

# **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 1988 and 2003. We present a range of summary measures that enable us to compare patterns in New Zealand with those found internationally. Geographic concentration across 58 Labour Market Areas (LMAs) has increased over the past 17 years, although industries have become more dispersed within LMAs.

## **JEL Classification**

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

## **Keywords**

Geographic concentration; agglomeration; business demography

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# 1 Introduction

Current 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, but 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, and examines patterns of co-location of firms from different industries, using summary measures that are now fairly standard in the international literature. The main contribution of the paper is to facilitate a comparison of New Zealand patterns with those in the now numerous international studies, and to develop hypotheses about the factors underlying the location choices of New Zealand firms.

## 2 Measuring agglomeration

### 2.1 Concentration

As a starting point for our analysis of agglomeration patterns, we need a summary measure of 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). 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).

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

$$s_i = \sum_{j=1}^N z_j u_{ji} \quad (1)$$

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 ( $\gamma$ ) 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:

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

which suggests an estimator for  $\gamma$  of:

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

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:<sup>2</sup>

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

<sup>2</sup> The Appendix to Maurel and Sedillot (1999) contains a more detailed derivation.

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:

$$\hat{\gamma} = \frac{\frac{\sum_i s_i^2 - \sum_i x_i^2}{1 - \sum_i x_i^2} - H}{1 - H} = \frac{G - H}{1 - H} \quad (5)$$

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

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

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. Some examples help to illustrate what types of concentration the different indices are capturing. Figure 1 shows hypothetical examples of industry distributions across four LMAs. The employment shares ( $x_i$ ) or 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. The discussion that follows ignores the influence of  $H$ , which would be reasonable if the industry's employment was spread across a very large number of firms.

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**Figure 1 Concentration Indices for hypothetical industries**

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The rightmost bars show the distribution of total employment. If an industry was 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  $\sum s_i^2$ ) matches the degree of 'bunching' of total employment (summarised by  $\sum x_i^2$ ). 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 an equal-shares allocation. 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.

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

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).

We will be calculating and analysing the Duranton and Overman (2002) measures in future work.

## 2.2 Co-location

Patterns of co-location between different industries can also be informative about the nature of agglomeration effects that are shaping location decisions. The required measure here is not the correlation of location decisions between two firms within the same industry but of two firms from different industries. The Maurel and Sedillot (1999) framework can still be applied, and equation (4) now takes the following form:

$$\hat{p} = \frac{\sum_{\substack{j,k \in i \\ j \neq k}} z_j z_k}{\sum_{\substack{j,k \\ j \neq k}} z_j z_k} = \sum_i s_i s_j \quad (7)$$

which implies a co-location index  $\gamma_{co}$  of

$$\gamma_{co} = \frac{\sum_i s_i s_j - \sum_i x_i^2}{1 - \sum_i x_i^2} \quad (8)$$

This index attains a value of zero when both industries are located proportionately to total employment, is highest when the two industries are located together in a single location, and is lowest (most negative) when the two industries are each fairly evenly spread across locations but never locate in the same location.

## 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 on from 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 wider agglomerations, 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 in a location 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<sup>3</sup>) and spillovers between firms undertaking a diverse range of activities (termed urbanisation, producing Jacobs-type<sup>4</sup> externalities).

### 3 Data<sup>5</sup>

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 1988 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.

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<sup>3</sup> See Henderson (2003) for a useful discussion.

<sup>4</sup> 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.

<sup>5</sup> This section draws on Carroll et al. (2002) and Statistics New Zealand (2004).

From 1988 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<sup>6</sup>) which has been conducted in mid-February each year, since 1987, and the Inland Revenue Department's (IRD) Client Registration File, which is the universe of GST registered enterprises.<sup>7</sup>

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.<sup>8</sup> In this paper, we deal exclusively with business units and not enterprises.

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

- The business unit was located in NZ; and
- The business unit had an in-scope, non-null industry. Both the ancillary (if applicable) and primary industry had to be in scope; and
- The associated enterprise had to have an in-scope, non-null industry.

In addition there were administrative rules in place that related to the timing of information in the SNZ database. Units 'birthed' during February of the year in question were excluded, units which ceased or were "killed" during February of the year in question were included, and (until 1996) the activity unit had a data confirm date no later than 1 January of the year in question. All GST-

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<sup>6</sup> The ABFU survey is administered to all businesses except farm type agriculture enterprises, and those that are not part of a group of enterprises and have no paid employees. 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.

<sup>7</sup> 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.

<sup>8</sup> Statistics New Zealand (2001) defines a geographic unit as "a separate operating unit engaged in New Zealand in one, or predominantly one, kind of economic activity from a single physical location or base"; while it defines an enterprise as "a business operating in New Zealand". Thus an enterprise will consist of one or more geographic units.

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 firms are monitored using PAYE tax information to see if and when they begin to employ staff. When businesses register for GST they are added (or 'birthed') onto the Business Frame, and are given a new reference number.<sup>9</sup> 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 are sold, merged, or liquidated this will result in a firm 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, business units were included only if they belonged to a GST-registered enterprise (i.e. with GST sales of at least \$30,000). From 1994 the business unit 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:

- Greater than \$30,000 annual GST expenses or sales;<sup>10</sup>
- 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 industry coverage of the business demography data has changed over time.<sup>11</sup> 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,

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<sup>9</sup> 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.

<sup>10</sup> 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.

<sup>11</sup> 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.

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, 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 business units are recorded at the level of meshblocks, which provide a high level of geographical detail. Meshblocks range in size from city blocks to large areas of rural land. For distance-based analyses, we will 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.<sup>12</sup> We also test the sensitivity of our results to the use of smaller geographic areas, in the form of Census Area Units.

### **3.1 Business Demography data as a time series.**

As noted in the previous section, the business demography data has 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.

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<sup>12</sup> 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.

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, at 7 to 10 percent for business units and around 5 percent for 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 that 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 defined 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.

This section starts by discussing broad trends in concentration over the 17-year period of our study (1988-2003).<sup>13</sup> We then summarise concentration measures across industries – first by means and medians, and then by examining the full distribution. Finally, we look at which industries are the most concentrated. In section 4.2, we examine which industries locate together, as an indication of possible sources of agglomeration effects. Finally, in section 4.3, we change our focus from industries to locations, and look at trends in the industrial specialisation of LMAs.

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<sup>13</sup> The dataset covers the 18 year period from 1987 to 2003. The exclusion of 1987 data from our analysis is due to a programming oversight, which will be rectified in the next draft.

## 4.1 Geographic Concentration of Industry

### 4.1.1 Trends: 1988-2003

Figure 2 shows the trends in the geographic concentration of New Zealand 2-digit industries across LMAs, for the 1988 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.<sup>14</sup>

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#### Figure 2 Trends in Concentration 2-digit industries; Labour Market Areas

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There is a clear upward trend in average concentration from the early 1990s, which is apparent both before and after the series break in 1994. The MS and EG series show remarkably similar trends and levels throughout. The Gini shows a different pattern, declining throughout the 1990s, before it increases after 1998. Industry concentration, as measured by the Herfindahl index, is declining monotonically throughout the period, with particularly strong declines until the mid-1990s.<sup>15</sup>

Over the past 5 to 10 years, industries have, on average, been becoming more geographically concentrated across labour market areas, at the same time as industry employment is being spread more evenly across business sites.

A different pattern is observed if we look at concentration across smaller geographic areas. Figure 3 shows repeats the analysis behind the previous figure, but uses 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 figures 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.<sup>16</sup>

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#### Figure 3 Trends in Concentration 2-digit industries; Area Units

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<sup>14</sup> 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). 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.

<sup>15</sup> Changes in Business and Property Services, Government Administration, Retailing, Construction and Road Transport made the strongest contributions to this decline.

<sup>16</sup> Such an effect may arise from changes in zoning policy, although we have no evidence with which to test this specific hypothesis.

#### 4.1.2 The degree and composition of Concentration

The annual summary measures presented so far abstract from the variation in concentration patterns that exists across industries. To examine the cross-sectional distribution of concentration, we create a single pooled cross section, based on all 17 years of data. For each industry, we average the concentration measure across all years in which the industry is observed and not suppressed. We thus derive a concentration measure even for industries that have suppressed results in some years.<sup>17</sup>

Figure 4 shows the density and cumulative distribution of the MS and EG indices, based on 4-digit industries and LMAs.<sup>18</sup> 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 is much 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 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, so the mean value of the employment-weighted MS (EG) index is 0.028 (0.025) and the median is lower, at 0.007 (0.008). Larger industries tend to have lower index values, so the mean of the unweighted MS (EG) distribution has a higher mean of 0.059 (0.034) and median 0.023 (0.015), but still displays similar skewness.

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

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The means and medians of the various concentration indices are shown in Table 1, for different combinations of industry and area definitions. The first panel of the table shows indices weighted by employment, whereas the second panel shows them unweighted. The unweighted measures across LMAs, calculated for 4-digit manufacturing industries provide a basis for comparing New Zealand's geographic concentration with that of other countries.

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**Table 1 Summary of Concentration Indices: Mean [Median]**

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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 for the concentration of 4-digit

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<sup>17</sup> Five two-digit industries have some suppressed data, but only one has data suppressed for all 17 years. Eighty-four four-digit industries have some suppressed data but only 17 have data suppressed for all 17 years.

<sup>18</sup> A visually similar pattern is observed for concentration of 2-digit industries across LMAs.

manufacturing industries across LMAs. 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).<sup>19</sup> Weighting by employment emphasises these industries, and raises the average. It also magnifies the difference between the MS and EG indices.

The unweighted mean concentration of 4-digit manufacturing industries across LMAs appears to be the best basis on which to compare patterns for New Zealand with those from the US, UK, and France, since this is close to what was examined by Ellison and Glaeser (1994) Maurel and Sedillot (1999) and Devereux et al. (2002). Based on the MS index value of 0.067, New Zealand manufacturing appears to be slightly more concentrated than that in France (0.06), and considerably more concentrated than that in the UK (0.033). The comparison with the US is possible only using the EG index, and here the low value of the New Zealand index (0.013) is somewhat surprising, both relative to the New Zealand MS index, and relative to the US (0.051). For the UK, Devereux et al. (2002) calculate both MS and EG indices, and find that the two indices are almost identical. This is clearly not the case in New Zealand.

The main cause of the low EG index for New Zealand manufacturing appears to be the high degree of industrial concentration, as measured by the plant Herfindahl index.<sup>20</sup> The impact of this can be seen in Table 1. The unweighted mean value of the Herfindahl index is 0.108 for 4-digit manufacturing industries. This is a high value for this index.<sup>21</sup> 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 ratio is 11 out of 459 (2.4%).

In Table 2, we present correlations between the different measures, again using various combinations of industry and location detail. 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 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.

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<sup>19</sup> The industries are: C2111 Meat Processing, C2129 Dairy Product Manufacturing nec, C2311 Log Sawmilling, C2173 Seafood Processing, C2130 Fruit and Vegetable Processing.

<sup>20</sup> 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.

<sup>21</sup> The comparable figure for the UK, from Table 3 in Devereux et al. (2002), is 0.0003, and for the US, from Ellison and Glaeser (1994) is 0.025. The maximum Herfindahl shown for the US is 0.223, a value exceeded by over 15% of New Zealand 4-digit manufacturing industries.

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**Table 2 Correlation between Concentration measures**

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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 low (below 0.02); moderate (0.02 – 0.05) and high (above 0.05) levels of concentration. In Table 3, we show the distribution of index values across these ranges, with the ‘low’ group being further split to isolate the negative value indices. 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 the highest weight is given to primary-sector-related industries with high values of EG.

Comparing the unweighted New Zealand measures for 4-digit manufacturing with those from international studies, we again get a mixed picture. The MS index shows 53% of industries with high levels of concentration, compared with only 27% for France. In contrast, the EG index shows New Zealand with a composition similar to that in the UK, with 63% of industries with low or negative concentration, compared with 65% for the UK. Similarly, the percent of industries with high concentration is 23% for New Zealand, and 16% for the UK. The US has a similar proportion of manufacturing industries in the high concentration group (25%), but the remainder are more likely to have moderate (65%) rather than low (10%) concentration.

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**Table 3 Degree of Concentration of 4-digit Industries Across Labour Market Areas**

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#### 4.1.3 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 range of different agglomeration effects.

Table 4 shows the average concentration of each 2-digit industry, derived by averaging the annual measures across all years for which data were not suppressed. The column marked ‘yrs’ indicates the number of years (out of 17) that data were available for each industry. Only one industry (Rail Transport) had data suppressed in every year. The row labelled ‘suppressed’ is an average of the measures for each year’s suppressed industries (calculated as the employment-weighted average for those industries). Six different industries contributed at least

one year of data to this average, identified as those for which the ‘yrs’ column is less than 17. The suppressed industries are, on average, highly concentrated.

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**Table 4 Concentration of 2-digit Industries across LMAs**

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The shaded 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 five most concentrated industries are in the Mining (ANZSIC group B) or Finance & Insurance (ANZSIC group K) industry groups. They are also highly concentrated according to both the MS and EG indices. There are also 3 ‘Agriculture, Forestry and Fishing’ industries (ANZSIC group A) with high concentration according to the EG index, but which are ranked near the bottom of the MS ranking. 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 4, there are still a range of possible explanations for their concentration – forward and backward linkages, sharing, matching and knowledge spillovers.

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.

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. Table 5 shows the proportion of employment within each 2-digit industry that is in low, moderate, and high density 4-digit industries.

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**Table 5 Concentration of 4-digit industries across LMAs (grouped by 2-digit group)**

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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 seventh most concentrated industry in Table 5, according to the MS index. Ninety percent 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 is highly concentrated and the other two have low concentration. Even though the first

contains only 10% of employment, the degree of concentration is sufficiently high to produce a high level of concentration for the 2-digit industry as a whole.

Similarly, industry C22 (Textile, clothing, footwear, and leather manufacturing) has a low-to moderate level of concentration at the 2-digit level (MS=0.021), even though it contains several highly concentrated 4-digit industries such as 'synthetic fibre textile manufacturing'(MS=0.295), footwear manufacturing (MS=0.200) and 'textile finishing' (MS=0.125). Basic Material Processing (MS=0.001) is a further example of a 2-digit industry whose measured concentration conceals some highly concentrated sub-industries – 'petroleum product wholesaling' (MS=0.137) and 'chemical wholesaling' (MS=0.093); as well as some very dispersed industries – 'timber wholesaling' (MS=0.002) and 'wool wholesaling' (MS=-0.013).

Table 6 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 4. High levels of concentration are evident for a number of resource-based, wholesaling, and heavy industries. Large negative values of MS occur for several land-based and primary-sector-related industries.

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**Table 6 Most and Least Concentrated 4-digit industries across LMAs**

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Table 7 presents a list of 4-digit industries whose employment is geographically spread roughly in proportion with total employment. These are detected as those industries with an EG index close to zero. There are 33 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.

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**Table 7 Most Dispersed 4-digit industries across LMAs (EG ≈ 0)**

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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. (2002) 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. (2002) for the UK. 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. (2002) 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<sup>22</sup> appear to be highly concentrated, both industrially (Herf=0.13) and geographically (MS=0.08), although the EG index shows only moderate concentration (EG=0.03)

## 4.2 Which industries locate together?

Patterns of co-location across industries can also 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 co-location 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 co-location 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 co-location 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 co-location, and from those patterns, we can begin to identify candidate explanations.<sup>23</sup> We use the co-location correlation index  $\gamma_{co}$  shown in equation (8) to derive an estimate for the correlation between each pair of industries. The analysis reported here is for 2-digit industries, and uses information from 2003 only. There are 51 2-digit industries in our data, although measures for 3 of them are suppressed to protect confidentiality. We therefore calculate 1,128 (=48\*47/2) co-location correlations and use these as the basis for grouping 2-digit industries into groups.

We transform this correlation matrix into a matrix of dissimilarity or distance measures by subtracting each entry from 1. Using this distance matrix, we

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<sup>22</sup> We have used an employment-weighted average of 4-digit industries that matches as closely as possible the list in Devereux et al. (2002). 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.

<sup>23</sup> This approach differs from many 'cluster analysis' studies, that look for similarity of identified covariates across geographic space.

apply a standard clustering procedure to perform a hierarchical clustering of industries.<sup>24</sup> The results are shown in Table 8.

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**Table 8 Colocation Groupings**

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We identify six main groups, some of which we further sub-classify on the basis of the strength of association within the group. We have assigned names to the group that roughly summarise the nature of industries involved.

The first group of land-related industries contains mostly industries that have negative MS indices and high levels of concentration according to the EG index. 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 high. Common reliance on land and land-based resources would appear to be an important cause of agglomeration for these industries. It may appear that the food, beverage and tobacco industry does not fit neatly with this explanation, although as we saw in Table 5, this 2-digit industry is an aggregation of 4-digit industries with quite dispersed concentration patterns. Over a third of employment for this group is in meat processing, which we would expect to locate with land-based industries.

The second group is mining, where again, access to land-based resources seems like a likely explanation of agglomeration. The location of the mining group is quite highly correlated with that of the first, land-related group.

The third industry grouping contains a large number of fairly dispersed services with MS and EG indices that are close to zero. 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. Around half of total employment is within this third, 'local services' group.

The fourth group is a mix of utilities, and government and other services. It appears to be the least homogeneous group and accounts for a relatively small proportion (5%) of total employment. Three of the four industries have low or negative EG indices, and negative MS indices. The exception is the 'government administration industry, which is a heterogeneous mix of concentrated central government and dispersed local government employment.

The fifth group, containing media and business services accounts for around 20% of employment, and is the group that, (speculatively at least) is most likely to be influenced by agglomeration forces such as knowledge spillovers. The group contains industries that tend to be highly concentrated.

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<sup>24</sup> We applied Ward's method, using unsquared distances. The analysis was undertaken using the SAS Proc Cluster procedure.

The final group is a mix of (mostly) highly concentrated 'industrial park' industries, some of which contain a mix of concentrated and dispersed 4-digit components.

Overall, this approach to grouping industries on the basis of co-location suggests a number of subsets of industries, between which the likely sources of agglomeration forces differ. Future work will pursue this type of analysis by applying it to 4-digit industries, and by seeking evidence to support or refute the loose hypotheses that have been suggested by the groupings.

### 4.3 Specialisation of areas

This section presents a related analysis of concentration, focused on the labour market area 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.

Figure 5 and Figure 6 show trends in (2-digit) industrial specialisation for an (employment-weighted) average LMA and average area unit respectively. The indices are constructed analogously to those for concentration but with the role of industry and location reversed. A high index indicates that employment in the LMA is 'concentrated' across industries. 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. For the EG index, a high index indicates that industry shares deviate from the national profile, although under-representation or 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.

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#### **Figure 5 Industrial Specialisation of Labour Market Areas (2-digit industries)**

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#### **Figure 6 Industrial Specialisation of Area Units (2-digit industries)**

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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.<sup>25</sup> 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

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<sup>25</sup> A similar pattern is observed using 4-digit industries as the basis of measuring specialisation.

large employment share and a moderately large increase in specialisation. Beyond that, the MS and EG indices give quite different pictures about which LMAs became more specialised or diversified. An adequate distilling of the patterns for each LMA is beyond the scope of this paper.

The pattern of average change, as shown in Figure 5 and Figure 6, is quite different for area units. In contrast to the LMA patterns, area units did not become significantly more specialised. The MS index shows a slight decline in specialisation (rise in diversification) whereas the EG index shows a slight increase. Reconciling the patterns for LMAs and area units remains as a bit of a puzzle. One possible explanation is that area units within the same LMA are maintaining their degree of diversity, but all are changing their industry mix in a similar way so that the overall mix in the LMA narrows.

Table 9 lists average levels of specialisation for each LMA.

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**Table 9 LMA Specialisation across 2-digit industries**

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## **5 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 1988 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 discuss the different insights 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 co-location, which we use to group 2-digit industries that tend to locate together. The identity of industries that are highly concentrated or that tend to locate together, provide some clues about the potential importance of different types of agglomeration economies.

## **6 Future Work**

A number of further analyses are already started or planned as part of the current project. We will examine the geographical scale of concentration using a continuous distance measure of concentration developed by Duranton and Overman (2002). We will analyse in more detail the dynamics of concentration, looking at the geographic distribution of firm births, deaths, expansions and contractions. We

will pay particular attention to the influence of location on firms' survival probabilities, as a coarse measure of firm performance. A more extensive set of comparisons with related international studies of concentration will be undertaken. Other future extensions are also being considered.

A key objective of this work is to provide insights for policy advisers and policy-makers who are considering policies to promote or sustain agglomeration – in clusters and in sustainable cities. Much of the value of the current research will be proven in discussing and analysing the implications of the patterns that we have identified for particular policy proposals.

## **7      Appendix A:      Data Issues**

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**Appendix Table 1      Industry Coverage**

**Appendix Table 2      Impact of Industry Coverage Restrictions**

**Appendix Table 3:      Impact of Series Discontinuity in 1994**

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**Table 1 Summary of Concentration Indices: Mean [Median]**

<i>Industry</i>	<i>Area</i>	<i>Herfindahl Index</i>	<i>Maurel- Sedillot Index</i>	<i>Ellison Glaeser Index</i>	<i>Gini</i>
<u>Weighted</u>					
<i>New Zealand</i>					
2-digit (50)	AU (1692)	0.004 [0.003]	0.008 [.002]	0.007 [.004]	0.570 [0.545]
2-digit (50)	LMA (58)	0.004 [0.003]	0.016 [-0.001]	0.016 [0.007]	0.300 [0.266]
4-digit (390)	LMA (58)	0.022 [0.006]	0.028 [0.007]	0.025 [0.008]	0.400 [0.377]
4-digit Manuf (137)	LMA (58)	0.057 [0.032]	0.039 [0.025]	0.030 [0.018]	0.571 [0.585]
<u>Unweighted</u>					
<i>New Zealand</i>					
2-digit (50)	AU (1692)	0.027 [0.005]	0.019 [0.004]	0.016 [0.004]	0.624 [0.628]
2-digit (50)	LMA (58)	0.027 [0.005]	0.038 [0.022]	0.043 [0.017]	0.408 [0.400]
4-digit (390)	LMA (58)	0.062 [0.028]	0.059 [0.023]	0.034 [0.015]	0.488 [0.495]
4-digit Manuf (137)	LMA (58)	0.108 [0.077]	<b>0.067</b> <b>[0.056]</b>	<b>0.013</b> <b>[0.010]</b>	0.578 [0.582]
<i>United States</i>					
4-digit Manuf (459)	State (51)			0.051 [0.026]	
<i>France</i>					
4-digit Manuf (273)	Dept (95)		0.06 [0.01]		
<i>United Kingdom</i>					
4-digit Manuf (211)	Postcode (113)		0.033 [0.006]	0.033 [0.007]	

Notes: The NZ industry-level measures are derived by averaging annual estimates from all years where data were not suppressed for confidentiality reasons. Weighted measures are weighted by FTE employment. Industry coverage for all NZ measures is restricted to those industries that were covered throughout the period.

**Table 2 Correlation between Concentration measures****2d\_AU\_MIN**

	<i>Herf</i>	<i>G_MS</i>	<i>G_EG</i>	<i>MS</i>	<i>EG</i>	<i>Gini</i>
Herf	1.00					
G_MS	0.93	1.00				
G_EG	0.95	0.99	1.00			
MS	0.49	0.78	0.72	1.00		
EG	0.50	0.77	0.74	<b>0.97</b>	1.00	
Gini	0.39	0.44	0.45	0.38	0.43	1.00

**2d\_LMA\_MIN**

	<i>Herf</i>	<i>G_MS</i>	<i>G_EG</i>	<i>MS</i>	<i>EG</i>	<i>Gini</i>
Herf	1.00					
G_MS	0.80	1.00				
G_EG	0.82	0.89	1.00			
MS	0.51	0.92	0.77	1.00		
EG	0.52	0.77	0.91	<b>0.80</b>	1.00	
Gini	0.52	0.36	0.50	0.16	0.35	1.00

**4d\_LMA\_MIN**

	<i>Herf</i>	<i>G_MS</i>	<i>G_EG</i>	<i>MS</i>	<i>EG</i>	<i>Gini</i>
Herf	1.00					
G_MS	0.75	1.00				
G_EG	0.82	0.88	1.00			
MS	0.23	0.82	0.59	1.00		
EG	0.06	0.50	0.61	<b>0.71</b>	1.00	
Gini	0.47	0.44	0.56	0.22	0.31	1.00

**4d\_LMA\_MF\_MIN**

	<i>Herf</i>	<i>G_MS</i>	<i>G_EG</i>	<i>MS</i>	<i>EG</i>	<i>Gini</i>
Herf	1.00					
G_MS	0.79	1.00				
G_EG	0.85	0.85	1.00			
MS	0.15	0.72	0.41	1.00		
EG	-0.39	-0.01	0.14	<b>0.43</b>	1.00	
Gini	0.14	0.00	0.24	-0.16	0.18	1.00

**2d AU v LMA**

	<i>LMA_Herf</i>	<i>LMA_G_MS</i>	<i>LMA_G_EG</i>	<i>LMA_MS</i>	<i>LMA_EG</i>	<i>LMA_Gini</i>
AU_Herf	1.00	0.80	0.82	0.51	0.52	0.52
AU_G_MS	0.93	0.87	0.82	0.64	0.56	0.54
AU_G_EG	0.95	0.86	0.85	0.62	0.59	0.55
AU_MS	0.49	0.68	0.54	<b>0.65</b>	<b>0.46</b>	0.38
AU_EG	0.50	0.70	0.62	<b>0.68</b>	<b>0.57</b>	0.41
AU_Gini	0.39	0.29	0.45	0.17	0.37	0.88

Notes: The NZ industry-level measures are derived by averaging annual estimates from all years where data were not suppressed for confidentiality reasons. All measures are unweighted. Industry coverage for all NZ measures is restricted to those industries that were covered throughout the period.

**Table 3 Degree of Concentration of 4-digit Industries Across Labour Market Areas**

<i>Industry</i>	<i>Area</i>	<i>Index</i>	<i>Range</i>			
			<i>Neg.</i> <i>&lt;0</i>	<i>Low</i> <i>0-0.02</i>	<i>Moderate</i> <i>0.02-0.05</i>	<i>High</i> <i>&gt;0.05</i>
<u>Weighted</u>						
<i>New Zealand</i>						
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%
<u>Unweighted</u>						
<i>New Zealand</i>						
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%
<i>United States</i>						
4-digit Manuf (459)	State (51)	EG		10% ( <i>&lt;0.02</i> )	65%	25%
<i>France</i>						
4-digit Manuf (273)	Dept (95)	MS		50% ( <i>&lt;0.02</i> )	23%	27%
<i>United Kingdom</i>						
4-digit Manuf (211)	Postcode (113)	EG		65% ( <i>&lt;0.02</i> )	19%	16%

Notes: The NZ industry-level measures are derived by averaging annual estimates from all years where data were not suppressed for confidentiality reasons. Weighted measures are weighted by FTE employment. Industry coverage for all NZ measures is restricted to those industries that were covered throughout the period.

**Table 4 Concentration of 2-digit Industries across LMAs**

<i>Industry</i>	<i>Name</i>	<i>yrs</i>	<i>Units</i>	<i>FTE</i>	<i>Herf</i>	<i>G_MS</i>	<i>G_EG</i>	<i>MS</i>	<i>EG</i>	<i>Gini</i>
B12	Oil and Gas Extraction	1	12	460	0.179	0.618	0.596	0.535	0.508	0.375
B15	Services to Mining	13	18	180	0.241	0.379	0.441	0.178	0.264	0.758
K74	Insurance	17	649	9045	0.015	0.169	0.098	0.156	0.084	0.486
B11	Coal Mining	12	54	861	0.071	0.213	0.274	0.153	0.218	0.618
K75	Services to Finance and Insurance	17	2431	9376	0.003	0.119	0.054	0.116	0.051	0.374
P91	Motion Picture, Radio and TV Services	17	1085	6868	0.019	0.132	0.061	0.115	0.042	0.402
I64	Air and Space Transport	7	487	8180	0.079	0.174	0.104	0.103	0.027	0.663
F47	Personal and Household Good Wholesaling	17	7601	39399	0.001	0.094	0.026	0.092	0.025	0.399
B13	Metal Ore Mining	17	86	635	0.087	0.167	0.282	0.085	0.212	0.795
I63	Water Transport	17	139	2101	0.151	0.214	0.160	0.074	0.009	0.700
C29	Other Manufacturing	17	2763	14354	0.002	0.070	0.022	0.068	0.020	0.401
C25	Petrol, Coal, Chemical & Assoc Prod Mfg	17	1257	20888	0.005	0.072	0.034	0.067	0.030	0.591
L78	Business Services	17	26437	118162	0.001	0.067	0.020	0.067	0.019	0.253
I66	Services to Transport	17	2124	16250	0.004	0.070	0.017	0.066	0.013	0.500
K73	Finance	17	2672	29186	0.005	0.066	0.032	0.061	0.027	0.166
F46	Machinery and Motor Vehicle Wholesaling	17	5352	30856	0.001	0.060	0.013	0.059	0.012	0.355
C24	Printing, Publishing and Recorded Media	17	2024	20670	0.005	0.062	0.013	0.058	0.008	0.355
C27	Metal Product Manufacturing	17	2919	26710	0.007	0.062	0.052	0.055	0.045	0.457
J71	Communication Services	11	3414	25638	0.009	0.053	0.014	0.045	0.005	0.304
P92	Libraries, Museums and the Arts	17	2006	7667	0.007	0.045	0.026	0.039	0.020	0.400
C28	Machinery and Equipment Manufacturing	17	5125	44584	0.003	0.038	0.025	0.035	0.022	0.348
L77	Property Services	17	11655	24227	0.001	0.028	0.005	0.027	0.004	0.264
M81	Government Administration	17	2028	48755	0.003	0.029	0.045	0.026	0.043	0.276
I67	Storage	17	304	2104	0.012	0.035	0.071	0.023	0.059	0.587
C26	Non-Metallic Mineral Product Manufacture	17	834	6708	0.010	0.032	0.039	0.023	0.030	0.417
C22	Textile, Clothing, Footwear, Leather Mfg	17	1041	13522	0.007	0.027	0.020	0.021	0.014	0.636
Q95	Personal Services	17	6187	18492	0.001	0.015	0.004	0.015	0.004	0.170
Q97	Private Households Employing Staff	17	18	138	0.218	0.225	0.191	0.011	-0.033	0.646
E42	Construction Trade Services	17	17942	50005	0.000	0.000	0.002	0.000	0.001	0.138
F45	Basic Material Wholesaling	17	3547	23493	0.001	0.000	0.008	-0.001	0.007	0.220
G52	Personal and Household Good Retailing	17	18631	70418	0.000	-0.002	0.001	-0.002	0.001	0.117
D37	Water Supply, Sewerage & Drainage Serv	17	239	1905	0.025	0.020	0.033	-0.004	0.008	0.316
Q96	Other Services	17	1101	15741	0.010	0.001	0.008	-0.009	-0.002	0.424
G51	Food Retailing	17	6646	23541	0.000	-0.010	0.001	-0.010	0.001	0.152
O87	Community Services	17	721	12889	0.003	-0.008	0.008	-0.011	0.005	0.301
O86	Health Services	17	8435	79119	0.008	-0.005	0.005	-0.013	-0.003	0.266
H57	Accommodation, Cafes and Restaurants	17	8547	57294	0.001	-0.014	0.005	-0.015	0.004	0.354
I61	Road Transport	17	7619	29170	0.001	-0.014	0.008	-0.016	0.007	0.203
P93	Sport and Recreation	17	2984	11234	0.002	-0.015	0.005	-0.017	0.003	0.398
N84	Education	17	6323	90896	0.004	-0.014	0.004	-0.018	0.000	0.153
E41	General Construction	17	12036	42444	0.001	-0.019	0.003	-0.020	0.003	0.191
G53	Motor Vehicle Retailing and Services	17	9382	42997	0.000	-0.019	0.004	-0.020	0.004	0.154
A04	Commercial Fishing	17	1849	4712	0.007	-0.021	0.104	-0.029	0.097	0.730
I65	Other Transport	11	55	146	0.120	0.091	0.092	-0.031	-0.040	0.496
C23	Wood and Paper Product Manufacturing	17	2014	24907	0.006	-0.028	0.034	-0.035	0.028	0.531
A03	Forestry and Logging	17	1922	8306	0.003	-0.033	0.107	-0.036	0.104	0.590
C21	Food, Beverage and Tobacco Manufactur	17	1668	60476	0.006	-0.040	0.036	-0.046	0.031	0.492
D36	Electricity and Gas Supply	17	308	9188	0.016	-0.031	0.022	-0.048	0.007	0.442
B14	Other Mining	17	299	1871	0.009	-0.043	0.047	-0.052	0.038	0.546
A02	Services to Agric, Hunting and Trapping	17	3130	13901	0.002	-0.060	0.076	-0.062	0.074	0.485
I62	Rail Transport	0								
	<b>Suppressed</b>	17	1223	18225	0.061	0.138	0.140	0.088	0.091	0.511
	<b>Weighted mean of industry means</b>	col	207344	1238895	0.004	0.020	0.020	0.016	0.016	0.300

**Table 5 Concentration of 4-digit industries across LMAs (grouped by 2-digit group)**

		MS	MS	MS	MS	EG	EG	EG	EG
		2-d Index	L	M	H	2-d index	L	M	H
B12	Oil and Gas Extraction	0.535	0%	0%	100%	0.508	0%	0%	100%
B15	Services to Mining	0.178	15%	0%	85%	0.264	15%	0%	85%
K74	Insurance	0.156	0%	0%	100%	0.084	7%	52%	40%
B11	Coal Mining	0.153	0%	0%	100%	0.218	0%	0%	100%
K75	Services to Finance and Insurance	0.116	0%	0%	100%	0.051	0%	46%	54%
P91	Motion Picture, Radio and TV Services	0.115	29%	10%	60%	0.042	73%	0%	27%
I64	Air and Space Transport	0.103	91%	0%	9%	0.027	91%	0%	9%
F47	Personal and Household Good Wholesaling	0.092	14%	20%	65%	0.025	35%	36%	29%
B13	Metal Ore Mining	0.085	0%	0%	100%	0.212	0%	0%	100%
I63	Water Transport	0.074	0%	14%	86%	0.009	0%	54%	46%
C29	Other Manufacturing	0.068	6%	0%	94%	0.020	82%	11%	7%
C25	Petrol, Coal, Chemical & Assoc Prod Mfg	0.067	6%	13%	81%	0.030	23%	38%	38%
L78	Business Services	0.067	27%	2%	71%	0.019	29%	50%	21%
I66	Services to Transport	0.066	18%	7%	74%	0.013	16%	13%	71%
K73	Finance	0.061	2%	0%	98%	0.027	2%	90%	8%
F46	Machinery and Motor Vehicle Wholesaling	0.059	11%	16%	73%	0.012	24%	24%	53%
C24	Printing, Publishing and Recorded Media	0.058	32%	0%	68%	0.008	76%	7%	16%
C27	Metal Product Manufacturing	0.055	37%	25%	38%	0.045	45%	24%	31%
J71	Communication Services	0.045	29%	27%	43%	0.005	57%	0%	43%
P92	Libraries, Museums and the Arts	0.039	61%	0%	39%	0.020	54%	11%	35%
C28	Machinery and Equipment Manufacturing	0.035	41%	16%	44%	0.022	34%	49%	17%
L77	Property Services	0.027	6%	67%	27%	0.004	100%	0%	0%
M81	Government Administration	0.026	30%	0%	70%	0.043	30%	0%	70%
I67	Storage	0.023	0%	100%	0%	0.059	0%	0%	100%
C26	Non-Metallic Mineral Product Manufacture	0.023	34%	36%	29%	0.030	35%	30%	34%
C22	Textile, Clothing, Footwear, Leather Mfg	0.021	43%	0%	57%	0.014	69%	15%	16%
Q95	Personal Services	0.015	52%	37%	11%	0.004	100%	0%	0%
Q97	Private Households Employing Staff	0.011	100%	0%	0%	-0.033	100%	0%	0%
E42	Construction Trade Services	0.000	78%	22%	0%	0.001	100%	0%	0%
F45	Basic Material Wholesaling	-0.001	47%	22%	31%	0.007	47%	27%	25%
G52	Personal and Household Good Retailing	-0.002	99%	1%	0%	0.001	100%	0%	0%
D37	Water Supply, Sewerage & Drainage Serv	-0.004	100%	0%	0%	0.008	100%	0%	0%
Q96	Other Services	-0.009	100%	0%	0%	-0.002	100%	0%	0%
G51	Food Retailing	-0.010	94%	6%	0%	0.001	92%	8%	0%
O87	Community Services	-0.011	100%	0%	0%	0.005	100%	0%	0%
O86	Health Services	-0.013	97%	0%	3%	-0.003	97%	3%	0%
H57	Accommodation, Cafes and Restaurants	-0.015	100%	0%	0%	0.004	100%	0%	0%
I61	Road Transport	-0.016	87%	13%	0%	0.007	100%	0%	0%
P93	Sport and Recreation	-0.017	100%	0%	0%	0.003	82%	18%	0%
N84	Education	-0.018	99%	1%	0%	0.000	99%	1%	0%
E41	General Construction	-0.020	100%	0%	0%	0.003	100%	0%	0%
G53	Motor Vehicle Retailing and Services	-0.020	100%	0%	0%	0.004	100%	0%	0%
A04	Commercial Fishing	-0.029	60%	40%	0%	0.097	0%	0%	100%
I65	Other Transport	-0.031	100%	0%	0%	-0.040	100%	0%	0%
C23	Wood and Paper Product Manufacturing	-0.035	68%	7%	25%	0.028	29%	26%	44%
A03	Forestry and Logging	-0.036	100%	0%	0%	0.104	0%	0%	100%
C21	Food, Beverage and Tobacco Manufacturing	-0.046	85%	2%	13%	0.031	22%	5%	73%
D36	Electricity and Gas Supply	-0.048	100%	0%	0%	0.007	100%	0%	0%
B14	Other Mining	-0.052	100%	0%	0%	0.038	0%	54%	46%
A02	Services to Agric, Hunting and Trapping	-0.062	100%	0%	0%	0.074	0%	2%	98%
	<b>TOTAL</b>		<b>62%</b>	<b>8%</b>	<b>30%</b>		<b>64%</b>	<b>16%</b>	<b>21%</b>

**Table 6 Most and Least Concentrated 4-digit industries across LMAs**

Industry		yrs	Units	FTE	Herf	G_MS	G_EG	MS	EG	Gini
	<b>20 Most concentrated 4-digit industries (descending order)</b>									
B1200	Oil and Gas Extraction	1	12	460	0.179	0.618	0.596	0.535	0.508	0.375
P9112	Film and Video Distribution	17	34	153	0.083	0.471	0.280	0.423	0.215	0.493
C2711	Basic Iron and Steel Manufacturing	7	40	2151	0.410	0.656	0.578	0.417	0.283	0.736
F4721	Textile Product Wholesaling	17	319	1535	0.011	0.376	0.207	0.369	0.199	0.633
F4791	Photographic Equipment Wholesaling	17	68	487	0.065	0.408	0.228	0.367	0.175	0.499
C2547	Ink Manufacturing	17	21	363	0.119	0.415	0.334	0.335	0.243	0.565
B1512	Petroleum Exploration Services	7	12	126	0.247	0.485	0.497	0.316	0.334	0.705
K7411	Life Insurance	17	182	3448	0.071	0.361	0.282	0.313	0.228	0.668
I6401	Scheduled International Air Transport	9	52	416	0.057	0.337	0.172	0.297	0.122	0.459
C2212	Synthetic Fibre Textile Manufacturing	17	30	303	0.107	0.373	0.295	0.297	0.211	0.636
F4794	Book and Magazine Wholesaling	17	162	1205	0.035	0.320	0.165	0.295	0.135	0.540
C2546	Cosmetic & Toiletry Preparation Mfg	17	47	745	0.082	0.351	0.224	0.294	0.155	0.659
C2565	Plastic Foam Product Manufacturing	17	16	142	0.140	0.385	0.267	0.286	0.147	0.368
I6301	International Sea Transport	17	35	701	0.135	0.384	0.229	0.284	0.104	0.608
C2181	Soft Drink,Cordial & Syrup Manufacturing	17	32	719	0.127	0.372	0.318	0.281	0.219	0.545
L7867	Contract Packing Services nec	17	62	699	0.089	0.340	0.253	0.277	0.180	0.677
B1319	Metal Ore Mining nec	16	38	186	0.153	0.387	0.430	0.274	0.320	0.696
F4792	Jewellery and Watch Wholesaling	17	146	442	0.018	0.278	0.137	0.265	0.121	0.538
P9111	Film and Video Production	17	748	1709	0.011	0.272	0.153	0.264	0.144	0.607
P9251	Sound Recording Studios	17	67	136	0.042	0.289	0.146	0.257	0.108	0.433
	<b>20 Least concentrated 4-digit industries (descending order)</b>									
Q9524	Funeral Directors,Crematoria,Cemeteries	17	181	682	0.009	-0.031	0.011	-0.041	0.002	0.278
K7323	Credit Unions	14	80	274	0.030	-0.010	0.048	-0.041	0.019	0.461
C2214	Wool Textile Manufacturing	17	46	2018	0.071	0.031	0.106	-0.043	0.038	0.737
F4611	Farm/Construction Machinery Wholesaling	17	411	2486	0.008	-0.034	0.057	-0.043	0.049	0.500
A0212	Shearing Services	17	355	4411	0.008	-0.035	0.121	-0.043	0.114	0.679
C2313	Timber Resawing and Dressing	17	94	1250	0.033	-0.010	0.072	-0.044	0.040	0.598
D3702	Sewerage and Drainage Services	17	121	813	0.035	-0.007	0.034	-0.044	-0.001	0.359
E4121	Road and Bridge Construction	17	554	7700	0.007	-0.040	0.021	-0.048	0.014	0.404
C2321	Plywood and Veneer Manufacturing	13	32	1712	0.102	0.058	0.121	-0.050	0.021	0.710
O8640	Veterinary Services	17	482	2136	0.004	-0.046	0.016	-0.050	0.012	0.384
D3610	Electricity Supply	17	279	8415	0.018	-0.033	0.022	-0.052	0.005	0.451
G5312	Motor Cycle Dealing	17	206	1052	0.011	-0.041	0.029	-0.052	0.019	0.454
F4519	Farm Produce & Supplies Wholesaling nec	17	857	3802	0.004	-0.048	0.041	-0.053	0.036	0.446
C2311	Log Sawmilling	17	421	6432	0.014	-0.038	0.091	-0.053	0.078	0.591
A0301	Forestry	16	816	2093	0.020	-0.035	0.077	-0.056	0.059	0.566
A0219	Services to Agriculture nec	17	2551	8885	0.004	-0.052	0.070	-0.056	0.066	0.454
C2129	Dairy Product Manufacturing nec	14	78	6446	0.039	-0.015	0.108	-0.057	0.072	0.674
B1419	Construction Material Mining nec	17	155	859	0.016	-0.044	0.067	-0.060	0.052	0.578
C2531	Fertiliser Manufacturing	17	57	948	0.077	0.017	0.127	-0.065	0.054	0.707
C2111	Meat Processing	17	209	22861	0.026	-0.040	0.095	-0.067	0.071	0.643
	<b>Total Counts &amp; Weighted mean indices</b>		<b>207722</b>	<b>1257328</b>	<b>0.022</b>	<b>0.049</b>	<b>0.046</b>	<b>0.028</b>	<b>0.025</b>	<b>0.400</b>

Notes: Highlighted cells have high concentration The weighted mean is weighted by FTE employment. Industry coverage for all measures is restricted to those industries that were covered throughout the period.

**Table 7 Most Dispersed 4-digit industries across LMAs (EG ≈ 0)**

<i>Industry</i>	<i>yrs</i>	<i>Units</i>	<i>FTE</i>	<i>Herf</i>	<i>G_MS</i>	<i>G_EG</i>	<i>MS</i>	<i>EG</i>	<i>Gini</i>	
O8621	General Practice Medical Services	17	2561	7713	0.001	-0.010	0.002	-0.011	0.001	0.170
E4243	Tiling and Carpeting Services	17	1119	2186	0.002	0.004	0.004	0.002	0.001	0.286
G5124	Bread and Cake Retailing	17	721	3549	0.003	-0.009	0.005	-0.012	0.001	0.320
G5234	Domestic Appliance Retailing	17	1108	4900	0.003	-0.014	0.004	-0.016	0.001	0.252
C2262	Leather/Leather Substitute Product Manuf	17	114	543	0.025	0.080	0.027	0.056	0.001	0.504
G5311	Car Retailing	17	1538	11856	0.002	-0.015	0.003	-0.017	0.001	0.277
E4232	Electrical Services	17	3165	9714	0.002	-0.005	0.003	-0.006	0.001	0.194
O8635	Physiotherapy Services	17	488	1031	0.003	0.008	0.004	0.005	0.001	0.270
G5261	Household Equip Repair Serv(Electrical)	17	787	2148	0.004	-0.007	0.005	-0.011	0.001	0.265
G5251	Pharmaceutical/Cosmetic/Toiletry Retail	17	1209	5985	0.001	-0.014	0.002	-0.015	0.001	0.144
E4244	Painting and Decorating Services	17	2836	7441	0.001	-0.011	0.002	-0.013	0.001	0.184
M8113	Local Government Administration	17	789	13786	0.008	-0.019	0.008	-0.027	0.001	0.325
N8422	Secondary Education	17	355	21249	0.004	-0.024	0.004	-0.028	0.001	0.163
P9113	Motion Picture Exhibition	17	88	727	0.028	0.066	0.029	0.038	0.000	0.279
Q9529	Personal Services nec	17	242	976	0.041	0.091	0.041	0.052	0.000	0.469
C2161	Bread Manufacturing	17	100	2549	0.030	0.013	0.030	-0.017	0.000	0.462
E4231	Plumbing Services	17	2601	6743	0.001	-0.010	0.001	-0.011	0.000	0.194
G5125	Takeaway Food Retailing	17	2906	9478	0.001	-0.005	0.001	-0.006	0.000	0.185
N8440	Other Education	17	1751	9054	0.004	0.011	0.004	0.007	0.000	0.387
G5123	Liquor Retailing	17	534	2171	0.004	0.006	0.004	0.002	0.000	0.272
G5231	Furniture Retailing	17	630	2726	0.004	-0.004	0.005	-0.008	0.000	0.303
O8632	Optometry and Optical Dispensing	17	296	965	0.005	0.006	0.005	0.001	0.000	0.234
G5242	Toy and Game Retailing	17	187	503	0.009	0.010	0.009	0.002	0.000	0.337
E4224	Structural Steel Erection Services	17	117	365	0.024	0.032	0.024	0.008	0.000	0.563
G5269	Household Equipment Repair Services nec	17	533	1186	0.004	0.008	0.004	0.004	0.000	0.313
G5222	Footwear Retailing	17	513	1860	0.010	0.008	0.010	-0.002	0.000	0.202
C2732	Non-Ferrous Metal(Roll/Draw/Extrude)nec	2	15	585	0.393	0.369	0.392	-0.039	0.000	0.802
Q9511	Video Hire Outlets	17	436	1463	0.004	-0.006	0.003	-0.009	-0.001	0.251
F4714	Fish Wholesaling	17	151	794	0.031	0.021	0.030	-0.011	-0.001	0.547
P9312	Sports Grounds and Facilities nec	17	619	3505	0.004	0.004	0.003	-0.001	-0.001	0.442
G5223	Fabric and Other Soft Good Retailing	17	708	2190	0.004	-0.005	0.003	-0.008	-0.001	0.249
C2749	Structural Metal Prod Manufacturing nec	17	395	2749	0.016	0.035	0.014	0.020	-0.001	0.385
D3702	Sewerage and Drainage Services	17	121	813	0.035	-0.007	0.034	-0.044	-0.001	0.359

Notes: The industry-level measures are derived by averaging annual estimates from all years where data were not suppressed for confidentiality reasons. Industry coverage for all measures is restricted to those industries that were covered throughout the period.

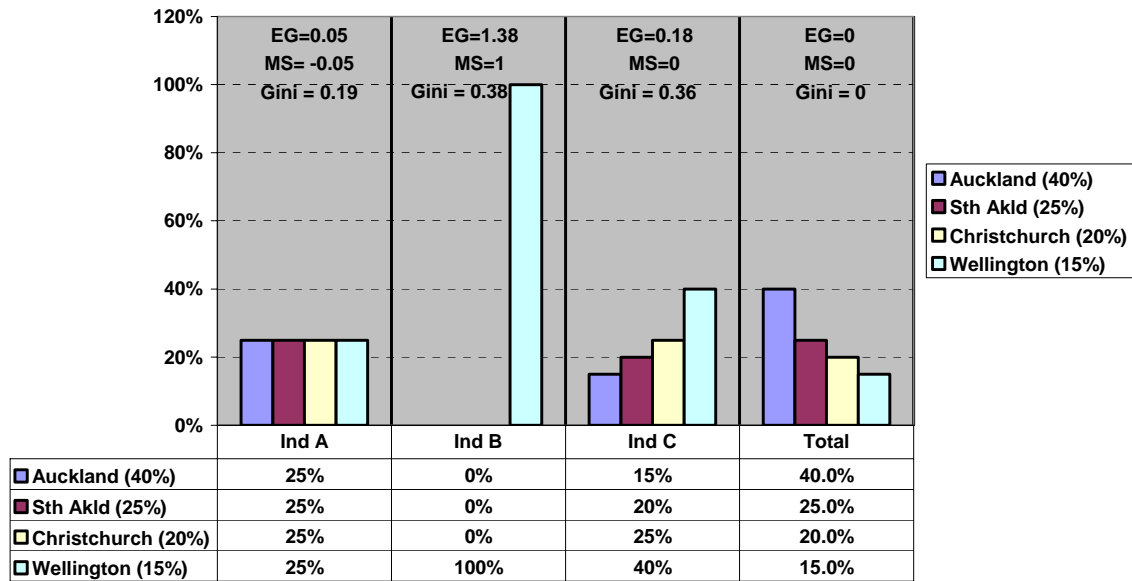
**Table 8 Colocation Groupings**

<i>Group</i>	<i>Group name</i>	<i>Industry</i>	<i>MS</i>	<i>EG</i>	<i>Mean MS</i>	<i>Mean EG</i>	
1a	Land related	A02	Services to Agric, Hunting and Trapping	-0.063	0.081	-0.036	0.060
1a	Land related	B14	Other Mining	-0.065	0.033	-0.036	0.060
1a	Land related	C21	Food, Beverage and Tobacco Manufacturing	-0.053	0.037	-0.036	0.060
1a	Land related	C23	Wood and Paper Product Manufacturing	-0.050	0.033	-0.036	0.060
1a	Land related	B15	Services to Mining	0.049	0.118	-0.036	0.060
1b	Land based	A03	Forestry and Logging	-0.047	0.102	-0.033	0.112
1b	Land based	A04	Commercial Fishing	-0.018	0.121	-0.033	0.112
2a	Mining	B11	Coal Mining	0.000	0.000	-0.020	0.048
2a	Mining	B13	Metal Ore Mining	-0.040	0.095	-0.020	0.048
3a	Local services	C22	Textile, Clothing, Footwear, Leather Mfg	0.007	0.015	-0.007	0.003
3a	Local services	L77	Property Services	0.017	0.002	-0.007	0.003
3a	Local services	Q95	Personal Services	0.014	0.004	-0.007	0.003
3a	Local services	P93	Sport and Recreation	-0.010	0.002	-0.007	0.003
3a	Local services	G52	Personal and Household Good Retailing	0.001	0.000	-0.007	0.003
3a	Local services	N84	Education	-0.008	-0.001	-0.007	0.003
3a	Local services	E42	Construction Trade Services	-0.006	0.001	-0.007	0.003
3a	Local services	O86	Health Services	-0.016	-0.002	-0.007	0.003
3a	Local services	H57	Accommodation, Cafes and Restaurants	-0.014	0.006	-0.007	0.003
3a	Local services	G51	Food Retailing	-0.004	0.000	-0.007	0.003
3a	Local services	O87	Community Services	-0.034	0.009	-0.007	0.003
3a	Local services	I65	Other Transport	-0.030	-0.001	-0.007	0.003
3b	Local services	E41	General Construction	-0.025	0.004	-0.024	0.006
3b	Local services	G53	Motor Vehicle Retailing and Services	-0.022	0.005	-0.024	0.006
3b	Local services	I61	Road Transport	-0.024	0.010	-0.024	0.006
4a	Utilities	D36	Electricity and Gas Supply	-0.032	0.015	-0.032	0.015
4b	Govt&services	M81	Government Administration	0.058	0.075	-0.006	0.000
4b	Govt&services	Q97	Private Households Employing Staff	-0.059	-0.073	-0.006	0.000
4b	Govt&services	Q96	Other Services	-0.017	-0.002	-0.006	0.000
5a	Media	C24	Printing, Publishing and Recorded Media	0.063	0.011	0.060	0.007
5a	Media	J71	Communication Services	0.056	0.003	0.060	0.007
5b	business services	I63	Water Transport	0.088	0.049	0.107	0.047
5b	business services	K73	Finance	0.093	0.036	0.107	0.047
5b	business services	K74	Insurance	0.220	0.109	0.107	0.047
5b	business services	P91	Motion Picture, Radio and TV Services	0.146	0.057	0.107	0.047
5b	business services	K75	Services to Finance and Insurance	0.111	0.045	0.107	0.047
5b	business services	L78	Business Services	0.071	0.019	0.107	0.047
5b	business services	P92	Libraries, Museums and the Arts	0.023	0.012	0.107	0.047
6a	Heavy/ transport	C25	Petrol, Coal, Chemical & Assoc Prod Mfg	0.065	0.026	0.074	0.021
6a	Heavy/ transport	F47	Personal and Household Good Wholesaling	0.105	0.032	0.074	0.021
6a	Heavy/ transport	I64	Air and Space Transport	0.108	0.026	0.074	0.021
6a	Heavy/ transport	F46	Machinery and Motor Vehicle Wholesaling	0.062	0.016	0.074	0.021
6a	Heavy/ transport	C29	Other Manufacturing	0.049	0.017	0.074	0.021
6a	Heavy/ transport	I66	Services to Transport	0.055	0.011	0.074	0.021
6b	Metal & machinery	C26	Non-Metallic Mineral Product Manufacture	0.029	0.038	0.046	0.048
6b	Metal & machinery	I67	Storage	0.086	0.097	0.046	0.048
6b	Metal & machinery	C27	Metal Product Manufacturing	0.033	0.031	0.046	0.048
6b	Metal & machinery	C28	Machinery and Equipment Manufacturing	0.035	0.027	0.046	0.048
6c	Water utility	D37	Water Supply, Sewerage & Drainage Serv	-0.007	0.002	-0.007	0.002
6d	Material Wholesale	F45	Basic Material Wholesaling	0.003	0.009	0.003	0.009

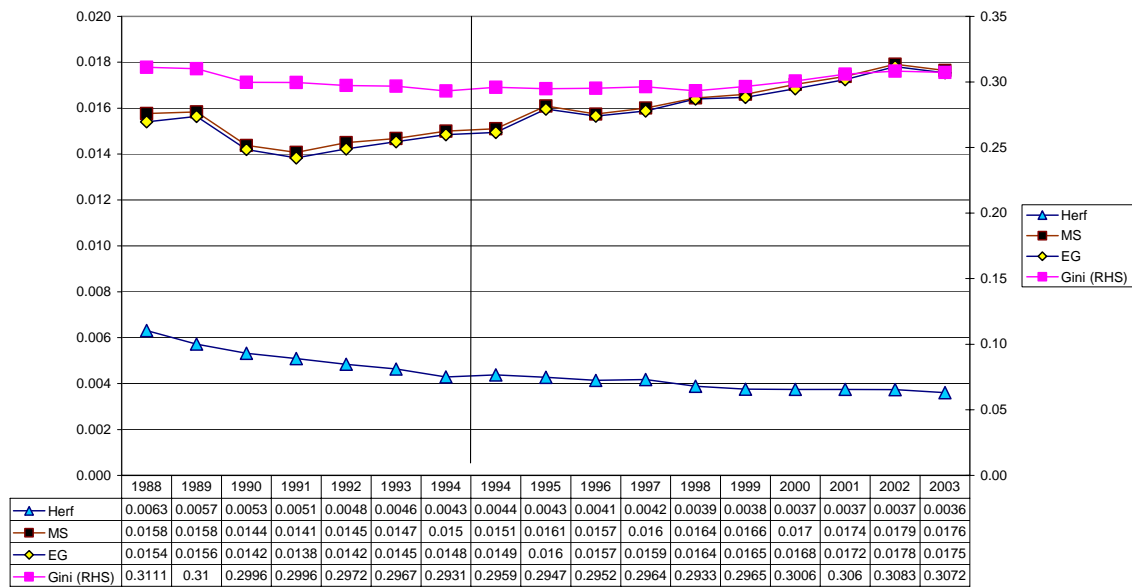
**Table 9 LMA Specialisation across 2-digit industries**

<i>Labour Market Area</i>	<i>yrs</i>	<i>Units</i>	<i>FTE</i>	<i>Herf</i>	<i>G MS</i>	<i>G EG</i>	<i>MS</i>	<i>EG</i>	<i>Gini</i>
Ngaruawahia	17	406	2758	0.0413	0.1677	0.1644	0.1322	0.1287	0.5784
MacKenzie	17	244	1183	0.0273	0.1228	0.1284	0.0982	0.1040	0.6662
Queenstown	17	1135	5053	0.0040	0.0702	0.0745	0.0666	0.0708	0.6297
Tokoroa	17	1100	7255	0.0114	0.0587	0.0743	0.0479	0.0636	0.6312
Hawera	17	837	5575	0.0293	0.0597	0.0599	0.0315	0.0317	0.7541
Kaikohe	17	496	2269	0.0091	0.0397	0.0312	0.0308	0.0223	0.5210
Picton	17	598	2161	0.0095	0.0394	0.0574	0.0301	0.0484	0.7665
Waipukurau	17	594	3476	0.0473	0.0740	0.0725	0.0285	0.0270	0.5753
Stratford	17	549	2931	0.0250	0.0452	0.0479	0.0210	0.0238	0.4463
Wellington	17	15859	114103	0.0017	0.0221	0.0159	0.0204	0.0142	0.4653
Kaikoura	17	256	985	0.0141	0.0329	0.0429	0.0190	0.0292	0.6816
Taihape	17	597	2562	0.0100	0.0245	0.0311	0.0147	0.0213	0.5869
Hastings	17	2883	19275	0.0084	0.0227	0.0224	0.0145	0.0142	0.3939
Whakatane	17	1851	11673	0.0177	0.0303	0.0366	0.0129	0.0193	0.5014
Alexandra	17	1358	5625	0.0045	0.0169	0.0216	0.0125	0.0173	0.5305
Kerikeri	17	1275	4774	0.0120	0.0227	0.0216	0.0108	0.0096	0.5155
Auckland	17	46759	248992	0.0007	0.0107	0.0059	0.0100	0.0052	0.3230
Gore	17	1335	7968	0.0181	0.0277	0.0378	0.0097	0.0200	0.5595
Waimate	17	2418	14678	0.0070	0.0166	0.0174	0.0097	0.0105	0.3401
Taupo	17	1902	9276	0.0037	0.0130	0.0245	0.0093	0.0209	0.5430
Te Puke	17	636	3249	0.0257	0.0321	0.0382	0.0066	0.0127	0.6382
Gisborne	17	1932	11814	0.0064	0.0129	0.0116	0.0065	0.0052	0.4769
Kaitaia	17	784	3441	0.0082	0.0145	0.0184	0.0063	0.0103	0.5433
Eketahuna	17	382	1761	0.0151	0.0212	0.0261	0.0061	0.0111	0.5458
Oamaru	17	876	5595	0.0378	0.0426	0.0436	0.0050	0.0060	0.4798
Ashburton	17	1292	7597	0.0141	0.0187	0.0228	0.0047	0.0088	0.5462
Palmerston Nth	17	5245	34608	0.0062	0.0108	0.0043	0.0046	-0.0018	0.2773
Te Awamutu	17	824	4041	0.0161	0.0205	0.0162	0.0045	0.0002	0.4237
Dunedin	17	5471	38746	0.0071	0.0112	0.0056	0.0041	-0.0015	0.3101
Morrinsville	17	454	2170	0.0125	0.0164	0.0140	0.0040	0.0015	0.4053
Hamilton	17	8854	56699	0.0038	0.0078	0.0027	0.0040	-0.0011	0.3598
Blenheim	17	1651	9095	0.0056	0.0091	0.0123	0.0035	0.0067	0.3869
Hutt Valley	17	6847	42386	0.0025	0.0058	0.0047	0.0033	0.0022	0.3237
Matamata	17	555	2856	0.0092	0.0125	0.0163	0.0033	0.0071	0.5910
Taumaranui	17	498	2543	0.0134	0.0160	0.0200	0.0026	0.0067	0.5168
Thames	17	1898	7508	0.0058	0.0083	0.0141	0.0025	0.0083	0.5007
Waihi	17	726	3087	0.0072	0.0096	0.0134	0.0024	0.0062	0.7616
Rotorua	17	3694	22282	0.0032	0.0054	0.0090	0.0022	0.0058	0.4255
Greymouth	17	1443	7604	0.0050	0.0068	0.0148	0.0018	0.0098	0.7568
Wanganui	17	2028	13151	0.0085	0.0101	0.0072	0.0017	-0.0013	0.3439
Invercargill	17	3476	24677	0.0098	0.0115	0.0143	0.0017	0.0045	0.3580
Christchurch	17	20868	132189	0.0010	0.0004	0.0008	-0.0006	-0.0002	0.1902
Napier	17	3416	20026	0.0040	0.0033	0.0034	-0.0007	-0.0006	0.2540
Whangarei	17	3569	19289	0.0049	0.0038	0.0040	-0.0011	-0.0009	0.2761
Bulls	17	444	2502	0.0167	0.0157	0.0164	-0.0011	-0.0003	0.5063
Nelson	17	4370	24258	0.0035	0.0024	0.0058	-0.0011	0.0023	0.4918
TeKuiti	17	461	2622	0.0154	0.0143	0.0250	-0.0012	0.0097	0.7408
Levin	17	1403	7162	0.0077	0.0064	0.0108	-0.0013	0.0031	0.3901
SthAuckland	17	23976	160315	0.0009	-0.0010	0.0075	-0.0019	0.0066	0.3738
Masterton	17	1797	9555	0.0054	0.0028	0.0077	-0.0026	0.0023	0.3749
New Plymouth	17	3608	21808	0.0041	0.0014	0.0040	-0.0027	-0.0002	0.6806
Tauranga	17	5947	28254	0.0022	-0.0008	0.0031	-0.0030	0.0009	0.2972
Dargaville	17	466	2086	0.0174	0.0143	0.0182	-0.0032	0.0008	0.4731
Warkworth	17	1408	4974	0.0059	0.0016	0.0130	-0.0043	0.0071	0.4782
Balclutha	17	665	4244	0.0561	0.0501	0.0547	-0.0064	-0.0016	0.5702
Motueka	17	545	2599	0.0270	0.0207	0.0238	-0.0065	-0.0033	0.5506
Otorohanga	17	359	1928	0.0550	0.0481	0.0575	-0.0073	0.0020	0.6209
Dannevirke	17	494	2978	0.0432	0.0350	0.0368	-0.0086	-0.0067	0.5187
<b>TOTAL</b>	<b>17</b>	<b>205805</b>	<b>1224264</b>	<b>0.0044</b>	<b>0.0108</b>	<b>0.0107</b>	<b>0.0064</b>	<b>0.0063</b>	<b>0.3730</b>

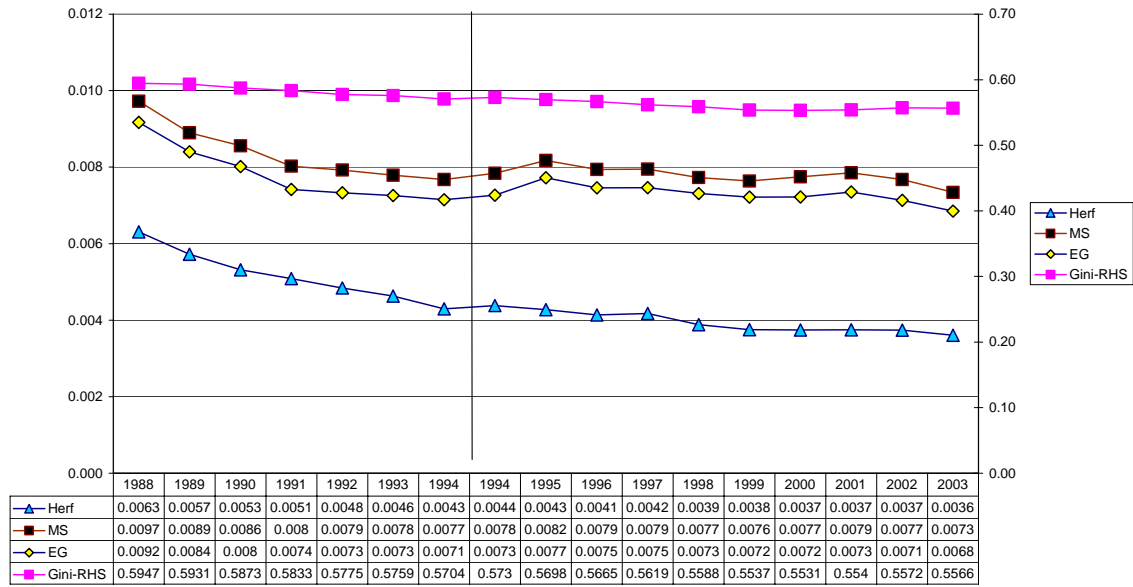
**Figure 1 Concentration Indices for hypothetical industries**



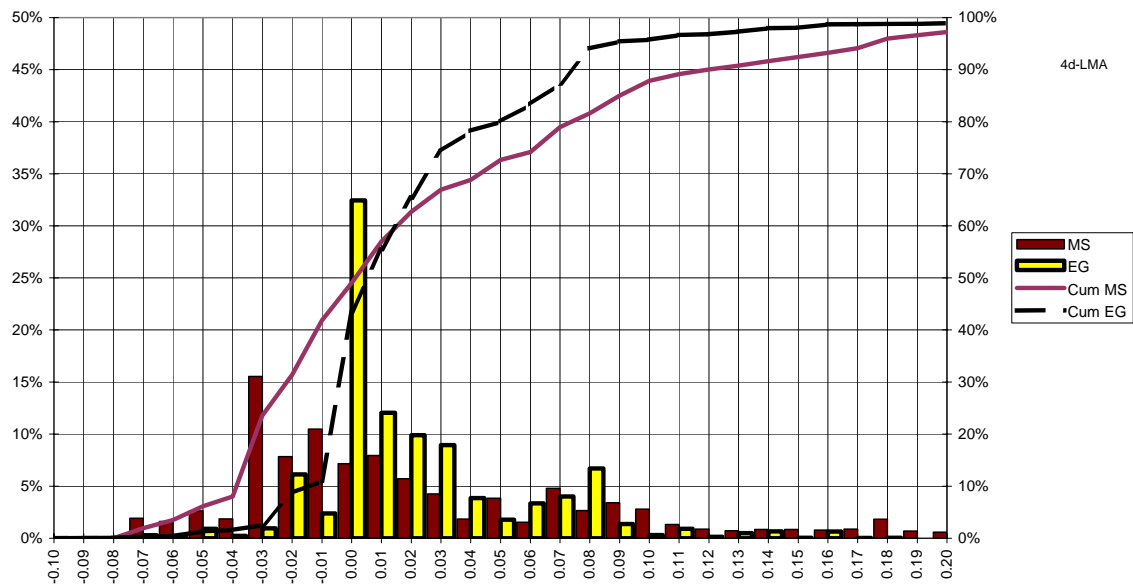
**Figure 2 Trends in Concentration**  
**2-digit industries; Labour Market Areas**



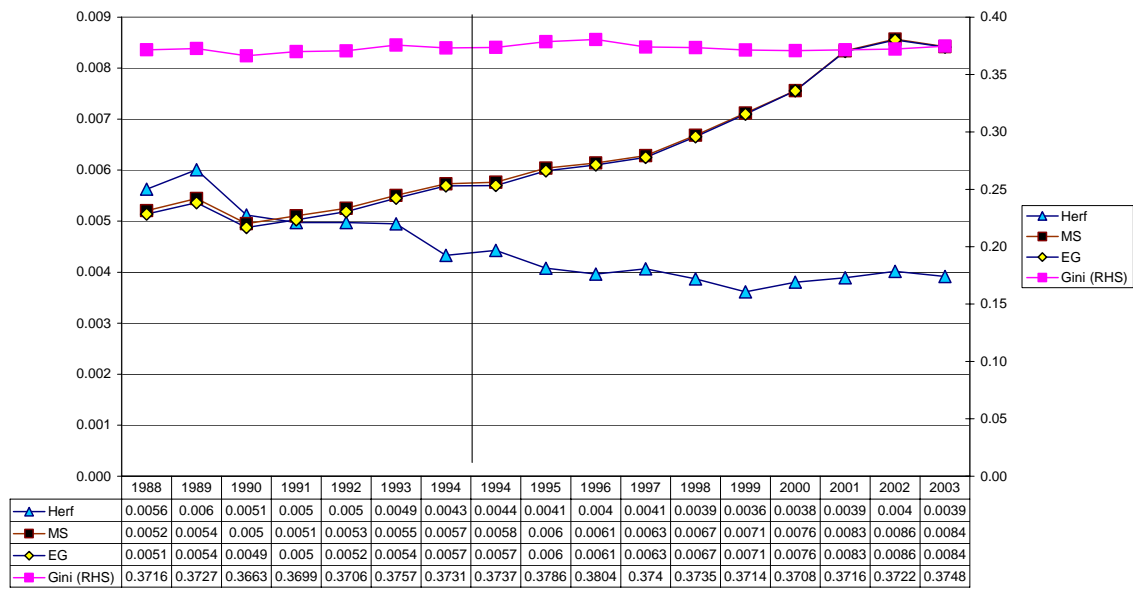
**Figure 3 Trends in Concentration**  
2-digit industries; Area Units



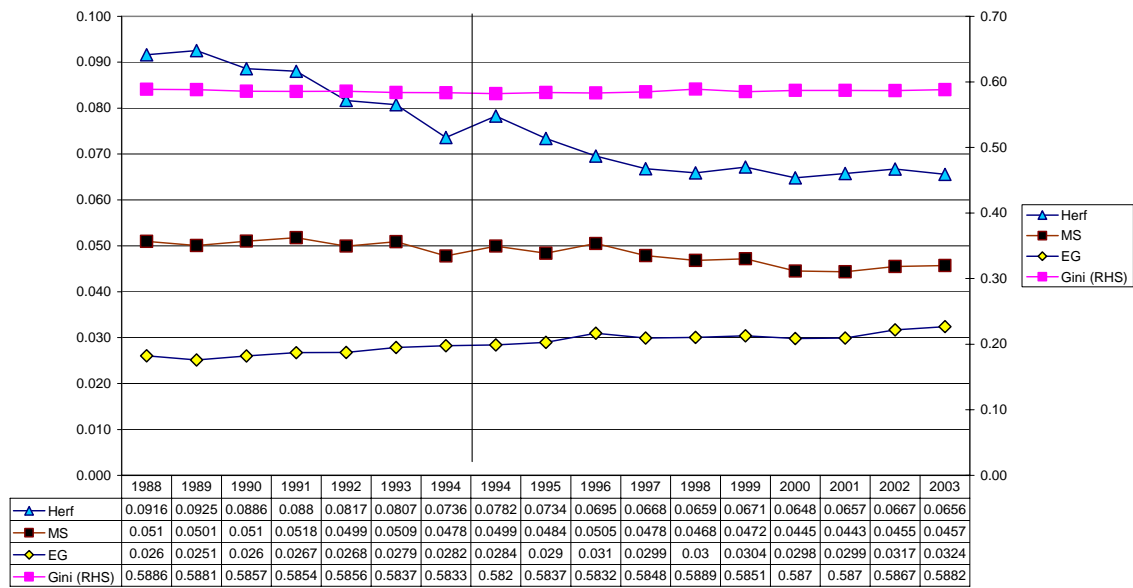
**Figure 4 Distribution of concentration indices**  
4-digit industries; Labour Market Areas



**Figure 5 Industrial Specialisation of Labour Market Areas (2-digit industries)**



**Figure 6 Industrial Specialisation of Area Units (2-digit industries)**





**Appendix Table 2    Impact of Industry Coverage Restrictions**Percentage of annual employment that falls within  
various coverage definitions

	Continuous coverage from 1987	Continuous Coverage from 1994	Continuous Coverage from 1997
1987	99.9%	n/a	n/a
1988	99.9%	n/a	n/a
1989	99.9%	n/a	n/a
1990	99.9%	n/a	n/a
1991	99.9%	n/a	n/a
1992	99.9%	n/a	n/a
1993	99.9%	n/a	n/a
1994	99.9%	n/a	n/a
1994.5	97.9%	100.0%	n/a
1995	98.1%	100.0%	n/a
1996	97.2%	98.7%	n/a
1997	96.0%	97.4%	100.0%
1998	76.9%	77.9%	80.0%
1999	96.0%	97.3%	100.0%
2000	96.1%	97.4%	100.0%
2001	96.1%	97.3%	100.0%
2002	96.0%	97.3%	100.0%
2003	95.9%	97.2%	100.0%

**Appendix Table 3: Impact of Series Discontinuity in 1994**

	Share		Units			Share		FTE		
	old def	new def	growth 1992-4	diff 1994	growth 1994-6	old def	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%