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Extending Shift-Share Analysis to Account for Spatial Effects: A Study Using Australian Census Data

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1. Introduction

Both economic geographers and economists are divided within their respective ranks over the question of how best to determine an appropriate balance between the macroeconomic management of aggregate demand, on one hand, and interventions designed to target public expenditure at a regional level, on the other hand. Keynesian macroeconomists have usually argued that the persistence of regional disparities in unemployment reflects a differential sensitivity of regions to variations in effective demand over the national business cycle. Most of these differences in the cyclical sensitivity of regions are then attributed to variations in the mix of industries within each region. Accordingly, it is argued that conventional fiscal and monetary policies of demand management must be supplemented by industry policy that compensates for the resulting industry -mix or -composition effect (Mitchell and Carlson, 2003, 2005).

Mitchell and Carlson (2003) argue that the current Australian Government has pursued a different complex of policies, embracing fiscal restraint, tight monetary conditions to control inflation, and the labour market deregulation to promote the spatial mobility of both firms and workers. However, despite policies to promote mobility and relative wage movements, and despite experiencing a sustained period of employment growth in the national economy, regional disparities in unemployment have persisted (ALGA, 2002; Dixon and Shepherd, 2001; Debelle and Vickery, 1999).

Similar outcomes have been observed in the European context (Martin, 1997). In response to the seeming intractability of this problem, a number of policy makers and regional development agencies in Europe and the UK have embraced a paradigm that has been termed 'New Regionalism' (Mitchell and Carlson, 2005: 3). Emerging in the 1980s in the wake of Piore and Sabel's (1984) flexible specialisation theory, and inspired by the growth of regions such as Silicon Valley, Emilia Romagna, and Baden-Württemberg, proponents of the 'New Regionalism' argue that the nation state has been (or should be) displaced by regions as both a source and a locus for policies aimed at promoting institutional collaboration, organisational learning, and political devolution to the most localised sites of administration and governance. In particular, macroeconomic policies are deemed to be of far less relevance to regions that can increasingly rely on inward flowing foreign direct investment and the international export of goods and services.

Nevertheless, this 'Neo-mercantilist' panacea for regional problems has attracted animated and hard-headed criticism from economic geographers who complain that arguments for the new regionalism have been made without adequate research or empirical confirmation (Lovering, 1999; Markusen, 1996).

While regional assistance was initially reduced after the Liberal-National Party Government won government in Australia, gradual increases in funding have been made available. This assistance has largely been allocated to regions on a project-by-project basis through the Department of Transport and Regional Services, although block funding has also been provided to selected regional groups of Councils through the Department's Sustainable Regions Programme. Science and Innovation policies have faced similar cuts in funding, but policy debates in both the Regional and the Science and Technology portfolios seem to have embraced a 'new regionalist' agenda.

In this context, the Mitchell and Carslon papers sought to address the question of the extent to which regional disparities in unemployment can be explained by the relative weight of the national business cycle, local industry mix, or some complex of region-specific factors conditioning employment growth or decline. To this end, techniques of shift-share decomposition have been employed drawing on Australian Labour Force Survey time-series data. The long duration of this regional and industry employment data has also enabled a detailed study of Granger causality and a statistical analysis of the co-movement in employment across regions (Mitchell and Carlson, June, 2003: 21, 23). Unfortunately, the sets of Australian Census data used in this paper preclude these forms of time-series analysis.

Mitchell and Carlson (2003) divide regions into high growth, moderate growth and low growth categories on the basis of their employment outcomes. They establish that regional unemployment is to a large extent determined by national fluctuations in employment aggregates. It appears that low-growth regions are characterised by a heightened sensitivity to downturns in national employment which persist for relatively longer periods of time. The mix of industries also plays a significant role. However, region-specific factors also contribute notably to both adverse and relatively benign performance of particular regions. Mitchell and Carlson (2005) extend their earlier analysis to incorporate a distinction between part-time and full-time employment. They find that non-metropolitan regions have failed to take advantage of shifting industry mix because they have been unable to offset substantial reductions in full-time employment with part-time employment growth.

In the light of these findings Mitchell and Carlson (2005: 12) recommend what they term a ‘spatial Keynesian’ policy regimen combining demand expansion to remove the spending gap occasioned by the desire of the private sector to net save, spatial distribution of public sector employment creation, and regionally directed public sector infrastructure and industry policy.

Spatial econometric techniques have increased in popularity because they attempt to account for the influence of spatial contiguity and proximity on the variables under investigation. The importance of accounting for such spatial effects, through the use of spatial weighting matrices, has lead to extensions of traditional forms of regional analysis; including shift-share decomposition and the calculation of various employment multipliers. This paper applies one such spatially sensitive technique of shift-share decomposition, which was developed by Nasara and Hewings (2004) to Australian data on levels of full-time employment, by one-digit ANZSIC industry, by SLA, for the census years 1991, 1996, and 2001.

The following section of the paper discusses the formal approach taken in decomposing regional employment growth. Both conventional and spatially weighted techniques of shift-share decomposition are discussed and two key formulas are introduced and explained. The next section discusses data issues and the construction of the spatial weighting matrix. This is followed by a section, which provides an interpretation of the aggregate results for each State under both decompositions. A highly selective interpretation is then provided of some of the disaggregated decomposition results for

three clusters of SLAs. Two of these are taken from regions with low employment growth, while the third cluster reflects a higher level of employment growth. Policy implications are discussed in the concluding section of the paper.

2.0 Spatial Shift Share Analysis

Following the notation in Mitchell and Carlson (2005), we define total national employment growth as:

$$(1) \qquad g_n = \left(E_t - E_{t-1}\right) / E_{t-1}$$

The growth rate in employment in industry i at the national level is:

$$(2) \qquad g_{in} = \left(E_{it} - E_{it-1}\right) / E_{it-1}$$

Finally, the employment growth rate for industry i in region r is defined as:

$$(3) \qquad g_{ir} = \left(E_{irt} - E_{irt-1}\right) / E_{irt-1}$$

There are 14 major regional groups identified in the study (as defined above, 6 metropolitan areas, 6 rest of state areas, and 2 Territories). Changes in employment within each of these groups are calculated by summing together employment growth for each of the 1,350 Statistical Local Areas or regions for which data on employment by 17 ANZSIC industries can be extracted from the ABS Census.

The total employment change for any region r and industry i is the sum of the three effects:

$$(4) \qquad \Delta E_{ir} = NS_{ir} + IM_{ir} + RS_{ir}$$

The components for each industry i in region r are defined as:

$$(5) \qquad NS_{ir} = E_{ir}^{t} g_n$$
$$IM_{ir} = E_{ir}^{t} \left(g_{in} - g_n\right)$$
$$RS_{ir} = E_{ir}^{t} \left(g_{ir} - g_{in}\right)$$

where E_{ir}^{t} is the level of employment in industry *i* in region *r* at time *t* (taken to be the start of the period under scrutiny). Given the growth rates, g_n, g_{in} and g_{ir} as defined earlier, for the region as a whole, these individual industry components are summed across industries to give NS_r, IM_r and RS_r. A derivative measure, the total shift (*TS*) measures the net variation in total employment that is not predicted by the national share and equals the actual change in employment minus the national share (which by definition is equal to *IM* + *RS*). The decomposition is summarised in Table 1.

Table 1 Decomposition of regional employment growth

Decomposition	Formula	Explanation
National share (national growth)	$NS_{ir} = E_{ir}^{t} g_n$	The regional employment change that would have occurred if industry *i* employment in region *r* had grown at the same rate as the nation *n*. This measure holds the employment shares in industry *i* in region *r* constant.
Industry mix (structural effect, composition effect, proportional effect)	$IM_{ir} = E_{ir}^{t} \left(g_{in} - g_n \right)$	The share of regional employment change that can be attributed to the local industry mix and reflects the degree to which the region specialises in industries that are either growing fast or slow nationally. A region with a lot of industries that are growing fast nationally will have a positive *IM* whereas a region with a concentration of industries that are growing slowly (or declining) nationally will have a negative *IM*.
Regional share (local-factor effect, competitive effect, differential effect)	$RS_{ir} = E_{ir}^{t} \left(g_{ir} - g_{in} \right)$	The change in regional employment due to differences between the local industry growth (decline) rate and the industry's national growth rate. This component indicates growth or decline in industries due to local factors. Berzeg (1978: 464) says that the regional share represents "how significantly the growth rates vary from one region to the next."
Total Shift	$TS = IM + RS$	The net variation in total employment that is not predicted by the national share
Total Change	$\Delta E_{ir} = NS + IM + RS$	Total change in employment in region *r* between the start date and end date.

The shift-share decomposition of regional employment growth for each industry (i.e. before summation) can be written as:

$$(6)\ \Delta E_{ir} = \left[g_n + \left(g_{in} - g_n \right) + \left(g_{ir} - g_{in} \right) \right] E_{ir}^t$$

As Nasara and Hewings observe (2004: 479), the regional (competitive) effect influenced by dynamism and specialisation, but they argue that the spatial structure within which a region is located is also important. To capture the inter-regional effects of this spatial structure they recommend the use of a spatial weight matrix with element $\mathbf{W}_{rs}$, which measures the level of interaction between region *r* and region *s* for *r, s* = 1,…, *R*. Proxies for the level of interaction include the distance between centroids, length of common boundaries etc. They favour the use of a row standardised version of the spatial weight matrix whose row sums are set equal 1, with cells on main diagonal set to zero. This spatial weighting matrix can now be used to calculate all sector and specific industry sector growth rates for each of the *r* regions (2004: 480).

All sector employment growth in region *r* is given by,

$$(7)\qquad \tilde{g}_r = \frac{\sum_{s=1}^{R} \tilde{w}_{rs} E_{st} - \sum_{s=1}^{R} \tilde{w}_{rs} E_{st-1}}{\sum_{s=1}^{R} \tilde{w}_{rs} E_{st-1}}$$

The specific sector *i* growth rate in region *r* is given by:

$$(8)\qquad \tilde{g}_{ir} = \frac{\sum_{s=1}^{R} \tilde{w}_{rs} E_{ist} - \sum_{s=1}^{R} \tilde{w}_{rs} E_{ist-1}}{\sum_{s=1}^{R} \tilde{w}_{rs} E_{ist-1}}$$

On the basis of these definitions the spatially weighted shift-share decomposition of regional employment growth for each industry (that is, before summation) can now be written as:

$$(9)\qquad (growth) = \left[g_n + \left(\tilde{g}_{ir} - g_n \right) + \left(g_{ir} - \tilde{g}_{ir} \right) \right].$$

which is equal to the national effect plus the nation-region industry–mix effect plus the neighbour-region sectoral region-shift effect.

While the first component on the right-hand side represents the usual national effect, the second component now represents the difference between the sectoral growth rate for neighbours and the all-sector growth rate, and the third component represents the difference between the growth of sector *i* and the corresponding sector in its neighbours.

Next, Nasara and Hewings (2004: 481) derive the following step-by-step decomposition of the combined national-neighbour industry-mix effect:

(10) $$(\tilde{g}_{ir} - g_n) = (\tilde{g}_{ir} - \tilde{g}_r) + (\tilde{g}_r - g_r) + (g_r - g_{ir}) + (g_{ir} - g_{in}) + (g_{in} - g_n)$$

= neighbour-industry effect plus the neighbour-nation regional shift effect plus the regional industry mix effect plus the regional shift effect plus the industry mix effect.

The neighbour-industry effect: denotes growth in sector *i* in comparison to the all sector growth rate amongst the region's neighbours. The neighbour-nation regional-shift effect: denotes the difference between the region and its neighbours in the growth rate of all sectors. The regional industry mix effect: denotes growth in sector *i* in that region in comparison with the all sector growth rate in that region. Finally, both the regional shift effect and industry mix effect are those appearing in the non-spatially weighted decomposition as discussed in relation to Equation (6) above. However, these effects are now incorporated as sub-components of the spatially weighted industry-mix effect, itself.

3.0 Application to Australian data

Both the conventional un-weighted shift-share decompositions and Nasara and Hewings's spatially weighted decomposition is applied to Australian data on levels of full-time employment, by one-digit ANZSIC industry, by SLA, for the periods 1991-1996 and 1996-2001 utilising ABS census data on employment by industry for the census years 1991, 1996, and 2001.

The spatial weighting matrix was constructed using an exponential distance function $w_{ij} = \exp(-cd_{ij}), w_{ij} = 0$ otherwise, where c is the distance decay parameter and d_{ij}, the distance between region i and region j, satisfies the truncation value $d_{ij}, < D_{\max}$ (Mitchell and Bill, 2004, 2005). This particular weighting scheme was chosen on the basis of a maximum likelihood grid search and the $D_{\max}$ truncation value of 130km was chosen on the basis of a detailed examination of journey-to-work data for the Lower Hunter Region (Mitchell and Bills, 2004). After normalisation the formula becomes:

$$w_{ij} = \frac{E_j \exp(-cd_{ij})}{\sum_{k \neq i} E_k \exp(-cd_{ik})}$$

$$w_{ij} = 0$$

This approach weights the spillovers between region *i* and region *j*, by the employment levels in region *j*.

3.1 Interpretation of the aggregate results

Following the precedent set in Mitchell and Carlson (2005), a simple coding technique has been applied to deal with the vast amount of information generated by both the spatially un-weighted and spatially weighted shift-share decomposition of regional employment growth. Table 2, classifies regions (SLAs) into six groups based on the relative size and signs of the respective industry-mix, and regional shift effects. In accordance with this taxonomy, Tables 3 and 4 provide information on the number of SLAs falling into each of the six groups (for both the weighted and un-weighted decompositions), where each SLA is assigned to its respective metropolitan or non-metropolitan region of the State.

As expected, the rapidly growing States of QLD and WA performed relatively well over both periods compared to their counterparts including SA and TAS. Needless to say, the overall employment outcome for each of the States depends not only on the relative proportion of SLAs with positively signed regional and industry-mix effects relative to the proportion of those with negatively signed effects, but also on the actual distribution of SLAs within each of these broad categories. For example, over the 1996-2001 period QLD-City had a relatively high proportion of SLAs falling into Groups 1 and 2, whereas Regional VIC had a relatively high proportion falling into Groups 5 and 6.

It can be seen that the effects of spatially-weighting the decomposition are quite varied. Over the 1991-1996 period the distribution for Regional NSW has been compressed towards the centre, while the NT has become more polarised, Victoria's distribution has been beneficially affected, while the distribution in metropolitan SA has worsened as a result of spatial weighting. Similarly, over the 1996-2001 period Metropolitan Queensland and WA have been beneficially affected by spatial weighting, while the effect on Tasmania's distribution has been adverse. The distributions in regional SA, NSW and Victoria have become more compressed while that for Regional WA has become more dispersed. This same information on the distribution of SLAs is presented in graphical form for each of the States (after aggregation across both metropolitan and non-metropolitan regions) in the graphs that appear on the next two pages (see Figure 1).

It should nevertheless be emphasised that the value of examining outcomes at such broad levels of aggregation is somewhat questionable because the aggregate figures conceal a diversity of outcomes that proximate to each individual SLA. In other words, the neighbourhood effects associated with the spatially-weighted shift-share decomposition are highly localised. For this reason, many of the cells in the normalised spatial weighting matrix will possess close to zero or zero values.

Another problematic issue is how to cope with the sheer mass of information derived from both the weighted and un-weighted decompositions. No simple descriptive techniques can encompass the findings of this study. For example, the decomposition process can take a variety of combinations and permutations, as Nasara and Hewings reveal through a detailed taxonomic analysis. Moreover, even if we choose to remain content with the shift-share approach summarised in Equations (9) and (10), formula (10)'s five-fold decomposition of the national-neighbour industry-mix effect escapes the kind of analysis that we have engaged in with formula (9), through our six-group taxonomy of regional shift and industry mix effects, simply due to the number of feasible permutations of possible inequalities between each component effects.

Accordingly, most of the remaining interpretation of the data will focus on specific clusters of SLAs. Two of these clusters have been chosen because they are characterised by adverse regional-shift and industry-mix effects. As such, they represent problematic regions that are susceptible neither to traditional Keynesian policies, which focus on the expansion of effective demand with only the crudest forms of spatial targeting, nor to "New Regionalist" policies that attend to 'untraded inter-dependencies' in the knowledge-based economy. The third cluster has been selected because it serves as an interesting case-study for beneficial neighbourhood effects that are revealed through spatial weighting.

3.2 Interpretation of the shift-share decomposition for specific SLA clusters

Tables 5, 6 and 7 provide information on the un-weighted and weighted shift-share decomposition for three clusters of SLAs over the 1991-1996 and 1996-2001 periods. The first of these clusters is situated in the Lower Hunter region of NSW and comprises the SLAs for Gosford, Wyong, Cessnock, Lake Macquarie, Maitland, Newcastle-Inner and Newcastle–Remainder. The second cluster is associated with the Latrobe Valley in Victoria and includes Latrobe-Moe, Latrobe-Morwell, Latrobe-Traralgon, Latrobe-Balance, Baw Baw-East, Baw Baw-West, and the Yarra Ranges. Finally, the third cluster is associated with the Adelaide Hills region of SA and includes Kangaroo Island, Adelaide Hills- North, Adelaide Hills-Balance, Mount Barker-Central, Mount Barker-Balance, Alexandrina-Coastal, and Alexandrina-Strathalbyn. For each of these clusters of SLAs, Tables 8, 9, and 10 depict the five-fold decomposition of the Nation-Region Industry Mix Effect for 1996-2001 and 1991-1996 (in accordance with formula 10 above).

In the first cluster, spatial weighting has had a redistributive affect for both periods under investigation: the previously beneficial industry-mix effect has inverted in both of the high growth regions of Gosford and Wyong, especially during the 1996-2001 period. For Newcastle, spatial weighting has benefited the Inner Newcastle SLA, while penalising the remainder of Newcastle, due to the negative Nation-Region Industry Mix Effect. Cessnock remains firmly positioned in Group 6 irrespective of which period or weighting approach is applied. To a large extent this reflects declining employment prospects in the mining industry as productivity growth increases and old mines are shut down. Holmes et al., (2002) have provided a valuable commentary commented on the variety of factors that are responsible for low levels of out-migration from such declining regions (including the capital cost of relocation and the loss of social networks).

The data in Table 8 suggest that the inversion of the nation-region industry mix effect comes about principally through the neighbour-nation regional shift effect, which in turn reflects difference between the region and it's neighbours in the spatially weighted growth rate of all sectors. The regional industry mix effect, reflecting the extent to which the ith sector's growth in that region exceeds the all sector growth rate in that region, plays a lesser though still significant role.

Similar issues have played out in our second cluster of regions in the Latrobe valley of Victoria, where adverse multiplier effects derived from the closure of coal-fired power stations, and associated mine closures, have rippled through the whole region. Here, the absence of beneficial neighbourhood effects has consigned these SLAs to a relentless low growth scenario. Once again, the previously beneficial industry-mix effect has been inverted, especially during the 1991-1996 period, where large and negative neighbour industry effects have been compounded by the regional shift and industry mix components of the Equation (10) decomposition.

A somewhat brighter story is revealed in the 1996-2001 shift-share decomposition for the cluster of SLAs in the general vicinity of the Adelaide Hills. Here, Mt. Barker (the only SLA with a positive industry-mix effect) has operated as a strong centre for regional growth, while the South Eastern Freeway affords job opportunities for city commuters. In all other SLAs, bar one (Adelaide Hills-North), the regional shift effects have been

positive and larger than the negative industry mix effects. Significantly, for all SLAs except Adelaide Hills-North, the spatially weighted decomposition has improved regional performance due to the strongly positive neighbour-nation regional shift effect and also the less powerful but still positive regional industry mix effect. For this cluster of SLAs the inversion of this latter component has turned a previously negative effect into a positive one. The decomposition in Table 11 reveals that this is largely due to the combination of positive neighbour industry effects and positive regional shift and industry mix effects over the 1996-2001 period.

4.0 Conclusions

Regional geographers have identified ways in which spatially weighting matrices can be utilised in the analysis of multipliers relating total employment growth to that occurring in basic industries, where the latter are determined through the calculation of spatially weighted location quotients (Biles, 2003). As Mitchell and Bill (2005) have shown, data from conventional (un-weighted) shift-share analysis can also be employed directly in spatial econometric regressions, with informative results. Initiatives of this kind may afford new opportunities for the effective utilisation of data derived from spatially weighted and un-weighted shift-share decompositions.

This paper has focused on new techniques for spatially weighted shift-share analysis. The motivation for spatially orientated research of this kind is straightforward. On one hand, it serves to raise doubts about the often simplistic policies advocated by practitioners of the "New Regionalism", which often skirt around the problems raised by declining regions, which feature persistent and high unemployment. 'Neo-Mercantilist' fantasies about escaping the constraints of the national business cycle through a combination of inward flowing foreign direct investment and outward looking export activity economists ignore the dilemmas faced by regions with a high proportion of 'rust-belt' industries and limited opportunities for research-intensive, high-technology development (Martin, 1997; Lovering, 1999). To this end, the detailed decomposition results selectively discussed in this paper will be made available to other researchers and practitioners on the CofFEE homepage.

On the other hand, data that reveals the uneven geographical concentration of both unemployment and opportunities for future employment growth can only emphasise the limitations of traditional Keynesian policies for managing effective demand through infrastructure investment and increased government spending, which does not respond adequately to the specific needs of declining regions. The development of appropriate mechanisms for the regional governance of what have been characterised as spatial Keynesian policies continues to be an active strand of research within CofFEE.

Table 2 Shift-share groups, classification criteria and policy implications

Group	Total Share	Condition	Interpretation
1	Positive	Both IM and RS positive	Region growing faster than national average with industry composition and local factors providing advantages. No regional policy indicated.
2	Positive	Positive IM > negative RS	Region growing faster than national average due to a favourable composition of employment offsetting unfavourable local factors. Regional policy could focus on improving local infrastructure (such as transport systems).
3	Positive	Positive RS > negative IM	Region growing faster than national average with local factors offsetting the unfavourable industry mix. Regional policy should focus on developing growth industries to offset the concentration of industries that are either static or in decline.
4	Negative	Positive RS < negative IM	Region growing slower than national average, due to unfavourable industry mix but offset by advantageous local factors. Regional policy should focus on developing growth industries to offset the concentration of industries that are either static or in decline.
5	Negative	Positive IM < negative RS	Region growing slower than national average due to disadvantageous local factors but offset by favourable industry mix. Regional policy could focus on improving local infrastructure (such as transport systems).
6	Negative	Both IM and RS negative	Region growing slower than national average with local factors and industry mix providing disadvantage. Little potential. Needs development of growth industries and productive and social infrastructure.

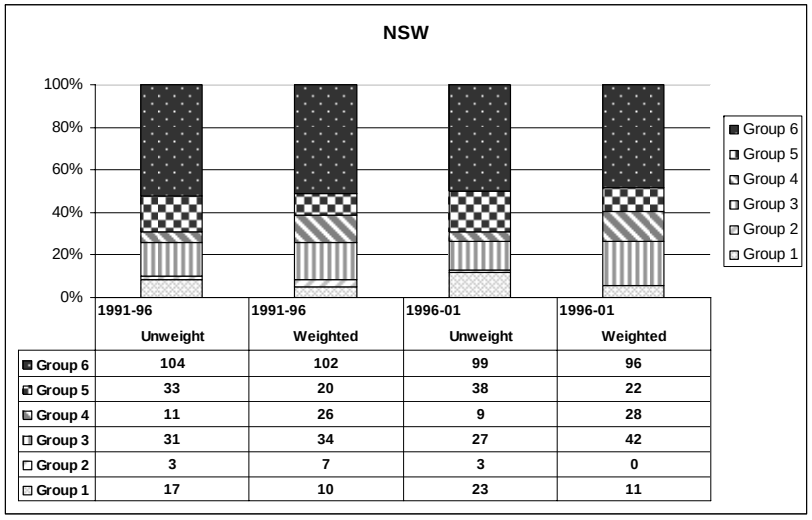
Table 3 Shift-share groups, classified by relative magnitude and sign of Regional Shift and Industry-Mix effects

1991-1996 Non-Weighted	NSW City 49	NSW Region 150	Vic City 75	Vic Region 125	Qld City 224	Qld Region 230	SA City 54	SA Region 71	WA City 37	WA Region 119	Tas 44	NT 65	ACT 107
Group 1	5	12	10	3	82	55	2	2	10	3	3	17	8
Group 2	2	1	3	1	14	6	0	0	10	0	1	1	1
Group 3	10	21	18	12	28	64	6	12	9	39	12	13	18
Group 4	0	11	0	13	5	12	0	10	0	14	5	1	1
Group 5	23	10	26	15	66	27	28	2	8	0	4	13	16
Group 6	9	95	18	81	29	66	18	45	0	63	19	20	63
1991-1996 Weighted	NSW City 49	NSW Region 150	Vic City 75	Vic Region 125	Qld City 224	Qld Region 230	SA City 54	SA Region 71	WA City 37	WA Region 119	Tas 44	NT 65	ACT 107
Group 1	2	8	6	0	86	65	0	0	16	16	0	16	11
Group 2	1	6	0	0	38	35	0	0	13	9	0	3	0
Group 3	14	20	25	16	0	25	8	14	0	17	16	12	16
Group 4	2	24	5	43	1	16	16	25	0	19	8	6	3
Group 5	10	10	3	1	99	43	0	3	8	13	1	16	8
Group 6	20	82	36	65	0	46	30	29	0	45	19	12	69

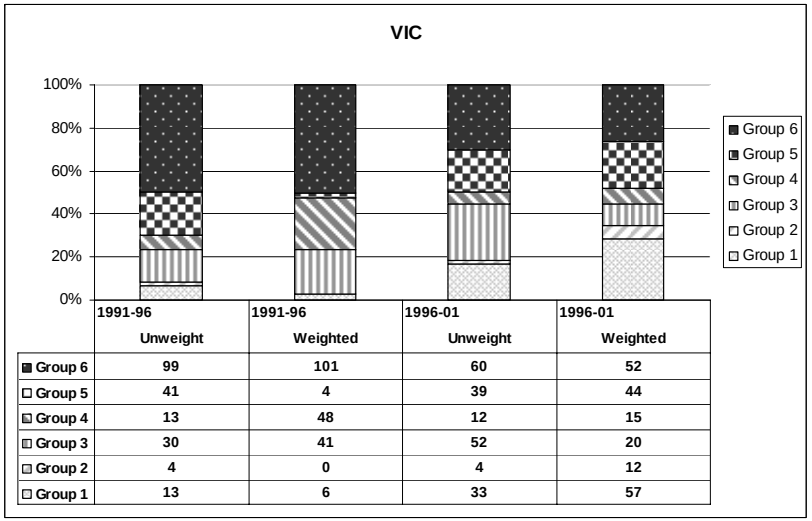
Table 4 Shift-share groups, classified by relative magnitude and sign of Regional Shift and Industry-Mix effects

1991-1996 Non-Weighted	NSW City 49	NSW Region 150	Vic City 75	Vic Region 125	Qld City 224	Qld Region 230	SA City 54	SA Region 71	WA City 37	WA Region 119	Tas 44	NT 65	ACT 107
Group 1	9	14	15	18	81	53	11	3	9	6	2	7	11
Group 2	3	0	4	0	6	5	2	0	3	0	0	0	0
Group 3	6	21	25	27	15	51	12	27	6	31	2	16	20
Group 4	0	9	1	11	1	18	1	8	0	8	2	0	1
Group 5	23	15	23	16	93	42	18	3	18	2	7	22	5
Group 6	8	91	7	53	28	61	10	30	1	72	31	20	70
1991-1996 Weighted	NSW City 49	NSW Region 150	Vic City 75	Vic Region 125	Qld City 224	Qld Region 230	SA City 54	SA Region 71	WA City 37	WA Region 119	Tas 44	NT 65	ACT 107
Group 1	3	8	30	27	82	57	3	11	6	12	0	9	21
Group 2	0	0	8	4	20	23	0	6	0	3	1	5	3
Group 3	15	27	6	14	0	29	22	13	12	22	3	9	7
Group 4	4	24	2	13	0	25	3	10	0	16	21	2	2
Group 5	4	18	23	21	121	53	3	14	8	13	1	9	28
Group 6	23	73	6	46	1	43	23	17	11	53	18	31	46

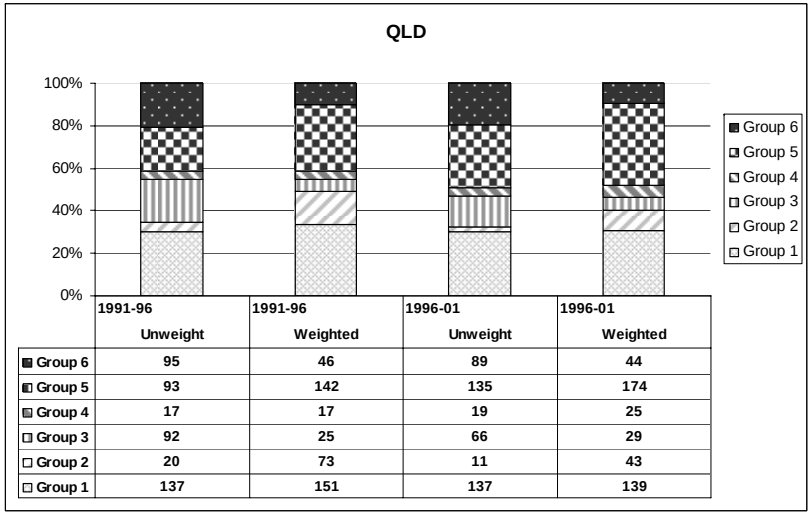
Figure 1 Shift-share groups, classified by relative magnitude and sign of Regional Shift and Industry-Mix effects



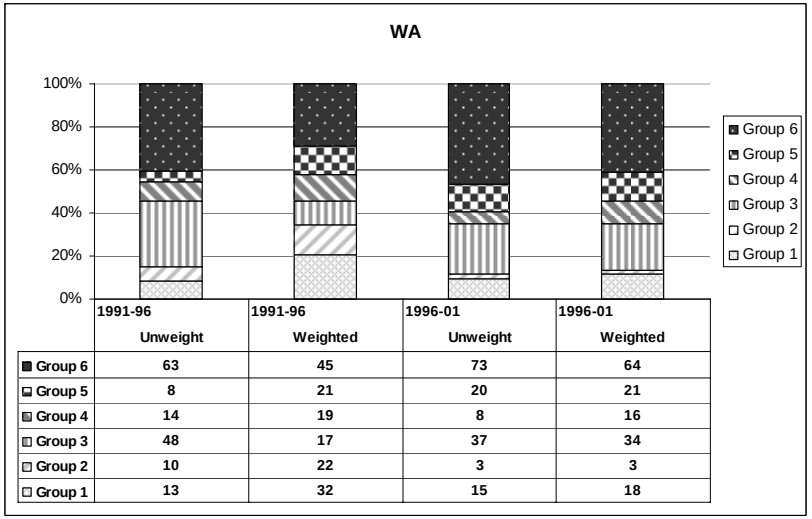
	1991-96 Unweight	1991-96 Weighted	1996-01 Unweight	1996-01 Weighted
Group 6	104	102	99	96
Group 5	33	20	38	22
Group 4	11	26	9	28
Group 3	31	34	27	42
Group 2	3	7	3	0
Group 1	17	10	23	11



	1991-96 Unweight	1991-96 Weighted	1996-01 Unweight	1996-01 Weighted
Group 6	99	101	60	52
Group 5	41	4	39	44
Group 4	13	48	12	15
Group 3	30	41	52	20
Group 2	4	0	4	12
Group 1	13	6	33	57



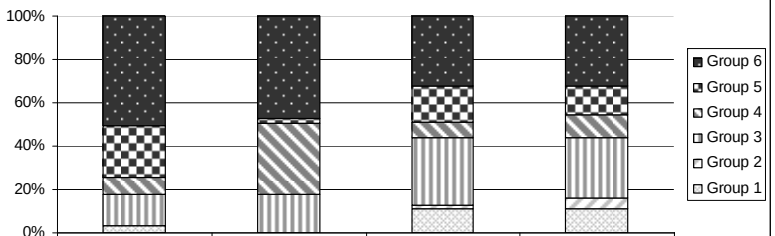
	1991-96 Unweight	1991-96 Weighted	1996-01 Unweight	1996-01 Weighted
Group 6	95	46	89	44
Group 5	93	142	135	174
Group 4	17	17	19	25
Group 3	92	25	66	29
Group 2	20	73	11	43
Group 1	137	151	137	139



	1991-96 Unweight	1991-96 Weighted	1996-01 Unweight	1996-01 Weighted
Group 6	63	45	73	64
Group 5	8	21	20	21
Group 4	14	19	8	16
Group 3	48	17	37	34
Group 2	10	22	3	3
Group 1	13	32	15	18

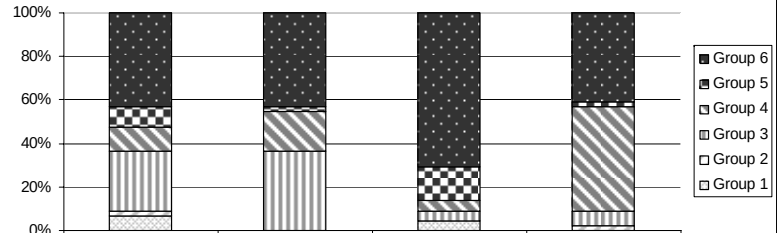
Figure 1 (continued)

SA



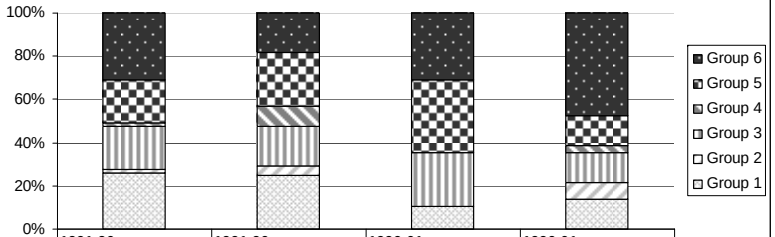
	1991-96 Unweight	1991-96 Weighted	1996-01 Unweight	1996-01 Weighted
Group 6	63	59	40	40
Group 5	30	3	21	17
Group 4	10	41	9	13
Group 3	18	22	39	35
Group 2	0	0	2	6
Group 1	4	0	14	14

TAS



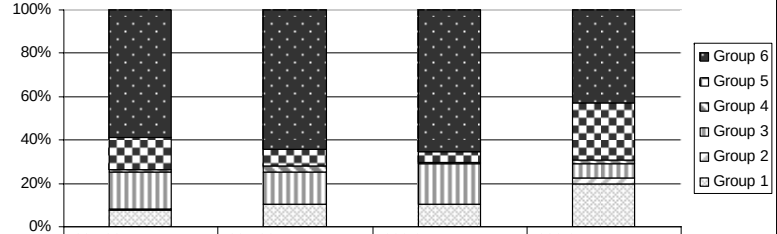
	1991-96 Unweight	1991-96 Weighted	1996-01 Unweight	1996-01 Weighted
Group 6	19	19	31	18
Group 5	4	1	7	1
Group 4	5	8	2	21
Group 3	12	16	2	3
Group 2	1	0	0	1
Group 1	3	0	2	0

NT



	1991-96 Unweight	1991-96 Weighted	1996-01 Unweight	1996-01 Weighted
Group 6	20	12	20	31
Group 5	13	16	22	9
Group 4	1	6	0	2
Group 3	13	12	16	9
Group 2	1	3	0	5
Group 1	17	16	7	9

ACT



	1991-96 Unweight	1991-96 Weighted	1996-01 Unweight	1996-01 Weighted
Group 6	63	69	70	46
Group 5	16	8	5	28
Group 4	1	3	1	2
Group 3	18	16	20	7
Group 2	1	0	0	3
Group 1	8	11	11	21

Table 5 Weighted and Un-weighted Decomposition for 1991-1996 and 1996-2001 – selected NSW SLAs

SLA CODE	SLA	GRP	*E*(96) * Regional-Shift Effect 1996-2001	*E*(96) * Industry Mix Effect 1996-2001	*E*(96) * National effect 1996-2001	GRP	*E*(91) * Regional-Shift Effect 1991-1996	*E*(91) * Industry Mix Effect 1991-1996	*E*(91) * National effect 1991-1996
Unweighted									
105703100	Gosford (C)	1	68.43	413.00	5,492.56	1	2,834.73	252.54	5829.73
105708550	Wyong (A)	1	3,520.32	242.41	3,784.27	3	3,848.48	-145.15	3842.67
110051720	Cessnock (C)	6	-730.63	-372.44	1,496.07	6	-1,115.79	-293.35	1836.14
110054650	Lake Macquarie (C)	6	-3,147.46	-13.53	6,415.99	6	-1,477.56	-387.96	7413.52
110055050	Maitland (C)	4	94.02	-133.30	1,933.28	6	-404.79	-194.13	2237.92
110055901	Newcastle (C) - Inner	5	-47.85	25.01	194.84	2	-18.65	51.38	215.27
110055902	Newcastle (C) - Remain	5	-3,060.70	281.54	4,901.16	5	-3,516.05	284.59	5862.46
Weighted									
105703100	Gosford (C)	3	890.60	-409.16	5,492.56	3	3,458.67	-371.40	5829.73
105708550	Wyong (A)	3	4,432.04	-669.31	3,784.27	3	4,454.88	-751.55	3842.67
110051720	Cessnock (C)	6	-197.62	-905.45	1,496.07	6	-705.35	-703.79	1836.14
110054650	Lake Macquarie (C)	6	-1,857.04	-1,303.95	6,415.99	6	-282.25	-1,583.26	7413.52
110055050	Maitland (C)	4	705.55	-744.83	1,933.28	6	-39.22	-559.70	2237.92
110055901	Newcastle (C) - Inner	4	3.93	-26.77	194.84	1	31.89	0.84	215.27
110055902	Newcastle (C) - Remain	6	-2,037.26	-741.90	4,901.16	6	-2,842.19	-389.28	5862.46

Note: GRP equals group.

Table 6 Weighted and Un-weighted Decomposition for 1991-1996 and 1996-2001 – selected VIC SLAs

SLA CODE	SLA	GRP	*E*(96) * Regional-Shift Effect 1996-2001	*E*(96) * Industry Mix Effect 1996-2001	*E*(96) * National effect 1996-2001	GRP	*E*(91) * Regional-Shift Effect 1991-1996	*E*(91) * Industry Mix Effect 1991-1996	*E*(91) * National effect 1991-1996
Unweighted									
255053811	Latrobe (C) - Moe	5	-200.82	10.18	523.63	6	-1,144.30	-876.94	811.24
255053814	Latrobe (C) - Morwell	5	-837.82	25.05	745.78	6	-1,642.09	-1,000.22	1129.31
255053815	Latrobe(C) - Traralgon	1	12.05	17.82	940.13	6	-815.36	-607.78	1213.14
255053818	Latrobe (C) Balance	6	-20.36	-8.57	107.93	4	36.32	-102.91	128.59
255100834	Baw Baw (S) - Pt B East	6	-18.11	-43.05	161.16	6	-218.35	-132.39	219.74
255100835	Baw Baw(S) - Pt B West	3	462.22	-96.01	974.79	6	-77.27	-294.86	1136.13
255107458	Yarra Ranges (S) - Pt B	6	-8.82	-2.27	17.09	6	-11.53	-6.30	20.83
Weighted									
255053811	Latrobe (C) - Moe	6	-164.28	-26.35	523.63	6	-471.23	-1,550.01	811.24
255053814	Latrobe (C) - Morwell	6	-793.23	-19.54	745.78	6	-802.99	-1,839.32	1129.31
255053815	Latrobe(C) - Traralgon	3	39.90	-10.03	940.13	6	-204.41	-1,218.73	1213.14
255053818	Latrobe (C) Balance	6	-13.08	-15.85	107.93	4	107.65	-174.24	128.59
255100834	Baw Baw (S) - Pt B East	4	4.62	-65.78	161.16	6	-176.36	-174.38	219.74
255100835	Baw Baw(S) - Pt B West	3	379.17	-12.96	974.79	4	79.57	-451.70	1136.13
255107458	Yarra Ranges (S) - Pt B	6	-10.59	-0.50	17.09	6	-5.15	-12.68	20.83

Note: GRP equals group.

Table 7 Weighted and Un-weighted Decomposition for 1991-1996 and 1996-2001 – selected SA SLAs

SLA CODE	SLA	GRP	*E*(96) * Regional-Shift Effect 1996-2001	*E*(96) * Industry Mix Effect 1996-2001	*E*(96) * National effect 1996-2001	GRP	*E*(91) * Regional-Shift Effect 1991-1996	*E*(91) * Industry Mix Effect 1991-1996	*E*(91) * National effect 1991-1996
Unweighted									
410102750	Kangaroo Island (DC)	3	131.16	-23.93	160.76	3	136.45	-43.83	170.38
410150125	Adelaide Hills (DC)- North	4	1.21	-20.34	277.14	6	-175.50	-21.58	333.08
410150128	Adelaide Hills (DC) Bal	3	283.90	-36.33	332.43	6	-230.54	-72.32	406.86
410154551	Mount Barker (DC)-Central	1	767.33	6.29	521.38	1	236.73	24.36	556.91
410154554	Mount Barker (DC) Bal	3	339.49	-28.92	310.43	3	187.08	-26.05	330.97
410200221	Alexandrina (DC) - Coastal	3	569.74	-3.37	233.63	1	144.12	1.48	246.40
410200224	Alexandrina (DC)-Strathalbyn	3	357.59	-55.75	303.16	3	135.49	-58.58	332.09
Weighted									
410102750	Kangaroo Island (DC)	1	8.85	98.39	160.76	3	211.99	-119.38	170.38
410150125	Adelaide Hills (DC)- North	5	-19.46	0.32	277.14	4	3.28	-200.36	333.08
410150128	Adelaide Hills (DC) Bal	1	235.71	11.86	332.43	6	-33.33	-269.54	406.86
410154551	Mount Barker (DC)-Central	1	769.47	4.15	521.38	3	590.91	-329.81	556.91
410154554	Mount Barker (DC) Bal	1	275.41	35.16	310.43	3	344.42	-183.39	330.97
410200221	Alexandrina (DC) - Coastal	1	515.95	50.42	233.63	3	257.70	-112.10	246.40
410200224	Alexandrina (DC)-Strathalbyn	1	233.12	68.72	303.16	3	262.73	-185.81	332.09

Note: GRP equals group.

Table 8 Decomposition of the Nation-Region Industry Mix Effect for 1996-2001 and 1991-1996 – selected NSW SLAs

SLA CODE	SLA	NIM 1996	NNRS 1996	RIM 1996	RS 1996	IM 1996	NRIM 1996
105703100	Gosford (C)	123.79	-1,014.39	0.00	68.43	413.00	-409.16
105708550	Wyong (A)	-35.58	-4,396.46	0.00	3,520.32	242.41	-669.3112
110051720	Cessnock (C)	-711.93	909.55	0.00	-730.63	-372.44	-905.4533
110054650	Lake Macquarie (C)	-738.16	2,595.20	0.00	-3,147.46	-13.53	-1303.952
110055050	Maitland (C)	-340.13	-365.42	0.00	94.02	-133.30	-744.8325
110055901	Newcastle (C) - Inner	24.35	-28.28	0.00	-47.85	25.01	-26.77243
110055902	Newcastle (C) - Remain	-49.83	2,087.09	0.00	-3,060.70	281.54	-741.9006
SLA CODE	SLA	NIM 1991	NNRS 1991	RIM 1991	RS 1991	IM 1991	NRIM 1991
105703100	Gosford (C)	56.30	-3,514.98	0.00	2,834.73	252.54	56.30
105708550	Wyong (A)	-427.91	-4,026.97	0.00	3,848.48	-145.15	-427.91
110051720	Cessnock (C)	-563.84	1,269.19	0.00	-1,115.79	-293.35	-563.84
110054650	Lake Macquarie (C)	-1,144.47	1,426.72	0.00	-1,477.56	-387.96	-1,144.47
110055050	Maitland (C)	-336.70	375.92	0.00	-404.79	-194.13	-336.70
110055901	Newcastle (C) - Inner	44.36	-76.25	0.00	-18.65	51.38	44.36
110055902	Newcastle (C) - Remain	56.30	-3,514.98	0.00	2,834.73	252.54	56.30

Note: GRP equals group.

Table 9 Decomposition of the Nation-Region Industry Mix Effect for 1996-2001 and 1991-1996 – selected VIC SLAs

SLA CODE	SLA	NIM 1996	NNRS 1996	RIM 1996	RS 1996	IM 1996	NRIM 1996
255053811	Latrobe (C) - Moe	-54.28	218.56	0.00	-200.82	10.18	-26.35
255053814	Latrobe (C) - Morwell	-24.31	817.54	0.00	-837.82	25.05	-19.54
255053815	Latrobe (C) - Traralgon	-9.98	-29.92	0.00	12.05	17.82	-10.03
255053818	Latrobe (C) Bal	-28.10	41.18	0.00	-20.36	-8.57	-15.85
255100834	Baw Baw (S) - Pt B East	-78.38	73.76	0.00	-18.11	-43.05	-65.78
255100835	Baw Baw (S) - Pt B West	-192.33	-186.84	0.00	462.22	-96.01	-12.96
255107458	Yarra Ranges (S) - Pt B	-3.35	13.94	0.00	-8.82	-2.27	-0.50
SLA CODE	SLA	NIM 1991	NNRS 1991	RIM 1991	RS 1991	IM 1991	NRIM 1991
255053811	Latrobe (C) - Moe	-1,229.60	1,700.83	0.00	-1,144.30	-876.94	-1,550.01
255053814	Latrobe (C) - Morwell	-1,381.79	2,184.78	0.00	-1,642.09	0.00	-1,839.32
255053815	Latrobe (C) - Traralgon	-619.98	824.39	0.00	-815.36	-607.78	-1,218.73
255053818	Latrobe (C) Bal	-110.87	3.22	0.00	36.32	-102.91	-174.24
255100834	Baw Baw (S) - Pt B East	-95.79	272.15	0.00	-218.35	-132.39	-174.38
255100835	Baw Baw (S) - Pt B West	-172.31	92.75	0.00	-77.27	-294.86	-451.70
255107458	Yarra Ranges (S) - Pt B	-7.48	9.63	3.00	-11.53	-6.30	-12.68

Note: GRP equals group.

Table 10 Decomposition of the Nation-Region Industry Mix Effect for 1996-2001 and 1991-1996 – selected SA SLAs

SLA CODE	SLA	NIM 1996	NNRS 1996	RIM 1996	RS 1996	IM 1996	NRIM 1996
410102750	Kangaroo Island (DC)	27.46	-36.31	0.00	131.16	-23.93	98.39
410150125	Adelaide Hills (DC) - North	13.43	6.03	0.00	1.21	-20.34	0.32
410150128	Adelaide Hills (DC) Bal	22.73	-258.45	0.00	283.90	-36.33	11.86
410154551	Mount Barker (DC) - Central	21.99	-791.46	0.00	767.33	6.29	4.15
410154554	Mount Barker (DC) Bal	29.35	-304.76	0.00	339.49	-28.92	35.16
410200221	Alexandrina (DC) - Coastal	43.80	-559.74	0.00	569.74	-3.37	50.42
410200224	Alexandrina (DC) - Strathalbyn	59.72	-292.84	0.00	357.59	-55.75	68.72
SLA CODE	SLA	NIM 1991	NNRS 1991	RIM 1991	RS 1991	IM 1991	NRIM 1991
410102750	Kangaroo Island (DC)	-65.26	-146.74	0.00	136.45	-43.83	-119.38
410150125	Adelaide Hills (DC) - North	-7.58	4.30	0.00	-175.50	-21.58	-200.36
410150128	Adelaide Hills (DC) Bal	-27.54	60.86	0.00	-230.54	-72.32	-269.54
410154551	Mount Barker (DC) - Central	9.36	-600.26	0.00	236.73	24.36	-329.81
410154554	Mount Barker (DC) Bal	6.85	-351.27	0.00	187.08	-26.05	-183.39
410200221	Alexandrina (DC) - Coastal	23.61	-281.31	0.00	144.12	1.48	-112.10
410200224	Alexandrina (DC) - Strathalbyn	-0.62	-262.11	0.00	135.49	-58.58	-185.81

Note: GRP equals group.

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