# B Technical notes for decomposition analysis of population growth

This appendix uses data from the last three censuses to analyse the differences in the population growth of different regions. The results of the analysis reported below are summarised in chapter 2.

Changes in a region's population over time can reflect a number of influences, such as the size of industries which are located in the region and the fortunes of those industries at both the national and regional levels. Thus, relatively high population growth may be due to a relatively high proportion of the population working in that region in an industry with growth above the national average. Above average population growth may also occur in a region due to more general demographic shifts resulting from, for example, the attractiveness of the region as a retirement location and the movement of people to take advantage of this.

One way of explaining differences in population growth between regions is to look at how growth differs from the national average, and to assess what has brought about that difference by examining the contribution of various industries (eg agriculture and mining) and population groups (eg older people or the employed) to the growth in that region. This can be done through a decomposition (or 'shift-share') analysis. The data used and the form of this analysis are explained below.

## B.1 Data

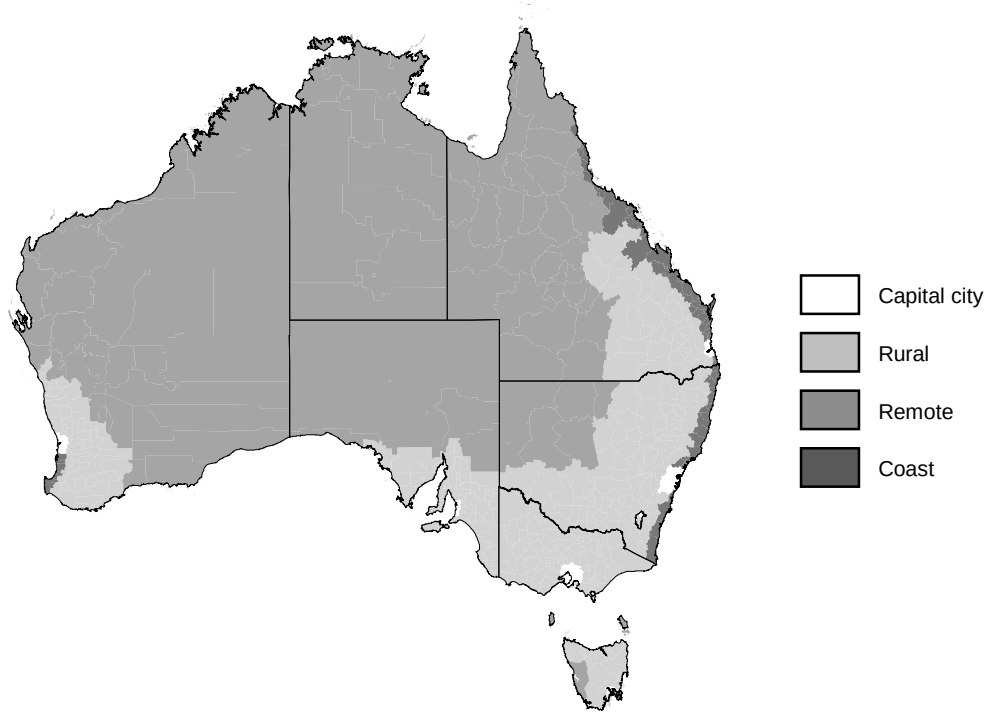
The data used in this decomposition analysis come from the 1986, 1991 and 1996 ABS Censuses of Population and Housing. Data from these censuses give the breakdown of population by labour force status and, when employed, the industry of employed persons for each of the 1336 statistical local areas (SLAs) across Australia. These data are used to calculate average annual regional population growth rates for the periods 1986–91 and 1991–96.

In order to differentiate effects on various regions in Australia, the SLAs have been combined into four regional groupings:

- capital city areas — made up of the statistical divisions of the eight capital cities plus the population Census group of offshore areas and migratory persons. This group accounts for 63 per cent of the Australian population;
- coastal areas — comprising all the SLAs along the coast between Port Douglas in Queensland and Eden in New South Wales, and between Margaret River and the outskirts of Perth in Western Australia. This region accounts for 15.6 per cent of the Australian population and is identified as an area of significant population growth (chapter 2). Thus, it has been selected in order to detect the main contributors to the difference in its population growth from the national average;
- remote areas — uses the definition of the Australian Taxation Office for its zone rebate scheme, and comprises more than three-quarters of the Australian landmass, with only 2.5 per cent of the Australian population; and
- rural areas — comprising the remaining SLAs, which include parts of Queensland, South Australia and Western Australia, and the majority of Victoria, New South Wales and Tasmania. Nineteen per cent of Australia's population resides in the rural region;

A map of the four regions appears in figure B.1 and a list of the SLAs included in each region appears in table B.1.

Figure B.1 **Map of Australia by Statistical Local Areas, shaded by region**




*Data sources:* ABS IRDB (1998c); ATO (1998).

## Table B.1 **List of Statistical Local Areas by region**

**Capital city – 569 SLAs**
Sydney (SD) – 46 SLAs
Melbourne (SD) – 74 SLAs
Brisbane (SD) – 225 SLAs
Adelaide (SD) – 31 SLAs
Perth (SD) – 37 SLAs
Greater Hobart (SD) – 8 SLAs
Darwin (SD) – 35 SLAs
Canberra (SD) – 106 SLAs
Offshore Areas and Migratory – 7 SLAs

**Coast – 170 SLAs**
NSW
Bellingen (A)
Coffs Harbour (C)
Grafton (C)
Greater Taree (C)
Great Lakes (A)
Hastings (A)
Illawarra (SD) exc Wingecarribee – 4 SLAs
Kempsey (A)
Lower South Coast (SSD) – 2 SLAs
Maclean (A)
Nambucca (A)
Newcastle (SSD) – 6 SLAs
Richmond–Tweed (SD) exc Kyogle – 7 SLAs
Ulmarra (A)

Qld
Atherton (S)
Biggenden (S)
Bundaberg (C)
Burnett (S) – Pt A
Burnett (S) – Pt B
Caboolture (S) – Pt B
Cairns City Part A (SSD) – 7 SLAs
Cairns (C) – Pt B
Calliope (S) – Pt A
Calliope (S) – Pt B
Caloundra (C) – Hinterland
Caloundra (C) – Rail Corridor
Cardwell (S)
Cooloola (S) (exc Gympie)
Cooloola (S) – Gympie only
Douglas (S)
Eacham (S)
Fitzroy (S) – Pt A
Fitzroy (S) – Pt B
Gladstone (C)
Gold Coast City Part B (SSD) – 40 SLAs
Hervey Bay (C)
Isis (S)
Johnstone (S)
Kolan (S)
Livingstone (S)
Mackay (SD) exc Belyando (S) and Nebo (S) – 6 SLAs
Maroochy (S) Bal
Maryborough (C)
Miriam Vale (S)
Mount Morgan (S)
Noosa (S) Bal
Northern (SD) exc Charters Towers (C) and Dalrymple (S) – 34 SLAs
Rockhampton (C)
Sunshine Coast (SSD) – 12 SLAs
Tiaro (S)
Woocoo (S)
WA
Bunbury (C)
Capel (S)
Dale (SSD) exc Boddington – 3 SLAs
Dardanup (S)
Harvey (S)
Vasse (SSD) – 2 SLAs
Other territories
Jervis Bay Territory

**Rural – 484 SLAs**
NSW – 106 SLAs
Central West (SD) – 18 SLAs
Copmanhurst (A)
Hunter SD Bal (SS) exc Great Lakes (A) – 7 SLAs
Kyogle (A)
Murray (SD) – 16 SLAs
Murrumbidgee (SD) – 14 SLAs
Northern (SD) – 21 SLAs
North Western (SD) exc Upper Darling (SSD) – 11 SLAs
Nymboida (A)
South Eastern (SD) exc Lower South Coast (SSD) – 15 SLAs
Wingecarribee (A)
Vic – 125 SLAs
All exc Melbourne (SD) and Offshore Areas and Migratory (SD)
Qld – 58 SLAs
Balonne (S)
Banana (S)
Bauhinia (S)
Beaudesert (S) – Pt B
Belyando (S)
Bendemere (S)
Boonah (S)
Booringa (S)
Bungil (S)
Darling Downs (SD) – 26 SLAs
Duaringa (S)
Eidsvold (S)
Emerald (S)
Esk (S)
Gatton (S)
Gayndah (S)
Ipswich (C) – South–West
Ipswich (C) – West
Jericho (S)
Kilcoy (S)
Kilkivan (S)
Kingaroy (S)
Laidley (S)
Monto (S)
Mundubbera (S)
Murgon (S)
Nanango (S)
Nebo (S)
Peak Downs (S)
Perry (S)
Roma (T)
Warroo (S)
Wondai (S)
SA – 92 SLAs
Carrieton (DC)
Crystal Brook–Redhill (DC)
Eyre (SD) exc Unincorp West Coast – 11 SLAs
Hallett (DC)
Hawker (DC)
Jamestown (DC)
Kanyaka–Quorn (DC)
Mount Remarkable (DC)
Murray Lands (SD) – 92 SLAs
Orroroo (DC)
Outer Adelaide (SD) – 16 SLAs
Peterborough (M)
Peterborough (DC)
Pirie (DC)
Port Augusta (C)
Port Pirie (C)
Rocky River (DC)
South East (SD) – 12 SLAs
Whyalla (C)
Yorke and Lower North (SD) – 18 SLAs
Unincorp. Whyalla
WA – 70 SLAs
Avon (SSD) – 14 SLAs
Blackwood (SSD) – 4 SLAs
Boddington (S)
Bruce Rock (S)
Collie (S)
Donnybrook–Balingup (S)
Greenough River (SSD) exc Mullewa (S) and Northampton (S) – 10 SLAs
Kellerberrin (S)
Lower Great Southern (SD) – 13 SLAs
Merredin (S)
Moore (SSD) – 5 SLAs
Narembeen (S)
Nungarin (S)
Trayning (S)
Upper Great Southern (SD) – 15 SLAs
Tas – 32 SLAs
Mersey–Lyell (SD) exc King Island (M) and West Coast (M) – 11 SLAs

Table B.1 **(continued)**

| | | |
|---|---|---|
| Northern (SD) exc Flinders (M) – 13 SLAs | Dalrymple (S) | Mount Marshall (S) |
| Southern (SD) – 8 SLAs | Etheridge (S) | Mukinbudin (S) |
| ACT | Herberton (S) | Mullewa (S) |
| Remainder of ACT | Mareeba (S) | Northampton (S) |
| | Murweh (S) | Pilbara (SD) – 4 SLAs |
| | North West (SD) – 9 SLAs | South Eastern (SD) – 9 SLAs |
| | Paroo (S) | Westonia (S) |
| **Remote – 113 SLAs** | Quilpie (S) | Yilgarn (S) |
| NSW – 7 SLAs | Torres (S) | Tas – 3 SLAs |
| Far West (SD) – 3 SLAs | SA – 6 SLAs | Flinders (M) |
| Lord Howe Island | Coober Pedy (DC) | King Island (M) |
| Upper Darling (SSD) – 3 SLAs | Roxby Downs (M) | West Coast (M) |
| Qld – 34 SLAs | Unincorp. West Coast | NT – 27 SLAs |
| Aurukun (S) | Unincorp. Pirie | Northern Territory – Bal (SD) |
| Bulloo (S) | Unincorp. Flinders Ranges | Other Territories – 2 SLAs |
| Central West (SD) – 11 SLAs | Unincorp. Far North | Territory of Christmas Island |
| Charters Towers (C) | WA – 34 SLAs | Territory of Cocos (Keeling) Islands |
| Cook (S) (exc Weipa) | Carnegie (SSD) – 7 SLAs | |
| Cook (S) – Weipa only | Gascoyne (SSD) – 4 SLAs | |
| Croydon (S) | Kimberley (SD) – 4 SLAs | |
| **Legend:** | | |
| SD – statistical division | A – area | M – municipality |
| SSD – sub-statistical division | C – city | S – shire |
| SLA – statistical local area | DC – district council | T – town |

## Model outline

The contribution of a population group to regional growth depends on the share of the population group in the regional population and the rate of growth of the grouping. Population growth in a region can be represented as the weighted sum of growth in each population group, that is:

$$p_r = s_{er}p_{er} + s_{ur}p_{ur} + s_{or}p_{or} + s_{tr}p_{tr} \quad (1)$$

where the items labelled *s* represent the share of each population category in the total population of the region and *p* represents the growth in each population category. Subscript *r* represents the region, *e* employed persons in the labour force, *u* unemployed persons in the labour force, *o* older persons not in the labour force, and *t* others (mainly the young, students and those performing full-time home duties). Adding and subtracting national population growth (subscript *A*):

$$p_r = p_A + ((s_{er}p_{er} + s_{ur}p_{ur} + s_{or}p_{or} + s_{tr}p_{tr}) - p_A) \quad (2)$$

Thus, if each group was equally important in each region and if each activity grew at the national average, each region would grow at the national rate, thus:

$$p_r = p_A \quad (3)$$

When (3) is not satisfied, the bracketed expression in (2) shows the difference between regional and national population growth. This difference can be explored by further disaggregation, as follows. First, the importance of differences between national and regional population group growth can be investigated by substituting into the bracketed expression the share-weighted components of national population growth to give:

$$p_r = p_A + (s_{er}p_{er} + s_{ur}p_{ur} + s_{or}p_{or} + s_{tr}p_{tr}) - (s_{eA}p_{eA} + s_{uA}p_{uA} + s_{oA}p_{oA} + s_{tA}p_{tA}) \quad (4)$$

Adding and subtracting the regional-share-weighted national growth, that is, $s_{er}p_{eA} + s_{ur}p_{uA} + s_{or}p_{oA} + s_{tr}p_{tA}$, and rearranging terms then gives:

$$p_r = p_A + [s_{er}(p_{er} - p_{eA}) + s_{ur}(p_{ur} - p_{uA}) + s_{or}(p_{or} - p_{oA}) + s_{tr}(p_{tr} - p_{tA})] - [(s_{eA} - s_{er})p_{eA} + (s_{uA} - s_{ur})p_{uA} + (s_{oA} - s_{or})p_{oA} + (s_{tA} - s_{tr})p_{tA}] \quad (5)$$

In this arrangement, the first bracketed expression describes the importance of different growth rates in the population groupings in contributing to differences between national and regional average population growth. The components of the second bracketed expression consider the contribution from different shares of the population groupings within the regional population.

A similar exercise can be undertaken to decompose differences in employment growth rates to derive the contributions from the major industries. The model in this case takes on the following appearance:

$$p_{er} = p_{eA} + [s_{1r}(p_{1r} - p_{1A}) + s_{2r}(p_{2r} - p_{2A}) + s_{3r}(p_{3r} - p_{3A}) + s_{4r}(p_{4r} - p_{4A})] - [(s_{1A} - s_{1r})p_{1A} + (s_{2A} - s_{2r})p_{2A} + (s_{3A} - s_{3r})p_{3A} + (s_{4A} - s_{4r})p_{4A}] \quad (5)$$

Where subscript *1* represents agriculture, forestry and fishing; *2* mining; *3* manufacturing; and, *4* other industries (mainly the service industries).

By using these expressions to decompose regional population growth and employment growth, it is possible to derive the main factors contributing to any differences from the national average. For example, if a relatively large proportion of the employed people in a particular region work in an industry providing declining employment opportunities across Australia, this national decline would be modelled as having a negative impact on the employment growth rate in that region. This negative impact could be offset by an above average performance of the regional industry or growth in other activities.

## B.2 Results

### Decomposition of differences in population growth rates

Results from the decomposition analysis of population growth rates are shown in figure B.2 and table B.2 (the latter is shown at the end of the appendix).

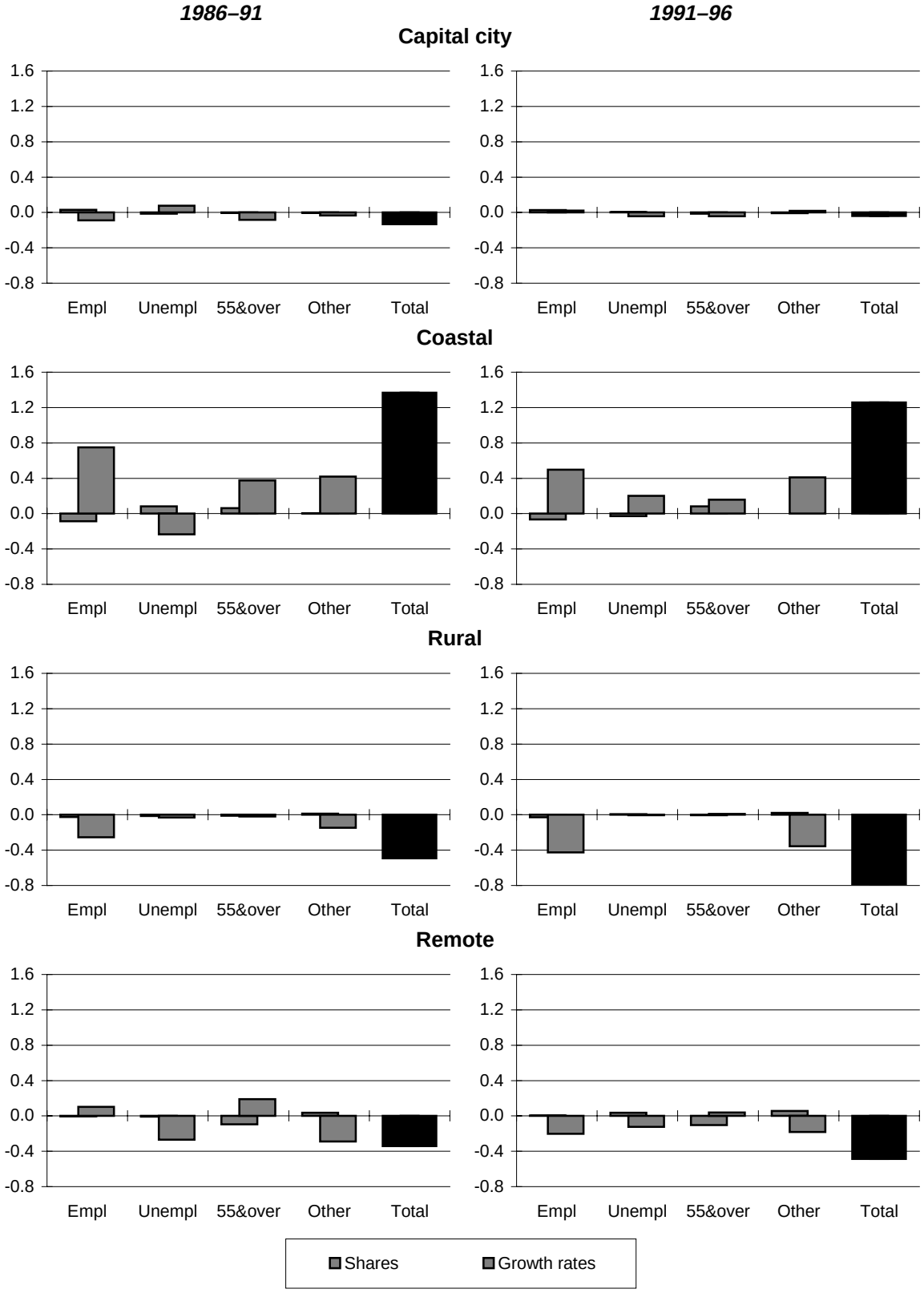
The total population growth data demonstrate the strong trend of 'coastal drift' as discussed in chapter 2. Population growth in coastal areas was considerably higher than the national average during both intercensal periods — 1.37 percentage points higher during 1986–91 and 1.26 percentage points higher during 1991–96. On the other hand, the capital city areas grew at a rate just below the national average — 0.13 and 0.04 percentage points less than the national average during 1986–91 and 1991–96, respectively. Rural and remote areas were the slowest growing of all regions over the two periods examined — 0.49 and 0.34 percentage points less than the national average, respectively, during 1986–91, and 0.79 and 0.49 percentage points during 1991–96.

Figure B.2 presents the factors contributing to each of the above regional differences. These factors sum across to the total difference from the national average population growth rate. Major features apparent from the data include:

- changes in employment growth were in general the single most important contributors to population changes for each regional grouping. Because of the importance of employment changes to regional population changes, relative differences in employment growth rates were also the main source of difference in population growth rates between regions. This was particularly so for coastal areas between 1986–91, where faster employment growth was the largest contributor to faster population growth (0.75 out of 1.37 per cent), and in rural areas between 1991–96, where slower employment growth was the largest contributor to slower population growth (-0.43 out of -0.79 per cent);

- changes in the number of unemployed were also important contributors to regional population changes. However, the direction of change varied between regions. During 1986–91, slower regional growth in persons made a negative contribution towards population growth in coastal areas (-0.24 per cent), remote areas (-0.27 per cent) and, to a lesser extent, in rural areas (-0.03 per cent). On the other hand, unemployment growth was faster in the capital city areas, contributing 0.07 per cent. In other words, in the years leading up to the 1991 recession, the number of unemployed tended to grow faster in the city areas. However, during 1991–96, a period of economic recovery and reduction in the total number of unemployed, the number of unemployed was a component of the

Figure B.2 **Decomposition of differences in population growth rates**




*Source*: Commission estimates.

stronger population growth on the coast (0.20 out of 1.26 per cent). This was due to a slower rate of decline in unemployment in that region;

- there is strong evidence of a preference by older people to move away from capital city and rural areas in favour of coastal areas, and to a lesser extent remote areas. For example, during the period 1986–91 stronger growth in the number of older persons was a notable positive component of population growth on the coast (0.38 out of 1.37 per cent), while weaker growth was a negative element in the capital city areas (-0.09 out of -0.13 per cent);
- the direction of change of the remainder of the population (the 'other' category, which includes those not in the labour force aged 15–54 years and all those aged 0–14 years) in general mirrors that of the employed (the only exception was in the remote region during 1986–91). This could stem from the fact that these people are often dependent on income-earners and thus move with them; and
- the contribution from differences in shares was smaller, on the whole, than from differences in growth rates. The most notable contribution was due to the smaller share of older persons in remote Australia, causing that region to 'miss out' on growth in that section of the population during both intercensal periods. This made a negative contribution to population growth in that regional group. On the other hand, the larger share of older persons on the coast made a positive contribution to its population growth. The larger share of unemployed persons on the coast also made a positive contribution to its population growth during 1986–91 when the number of unemployed was growing nationwide. Of course, the larger shares of unemployed and older persons, by definition, mean a smaller share of employed persons, which made a negative contribution to population growth on the coast.

## Decomposition of differences in employment growth rates

The decomposition analysis of differences in employment growth rates represents further breakdown of the above population changes. The analysis decomposes the difference between the regional employment growth rate and the national average into contributions from each of four industry sectors: agriculture, mining, manufacturing and other (hereafter called 'services'). Results from the decomposition analysis of employment growth rates are shown in figure B.3 and table B.3 (the latter is shown at the end of the appendix).

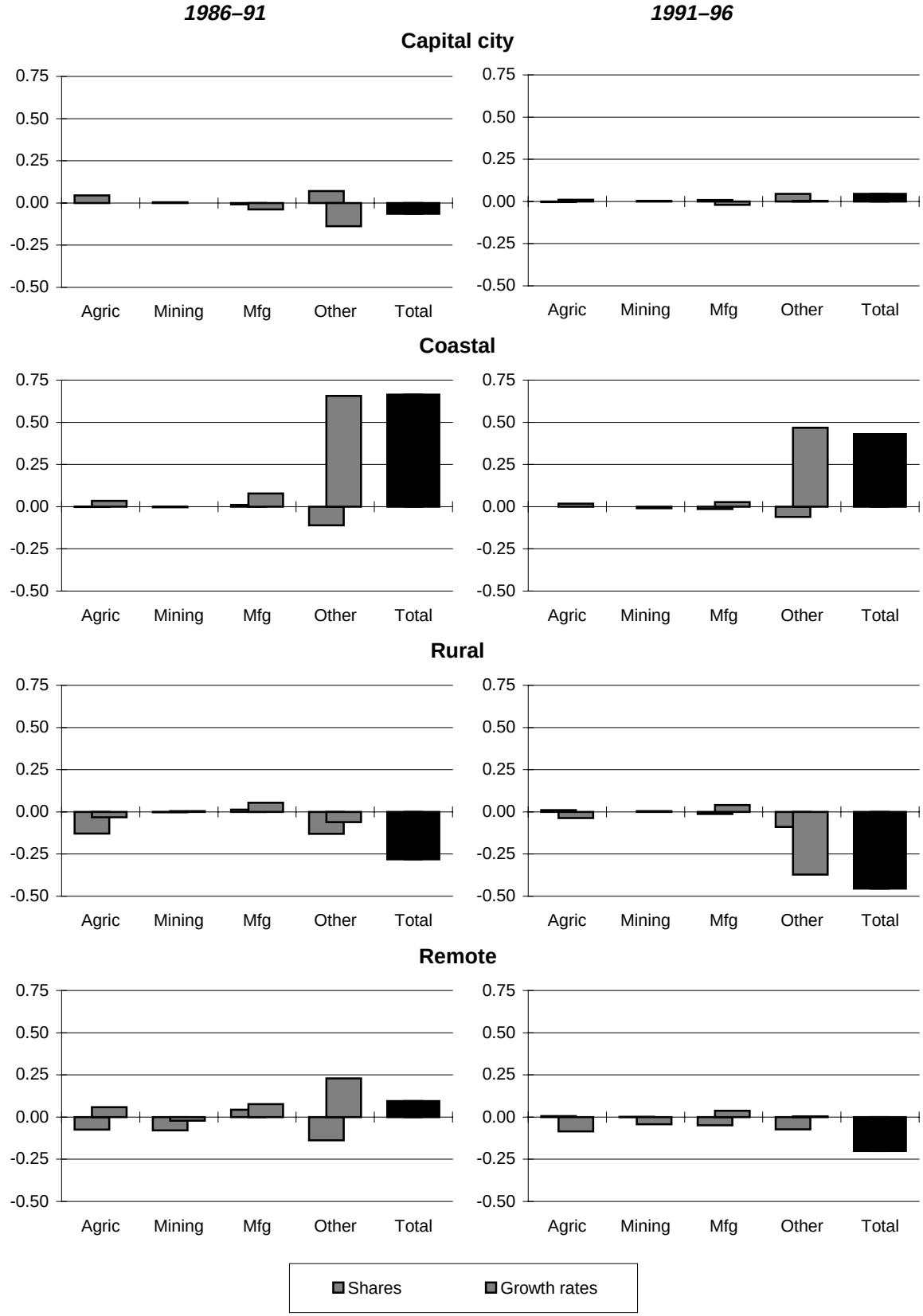
The total employment growth data again demonstrate the trend of 'coastal drift'. Employment growth in coastal areas was considerably higher than the national average during both intercensal periods — 0.66 percentage points higher during the period 1986–91 and 0.43 percentage points higher during 1991–96. On the other hand, employment growth in rural areas was substantially slower than the average

— 0.28 and 0.45 percentage points, during 1986–91 and 1991–96, respectively. Employment in capital city areas grew slightly below the average during 1986–91 and more quickly during 1991–96. Employment in remote areas grew slightly above the average during 1986–91 (by 0.09 percentage points) and below average during 1991–96 by (0.20 percentage points).

Figure B.3 presents the elements of each of the above regional differences. Again, these factors sum across to the total difference from the national average employment growth rate. Major conclusions which can be drawn include:

- the main difference in regional employment growth rates was the difference in the employment growth in services. Significantly higher growth in employment in coastal areas was mainly due to higher growth in employment in service industries. The opposite was the case in rural Australia, where slower growth in employment in services contributed strongly to a reduced employment growth rate, particularly in the 1991–96 (0.37 out of 0.45 per cent). There also was slower growth in employment in that sector in the capital city areas, which made a negative contribution there. However, that was not the case with remote areas which experienced a growth in service activity in both periods, but particularly in 1986–91;
- differences in the share of services were also notable components of differing rates of overall employment growth during both periods. This was attributable to the large role played by such industries in the economy and the strong growth occurring in many of the service industries. The higher share of services in the capital city areas was a positive element in employment growth, whereas the lower share of services gave a negative contribution in all other regions, as those regions 'missed out' on employment growth in those industries;
- agricultural employment contracted nationwide during 1986–91 and grew fractionally during 1991–96. Over both the 1986–91 and the 1991–96 periods, a decline in rural agricultural employment was a component in slower employment growth in rural areas (for example, -0.03 out of -0.28 per cent in 1986–91). However, faster growth in agricultural employment in the capital city areas and in coastal areas contributed positively to employment growth in those regions;
- national employment in the mining industry contracted during 1986–91 and was stagnant during 1991–96. The contraction contributed to slower employment growth in the remote region, due to its higher share of mining employment; and
- manufacturing industry employment in Australia contracted during 1986–91 and expanded during 1991–96. An important influence in these changes is likely to have been the effects of the recession centred around 1991. In capital city areas, the contraction of manufacturing employment was more severe than the national average in 1986–91 and growth was slower than average in 1991–96.

Figure B.3 **Decomposition of differences in employment growth rates**




*Source:* Commission estimates.

Hence, the rate of change of manufacturing employment was a negative component of total employment growth in capital city areas (-0.04 per cent in 1986–91 and -0.02 per cent in 1991–96). On the other hand, above-average growth in manufacturing employment ensured it was a positive element in employment growth in all other regions between 1986 and 1996.

The Commission also undertook a further decomposition analysis of the male and female population. It found the pattern of change to be similar to the results reported here for males and females combined.

## Table B.2 **Decomposition of differences in population growth rates, 1986–96**

| *Population group* | | *Employed* | | *Unemployed* | | *55 & over* | | *Others* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Contribution of differences in: | | shares | growth rates | shares | growth rates | shares | growth rates | shares | growth rates | Total difference | National growth rate |
| 1986–91 | Capital cities | 0.0277 | -0.0911 | -0.0131 | 0.0748 | -0.0065 | -0.0854 | -0.0059 | -0.0349 | -0.1343 | 1.5221 |
| | Coast | -0.0877 | 0.7510 | 0.0803 | -0.2356 | 0.0619 | 0.3760 | 0.0016 | 0.4202 | 1.3677 | 1.5221 |
| | Rural | -0.0249 | -0.2561 | -0.0131 | -0.0306 | -0.0109 | -0.0209 | 0.0129 | -0.1486 | -0.4923 | 1.5221 |
| | Remote | -0.0070 | 0.1014 | -0.0087 | -0.2698 | -0.0949 | 0.1912 | 0.0347 | -0.2885 | -0.3416 | 1.5221 |
| 1991–96 | Capital cities | 0.0248 | 0.0203 | 0.0039 | -0.0427 | -0.0139 | -0.0421 | -0.0086 | 0.0185 | -0.0398 | 1.1380 |
| | Coast | -0.0677 | 0.4973 | -0.0286 | 0.2040 | 0.0818 | 0.1597 | -0.0011 | 0.4125 | 1.2578 | 1.1380 |
| | Rural | -0.0282 | -0.4258 | 0.0051 | -0.0051 | -0.0044 | 0.0074 | 0.0215 | -0.3569 | -0.7864 | 1.1380 |
| | Remote | 0.0032 | -0.2042 | 0.0341 | -0.1245 | -0.1054 | 0.0364 | 0.0547 | -0.1817 | -0.4875 | 1.1380 |

*Source:* Commission estimates

## Table B.3 **Decomposition of differences in employment growth rates, 1986–96**

| *Industry* | | *Agriculture, forestry and fishing* | | *Mining* | | *Manufacturing* | | *Other* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Contribution of differences in: | | shares | growth rates | shares | growth rates | shares | growth rates | shares | growth rates | Total difference | National growth rate |
| 1986–91 | Capital cities | 0.0443 | 0.0003 | 0.0043 | -0.0001 | -0.0086 | -0.0378 | 0.0712 | -0.1369 | -0.0633 | 1.7139 |
| | Coast | -0.0024 | 0.0339 | -0.0028 | -0.0009 | 0.0106 | 0.0780 | -0.1098 | 0.6570 | 0.6633 | 1.7139 |
| | Rural | -0.1283 | -0.0326 | -0.0012 | 0.0036 | 0.0140 | 0.0539 | -0.1295 | -0.0613 | -0.2810 | 1.7139 |
| | Remote | -0.0743 | 0.0592 | -0.0791 | -0.0212 | 0.0432 | 0.0762 | -0.1380 | 0.2290 | 0.0944 | 1.7139 |
| 1991–96 | Capital cities | -0.0035 | 0.0105 | 0.0000 | 0.0024 | 0.0089 | -0.0207 | 0.0449 | 0.0025 | 0.0451 | 1.4964 |
| | Coast | 0.0002 | 0.0172 | 0.0000 | -0.0090 | -0.0134 | 0.0275 | -0.0600 | 0.4671 | 0.4296 | 1.4964 |
| | Rural | 0.0105 | -0.0364 | 0.0000 | 0.0047 | -0.0120 | 0.0408 | -0.0893 | -0.3721 | -0.4540 | 1.4964 |
| | Remote | 0.0061 | -0.0842 | 0.0005 | -0.0426 | -0.0484 | 0.0368 | -0.0731 | 0.0037 | -0.2011 | 1.4964 |

*Source:* Commission estimates