degree of 'bunching' of total employment (summarised by Σx_i^2). In contrast, the *EG* records positive concentration, since in each location, the industry is either over-represented or under-represented. In each case, $(s_i - x_i)^2$ is positive. For the *MS* index, the relevant difference is whether the

profile of area shares is steeper or flatter than total employment. The *EG* index captures any deviations from proportional representation of the industry across areas. An implication of these differences is that, when the *EG* index is close to zero (with a profile like the total), the *MS* index will also be close to zero. However, the a zero value for *MS* does not necessarily imply a zero value of *EG*.

Industry B shows an extreme case of a steep shares profile – one in which all employment is in a single location, in this case Wellington. The *MS* index reaches its maximum of 1. The *MS* index would be the same no matter which area all the employment was in. The *EG* index reaches its maximum (in this case 1.38) because all employment is in the area with the smallest share of employment, thus maximising the deviation from proportional distribution. If all employment had been in Auckland rather than in Wellington, the difference between industry and total employment would have been smaller and the *EG* index would have been 0.68.

Finally, Industry A shows a uniform employment distribution. The profile is flatter than that of total employment, so the *MS* index is negative. The profile is different from that of total employment, so the *EG* index is positive. In fact, the value of the *MS* index is exactly the negative of the *EG* index.

In summary, the *MS* index indicates whether the profile of shares (s_i) for an industry is steeper than the profile of shares (x_i) for total employment. A steeper profile is represented by a positive index; a flatter profile by a negative index. In contrast, the *EG* index measures how well the profile of industry employment matches that of total employment, with both steeper and flatter profiles being represented by a positive index. The *EG* index can be negative only as a result of the influence of the Herfindahl index. G_{EG} is never negative.

Both *EG* and *MS* are measures of within-industry concentration patterns, and thus measure the extent to which firms or jobs in the same industry tend to locate together. The two indices, however, differ in the way that they reflect the extent to which firms choose their location to be near to other industries, or to large labour markets. The *MS* index is independent of the degree of between-industry colocation

or LMA size. The *EG* index, however, records greater concentration if within-industry colocation is greatest in LMAs where total employment is low, and thus measures *lower* concentration in the presence of between-industry or LMA size colocation. As already discussed, a high value of the *EG* index can equally reflect an industry that is highly concentrated in a few LMAs, or an industry that is uniformly distributed across LMAs. Overall, we will rely mostly the *MS* in our analyses, because of the independence of the measure to between industry and size colocation, [4] and because of its ability to distinguish uniform from highly peaked distributions.

Another commonly used measure of concentration is the 'relative locational Gini'. The Gini coefficient is a widely used summary measure of inequality. In this context, it measures the degree of inequality in the locational quotient (s_i/x_i). Thus, like the *EG* index, it is never negative, and reflects whether an industry is located in different areas than is employment as a whole. Figure 1 shows the value of the Gini for the hypothetical industries. The Gini coefficient is included in many of the summaries that follow, although it is included for information only, and is not a major focus of our analyses.

The different concentration measures all reflect different aspects of firm location patterns. No single measure should be relied on in isolation.

2.1.2 Distance-based measures

An alternative to the area-based indices discussed so far is to use distance between plants or jobs as the basis of a continuous measure. Examples of such an approach include Duranton and Overman (2002) and Marcon and Puech (2003). Extensive use of distance based measures is also made in the geography literature, using a variety of summary measures such as Moran's I index (Moran (1948)). We adopt the general approach of Duranton and Overman (2002), which analyses the distribution of bilateral distances between jobs or plants. More specifically, we use

[4] Between-industry colocation patterns are examined separately, using a separately calculated colocation index, described below.

their measures of 'local localisation and dispersion', with plant locations weighted by employment.

Using Duranton and Overman's notation, let e_i and e_j be the number of jobs at location i and j respectively, and let $D(i,j)$ be the straight-line distance between location i and location j. If there are n different locations, there are $n(n-1)/2$ unique bilateral distances. We calculate a frequency distribution for these distances, and summarise the density.

Define an indicator variable $\delta(i,j,d)$ that takes the value one when $D(i,j)=d$, and zero otherwise. The frequency at distance d is:

$$K(d) = \frac{\sum_{i=1}^{n}\sum_{j=i+1}^{n}\delta(i,j,d)e(i)e(j) + \sum_{i=1}^{n}\frac{\delta(i,i,d)e(i)\left(e(i)-1\right)}{2}}{\sum_{i=1}^{n}\sum_{j=i}^{n}e(i)e(j) + \sum_{i=1}^{n}\frac{e(i)\left(e(i)-1\right)}{2}}$$

This is slightly more complicated than Duranton and Overman's equation 2 because, unlike Duranton and Overman, we include zero distances. They exclude from their frequency distribution instances where $i=j$ because they do not want their summary measure to be influenced by large plants. Unfortunately, we do not observe the exact locations of plants, although we do observe location at a fairly detailed (meshblock) level. A number of plants can thus be observed in the same location and we wish to count distances between nearby plants in the distance density, even though they are observed at zero distance.

The resulting frequency distributions are calculated for total employment as well as for each 2-digit and 4-digit industry, and for groupings of industries as described in the following section.

Each frequency distribution $K(d)$ is smoothed using kernel density methods. We use the same smoothing method as used by Duranton and Overman (2002), which makes use of a Gaussian kernel, with bandwidth set by Silverman's rule of thumb.

Bootstrap standard errors are estimated from the 'total employment' distance density. In order to judge whether a specific industry's distance density differs significantly from the total density, we sample with replacement from the total population of jobs, and calculate a distance density from the selected sample. The size of the sample is chosen to equal the number of jobs in the industry.

In practice, the derived bootstrap standard errors were approximate. We carried out 50 replications, each with a sample of 50,000. Approximate 95 percent confidence intervals at each distance were estimated as 1.96 times the standard deviation of the densities at that distance. This single set of distance-specific standard errors was then scaled for each industry, to reflect the employment in that industry. If s^2 is an estimate of the variance for the population, the standard error for a sample of size n (denoted s*(n)*) is $s/\sqrt{n}$. Having obtained s*(50,000)*, we can derive the standard error for an industry with employment E as s*(E) = s(50,000)** $\sqrt{50{,}000}/\sqrt{E}$. This approach gave confidence intervals that were extremely close to confidence intervals using 250 replications and separately drawn replications, at least for a selection of 2-digit industries. Our approach thus yields bands that are similar to Duranton and Overman's 'local confidence' bands.[5]

2.2 Colocation

In order to gauge the strength of between-industry colocation patterns, we use a colocation correlation index γ_{co}, defined for each pair of industries. This index is derived by applying the Maurel and Sedillot framework to provide an estimate of the correlation of location decisions between two firms from different industries (rather than between two firms within the same industry). With this change, equation (4) now takes the following form:

[5] Duranton and Overman take a more rigorous approach. They take 1,000 replications, and calculate error bounds based on 5th and 95th quantiles of the resulting distribution. They also calculate 'global confidence bounds', defined so that only 5 percent of densities lie outside the bounds *at some distance* (rather than 5 percent lying outside the band at a given distance. As we do not consider global confidence bounds, all references to confidence bounds, localisation, and dispersion refer to Duranton and Overman's *local* versions.

$$\hat{p} = \frac{\sum_{j,k \in i} z_j z_k}{\sum_{j,k} z_j z_k} = \sum_i s_i^m s_i^n \qquad (7)$$

where firm *j* belongs to industry *m*, firm *k* belongs to industry *n*, and s_i^w is the share of industry *w* employment that is in area *i*. This implies a a colocation index γ_{co} of

$$\gamma_{co}(m,n) = \frac{\sum_i s_i^m s_i^n - \sum_i x_i^2}{1 - \sum_i x_i^2} \qquad (8)$$

This index, like the G measure, potentially takes on values from -∞ to 1. The index attains a value of zero when both industries are identically distributed proportionately to total employment, is highest (=1) when the two industries are located together in a single location, and is lowest (most negative) when the two industries are never located in the same location. Given an observed value of roughly Σx_i^2 = 0.09, the colocation index could potentially lie in the range (-0.099 , 1).

2.2.1 Grouping based on colocation patterns

Collecting together these indices for each pair of industries, we can form a matrix of pairwise colocation indices. This matrix can be used to group industries that tend to locate together. We apply a standard statistical clustering procedure to derive a hierarchical clustering of industries.[6] To do this, we first transform the correlation matrix into a matrix of dissimilarity or distance measures by subtracting each entry from 1. We use this distance matrix as the basis for the statistical clustering.

The resulting industry groups will each contain industries with similar location patterns, and prove to be a useful way of separating high and low concentration industries. The size of the groups can also reveal the quantitative importance of different patterns of concentration. Finally, the groups are a convenient

[6] We applied Ward's method, using unsquared distances. The analysis was undertaken using the SAS Proc Cluster procedure.

way of condensing findings for 4-digit industries in a way that can be easily summarised.

2.3 Inferring agglomeration mechanisms from concentration patterns

The indices that we use summarise the extent to which firms choose to locate together. Firms choose to locate together whenever agglomerative forces are stronger than dispersion forces. One of the key motivations for the work reported in this paper is to learn about the nature of the agglomerative forces that operate in New Zealand, particularly to assist policy-makers considering proposals to encourage further agglomeration. As noted in the introduction, many different agglomerative forces can produce observationally equivalent patterns of concentration. Describing concentration patterns alone therefore cannot identify which mechanisms are operating.

Following Marshall (1920), which contains a highly influential discussion of agglomeration effects, agglomeration economies are often discussed under the three headings of 'input-output linkages', 'labour market interactions', and 'knowledge spillovers'.

Perhaps the most mundane of these effects are under the heading of input-output linkages. These effects can lead two firms to locate together without necessarily leading to wider agglomeration. A firm may choose to locate close to another that provides inputs for its production, or close to another firm or final consumer that uses its outputs. For this type of mechanism to generate agglomeration effects across a broader set of industries, additional mechanisms are needed.

Duranton and Puga (2003) review the microfoundations of urban agglomeration economies, and group the additional mechanisms under the headings of 'sharing', 'matching', and 'learning'. For instance, a firm's choice to locate near input sources is more likely to generate agglomeration if the input is to some extent indivisible, and is shared by other firms. Examples might include shared use of transport infrastructure, shared climate conditions for primary production, or access to a shared mineral resource (such factors may be referred to as natural advantages). Similar sharing may occur for outputs as well as inputs. For instance, access to a marketplace has long been recognised as one cause of agglomerations.

There may be advantages stemming from scale of activity, in the form of better matching of firms producing intermediate inputs and the users of those inputs, or matching of firms producing final goods and the consumers of those goods. The thickness of the market *per se* is what supports better matching, reducing search times and hold-ups, and facilitating specialisation, in the sense emphasised by Smith (1776). The improved matching that is facilitated by agglomeration is one of the key aspects of Marshall's 'labour market interactions', although the mechanism may apply to a much broader range of inputs and outputs than labour alone.

Finally, learning may occur more productively in an agglomerated area, and there may be spillover benefits from locating where the number and variety of

interactions is large. There are many ways that learning and knowledge spillovers may occur. There is much discussion in the literature about the relative strengths of spillovers between firms undertaking related activities (referred to as localisation, producing Marshall-Arrow-Romer externalities[7]) and spillovers between firms undertaking a diverse range of activities (termed urbanisation, producing Jacobs-type[8] externalities).

3 Data[9]

The data used in this study are taken from Statistics New Zealand's (SNZ) business demography datasets, and provide annual longitudinal data on the majority of New Zealand businesses from 1987 to 2003, measured as at February each year. The target population for these datasets is 'all New Zealand businesses', although, as outlined below, there are some exclusions and variations over time in coverage. The business demography dataset is updated in February each year as an annual snap-shot from the SNZ Business Frame at that point in time.

From 1987 to 1994, the data are taken from the SNZ Business Directory, and from 1994 to 2003, they are from the SNZ Business Frame.

The data are collected from a combination of survey and administrative sources – primarily the SNZ Annual Business Frame Update Survey (ABFU[10]) which has been conducted in mid-February each year, since 1987, and the Inland Revenue

[7] See Henderson (2003) for a useful discussion.
[8] The benefits of locating in a diverse location were emphasised by Jacobs (1969), who noted that new and productive combinations of diverse ideas were a strong force for innovation and growth.
[9] This section draws on Carroll et al (2002) and Statistics New Zealand (2004).
[10] The ABFU survey is administered to all businesses except farm type agriculture enterprises, and those with no employees that are not part of a group of enterprises. Prior to 1997 the survey was called the Annual Business Directory Update Survey. The response rate to the ABFU survey is about 90% overall, but higher for larger firms. In the case of non-response, the BF carries forward the last known survey details. There are approximately 100,000 smaller enterprises, which are not covered by the ABFU. In addition, enterprises that indicate to the IRD that they have no paid employees have their data for working proprietors estimated from the data provided to the IRD. The ABFU collects a variety of information, including number of employees, overseas ownership and activities, location, and main activity.

Department's (IRD) Client Registration File, which is the universe of GST registered enterprises.[11]

Data are available for business units (called activity units until 1996, and geographic units thereafter), and for enterprises. A business unit relates to a particular business site and an enterprise may contain several business units. Two sets of industry coding are available for each business unit. The primary industry code relates to the main activity of the business unit. Where a business unit provides ancillary services to other units in the same enterprise or group of enterprise, the ancillary industry code indicates the predominant activity of the units to which the services are provided. In this study, industry classification is based on the ancillary industry code, which is the classification that Statistics New Zealand uses for its published Business Demography analyses. In this paper, we deal exclusively with business units and not enterprises. We will refer to business units as 'firms' for the remainder of this paper.

The criteria for including firms changed during the period of our study, although the following requirements were in force throughout:

- The firm was located in NZ; and
- The firm's industry was in-scope[12]. Both the ancillary (if applicable) and primary industry had to be in scope; and
- The industry of the enterprise to which the firm belonged had to be in-scope.

[11] GST is a broad-based sales tax, introduced on 1 October 1986 at the rate of 10%, and increased on 1 July 1989 to 12.5%. The few GST-exempt industries include banking and financial services, superannuation and life insurance and residential property leasing and rental. Businesses must register for GST, and therefore be added to the IRD client registration file, if they are conducting a taxable activity and their annual turnover has exceeded, or is expected to exceed, $40,000 (this was increased from $30,000 as of 1 October 2000). The Client Registration File currently includes 530,000 enterprises. For GST-exempt financial services enterprises, SNZ supplements the Client Registration File data using various sources, including association lists, financial reports, and a list of superannuation (pension) schemes from the Government Actuary. In addition, in order to ensure appropriate timing of firm births and deaths Statistics New Zealand uses a variety of other sources including its own surveys and media reports to identify businesses for entry onto and exit from the business frame.

[12] The set of industries for which data are available varies from year to year, as a result of imposed coverage restrictions. An in-scope industry is one that is not excluded by industry coverage rules. See below for further details of coverage rules and changes.

In addition there were administrative rules in place that related to the timing of information in the SNZ database. Firms administratively 'birthed' during February of the year in question were excluded, firms that ceased or were administratively "killed" during February of the year in question were included, and (until 1996) the firm had a data confirm date no later than 1 January of the year in question. All GST-registered enterprises recorded on the IRD's client registration file are continually monitored to determine if they meet the 'economic significance' criteria described below. In addition, non-employing enterprises are monitored using PAYE tax information to see if and when they begin to employ staff. When firms or enterprises register for GST they are added (or 'birthed') onto the Business Frame, and are given a new reference number.[13] In practice, the selection criteria tend to be applied liberally, and the business frame continues to monitor a number of firms that fail to satisfy the criteria of economical significance. Where firms or enterprises are sold, merged, or liquidated this will result in them de-registering for GST. A non-employing enterprise is removed from the business frame once it deregisters for GST or files 12 months of consecutive zero GST returns.

A major change in the data is the shift from GST-registration to economic significance, which occurred in 1994. From 1987 to 1994, firms were included only if they belonged to a GST-registered enterprise (i.e. with GST sales of at least $30,000). From 1994 the firm was included only if it belonged to an 'economically significant' enterprise, where an enterprise was regarded as economically significant if it met any one of the following criteria:

[13] According to recent work carried out by SNZ as part of the LEED (Linked Employer-Employee Data) initiative, "Births on the [Business Frame] that later turn out to be changes of ownership of geographic units already on the frame average approximately 15 percent of enterprise births per month" Seyb (2003), p. 14.

- Greater than $30,000 annual GST expenses or sales;[14]
- More than 2 full-time equivalent paid employees;
- In a GST-exempt industry except residential property leasing and rental; or
- Part of a group of enterprises.

The economic significance definition thus excludes enterprises employing 2 or fewer FTE employees that were previously included, but adds in smaller enterprises that were in a GST exempt industry or were part of a group. The net effect was to decrease the number of enterprises.

The industry coverage of the business demography data has changed over time. [15] The primary exclusion from the BDS is firms in agricultural production industries. Until 1996 the industry selection criteria were based on the New Zealand Standard Industrial Classification (NZSIC); while from 1997 onwards the Australian and New Zealand SIC (ANZSIC) was used. We rely on ANZSIC codes for our analysis, even though these are derived from NZSIC codes prior to 1997, and accepting the caveat in Statistics New Zealand (2004) that the quality of industry coding will therefore be poorer in earlier years.

Appendix Table 1 summarises the changing industry coverage restrictions throughout the period of the study. Our central analyses in the paper will be restricted to industries that are within coverage throughout the 1987 to 2003 period. Only in 1998, when industry coverage was expanded to include agriculture,

[14] The annual GST limit was set at $30,000 from 1994, and increased to $40,000 in October 2000 (IRD: GST Guide – November 2000). In practice SNZ uses a GST 'buffer zone' of $35,000 – $45,000 in order to limit the extent of movements in- and out-of the BF because of the $40,000 GST criteria: GST sales must exceed $45,000 before being included, and fall below $35,000 before being dropped. From 2001, enterprises were also included if their GST registration was compulsory, special or forced, which means that the business is expected to exceed the $30,000 boundary. In 1994 enterprises satisfying both criteria were included, enabling a comparison of the sample frames for this year.

[15] Between 1994 and 2001, the excluded industries were as follows: Agriculture and livestock production (NZSIC 11111-11199 in 1994-96; ANZSIC 01110-01699 in 1997, 1999-2001); Residential property leasing and rental (NZSIC 83121), Commercial property and leasing (NZSIC 83123), Child care services (NZSIC 93402), Residential and non-residential services (NZSIC 93403), and Business, professional and labour organisations (NZSIC 93500) in 1994-95; and Religious organisations (NZSIC 93910), Social and community groups (NZSIC 93990), and Sporting and recreational services (NZSIC 94402) in 1994-96.

does this restriction cause a loss of more than 5 percent of (full-time equivalent) total employment. Appendix Table 2 summarises the impact on employment in each year of restricting industry coverage to continually covered industries.

We measure employment in full-time equivalents, giving part-time employment half the weight of full-time employment. Working proprietors are included in this count of labour input.

The locations of firms are recorded at the level of meshblocks, which provide a very disaggregated level of geographical detail. Meshblocks range in size from city blocks to large areas of rural land. For distance-based analyses, we use 1991 meshblocks, with the location of each meshblock fixed at its geographic centroid. This introduces some noise in the distance measure, although for around 75 percent of meshblocks, the maximum error is under 1 kilometre. Many of the larger meshblocks have few or no residents, so that over 91% of the population lives in meshblocks where their true location is within 1 kilometre of the centroid.

For many of our analyses, we look at the distribution of employment across larger areas, which are obtained by aggregating meshblocks. Our main analyses group employment into 58 labour market areas (LMAs), as defined by Newell and Papps (2001) on the basis of commuting patterns.[16] We also test the sensitivity of our results to the use of smaller geographic areas, in the form of Census Area Units. Figure 2 provides a map of LMAs. A little over half of all employment is accounted for by the four largest LMAs, which contain the three largest metropolitan areas. In 2003, Auckland and South Auckland, in the upper North Island, accounted for around 21 percent and 14 percent of employment respectively. Christchurch, on the East coast of the South Island, accounted for 11 percent, and Wellington, the capital city, located at the bottom of the North Island, accounted for 9 percent. Of the remaining LMAs, the two largest abut metropolitan areas. Hamilton, just south of South Auckland, and Hutt

[16] Newell and Papps (2001) define two sets of labour market areas – one with 140 areas and one with 58. We have chosen to use the more aggregated areas.

Valley, East of Wellington, account for 5 percent and 3 percent of employment respectively.

There are 12 LMAs that contain smaller centres, each accounting for between 1 and 3 percent of employment (Dunedin, Tauranga, Palmerston Nth, Nelson, Invercargill, Rotorua, Hastings, New Plymouth, Whangarei, Napier, Waimate, Wanganui) and the remaining 40 LMAs each account for less than 1 percent of total employment.

Figure 2: Map of Labour Market Areas

3.1 Analysis subsamples

The primary sample for analysis is for 2003, and reflects location patterns in mid-February. There are 424 4-digit industries represented in the 2003 data. Our analyses use information on all 424 industries, although industry-specific information in tables is suppressed for 38 industries, in order to protect confidentiality. Analyses based on 2-digit industries use 2003 information on 51 2-digit industries, although information for 3 of these industries is suppressed from tables.

Where we examine trends over time, we restrict attention to industries that were included in the Business Demography dataset continuously from 1998 to 2003. Of the 448 4-digit industries that are represented in the data in at least one period, 41 are dropped because they are out of coverage in some periods, leaving 407 industries represented in the time series analyses. Fifty-one 2-digit industries are represented in the 'minimum coverage' data, but any component 4-digit industries with discontinuous coverage are omitted from the 2-digit counts. Table 2 summarises the number of industries and the impact of suppression.

Table 2: Number of industries included

3.1.1 Business Demography data as a time series.

As noted above, the business demography data have not been collected on a consistent basis for the entire period covered by this study. In particular, the change of scope from GST-registered enterprises to 'economically significant' enterprises,

which occurred in 1994, will have led to a decline in measured employment and the measured number of business units. To gauge the severity of the discontinuity, we examined the time pattern of employment and the number of business units – in total and disaggregated by industry, firm-size, and region. The results are summarised in Appendix Table 3, all of which restrict industry coverage to those industries that were continuously covered throughout the period ("minimum coverage"). The table presents information on the number of business units as well as on full-time equivalent employment. It shows shares for 1994, measured under the old and new definitions. It also shows percentage changes in the two years before the series break and in the two years after the series break, and the difference between the two 1994 counts.

In aggregate, the change in definition caused a 10 percent decline in the number of business units covered, and a 1 percent decline in measured FTE employment. Although the levels dropped, the changes prior to and following the change were generally quite similar, with 7 to 10 percent growth in the number of business units and around 5 percent growth in FTE employment. The change was fairly uniform across one digit industries, with only finance and insurance showing more units and employment under the new definitions than under the old. Shares across industries changed only slightly. As would be expected, the changes were more noticeable across the firm-size distribution, with the declines resulting from definitional change being confined to small (0-5 FTE) firms. Perhaps most importantly for our study, the geographic impact of the definitional change appears remarkably uniform, with almost all regions sharing in the declines.

Overall, the series break in 1994 had a much smaller effect on employment than on the number of business units, and as expected most of the effect was to remove small business units. Given that most of our analyses are employment-weighted, the impact is likely to be small. Furthermore, it appears that the geographic and industry impact of the changes were widespread, so that the discontinuities in the sort of indices that we are looking at will be minor. One exception would be the Herfindahl indices, which would be higher after the definitional change – the removal

of small firms will increase estimated industrial concentration. While we will be cautious in interpreting any changes around 1994, we consider that pooled analysis is still justified.

4 New Zealand Patterns

This section summarises overall levels of concentration in New Zealand, and variation across industries in the degree of concentration. The summary measures described in section 2 (*EG*, *MS*, Gini) are examined for each industry. We have calculated them separately for two-digit industries and for four-digit industries, and have measured location at the level of Labour Market Areas as well as the much smaller Census Area Units.

The first section summarises the degree and composition of concentration in 2003, comparing findings with those from selected international studies. Section 4.1 then examines which industries are the most and least concentrated. In section 4.3, we examine which industries locate together, as an indication of possible sources of agglomeration effects. Finally, in section 4.4 we consider the geographic scope of concentration, using distance-based indicators of localisation developed by Duranton and Overman (2002). In section 4.4, we examine trends in concentration from 1987 to 2003.

4.1 The degree and composition of Concentration

Figure 3 shows the density and cumulative distribution of the *MS* and *EG* indices, based on 4-digit industries and LMAs.[17] The cumulative distribution is weighted by employment, and thus shows the proportion of employment that is in industries with concentration below each level. The *EG* index distribution is more concentrated at levels close to zero. In contrast, the *MS* index registers more negative values, as would be expected based on the discussion in Section 2, but also has a

[17] The graph is based on information from 386 industries for which no information has been suppressed. The suppressed industries, on average, have relatively high *MS* and *EG* index values. A visually similar pattern is observed for concentration of 2-digit industries across LMAs.

longer right tail. The cumulative distributions cross at around 0.015 – a value below which around 60% of employment falls. The distribution is skewed to the right. The employment-weighted *MS* (*EG*) index has a mean value of 0.028 (0.025) and a median value of 0.005 (0.008).

Larger industries tend to have lower index values, so the *unweighted MS* (*EG*) distribution has a higher mean of 0.056 (0.028) and median 0.020 (0.016), but still displays similar skewness. There are several small industries that have extreme values of the concentration indices. This makes the unweighted averages sensitive to inclusion or exclusion of particular industries. For this reason, we prefer to rely on the employment-weighted indices.

Figure 3 Distribution of concentration indices
4-digit industries; Labour Market Areas

The means and medians of the various concentration indices are summarised in Table 3, for different combinations of industry and area definitions. The upper panel of the table shows indices weighted by employment, whereas the lower panel shows them unweighted. The '4-digit manufacturing' measures are based on manufacturing data only – the 'total employment' shares (x_i) in equations (5) and (6) refer to shares of manufacturing employment. All other New Zealand indices shown use the distribution of total employment as the benchmark distribution.

Table 3 Summary of Concentration Indices: Mean [Median] – 2003

The level of aggregation, either of industry or of area, clearly makes a difference to the size of the indices. Both the *MS* and *EG* indices show greater concentration across LMAs than across Area Units, and greater concentration of 4-digit than of 2-digit industries.

The employment weighting generally lowers estimated concentration, reflecting the fact that larger industries tend to have lower concentration. The exception to this is the concentration of 4-digit manufacturing industries across LMAs, for which weighting by employment raises mean and median concentration estimates. The reason appears to be that there are a number of relatively large

primary-sector-related manufacturing industries that have high *EG* indices (and negative *MS* indices).[18] Weighting by employment emphasises these industries, and raises the average. It also magnifies the difference between the *MS* and *EG* indices. In addition, there are a number of small industries that have high levels of industrial concentration (Herfindahl index), and which consequently have low or negative values of *EG*. Weighting by employment reduces the effect that these industries have in lowering mean and median *EG* values.

4.1.1 How does New Zealand compare?

International comparisons of area-based indices such as the *MS* and *EG* indices are, at best, imperfect, given the impossibility of using directly comparable area definitions. For instance, given New Zealand's relatively low geographic density of economic activity, it is not possible to match both on the size of geographic areas and on employment numbers. A number of studies have, nevertheless, compared indices across different countries. The most common approach is to compare unweighted averages of indices for 4-digit industries. This is the statistic that is available from the greatest range of studies, including those for the US, UK, and France, as presented in Ellison and Glaeser (1994) Devereux et al.

(2004) and Maurel and Sedillot (1999) respectively.[19]

The sensitivity of the New Zealand measures to weighting makes it more difficult to draw firm conclusions about whether New Zealand employment is more or less concentrated than that of other countries. As already noted, we believe that the employment-weighted average indices provide a more reliable and robust basis for comparison, as they are not as sensitive to extreme values for small industries.

[18] The industries are: C2111 Meat Processing, C2129 Dairy Product Manufacturing nec, C2311 Log Sawmilling, C2173 Seafood Processing, C2130 Fruit and Vegetable Processing.

[19] Maurel and Sedillot (1999) calculate indices of concentration for 273 4-digit industries across 95 geographic Departments. The comparisons from Devereux et al (2004) use concentration of 211 4-digit industries across 113 postcode areas. Ellison and Glaeser (1994) use concentration of 459 4-digit manufacturing industries across 51 areas (50 States plus the District of Columbia). Our use of 137 4-digit industries across 58 LMAs gives around 8,000 industry*area cells, which is smaller than the 23,000 to 26,000 in the other studies. Nevertheless, because of New Zealand's relatively low size (firm and employment count), the average number of plants per cell is lower in New Zealand.

Weighting does not appear to be as important a consideration for countries other than New Zealand, which gives us some confidence in comparing weighted New Zealand measures with unweighted measures from other countries. Table 3 shows the employment-weighted average value of the *EG* index for the US, calculated from the data provided in Ellison and Glaeser (1994). The weighted *EG* for United States manufacturing is 0.045, as compared with 0.051 unweighted.

Devereux et al. (2004) calculate both *MS* and *EG* indices, and find that the two indices are almost identical. This is clearly not the case in New Zealand if we use unweighted indices, but is true if we apply employment weights.

Overall, although the comparisons are cloudy, it appears that New Zealand manufacturing has a relatively high level of geographic concentration (*EG*=*MS*=0.045)– similar to that of the United States (*EG*=0.045 weighted and 0.051 unweighted). The level is also similar to that of France (unweighted *MS* of 0.06), and above the 0.033 found for both *EG* and *MS* for the UK.

The strongest evidence against this conclusion is the relatively low unweighted *EG* measure for New Zealand (0.036). This appears to be a consequence of the high degree of industrial concentration, as measured by the plant Herfindahl index.[20] The impact of this can be seen in Table 3. The unweighted mean value of the Herfindahl index is 0.108 for 4-digit manufacturing industries. This is a relatively high value for this index.[21] One implication of the high Herfindahls in manufacturing is that it leads to a large number of negative values for the *EG* index. (Recall that a negative value of *EG* is possible only when the Herfindahl index exceeds raw geographic concentration G_{EG}). In the New Zealand data, the *EG* index is negative in 53 of 137 manufacturing industries (39%), whereas in the US data, the index is negative in only 11 out of 459 industries (2.4%).

[20] Note that high Herfindahl values also lower the *MS* index. The impact is not, however, as readily apparent because the *MS* index can be negative for other reasons.

[21] The comparable figure for the US, from Ellison and Glaeser (1994) is 0.028. The maximum Herfindahl shown for the US is 0.223, a value exceed by over 15% of New Zealand 4-digit manufacturing industries.

A more detailed examination of the differences between the US and New Zealand patterns is contained in Table 4, which shows average concentration for each 2-digit manufacturing industry in New Zealand and the United States, both weighted and unweighted.[22] Weighting has a more significant effect on the New Zealand measures, with a particularly pronounced effect for the Food, Beverage and Tobacco industry group. This group accounts for 26 percent of manufacturing employment in New Zealand, and only 8 percent in the US. Furthermore, weighting the component 4-digit industries changes the estimated *EG* index from a small negative value (-0.006) to a moderately large positive value (0.055). As noted above, New Zealand industries have relatively high industry (plant) Herfindahl indices. New Zealand 4-digit manufacturing industries have industrial concentration that is, on average, around 3 times that of US industries. The impact of the employment weighting is to give less weight to highly (industrially-) concentrated small industries in New Zealand.

Table 4 also shows the US measures for total manufacturing, reweighted to show what they would have been if the US had had the same distribution of employment across 2-digit industries. The differences are small, confirming that the low unweighted measure for New Zealand are due to the influence of small 4-digit industries within New Zealand 2-digit groups rather than to compositional differences between the countries.

Table 4 Comparison of US and NZ Manufacturing patterns

In Table 5, we present correlations between the different measures, again using various combinations of industry and location detail. The correlations are all based on unweighted measures. The fourth panel shows correlations for the manufacturing industries and shows a negative correlation between the Herfindahl and the *EG* index, and a low correlation between *EG* and *MS*. A similar, though much

[22] The US measures are calculated from the data provided in Ellison and Glaeser (1994). The linking of 2-digit industries is based on the US SIC coding, as shown in U.S. Census Bureau (2000), pp 428ff.

less dramatic, relationship is also evident for 4-digit industries generally (35% of which are the manufacturing industries).

More generally, the correlation between the *MS* and *EG* measures is highest (0.97) when examining 2-digit industries across Area Units. Moving to LMAs, or to 4-digit industries lowers the correlation. The difference between the two measures is greatest for the very case which we used for international comparisons – 4-digit manufacturing industries across LMAs.

The influence of industrial concentration (*H*=industry Herfindahl) can be seen clearly by comparing correlations between the *G* and G_{EG} measures, which are around 90 percent, with the correlations between the *MS* and *EG* measures, which differ from *G* and G_{EG} respectively solely as a result of *H*. The correlation between *MS* and *EG* is a statistically insignificant 0.45 when calculated for 4-digit industries across LMAs, and an insignificant 0.09 for 4-digit manufacturing industries across LMAs.

Table 5 Correlation between Concentration measures – 2003

Another commonly used way of comparing variation in concentration across industries is to group index values into ranges. Following Ellison and Glaeser (1994), the customary, although somewhat arbitrary, groupings are into low (below 0.02); moderate (0.02 – 0.05) and high (above 0.05) levels of concentration. In Table 6, we show the distribution of index values across these ranges, with the 'low' group being further split to isolate negative index values. As noted before, weighting by employment tends to give more weight to industries with low or negative indices, with the exception of the *EG* index for manufacturing, where greater weight is given to primary-sector-related industries with high values of *EG*.

The weighted measures for New Zealand suggest a greater prevalence of industries with either very high or very low concentration. Thirty-four percent of New Zealand employment is in industries with *EG* greater than 0.05, compared with only 28 percent for the US, and only 16 (unweighted) for the UK. Low-concentration industries, with *EG* less than 0.02, account for 52 percent of New Zealand

employment, compared with 44 percent in the US. Using the *MS* index, New Zealand has 41 percent of employment in high-concentration industries, and 50 percent in low- or negative-concentration industries. This compares with (unweighted) 27 percent high and 50 percent low in France.

Table 6 Degree of Concentration of 4-digit Industries Across Labour Market Areas – 2003

4.1.2 Specialisation of areas

This section presents a related analysis of concentration, focused on the labour market areas rather than on industries. The degree to which industries are concentrated across LMAs is obviously related to the diversity of industrial structure within LMAs. However, as shown by Aiginger and Davies (2000) for European countries, concentration of industries and specialisation of locations can sometimes move in different directions.

Table 7 lists average levels of specialisation for each LMA. These measures capture the potential for between-industry agglomeration effects (urbanisation). This contrasts with the industry-level indices presented above, which are measures of own-industry agglomeration (localisation). The area specialisation indices are constructed analogously to those for concentration but with the role of industry and location reversed. Thus, we can use equations in the form of equations (5) and (6), but with i representing industry, s_i denoting the share of area employment accounted for by industry i, and x_i denoting the share of national employment accounted for by industry i. A high value of the indices indicates that employment in the LMA is 'concentrated' across industries. We will refer to this as "area specialisation". For the *MS* index, a high index means that the profile of industry shares of LMA employment is steeper than that of industry shares nationally, and reaches a maximum of one when the area contains only one industry. For the *EG* index, a high index indicates that industry shares deviate from the national profile, although under-representation and over-representation of an industry affect the index identically. The Herfindahl index here measures the extent to which LMA employment (rather than industry employment) is dominated by a few plants.

The larger LMAs of South Auckland, Christchurch and Hutt Valley are also the most diversified LMAs, with (*MS*) specialisation of –0.001 or –0.002. Auckland, which is the largest LMA, has (*MS*) specialisation of 0.001, suggesting that it is only slightly more industrially specialised than is the economy as a whole, reflecting Auckland's relative specialisation in business services. Overall, there is a negative correlation of -0.42 between LMA specialisation (LMA *MS*) and log employment. Eight LMAs have specialisation measures above 0.02 and all have employment less than 9,000, compared with an average LMA size of 26,000 and a median of 8,000. None of the 23 LMAs with employment greater than 10,000 have specialisation index values greater than 0.011, whereas 11 of the 35 smaller LMAs do. Agglomeration explanations that emphasise industry diversity within a location will be hard to distinguish from those that are based on the effects of the size alone.

Although larger LMAs tend to have lower specialisation, Wellington is a clear exception. It has relatively high (*MS*) specialisation of 0.01, reflecting its specialisation in central government administration, finance and insurance. The most specialised LMA is MacKenzie, a tourism-dominated area in the lower South Island, which has around 40 percent of its employment in cafés, restaurants and accommodation. Many of the other areas with a high degree of specialisation are smaller LMAs with a disproportionately large share of employment in services to agriculture, food manufacturing, tourism, or forestry and logging.

Table 7 LMA Specialisation across 4-digit industries – 2003

4.2 Which industries are concentrated?

So far, we have been concerned with summarising overall patterns of concentration, without much attention to the identification of which industries are most concentrated. Knowing which industries are concentrated is the first step in building a picture of what sort of factors might be behind geographic concentration, and may give us some clues about the mechanisms. Mining industries for instance are likely to be concentrated just because mineral resources are unevenly spread.

Concentration of financial services industries could reflect a broader range of different agglomeration effects.

4.2.1 Concentration of 2-digit industries

Although most of the following analysis is based on 4-digit industries, Table 8 shows the average concentration of each 2-digit industry in 2003, to provide an overview of concentration patterns. The row labelled 'suppressed' is an average of the measures for suppressed industries (calculated as the employment-weighted average for those industries). The suppressed industries are, on average, highly concentrated, both geographically and industrially.

Table 8 Concentration of 2-digit Industries across LMAs – 2003

The bold cells are those where the level of concentration is high (*EG* or *MS* index is greater than 0.05). The table is sorted in descending order of the *MS*. The nine most concentrated industries are tertiary-sector[23] industries in Wholesale Trade (ANZSIC group F), Transport and Storage (I), Finance and Insurance (K), Property and Business Services, or Cultural and Recreational Services (P). They are relatively highly concentrated according to both the *MS* and *EG* indices.

There are five 2-digit industries that are highly concentrated according to the *EG* index but not according to the *MS* index. These are in the 'Agriculture, Forestry and Fishing' or 'Mining' groups (ANZSIC groups A and B). This arises because those industries are overrepresented in LMAs where the share of total employment (x_i) is low (similar to industry A in Figure 1).

The patterns for resource-based and primary-sector-related industries are not surprising. Their location reflects access to resources and their profile is therefore not expected to resemble that of total employment. For other concentrated industries shown in Table 8, there is still a range of possible explanations for their concentration – forward and backward linkages, sharing, matching and knowledge spillovers.

[23] Primary sector refers to ANZSIC groups A and B. Secondary refers to ANZSIC groups C, D and E. Remaining industries are Tertiary industries.

The industries for which employment is distributed most like total employment can be identified as those with *EG* close to zero. These are construction trade services, personal and household good retailing, food retailing, and education. All of these industries offer localised services, and it is therefore not surprising that they are dispersed in proportion to overall activity.

4.2.2 Concentration of 4-digit industries

The concentration measures for two 2-digit industries may mask concentrated 4-digit industries. A 2-digit industry may appear highly dispersed even though each of its component sub-industries is concentrated in different LMAs. Alternatively, average concentration within a 2-digit industry may be an average of some highly concentrated and some highly dispersed 4-digit components.

Table 9 shows the proportion of employment within each 2-digit industry that is in low, moderate, and high density 4-digit industries.

Table 9 Concentration of 4-digit industries across LMAs (grouped by 2-digit group) – 2003

For many industries, concentration at the 2-digit industry reflects concentration of all 4-digit sub-industries (in some cases simply because there is only one 4-digit industry within the 2-digit industry). In most, however, the degree of concentration is not uniform. Air and Space Transport, for instance, is the fourth most concentrated industry in Table 9, according to the *MS* index. Over half of employment is, however, in a 4-digit industry that has a low level of concentration. In this case, the 2-digit industry contains three 4-digit industries – 'Scheduled International Air Transport', 'Scheduled Domestic Air Transport', and 'Non-Scheduled Air and Space Transport'. Of these, the first contains around 47 percent of employment and is sufficiently highly concentrated to give a high value of the *MS* index for the entire 2-digit industry, even though the other component industries have low concentration.

Similarly, industry C22 (Textile, clothing, footwear, and leather manufacturing) has a low-to moderate level of concentration at the 2-digit level

(*MS*=0.008), even though it contains several highly concentrated 4-digit industries such as 'synthetic fibre textile manufacturing' (*MS*=0472), footwear manufacturing (*MS*=0.303) and `textile finishing' (*MS*=0.168). Basic Material Wholesaling (*MS*=0.004) is a further example of a 2-digit industry whose measured concentration conceals some highly concentrated sub-industries – 'Cereal Grain wholesaling' (*MS*=0.122), `chemical wholesaling' (*MS*=0.105) and `petroleum product wholesaling' (*MS*=0.098); as well as some very dispersed industries – 'timber wholesaling' (*MS*=0.013), `wool wholesaling' (*MS*=0.008), and 'Farm Produce and Supplies wholesaling' (*MS*=-0.046).

Table 10 lists the 20 4-digit industries with the highest values of the *MS* concentration index, and the 20 with the lowest values. The list reflects some of the patterns that were evident for 2-digit industries in Table 8, but also contains a number of concentrated 4-digit manufacturing industries, whose concentration was not evident in the 2-digit table. This emphasises the limitations of examining concentration using too aggregated an industry breakdown.

Large negative values of *MS* occur for several land-based and primary-sector-related industries. For some of these, the *EG* index is large and positive, indicating that these industries are more evenly distributed across areas than is total employment, and in a way that differs markedly from total employment.

Table 10 Most and Least Concentrated 4-digit industries across LMAs - 2003

Table 11 presents a list of 4-digit industries whose employment is geographically spread roughly in proportion with total employment. These are identified as those industries with an *EG* index close to zero. There are 36 4-digit industries with a value of the *EG* index between -0.001 and 0.001. The industries are predominantly those related to the delivery of local goods and services and retail industries.

Table 11 Most Dispersed 4-digit industries across LMAs (EG ≈ 0) – 2003

The industries identified as highly concentrated in New Zealand overlap with those found to be concentrated elsewhere, although a full comparison is not possible since we consider a wider range of industries than most other studies. Devereux et al. (2004) note that extractive industries are found to be highly concentrated in both the UK, similar to the Maurel and Sedillot (1999) findings for France. Textile industries are also found to be highly concentrated in the UK, France, and US. Ellison and Glaeser (1999) find that low wage levels account for the concentration of textile industries in the US – a finding supported by Devereux et al. (2004) for the UK using information on skill mix. In New Zealand, the textile industry includes some highly concentrated components (2212 Synthetic fibre textile) as well as some that appear to be dispersed according to the *MS* index but moderately concentrated according to the *EG* index (2214 Wool textile). We have not examined the role of local wage levels in these patterns.

Devereux et al. (2004) point to the low concentration of high-tech industries, and note that this pattern casts some doubt on the importance of knowledge spillovers. In New Zealand, high tech industries[24] account for a little less than 10,000 full time equivalent employment, and appear to be highly concentrated, both industrially (Herf=0.14) and geographically (*MS*=0.07), although the *EG* index shows only moderate concentration (*EG*=0.03)

4.2.3 Other groupings of 4-digit industries

Although it is convenient for presentational purposes to group 4-digit industries according to their 'parent' 2-digit industry, as was done in Table 9, or by industry sector (primary, secondary, or tertiary) there are other meaningful ways to group 4-digit industries. In the following section, we group 4-digit industries that have common location patterns, as measured by a colocation index.

[24] We have used an employment-weighted average of 4-digit industries that matches as closely as possible the list in Devereux et al (2004). The industries are: C2849: Electronic Equipment Manufacturing nec, C2842: Telecommun/Broadcast/Transceive Equip Mf, C2841: Computer/Business Machine Manufacturing, C2824: Aircraft Manufacturing, C2549: Chemical Product Manufacturing nec, C2543: Medicinal & Pharmaceutical Product Mfg.

4.3 Which industries locate together in 2003?

Patterns of colocation across industries can be informative about the nature and causes of agglomeration. Knowing which industries locate together can provide clues about what shared interests the industries have. Previous studies have generally chosen a particular candidate link between industries, and then tested whether colocation occurs between linked industries. For instance, Ellison and Glaeser (1994, (1997) consider the correlation in locational patterns between 4-digit industries that are part of the same 2-digit industry group. Industry groupings are somewhat arbitrary, but can probably be seen as a proxy for some commonality of outputs. Ellison and Glaeser (1994, p. 26) find that "spillovers are nearly as strong across 4-digit industries in the same 3-digit industry as within the 4-digit industries themselves only in about 20% of the cases" but are hesitant to label the causes of colocation of 4-digit industries. Their approach of grouping by broader industry categorisation has been followed in a number of subsequent papers.

Other studies have focused on flows of goods and services between industries, often identified by reference to input-output tables (eg: Alonso-Villar et al. (2002), Porter (2003), Holmes (1999)). Other alternatives include looking at colocation of firms that share a common science base (Feldman and Audretsch (1999)) or that use similar types of labour input (Audretsch and Feldman (1996).

In our study, we take an approach less structured by prior hypotheses. Instead, we look for evidence of colocation between pairs of 4-digit industries, and from those patterns, we can begin to identify candidate explanations.[25] We use the colocation correlation index γ_{co} shown in equation (8) to derive an estimate for the

[25] This approach differs from many 'cluster analysis' studies, that look for similarity of identified covariates across geographic space.

correlation between each pair of industries. We calculate $\gamma_{co}(m,n)$ for each pair, using information on 424 industries present in the 2003 data. We thus calculate 89,676 (=424*423/2) colocation correlations and use these as the basis for grouping 4-digit industries into groups, as outlined in section 2.2.1.

The number of groups is chosen by the researcher. I have chosen eight groups, which fairly reflects the main patterns in the data.[26] Roughly 30 percent of employment is in industry groups that have high geographic concentration. Around 60 percent is in industries with low levels of concentration (*MS* around zero), and around 7 percent is in resource-based industries, which have a high *EG* index but which are very dispersed according to the *MS* index. The balance of employment (4 percent) is in four small clusters, which have been grouped together for presentational purposes, and to maintain confidentiality.

Table 12 Colocation Groupings – 2003

Table 12 shows the number of industries, number of geographic units, employment shares, and employment weighted averages for Herfindahl, *MS* and *EG* indices for each group. The groups are listed in descending order of concentration, as measured by the *MS* index. The titles given to the groups are indicative, and while providing a useful shorthand, they do not convey the broad range of industries that are included in each group. A full listing of 4-digit industries in each group appears as Appendix Table 4.

Note that the concentration indices shown in Table 12 represent the correlation between two jobs in the same colocation group, in the same way that the industry-specific indices represented the correlation between two jobs within the same industry. The indices thus capture both industry-specific concentration, and

[26] Expanding the number of groups results in the splitting of the 'Concentrated Manufacturing' group into two subgroups, and the splitting of the 'Wholesale' group into two components. Reducing the number of groups leads to the merging of the 'Local Manufacturing' and 'Local Services' groups, and merging of the 'Business Services' and 'Wholesaling' groups. Although using different methods of cluster analysis results in some industries being assigned to different clusters, the overall sizes and nature of clusters is fairly robust to different methods.

cross-industry colocation, which is the extent to which different industries in the same colocation group tend to locate together. We examine these components separately below.

The largest group is the *Local Services* group, containing 101 4-digit industries. It has concentration measures close to zero, and accounts for 45 percent of all employment. Table 13 shows the composition of each colocation group in terms of 1-digit industry groupings. About half of employment in the *Local Services* group is accounted for by Retail Trade, Health and Community Services, and Education, although 14 of the 17 1-digit industry groups are represented. The industries generally provide local goods and services, and are distributed fairly well in proportion to total employment. It seems likely that proximity to output markets is an important factor in location decisions for these industries, although there may be other interactions as well.

A further 18 percent of employment is in another group of 81 low-concentration industries grouped under the heading of *Local Manufacturing*. Manufacturing, Retail Trade, and Construction account for around half of employment for this group. It also has 14 percent of its employment in Wholesale Trade industries, mainly for wholesaling of consumer goods. Proximity to local input and output markets seems to be a plausible explanation for the location patterns of industries in this group as well.

Table 13 Colocation Groupings – composition by 1-digit industry – 2003

Geographic concentration is high for three groups that together account for 29 percent of employment. The most concentrated group (*MS*=0.147) is the *Concentrated Manufacturing* group of 65 industries, which is dominated by Manufacturing industries and accounts for 6 percent of FTE employment. The industries in this group tend to be producers of heavier goods that may benefit from proximity to shared (transport) infrastructure or concentrated input suppliers, or industries for which economies of scale are important.

The *Wholesaling* group is the second most concentrated group (*MS*=0.140), also accounting for 6 percent of total employment, and containing 49 4-digit industries. Wholesale Trade employment accounts for 43% of employment in this group. Wholesale Trade industries in this group tend to deal with wholesaling of heavier goods or manufacturing inputs, in contrast to the consumer good wholesaling that appears in the *Local Manufacturing* group. We hypothesise that proximity to infrastructure and customers, especially those in the *Concentrated Manufacturing* group, and economies of scale are likely to be importance determinants of agglomeration for industries in this group.

The *Business Services* Group is the largest of the high-concentration groups, with *MS=0.093*. It accounts for 17% of total employment and contains 52 4-digit industries. Two thirds of this group's employment is in Property and Business Services and Finance Insurance industries. This is the group that, (speculatively at least) is most likely to be influenced by agglomeration forces such as knowledge spillovers.

Just over 7% of employment is in a *Resource-based* group of 42 industries, which have a negative *MS* index (*MS=-0.071)* and high levels of concentration according to the *EG* index (*EG*=0.068). As noted already these are industries in which employment is distributed more evenly across LMAs than is total employment, and is disproportionately in LMAs where the share of total employment is low. Common reliance on land and land-based resources would appear to be an important cause of agglomeration for these industries.

The final grouping contains 34 4-digit industries under the heading of *Other*. It is a pooling of 4 separate colocation groups identified by the statistical clustering procedure. It is dominated by employment in Government Administration and Defence, which accounts for 60 percent of its employment.

Overall, this approach to grouping industries on the basis of colocation suggests a number of subsets of industries, between which the likely sources of agglomeration forces may differ. The other major advantage of such a grouping is

that it provides a convenient basis for summarising industry patterns. It provides a more appropriate basis for grouping industries if we wish to identify differences in geographic concentration patterns. Table 14 shows the proportions of employment in low, medium, and high concentration 4-digit industries, for three types of grouping – colocation groups, one-digit industry, and industry sector (primary, secondary, tertiary). The colocation groupings provide a clearer separation of industries into groups that are relatively homogeneous in their degree of concentration. Although not shown in the table, a similar degree of own-industry heterogeneity is evident for 2-digit and 3-digit industries as well.

Table 14 Groupings of 4-digit industries – 2003

Because the colocation groupings have been chosen to maximise similarities in location patterns, we would expect that between-industry colocation correlation to be relatively strong. In Table 15, we show three concentration measures for each colocation group. The first is an indication of the strength of within-industry concentration for each group. This is the employment weighted mean of the industry-specific *MS* indices for all of the 4-digit industries within the group. The second shows the strength of between-industry colocation. The measure is the employment weighted mean of the colocation[27] index for all pairs of industries. For a group with *n* industries, the mean is over *n(n-1)/2* elements. The final column repeats the value of the group *MS* index, as shown in Table 12.

Table 15 Within- and between- industry concentration for colocation groups – 2003

For the most concentrated groups, between-industry concentration is slightly greater than within-industry concentration, suggesting that agglomeration effects may be operating between the industries within each group, as well as within industries. For the other groups, the within, between, and total concentration measures are very similar. The only exception is the *Other* group, for which between-

[27] Each observation is for a pair of industries. The weight used for employment weighting is the geometric mean of employment in the two industries.

industry concentration is relatively weak. This is not surprising given that this group is an amalgam of four separate groups, merged solely for presentational purposes.

Table 16 shows the strength of between-industry concentration across colocation groups. The measures are thus an indication of the correlation in location decisions between two jobs, chosen one from each of two different colocation groups. The measures on the diagonal should be stronger than the off-diagonals, since that is what the cluster procedure is designed to achieve. While this is true, the off-diagonal measures do suggest reasonably strong patterns of colocation between the *Concentrated Manufacturing*, *Wholesaling*, and *Business Services* groups, all of which are themselves highly concentrated. The resource-based group shows negative colocation with all of the other groups.

Table 16 Strength of colocation for colocation groups – 2003

4.3.1 Where does agglomeration occur?

Differences in measured concentration between the industry groups reflect the fact that the groups are concentrated in different LMAs rather than that the degree of concentration differs proportionately.

As an indication of the sort of areas that each colocation group tends to locate in, Table 17 shows, for each colocation group, the average degree of LMA specialisation, weighted according to which LMAs contain that group's employment. It also shows the weighted mean LMA size, and the weighted mean locational quotient. The locational quotient is a measure of how over-represented a particular industry is in an LMA.[28]

It is clear from the table that the most agglomerated groups are located, on average, in larger LMAs – with mean LMA employment of 180,000 to 220,000. In

[28] The formula for the locational quotient is $LQ = E_{ij}E \Big/ E_i E_j = \left(E_{ij} \Big/ E_j \right) \Big/ \left(E_i \Big/ E \right)$, where i denotes industry and j denotes LMA. LQ is thus the ratio of the industry's share of LMA employment, to the industry's share of national employment. A value greater than one implies that the industry is over-represented in the LMA.

contrast, *Resource-based* industries on average locate in smaller LMAs, with a mean size of only 114,000. The LMAs in which they tend to locate are also less industrially specialised. As noted earlier, there is a negative correlation between LMA size and specialisation, so these two patterns are not necessarily independent.

A comparison of the *Concentrated Manufacturing* and *Business Services* groups is, however, suggestive. Although the *Business Services* industries tend to locate in larger LMAs than do the *Concentrated Manufacturing* industries, the areas that they locate in have greater specialisation. At the risk of over-interpreting the modest differences, it may be that industry diversity is more important for the *Concentrated Manufacturing* industries, consistent with Jacobs-type agglomeration effects. *Business Services* may benefit more from being located with a narrower range of industries. Presumably this captures the concentration of *Business Services* industries in the main metropolitan areas of Auckland and Wellington. Wellington has a relatively high degree of specialisation (LMA *MS*=0.010), largely because of specialisation in government administration as well as finance industries. Auckland's specialisation is much less pronounced, and is in Business Services, Finance, and Wholesaling.

Table 17 Average Area characteristics - by colocation group – 2003

A more complete picture of where the various colocation groups locate can be seen in Figure 4. The most noticeably differences in concentration are due to differences in the shares of employment in Auckland, South Auckland, and Wellington. Figure 4 shows, for the seven colocation groups, the distribution of employment across LMAs, and compares this with the aggregate employment distribution. [29] Recall that differences between these two distributions determine the raw concentration indices (G and G_{EG}), and thus do not reflect differences in Herfindahl index values that contribute to the *MS* and *EG* indices. The *EG* index is

[29] The graphs reflect the information displayed in Figure 1 for an illustrative example. The data used in the graphs excludes some industry by LMA cells that were suppressed to protect confidentiality, and will therefore understate the proportion of employment in smaller LMAs. Overall, 2.5% of FTE employment is suppressed.

larger where industry employment is distributed differently from the aggregate, whereas the *MS* index is larger where the size profile across LMAs is steeper.

Each panel of Figure 4 contains three sets of information. LMAs are sorted according to their share of total employment, with the largest LMA (Auckland) at the left. The solid line is the same in each panel, and shows the share of total employment in each LMA. The vertical bars show the shares of *group* employment in each LMA. Finally, the dotted lines display the same information as is in the vertical bars, but resorted according to employment shares. The left-most point on the dotted line is thus aligned with the Auckland LMA but refers not necessarily to Auckland's share, but to the share accounted for by the LMA in which the group is most concentrated. This re-sorted line shows clearly whether the size profile of group employment is more or less steep than that of total employment, and thus illustrates the patterns behind the *MS* index. Information for 27 LMAs that each contain less than 0.5 percent of total employment are pooled into a single item at the right of the graph. Collectively, they contain 7 percent of total employment.

The *Concentrated Manufacturing* group, and to a lesser extent the *Wholesaling* and *Local Manufacturing* groups, is concentrated in South Auckland. The *MS* index for the *Concentrated Manufacturing* group is high, due largely to the fact that over 40% of employment is in the dominant LMA. The *EG* index is the highest of any of the groups, in large part because the dominant LMA is one in which only 15 percent of total employment is located. The difference between 40 percent and 15 percent makes a large contribution to the *EG* index.

The *Wholesaling* group is concentrated in Auckland and South Auckland, with almost 40 percent of its employment in Auckland and 20 percent in South Auckland. The *Business Services* group has a similar degree of concentration, but is disproportionately concentrated in Auckland (36 percent) and Wellington (16 percent), with proportionately little employment in South Auckland.

For the *Other* group, around 30% of group employment is in Wellington, compared with only 10% of total employment. The *EG* index for the *Other* group is

large because employment is concentrated in an LMA where there is a relatively small proportion of total employment.

The *Local Services* and *Local Manufacturing* groups have size profiles and employment distributions that are very similar to that of total employment. The only visual difference is that *Local Services* is slightly under-represented in South Auckland, whereas *Local Manufacturing* is slightly over-represented. Both the *EG* and *MS* indices take values close to zero.

For the *Resource-based* group, the employment distribution, as shown by the vertical bars, differs noticeably from the total distribution, leading to a high *EG* index. As is evident from the dotted line, the group size profile is considerably less steep that that of total employment, which generates a negative *MS* index.

Figure 4 Distribution of Group Employment across Labour Market Areas – 2003

4.4 Trends: 1987-2003

Figure 5 shows the trends in the geographic concentration of New Zealand 4-digit industries across LMAs, for the 1987 to 2003 period. The measures shown are the Maurel-Sedillot index (*MS*), the Ellison-Glaeser index (*EG*), and the Relative locational Gini (Gini). Also shown is the industry Herfindahl, which captures the degree to which industry employment is dominated by a few business sites.

The annual observations are calculated separately from each year of data. Industry coverage is restricted to firms in 4-digit industries that are within coverage throughout the period (See Appendix Table 1). The 2003 figures do not therefore match those in earlier tables. Industry-specific concentration indices are weighted by full-time equivalent employment to generate annual averages. Concentration indices for some small industries are volatile, and can take on extremely high and low values. Using unweighted averages leads to a high degree of noise in the year-to-year changes.

Figure 5 Trends in Concentration: 4-digit industries; Labour Market Areas – 2003

There has been a general rise in concentration over the 1987 to 2003 period. The rise has predominantly been due to an increase in the degree of concentration within industries rather than as a result of more concentrated industries increasing their shares of employment. Holding employment shares constant, within-industry increases in concentration accounted for 50 to 100 percent of the observed change, depending on whether initial or final shares are used. Changes in employment shares had a smaller impact, although generally also positive.[30] There is a negative correlation between changes in shares and changes in concentration – industries that increased employment most during the period also tended to experience lower than average concentration growth.

Figure 6 and Figure 7 provide further insight into the change in average concentration, by showing changes separately by colocation group. Figure 6 shows the change in employment shares. The two service-dominated groups, *Local Services* and *Business Services* both showed an increase in employment shares. Recall, however, that the former has a low level of concentration whereas the latter has a high level. The contribution of these share increases to average concentration is therefore ambiguous. Similarly, both *Concentrated Manufacturing* and *Local Manufacturing* groups saw their employment shares decline. The *Resource-based* group also declined as a proportion of total employment. Recall that the *Resource-based* group is highly concentrated according to the *EG* measure, but is highly dispersed according to the *MS* measure. The impact of the declining share on average concentration is therefore negative for the *EG* index but positive for *MS*.

Figure 6: Trends in employment shares 1987-2003
colocation groups of 4-digit industries; Labour Market Areas

Figure 7 shows the trends in average concentration for each of the colocation groups. Panel (a) shows *MS* concentration and panel (b) shows *EG* concentration. The general pattern, most clearly seen in the top panel, is that concentrated groups have shown the greatest increases in concentration. *Concentrated*

[30] The exception is the decomposition of the *EG* index, when share-changes are weighted by final-period concentration. In this case, the contribution of changing shares is small and negative.

Manufacturing, *Wholesaling*, and *Business Services* all had moderate increases in average concentration whereas the *Local Manufacturing* and *Resource-based* groups experienced declines.[31] In the case of the *Resource-based* group, this represented an increasing dispersion, which shows up in the lower panel as a trend increase in concentration according to the *EG* index.

Figure 7: Trends in concentration 1987-2003
colocation groups of 4-digit industries; Labour Market Areas

The pattern of concentration change is somewhat different if we look at concentration across smaller geographic areas, such as Area Units. Examining 4-digit industries across Area Units would require suppression of many cells, in order to protect confidentiality. We therefore look at Area Unit-based patterns for a more aggregated (2-digit) grouping of industries. The top panel of Figure 8 repeats the analysis shown in the previous figure, to confirm that the LMA-based patterns using 2-digit industries are similar to those using 4-digit industries.

Figure 8 Trends in Concentration of 2-digit industries

Panel b of Figure 8 shows the same analysis using Area Units instead of LMAs as the definition of geographic area. All of the geographic and industrial concentration measures show declines through most of the period. The implication of the two levels of geographic aggregation together is that although industries are becoming more concentrated within labour market areas, they are becoming more dispersed across area units within labour market areas.

Figure 9 shows trends in specialisation of geographic areas (as opposed to concentration of industries). The top panel shows concentration patterns for LMAs, based on each area's mix of 2-digit industries (the patterns for 4-digit industries are similar). The lower panel shows the trends for specialisation of area units.

Figure 9 Industrial Specialisation of Labour Market Areas and Area Units

[31] The marked fluctuations in the *EG* index for the *Wholesaling* group reflects changes in industrial concentration (industry Herfindahl) for one moderately sized industry in this group.

On average, LMAs became significantly more specialised over the 1988 to 2003 period, and the *MS* and *EG* indices show almost identical levels and changes.[32] The pattern of change across the various LMAs is not, however, uniform. Some LMAs increased in specialisation whereas others became more diversified. Increased specialisation in Auckland and Wellington make strong contributions to the average increase over the period, due to a combination of a large employment share and a moderately large increase in specialisation. Specialisation of area units also increased over the period.

4.5 Geographic scope of concentration

All of the analysis so far has been based on boundaried areas – either LMAs or Area Units. Although using commuting-based LMAs reduces the arbitrariness of the boundaries, the indices draw no distinction between concentrations in two contiguous areas and two areas that are distant from each other. Concentration in contiguous areas arguably provides greater evidence of agglomeration. An alternative approach is to measure concentration on the basis of geographic distance, as was done by Duranton and Overman (2002).

As noted in section 2.1.2, the essence of the approach is to measure the bilateral distance between each pair of jobs and then examine the proportion of pairs that occur at each distance. Distances range between zero and 1468km, with a mean distance of 405km and a median distance of 360km. Figure 10 shows a portion of the density of bilateral distances for all job pairs – for distances between zero and 500km.[33] The most striking feature of the density is the concentration of mass between 0 and 20 km – a pattern also found by Duranton and Overman (2002) using UK data. There are other local peaks in the density, reflecting distances between employment centres.

The peak around 480km reflects the distance between Wellington and Auckland. A 310km peak reflects the approximate distance between Wellington and

[32] A similar pattern is observed using 4-digit industries as the basis of measuring specialisation.

Christchurch and between Christchurch and Dunedin. A 250km peak reflects a number of city-pairs (Auckland-New Plymouth; Wellington-New Plymouth; Wellington-Napier; Christchurch-Nelson; Whangarei-Hamilton; Whangarei-Tauranga; Tauranga-New Plymouth). A 110km peak reflects the approximate distance between Auckland and Hamilton and between Wellington and Palmerston North.

Figure 10 Total Distance Density (with bootstrap standard errors) – 2003

Figure 10 also shows approximate 95% confidence intervals for the density, based on the bootstrap procedure described earlier. The top panel of Figure 10 shows the upper and lower bounds for an industry with FTE employment of 100 and the lower panel shows bounds for an industry of 1,000. The middle bold line is the actual density. Upper and lower bounds are calculated at each kilometre, and are calculated in two ways. First, the bounds are calculated as 1.96 times the estimated bootstrap standard error. Second, they are calculated as the 2.5^{th} and 97.5^{th} percentiles of the bootstrap replications.[34] The upper bounds are extremely close using the two methods. There is a slight difference in the lower bounds for the smaller (FTE=100) case, since the actual density is bounded below at zero and the lower bounds estimated from bootstrap standard errors are negative in many cases.

Comparing the upper and lower panels of Figure 10 reveals that, even for small to moderate sized industries, the confidence band is relatively narrow. Only about 3% of 4-digit industries are smaller than 100, and thus have bands wider than those shown in the upper panel. Seventy-six percent of the 374 4-digit industries examined have employment greater than 1,000, and thus have bands narrower than those shown in the lower panel.

In order to investigate the variation in distance densities between industry groups, we focus our attention on distances between 0 and 150 km, and we smooth

[33] Thirty-one percent of the density lies at distances greater than 500km.
[34] Because there are only 50 replications, these percentiles are interpolated values between the second and third extreme values.

densities using kernel density smoothing. We focus attention on a limited geographic range because of our interest in interaction-related agglomeration, and in patterns of concentration within rather than between settled areas. Duranton and Overman (2002) focus on a range of 180 km, which is the median distance in their dataset. Our choice of range is more restrictive, as only 27 percent of bilateral distances are between zero and 150km.

Figure 11 shows the distance densities for each colocation group separately. Each density is thus the density of distances between pairs of jobs within the same colocation group, and captures within and between industry job-pairs.[35] Each panel of Figure 11 contains three series. The two dotted lines indicate the upper and lower bounds of the 95 percent confidence interval for the aggregate density, for a sample of jobs equal to the number of jobs in the relevant colocation group. Given that the colocation groups are all reasonably large (the smallest, *Wholesaling*, has employment of almost 90,000), the confidence bands are very narrow, and the two dotted lines appear almost as one line. The dark solid line shows the distance density for the relevant colocation group.

The first panel of Figure 11 shows the distance density for the most concentrated group – *Concentrated Manufacturing*. The group density lies well above the confidence interval for distances below 50 km, indicating significant localisation over these distances, reaching a peak at around 10km.

Figure 11 Distance Density by Group – 2003

The remaining panels of Figure 11 show similarly constructed distance densities for the other colocation groups. The three groups with the most pronounced localisation are those that also have the highest Maurel-Sedillot index values – *Concentrated Manufacturing*, *Wholesaling*, and *Business Services*. All three are localised, with peaks at around 10km. Business Services appears to have a smaller

[35] The densities are similar, although slightly more peaked, if we exclude between-industry job-pairs.

range of localisation, at distances below 30km, compared to the 50km range for the others.

In contrast, the *Local Services* group, and the *Local Manufacturing* group have distance densities that are much more similar to the total density. Both are slightly dispersed at short distances, reflecting the presence of the more concentrated industries in the total density.

The group of *Resource-based* industries has a distinct distance density, reflecting relatively low geographic concentration. It is flatter than the pooled density for all industries. Employment in this group is *less* localised (more dispersed) than average between 0 km and 45 km, and is localised in the 45km to 90km range.

These group-level distance densities may conceal considerable variation between industries within each group. To investigate the cross-industry variation, we first tally the proportion of industries within each group that is localised. We also weight these tallies by employment levels, to determine the proportion of employment that is localised.

Table 18 reports the proportion of industries that are significantly localised at 4 distances – 5km, 30km, 100km, and 150km. The distances are fairly arbitrary, although 3 of them are also distances considered by Duranton and Overman (2002), who provide a similar summary. We have added data on localisation at an additional intermediate point of 100km. Panel A of Table 18 shows the proportion of industries that are localised at each of these distances. Sixty three percent of industries are localised at 5km, 49% at 30km, 30% at 100km, and 32% at 150km. The comparable figures in panel B show the proportion of employment accounted for by these localised industries, which tends to be lower at the shorter distances, suggesting that there are a number of small industries localised at shorter distances.

The last four columns of the table repeat the same measures, but excluding job pairs from the same area unit, for which estimated distance is zero.[36] The set of zero-distance pairs includes pairs of jobs within the same firm, as well as pairs of jobs in different firms. Ideally, these same-firm pairs should be excluded, to separate the impact of the firm-size distribution from the effects of location decisions. The removal of all zero-distance pairs over-corrects for the influence of firm size but is calculated to provide an approximate comparison with numbers for the United Kingdom, provided by Duranton and Overman (2002). The comparison is still imperfect, since Duranton and Overman (2002) exclude only jobs at the same plant, and include the small distances between job pairs from different plants in the same local area. As is evident from the table, the greatest impact of removing zero-distance pairs is on the results at 5km. Our densities will understate the density at low distances relative to theirs. Nevertheless, it appears that employment in New Zealand industries is more localised at 5, 30, and 150km than is employment in the UK. Even using the lower employment-weighted figures, New Zealand shows greater localisation.

Table 18 Summary of distance densities, by group – 2003

Table 18 also shows summaries of industry diversity within the colocation groups. Clearly, the group-level patterns in Figure 11 do not accurately represent the densities for all industries in each group. For instance, Figure 11 showed significant localisation at 30km for the *Concentrated Manufacturing* and *Wholesaling* group, whereas only 72 percent of the 65 industries in this group are localised at that distance.

Even greater differences are evident for the *Local Services*, and *Local Manufacturing* groups, both of which appeared to follow the overall distance density fairly closely. Sizeable proportions of industries within these groups are localised at

[36] As a result of the kernel density smoothing of all densities, the removal of pairs with distance of zero reduces the estimated density over a range of small distances. As a consequence, the total number of bilateral job pairs is also reduced, mechanically increasing the proportion of retained pairs that occur at longer distances.

each of the distances considered. For instance, 32 percent of industries in the *Local Services* group are localised at 5km, and 35 percent at 30km, even though for the group as a whole, the density lies below the lower bound of the overall density at each of these distances. The proportion of industries within these groups that are localised is relatively similar across the different distances

Further analysis is needed to determine whether localisation measures at the arbitrarily chosen distances are capturing localisation within the same subset of industries, or if different industries are localised at each distance. For instance, 63 percent of firms overall are localised at 5 km, and 49 percent at 30 km, but we cannot tell from Table 18 whether it is the same industries that are contributing to the localisation at both of these distances. Duranton and Overman (2002) show the extent to which localised industries are localised over a range of distances. For instance, they consider whether industries localised at 5km are also localised at 30km or 150km, or both. The New Zealand data show similar patterns to the UK data, in that a high proportion of industries appear to be localised at more than one of the distances considered. Overall, 42% of industries are localised at both 5km and 30km. This represents around two thirds of the industries localised at 5km, and over 85% of industries localised at 30km. Only around a quarter of industries are localised at only one of the distances considered (11% at 5km only, 1% at 30km only, 3% at 100km only, and 8% at 150km only).

The localisation measures shown in Table 18 can be calculated for all distances. Figure 12 shows the proportion of industries localised at *each* distance between 0km and 150km, for industries within each group. The figure shows not only the incidence of localisation at each distance, but also the degree of localisation, using the localisation index presented in Duranton and Overman (2002). At each distance, the degree of localisation is calculated as the average amount that the density for localised industries exceeds the upper bound of the 95 percent confidence interval for the overall density.

$$\gamma_d = Max\left[K_d - K_d^{95}, 0\right] \qquad (9)$$

where K_d is the kernel density estimate for an industry at distance d, and K_d^{95} is the kernel density estimate of the upper bound for the confidence interval of the overall density at distance d. This index is calculated for each industry and is then averaged across industries, weighted by employment.

This index allows us to see, for instance, whether the 31 percent of industries within the *Local Services* group that are localised at 30km have densities that are only slightly above the confidence interval for the overall density, or show substantial localisation that is offset by substantial dispersion for other industries within the group.

Each panel of Figure 12 contains two lines. The upper line shows the (employment-weighted) incidence of localisation, as summarised in the lower panel of Table 18. The left-hand scale thus measures the proportion of total employment that is in localised industries. The lower line shows (using the scale on the right-hand axis) the degree of localisation (γ_d), weighted by employment.

Figure 12 Localisation and percent localised – 2003

The final panel of Figure 12 shows the patterns for all industries. The percentage of employment in localised industries lies in a fairly narrow band of 35 percent to 50 percent across all distances, with a higher percent localised only at short distances below 10 km. The degree of localisation, however, differs markedly, with relatively strong localisation only for distances below about 30km. The other panels show comparable information for each of the colocation groups. Clearly, the evenness of the incidence of localisation masks considerable variation between the different groups.

The first panel of Figure 12 shows that the proportion of employment within the *Concentrated Manufacturing* group that is in localised industries ranges from 100 percent at 0km, to 10 percent at 60 km and 120 km. The different insights gained from examining incidence and extent of localisation can be appreciated by observing that even though 50 percent of employment is in industries that are

localised at 100 km, the degree of localisation is small. Overall, the localisation index reflects the patterns of localisation observed in Figure 11, with localisation for the *Concentrated Manufacturing* group being most pronounced between 0km and 50km.

The other highly concentrated groups (*Wholesaling* and *Business Services*) all show high incidence and extent of localisation at shorter distances. The two least concentrated and localised groups (*Local Services*, and *Local Manufacturing*) have moderately high incidence of localisation, but the extent of localisation is close to zero. Although many of the industries in these groups are localised, they are not very localised. Finally, the *Resource-based* group shows very high incidence of localisation, especially between 40km and 100km, but only a moderate degree of localisation.

5 Concentration and Gross Job Flows

Geographic agglomeration is an economically important issue because it has the potential to increase firm and economic performance, through a range of mechanisms, as summarised by Duranton and Puga (2003). The current paper has so far been concerned solely with describing and summarising patterns of concentration and localisation in New Zealand. In this section, we examine evidence for a link between industry concentration and firm performance, as measured by gross and net job flow rates.

Devereux et al. (2004) examine the dynamics of agglomeration by regressing various measures of job and firm turnover on an index of concentration. They find that job creation rates are lower in more concentrated industries, although for a number of concentrated industries that they consider, job creation occurs disproportionately in areas where concentration is already high. In contrast to the findings of Dumais et al. (2002) for the US, employment dynamics in the UK do not appear to unequivocally lead to greater industry dispersion.

We follow the Devereux et al. (2004) approach of regressing a range of job creation and destruction measures against measures of concentration. Specifically, we

use flow measures as defined by Davis et al. (1998). For a given time span, firms are classified according to whether they are born, die, expand employment, reduce employment, or continue with the same employment. Employment changes are summed for each of these categories, and the sums are expressed as a proportion of average total employment for the industry-LMA observation (rather than of initial employment as in a standard growth rate formulae). The Davis et al. (1998) approach can capture births (which would have an infinite growth rate using the standard formula) and produces an index which is bounded between –2 and 2).[37] Job creation is the sum of employment changes for newly born and expanding firms. Similarly, job destruction is the sum of changes in dying and contracting firms. Net employment change is the difference between job creation and job destruction.

Identification of the causal effect of geographical concentration is problematic because of the potential confounding effects of omitted industry and LMA factors. In particular, industries with different degrees of concentration may have different gross job flow rates, for reasons correlated with, but unrelated to their concentration. Similarly, rates may be higher or lower in particular LMAs, for reasons other than their degree of specialisation.

Our approach to controlling for these factors is to use a panel of LMA-industries. Each observation is for an industry-LMA-period combination. The panel structure of the data allows us to control for area and industry fixed effects, in addition to time dummies. Identification of the effects of concentration is therefore based on co-variation across time between concentration and job flow rates, at the level of the industry, allowing rates to differ across LMAs.

Table 19 shows estimates of regressions of the following form:

[37] The standard percentage growth rate (g) is a monotonic transformation of the Davis et al rate (λ): $g=2\lambda/(\lambda-2)$

$$
\begin{aligned}
f_{ijt} = {} & \alpha + \beta_1 MS_{it} + \beta_2 Herf_{it} + \beta_3 \ln\left(Emp_{it}\right) \\
& + \beta_4 LMA\_MS_{jt} + \beta_5 LMA\_Herf_{jt} + \beta_6 \ln\left(Emp_{jt}\right) \\
& + \beta_7 \ln\left(LQ_{ijt}\right) \\
& + \tau_t + \lambda_i + \eta_j + \varepsilon_{ijt}
\end{aligned}
\tag{10}
$$

where *i* denotes industry, *j* denotes LMA, and *t* denotes time period. Each observation is for an industry in an LMA, in a year. We use observations on 407 4-digit industries in 58 LMAs, over 16 one-year spells (1987/88 to 2002/03). The panel is unbalanced, due to the fact that not every industry is represented in each LMA every year. The total number of observations is 206,331.

The dependent variable f_{ijt} is a job flow rate, and is one of seven measures: birth rate, expansion rate, job creation rate (births plus expansions); death rate, contraction rate, job destruction rate (deaths plus contractions), or employment change (creation less destruction).

The first three covariates are industry-level measures of Maurel Sedillot concentration (*MS*), firm Herfindahl for the industry (*Herf*), and industry size as measured by the log of industry employment.[38] These are observed annually for each industry. The second row of covariates are equivalent measures for Labour Market Areas. They are the *(LMA-)MS* measure of industry specialisation for the LMA, the degree of plant concentration (*LMA_Herf)*, and LMA size (*ln(Emp)*). The fifth covariate is the log of the locational quotient. This is the only variable that is measured separately for each LMA-industry combination. It is a measure of the degree to which an industry is over-represented in a particular LMA. The coefficient on this variable captures the impact on job flow rates of an industry being in an area where it is disproportionately concentrated. The final line of the equation shows time, LMA, and industry fixed effects, and a random error term.

[38] The industry Herfindahl is included because of the well established positive relationship between job flow rates and industry competitiveness. The inclusion of employment size captures the negative relationship between flow rates and employment size.

All covariates are measured as at the beginning of the period for which the flow rates are measured. Regressions are weighted by initial employment in the LMA-Industry cell, to reduce the undue influence of some very small outliers. For the sample used in the regressions, the (weighted) mean total employment growth rate was –1.1, which equates to an average annual growth rate of -2.4%. This was lower than actual employment growth during the sample period because of the exclusion of firm births in LMAs where the firm's industry was not previously represented. For such births, the log of the locational quotient is undefined, and the observation is thus excluded. The observed change was the result of a job creation rate of 15.3 and a job destruction rate of 16.5. Job creation arose from births (6.3) and expansions (9.1). Job destruction was accounted for by deaths (6.8) and contractions (9.7).

The coefficients from equation (10) capture the impacts of different types of potential agglomeration mechanisms. Marshallian, or 'own-industry' externalities are captured by two measures of industry geographic concentration. The *MS* coefficient shows the industry-wide effect of an industry being geographically concentrated. The coefficient on *ln(LQ)* reflects the local impact of an industry being over-represented in a particular LMA, whether or not the industry as a whole is concentrated. Between-industry, or Jacobs-type externalities are captured by the measure of area specialisation. A negative coefficient on *LMA_MS* indicates that diversity of local industry composition has a positive effect on the dependent variable, as would be predicted by Jacobs.

The two employment variables reflect the density of local economic activity ($ln(E_j)$), and industry scale ($ln(E_i)$). The thickness of the local market is reflected by ($ln(E_j)$), and negatively by *LMA_Herf*. *Herf* reflects (the inverse of) industry competitiveness.

Table 19 Concentration and Gross Job Flows

The top panel of Table 19 shows regression results from an OLS regression that *excludes* industry and LMA fixed effects.

It is clear from the top line of coefficients (*MS*) that industries that are more geographically concentrated have higher job flow rates, and higher net employment change. The coefficients are all significant, although standard errors are somewhat overstated because of intra-LMA correlation of residuals. The coefficients on *LnLQ* suggest, however, that being in an LMA where your industry is particularly concentrated has an offsetting effect, with lowered flows and employment growth.

Between industry agglomeration forces do not appear to be associated with greater job creation, destruction, or employment growth. The coefficients on area specialisation (*LMA_MS)* are positive, indicating that local industry diversity is associated with lower job creation and destruction rates, with an insignificant effect on employment change.

Industries with higher total employment ($LnEmp_i$) tend to have lower job flow rates, and higher total employment growth. There is evidence of size divergence for LMAs ($LnEmp_j$), with larger LMAs having higher birth, expansion and thus job creation rates, and lower death, contraction, and thus job destruction rates. The competitiveness of the industry, as reflected by the Herfindahl index, and the thickness of local markets, as reflected by the LMA-Herfindahl, both raise job flow rates and net employment growth.

The lower panel shows estimates from regressions that include both LMA and industry fixed effects. By comparing the estimates from the upper panel with those from the lower panel, we see that the upper panel patterns are largely a result of heterogeneity of industries and LMAs, rather than a consequence of variation in concentration or size *per se*. The heterogeneity arises at a detailed industry level. Controlling for 2-digit rather than 4-digit industries, as done by Devereux et al. (2004) still leaves a good deal of cross-sectional between-industry heterogeneity, and yields coefficients much more like those in the upper panel. The middle panel shows estimates from a regression containing only LMA fixed effects, reflecting the impact of controlling for time-invariant characteristics of geographic areas, while still including cross-sectional differences between industries.

The coefficients in the lower panel reflect the impact of changing levels of concentration within a given industry, controlling for LMA fixed effects. Many of the coefficients lose significance once industry and LMA fixed effects are added.[39] In particular, the impact of changing geographic concentration for an industry (*MS*) is no longer significant. The fact that high-concentration industries do not grow significantly faster than low-concentration industries confirms that the trend increases in concentration seen in Figure 5 are a consequence of industries becoming more concentrated over time.

The coefficients on the log locational quotient ($lnLQ_{ij}$) capture the impact of industry employment being disproportionately concentrated in an LMA, and thus identify the impact of being in an own-industry agglomeration. Where the degree of own-industry concentration increases, job creation and, to a lesser extent, job destruction rates are lower. Both birth and death rates are lower as a result of being in the agglomeration. Continuing firms are less likely to expand, and more likely to contract, leading to overall slower employment growth.

The lower panel shows mean reversion in both industry size ($lnEmp_i$) and LMA size ($lnEmp_j$), with larger industry and LMA size leading to lower job creation rates and higher job destruction rates, and thus lower employment growth. Finally, in the full fixed-effects specification, lack of industry competition ($Herf_i$) leads to lower creation rates and higher destruction rates, leading to lower employment growth rates in industrially concentrated industries, as does the concentration of LMA employment in relatively few plants (LMA_Herf_i).

Overall, there is no evidence of job flow rates, or net employment growth benefiting from own-industry agglomeration forces (*MS* and *lnLQ*), or from between-industry agglomeration forces (*LMA_MS*). The coefficients on these variables are generally insignificant, and suggest, if anything, that local congestion or excessive diversity may be hindering growth.

[39] Some of this is due to having the correct standard errors. Intraclass correlation of residuals is removed by the inclusion of fixed effects.

Industry competition (negative coefficient on *Herf*), and local labour market thickness (negative coefficient on *LMA_Herf*) are the only variables to have a significant positive impact on net employment growth, operating through both higher job creation rates, and lower job destruction rates.

Table 19 summarises patterns across all industries but it may be that job flows are more closely linked to covariates for particular industries. Table 20 repeats the fixed effects specification as shown in the lower panel of the previous table, but estimated separately for each colocation group. Separate panels are shown for regressions of total employment change, job creation, and job destruction rates.

Table 20 Concentration and Gross Job Flows – by colocation group

Clearly, standard errors are increased by reducing the number of observations, and there is some variation between groups in coefficients associated with this imprecision. However, there is no strong evidence that own-industry or between-industry agglomeration effects vary across the different colocation groups. None of the significant coefficients in Table 20 shows a pattern that is different in sign from the aggregate results in the previous table.

Table 21 Concentration and Gross Firm Flows – by colocation group

The final table, Table 21 repeats the analysis of Table 20, but for firm birth and death rates rather than job flow rates. There is some evidence that geographic concentration of industries (*MS*) raises the rate of firm births, with the effect being strongest for less concentrated industry groups (*Local Services* and *Resource-based* groups). For industries in the *Business Services* group, an increase in geographic concentration appears to raise the firm death rate by more than it raises firm births, which is consistent with congestion effects outweighing positive agglomeration effects at the margin. Mean reversion in industry or area size, as measured by the number of firms, is evident in Table 21, as it was for employment in the previous tables.

6 Summary

The paper is the first New Zealand study to use the Statistics New Zealand business demography microdata to assess the degree of geographic concentration of New Zealand industries. Although there are some statistical breaks in the series for the 1987 to 2003 period, our analysis of time trends indicates that the breaks do not prevent us from cautiously using the data to examine changes over time.

We examine patterns of own-industry concentration, and discuss the different insight into these patterns provided by the closely-related Ellison-Glaeser and Maurel-Sedillot indices, and present also the relative locational Gini. The concentration of industry employment across Labour Market Areas has increased during the period of our study, although concentration has not increased across the smaller Area Units. Industries are sorting themselves into different LMAs, but are dispersing within LMAs. As a consequence, LMAs have been becoming more industrially specialised, although the degree of specialisation within areas units has not changed to any great degree.

We derive an index of colocation, which we use to group 4-digit industries that tend to locate together. The resulting industry groups contain industries that tend to locate together, and thus provide some clues about the sets of industries for which between-industry agglomeration forces may be operating.

Overall, around 30 percent of FTE employment is in highly concentrated industry groups. These groups contain mainly *Concentrated Manufacturing* industries (6%), *Wholesaling* (6%), and *Business Services* (17%). All three groups of industries are disproportionately located in larger cities. The *Concentrated manufacturing* industries and, to a lesser extent *Wholesaling* industries, are most over-represented in South Auckland, whereas *Business Services* are disproportionately in Auckland and Wellington. The degree of concentration is similar for the three groups.

In contrast, around 60 percent of employment is in *Local Services* (43%) and *Local Manufacturing* (18%) groups, where industry employment is spread fairly

evenly in proportion to total employment. A *Resource-based* group of industries account for a further 7 percent of employment, and are distributed more evenly across LMAs than is total employment.

While it is difficult to make a direct comparison with international studies, the comparisons presented in the paper suggest that New Zealand industries have concentration similar to that of the UK, and below that of the US and France. New Zealand also has a more dispersed distribution of concentration across industries, with a higher proportion of employment in industries with very high or very low levels of concentration. A more pronounced difference is that employment in New Zealand industries is more likely to be (industrially) concentrated in a relatively small number of plants, as shown by the high Herfindahl index.

Using distance-based measures of localisation developed by Duranton and Overman (2002), we see that, in concentrated industries, the degree of localisation is greatest at relatively short distances, between zero and 50km.

As an initial step in investigating the links between geographic concentration and economic performance, we examined the relationship between concentration and job creation and destruction. Rates of job creation, job destruction, and net employment growth are higher for industries that are more geographically concentrated, but the relationship disappears when we control for area and industry fixed effects. This suggests that it is not the concentration *per se* that is driving the high flows and employment growth, but other unobserved characteristics of areas and industries.

Areas with a more diverse mix of local industries appear to have lower job flow rates and lower employment growth, although this relationship is reversed and becomes insignificant once area and industry fixed effects are controlled for. Industry competition and local labour market thickness are the only variables to have a significant positive impact on net employment growth, operating through both higher job creation rates, and lower job destruction rates.

Future work will examine in greater detail the relationship between firm productivity and patterns of own-industry and between-industry agglomeration.

7 Tables and Figures

Table 1: Possible values of Maurel-Sedillot (G) and Ellison-Glaeser (G_{EG}) raw concentration indices

	Industry employment uniformly distributed $s_i = 1/M \ \forall i; \ \Sigma s_i^2 = 1/M$	*Intermediate degrees of industry concentration*	*Industry employment concentrated in a single area* $\Sigma s_i^2 = 1$
Total employment uniformly distributed $x_i = 1/M \ \forall i; \ \Sigma x_i^2 = 1/M$	$G = -G_{EG} = 0$		$G = G_{EG} = 1$
Total employment distributed as in actual data: $\Sigma x_i^2 = 0.09$	$G = -0.08$ $G_{EG} = -G = 0.08$	Actual observed range: $G \subset (-0.06 , 0.82)$ $G_{EG} \subset (0 , 0.75)$	$G = 1$ $G_{EG} \subset (0.74 , 1.20)$
Total employment concentrated in a single area $\Sigma x_i^2 \rightarrow 1$	$G \rightarrow -\infty$ $G_{EG} = -G \rightarrow \infty$		$G=1$ $G_{EG} \rightarrow \infty$ or $G_{EG=}$ 0[40]

Notes: G refers to the raw concentration index as defined by Maurel and Sedillot (1999), and as shown in equation (5). G_{EG} is the corresponding formula from Ellison and Glaeser (1994), and as shown in equation (6). s_i is the share of industry employment in labour market area i (i=1, …, M). x_i is the share of total employment in LMA i.

Table 2: Number of industries included

			Impact of Suppression		
Period	**Industry**	**number of industries in data**	**number of unsuppressed industries**	**% GU**	**% FTE**
2003	4-digit industries	424	386	99.5%	96.3%
	2-digit industries	51	48	99.95 %	99.82%
Full period	4-digit industries	448	n/a		
	4-digit minimum coverage	407	n/a		

Notes: Statistics New Zealand Business Demography data. Industries are defined according to the ANZSIC classification. Industries have information suppressed where release of information would violate Statistics New Zealand's rules to protect confidentiality. Suppression is not an issue for the full-period data, since individual industry observations are not reported in this paper.

[40] G_{EG} equals zero in the special (and uninteresting) case where both industry and total employment are completely concentrated in a single area.

Table 3: Summary of Concentration Indices: Mean [Median] – 2003

Industry	*Area*	*Herfindahl Index (Herf)*	*Maurel-Sedillot Index (MS)*	*Ellison Glaeser Index (EG)*	*Gini*
Weighted					
New Zealand					
2-digit (51)	AU (1692)	0.003 [0.001]	0.007 [.001]	0.007 [.004]	0.556 [0.536]
2-digit (51)	LMA (58)	0.003 [0.001]	0.018 [0.000]	0.018 [0.010]	0.307 [0.282]
4-digit (424)	LMA (58)	0.022 [0.005]	0.028 [0.005]	0.025 [0.008]	0.401 [0.377]
4-digit Manuf (147)	LMA (58)	0.062 [0.030]	0.045 [0.029]	0.045 [0.024]	0.580 [0.586]
United States					
4-digit Manuf (459)	State (51)	0.017 [0.008]		0.045 [0.023]	
Unweighted					
New Zealand					
2-digit (50)	AU (1692)	0.027 [0.004]	0.017 [0.004]	0.015 [0.005]	0.616 [0.621]
2-digit (50)	LMA (58)	0.027 [0.004]	0.033 [0.008]	0.044 [0.016]	0.419 [0.402]
4-digit (390)	LMA (58)	0.083 [0.025]	0.056 [0.020]	0.028 [0.016]	0.491 [0.495]
4-digit Manuf (137)	LMA (58)	0.135 [0.082]	0.076 [0.044]	0.036 [0.015]	0.593 [0.593]
United States					
4-digit Manuf (459)	State (51)	0.028 [0.016]		0.051 [0.026]	
France					
4-digit Manuf (273)	Dept (95)		0.06 [0.01]		
United Kingdom					
4-digit Manuf (211)	Postcode (113)		0.033 [0.006]	0.033 [0.007]	

Notes: Statistics New Zealand 2003 Business Demography data. The New Zealand industry-level measures are calculated using all ANZSIC industries for which data are available in that year. New Zealand geographic areas are either Census Area Units (AU) or Labour Market Areas (LMA). Weighted measures are weighted by FTE employment. United States measures are for 1987 and are taken from Ellison and Glaeser (1997). French measures are for 1993 and are taken from Maurel and Sedillot (1999). UK measures are for 1992 and are taken from Devereux et al (2004).

Table 4: New Zealand and United States Manufacturing compared

	Country	FTE share	Herf	G_EG	EG
WEIGHTED BY EMPLOYMENT					
C21: Food, Beverage and Tobacco	**NZ**	**27%**	**0.059**	**0.113**	**0.055**
	USA	8%	0.018	0.057	0.040
C22: Textile, Clothing, Footwear and Leather Manufacturing	**NZ**	**5%**	**0.077**	**0.105**	**0.030**
	USA	11%	0.012	0.118	0.108
C23: Wood and Paper Product Manufacturing	**NZ**	**11%**	**0.042**	**0.106**	**0.068**
	USA	7%	0.007	0.037	0.031
C24: Printing, Publishing and Recorded Media	**NZ**	**8%**	**0.017**	**0.063**	**0.048**
	USA	8%	0.004	0.017	0.013
C25: Petroleum, Coal, Chemical and Associated Product Manufacturing	**NZ**	**8%**	**0.087**	**0.123**	**0.041**
	USA	10%	0.016	0.045	0.030
C26: Non-Metallic Mineral Product Manufacturing	**NZ**	**3%**	**0.077**	**0.076**	**-0.001**
	USA	3%	0.015	0.032	0.018
C27: Metal Product Manufacturing	**NZ**	**12%**	**0.093**	**0.115**	**0.109**
	USA	23%	0.017	0.050	0.034
C28: Machinery and Equipment Manufacturing	**NZ**	**19%**	**0.072**	**0.079**	**0.003**
	USA	25%	0.027	0.078	0.053
C29: Other Manufacturing	**NZ**	**6%**	**0.022**	**0.028**	**0.003**
	USA	5%	0.015	0.063	0.049
Total Manufacturing	**NZ**	**100%**	**0.062**	**0.096**	**0.045**
	USA	100%	0.017	0.061	0.045
	USA (NZ shares)	100%	0.016	0.057	0.041
UNWEIGHTED					
C21: Food, Beverage and Tobacco	**NZ**	**27%**	**0.147**	**0.160**	**-0.006**
	USA	8%	0.037	0.104	0.071
C22: Textile, Clothing, Footwear and Leather Manufacturing	**NZ**	**5%**	**0.101**	**0.138**	**0.040**
	USA	11%	0.021	0.123	0.103
C23: Wood and Paper Product Manufacturing	**NZ**	**11%**	**0.093**	**0.137**	**0.046**
	USA	7%	0.011	0.050	0.039
C24: Printing, Publishing and Recorded Media	**NZ**	**8%**	**0.028**	**0.106**	**0.081**
	USA	8%	0.013	0.031	0.019
C25: Petroleum, Coal, Chemical and Associated Product Manufacturing	**NZ**	**8%**	**0.147**	**0.188**	**0.051**
	USA	10%	0.027	0.069	0.044
C26: Non-Metallic Mineral Product Manufacturing	**NZ**	**3%**	**0.148**	**0.139**	**-0.012**
	USA	3%	0.031	0.060	0.030
C27: Metal Product Manufacturing	**NZ**	**12%**	**0.211**	**0.239**	**0.179**
	USA	23%	0.030	0.064	0.035
C28: Machinery and Equipment Manufacturing	**NZ**	**19%**	**0.140**	**0.134**	**-0.020**
	USA	25%	0.038	0.075	0.039
C29: Other Manufacturing	**NZ**	**6%**	**0.059**	**0.047**	**-0.023**
	USA	5%	0.027	0.075	0.049
Total Manufacturing	**NZ**	**100%**	**0.135**	**0.155**	**0.036**
	USA	100%	0.028	0.078	0.051
	USA (NZ shares)	100%	0.029	0.076	0.050

Notes: Statistics New Zealand 2003 Business Demography data. The New Zealand measures use information on all available industries. *Herf* is the industry plant Herfindahl index of industrial concentration. G_{EG} and EG are indices of geographic concentration as defined in Ellison and Glaeser (1997) and shown in Equation (6) (EG=γ_{EG}). All measures are based on 2-digit ANZSIC averages of 4-digit industry measures of concentration, across LMAs for NZ, and across States for the US. For the US, 4-digit SIC industries are grouped to match ANZSIC 2-digit groups. ANZSIC codes (and US SIC 2-digit codes) are: 21 (20,21), 22 (22,23,31), 24 (27), 25 (28-30), 26 (32), 27 (33-35), 28 (36-38), and 29 (39). Weighted measures are weighted by FTE employment. US figures are for 1987 and are taken from Ellison and Glaeser (1994). Weighted US measures obtained by author's analysis of data provided in the appendix of Ellison and Glaeser (1994).

Table 5: Correlation between Concentration measures – 2003

Concentration of 2-digit industries across Area Units

	Herf	*G_MS*	*G_EG*	*MS*	*EG*	*Gini*
Herf	1.00					
G_MS	0.92	1.00				
G_EG	0.95	0.99	1.00			
MS	0.30	0.65	0.59	1.00		
EG	0.34	0.66	0.62	0.98	1.00	
Gini	0.29	0.38	0.38	0.36	0.38	1.00

Concentration of 2-digit industries across Labour Market Areas

	Herf	*G_MS*	*G_EG*	*MS*	*EG*	*Gini*
Herf	1.00					
G_MS	0.76	1.00				
G_EG	0.84	0.87	1.00			
MS	0.39	0.89	0.68	1.00		
EG	0.54	0.77	0.91	0.78	1.00	
Gini	0.42	0.33	0.48	(0.17)	0.37	1.00

Concentration of 4-digit industries across Labour Market Areas

	Herf	*G_MS*	*G_EG*	*MS*	*EG*	*Gini*
Herf	1.00					
G_MS	0.85	1.00				
G_EG	0.88	0.92	1.00			
MS	(0.06)	0.61	0.41	1.00		
EG	-0.41	(-0.08)	(-0.03)	(0.45)	1.00	
Gini	0.13	0.21	0.31	0.19	0.16	1.00

Concentration of 4-digit Manufacturing industries across Labour Market Areas

	Herf	*G_MS*	*G_EG*	*MS*	*EG*	*Gini*
Herf	1.00					
G_MS	0.86	1.00				
G_EG	0.92	0.91	1.00			
MS	(-0.03)	0.50	0.22	1.00		
EG	0.27	-0.31	0.45	(0.09)	1.00	
Gini	(-0.13)	(-0.15)	(-0.03)	(-0.08)	(0.17)	1.00

Concentration of 2-digit industries: Area Units v Labour Market Areas

	LMA_Herf	*LMA_G_MS*	*LMA_G_EG*	*LMA_MS*	*LMA_EG*	*LMA_Gini*
AU_Herf	1.00	0.76	0.84	0.39	0.54	0.42
AU_G_MS	0.92	0.81	0.80	0.49	0.52	0.52
AU_G_EG	0.95	0.79	0.82	0.45	0.53	0.52
AU_MS	0.30	0.47	0.30	0.40	(0.19)	0.46
AU_EG	0.34	0.44	0.33	0.34	(0.21)	0.48
AU_Gini	0.29	(0.25)	0.41	(0.16)	0.39	0.84

Notes: Statistics New Zealand 2003 Business Demography data. The New Zealand measures use information on all available industries. *Herf* is the industry plant Herfindahl index of industrial concentration. *Herf* is the industry plant Herfindahl index of industrial concentration. G_{EG} and EG are indices of geographic concentration as defined in Ellison and Glaeser (1997) and shown in Equation (6) (EG=γ_{EG}). G_{MS} and MS are indices of geographic concentration as defined in Maurel and Sedillot (1999) and shown in Equation (5) (MS=γ). Gini is the relative locational Gini, which measures the degree of inequality in the locational quotient. Correlations are not weighted by employment. All correlations are statistically significant except for those in brackets.

Table 6: Degree of Concentration of 4-digit Industries Across Labour Market Areas – 2003

Industry	*Area*	*Index*	*Range*			
			Neg. <0	*Low 0-0.02*	*Moderate 0.02-0.05*	*High >0.05*
Weighted						
New Zealand						
4-digit (390)	LMA (58)	MS	46%	16%	8%	30%
		EG	15%	49%	15%	21%
4-digit Manuf (137)	LMA (58)	MS	40%	10%	9%	41%
		EG	23%	29%	14%	34%
United States						
4-digit Manuf (459)	State (51)	EG	1%	43%	28%	28%
Unweighted						
New Zealand						
4-digit (390)	LMA (58)	MS	31%	17%	11%	41%
		EG	21%	36%	17%	27%
4-digit Manuf (137)	LMA (58)	MS	24%	11%	11%	53%
		EG	39%	24%	15%	23%
United States						
4-digit Manuf (459)	State (51)	EG	2%	40%	29%	28%
France						
4-digit Manuf (273)	Dept (95)	MS		50% (<0.02)	23%	27%
United Kingdom						
4-digit Manuf (211)	Postcode (113)	EG		65% (<0.02)	19%	16%

Notes: See Notes to Table 3. The degree of concentration is based on the value of the respective index (*EG* or *MS*): High (0.05 or above), medium (0.02 to 0.05), and low (below 0.02). For New Zealand, the low-concentration group is further disaggregated to separate those industries with index values below zero.

Table 7: LMA Specialisation across 4-digit industries – 2003

Labour Market Area	*Units*	*FTE*	*Herf*	*G_MS*	*G_EG*	*MS*	*EG*	*Gini*
MacKenzie	300	1330	0.025	0.084	0.075	**0.061**	**0.051**	0.647
Waipukurau	700	4380	0.084	0.140	0.131	**0.060**	**0.051**	0.600
Ngaruawahia	460	3550	0.056	0.092	0.090	0.039	0.036	0.758
Queenstown	1910	8470	0.002	0.037	0.033	0.035	0.031	0.606
Picton	750	2830	0.008	0.035	0.033	0.027	0.025	0.814
Kaikoura	330	1160	0.008	0.034	0.025	0.026	0.017	0.687
TeKuiti	510	3150	0.019	0.044	0.038	0.025	0.019	0.813
Te Puke	880	4530	0.017	0.040	0.036	0.023	0.019	0.571
Gore	1480	9320	0.020	0.036	0.031	0.016	0.012	0.740
Stratford	550	3470	0.045	0.059	0.053	0.014	0.008	0.585
Tokoroa	1100	7820	0.008	0.021	0.022	0.013	0.014	0.675
Whakatane	2250	13050	0.006	0.016	0.015	0.011	0.010	0.609
Wellington	20420	134400	0.001	0.012	0.009	0.010	0.007	0.518
Kerikeri	1690	7090	0.005	0.016	0.011	0.010	0.006	0.559
Taupo	2400	11430	0.002	0.012	0.010	0.010	0.007	0.592
Taumaranui	470	2450	0.010	0.019	0.015	0.009	0.005	0.596
Kaikohe	510	2620	0.008	0.017	0.012	0.009	0.004	0.565
Ashburton	1540	9990	0.015	0.024	0.020	0.009	0.005	0.707
Hastings	3660	25110	0.007	0.015	0.013	0.008	0.006	0.532
Alexandra	1890	7870	0.002	0.011	0.009	0.008	0.006	0.581
Eketahuna	390	1590	0.010	0.018	0.013	0.007	0.003	0.622
Otorohanga	450	2400	0.036	0.042	0.040	0.006	0.004	0.739
Balclutha	740	4920	0.049	0.055	0.051	0.006	0.002	0.660
Greymouth	1580	8540	0.005	0.011	0.008	0.006	0.003	0.733
Taihape	620	3780	0.059	0.063	0.059	0.005	0.000	0.669
Thames	2410	9410	0.003	0.007	0.006	0.005	0.003	0.566
Matamata	670	3480	0.008	0.012	0.010	0.004	0.002	0.737
Blenheim	2200	12930	0.006	0.009	0.009	0.004	0.003	0.598
Rotorua	4350	26360	0.002	0.006	0.005	0.004	0.003	0.501
Gisborne	2250	14040	0.004	0.007	0.006	0.004	0.002	0.627
Kaitaia	960	4740	0.007	0.010	0.009	0.004	0.002	0.643
Warkworth	1970	6990	0.007	0.010	0.010	0.003	0.002	0.627
Te Awamutu	1050	4820	0.005	0.008	0.008	0.003	0.003	0.527
Morrinsville	520	2680	0.008	0.011	0.009	0.003	0.001	0.644
Motueka	720	3440	0.013	0.016	0.014	0.002	0.001	0.601
Waimate	2760	16880	0.006	0.009	0.008	0.002	0.001	0.585
Oamaru	980	6080	0.028	0.031	0.027	0.002	-0.001	0.591
Invercargill	3840	26790	0.009	0.012	0.010	0.002	0.001	0.589
Waihi	880	3510	0.006	0.008	0.006	0.002	0.001	0.716
Dargaville	530	2460	0.023	0.025	0.020	0.002	-0.003	0.549
Levin	1630	7660	0.004	0.006	0.005	0.002	0.000	0.642
Nelson	5880	31220	0.002	0.004	0.004	0.002	0.002	0.529
Dunedin	6380	44950	0.007	0.008	0.006	0.001	-0.001	0.474
Wanganui	2210	14860	0.007	0.008	0.006	0.001	-0.001	0.561
Masterton	2190	11140	0.004	0.005	0.004	0.001	0.000	0.570
Auckland	61900	323760	0.001	0.001	0.002	0.001	0.001	0.389
Hawera	910	6400	0.033	0.034	0.033	0.001	0.000	0.665
Dannevirke	550	3360	0.058	0.059	0.055	0.000	-0.004	0.707
Bulls	480	3110	0.048	0.049	0.045	0.000	-0.004	0.768
Palmerston Nth	6220	41860	0.007	0.007	0.005	0.000	-0.002	0.457
Tauranga	8680	41680	0.001	0.001	0.002	0.000	0.001	0.486
New Plymouth	4230	25030	0.003	0.003	0.003	0.000	0.000	0.686
Hamilton	11250	71370	0.003	0.002	0.001	0.000	-0.001	0.453
Napier	4100	22930	0.002	0.002	0.002	0.000	0.000	0.550
Whangarei	4530	24780	0.005	0.004	0.002	-0.001	-0.002	0.553
Hutt Valley	8000	46760	0.002	0.001	0.002	-0.001	0.000	0.558
Christchurch	26610	167990	0.001	0.000	0.000	-0.001	0.000	0.319
SthAuckland	31470	208440	0.001	-0.001	0.002	-0.002	0.001	0.432
TOTAL	260850	1527170	0.004	0.006	0.006	0.002	0.002	0.476

Notes: Labour Market Areas (LMAs) are commuting zones as described in Newell and Papps (2001). Measures reflect, for each LMA, the degree of specialisation across 4-digit ANZSIC industries. The table is sorted in descending order of MS concentration. Numbers in bold are those where concentration is high (greater than 0.05).

Table 8: Concentration of 2-digit Industries across LMAs – 2003

Industry Name	*Units*	*FTE*	*Herf*	*G_MS*	*G_EG*	*MS*	*EG*	*Gini*
K74:Insurance	370	7350	0.024	0.240	0.132	**0.222**	**0.111**	0.580
P91:Motion Picture, Radio and TV Services	2060	8770	0.014	0.158	0.071	**0.146**	**0.058**	0.390
K75:Services to Finance and Insurance	4030	13660	0.002	0.111	0.046	**0.110**	0.045	0.373
I64:Air and Space Transport	480	8290	0.074	0.173	0.098	**0.107**	0.026	0.652
F47:Personal & Household Good Wholesal.	8840	45520	0.001	0.107	0.034	**0.106**	0.033	0.435
K73:Finance	1830	25550	0.007	0.099	0.043	**0.093**	0.036	0.202
I63:Water Transport	300	2850	0.031	0.121	0.087	**0.092**	**0.057**	0.794
I67:Storage	450	3720	0.012	0.096	0.108	**0.086**	**0.097**	0.590
L78:Business Services	42580	180840	0.000	0.071	0.019	**0.071**	0.019	0.282
C24:Printing, Publishing &Recorded Media	2180	20270	0.004	0.068	0.015	**0.065**	0.012	0.353
C25:Petrol,Coal,Chemical&AssocProd Mfg	1360	20360	0.004	0.067	0.029	**0.064**	0.025	0.556
F46:Machinery &Motor Vehicle Wholesal	6550	36690	0.001	0.063	0.017	**0.062**	0.016	0.343
M81:Government Administration	1750	45810	0.003	0.061	0.078	**0.058**	**0.075**	0.334
J71:Communication Services	3600	27820	0.012	0.068	0.015	**0.056**	0.003	0.336
I66:Services to Transport	2710	18470	0.003	0.058	0.014	**0.055**	0.011	0.516
C29:Other Manufacturing	3080	15580	0.002	0.051	0.018	0.049	0.016	0.381
B15:Services to Mining	18	150	0.227	0.259	0.309	0.042	**0.107**	0.737
C28:Machinery &Equipment Manufactur	5820	47450	0.003	0.042	0.032	0.039	0.029	0.329
C27:Metal Product Manufacturing	3530	29240	0.004	0.038	0.036	0.035	0.032	0.442
C26:Non-Metallic Mineral Prod Manufact	900	7100	0.007	0.035	0.044	0.029	0.038	0.404
P92:Libraries, Museums and the Arts	3020	11650	0.004	0.030	0.017	0.026	0.012	0.402
L77:Property Services	18450	34260	0.000	0.018	0.003	0.018	0.003	0.205
Q95:Personal Services	8170	23860	0.001	0.014	0.004	0.013	0.004	0.170
C22:Textile,Clothing,Footwear,Leather Mfg	1060	12630	0.008	0.016	0.022	0.008	0.015	0.664
F45:Basic Material Wholesaling	4360	26170	0.001	0.005	0.009	0.004	0.008	0.197
G52:Personal &Household Good Retailing	19350	81990	0.000	0.001	0.001	0.000	0.000	0.123
G51:Food Retailing	7210	26750	0.000	-0.004	0.001	-0.004	0.000	0.167
E42:Construction Trade Services	23660	70960	0.000	-0.005	0.002	-0.005	0.001	0.149
D37:WaterSupply,Sewerage&DrainageServ	150	1380	0.035	0.027	0.037	-0.008	0.003	0.353
P93:Sport and Recreation	4460	18080	0.001	-0.008	0.004	-0.010	0.002	0.353
N84:Education	7600	111640	0.003	-0.007	0.003	-0.010	-0.001	0.174
H57:Accommodation, Cafes & Restaurants	11900	79150	0.000	-0.013	0.006	-0.013	0.006	0.374
O86:Health Services	11860	97400	0.007	-0.009	0.005	-0.015	-0.002	0.266
Q96:Other Services	1290	19080	0.007	-0.010	0.005	-0.017	-0.002	0.421
A04:Commercial Fishing	2030	5070	0.011	-0.008	0.129	-0.019	**0.120**	0.739
G53:Motor Vehicle Retailing and Services	10860	49260	0.000	-0.022	0.005	-0.022	0.005	0.144
I61:Road Transport	7800	34580	0.001	-0.023	0.011	-0.025	0.010	0.210
E41:General Construction	13970	50150	0.001	-0.024	0.004	-0.025	0.004	0.208
I65:Other Transport	120	310	0.019	-0.010	0.018	-0.030	-0.002	0.607
D36:Electricity and Gas Supply	170	5470	0.025	-0.007	0.041	-0.032	0.016	0.510
O87:Community Services	770	17010	0.003	-0.031	0.011	-0.033	0.009	0.289
B13:Metal Ore Mining	50	450	0.146	0.115	0.231	-0.036	**0.099**	0.772
A03:Forestry and Logging	2400	11560	0.003	-0.045	0.103	-0.048	**0.100**	0.569
C23:Wood&Paper Product Manufacturing	2400	27400	0.003	-0.045	0.036	-0.048	0.033	0.513
C21:Food, Beverage&Tobacco Manufactur	1860	66040	0.005	-0.047	0.042	-0.053	0.037	0.546
Q97:Private Households Employing Staff	9	25	0.240	0.195	0.185	-0.059	-0.072	0.436
A02:Services to Agric, Hunting&Trapping	4900	21980	0.002	-0.060	0.084	-0.062	**0.082**	0.483
B14:Other Mining	300	1880	0.009	-0.056	0.042	-0.065	0.034	0.555
Suppressed (3 industries)	120	2630	0.100	0.219	0.264	**0.148**	**0.200**	0.574
Total Counts/Weighted Mean Indices	0.262m	1.474m	0.003	0.021	0.021	0.018	0.018	0.307

Notes: See notes to Table 3 and Table 5. All measures are based on industry measures of concentration, across LMAs, calculated for each 2-digit ANZSIC industry. The table is sorted in descending order of MS concentration. Numbers in bold are those where concentration is high (greater than 0.05). The weighted mean is weighted by FTE employment.

Table 9: Concentration of 4-digit industries across LMAs (grouped by 2-digit group) – 2003

	MS	MS	MS	MS	EG	EG	EG	EG
	2-d Index	L	M	H	2-d index	L	M	H
K74:Insurance	**0.222**	0%	0%	100%	**0.111**	10%	0%	90%
P91:Motion Picture, Radio and TV Services	**0.146**	12%	25%	63%	**0.058**	39%	25%	37%
K75:Services to Finance and Insurance	**0.110**	0%	0%	100%	0.045	42%	14%	44%
I64:Air and Space Transport	**0.107**	53%	0%	47%	0.026	91%	9%	0%
F47:Personal & Household Good Wholesal.	**0.106**	5%	29%	66%	0.033	27%	29%	44%
K73:Finance	**0.093**	3%	0%	97%	0.036	2%	98%	0%
I63:Water Transport	**0.092**	23%	0%	77%	**0.057**	0%	23%	77%
I67:Storage	**0.086**	0%	0%	100%	**0.097**	0%	0%	100%
L78:Business Services	**0.071**	16%	9%	75%	0.019	39%	43%	19%
C24:Printing, Publishing &Recorded Media	**0.065**	28%	0%	72%	0.012	75%	7%	17%
C25:Petrol,Coal,Chemical&AssocProd Mfg	**0.064**	17%	2%	81%	0.025	28%	27%	45%
F46:Machinery &Motor Vehicle Wholesal	**0.062**	12%	13%	75%	0.016	0%	44%	56%
M81:Government Administration	**0.058**	27%	0%	73%	**0.075**	27%	0%	73%
J71:Communication Services	**0.056**	53%	0%	47%	0.003	53%	0%	47%
I66:Services to Transport	**0.055**	10%	6%	84%	0.011	12%	1%	87%
C29:Other Manufacturing	0.049	9%	20%	71%	0.016	74%	26%	0%
B15:Services to Mining	0.042	0%	35%	65%	**0.107**	35%	0%	65%
C28:Machinery &Equipment Manufactur	0.039	39%	17%	43%	0.029	29%	56%	15%
C27:Metal Product Manufacturing	0.035	44%	35%	22%	0.032	44%	29%	27%
C26:Non-Metallic Mineral Prod Manufact	0.029	51%	10%	39%	0.038	38%	27%	34%
P92:Libraries, Museums and the Arts	0.026	63%	0%	37%	0.012	69%	7%	24%
L77:Property Services	0.018	47%	44%	8%	0.003	100%	0%	0%
Q95:Personal Services	0.013	89%	0%	11%	0.004	95%	5%	0%
C22:Textile,Clothing,Footwear,Leather Mfg	0.008	24%	12%	63%	0.015	26%	67%	6%
F45:Basic Material Wholesaling	0.004	42%	41%	17%	0.008	51%	28%	21%
G52:Personal &Household Good Retailing	0.000	99%	1%	1%	0.000	100%	0%	0%
G51:Food Retailing	-0.004	94%	6%	0%	0.000	100%	0%	0%
E42:Construction Trade Services	-0.005	92%	5%	3%	0.001	100%	0%	0%
D37:WaterSupply,Sewerage&DrainageServ	-0.008	100%	0%	0%	0.003	100%	0%	0%
P93:Sport and Recreation	-0.010	100%	0%	0%	0.002	69%	23%	9%
N84:Education	-0.010	87%	13%	0%	-0.001	98%	2%	0%
H57:Accommodation, Cafes & Restaurants	-0.013	100%	0%	0%	0.006	68%	32%	0%
O86:Health Services	-0.015	96%	0%	4%	-0.002	96%	4%	0%
Q96:Other Services	-0.017	85%	7%	9%	-0.002	91%	0%	9%
A04:Commercial Fishing	-0.019	60%	0%	40%	**0.120**	0%	0%	100%
G53:Motor Vehicle Retailing and Services	-0.022	100%	0%	0%	0.005	97%	3%	0%
I61:Road Transport	-0.025	100%	0%	0%	0.010	29%	71%	0%
E41:General Construction	-0.025	100%	0%	0%	0.004	99%	1%	0%
I65:Other Transport	-0.030	100%	0%	0%	-0.002	100%	0%	0%
D36:Electricity and Gas Supply	-0.032	100%	0%	0%	0.016	96%	0%	4%
O87:Community Services	-0.033	100%	0%	0%	0.009	100%	0%	0%
B13:Metal Ore Mining	-0.036	91%	0%	9%	**0.099**	22%	0%	78%
A03:Forestry and Logging	-0.048	100%	0%	0%	**0.100**	0%	0%	100%
C23:Wood&Paper Product Manufacturing	-0.048	78%	1%	22%	0.033	38%	12%	50%
C21:Food, Beverage&Tobacco Manufactur	-0.053	73%	8%	20%	0.037	9%	15%	76%
Q97:Private Households Employing Staff	-0.059	100%	0%	0%	-0.072	100%	0%	0%
A02:Services to Agric, Hunting&Trapping	-0.062	100%	0%	0%	**0.082**	0%	2%	98%
B14:Other Mining	-0.065	100%	0%	0%	0.034	49%	51%	0%
Total		64%	8%	29%		62%	18%	20%

Notes: See notes to Table 3 and Table 5. The '2-d industry' measures are repeated from Table 8. Other columns show shares of employment in 4-digit ANZSIC industries that have high (H: greater than 0.05), medium (M: 0.02-0.05), and low (less than 0.02) degrees of concentration. The table is sorted in descending order of MS concentration. Numbers in bold are those where concentration is high (greater than 0.05).

Table 10: Most and Least Concentrated 4-digit industries across LMAs – 2003

Industry		Units	FTE	Herf	G_MS	G_EG	MS	EG	Gini
	20 Most concentrated 4-digit industries (descending order)								
B1319	Metal Ore Mining nec	9	40	0.338	0.696	0.685	**0.541**	**0.524**	0.336
C2212	Synthetic Fibre Textile Manufacturing	30	260	0.106	0.527	0.438	**0.472**	**0.371**	0.712
C2763	Nut, Bolt, Screw and Rivet Manufacturing	12	250	0.170	0.558	0.390	**0.468**	**0.266**	0.514
I6301	International Sea Transport	55	760	0.064	0.455	0.266	**0.418**	**0.216**	0.566
P9112	Film and Video Distribution	55	160	0.040	0.419	0.229	**0.395**	**0.197**	0.491
K7411	Life Insurance	65	2300	0.111	0.428	0.278	**0.357**	**0.188**	0.814
F4791	Photographic Equipment Wholesaling	70	530	0.051	0.381	0.195	**0.348**	**0.152**	0.500
C2181	Soft Drink,Cordial & Syrup Manufacturing	45	1210	0.123	0.425	0.364	**0.344**	**0.275**	0.669
F4723	Footwear Wholesaling	90	340	0.046	0.360	0.186	**0.330**	**0.147**	0.449
C2762	Spring and Wire Product Manufacturing	90	1160	0.039	0.352	0.268	**0.325**	**0.238**	0.547
F4721	Textile Product Wholesaling	340	1740	0.012	0.332	0.165	**0.324**	**0.155**	0.587
C2250	Footwear Manufacturing	50	710	0.124	0.389	0.235	**0.303**	**0.126**	0.661
F4612	Professional Equipment Wholesaling	290	1690	0.015	0.306	0.145	**0.295**	**0.132**	0.580
C2565	Plastic Foam Product Manufacturing	30	310	0.109	0.370	0.271	**0.293**	**0.182**	0.494
Q9621	Business and Professional Associations	370	1730	0.012	0.301	0.271	**0.293**	**0.262**	0.566
C2546	Cosmetic & Toiletry Preparation Mfg	55	560	0.090	0.356	0.280	**0.293**	**0.209**	0.822
I6643	Freight Forwarding (Except Road)	210	2180	0.014	0.299	0.212	**0.290**	**0.201**	0.576
L7867	Contract Packing Services nec	65	700	0.086	0.348	0.280	**0.286**	**0.212**	0.710
C2731	Aluminium Rolling, Drawing, Extruding	30	780	0.133	0.375	0.358	**0.279**	**0.259**	0.765
L7851	Advertising Services	1060	4620	0.006	0.275	0.139	**0.271**	**0.134**	0.500
	20 Least concentrated 4-digit industries (descending order)								
C2313	Timber Resawing and Dressing	120	1860	0.028	-0.025	0.085	-0.054	**0.059**	0.645
A0219	Services to Agriculture nec	4110	15780	0.002	-0.053	0.083	-0.055	0.081	0.451
D3702	Sewerage and Drainage Services	55	560	0.048	-0.006	0.042	-0.056	-0.006	0.348
C2311	Log Sawmilling	470	7870	0.012	-0.043	0.103	-0.056	**0.092**	0.568
A0301	Forestry	860	1560	0.016	-0.040	0.074	-0.057	**0.059**	0.497
O8640	Veterinary Services	600	2830	0.003	-0.054	0.018	-0.057	0.014	0.402
C2622	Ceramic Product Manufacturing	12	180	0.335	0.297	0.370	-0.057	**0.053**	0.770
Q9700	Private Households Employing Staff	6	20	0.240	0.195	0.184	-0.058	-0.074	0.437
K7322	Building Societies	30	260	0.135	0.081	0.168	-0.062	0.039	0.641
C2322	Fabricated Wood Manufacturing	30	1150	0.127	0.072	0.162	-0.063	0.040	0.703
C2813	Automotive Electrical & Instrument Manuf	20	160	0.389	0.350	0.314	-0.064	-0.122	0.813
C2531	Fertiliser Manufacturing	65	910	0.071	0.012	0.146	-0.064	**0.080**	0.735
P9239	Recreational Parks and Gardens	130	2160	0.016	-0.049	0.030	-0.066	0.013	0.593
C2862	Mining & Construction Machinery Manuf	25	220	0.148	0.092	0.124	-0.066	-0.028	0.805
B1419	Construction Material Mining nec	160	940	0.015	-0.053	0.062	-0.068	0.049	0.567
G5312	Motor Cycle Dealing	300	1380	0.006	-0.062	0.042	-0.069	0.036	0.486
C2321	Plywood and Veneer Manufacturing	35	1970	0.090	0.020	0.129	-0.077	0.043	0.756
I6623	Port Operators	60	1800	0.103	0.033	0.033	-0.079	-0.078	0.599
C2111	Meat Processing	180	22950	0.030	-0.047	0.110	-0.079	**0.082**	0.667
O8612	Psychiatric Hospitals	25	1520	0.253	0.188	0.188	-0.086	-0.086	0.500
	Total Counts & Weighted mean indices	260850	1527260	0.022	0.049	0.047	0.028	0.025	0.401

Notes: See notes to Table 3 and Table 5. All measures are based on industry measures of concentration, across LMAs, calculated for each 4-digit ANZSIC industry. The table is sorted in descending order of MS concentration. Numbers in bold are those where concentration is high (greater than 0.05). The weighted mean is weighted by FTE employment.

Table 11: Most Dispersed 4-digit industries across LMAs (EG ≈ 0) – 2003

Industry		*Units*	*FTE*	*Herf*	*G_MS*	*G_EG*	*MS*	*EG*	*Gini*
F4719	Grocery Wholesaling nec	1080	8910	0.013	0.050	0.014	0.038	0.001	0.439
G5234	Domestic Appliance Retailing	1170	5400	0.002	0.018	0.004	0.016	0.001	0.194
G5252	Antique and Used Good Retailing	1050	2380	0.002	-0.013	0.003	-0.015	0.001	0.280
Q9525	Gardening Services	2100	3940	0.001	0.001	0.002	0.000	0.001	0.317
O8621	General Practice Medical Services	3090	9530	0.001	-0.015	0.002	-0.015	0.001	0.164
N8440	Other Education	2410	14610	0.004	0.033	0.005	0.029	0.001	0.393
E4221	Concreting Services	730	2320	0.003	0.004	0.004	0.001	0.001	0.386
G5255	Watch and Jewellery Retailing	540	2040	0.003	0.005	0.004	0.002	0.001	0.292
O8722	Residential Care Services nec	460	6620	0.008	0.000	0.009	-0.008	0.001	0.322
G5110	Supermarket and Grocery Stores	2790	36640	0.003	-0.027	0.003	-0.030	0.001	0.155
E4244	Painting and Decorating Services	3170	8610	0.002	-0.013	0.002	-0.015	0.001	0.206
P9252	Performing Arts Venues	120	630	0.089	0.173	0.089	0.093	0.001	0.472
E4232	Electrical Services	3860	13930	0.002	-0.011	0.002	-0.013	0.001	0.202
G5254	Flower Retailing	480	1140	0.003	0.014	0.004	0.011	0.001	0.238
O8729	Non-Residential Care Services nec	990	9070	0.007	-0.004	0.008	-0.011	0.001	0.435
E4242	Carpentry Services	2180	4120	0.002	0.015	0.002	0.013	0.001	0.337
L7822	Surveying Services	370	1860	0.009	-0.010	0.009	-0.019	0.000	0.385
G5311	Car Retailing	1710	11950	0.002	-0.014	0.003	-0.016	0.000	0.272
E4231	Plumbing Services	2980	8000	0.001	-0.012	0.001	-0.013	0.000	0.184
P9319	Sports and Services to Sports nec	1750	5450	0.005	0.012	0.005	0.008	0.000	0.224
G5251	Pharmaceutical/Cosmetic/Toiletry Retail	1150	6960	0.002	-0.011	0.002	-0.012	0.000	0.136
P9312	Sports Grounds and Facilities nec	770	5230	0.004	0.021	0.004	0.017	0.000	0.367
P9210	Libraries	270	3150	0.028	0.023	0.028	-0.005	0.000	0.235
C2839	Professional/Scientific Equip Manuf nec	100	710	0.133	0.243	0.133	0.127	0.000	0.612
E4243	Tiling and Carpeting Services	1540	2910	0.001	0.005	0.001	0.004	0.000	0.220
M8113	Local Government Administration	600	12410	0.008	-0.018	0.008	-0.027	0.000	0.370
C2854	Electric Light and Sign Manufacturing	75	560	0.066	0.196	0.066	0.139	0.000	0.510
G5125	Takeaway Food Retailing	3250	11130	0.001	-0.008	0.001	-0.009	0.000	0.190
O8710	Child Care Services	790	5700	0.002	-0.002	0.001	-0.004	0.000	0.200
Q9511	Video Hire Outlets	410	1780	0.003	-0.004	0.003	-0.008	-0.001	0.213
G5243	Newspaper, Book and Stationery Retailing	1050	4920	0.002	-0.004	0.002	-0.007	-0.001	0.197
I6509	Transport nec	110	300	0.020	-0.009	0.019	-0.030	-0.001	0.610
G5121	Fresh Meat, Fish and Poultry Retailing	660	2860	0.004	0.004	0.003	0.000	-0.001	0.337
N8423	Combined Primary and Secondary Education	70	1640	0.031	0.006	0.030	-0.026	-0.001	0.599
N8422	Secondary Education	360	22160	0.004	-0.020	0.003	-0.025	-0.001	0.192
G5269	Household Equipment Repair Services nec	530	1230	0.004	0.003	0.003	-0.001	-0.001	0.301

Notes: See notes to Table 3 and Table 5. All measures are based on industry measures of concentration, across LMAs, calculated for each 4-digit industry. The table is sorted in descending order of EG concentration.

Table 12: Colocation Groupings – 2003

Employment weighted	*# Inds*	*Units*	*FTE*	*FTE %*	*Herf*	*MS*	*EG*
Concentrated Manufacturing	65	11400	96520	6%	0.002	0.147	0.112
Wholesaling	49	13960	88670	6%	0.001	0.140	0.045
Business Services	52	57120	272710	17%	0.001	0.093	0.034
Other	34	2960	55700	4%	0.003	0.045	0.067
Local Services	101	130170	668690	43%	0.000	-0.008	0.001
Local Manufacturing	81	45120	281440	18%	0.000	-0.011	0.009
Resource-based	42	11610	105140	7%	0.002	-0.071	0.068
TOTAL	424	272330	1568870	100%	0.001	0.024	0.024

Note: See notes to Table 3 and Table 5. Colocation groups are groupings of 4-digit ANZSIC industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text. All measures are based on concentration across LMAs , calculated for each colocation group.

Table 13: Colocation Groupings – composition by 1-digit industry – 2003

	% Emp	cumul. % Emp
Business Services		
L:Property & Business Services	50%	50%
K:Finance and Insurance	17%	67%
N:Education	10%	77%
P:Cultural and Recreational Services	5%	82%
J:Communication Services	3%	85%
C:Manufacturing	3%	88%
Q:Personal and other Services	3%	91%
I:Transport and Storage	3%	94%
F:Wholesale Trade	3%	97%
O:Health & Community Services	2%	99%
G:Retail Trade	1%	100%
Concentrated Manufacturing		
C:Manufacturing	51%	51%
F:Wholesale Trade	25%	77%
I:Transport and Storage	12%	89%
J:Communication Services	6%	95%
L:Property & Business Services	5%	100%
B:Mining	0%	100%
P:Cultural and Recreational Services	0%	100%
Local Manufacturing		
C:Manufacturing	26%	26%
G:Retail Trade	16%	42%
E:Construction	14%	56%
F:Wholesale Trade	14%	70%
I:Transport and Storage	10%	80%
O:Health & Community Services	9%	89%
L:Property & Business Services	5%	94%
D:Electricity, Gas and Water Supply	2%	96%
Q:Personal and other Services	1%	98%
H:Accomm., Cafes & Restaurants	1%	98%
P:Cultural and Recreational Services	1%	99%
N:Education	1%	100%
B:Mining	0%	100%
Other		
M:Government Admin & Defence	60%	60%
C:Manufacturing	21%	81%
F:Wholesale Trade	6%	87%
N:Education	4%	91%
Q:Personal and other Services	3%	94%
L:Property & Business Services	3%	97%
I:Transport and Storage	3%	100%
B:Mining	0%	100%

	% Emp	cumul. % Emp
Local Services		
G:Retail Trade	22%	22%
O:Health & Community Services	17%	39%
N:Education	13%	52%
E:Construction	12%	64%
H:Accomm., Cafes & Restaurants	12%	75%
L:Property & Business Services	8%	83%
Q:Personal and other Services	4%	87%
P:Cultural and Recreational Services	3%	90%
C:Manufacturing	3%	94%
J:Communication Services	2%	96%
M:Government Admin & Defence	2%	98%
I:Transport and Storage	2%	100%
F:Wholesale Trade	0%	100%
D:Electricity, Gas and Water Supply	0%	100%
Resource-based		
C:Manufacturing	56%	56%
A:Agriculture, Forestry and Fishing	39%	95%
I:Transport and Storage	2%	97%
G:Retail Trade	1%	98%
B:Mining	1%	99%
K:Finance and Insurance	1%	100%
Wholesaling		
F:Wholesale Trade	43%	43%
C:Manufacturing	29%	72%
L:Property & Business Services	16%	88%
K:Finance and Insurance	3%	91%
P:Cultural and Recreational Services	3%	94%
E:Construction	3%	96%
G:Retail Trade	2%	99%
I:Transport and Storage	1%	100%

Notes: Statistics New Zealand 2003 Business Demography data. Colocation groups are groupings of 4-digit ANZSIC industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text.

Table 14: Groupings of 4-digit industries – 2003

	Percent of Employment		
	Low Concentration	*Medium Concentration*	*High Concentration*
Total	64	8	29
Colocation groupings			
Concentrated Manufacturing	4	14	82
Wholesaling	3	3	95
Business Services	12	11	76
Other	22	3	75
Local Services	92	6	2
Local Manufacturing	81	14	5
Resource-based	88	2	10
Primary Industry Group	**91**	**0**	**9**
A:Agriculture, Forestry and Fishing	95	0	5
B:Mining	56	3	41
Secondary Industry Group	**63**	**9**	**28**
C:Manufacturing	47	12	41
D:Electricity, Gas and Water Supply	100	0	0
E:Construction	95	3	2
Tertiary Industry Group	**62**	**8**	**30**
F:Wholesale Trade	16	26	57
G:Retail Trade	98	2	0
H:Accommodation, Cafes & Restaurants	100	0	0
I:Transport and Storage	62	1	36
J:Communication Services	53	0	47
K:Finance and Insurance	2	0	98
L:Property & Business Services	21	15	64
M:Government Administration & Defence	22	20	59
N:Education	87	13	0
O:Health & Community Services	97	0	3
P:Cultural and Recreational Services	71	5	24
Q:Personal and other Services	86	4	10

Notes: Statistics New Zealand 2003 Business Demography data. Columns show shares of employment in 4-digit ANZSIC industries that have high (H: greater than 0.05), medium (M: 0.02-0.05), and low (less than 0.02) degrees of concentration according to the Maurel-Sedillot index. Four-digit industries are grouped by colocation group, sector, or one-digit industry. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text.

Table 15: Within- and between- industry concentration for colocation groups – 2003

Employment weighted	*Within-industry*	*Between Industry (within group)*	*Total Concentration*
Concentrated Manufacturing	0.128	0.162	0.147
Wholesaling	0.132	0.162	0.140
Business Services	0.098	0.099	0.093
Other	0.093	0.010	0.045
Local Services	-0.009	-0.005	-0.008
Local Manufacturing	-0.008	-0.010	-0.011
Resource-based	-0.035	-0.069	-0.071

Notes: Within industry concentration is the employment-weighted average of concentration, as measured by the Maurel-Sedillot index, for each 4-digit industry within the group. The between industry measure is the employment weighted average of the coagglomeration index, as defined in the text, for each pair of industries within the group. Total concentration is the MS index of concentration, calculated for the colocation group. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text.

Table 16: Strength of colocation for colocation groups – 2003

	Conc_Mfrg	*Wholesale*	*Bus_Serv*	*Other*	*Local_Serv*	*Local_Mfrg*	*Resource*
Conc_Mfrg	**0.162**	**0.073**	**0.004**	**0.003**	**0.006**	**0.036**	**-0.063**
	(0.002)	***(0.001)***	***(0.001)***	***(0.002)***	***(0.000)***	***(0.001)***	***(0.001)***
Wholesale		**0.162**	**0.113**	-0.001	**0.046**	**0.030**	**-0.062**
		0.003	***(0.002)***	*(0.002)*	***(0.001)***	***(0.001)***	***(0.001)***
Bus_Serv			**0.099**	-0.001	**0.029**	0.001	**-0.066**
			(0.002)	*(0.002)*	***(0.000)***	*(0.001)*	***(0.001)***
Other				0.010	**-0.018**	**-0.023**	**-0.072**
				(0.007)	***(0.001)***	***(0.001)***	***(0.001)***
Local_Serv					**-0.005**	**-0.014**	**-0.066**
					(0.000)	***(0.000)***	***(0.000)***
Local_Mfrg						**-0.010**	**-0.066**
						(0.001)	***(0.000)***
Resource							**-0.069**
							(0.001)

Notes: The measures in the table are employment-weighted averages of the coagglomeration index, as defined in the text, for pairs of industries, where one industry is taken from the colocation group specified in the row, and the other from the colocation group specified in the column. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text.

Table 17: Average Area characteristics, by colocation group – 2003

	FTE	*Mean Area Specialisation*	*Mean LMA size*	*Mean Locational Quotient*
Total	1,428,400	0.0020	157,353	1.7
Colocation groupings				
Concentrated Manufacturing	88,635	-0.0002	183,540	1.9
Wholesaling	83,620	0.0009	219,034	1.6
Business Services	250,360	0.0024	198,891	1.5
Other	51,350	0.0034	156,032	2.7
Local Services	587,055	0.0024	142,886	1.2
Local Manufacturing	270,110	0.0016	138,642	1.6
Resource-based	97,270	0.0025	113,527	5.5
Primary Industry Group	38,610	0.0051	44,895	7.5
A:Agriculture, Forestry and Fishing	36,560	0.0053	41,640	7.3
B:Mining	2,050	0.0020	102,940	11.5
Secondary Industry Group	356,090	0.0008	165,323	2.0
C:Manufacturing	234,060	0.0003	180,315	2.5
D:Electricity, Gas and Water Supply	5,380	-0.0012	174,370	1.2
E:Construction	116,650	0.0019	134,825	1.2
Tertiary Industry Group	1,033,700	0.0023	158,808	1.4
F:Wholesale Trade	105,500	0.0007	180,635	1.7
G:Retail Trade	190,170	0.0022	136,989	1.1
H:Accommodation, Cafes & Restaurants	76,250	0.0042	128,088	1.6
I:Transport and Storage	66,375	0.0033	144,238	1.9
J:Communication Services	27,550	0.0016	156,199	1.4
K:Finance and Insurance	45,700	0.0028	195,165	1.6
L:Property & Business Services	208,000	0.0021	178,479	1.4
M:Government Administration & Defence	43,150	0.0043	160,291	2.1
N:Education	108,350	0.0021	167,437	1.1
O:Health & Community Services	87,850	0.0018	137,565	1.2
P:Cultural and Recreational Services	36,965	0.0034	173,148	1.8
Q:Personal and other Services	37,840	0.0022	153,849	1.3

Notes: Industry specialisation is the employment-weighted average of LMA specialisation, as shown in Table 7 as MS, weighted according to the proportion of industry, sector, or group employment in each LMA. The 'mean locational quotient' column shows the employment weighted average of the locational quotient, for all 4-digit industries within the industry, sector, or group. The locational quotient is defined for each 4-digit industry*LMA combination, as EijE/EiEj where i denotes industry and j denotes LMA. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text.

Table 18: Summary of distance densities, by group – 2003

Name of Industry Grouping	# ind	FTE Emp (000)	0-150 5km	30km	100km	150km	# ind	FTE Emp (000)	1-150 5km	30km	100km	150km
A: UNWEIGHTED												
Total	417	1526	63%	49%	30%	32%	414	1522	45%	46%	33%	34%
UK Comparison (Duranton &Overman)									37%	37%		17%
Conc Manufacturing	65	94	98%	72%	35%	28%	64	93	81%	69%	36%	31%
Wholesaling	47	86	96%	91%	17%	9%	46	84	96%	93%	20%	9%
Business Services	52	266	94%	46%	12%	6%	52	266	81%	46%	13%	6%
Other	31	55	84%	35	10%	10%	31	55	32%	19%	19%	19%
Local Services	101	650	32%	35%	31%	16%	101	649	18%	37%	33%	47%
Local Manufacturing	81	275	43%	43%	54%	11%	81	274	23%	37%	57%	57%
Resource-based	40	101	33%	20%	28%	5%	39	102	8%	13%	36%	38%
B: EMPLOYMENT WEIGHTED												
Total	417	1526	51%	38%	37%	42%	414	1522	41%	38%	39%	43%
Conc Manufacturing	65	94	100%	73%	46%	33%	64	93	88%	72%	46%	39%
Wholesaling	47	86	100%	95%	12%	6%	46	84	100%	98%	14%	6%
Business Services	52	266	100%	47%	16%	8%	52	266	77%	47%	18%	8%
Other	31	55	88%	12%	5%	6%	31	55	72%	9%	9%	11%
Local Services	101	650	26%	28%	39%	52%	101	649	22%	29%	42%	53%
Local Manufacturing	81	275	37%	40%	62%	70%	81	274	25%	38%	64%	72%
Resource-based	40	101	19%	11%	36%	41%	39	102	5%	5%	45%	41%

Notes: Distances densities are as defined in the text, following the approach of Duranton and Overman (2002). Distances are calculated between each pair of jobs in the economy, and the graphs summarise the density of these distances. The table summarises the proportion of industries (of employment in the 'weighted' panel) that is localised at each of 4 distances. The localisation measures are calculated for each 4-digit industries, and summarised for each colocation group, and across all industries. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text.

Table 19: Concentration and Gross Job Flows

a) OLS

	Birth	Expansion	**Job Creat.**	Death	Contraction	**Job Destr.**	Empl Ch
MS_i	9.743	3.974	**13.717**	6.705	1.284	**7.989**	5.728
	*(0.703)***	*(0.692)***	***(1.013)****	*(0.870)***	*(1.076)*	***(1.372)****	*(1.577)***
$Herf_i$	-22.730	-13.317	**-36.048**	-14.904	-2.472	**-17.376**	-18.672
	*(1.367)***	*(0.817)***	***(1.903)****	*(1.226)***	*(1.421)*	***(1.787)****	*(2.427)***
$\ln(Emp_i)$	-0.923	-0.383	**-1.306**	-1.458	-0.068	**-1.525**	0.219
	*(0.049)***	*(0.051)***	***(0.075)****	*(0.071)***	*(0.084)*	***(0.120)****	*(0.123)**
LMA_MS_i	48.222	36.399	**84.621**	49.428	18.980	**68.409**	16.212
	*(7.153)***	*(7.703)***	***(10.710)****	*(12.373)***	*(12.859)*	***(18.872)****	*(20.391)*
LMA_Herf_i	-25.071	-31.600	**-56.670**	-12.486	-5.831	**-18.317**	-38.354
	*(4.143)***	*(4.380)***	***(5.971)****	*(7.582)*	*(16.572)*	***(17.668)***	*(17.368)***
$\ln(Emp_i)$	0.220	0.210	**0.430**	-0.361	-0.105	**-0.466**	0.896
	*(0.046)***	*(0.044)***	***(0.067)****	*(0.063)***	*(0.080)*	***(0.107)****	*(0.110)***
$\ln(LQ_{ij})$	-1.605	-0.426	**-2.031**	-1.234	0.958	**-0.276**	-1.754
	*(0.058)***	*(0.063)***	***(0.087)****	*(0.093)***	*(0.124)***	***(0.156)***	*(0.170)***
Obs	206331	206331	**206331**	206331	206331	**206331**	206331
R^2	0.07	0.03	**0.08**	0.03	0.03	**0.04**	0.04

b) LMA Fixed Effects

	Birth	Expansion	**Job Creat.**	Death	Contraction	**Job Destr.**	Empl Ch
MS_i	11.321	1.924	**13.245**	6.590	-3.119	**3.470**	9.775
	*(0.754)***	*(0.796)**	***(1.119)****	*(1.248)***	*(1.304)**	***(1.778)***	*(2.000)***
$Herf_i$	-8.964	-11.765	**-20.729**	-4.410	-1.665	**-6.076**	-14.653
	*(0.913)***	*(0.882)***	***(1.523)****	*(1.303)***	*(1.495)*	***(1.899)****	*(2.467)***
$\ln(Emp_i)$	-0.514	-0.783	**-1.297**	-0.858	-0.334	**-1.192**	-0.105
	*(0.050)***	*(0.054)***	***(0.076)****	*(0.083)***	*(0.093)***	***(0.128)****	*(0.140)*
LMA_MS_i	16.026	-22.454	**-6.427**	44.719	-43.407	**1.312**	-7.739
	(19.495)	*(19.593)*	***(27.076)***	*(35.158)*	*(39.609)*	***(49.837)***	*(60.794)*
LMA_Herf_i	-8.953	-44.950	**-53.903**	-28.192	74.184	**45.992**	-99.895
	(8.015)	*(8.342)***	***(11.091)****	*(14.240)**	*(31.863)**	***(33.044)***	*(33.819)***
$\ln(Emp_i)$	-0.634	-1.344	**-1.978**	2.139	4.167	**6.306**	-8.284
	(0.597)	*(0.667)**	***(0.908)****	*(1.100)*	*(1.174)***	***(1.621)****	*(1.794)***
$\ln(LQ_{ij})$	-1.512	-0.514	**-2.026**	-1.360	0.966	**-0.394**	-1.632
	*(0.053)***	*(0.063)***	***(0.083)****	*(0.095)***	*(0.127)***	***(0.157)****	*(0.175)***
Obs	206331	206331	**206331**	206331	206331	**206331**	206331
R^2	0.20	0.05	**0.17**	0.07	0.07	**0.09**	0.06

Table 19 (cont) Concentration and Gross Job Flows

c) LMA and 4-digit Industry Fixed Effects

	Birth	Expansion	**Job Creat.**	Death	Contraction	**Job Destr.**	Empl Ch
MS_i	-0.668	-0.479	**-1.147**	3.548	-1.453	**2.095**	-3.242
	(1.272)	*(1.841)*	***(2.268)***	*(2.508)*	*(3.828)*	***(4.043)***	*(1.741)*
$Herf_i$	-1.389	-16.895	**-18.284**	5.913	29.734	**35.647**	-53.931
	(2.190)	*(3.553)***	***(4.175)****	*(6.239)*	*(10.294)***	***(10.072)****	*(2.911)***
$\ln(Emp_i)$	-3.653	-1.500	**-5.154**	1.763	4.931	**6.694**	-11.847
	*(0.234)***	*(0.250)***	***(0.318)****	*(0.601)***	*(0.532)***	***(0.895)****	*(0.202)***
LMA_MS_i	10.158	-19.092	**-8.934**	41.674	-42.863	**-1.189**	-7.745
	(18.304)	*(18.932)*	***(25.010)***	*(32.598)*	*(38.818)*	***(46.537)***	*(24.639)*
LMA_Herf_i	-8.875	-43.298	**-52.173**	-22.881	74.473	**51.592**	-103.765
	(8.004)	*(8.318)***	***(11.007)****	*(14.046)*	*(30.487)**	***(30.712)***	*(14.307)***
$\ln(Emp_i)$	-0.291	-1.134	**-1.424**	1.377	3.271	**4.648**	-6.072
	(0.532)	*(0.642)*	***(0.825)***	*(0.974)*	*(1.112)***	***(1.439)****	*(0.795)***
$\ln(LQ_{ij})$	-1.498	-0.521	**-2.019**	-1.380	1.062	**-0.318**	-1.701
	*(0.049)***	*(0.065)***	***(0.080)****	*(0.097)***	*(0.136)***	***(0.163)***	*(0.071)***
Obs	206331	206331	**206331**	206331	206331	**206331**	206331
R^2	0.32	0.09	**0.28**	0.12	0.10	**0.14**	0.10

Notes: Each column contains estimates from a separate regression. Regressions are based on an unbalanced panel of 386 4-digit industries over 16 one-year periods. Covariates are measured as at the beginning of the period for which the dependent variable flow is measured. Regressions are weighted by initial FTE employment. Robust standard errors are shown in brackets. All regressions also contain period intercepts, and a constant.

Table 20: Concentration and Gross Job Flows – by colocation group

a) Total Employment Change

	Conc_Mfrg	Wholesale	Bus_Serv	Other	Local_Serv	Local_Mfg	Resource
MS_i	2.127	19.272	-29.449	-2.969	34.873	24.981	-31.176
	(7.794)	*(10.012)*	*(11.564)**	*(12.381)*	*(23.134)*	*(11.763)**	*(20.903)*
$Herf_i$	-21.525	-99.606	-140.484	-14.486	-73.345	-40.465	-50.432
	(26.688)	*(38.591)***	*(35.735)***	*(11.861)*	*(32.844)**	*(17.149)**	*(22.479)**
$\ln(Emp_i)$	-21.512	-11.485	-9.767	-10.857	-11.563	-6.118	-12.546
	*(3.999)***	*(2.040)***	*(1.404)***	*(2.426)***	*(1.183)***	*(1.253)***	*(2.492)***
LMA_MS_i	516.858	-315.319	145.598	-205.869	-43.091	42.605	0.433
	(364.093)	*(413.287)*	*(133.884)*	*(227.215)*	*(68.191)*	*(67.888)*	*(144.948)*
LMA_Herf_i	53.420	-380.832	-36.428	165.862	-43.878	-63.975	-286.341
	(106.447)	*(212.506)*	*(50.301)*	*(129.739)*	*(29.089)*	*(40.932)*	*(82.773)***
$\ln(Emp_i)$	-32.259	-10.679	1.941	-0.148	-2.670	-6.973	-19.603
	*(9.600)***	*(9.245)*	*(4.379)*	*(7.905)*	*(2.056)*	*(2.459)***	*(6.807)***
$\ln(LQ_{ij})$	-4.437	-5.679	-4.786	-0.812	-5.795	-3.562	-1.808
	*(0.997)***	*(1.053)***	*(0.517)***	*(0.568)*	*(0.445)***	*(0.358)***	*(0.461)***
Obs	19681	16950	28538	7202	66674	49554	17732
R^2	0.20	0.18	0.13	0.08	0.11	0.10	0.09

b) Job Creation Rate

	Conc_Mfrg	Wholesale	Bus_Serv	Other	Local_Serv	Local_Mfg	Resource
MS_i	1.245	-2.079	-12.281	0.184	-0.859	5.326	3.554
	(2.782)	*(4.981)*	*(6.707)*	*(6.262)*	*(11.389)*	*(6.093)*	*(9.636)*
$Herf_i$	-7.525	-29.902	-58.822	-25.074	6.008	-15.767	-16.919
	(6.241)	*(11.955)**	*(16.132)***	*(8.999)***	*(20.907)*	*(8.205)*	*(10.349)*
$\ln(Emp_i)$	-2.245	-4.896	-6.975	-4.917	-6.752	-4.143	-2.598
	*(0.822)***	*(0.783)***	*(0.935)***	*(1.191)***	*(0.589)***	*(0.542)***	*(0.997)***
LMA_MS_i	74.844	31.989	47.995	-163.052	-38.408	38.765	0.138
	(103.469)	*(87.720)*	*(87.522)*	*(154.132)*	*(25.564)*	*(38.107)*	*(71.361)*
LMA_Herf_i	-37.676	-18.077	-75.788	86.135	-26.784	-29.984	-107.640
	(32.378)	*(39.353)*	*(27.119)***	*(63.169)*	*(11.375)**	*(15.376)*	*(39.708)***
$\ln(Emp_i)$	-4.074	-3.688	5.109	0.835	-0.911	-4.817	-7.300
	(2.893)	*(3.160)*	*(2.742)*	*(5.003)*	*(1.074)*	*(1.336)***	*(3.497)**
$\ln(LQ_{ij})$	-3.766	-4.023	-3.908	-2.505	-3.580	-3.085	-2.557
	*(0.235)***	*(0.250)***	*(0.300)***	*(0.345)***	*(0.190)***	*(0.166)***	*(0.204)***
Obs	19681	16950	28538	7202	66674	49554	17732
R^2	0.21	0.22	0.38	0.18	0.35	0.15	0.23

Table 20 (cont) Concentration and Gross Job Flows – by colocation group

c) Job Destruction Rate

	Conc_Mfrg	Wholesale	Bus_Serv	Other	Local_Serv	Local_Mfg	Resource
MS_i	-0.882	-21.351	17.167	3.153	-35.731	-19.655	34.730
	(7.016)	*(8.448)**	*(10.580)*	*(11.377)*	*(20.688)*	*(10.517)*	*(17.930)*
$Herf_i$	14.000	69.704	81.662	-10.588	79.352	24.698	33.513
	(23.804)	*(33.687)**	*(33.847)**	*(11.976)*	*(36.954)**	*(15.263)*	*(18.825)*
$\ln(Emp_i)$	19.267	6.589	2.792	5.940	4.811	1.975	9.948
	*(4.247)***	*(1.805)***	*(1.114)**	*(2.152)***	*(1.042)***	*(1.131)*	*(2.269)***
LMA_MS_i	-442.014	347.308	-97.604	42.817	4.683	-3.840	-0.295
	(343.149)	*(405.630)*	*(100.561)*	*(189.474)*	*(62.433)*	*(58.256)*	*(120.857)*
LMA_Herf_i	-91.096	362.755	-39.361	-79.727	17.094	33.991	178.701
	(97.504)	*(212.019)*	*(39.721)*	*(103.574)*	*(25.038)*	*(37.551)*	*(83.261)**
$\ln(Emp_i)$	28.186	6.991	3.168	0.983	1.759	2.155	12.302
	*(9.551)***	*(8.477)*	*(3.493)*	*(6.230)*	*(1.792)*	*(2.048)*	*(5.913)**
$\ln(LQ_{ij})$	0.671	1.656	0.878	-1.693	2.215	0.477	-0.749
	(1.022)	*(1.025)*	*(0.419)**	*(0.464)***	*(0.392)***	*(0.318)*	*(0.395)*
Obs	19681	16950	28538	7202	66674	49554	17732
R^2	0.26	0.17	0.20	0.13	0.19	0.10	0.13

Notes: Each column contains estimates from a separate regression. Regressions are based on an unbalanced panel of 386 4-digit industries over 16 one-year periods. Covariates are measured as at the beginning of the period for which the dependent variable flow is measured. Regressions are weighted by initial FTE employment. Robust standard errors are shown in brackets. All regressions contain a constant, period intercepts, 4-digit industry fixed effects, and LMA fixed effects.

Table 21: Concentration and Gross Firm Flows – by colocation group

a) Firm birth rate

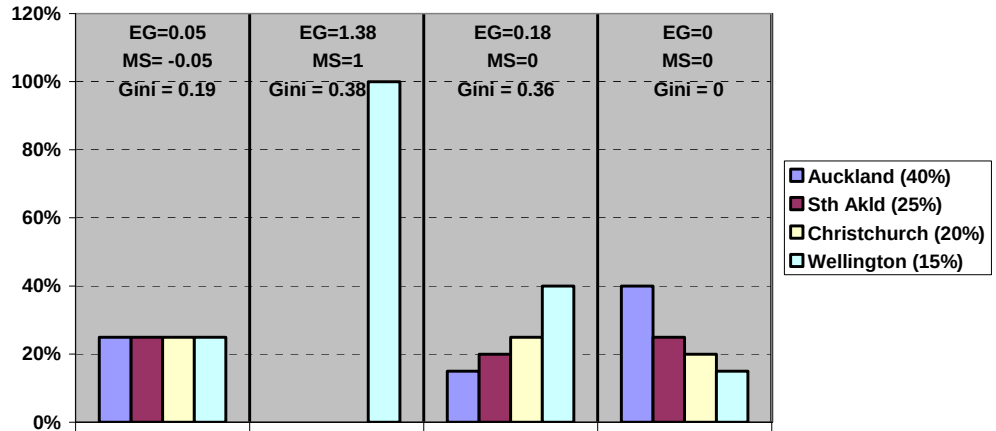
	Total	Conc Mfrg	Wholesal	Bus_Serv	Other	Local Serv	Local Mfg	Resource
MS_i	59.063	-3.894	11.153	1.596	-19.345	243.238	-1.838	71.660
	(15.20)**	(3.566)	(4.417)*	(4.481)	(4.647)**	(61.04)**	(4.571)	(8.416)**
$Herf_i$	49.845	9.582	-18.169	14.615	-6.994	-110.979	9.207	219.611
	(7.040)**	(6.309)	(9.041)*	(16.092)	(9.867)	(44.906)*	(8.002)	(34.14)**
$\ln(Emp_i)$	-15.336	-1.200	-8.478	-3.274	-4.232	-26.268	-2.406	2.139
	(1.939)**	(0.674)	(0.778)**	(0.633)**	(0.626)**	(2.607)**	(0.449)**	(1.112)
LMA_MS_i	34.086	63.288	-7.863	27.771	133.428	36.150	72.049	9.354
	(41.300)	(71.256)	(91.256)	(51.038)	(114.367)	(58.749)	(24.18)**	(67.523)
LMA_Herf_i	-43.142	-27.467	58.520	-72.837	123.655	-44.705	-18.508	9.951
	(15.69)**	(45.688)	(39.796)	(25.89)**	(70.086)	(23.331)	(13.099)	(33.700)
$\ln(Emp_i)$	-0.654	-0.953	-3.606	-0.871	0.193	-1.651	-2.120	-0.668
	(1.675)	(2.485)	(2.733)	(1.812)	(3.519)	(2.623)	(0.911)*	(2.965)
$\ln(LQ_{ij})$	-2.602	-3.172	-3.449	-3.387	-1.336	-4.413	-2.728	-2.588
	(0.239)**	(0.207)**	(0.208)**	(0.197)**	(0.209)**	(1.005)**	(0.123)**	(0.248)**
Obs	206331	19681	16950	28538	7202	66674	49554	17732
R^2	0.37	0.32	0.33	0.47	0.19	0.49	0.26	0.30

b) Firm death rate

	Total	Conc Mfrg	Wholesal	Bus_Serv	Other	Local Serv	Local Mfg	Resource
MS_i	0.532	-3.392	-7.133	15.534	14.714	-1.931	-5.155	1.970
	(2.769)	(3.526)	(2.892)*	(3.118)**	(15.497)	(7.828)	(4.150)	(6.434)
$Herf_i$	5.334	-13.446	16.519	-10.185	29.801	29.137	-22.363	0.931
	(5.429)	(5.780)*	(6.677)*	(9.113)	(12.419)*	(10.64)**	(7.564)**	(8.314)
$\ln(Emp_i)$	2.933	0.489	2.917	4.367	-2.664	2.545	0.089	3.825
	(0.243)**	(0.574)	(0.475)**	(0.313)**	(1.631)	(0.365)**	(0.393)	(0.517)**
LMA_MS_i	-15.920	-19.900	12.078	-1.521	-106.417	-0.086	-55.638	-32.937
	(15.123)	(96.375)	(90.253)	(42.738)	(128.842)	(20.561)	(26.393)*	(45.578)
LMA_Herf_i	-3.171	-35.477	-48.686	4.258	16.803	-2.813	6.688	-26.069
	(8.457)	(66.995)	(53.717)	(26.481)	(81.278)	(11.685)	(15.430)	(24.548)
$\ln(Emp_i)$	1.235	7.441	1.185	-0.121	0.213	0.855	0.539	2.725
	(0.510)*	(2.364)**	(2.099)	(1.257)	(5.317)	(0.748)	(0.861)	(1.710)
$\ln(LQ_{ij})$	-1.341	-2.379	-2.223	-1.118	-2.254	-0.461	-1.604	-1.817
	(0.060)**	(0.184)**	(0.189)**	(0.155)**	(0.424)**	(0.158)**	(0.108)**	(0.147)**
Obs	206331	19681	16950	28538	7202	66674	49554	17732
R^2	0.17	0.11	0.10	0.23	0.14	0.26	0.10	0.11

Notes: Each column contains estimates from a separate regression. Regressions are based on an unbalanced panel of 386 4-digit industries over 16 one-year periods. Covariates are measured as at the beginning of the period for which the dependent variable flow is measured. Regressions are weighted by initial number of firms. Robust standard errors are shown in brackets. All regressions contain a constant, period intercepts, 4-digit industry fixed effects, and LMA fixed effects.

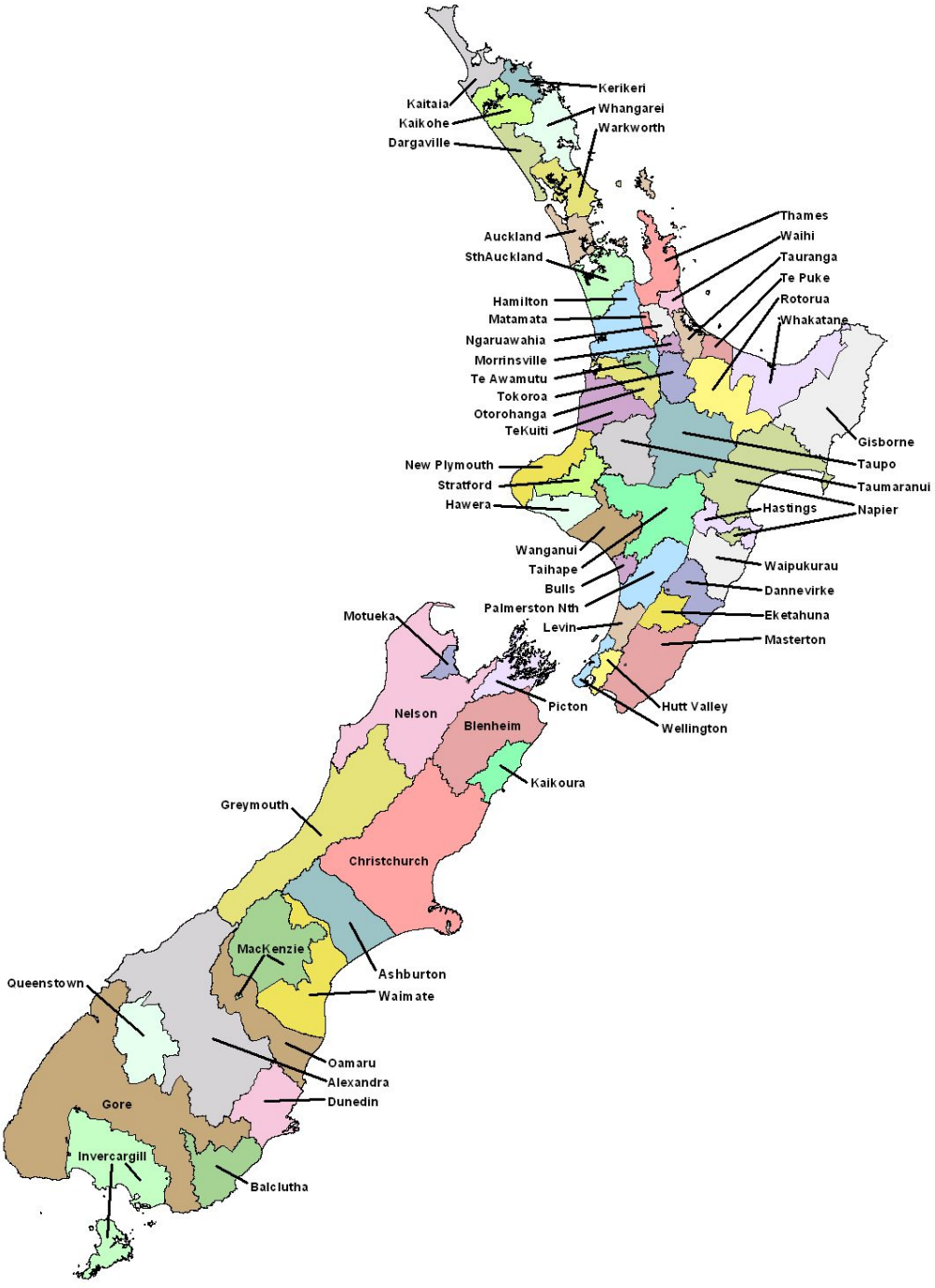
Figure 1: Concentration Indices for hypothetical industries



	Ind A	Ind B	Ind C	Total
Auckland (40%)	25%	0%	15%	40.0%
Sth Akld (25%)	25%	0%	20%	25.0%
Christchurch (20%)	25%	0%	25%	20.0%
Wellington (15%)	25%	100%	40%	15.0%

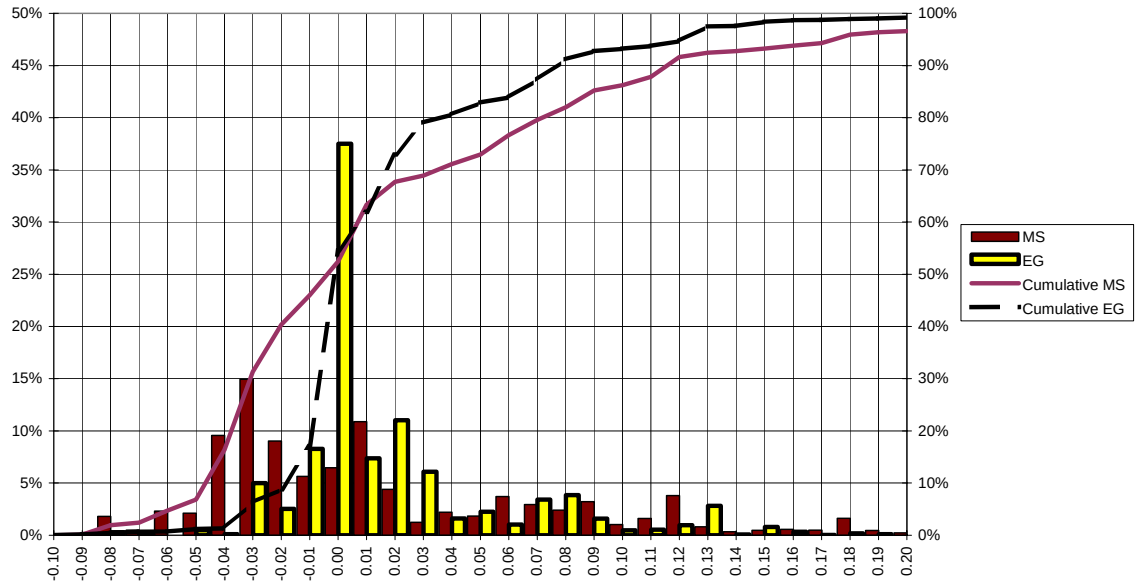
Notes: The figure shows hypothetical examples of the distribution of industry employment across four geographic regions. The regions are named for expositional purposes. MS refers to the raw geographic concentration index G, as defined in equation (5). EG refers to the raw geographic concentration index GEG, as defined in equation (6). Gini refers to the relative locational Gini, which measures the degree of inequality in the locational quotient.

Figure 2: Map of Labour Market Areas



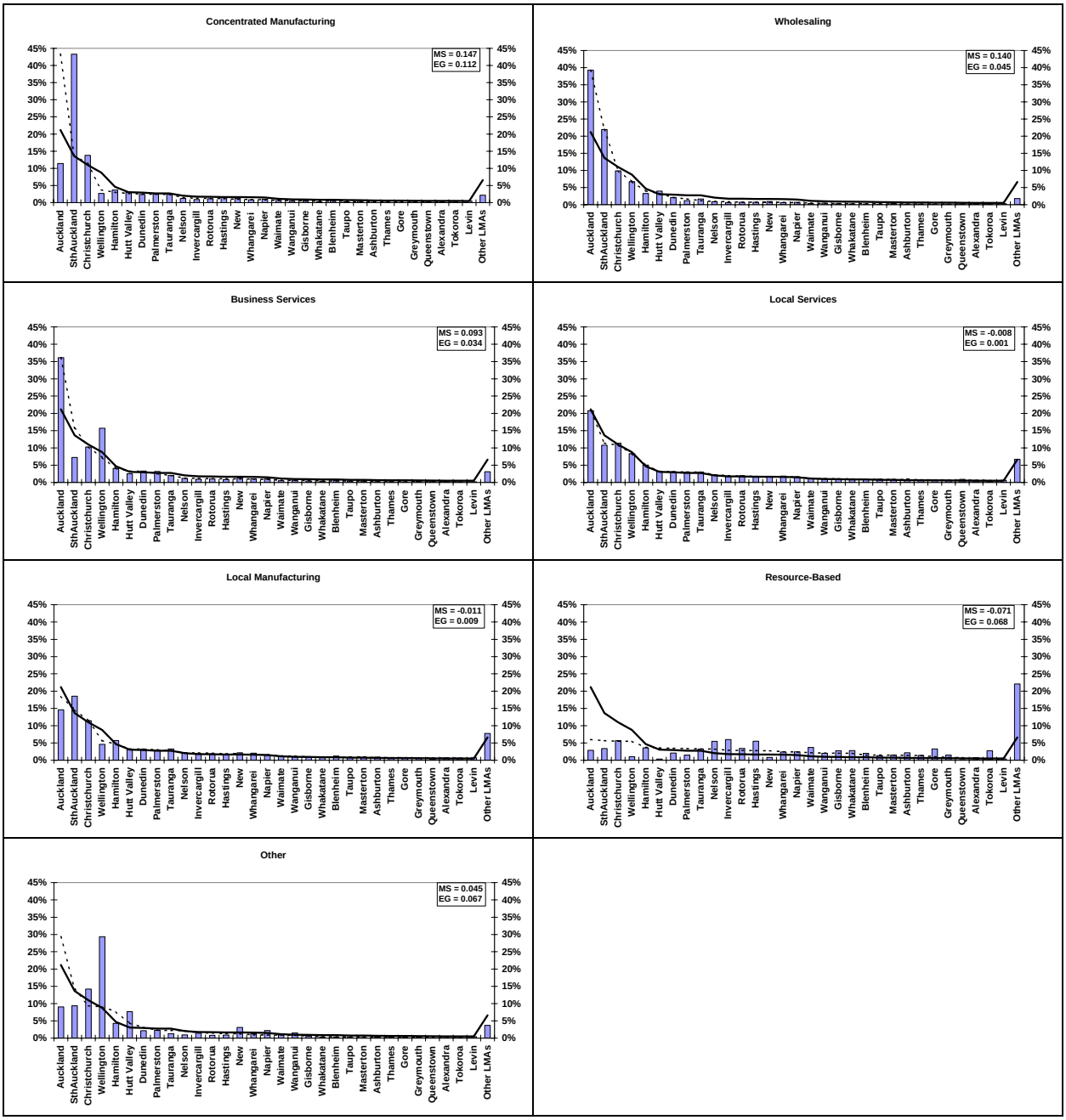
Notes: The Labour Market Areas are defined based on commuting patterns, as outlined in Newell and Papps (2001).

Figure 3: Distribution of concentration indices: 4-digit industries; Labour Market Areas – 2003



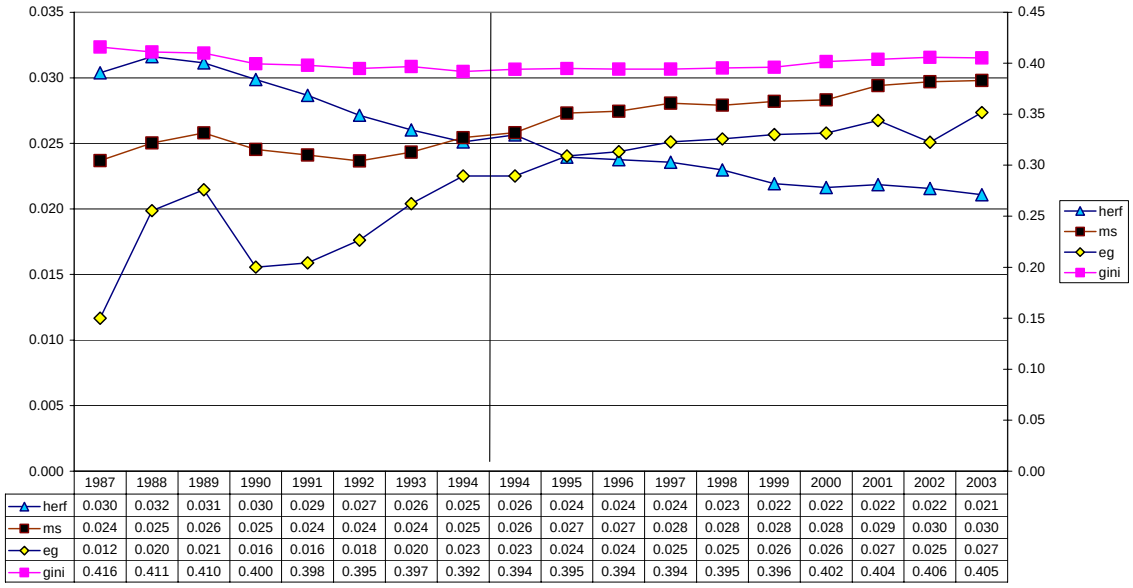
Notes: Statistics New Zealand 2003 Business Demography data. The graph uses information on 386 industries for which no information has been suppressed. EG is the index of geographic concentration as defined in Ellison and Glaeser (1997) and shown in Equation (6) (EG=□EG). GMS and MS are indices of geographic concentration as defined in Maurel and Sedillot (1999) and shown in Equation (5) (MS=□). Cumulative densities use the right-hand axis.

Figure 4: Distribution of Group Employment across Labour Market Areas – 2003



Note: Statistics New Zealand 2003 Business Demography data. Each panel shows a graph for a colocation group. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text. Vertical bars show the proportion of group employment in each LMA. The solid line shows the proportion of total employment in each LMA. The dotted lines show the same information as in the vertical bars, but resorted with the highest proportion at the left.

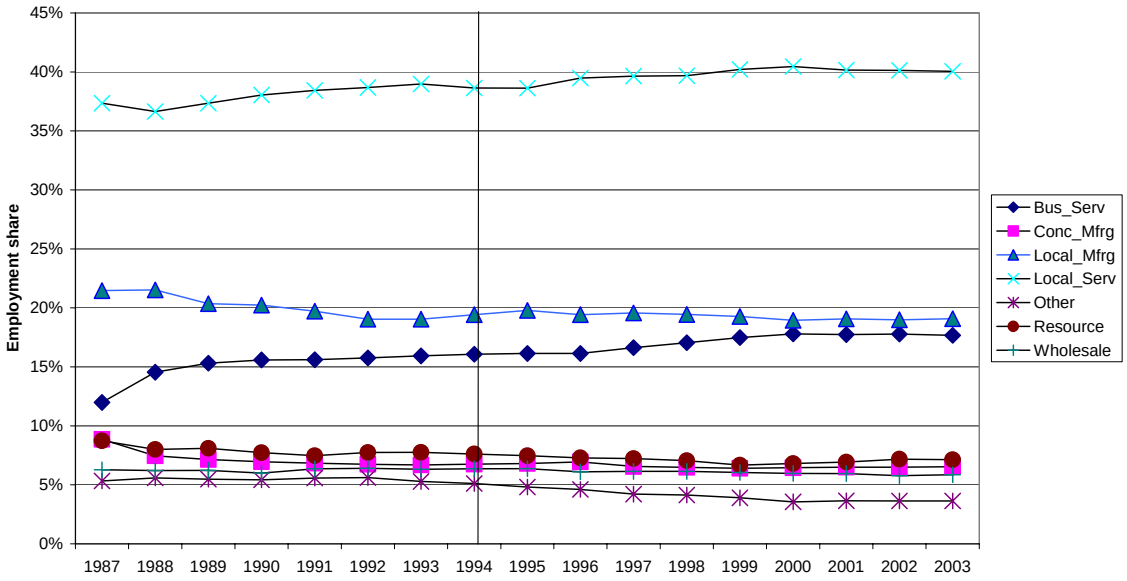
Figure 5: Trends in Concentration: 4-digit industries; Labour Market Areas



	1987	1988	1989	1990	1991	1992	1993	1994	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
herf	0.030	0.032	0.031	0.030	0.029	0.027	0.026	0.025	0.026	0.024	0.024	0.024	0.023	0.022	0.022	0.022	0.022	0.021
ms	0.024	0.025	0.026	0.025	0.024	0.024	0.024	0.025	0.026	0.027	0.027	0.028	0.028	0.028	0.028	0.029	0.030	0.030
eg	0.012	0.020	0.021	0.016	0.016	0.018	0.020	0.023	0.023	0.024	0.024	0.025	0.025	0.026	0.026	0.027	0.025	0.027
gini	0.416	0.411	0.410	0.400	0.398	0.395	0.397	0.392	0.394	0.395	0.394	0.394	0.395	0.396	0.402	0.404	0.406	0.405

Notes: Statistics New Zealand Business Demography data. All series are employment-weighted averages of concentration measures for all 4-digit ANZSIC industries, based on distribution of employment across Labour Market Areas. Herf is the industry plant Herfindahl index of industrial concentration, and is plotted against the right-hand axis. EG is the index of geographic concentration as defined in Ellison and Glaeser (1997) and shown in Equation (6) (EG=□EG). MS is the index of geographic concentration as defined in Maurel and Sedillot (1999) and shown in Equation (5) (MS=□). Gini is the relative locational Gini, which measures the degree of inequality in the locational quotient. The graph contains two observations for 1994, to show the impact of the series break in 1994. The first 1994 observation is consistent with the 1987-1994 data. The second is consistent with the 1994-2003 data.

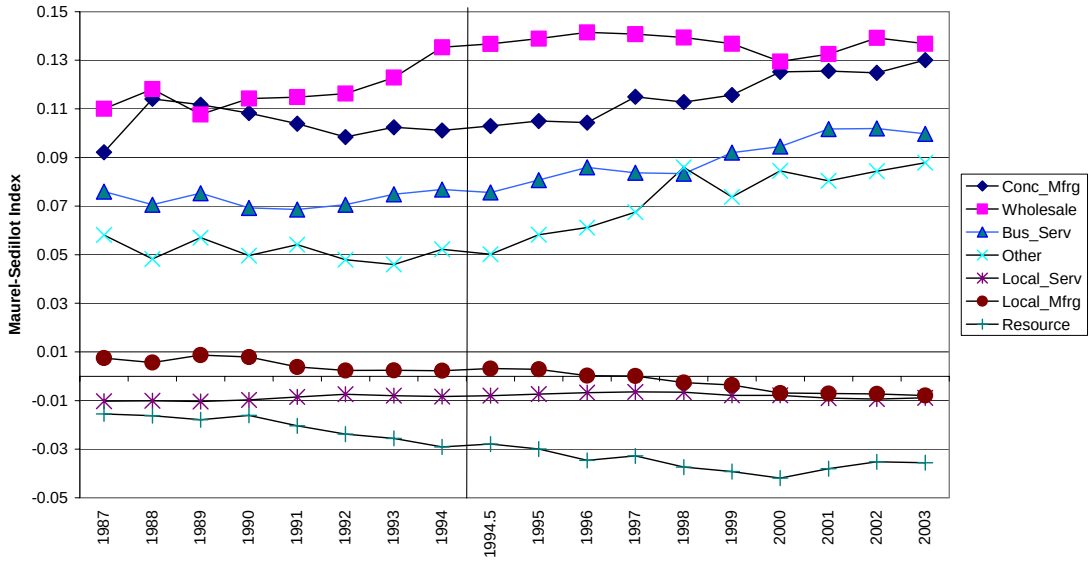
Figure 6: Trends in employment shares 1987-2003
colocation groups of 4-digit industries; Labour Market Areas



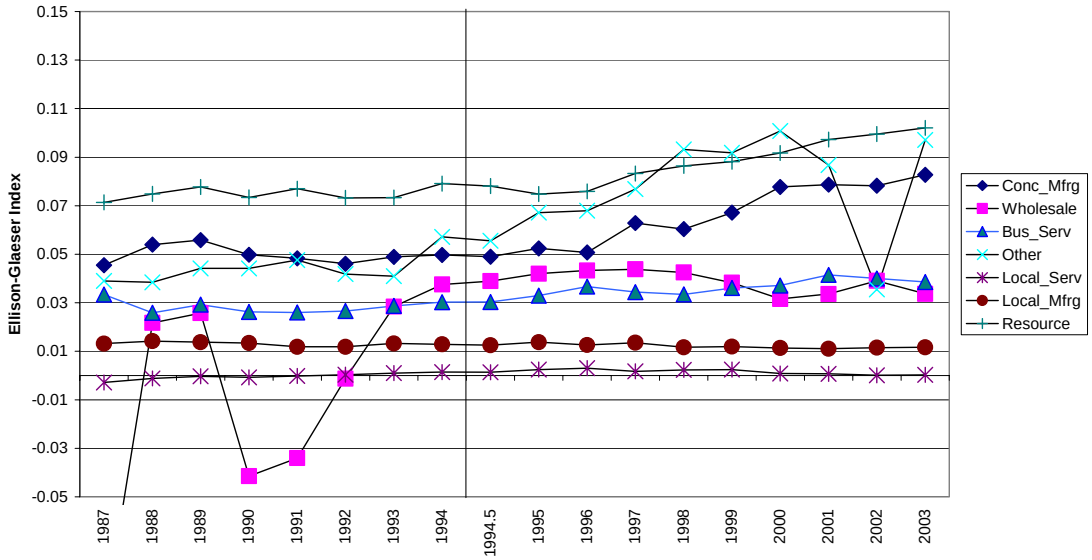
Note: Statistics New Zealand Business Demography data. All series are shares of total employment in each colocation group. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text. The graph contains two observations for 1994, to show the impact of the series break in 1994. The first 1994 observation is consistent with the 1987-1994 data. The second is consistent with the 1994-2003 data.

Figure 7: Trends in concentration 1987-2003
colocation groups of 4-digit industries; Labour Market Areas

a) Maurel Sedillot index



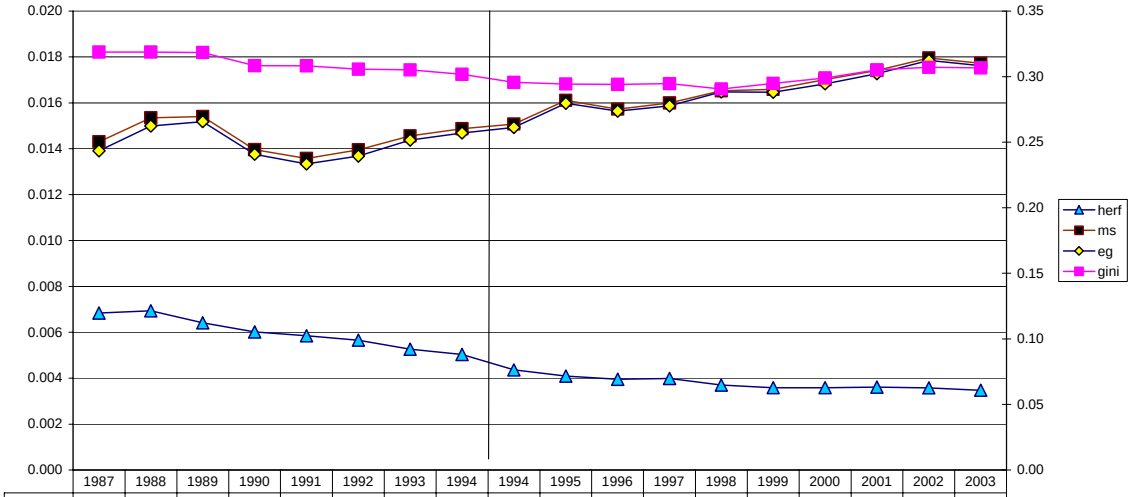
b) Ellison Glaeser index



Note: Statistics New Zealand Business Demography data. All series are employment-weighted averages of concentration measures for all 4-digit ANZSIC industries, based on distribution of employment across Labour Market Areas. The averages are shown separately for each colocation group. Panel (a) shows average concentration, measured by the Maurel Sedillot index as defined in Maurel and Sedillot (1999) and shown in Equation (5) (MS=□). Panel (b) shows concentration measured by the Ellison-Glaeser index, as defined in Ellison and Glaeser (1997) and shown in Equation (6) (EG=□EG). Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text. The graph contains two observations for 1994, to show the impact of the series break in 1994. The first 1994 observation is consistent with the 1987-1994 data. The second is consistent with the 1994-2003 data.

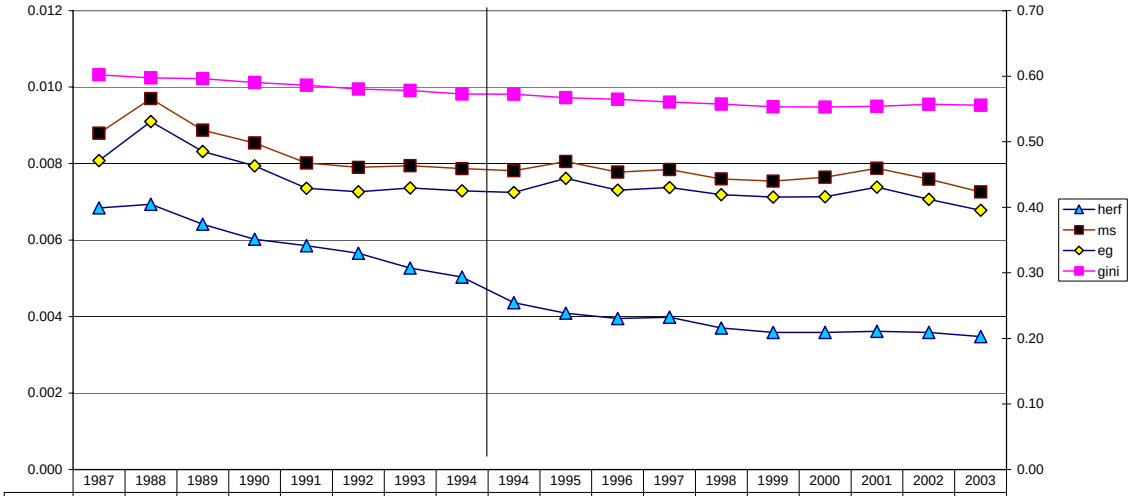
Figure 8: Trends in Concentration of 2-digit industries

a) across Labour Market Areas



	1987	1988	1989	1990	1991	1992	1993	1994	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
herf	0.0068	0.0069	0.0064	0.006	0.0059	0.0057	0.0053	0.005	0.0044	0.0041	0.004	0.004	0.0037	0.0036	0.0036	0.0036	0.0036	0.0035
ms	0.0143	0.0153	0.0154	0.014	0.0136	0.014	0.0146	0.0149	0.0151	0.0161	0.0157	0.016	0.0165	0.0166	0.017	0.0174	0.018	0.0177
eg	0.0139	0.015	0.0152	0.0138	0.0133	0.0137	0.0144	0.0147	0.0149	0.016	0.0156	0.0159	0.0165	0.0165	0.0168	0.0173	0.0179	0.0176
gini	0.3187	0.3187	0.3184	0.3083	0.3083	0.3057	0.3052	0.3017	0.2957	0.2944	0.2941	0.2947	0.2906	0.2948	0.299	0.3052	0.307	0.3067

b) across Area Units

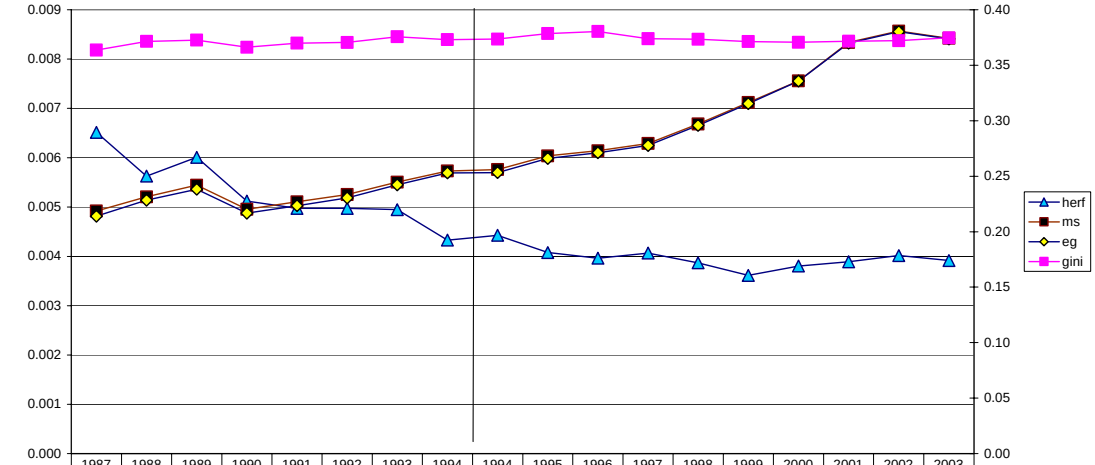


	1987	1988	1989	1990	1991	1992	1993	1994	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
herf	0.0068	0.0069	0.0064	0.006	0.0059	0.0057	0.0053	0.005	0.0044	0.0041	0.004	0.004	0.0037	0.0036	0.0036	0.0036	0.0036	0.0035
ms	0.0088	0.0097	0.0089	0.0085	0.008	0.0079	0.0079	0.0079	0.0078	0.0081	0.0078	0.0078	0.0076	0.0075	0.0076	0.0079	0.0076	0.0073
eg	0.0081	0.0091	0.0083	0.0079	0.0074	0.0073	0.0074	0.0073	0.0072	0.0076	0.0073	0.0074	0.0072	0.0071	0.0071	0.0074	0.0071	0.0068
gini	0.6022	0.5974	0.5963	0.5905	0.5862	0.5803	0.5782	0.5728	0.5725	0.5673	0.5647	0.5604	0.5573	0.5532	0.553	0.5539	0.5572	0.5557

Notes: Statistics New Zealand Business Demography data. All series are employment-weighted averages of concentration measures for all 2-digit ANZSIC industries, based on distribution of employment across Labour Market Areas in panel (a) and across Census Area Units in panel (b). Herf is the industry plant Herfindahl index of industrial concentration, and is plotted against the right-hand axis. EG is the index of geographic concentration as defined in Ellison and Glaeser (1997) and shown in Equation (6) (EG=□EG). MS is the index of geographic concentration as defined in Maurel and Sedillot (1999) and shown in Equation (5) (MS=□). Gini is the relative locational Gini, which measures the degree of inequality in the locational quotient. The graph contains two observations for 1994, to show the impact of the series break in 1994. The first 1994 observation is consistent with the 1987-1994 data. The second is consistent with the 1994-2003 data.

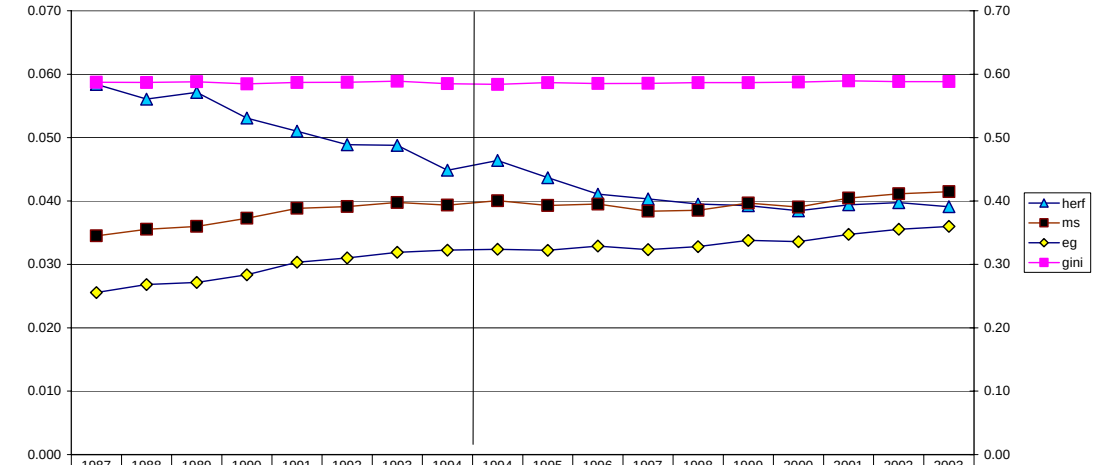
Figure 9: Industrial Specialisation of Labour Market Areas and Area Units

a) Labour Market Areas



	1987	1988	1989	1990	1991	1992	1993	1994	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
herf	0.0065	0.0056	0.006	0.0051	0.005	0.005	0.0049	0.0043	0.0044	0.0041	0.004	0.0041	0.0039	0.0036	0.0038	0.0039	0.004	0.0039
ms	0.0049	0.0052	0.0054	0.005	0.0051	0.0053	0.0055	0.0057	0.0058	0.006	0.0061	0.0063	0.0067	0.0071	0.0076	0.0083	0.0086	0.0084
eg	0.0048	0.0051	0.0054	0.0049	0.005	0.0052	0.0054	0.0057	0.0057	0.006	0.0061	0.0063	0.0067	0.0071	0.0076	0.0083	0.0086	0.0084
gini	0.3638	0.3716	0.3727	0.3663	0.3699	0.3706	0.3757	0.3731	0.3737	0.3785	0.3804	0.374	0.3735	0.3714	0.3708	0.3716	0.3722	0.3748

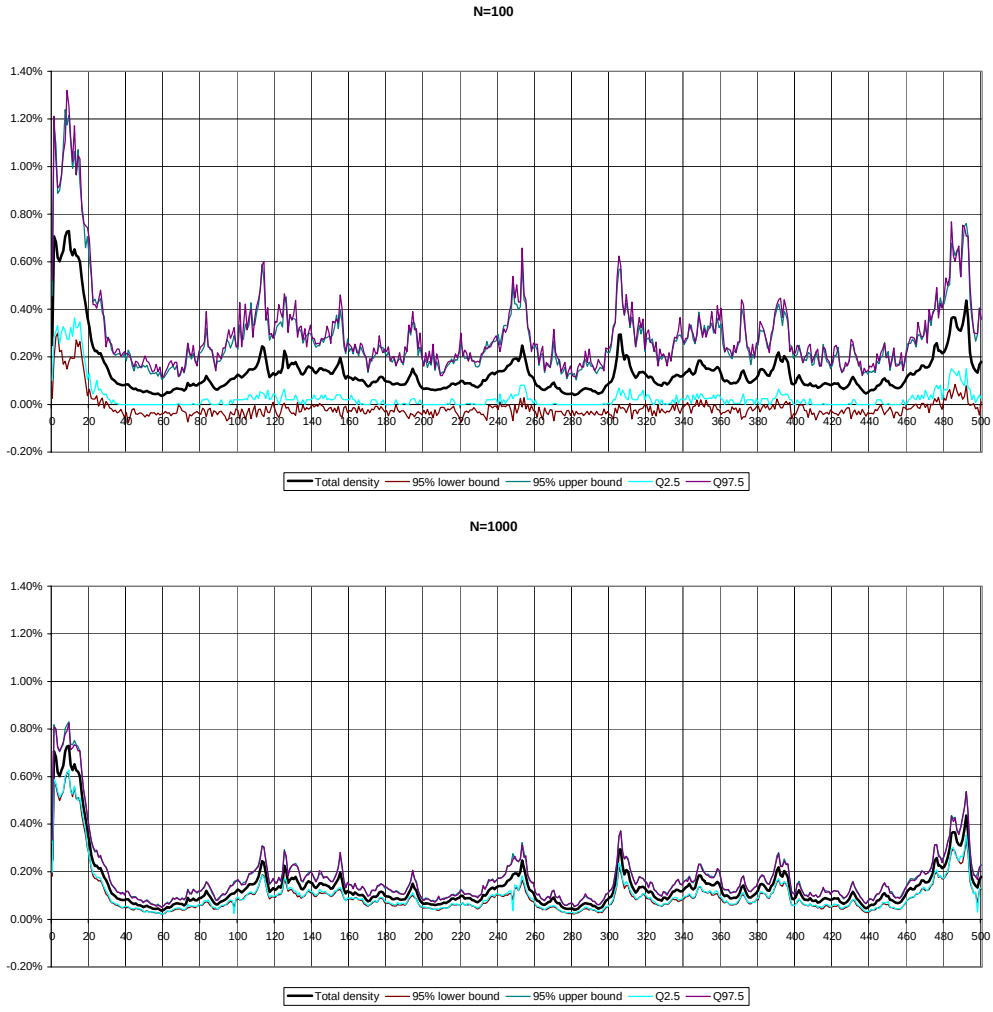
a) Area Units



	1987	1988	1989	1990	1991	1992	1993	1994	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
herf	0.0584	0.0561	0.0571	0.0531	0.051	0.0489	0.0488	0.0449	0.0464	0.0437	0.0411	0.0403	0.0395	0.0393	0.0385	0.0394	0.0397	0.0391
ms	0.0345	0.0356	0.036	0.0373	0.0388	0.0391	0.0398	0.0393	0.0401	0.0393	0.0395	0.0384	0.0385	0.0397	0.039	0.0405	0.0411	0.0415
eg	0.0256	0.0268	0.0271	0.0284	0.0304	0.031	0.0319	0.0322	0.0324	0.0322	0.0329	0.0323	0.0328	0.0338	0.0336	0.0347	0.0355	0.036
gini	0.5872	0.5871	0.588	0.5849	0.587	0.5873	0.589	0.5852	0.5839	0.5869	0.5854	0.5855	0.5866	0.5866	0.5874	0.5897	0.5885	0.5885

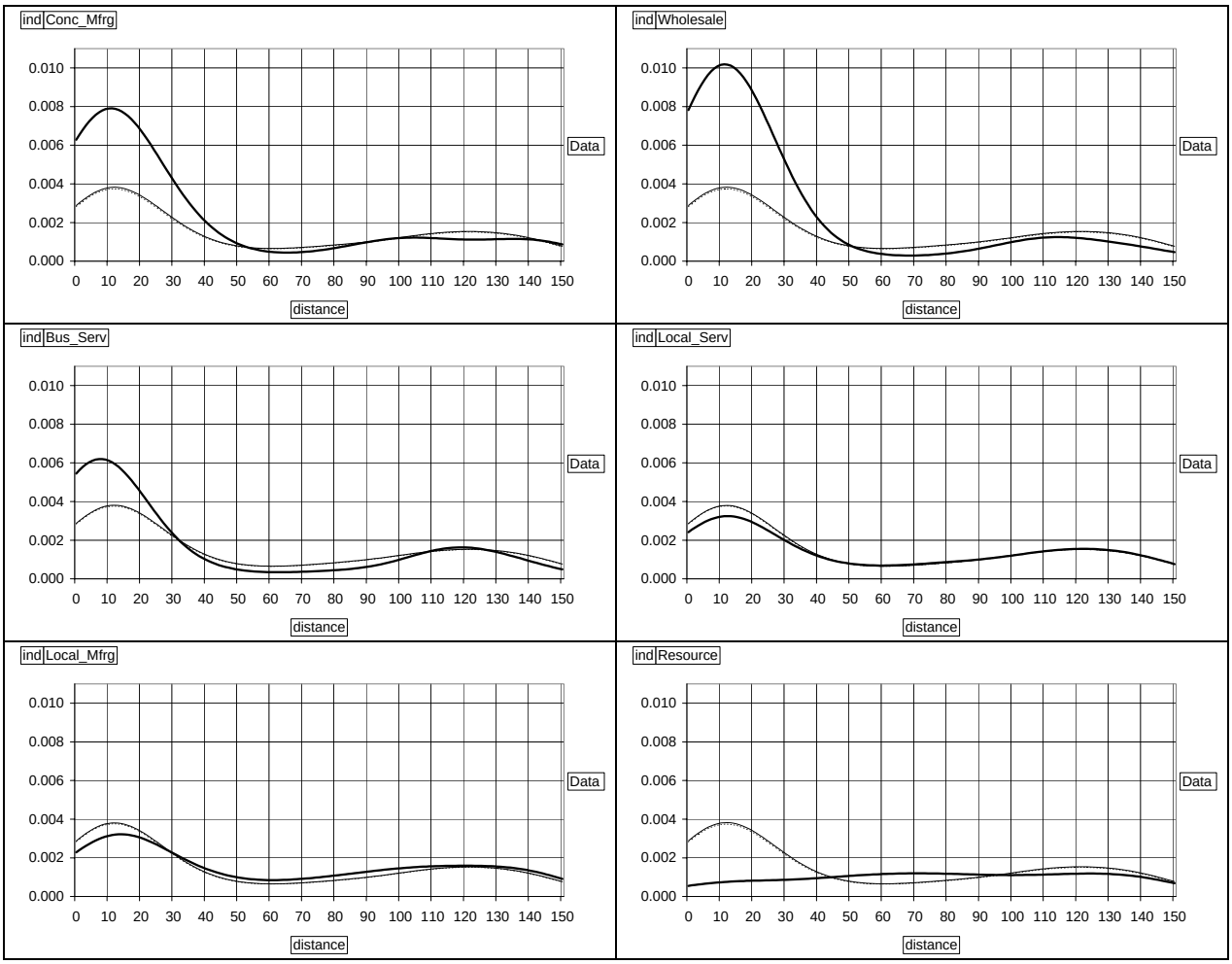
Notes: Statistics New Zealand Business Demography data. Panel (a) shows employment-weighted averages of concentration measures for all Labour Market Areas, based on the composition of employment across 2-digit ANZSIC industries within each LMA. Panel (b) shows comparable measures for Census Area Units. Herf is the industry plant Herfindahl index of industrial concentration, and is plotted against the right-hand axis. The EG is an index of area specialisation using the formula from Ellison and Glaeser (1997) as shown in Equation (6) (EG=□EG), but with the roles of industry and area reversed. MS is an index of area specialisation using the formula from Maurel and Sedillot (1999) as shown in Equation (5) (MS=□) but with the roles of industry and area reversed. Gini is the relative locational Gini, which measures the degree of inequality in the locational quotient. The graph contains two observations for 1994, to show the impact of the series break in 1994. The first 1994 observation is consistent with the 1987-1994 data. The second is consistent with the 1994-2003 data.

Figure 10: Total Distance Density (with bootstrap standard errors) – 2003



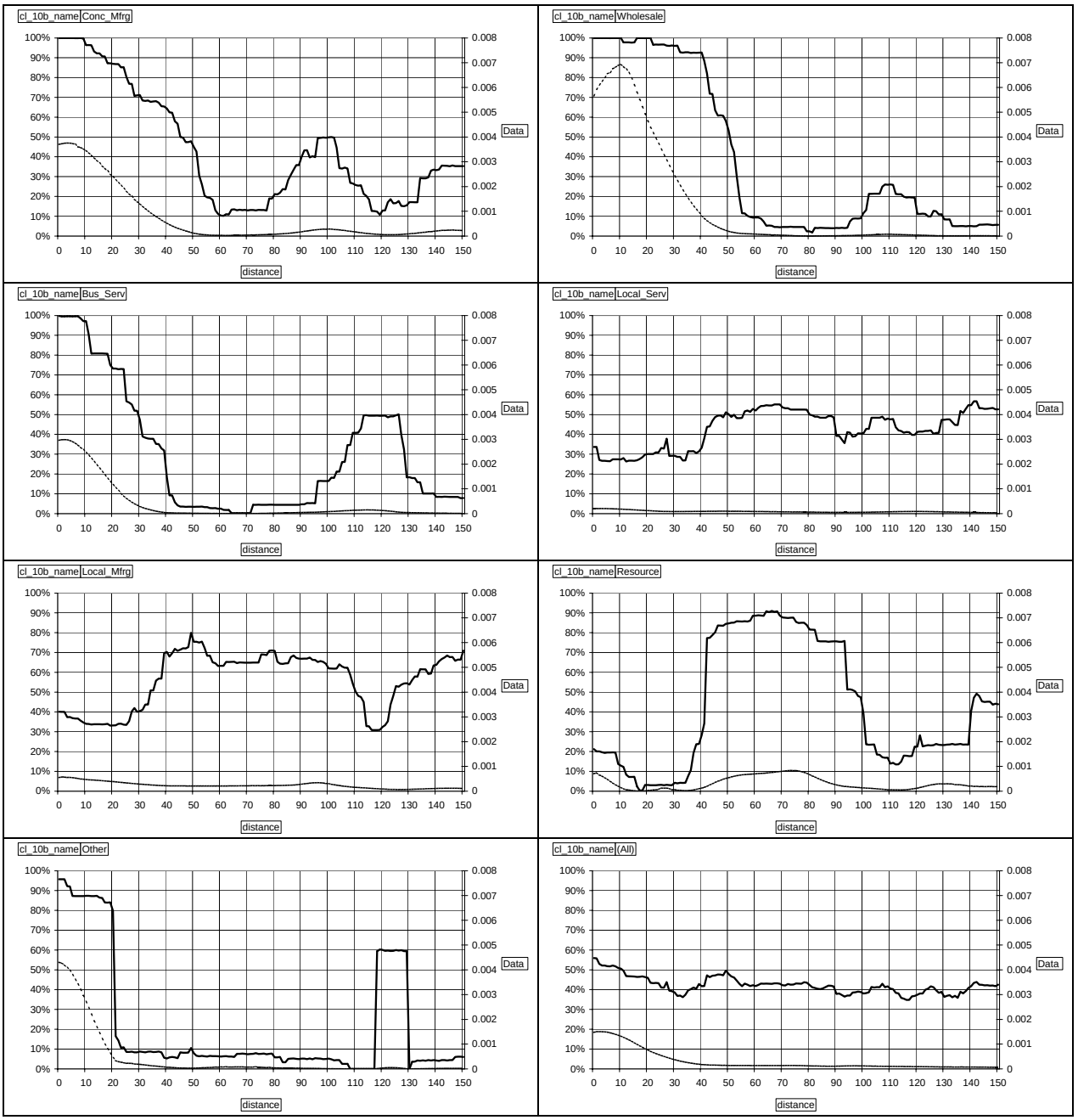
Notes: These graphs show distances densities as defined in the text, following the approach of Duranton and Overman (2002). Distances are calculated between each pair of jobs in the economy, and the graphs summarise the density of these distances. The dark line labelled 'Total density is the same in both panels, and shows the density of distances based on total employment. The horizontal axis shows distances in kilometres. The graphs also show approximate 95% confidence intervals for the density, based on the bootstrap procedure described in the text. The top graph shows the upper and lower bounds for an industry with FTE employment of 100 and the lower panel shows bounds for an industry of 1,000. Upper and lower bounds are calculated in two ways. First, the bounds are calculated as 1.96 times the estimated bootstrap standard error (labelled '95% lower bound' and '95% upper bound'). Second, they are calculated as the 2.5th and 97.5th percentiles of the bootstrap replications (labelled Q2.5 and Q97.5).

Figure 11: Distance Density by Group – 2003



Notes: These graphs show distance densities for each co-location group separately. The distance densities are as defined in the text, following the approach of Duranton and Overman (2002). Distances are calculated between each pair of jobs in a colocation group, and the graphs summarise the density of these distances. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text. Each panel contains three series. The two dotted lines indicate the upper and lower bounds of the 95 percent confidence interval for the aggregate density, for a sample of jobs equal to the number of jobs in the relevant colocation group. The dark solid line shows the distance density for the relevant colocation group. The horizontal axis shows distances in kilometres.

Figure 12: Localisation and percent localised – 2003



Notes: These graphs show the incidence and degree of localisation for each co-location group separately and, in the final panel, for total employment. Colocation groups are groupings of 4-digit industries. The grouping is derived using a statistical clustering procedure, based on the strength of colocation, as measured by a coagglomeration index, as described in the text. The dark solid line shows the proportion of employment in 4-digit ANZSIC industries that are localised at each distance. The lighter dotted line shows the degree of localisation in those industries that are localised, and uses the right-hand axis. Details of the localisation measures used are contained in the text. The horizontal axis shows distances in kilometres.

Appendix Table 1: Industry coverage

		Year																		Coverage		
		87	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**base**	**9503**	**9703**
A011	Hort&Fruit													■								
A012	Grain Sheep Beef													■								
A013	Dairy													■								
A0141	Poultry Meat							■	■	■	■	■		■								
A0142	Poultry Eggs									■	■	■		■								
A015	Other Livestock													■								
A016	Other Crop													■								
B1102	Brown Coal Mine	■	■	■	■			■	■	■	■	■	■	■	■	■	■	■	■		■	■
B1511	Petrol explor own								■	■	■	■	■	■	■	■	■	■	■		■	■
B1520	Other mining													■								
C2240	Clothing Manufacture									■	■	■	■	■	■	■	■	■	■		■	■
C2249	???	■	■	■	■	■	■	■	■	■	■											
G5110	Supermkt/ groc									■	■	■	■	■	■	■	■	■	■		■	■
I6501	Pipeline transp	■							■	■	■	■	■	■	■	■	■	■	■		■	■
I6701	Grain storage	■		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■
K7324	Money Mkt dealers	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■			
L7711	Resid. Prop ops												■	■	■	■	■	■	■			■
M8112	???	■	■	■	■	■																
M8130	Foreign Govt Reps														■							
M8200	Defence									■	■	■	■	■	■	■	■	■	■		■	■
O8710	Child Care Serv											■	■	■	■	■	■	■	■			■
O8722	Resid Care nec											■	■	■	■	■	■	■	■			■
O8729	Non resid care nec											■	■	■	■	■	■	■	■			■
P9322	Casinos				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■
Q9610	Religious Orgs												■	■	■	■	■	■	■			■
Q9621	Bus&Prof orgs											■	■	■	■	■	■	■	■			■
Q9622	Labour Assocs											■	■	■	■	■	■	■	■			■
Q9629	Interest gps nec												■	■	■	■	■	■	■			■
	ALL OTHER	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Notes: Shaded cells indicate that the ANZSIC industry group is within coverage in the relevant year. The three final columns show which industries are continuously within coverage for the entire period (base), since 1995 (9503) and since 1997 (9703). All analyses in the paper use either base coverage, for analysis of trends, or 2003 coverage, for analysis of 2003 patterns in isolation.

Appendix Table 2: Impact of Industry Coverage Restrictions

	Percent of geographic units retained	Percent of FTE employment retained
1987	99.9%	99.9%
1988	99.9%	99.9%
1989	99.9%	99.9%
1990	99.9%	99.9%
1991	99.9%	99.9%
1992	99.9%	100.0%
1993	99.9%	99.9%
1994	99.9%	99.9%
1994.5	97.9%	95.3%
1995	98.1%	95.5%
1996	97.2%	94.6%
1997	96.0%	94.0%
1998	76.9%	85.6%
1999	96.0%	94.0%
2000	96.1%	94.0%
2001	96.1%	94.0%
2002	96.0%	93.9%
2003	95.9%	94.0%

Notes: The table shows the percentage of each year's geographic units and annual employment that is in industries covered continuously from 1987 to 2003.

Appendix Table 3: Impact of Series Discontinuity in 1994

	Units					FTE				
	Share old def	Share new def	growth 1992-4	diff 1994	growth 1994-6	Share old def	Share new def	growth 1992-4	diff 1994	growth 1994-6
Total	100%	100%	7%	-10%	10%	100%	100%	4%	-1%	5%
A: Agric, Forest, Fish	3%	3%	7%	-8%	9%	2%	2%	8%	1%	5%
B: Mining	0%	0%	1%	-8%	2%	0%	0%	0%	-1%	3%
C: Manufacturing	10%	10%	5%	-8%	4%	20%	20%	4%	1%	3%
D: Elect, Gas, Water	0%	0%	0%	0%	-3%	1%	1%	-6%	0%	-5%
E: Construction	14%	14%	4%	-14%	13%	7%	7%	5%	-5%	12%
F: Wholesale	9%	8%	9%	-11%	7%	8%	8%	6%	-2%	5%
G: Retail	18%	18%	3%	-8%	2%	12%	11%	4%	-3%	3%
H: Acc, Café, Restaur	4%	4%	5%	-8%	6%	5%	5%	6%	-2%	6%
I: Transport&Storage	6%	5%	2%	-12%	6%	5%	5%	3%	-2%	5%
J: Communic. Serv	1%	1%	7%	-6%	15%	2%	2%	-5%	-1%	2%
K: Finance&Insurance	3%	4%	7%	8%	-2%	4%	4%	-3%	2%	2%
L: Prop & Bus Serv	17%	16%	22%	-18%	30%	11%	10%	9%	-4%	13%
M: Govt Admin/ Def	1%	1%	-1%	0%	-6%	4%	4%	-3%	0%	-1%
N: Education	3%	3%	6%	-2%	4%	8%	8%	5%	1%	5%
O: Health&Comm. Serv	4%	4%	9%	-6%	7%	8%	8%	3%	0%	-1%
P: Cult&Recr Serv	3%	3%	10%	-18%	10%	2%	2%	9%	-4%	8%
Q: Pers&other Serv	3%	4%	5%	-10%	8%	3%	3%	6%	-2%	2%
b: (0,5]	81%	78%	8%	-13%	12%	27%	25%	7%	-8%	7%
c: (5,10]	10%	11%	7%	3%	2%	12%	13%	6%	2%	2%
d: (10,20]	5%	6%	4%	2%	3%	13%	13%	4%	2%	3%
e: (20,50]	3%	3%	5%	1%	6%	15%	16%	5%	1%	6%
f: (50,100]	1%	1%	1%	1%	4%	10%	10%	1%	1%	4%
g: >100	1%	1%	0%	1%	5%	22%	23%	0%	1%	3%
Auckland	34%	33%	8%	-13%	13%	33%	32%	5%	-2%	7%
Bay of Plenty	6%	6%	8%	-8%	10%	5%	5%	6%	-1%	5%
Canterbury	13%	13%	9%	-10%	9%	13%	13%	4%	-1%	5%
Gisborne	1%	1%	4%	-6%	7%	1%	1%	4%	1%	1%
Hawke's Bay	3%	3%	7%	-7%	7%	4%	4%	4%	1%	0%
Manawatu-Wanganui	5%	6%	5%	-7%	7%	6%	6%	3%	0%	2%
Marlborough	1%	1%	7%	-4%	8%	1%	1%	3%	1%	4%
Nelson	1%	1%	9%	-7%	8%	1%	1%	6%	-1%	2%
Northland	3%	3%	6%	-9%	9%	3%	3%	4%	-1%	5%
Otago	5%	5%	8%	-8%	7%	5%	5%	4%	-1%	1%
Southland	2%	2%	4%	-7%	5%	3%	3%	2%	0%	3%
Taranaki	3%	3%	7%	-8%	7%	3%	3%	2%	-1%	5%
Tasman	1%	1%	11%	-5%	10%	1%	1%	10%	0%	4%
Waikato	9%	9%	7%	-9%	9%	8%	8%	4%	-1%	4%
Wellington	12%	12%	6%	-11%	9%	14%	14%	2%	-1%	3%
West Coast	1%	1%	3%	-8%	7%	1%	1%	3%	-1%	2%

Notes: This table compares the composition of employment and geographic units for the two versions of data available for 1994. The first, referred to as 'old def', relates to the 1994 data that is consistent with the 1987-1994 period. The second, labeled as 'new def', relates to the 1994 data that is consistent with the 1994-2003 period. For information of the nature of changes, see the text.

Appendix Table 4: Co-location Groups of 4-digit industries

Ind4_Descriptor	units	fte	herf	ms	eg	gini
Bus_Serv						
C2423:Book and Other Publishing	210	1,490	0.051	0.214	0.098	0.694
C2430:Recorded Media Manufacturing/Publishing	40	100	0.056	0.133	0.012	0.370
C2621:Clay Brick Manufacturing	9	90	0.275	-0.032	-0.215	0.391
C2629:Ceramic Product Manufacturing nec	170	530	0.044	0.066	0.021	0.615
C2822:Boatbuilding	630	4,320	0.018	0.110	0.043	0.666
C2941:Jewellery and Silverware Manufacturing	350	1,080	0.009	0.086	0.024	0.504
F4613:Computer Wholesaling	700	4,650	0.012	0.194	0.073	0.483
F4614:Business Machine Wholesaling nec	290	2,550	0.022	0.121	0.027	0.369
G5129:Specialised Food Retailing nec	610	1,610	0.003	0.044	0.010	0.350
G5235:Recorded Music Retailing	180	620	0.016	0.078	0.017	0.277
G5242:Toy and Game Retailing	190	500	0.009	0.025	0.005	0.396
G5244:Photographic Equipment Retailing	110	470	0.014	0.017	0.005	0.377
I6611:Parking Services	75	400	0.038	0.059	-0.008	0.323
I6641:Travel Agency Services	1,490	6,960	0.003	0.130	0.061	0.577
J7120:Telecommunication Services	360	8,090	0.037	0.225	0.099	0.649
K7321:Banks	930	21,430	0.010	0.095	0.039	0.216
K7340:Financial Asset Investors	430	800	0.007	0.115	0.038	0.409
K7411:Life Insurance	65	2,300	0.111	0.357	0.188	0.814
K7422:General Insurance	260	4,320	0.029	0.180	0.072	0.468
K7511:Financial Asset Broking Services	390	1,860	0.014	0.113	0.041	0.438
K7519:Services to Finance & Investment nec	1,700	5,820	0.005	0.165	0.075	0.430
K7520:Services to Insurance	1,770	5,630	0.003	0.061	0.018	0.313
L7821:Architectural Services	2,000	4,810	0.002	0.129	0.052	0.381
L7823:Consulting Engineering Services	3,460	12,830	0.003	0.077	0.025	0.401
L7832:Information Storage & Retrieval Services	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L7833:Computer Maintenance Services	400	1,440	0.020	0.061	0.007	0.396
L7834:Computer Consultancy Services	5,930	19,120	0.003	0.181	0.077	0.549
L7841:Legal Services	2,550	14,830	0.003	0.080	0.034	0.243
L7842:Accounting Services	3,360	15,130	0.004	0.025	0.010	0.255
L7851:Advertising Services	1,060	4,620	0.006	0.271	0.134	0.500
L7852:Commercial Art and Display Services	1,800	4,360	0.001	0.109	0.037	0.383
L7855:Business Management Services	9,770	22,180	0.001	0.066	0.020	0.320
L7861:Employment Placement Services	680	9,330	0.012	0.095	0.022	0.545
L7863:Secretarial Services	480	1,600	0.010	0.078	0.010	0.391
L7869:Business Services nec	3,930	16,200	0.003	0.083	0.023	0.409
M8120:Justice	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
M8200:Defence	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
N8431:Higher Education	130	25,410	0.053	0.017	-0.011	0.541
O8622:Specialist Medical Services	1,510	3,790	0.003	0.062	0.022	0.474
P9111:Film and Video Production	1,540	2,930	0.003	0.246	0.132	0.633
P9113:Motion Picture Exhibition	90	1,030	0.024	0.007	-0.010	0.294
P9121:Radio Services	190	2,080	0.016	0.042	0.022	0.321
P9220:Museums	170	1,600	0.068	-0.013	0.002	0.522
P9241:Music and Theatre Productions	180	770	0.028	0.092	0.036	0.541
P9242:Creative Arts	1,580	1,980	0.001	0.154	0.075	0.419
P9251:Sound Recording Studios	130	210	0.016	0.256	0.114	0.446
P9252:Performing Arts Venues	120	630	0.089	0.093	0.001	0.472
P9259:Services to the Arts nec	290	580	0.022	0.269	0.135	0.500
Q9521:Laundries and Dry-Cleaners	600	3,830	0.012	0.020	0.003	0.308
Q9523:Photographic Studios	690	1,180	0.003	0.085	0.025	0.376
Q9529:Personal Services nec	450	1,450	0.024	0.075	0.010	0.477
Q9622:Labour Associations	190	910	0.018	0.083	0.066	0.528
Conc_Mfrg						
B1311:Iron Ore Mining	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

B1514:Mineral Exploration Services	9	40	0.410	0.028	-0.119	0.726
C2122:Ice Cream Manufacturing	30	600	0.122	0.124	0.030	0.592
C2140:Oil and Fat Manufacturing	40	310	0.168	0.020	0.062	0.692
C2152:Cereal Food and Baking Mix Manufacturing	30	660	0.136	0.236	0.140	0.489
C2161:Bread Manufacturing	90	2,900	0.033	0.015	0.031	0.632
C2179:Food Manufacturing nec	300	4,140	0.028	0.214	0.160	0.628
C2181:Soft Drink,Cordial & Syrup Manufacturing	45	1,210	0.123	0.344	0.275	0.669
C2182:Beer and Malt Manufacturing	55	1,050	0.082	0.119	0.050	0.768
C2184:Spirit Manufacturing	18	150	0.251	0.014	-0.125	0.596
C2212:Synthetic Fibre Textile Manufacturing	30	260	0.106	0.472	0.371	0.712
C2215:Textile Finishing	30	260	0.130	0.168	0.176	0.839
C2222:Textile Floor Covering Manufacturing	25	840	0.214	0.037	-0.037	0.644
C2332:Solid Paperboard Container Manufacturing	25	650	0.112	0.096	0.011	0.460
C2333:Corrugated Paperboard Container Mfg	20	1,030	0.108	0.157	0.126	0.754
C2532:Industrial Gas Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2533:Synthetic Resin Manufacturing	85	1,970	0.042	0.117	0.019	0.460
C2535:Inorganic Industrial Chemical Mfg nec	30	390	0.060	0.152	0.149	0.775
C2541:Explosive Manufacturing	6	55	0.240	0.222	0.026	0.265
C2543:Medicinal & Pharmaceutical Product Mfg	95	1,520	0.048	0.130	0.059	0.491
C2544:Pesticide Manufacturing	15	190	0.167	0.109	0.004	0.558
C2546:Cosmetic & Toiletry Preparation Mfg	55	560	0.090	0.293	0.209	0.822
C2547:Ink Manufacturing	40	250	0.113	0.224	0.120	0.484
C2563:Plastic Bag and Film Manufacturing	50	1,490	0.056	0.147	0.057	0.508
C2565:Plastic Foam Product Manufacturing	30	310	0.109	0.293	0.182	0.494
C2610:Glass and Glass Product Manufacturing	130	1,120	0.071	0.098	0.078	0.568
C2632:Plaster Product Manufacturing	30	350	0.193	0.166	0.068	0.453
C2634:Concrete Pipe/Box Culvert Manufacturing	45	760	0.083	0.080	0.101	0.565
C2640:Non-Metallic Mineral Product Mfg nec	120	680	0.096	0.048	0.016	0.724
C2711:Basic Iron and Steel Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2759:Sheet Metal Product Manufacturing nec	360	3,020	0.008	0.046	0.052	0.507
C2762:Spring and Wire Product Manufacturing	90	1,160	0.039	0.325	0.238	0.547
C2763:Nut, Bolt, Screw and Rivet Manufacturing	12	250	0.170	0.468	0.266	0.514
C2764:Metal Coating and Finishing	300	1,620	0.010	0.085	0.041	0.440
C2819:Automotive Component Manufacturing nec	300	2,450	0.065	0.058	0.036	0.551
C2824:Aircraft Manufacturing	150	3,720	0.172	0.065	0.038	0.717
C2832:Medical/Surgical Equipment Manufacturing	210	1,260	0.176	0.039	-0.029	0.439
C2849:Electronic Equipment Manufacturing nec	190	2,270	0.076	0.062	0.011	0.615
C2851:Household Appliance Manufacturing	55	3,400	0.104	0.205	0.150	0.739
C2853:Battery Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2863:Food Processing Machinery Manufacturing	30	190	0.112	0.133	0.085	0.636
C2866:Pump and Compressor Manufacturing	50	330	0.093	0.050	0.066	0.853
C2867:Commercial Space Heat/Cooling Equip Mfg	50	480	0.341	0.046	-0.047	0.599
C2923:Mattress Manufacturing (Except Rubber)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2929:Furniture Manufacturing nec	120	730	0.046	0.091	0.045	0.612
F4522:Metal and Mineral Wholesaling	400	2,410	0.007	0.042	0.059	0.439
F4619:Machinery and Equipment Wholesaling nec	1,590	8,300	0.002	0.112	0.076	0.425
F4621:Car Wholesaling	420	1,530	0.027	0.162	0.119	0.540
F4622:Commercial Vehicle Wholesaling	150	930	0.021	0.057	0.084	0.613
F4711:Meat Wholesaling	160	1,060	0.020	0.063	0.047	0.599

F4712:Poultry and Smallgood Wholesaling	50	290	0.059	0.130	0.092	0.538
F4715:Fruit and Vegetable Wholesaling	250	2,860	0.019	0.040	0.067	0.705
F4716:Confectionery and Soft Drink Wholesaling	210	1,010	0.063	0.026	-0.011	0.453
F4795:Paper Product Wholesaling	470	3,660	0.011	0.137	0.081	0.487
I6401:Scheduled International Air Transport	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
I6630:Services to Air Transport	80	1,440	0.079	0.075	0.057	0.665
I6642:Road Freight Forwarding	140	1,510	0.021	0.215	0.192	0.439
I6643:Freight Forwarding (Except Road)	210	2,180	0.014	0.290	0.201	0.576
I6644:Customs Agency Services	170	770	0.022	0.268	0.153	0.489
I6649:Services to Transport nec	180	1,210	0.025	0.069	0.084	0.546
I6709:Storage nec	450	3,700	0.012	0.086	0.098	0.593
J7112:Courier Services	2,180	4,980	0.007	0.066	0.051	0.343
L7862:Contract Staff Services	220	3,880	0.031	0.055	0.039	0.585
L7867:Contract Packing Services nec	65	700	0.086	0.286	0.212	0.710
P9321:Lotteries	12	35	0.090	0.015	0.032	0.592
Local_Mfrg						
B1314:Gold Ore Mining	35	310	0.255	-0.015	0.099	0.759
B1411:Gravel and Sand Quarrying	120	760	0.021	-0.020	0.017	0.669
C2112:Poultry Processing	30	2,100	0.115	-0.036	-0.016	0.849
C2113:Bacon, Ham and Smallgood Manufacturing	70	1,910	0.054	-0.009	0.029	0.598
C2121:Milk and Cream Processing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2162:Cake and Pastry Manufacturing	130	1,850	0.029	0.021	0.021	0.536
C2172:Confectionery Manufacturing	80	1,900	0.130	-0.034	-0.048	0.604
C2183:Wine Manufacturing	190	2,760	0.041	0.024	0.084	0.773
C2223:Rope, Cordage and Twine Manufacturing	25	240	0.196	0.000	-0.043	0.606
C2239:Knitting Mill Product Manufacturing nec	35	880	0.067	0.045	0.023	0.515
C2323:Wooden Structural Component Mfg	1,040	5,370	0.003	-0.022	0.010	0.342
C2329:Wood Product Manufacturing nec	450	2,330	0.010	-0.011	0.011	0.467
C2561:Plastic Blow Moulded Product Mfg	45	770	0.127	0.064	0.041	0.619
C2562:Plastic Extruded Product Manufacturing	50	1,440	0.085	0.001	-0.044	0.605
C2633:Concrete Slurry Manufacturing	160	1,590	0.016	-0.021	0.004	0.441
C2635:Concrete Product Manufacturing nec	180	1,380	0.014	0.003	0.032	0.512
C2713:Steel Pipe and Tube Manufacturing	55	170	0.126	0.035	0.043	0.441
C2731:Aluminium Rolling, Drawing, Extruding	30	780	0.133	0.279	0.259	0.765
C2741:Structural Steel Fabricating	280	2,840	0.022	-0.027	0.025	0.517
C2742:Architectural Aluminium Product Mfg	360	2,820	0.005	-0.006	0.007	0.318
C2749:Structural Metal Prod Manufacturing nec	410	2,930	0.019	0.010	-0.005	0.523
C2751:Metal Container Manufacturing	45	1,390	0.070	0.033	0.025	0.735
C2761:Hand Tool/General Hardware Manufacturing	120	1,120	0.175	-0.035	0.035	0.867
C2769:Fabricated Metal Prod Manufacturing nec	1,100	5,340	0.006	0.024	0.006	0.469
C2811:Motor Vehicle Manufacturing	40	250	0.076	-0.013	0.004	0.631
C2812:Motor Vehicle Body Manufacturing	200	1,620	0.020	-0.009	0.031	0.680
C2823:Railway Equipment Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2841:Computer/Business Machine Manufacturing	85	370	0.161	-0.005	-0.003	0.580
C2861:Agricultural Machinery Manufacturing	370	2,820	0.019	-0.035	0.050	0.573
C2862:Mining & Construction Machinery Manuf	25	220	0.148	-0.066	-0.028	0.805
C2864:Machine Tool and Part Manufacturing	250	1,660	0.024	0.061	0.028	0.553
C2865:Lifting & Material Handling Equip Manuf	140	1,150	0.023	0.036	-0.008	0.476
C2869:Industrial Machinery/Equipment Manuf nec	2,100	11,420	0.002	-0.014	0.021	0.357
C2911:Prefabricated Metal Building Manufact	35	170	0.056	-0.026	0.002	0.618
C2919:Prefabricated Building Manufact nec	75	670	0.049	-0.018	0.040	0.660

C2921:Wooden Furniture/Upholstered Seat Manuf	1,560	7,580	0.004	0.051	0.017	0.404
C2949:Manufacturing nec	440	2,230	0.008	0.045	0.011	0.557
D3610:Electricity Supply	140	5,140	0.028	-0.030	0.015	0.524
D3701:Water Supply	90	810	0.078	-0.016	-0.034	0.403
D3702:Sewerage and Drainage Services	55	560	0.048	-0.056	-0.006	0.348
E4112:Residential Building Construction nec	170	410	0.027	-0.004	0.022	0.736
E4113:Non-Residential Building Construction	1,120	8,900	0.004	-0.023	0.004	0.436
E4121:Road and Bridge Construction	560	9,800	0.007	-0.048	0.012	0.425
E4122:Non-Building Construction nec	950	7,730	0.006	-0.023	0.006	0.399
E4210:Site Preparation Services	1,720	7,160	0.003	-0.033	0.009	0.353
E4222:Bricklaying Services	960	2,420	0.003	-0.002	0.006	0.368
E4223:Roofing Services	820	2,220	0.004	-0.006	0.008	0.319
E4224:Structural Steel Erection Services	180	510	0.018	0.023	0.009	0.462
F4519:Farm Produce & Supplies Wholesaling nec	1,180	4,790	0.003	-0.045	0.039	0.353
F4531:Timber Wholesaling	500	4,970	0.006	0.014	0.015	0.336
F4539:Building Supplies Wholesaling nec	1,290	8,150	0.003	0.041	0.010	0.343
F4611:Farm/Construction Machinery Wholesaling	480	3,090	0.005	-0.054	0.059	0.517
F4623:Motor Vehicle New Part Dealing	890	4,590	0.003	0.043	0.021	0.321
F4624:Mtr Vehcle Dismantling/Used Part Dealing	350	1,330	0.008	-0.006	0.025	0.321
F4713:Dairy Produce Wholesaling	130	1,020	0.059	0.014	0.026	0.527
F4719:Grocery Wholesaling nec	1,080	8,910	0.013	0.038	0.001	0.439
G5126:Milk Vending	300	980	0.005	-0.042	0.016	0.342
G5210:Department Stores	260	12,480	0.012	0.002	-0.007	0.175
G5253:Garden Supplies Retailing	370	1,740	0.007	-0.039	0.005	0.281
G5261:Household Equip Repair Serv(Electrical)	910	2,350	0.004	-0.007	0.003	0.263
G5313:Trailer and Caravan Dealing	55	140	0.030	-0.024	0.017	0.447
G5322:Automotive Electrical Services	480	1,510	0.004	-0.030	0.003	0.282
G5323:Smash Repairing	1,880	7,270	0.001	-0.005	0.005	0.198
G5324:Tyre Retailing	570	2,560	0.003	-0.029	0.010	0.215
G5329:Automotive Repair and Services nec	3,950	13,300	0.001	-0.020	0.007	0.182
H5740:Clubs (Hospitality)	350	2,380	0.005	-0.049	0.015	0.344
I6110:Road Freight Transport	4,580	23,880	0.001	-0.026	0.025	0.257
I6402:Scheduled Domestic Air Transport	90	3,620	0.110	-0.010	-0.070	0.678
I6403:Non-Scheduled Air and Space Transport	280	730	0.012	-0.041	0.024	0.559
L7741:Motor Vehicle Hiring	1,030	2,870	0.007	0.065	0.019	0.521
L7743:Plant Hiring or Leasing	1,210	4,190	0.003	0.015	0.007	0.297
L7864:Security/Investigative Serv(not Police)	640	5,870	0.029	0.007	-0.022	0.433
L7865:Pest Control Services	170	630	0.023	-0.041	-0.004	0.670
N8423:Combined Primary and Secondary Education	70	1,640	0.031	-0.026	-0.001	0.599
O8631:Pathology Services	190	2,460	0.046	-0.022	-0.013	0.430
O8633:Ambulance Services	110	1,380	0.048	-0.017	-0.007	0.292
O8640:Veterinary Services	600	2,830	0.003	-0.057	0.014	0.402
O8721:Accommodation for the Aged	740	16,670	0.003	-0.033	0.009	0.281
P9311:Horse and Dog Racing	560	1,660	0.007	-0.010	0.053	0.704
Q9524:Funeral Directors,Crematoria,Cemeteries	230	870	0.008	-0.047	0.003	0.299
Q9634:Waste Disposal Services	690	3,200	0.008	0.007	0.012	0.468
Local_Serv						
C2221:Made-Up Textile Product Manufacturing	400	2,400	0.017	0.065	0.007	0.400
C2232:Cardigan and Pullover Manufacturing	40	420	0.076	0.077	-0.019	0.572
C2240:C2240	990	7,470	0.007	0.081	0.023	0.615
C2262:Leather/Leather Substitute Product Manuf	80	350	0.034	0.023	-0.002	0.514
C2421:Newspaper Printing or Publishing	250	5,550	0.026	-0.034	-0.022	0.338
C2520:Petroleum/Coal Product Manufacturing nec	35	250	0.061	0.002	-0.014	0.561

C2559:Rubber Product Manufacturing nec	75	800	0.109	0.077	0.010	0.540
C2831:Photographic/Optical Good Manufacturing	30	180	0.056	0.139	0.043	0.306
C2859:Electrical & Equipment Manufact nec	250	2,690	0.026	0.031	0.002	0.533
C2942:Toy and Sporting Good Manufacturing	230	800	0.017	0.026	0.003	0.449
D3620:Gas Supply	30	240	0.086	-0.016	0.079	0.657
E4111:House Construction	10,580	21,710	0.000	-0.012	0.002	0.233
E4221:Concreting Services	730	2,320	0.003	0.001	0.001	0.386
E4231:Plumbing Services	2,980	8,000	0.001	-0.013	0.000	0.184
E4232:Electrical Services	3,860	13,930	0.002	-0.013	0.001	0.202
E4233:Air Conditioning and Heating Services	520	3,020	0.008	0.022	0.003	0.397
E4241:Plastering and Ceiling Services	1,380	3,330	0.002	0.006	0.002	0.332
E4242:Carpentry Services	2,180	4,120	0.002	0.013	0.001	0.337
E4243:Tiling and Carpeting Services	1,540	2,910	0.001	0.004	0.000	0.220
E4244:Painting and Decorating Services	3,170	8,610	0.002	-0.015	0.001	0.206
E4245:Glazing Services	390	1,310	0.007	-0.010	-0.005	0.327
E4251:Landscaping Services	780	2,350	0.012	0.011	-0.004	0.367
E4259:Construction Services nec	890	3,740	0.004	0.004	0.002	0.419
F4714:Fish Wholesaling	160	780	0.030	-0.026	-0.010	0.536
G5110:Supermarket and Grocery Stores	2,790	36,640	0.003	-0.030	0.001	0.155
G5121:Fresh Meat, Fish and Poultry Retailing	660	2,860	0.004	0.000	-0.001	0.337
G5123:Liquor Retailing	680	2,650	0.004	-0.005	0.002	0.214
G5124:Bread and Cake Retailing	950	4,600	0.002	-0.006	0.003	0.320
G5125:Takeaway Food Retailing	3,250	11,130	0.001	-0.009	0.000	0.190
G5221:Clothing Retailing	2,580	8,870	0.001	0.020	0.003	0.243
G5222:Footwear Retailing	460	1,700	0.003	0.020	0.002	0.248
G5223:Fabric and Other Soft Good Retailing	540	2,090	0.006	-0.006	-0.004	0.281
G5231:Furniture Retailing	720	3,220	0.004	0.001	-0.002	0.284
G5232:Floor Covering Retailing	360	1,600	0.008	-0.016	-0.003	0.324
G5233:Domestic Hardware & Houseware Retailing	970	5,370	0.003	-0.034	0.003	0.265
G5234:Domestic Appliance Retailing	1,170	5,400	0.002	0.016	0.001	0.194
G5241:Sport and Camping Equipment Retailing	830	3,330	0.003	-0.012	0.003	0.310
G5243:Newspaper, Book and Stationery Retailing	1,050	4,920	0.002	-0.007	-0.001	0.197
G5245:Marine Equipment Retailing	240	960	0.010	0.007	0.004	0.495
G5251:Pharmaceutical/Cosmetic/Toiletry Retail	1,150	6,960	0.002	-0.012	0.000	0.136
G5252:Antique and Used Good Retailing	1,050	2,380	0.002	-0.015	0.001	0.280
G5254:Flower Retailing	480	1,140	0.003	0.011	0.001	0.238
G5255:Watch and Jewellery Retailing	540	2,040	0.003	0.002	0.001	0.292
G5259:Retailing nec	3,970	10,580	0.001	0.018	0.003	0.304
G5269:Household Equipment Repair Services nec	530	1,230	0.004	-0.001	-0.001	0.301
G5311:Car Retailing	1,710	11,950	0.002	-0.016	0.000	0.272
G5321:Automotive Fuel Retailing	1,520	9,750	0.001	-0.032	0.005	0.227
H5710:Accommodation	3,860	24,080	0.002	-0.039	0.021	0.554
H5720:Pubs, Taverns and Bars	1,430	9,540	0.001	-0.030	0.010	0.287
H5730:Cafes and Restaurants	5,750	40,250	0.001	0.019	0.005	0.321
I6121:Long Distance Bus Transport	130	1,130	0.030	0.007	0.009	0.577
I6122:Short Distance Bus Transpt-incl Tramway	440	4,630	0.019	-0.009	-0.016	0.369
I6123:Taxi and Other Road Passenger Transport	2,300	4,060	0.002	0.008	0.003	0.359
I6200:Rail Transport	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
I6509:Transport nec	110	300	0.020	-0.030	-0.001	0.610
I6619:Services to Road Transport nec	40	95	0.068	0.020	0.024	0.556
I6623:Port Operators	60	1,800	0.103	-0.079	-0.078	0.599
J7111:Postal Services	920	14,480	0.032	0.005	-0.025	0.311
L7711:Residential Property Operators	650	1,430	0.008	0.008	-0.003	0.363
L7712:Commercial Property Operators/Developers	6,780	9,700	0.000	0.011	0.003	0.217
L7720:Real Estate Agents	7,800	14,800	0.000	0.026	0.007	0.302

L7730:Non-Financial Asset Investors	570	920	0.004	-0.027	0.010	0.486
L7810:Scientific Research	250	6,060	0.026	0.004	0.038	0.614
L7822:Surveying Services	370	1,860	0.009	-0.019	0.000	0.385
L7866:Cleaning Services	2,080	13,640	0.005	0.015	-0.003	0.377
M8113:Local Government Administration	600	12,410	0.008	-0.027	0.000	0.370
N8410:Preschool Education	2,020	7,880	0.001	-0.024	0.004	0.317
N8421:Primary Education	2,170	32,080	0.001	-0.029	0.004	0.195
N8422:Secondary Education	360	22,160	0.004	-0.025	-0.001	0.192
N8424:Special School Education	65	2,630	0.028	0.000	-0.021	0.228
N8440:Other Education	2,410	14,610	0.004	0.029	0.001	0.393
O8611:Hospitals (Except Psychiatric Hospitals)	230	43,160	0.031	-0.033	-0.026	0.336
O8612:Psychiatric Hospitals	25	1,520	0.253	-0.086	-0.086	0.500
O8613:Nursing Homes	65	1,400	0.030	-0.003	-0.004	0.419
O8621:General Practice Medical Services	3,090	9,530	0.001	-0.015	0.001	0.164
O8623:Dental Services	1,420	4,440	0.001	0.020	0.004	0.198
O8632:Optometry and Optical Dispensing	410	1,290	0.004	0.007	0.003	0.238
O8635:Physiotherapy Services	680	1,400	0.002	0.006	0.002	0.257
O8636:Chiropractic Services	410	780	0.003	-0.003	0.007	0.268
O8639:Health Services nec	2,620	21,870	0.009	-0.026	0.008	0.465
O8710:Child Care Services	790	5,700	0.002	-0.004	0.000	0.200
O8722:Residential Care Services nec	460	6,620	0.008	-0.008	0.001	0.322
O8729:Non-Residential Care Services nec	990	9,070	0.007	-0.011	0.001	0.435
P9210:Libraries	270	3,150	0.028	-0.005	0.000	0.235
P9231:Zoological and Botanic Gardens	30	320	0.073	-0.039	-0.049	0.634
P9239:Recreational Parks and Gardens	130	2,160	0.016	-0.066	0.013	0.593
P9312:Sports Grounds and Facilities nec	770	5,230	0.004	0.017	0.000	0.367
P9319:Sports and Services to Sports nec	1,750	5,450	0.005	0.008	0.000	0.224
P9329:Gambling Services nec	140	740	0.049	-0.022	-0.004	0.472
P9330:Other Recreation Services	1,080	4,360	0.006	-0.020	0.029	0.669
Q9511:Video Hire Outlets	410	1,780	0.003	-0.008	-0.001	0.213
Q9519:Personal and Household Goods Hiring nec	220	590	0.009	0.015	-0.004	0.459
Q9522:Photographic Film Processing	260	1,120	0.009	0.006	-0.006	0.323
Q9525:Gardening Services	2,100	3,940	0.001	0.000	0.001	0.317
Q9526:Hairdressing and Beauty Salons	2,790	8,140	0.001	0.012	0.005	0.192
Q9610:Religious Organisations	480	2,030	0.008	0.029	-0.002	0.354
Q9629:Interest Groups nec	1,420	7,070	0.003	-0.019	0.003	0.393
Q9631:Police Services	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q9632:Corrective Centres	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q9633:Fire Brigade Services	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q9700:Private Households Employing Staff	6	20	0.240	-0.058	-0.074	0.437

Other						
B1200:Oil and Gas Extraction	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
B1511:Petroleum Exploration (Own Account)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
B1512:Petroleum Exploration Services	9	100	0.379	0.229	0.275	0.738
B1520:Other Mining Services	15	120	0.309	0.182	0.302	0.725
C2151:Flour Mill Product Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2163:Biscuit Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2190:Tobacco Product Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2214:Wool Textile Manufacturing	50	1,850	0.081	-0.048	0.047	0.799
C2261:Leather Tanning and Fur Dressing	60	2,500	0.079	-0.028	0.041	0.635
C2334:Paper Bag and Sack Manufacturing	6	190	0.307	0.037	-0.076	0.509
C2534:Organic Industrial Chemical Mfg nec	15	330	0.313	0.029	0.160	0.768
C2545:Soap and Other Detergent Manufacturing	70	970	0.103	0.087	0.128	0.667
C2549:Chemical Product Manufacturing nec	70	550	0.039	0.159	0.098	0.642
C2551:Rubber Tyre Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2712:Iron and Steel Casting and Forging	120	1,300	0.060	-0.031	0.033	0.693
C2723:Copper,Silver,Lead,Znc Smelting,Refining	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2729:Basic Non-Ferrous Metal Mfg nec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2732:Non-Ferrous Metal(Roll/Draw/Extrude)nec	15	500	0.344	-0.030	-0.009	0.786
C2813:Automotive Electrical & Instrument Manuf	20	160	0.389	-0.064	-0.122	0.813
C2829:Transport Equipment Manufacturing nec	35	190	0.149	-0.041	-0.004	0.625
C2842:Telecommun/Broadcast/Transceive Equip Mf	60	1,050	0.379	0.038	0.014	0.642
C2852:Electric Cable and Wire Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2922:Sheet Metal Furniture Manufacturing	130	1,410	0.026	0.057	0.038	0.528
F4511:Wool Wholesaling	180	900	0.015	0.008	0.095	0.513
F4512:Cereal Grain Wholesaling	50	380	0.048	0.122	0.142	0.668
F4521:Petroleum Product Wholesaling	160	1,590	0.051	0.098	0.111	0.486
I6302:Coastal Water Transport	180	1,350	0.091	0.129	0.130	0.787
I6701:Grain Storage	6	25	0.221	0.162	0.106	0.562
K7310:Central Bank	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
K7412:Superannuation Funds	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L7831:Data Processing Services	120	1,540	0.068	0.088	0.085	0.738
M8111:Central Government Administration	1,020	30,740	0.006	0.123	0.135	0.416
N8432:Technical and Further Education	65	1,940	0.218	0.009	0.034	0.606
Q9621:Business and Professional Associations	370	1,730	0.012	0.293	0.262	0.566
Resource						
A0212:Shearing Services	290	4,150	0.011	-0.045	0.122	0.736
A0213:Aerial Agricultural Services	130	420	0.015	-0.020	0.030	0.595
A0219:Services to Agriculture nec	4,110	15,780	0.002	-0.055	0.081	0.451
A0220:Hunting and Trapping	130	310	0.025	-0.024	0.088	0.591
A0301:Forestry	860	1,560	0.016	-0.057	0.059	0.497
A0302:Logging	730	5,210	0.004	-0.039	0.108	0.657
A0303:Services to Forestry	680	4,300	0.011	-0.043	0.119	0.554
A0411:Rock Lobster Fishing	280	590	0.005	0.005	0.125	0.682
A0413:Finfish Trawling	580	1,940	0.069	0.096	0.237	0.692
A0415:Line Fishing	510	970	0.005	-0.036	0.079	0.632
A0419:Marine Fishing nec	160	270	0.011	-0.030	0.123	0.781
A0420:Aquaculture	390	1,060	0.007	0.008	0.153	0.833
B1101:Black Coal Mining	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
B1102:Brown Coal Mining	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
B1315:Mineral Sand Mining	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
B1319:Metal Ore Mining nec	9	40	0.338	0.541	0.524	0.336
B1419:Construction Material Mining nec	160	940	0.015	-0.068	0.049	0.567

B1420:Other Mining	15	150	0.224	-0.029	-0.012	0.656
C2111:Meat Processing	180	22,950	0.030	-0.079	0.082	0.667
C2129:Dairy Product Manufacturing nec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2130:Fruit and Vegetable Processing	110	4,670	0.064	0.059	0.170	0.756
C2173:Seafood Processing	160	5,420	0.037	-0.001	0.085	0.777
C2174:Prepared Animal/Bird Feed Manufacturing	85	1,190	0.112	0.005	0.121	0.712
C2211:Wool Scouring	25	370	0.111	0.032	0.023	0.648
C2231:Hosiery Manufacturing	15	240	0.209	-0.026	0.030	0.667
C2311:Log Sawmilling	470	7,870	0.012	-0.056	0.092	0.568
C2312:Wood Chipping	6	40	0.193	-0.021	-0.056	0.359
C2313:Timber Resawing and Dressing	120	1,860	0.028	-0.054	0.059	0.645
C2321:Plywood and Veneer Manufacturing	35	1,970	0.090	-0.077	0.043	0.756
C2322:Fabricated Wood Manufacturing	30	1,150	0.127	-0.063	0.040	0.703
C2331:Pulp, Paper and Paperboard Manufacturing	20	2,590	0.115	0.213	0.373	0.752
C2510:Petroleum Refining	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2531:Fertiliser Manufacturing	65	910	0.071	-0.064	0.080	0.735
C2622:Ceramic Product Manufacturing	12	180	0.335	-0.057	0.053	0.770
C2631:Cement and Lime Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2722:Aluminium Smelting	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2821:Shipbuilding	75	1,010	0.094	0.024	0.011	0.704
G5312:Motor Cycle Dealing	300	1,380	0.006	-0.069	0.036	0.486
I6303:Inland Water Transport	55	630	0.110	0.018	0.024	0.780
I6621:Stevedoring	40	880	0.052	0.046	0.101	0.581
K7322:Building Societies	30	260	0.135	-0.062	0.039	0.641
K7323:Credit Unions	70	350	0.031	-0.045	0.011	0.462
Wholesale						
A0414:Squid Jigging	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2171:Sugar Manufacturing	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C2229:Textile Product Manufacturing nec	140	940	0.030	0.091	0.007	0.479
C2250:Footwear Manufacturing	50	710	0.124	0.303	0.126	0.661
C2339:Paper Product Manufacturing nec	60	1,490	0.063	0.124	0.006	0.528
C2412:Printing	990	9,210	0.005	0.073	0.012	0.466
C2413:Services to Printing	290	1,480	0.011	0.153	0.042	0.495
C2422:Other Periodical Publishing	290	1,950	0.025	0.174	0.061	0.765
C2542:Paint Manufacturing	50	820	0.058	0.124	0.042	0.638
C2564:Plastic Prod Rigid Fibre Reinforced Mfg	130	1,210	0.076	0.182	0.050	0.452
C2566:Plastic Injection Moulded Product Mfg	260	3,750	0.015	0.101	0.023	0.549
C2623:Ceramic Tile and Pipe Manufacturing	18	50	0.106	0.017	-0.053	0.779
C2733:Non-Ferrous Metal Casting	50	550	0.064	0.124	-0.007	0.546
C2765:Non-Ferrous Pipe Fitting Manufacturing	30	240	0.093	0.058	-0.029	0.536
C2839:Professional/Scientific Equip Manuf nec	100	710	0.133	0.127	0.000	0.612
C2854:Electric Light and Sign Manufacturing	75	560	0.066	0.139	0.000	0.510
E4234:Fire and Security System Services	500	2,150	0.017	0.053	0.003	0.380
F4523:Chemical Wholesaling	470	2,330	0.008	0.105	0.030	0.352
F4612:Professional Equipment Wholesaling	290	1,690	0.015	0.295	0.132	0.580
F4615:Electric/Electronic Equip Wholesale nec	1,170	7,130	0.003	0.094	0.021	0.439
F4717:Liquor Wholesaling	220	1,010	0.017	0.091	0.020	0.415
F4718:Tobacco Product Wholesaling	20	250	0.114	0.003	-0.090	0.271
F4721:Textile Product Wholesaling	340	1,740	0.012	0.324	0.155	0.587
F4722:Clothing Wholesaling	490	2,030	0.008	0.196	0.072	0.582
F4723:Footwear Wholesaling	90	340	0.046	0.330	0.147	0.449
F4731:Household Appliance Wholesaling	220	1,250	0.020	0.188	0.065	0.499
F4732:Furniture Wholesaling	160	510	0.020	0.147	0.053	0.430
F4733:Floor Covering Wholesaling	80	360	0.049	0.166	0.023	0.397
F4739:Household Good Wholesaling nec	220	1,250	0.015	0.186	0.074	0.507
F4791:Photographic Equipment Wholesaling	70	530	0.051	0.348	0.152	0.500

F4792:Jewellery and Watch Wholesaling	150	460	0.019	0.188	0.059	0.452
F4793:Toy and Sporting Good Wholesaling	330	1,100	0.008	0.121	0.033	0.414
F4794:Book and Magazine Wholesaling	160	970	0.040	0.241	0.082	0.503
F4796:Pharmaceutical and Toiletry Wholesaling	380	3,610	0.015	0.264	0.124	0.585
F4799:Wholesaling nec	3,000	9,190	0.002	0.124	0.039	0.389
G5122:Fruit and Vegetable Retailing	460	1,890	0.005	0.041	0.008	0.349
I6301:International Sea Transport	55	760	0.064	0.418	0.216	0.566
I6501:Pipeline Transport	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
I6629:Services to Water Transport nec	100	430	0.061	0.186	0.071	0.440
K7329:Deposit Taking Financiers nec	55	880	0.075	0.171	0.035	0.447
K7330:Other Financiers	290	1,610	0.027	0.154	0.043	0.443
K7421:Health Insurance	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L7742:Other Transport Equipment Leasing	220	490	0.016	0.040	0.011	0.658
L7829:Technical Services nec	590	2,870	0.026	0.050	0.002	0.458
L7853:Market Research Services	160	2,820	0.193	0.147	-0.044	0.654
L7854:Business Administrative Services	360	7,280	0.026	0.113	0.030	0.622
P9112:Film and Video Distribution	55	160	0.040	0.395	0.197	0.491
P9122:Television Services	70	2,210	0.197	0.116	-0.072	0.570
P9322:Casinos	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Notes: Cells containing #N/A relate to 4-digit ANZSIC industries for which information has been suppressed, to protect confidentiality.

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