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Measures of Manufacturing Industry Concentration - Implications for South Africa

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Abstract

The issues of industry concentration of industry, industry location and agglomeration are a key part of the discussion around the New Economic Geography in recent years. Industry concentration is extremely important in the South African context due to the country's apartheid-era economic history involving the Regional Industrial Decentralisation Programme (RIDP) and the Industrial Decentralisation Policy (IDP).

The focus of this paper is on the level of concentration of the manufacturing industry in South Africa. The paper first reviews international literature on industry concentration and agglomeration, including the New Economic Geography as put forward by Krugman and the recent work on agglomeration and industry concentration by Ellison and Glaeser as well as Maurel and Sedillot. The paper reviews recent international work on industry concentration using the Gini coefficient, as well as the Ellison-Glaeser (EG) index and Maurel-Sedillot (MS) index of concentration. It also provides a review of industry policy in South Africa, ranging from the Industrial Development Policy (IDP) and Regional Industrial Development Programme (RIDP) of the pre-1994 era, to the more recent Regional Industrial Location Study (RILS), Spatial Development Initiatives (SDIs) and draft Regional Industrial Development Strategy (RIDS). A brief overview of the location of the manufacturing sector across the various provinces is also provided. The paper then examines measures of industry concentration that have been compiled for South Africa, e.g. in terms of the Gini coefficient and Rosenbluth measure of industry concentration. This enables the identification of which subsectors of the South African manufacturing sector are more concentrated and to what extent and these results are compared to studies undertaken in other countries. Finally, some policy implications and areas of further research are put forward.

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1 Introduction

In the past, socio-political objectives have played a very significant role in industrial strategy in South Africa. In particular the years between 1946 and 1994 reflect the era of apartheid and the policy of industrial decentralisation. In the post-1994 democratic era, the government has faced significant challenges in attempting to formulate a coherent industrial strategy for the country that will translate into economic gains for the poor in terms of employment and higher living standards across the various provinces in the country.

In terms of this paper, a review of economic literature on the location and concentration of industry is undertaken emphasising the recent work on the "New Economic Geography" by Krugman (1991a) and other authors such as Neary (2001). The work on agglomeration and measures of industry concentration put forward by Ellison and Glaeser (1994) and Maurel and Sedillot (1999) are also reviewed. Recent international work such as Mare (2005) using the Gini coefficient, as well as the Ellison-Glaeser (EG) index and Maurel-Sedillot (MS) index is presented. Then, industrial policy and industry development in South Africa is examined, including the apartheid-era Regional Industrial Development Programme (RIDP) and Industrial Decentralisation Policy (IDP). This will be followed by the more recent Regional Industrial Location Study (RILS), Spatial Development Initiatives (SDIs) and draft Regional industrial Development Strategy (RIDS) of the post-1994 era. The paper then examines recent work on industry concentration in South Africa using the Gini coefficient and Rosenbluth index as in Fedderke and Szalontai (2005). The paper therefore identifies those subsectors of manufacturing that are most concentrated. Finally, some policy implications and areas of further research are put forward.

2 Literature Review

The background theory of industrial location was first developed by Marshall (1920) and Weber (1929). Marshall (1920) first suggested three reasons why industries choose to concentrate spatially. A series of more modern studies have adapted these ideas to consider a number of economically relevant factors that can influence industry concentration and agglomeration. These include:

- transportation costs (see Fujita, *et al.* 1999; Ellison & Glaeser, 1994; and Neary, 2001);
- density of and investment in transport infrastructure networks (see Krugman, 1991a and Martin & Rogers, 1995);
- role of ports in facilitating international trade and industry activity (Fujita and Mori, 1996 & Fujita *et al*., 1999);
- resource endowments (see Head, *et al.*, 1995);
- technology spillovers (see Audretsch & Feldman, 1996; Jaffe, *et al.*, 1993; Feldman, 1994, Porter, 1990 & Fujita and Thisse, 1996);
- specialisation of labour (see David & Rosenbloom, 1990);
- linkages between industries in terms of intermediate inputs (see Krugman, 1991b);

- location fundamentals and their role in enabling cities to revert to their long term growth path even after major shocks (Davis & Weinstein, 2002); and
- agglomeration of population and technological economies of scale in production and consumption in terms of cities (see Henderson, 1974; Henderson, 1986; Glaeser, *et al*., 1992; Fujita and Thisse, 1996; Brezis & Krugman, 1997; Gabaix, 1999; and Davis & Weinstein, 2002).

This paper will focus on the work of Ellison and Glaeser (1994) and then Maurel and Sedillot (1999) amongst others as key references for developing measures of manufacturing industry concentration and its constituent subsectors.

2.1 New Economic Geography

More recently, the "New Economic Geography" has arisen as a compelling alternative paradigm for industrial location and was first proposed by Krugman (1991a) and Krugman (1991b), then taken further in Krugman and Venables (1995) and Krugman (1998). The concept of industrial location and concentration put forward in these papers has since been examined in papers such as Neary (2001).

The New Economic Geography model discussed in Krugman (1991a) introduces a more dynamic approach. The economy in the model is initially characterised by two regions with high transportation costs which prevent specialisation, implying that each region has an equal portion of manufacturing activity. As transportation costs fall over time, trade between the regions takes place. As one region emerges with a stronger manufacturing base, it will eventually attract more industries involved in intermediate activities (the production process – leading to backward linkages between industries). If one region produces more intermediate goods, better access to these goods will mean reduced costs of production of final goods (forward linkages). This will result in increased movement of manufacturing to that region. When transportation costs fall below a critical level, the global (or domestic) economy will organise itself into an industrialised *core* and deindustrialised *periphery*.

The development of the economy continues as demand for labour increases in the industrial region or *core* through the concentration and growth of industry, and falls in the *periphery*. Real wages then fall in the *periphery* and increase in the *core* (Krugman & Venables, 1995). If transport costs continue to fall, the advantage of being located closer to markets and suppliers begins to decline. The *periphery* then emerges with an advantage in the form of a lower wage rate, to the point where this outweighs the disadvantage of distance from markets and suppliers. Manufacturing activities then move from the core to the periphery, enabling a convergence of wage rates and economic growth between the regions.

It is also argued by Krugman (*op.cit*.) that, while cost and other factors are important, historical events and accident can result in certain activities initially taking place in particular areas for non-economic reasons. In due course, economic advantages accrue to industries or activities which perpetuate the activities in the areas long after the original rationale has become of lesser importance or even irrelevant.

There are two points from this Krugman model especially relevant to our understanding of South African industrial policy: (1) the historic establishment of a central, industrialised core which may at some time find its advantage tipped to the periphery; and (2) the logic of historical events determining current economic patterns. In the former, we can identify the province of Gauteng as being established as a centralised industrialised core. In the latter we can think about the apartheid and post-apartheid policies of the South African government. In fact, these policies strictly limited the market's ability to motivate industrial location, artificially inflating the *core* and *periphery* in the South African economic landscape.

2.2 Indices of industry concentration

In order to analyse agglomeration in an industry, an overall measure of own-industry agglomeration is required which shows the extent to which industry employment is geographically concentrated.

The "relative locational Gini coefficient" index of industry concentration is also used, as well as the Rosenbluth index. The Herfindahl index will also be examined because it is one of the most common measures of industry concentration. The indices of industry concentration most extensively used are the "area-based" indices of Ellison and Glaeser (1994) and Maurel and Sedillot (1999), also termed the EG and MS indices of industry concentration respectively. Both of these measures of industry concentration use the Herfindahl index in their calculation. An alternative measure of industry concentration to the area-based indicators is a "distance-based" measure as put forward by Duranton and Overman (2002). Most recently, Mare (2005) has compiled EG, MS and relative locational Gini coefficients to measure manufacturing industry concentration in New Zealand, while the Gini coefficient and Rosenbluth measures of industry concentration have also been applied in South Africa as in Fedderke and Szalontai (2005).

In this section, the relative Gini coefficient as a measure of industry concentration will be assessed, as well as the EG and MS indices of industry concentration together with advice on their interpretation. The paper will also examine the Herfindahl index, Rosenbluth index and, to a lesser extent, distance-based measures of industry concentration.

2.2.1 Gini coefficient

The **Gini coefficient** is a measure of inequality of a distribution, defined as the ratio of area between the Lorenz curve of the distribution and the curve of the uniform distribution, to the area under the uniform distribution. It is often used to measure income inequality. It is a number between 0 and 1, where 0 corresponds to perfect equality (i.e. everyone has the same income) and 1 corresponds to perfect inequality (i.e. one person has all the income, while everyone else has zero income). The Gini index is the Gini coefficient expressed as a percentage, and is equal to the Gini coefficient multiplied by 100. While the Gini coefficient is mostly used to measure income inequality, it can also

be used to measure wealth inequality. This use requires that no one has a negative net wealth.

In terms of industry concentration, the Gini coefficient is referred to as a *relative* measure of industry concentration as distinct from an absolute measure such as the Herfindahl and Rosenbluth indices (Fedderke & Szalontai, 2005). As a relative measure, the Gini coefficient uses Lorenz curves to focus attention on the degree of inequality of firm sizes. The relative locational Gini coefficient is therefore the ratio of the area between the Lorenz curve and the line of absolute inequality.

2.2.2 Rosenbluth index

The Rosenbluth index of industry concentration (like the Herfindahl index) is an *absolute* or *summary* measure of concentration and relates to a limited number of firms in an industry. Summary concentration measures, in contrast to the *discrete* measures, take into account *all* the firms in the industry. The basic differences between various summary measures of concentration lie in the weights assigned to the market shares of firms in calculating the respective indices (Needham, 1978 in Fedderke & Szalontai, 2005). Changes in the size distribution of firms will produce changes of different magnitudes in the various indices. The Herfindahl Index will be relatively insensitive to changes in small firms' shares, while the Rosenbluth index will react strongly, due to the different weights assigned to small firms by each index. The basic difference between relative and absolute measures of concentration lies in their weighting. Absolute concentration measures are weighted *sums* of the firms' shares, while relative measures are weighted *averages* (Needham, 1978 in Fedderke & Szalontai, 2005).

Discrete industry concentration measures (such as the Gini coefficient) are frequently used measures and include the percentage of industry size accounted for by a certain number of firms in the industry. They are relatively easy to calculate as they are dependent on only one point on the concentration curve. If concentration curves of industries under study intersect, however, it becomes difficult to determine which industry is more concentrated and that is where the relative measures come in (e.g. the relative locational Gini coefficient).

The Rosenbluth index is defined as:

$$R = \left\{ 2\sum_{i=1}^{n} (i.ms_i) - 1 \right\}^{-1} \quad (1)$$

Where ms_i is defined as the market share of the ith-ranked firm and n the number of firms (see discussion in Leach, 1992 in Fedderke & Szalontai, 2005). The Rosenbluth index is limited by 1/n when firm size is equal and tending to 1 the more unequal firm sizes. As noted by Leach (1992) the Rosenbluth index of concentration can also be expressed below as a positive function of the Gini coefficient and a negative function of the number of firms:

$$R = \{n(1-G)\}^{-1} \quad (2)$$

Where G is defined as the Gini coefficient and n is the number of firms in the industry.

Fedderke & Szalonati (2005) argue that in comparing the Rosenbluth and Gini measures of industry concentration, it should be noted that firstly, the functional relationship between the two measures is of a non-linear nature, while secondly, the Rosenbluth index responds strongly to changes in the number of firms present in the industry, to which the Gini coefficient does not.

2.2.3 Herfindahl index

The Herfindahl index, also known as Herfindahl-Hirschman Index, is a measure of the size of firms relative to the industry and an indicator of the amount of competition among the firms in the industry. It is defined as the sum of the squares of the market shares of each individual firm. As such, it can range from 0 to 1 moving from a very large amount of very small firms to a single monopolistic producer. Decreases in the Herfindahl index generally indicate a loss of pricing power and an increase in competition, whereas increases imply the reverse. The formula for the calculation of the Herfindahl index can be expressed as follows:

$$H = \sum_{i=1}^{n} (s_i^2) \quad (3)$$

Where s_i is the market share of firm i in the market, and n is the number of firms.

The Herfindahl Index (H) ranges from 1/N to one, where N is the number of firms in the market. Equivalently, the index can range up to 10,000, if percents are used as whole numbers, as in 75 instead of 0.75. The maximum in this case is $100^2 = 10{,}000$. A small index indicates a competitive industry with no dominant players. If all firms have an equal share the reciprocal of the index shows the number of firms in the industry. When firms have unequal shares, the reciprocal of the index indicates the "equivalent" number of firms in the industry. The Herfindahl index may be explained as follows:

- below 0.1 (or 1,000) indicates an unconcentrated index
- between 0.1 to 0.18 (or 1,000 to 1,800) indicates moderate concentration
- above 0.18 (above 1,800) indicates high concentration.

2.2.4 Ellison and Glaeser (1994) index

The Ellison-Glaeser (1994) index of industry concentration (explained in more detail later), as put forward in their landmark study of manufacturing industry concentration in the U.S., makes use of the Herfindahl index and is formulated as follows:

$$EG = \hat{\gamma}_{EG} \frac{\frac{\sum_i (s_i - x_i)^2}{1 - \sum_i x_i^2} - H}{1 - H} = \frac{G_{EG} - H}{1 - H} \tag{4}$$

2.2.5 Maurel Sedillot (1999) index

Maurel and Sedillot (1999) (explained in more detail later) took the EG index further and developed their own industry concentration index and applied it to the French manufacturing sector. In the *MS* model, there are *N* plants in an industry, with industry employment shares $z_1 \ldots z_N$. These are located across M geographic areas, and $x_1 \ldots x_M$ are the area shares of total employment. The fraction of the industry's employment that is in area *i* is:

$$s_i = \sum_{j=1}^{N} z_j u_{ji} \tag{5}$$

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

The Maurel-Sedillot (1999) index of industry concentration is set out below:

$$MS = \hat{\gamma} = \frac{\frac{\sum_i s_i^2 - \sum_i x_i^2}{1 - \sum_i x_i^2} - H}{1 - H} = \frac{G - H}{1 - H} \tag{6}$$

Where the variables contained in the two indices above are defined as:

s_i = geographic area share of manufacturing industry employment

x_i = geographic area share of total employment

H = Herfindahl index of industrial (employment) concentration, being the sum of squared plant shares in industry employment.

In terms of the Herfindahl index and its significance in both the EG and MS indices, an industry with a single plant will necessarily be located in a single location, even if the

choice of location were totally random. Therefore, it is not correct 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.

2.2.6 Comparison of the EG and MS indices

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 slight difference between the two indices in terms of their formulae can, however, lead to very different conclusions about whether an industry is geographically concentrated or not. The difference between the two indices reflects the difference between the terms $(s_i - x_i)^2$ in the numerator of G_{EG} and $(s_i^2 - x_i^2)$ from the numerator of *G*. The difference is $x_i(s_i - x_i)$, which is positive when the industry is over-represented in areas where total employment is concentrated, and negative when it is over-represented where the total employment share is small. The G_{EG} measure is always positive, and can take on values from 0 to ∞. The G measure takes on values from -∞ to 1 (Mare, 2005).

In terms of Maurel and Sedillot (1999), the EG and MS indices do share some important features in that they control for differences in the size distribution of plants, thereby providing a measure of localisation beyond the concentration of employment (an industry will not be regarded as localised simply because it is concentrated in a small number of plants). Furthermore, the indices also allow for comparisons between industries.

2.2.7 Distance-based measures of industry concentration

An alternative measure of industry concentration to the area-based indices such as the EG and MS indices are the distance-based measures that use distance between plants or jobs as the basis of a continuous measure, as set out in Duranton and Overman (2002) for example. These distance-based measures will not be explored further in the paper.

3 International studies of industry concentration

Numerous studies have been completed of industry concentration using various indices. The Ellison Glaeser (1994) study of manufacturing industry concentration in the U.S. was based upon a model of locational choice which examined the extent to which the geographic location of an industry was a result of deliberate profit-maximising decisions by individual plants or whether it followed a random 'dartboard' approach. Key factors in the model included the role played by natural advantages (e.g. climate, proximity to natural resources), spillovers (technological spillovers, gains from sharing labour markets, intrafirm trade) and localisation (extent to which industry is localised). The study also examined the role of coagglomeration (certain, related, industries agglomerate in the same areas). The study used the EG index set out earlier in this paper. Key findings of the paper were that geographic concentration of subsectors of the manufacturing industry was extensive and some industries were indeed highly concentrated, due in some cases to natural advantages.

Similarly, Maurel and Sedillot (1999) measure geographic concentration of the manufacturing industry in France, using the MS index described earlier in this paper, a location model much along the same lines as Ellison and Glaeser. Maurel and Sedillot (1999) distinguish between two types of spillovers: localisation economies (benefit firms in the same industry) and urbanisation economies (benefit all firms). The results of the study found that there was a high degree of localisation, with the strongest results from extractive industries where access to raw materials or physical geography a key issue, e.g. iron ore, mineral for the chemicals industry and fertilizers and shipbuilding. The second group comprised traditional industries or those with historical specialisation (e.g. leather & footwear products). Finally, a group of high technology industries were highly localised for which knowledge spillovers within industries was an important factor. The least localised in terms of the study were motor vehicles, electronic goods, machinery and non-ferrous metals.

Besides these two studies, most recently Mare (2005) has applied the relative locational Gini coefficient, as well as the EG and MS indices, to a range of industries in New Zealand to examine the issues of concentration, specialisation and agglomeration.
The study finds that concentration of industry employment across New Zealand Labour Market Areas (akin to statistical districts) has increased over the period of the study. The study also derived an index of colocation, which was used to group industries and therefore provide some clues about the sets of industries for which between-industry agglomeration forces may be operating. Overall, the study also found that around 30 percent of full time employment was in highly concentrated industry groups. These groups contained Manufacturing industries (6%), Wholesaling (6%), and Business Services (17%). All three of these groups of industries were found to be disproportionately located in larger cities.

The study also found that although it is difficult to compare industry concentration across international studies, results suggested that New Zealand industries display concentration levels similar to that of the UK and, significantly, below that of the US and France (see aforementioned Ellison-Glaeser and Maurel Sedillot studies earlier). The results of the study showed that New Zealand also has a more dispersed distribution of concentration across industries, with a higher proportion of employment in industries with very high or very low levels of concentration. A more pronounced difference is that employment in New Zealand industries is more likely to be (industrially) concentrated in a relatively small number of plants, as shown by the high Herfindahl index.

A snapshot (albeit a limited one) of some of the results obtained from the studies referred to in this section is contained in Table 1.

Table 1: International comparison of concentration levels (U.S., France & New Zealand), for 15 most concentrated industries, at 2-digit industry level

United States (EG index)		**France (EG index)**		**New Zealand (EG index)**		**France (MS index)**		**New Zealand (MS index)**	
Textile mill products	0.127	Leather & leather products	0.039	Non-metallic mineral products	0.038	Textile yarns & fabrics	0.079	Printing & publishing	0.065
Leather & leather products	0.029	Textile mill products	0.036	Food, beverage & tobacco	0.037	Optical instruments	0.074	Petrol, coal, chemical & assoc. products	0.064
Furniture & fixtures	0.019	Printing & publishing	0.032	Wood & paper products	0.033	Knitted fabrics & articles	0.055	Other manufacturing	0.049
Wood & wood products	0.018	Apparel & textile products	0.020	Metal products	0.032	Pharmaceuticals	0.049	Machinery & equipment	0.039
Basic iron & steel	0.018	Instruments & related products	0.018	Machinery & equipment	0.029	Soap & cleaning products	0.044	Metal products	0.035
Instruments & related products	0.018	Misc. manufacturing	0.014	Petrol, coal, chemical & assoc. products	0.025	Shipbuilding	0.042	Non-metallic mineral products	0.029
Transportation equipment	0.016	Chemicals & allied products	0.012	Other manufacturing	0.016	Textiles	0.039	Textiles, clothing, footwear & leather manu	0.008
Apparel & textile products	0.016	Wood & wood products	0.012	Textiles, clothing, footwear & leather	0.015	Printing & publishing	0.037	Wood & paper products	-0.048
Misc. manufacturing	0.012	Basic iron & steel	0.010	Printing & publishing	0.012	Basic iron & steel	0.037	Food, beverages & tobacco	-0.053
Chemicals & allied products	0.009	Furniture & fixtures	0.008	NA	NA	Scientific instruments	0.034	NA	NA

The results of the studies in Table 1 compare concentration levels of industries at the 2-digit level[1] for the 'top 10' most concentrated industries and give some idea of the ranking of different industries. The comparison of results in Table 1 for the EG index show results of a similar magnitude and scale. Moreover, certain sectors feature in all studies, even if to varying extents, e.g. textiles, wood & wood products and printing & publishing. The results for the MS index show a greater range of results with fewer sectors featuring in both studies.

4 South African studies of industry concentration

Industry concentration in South Africa is especially interesting given the country's history of policy involving industrial decentralisation. Naude and Gries (2004) and then Naude, et al (2005) apply the New Economic Geography framework to South Africa by examining the issue of concentration of manufacturing exports across geographic areas (magisterial districts). Some 84 percent of manufactured exports emanate from 22 out of 354 magisterial districts in South Africa. The papers model the spatial determinants of manufacturing exports in South Africa and finds that the New Economic Geography-trade theory framework is useful in explaining manufacturing export performance across regions within the country[2].

A key finding of Naude & Gries (2004) was that the variation in manufactured exports across South Africa's magisterial districts was better explained in terms of the geography model. Naude, et al (2005) finds that the significant determinants of local economic growth rates (on a geographic area basis) include market potential and access (distance from internal markets), human capital, the propensity to export and the capital stock of municipalities (reflecting institutional quality and governance on local government level as well as infrastructure provision). Distance from international harbors, as a measure of transport costs, and urban agglomeration (or density) affects growth indirectly through their significant effects on the ability of a region to export. The concentration of the ability to export in relatively few areas in South Africa implies that the gains from export-led economic growth will elude extensive areas of the country, increasing the pressure to migrate to those areas in which exports are manufactured.

While concentration measures such as the Herfindahl index have become widely used internationally, it has not been possible in the past to compute the Herfindahl index for South Africa over an extended period, due to the unavailability of historical firm-level market share data (Fedderke & Szalontai, 2005). Previous research of industry concentration in South Africa (e.g. Du Plessis, 1989, Fourie & Smith, 1989 and Leach, 1992 in Fedderke & Szalontai, 2005) has, therefore, been restricted to the Rosenbluth and Gini indices of concentration because of the unavailability of this firm-level market share

[1] Results for the U.S. definition of 2-digit industries. Results were also available at the 4-digit level for industries and could also have been shown. Maurel & Sedillot (1999) have found that concentration levels were higher for 4-digit level analysis than for 2-digit and this needs to be borne in mind when perusing the comparison. Also, the difficulty of comparing results of concentration studies needs to be borne mind, especially when comparing results or rankings in terms of different measures of concentration.

[2] The "Skills-and-land Heckscher Ohlin" and "Geography Heckscher Ohlin" models were estimated (Naude & Gries, 2004).

data. The HI is, however, now published for the South African manufacturing sector by Statistics South Africa.

Fedderke and Szalontai (2005) have examined manufacturing industry concentration in South Africa over the period 1972 to 1996 in terms of the Gini coefficient and the Rosenbluth index. Their findings are summarised in Table 2.

Table 2: Manufacturing industry concentration in South Africa

Sector	Gini[3] coefficient 1996	Δ 1972 – 1996	Rank 1996	Δ rank 1972 - 1996	Rosenbluth[4] index 1996	Δ 1972 – 1996	Rank 1996	Δ rank 1972 - 1996
Food & food products	0.8843	0.0663	5	-2	0.0051	0.0005	16	-6
Beverages	0.8778	0.0298	7	3	0.0502	0.0220	4	-4
Textiles	0.7616	0.0006	24	6	0.0062	-0.0019	15	-2
Clothing, excl. footwear	0.8023	0.0173	18	5	0.0031	-0.0008	19	-4
Leather & leather products	0.8669	0.1999	10	-14	0.0485	0.0247	5	-5
Footwear	0.7713	0.0673	23	1	0.0171	-0.0110	10	1
Wood & wood products	0.8031	0.0921	17	-4	0.0039	-0.0026	18	0
Furniture	0.7905	0.0335	21	2	0.0031	-0.0033	20	1
Paper & paper products	0.8893	0.1373	4	-16	0.0242	-0.0052	9	2
Printing & publishing	0.8354	0.0494	15	4	0.0031	-0.0024	22	2
Basic chemicals	0.8786	0.0636	6	-3	0.0448	0.0008	7	1
Other chemicals	0.8561	0.0791	14	0	0.0096	-0.0031	12	-3
Rubber products	0.8763	0.0453	8	3	0.0449	-0.0522	6	4
Plastic products	0.7800	0.0890	22	-1	0.0044	-0.0086	17	3
Glass & glass products	0.9162	0.0882	2	-4	0.1657	0.0124	1	0
Other non-metals	0.8621	0.0661	12	2	0.0064	-0.0074	14	1
Basic iron & steel	0.8723	0.0173	9	6	0.0860	0.0345	2	-2
Non-ferrous metals	0.8615	0.0855	13	-2	0.0811	0.0304	3	-2
Metal products	0.8141	0.0291	16	4	0.0013	-0.0012	24	0
Machinery	0.7936	0.0246	20	3	0.0017	-0.0032	23	2
Electrical machinery	0.7973	-0.0177	19	11	0.0031	-0.0088	21	5
Motor vehicles, parts & access.	0.9181	0.0321	1	0	0.0108	-0.0058	11	-1
Transport equipment	0.8637	-0.0093	11	9	0.0281	-0.0416	8	5
Other manufacturing	0.8978	0.1243	3	-13	0.0083	-0.0113	13	2

Source: Fedderke & Szalontai (2005)

The results of the study in Table 2 shows that in terms of the Gini coefficient and Rosenbluth index, concentration in the South African manufacturing industry has historically been high and has indeed increased in the period examined. The results, especially in terms of the Rosenbluth index, show substantial movement in the concentration ranking of different sectors. Moreover, the differences between the Gini and Rosenbluth results can be attributed to, firstly, the fact that only the Rosenbluth index

[3] Low rank indicates high concentration for Gini coefficient (Fedderke & Szalontai, 2005).
[4] Low rank indicates low concentration for Rosenbluth index (Fedderke & Szalontai, 2005).

takes into account the number of firms in an industry. Secondly, the Rosenbluth index is sensitive to the existence of small firms with low market share, a factor that has favoured the use of the Herfindahl index internationally. The study also found that, in terms of both industry concentration measures, there was a negative relationship between concentration and real output growth – increasing concentration means declining real output growth. Analysis also showed increasing manufacturing industry concentration associated with a higher unit relative labour cost and lower labour productivity.

5 Industrial policy in South Africa

This section (drawn from Naude, 2003) examines the key policy changes affecting the concentration of industry in South Africa both during the apartheid era and during the democratic era. The policy elements applied during the former period were the Industrial Decentralisation Policy (IDP) and the Regional Industrial Development Programme (RIDP). The policy applied during the latter period, until the present, includes the Spatial Development Initiatives (SDIs), the Regional Industrial Location Study (RILS) and the draft Regional Industrial Development Strategy (RIDS).

Since 1994, South Africa has been divided into nine provinces under a federal system of government. Each of the nine provinces (state-level equivalent) is composed of a number of magisterial districts (county-level division). The provinces concerned are the Western Cape, Northern Cape, Eastern Cape, Free State, KwaZulu-Natal, Gauteng, Mpumalanga, Northern Province, and North West Province.

5.1 Regional economic policy in South Africa during the Apartheid Era: Industrial Decentralisation Policy and the Regional Industrial Development Programme

The regional economic policy applied to South Africa during the apartheid era is examined in this section. Its importance lies in the fact that along with the creation of the political entities

known as homelands, a policy of *industrial decentralisation* was pursued between 1982 and 1991, which involved the use of various incentives (e.g. subsidies based on number of workers employed) to manufacturing industry to establish itself in certain areas of the homelands[5]. The country, including the homelands, was divided into nine development regions for the purposes of the industrial decentralisation policy. Each of the nine development regions of the country and its development programme was set out in the RIDPs[6]. The rationale to the policy was to place industry close to concentrations of labour to avoid large-scale transportation of workers into the main industrial centres in line with the notion of *apartheid* or separate development (transport was also subsidised).

[5] The system of homelands included "autonomous" states such as Transkei, Bophuthatswana, Venda & Ciskei – the so-called TBVC states and the "self-governing territories" that included Gazankulu, Kangwane, Kwandebele, KwaZulu, Lebowa and Qwa Qwa.

[6] The boundaries of the nine development regions were then used to broadly define the nine provinces of the democratic South Africa from 1994 onwards.

The extent to which this policy influenced the location of industry and impacted on employment is an important issue. That is, whether industry simply moved to maximise the benefits of the incentives offered to firms wishing to establish themselves outside the main centres and whether they remained in these locations once these incentives were removed.[7] In this regard, Lewis and Bloch in DBSA (1998) make the point that "…three decades of regional industrial development programmes premised on a logic of promoting dispersion…did not actually accomplish much dispersal of industry". In an assessment of the dispersal of industry in South Africa, Maasdorp (1990) concluded that dispersal did not materialise in the country.

5.2 Industrial policy in the Democratic Era: Spatial Development Initiatives (SDIs) and the Regional Industrial Location Study (RILS)

Since the country's democratic elections in 1994, industrial policy has been driven through the SDIs, together with initiatives such as the RILS.

The SDI process began in 1995 and has sought to identify key areas of the country that could be the focus for economic development in the post-apartheid era and promote investment in these areas. The areas would be identified on the strength of the core economic activities (along sectoral lines) that characterised the area and then strategies could be devised focused on these lead sectors. The role of government would then be to identify projects and to facilitate involvement by interested parties.

Other initiatives have identified projects, e.g. the Platinum SDI and Maputo Corridor. In addition, various centres were identified for the location of Industrial Development Zones (IDZs) to support the SDIs, e.g. Saldhana, Durban and Richards Bay. The SDIs have identified projects to the value of $32.4 billion, possibly creating 86 000 jobs according to estimates in 2002.

A further key study in the post-apartheid era has been the RILS completed by the Industrial Development Corporation (IDC), which examined the "modus industry" or concentration of industry in terms of number of manufacturing establishments or employees, at the magisterial district level. The RILS also examined the clustering of industries at the regional or provincial level, in terms of their inward-orientation and outward orientation. The RILS found that KwaZulu-Natal and Gauteng were the most export-oriented provinces, with lesser dependence on other provinces as markets and a higher proportion of output taken up by intermediate and final demand within the province (see Industrial Development Corporation, 1997).

More recently, the Department of Trade and Industry (DTI) has completed a draft Regional Industrial Development Strategy (RIDS) a fundamental aim of which is to address economic disparities across regions within the country.

[7] The incentives in the RIDP included a rail rebate, employment concession, interest concession on industrial investments and a rebate on road transport.

6 Policy implications and concluding remarks

The level of manufacturing industry concentration in South Africa is high in terms of the traditional measures compiled so far, namely the Gini coefficient and the Rosenbluth index and has been shown to have increased over time. This concentration of industry has also been brought out by the concentration of exports found to exist. Also, it is significant that the Herfindahl index is compiled on a regular basis for the country.

However, to assist regional economic and industrial policy analysis in South Africa in future it is important that other measures such as the EG and MS indices are also calculated for the manufacturing sector (and other sectors for that matter) in South Africa in future. To this end, it is vital that more recent data on the manufacturing sector is made available (the 1996 Manufacturing Census is the last available) and the level of detail of the information increased, i.e. including more plant level data across regions.

The fact that available studies of manufacturing industry concentration in South Africa indicate high and increasing levels of concentration also imply that the past policies aimed at industrial decentralisation were not successful. This raises the question of whether policies aimed at spreading the benefits of economic development more evenly across regions in South Africa will ultimately be successful and if so, what policy mix and resources are required to actually achieve this goal. This also has important implications for future land use and socio-demographic policy, as well as infrastructure investment priorities. In this regard, current initiatives such as the SDIs, RILS and now RIDS are critical. The question in the final analysis is, however, whether any aim of ensuring a more even spread of development actually runs counter to the New Economic Geography notion of the "core" and "periphery" of the national or regional economy.

Industry concentration trends have also been shown to be important to analyse because while they can imply benefits in the way of agglomeration and spillovers, they have also been shown to be associated with declining labour productivity and real output growth as manufacturing has become concentrated in fewer firms and areas. This area also merits further research if South Africa's regional economic development, economic performance and ultimately international competitiveness are to be enhanced.

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The reference section will be expanded in the final version of the paper.

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