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Examining the relationship between commuting patterns, employment growth and unemployment in the Sydney Major Statistical Region

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1. Introduction

The analysis of regional labour markets in Australia reveals persistent disparities in rates of labour utilisation (Mitchell and Carlson, 2005; Mitchell and Bill, 2005b). In particular, unemployment dispersion has not fallen despite the decline in the national unemployment rate since 1993. There is increasing evidence that regional labour market outcomes are not determined exclusively by the national business cycle, even if account is taken of industrial structure, so that reliance on indiscriminate Keynesian macroeconomic policy will not redress persistent inequality in labour utilisation rates (Mitchell and Carlson, 2005). In addition, regions differ in their composition of unemployment between short and long term, but notwithstanding the spatial persistence of unemployment, the evidence does not support the commonly held view that long term unemployment is irreversible (Mitchell and Bill, 2005a).

This dispersion of labour market outcomes persists even within urban areas in Australia, with, for example, the residents of Ku-Ring-Gai in Sydney experiencing a rate of unemployment of 4.9 per cent in August 2001, as compared to a rate of 19.8 for residents of Fairfield, another Sydney suburb (ABS, 2001).

Individual and family poverty is directly related to unemployment. Also, since spatial population and employment increases tend to be uneven between the urban and regional areas, there tends to be congestion and infrastructure duplication in some areas, but under-utilised infrastructure in others (Denniss and Watts, 2001).

Moreover, when employment growth is spatially uneven as it has been over the 1990s, regionally localised growth (and stagnation) may promote strong migratory and commuting responses, as relatively advantaged workers seek out employment opportunities. Thus commuting and migration are liable to directly impact on the effectiveness of local employment growth in reducing local unemployment (Renkow, 2003). In-commuting may frustrate the attempts of local policymakers to deliver opportunities to resident unemployed or to stimulate local business via increased resident purchasing power. On the other hand, local job creation strategies may not be strictly necessary to revitalise flagging local economies, if resident workers are able to secure employment in neighbouring regions. This reliance on residential mobility to remedy regional downturns may heavily disadvantage low-skilled workers who are less likely to commute or migrate (Mitchell and Bill, 2005b).

In this paper we employ the labour market accounts (LMA) framework to decompose these labour market responses in the period 1996-2001 for the Sydney MSR, one of the most buoyant economic regions in Australian over the 1990s. The LMA framework decomposes the movements in working age population (*WAP*) and labour force (*LF*) for a particular area to determine who fills the jobs arising from changing employment levels. We provide estimates for the following components: (a) labour force changes due to demographic processes, which are broken down into natural increase and net in-migration; (b) labour force changes due to changes in the labour force participation rate; (c) changes in unemployment, which are broken down into changes arising from demographic processes and changes arising from changes in the percentage of the labour force that are unemployed; and (d) changes in net in-commuting.

Regression models are estimated to consider the relative strength of the relationships between each of these adjustment responses and percentage employment change. Separate models are estimated for men and women to test whether their respective

adjustment processes are different. We also augment the regressions to determine whether the initial occupational structure of an area impacts on the adjustment process.

The results show emphatically that employment growth between 1996 and 2001 has elicited substantial changes in commuting behaviour although there are clear differences between men and women. Men show relatively greater in-commuting responsiveness to employment growth although migration and commuting responses dominate the labour market responses. Unemployment changes in local areas are muted.

In Section 2, recent studies that have employed the LMA framework are reviewed followed in Section 3 by an analytical presentation of the LMA framework. Section 4 provides a detailed description of the data. Section 5 then utilises the decomposed labour market responses in regression models to estimate the relation between employment change and labour market adjustment. Concluding comments are presented in the final section.

2. The labour markets accounts literature

A number of UK studies have analysed the 'sectoral and spatial shifts for different sections of the labour force' for cities (Bailey and Turok, 2000: 631) arising from the processes of de-industrialisation and de-urbanisation within the LMA framework. An equivalent approach to regional labour market analysis with extensions to analysing localised fiscal impacts of growth was developed separately in the US by researchers under the banner of the Community Policy Analysis Network (CPAN) (see Scott and Johnson, 2000; Renkow, 2003). The major differences between the two approaches relate to the analytical methods used and applications by the two groups (compare Bailey and Turok, 2000 and Renkow, 2003).

Owen *et al*. (1984) and Green and Owen (1991) used the LMA framework to explore British local labour market areas for the periods, 1971-81, and 1981-84 and 1984-87 respectively. Each study used clustering analysis to identify similarities and differences between local labour market areas. Owen *et al*. (1984) highlight the influence of a range of spatial processes operating at different levels, both between broad labour market regions as well as along the urban-rural continuum, with non-spatial factors such as the industrial composition of employment also influencing labour market processes. There was evidence of a north-south dichotomy in the labour market responses estimated. This spatial distinction is least apparent for unemployment, due to the offsetting impact of regionally differentiated patterns of migration. Green and Owen's study spanned periods of depression and improved economic circumstances. They also found evidence of the north-south divide in economic performance, but a closer comparison of the two studies is not possible because they are based on different local labour market areas.

Bailey and Turok (2000) looked at the impact of job loss on the labour market adjustment process across major cities in Britain from 1981 to 1991. They found high rates of adjustment occurred through migration and changes in commuting patterns, but some of these changes arose from workers relocating out of the cities, but continuing to work in them. For some of the resident workforce, however, the adjustment took the form of higher levels of economic inactivity, which combined with the out-migration lead to unemployment falling despite lower employment. The authors identified major gender and occupational differences in responses to

employment changes. Women were more likely to drop out of the labour force in response to employment loss, and women in less skilled occupations had a much higher rate of inactivity than their more skilled counterparts.

Also cities with high shares of manual workers experienced less out-migration and greater increases in inactivity when employment fell. The authors attribute these results to a number of factors. First more qualified individuals have higher incomes and are able to commute greater distances. In addition, women tend to be more constrained than men due to their higher level of domestic responsibilities, and greater incidence of part-time work. Second, less qualified workers are alleged to experience greater barriers to migration than professional and managerial employees, which can be attributed to income levels, moving costs and barriers to migration arising from the social housing system. Bailey and Turok (2000: 648) suggest that there are likely to be few direct benefits for residents from creating professional and managerial employment because: (a) there are few unemployed residents in these occupations; and (b) the potential applicants for these jobs have wide commuting fields and hence significant choice about housing location. On the other hand, job creation for less qualified workers brings direct benefits. Over half of the jobs are obtained by residents previously unemployed or inactive; while more than a quarter go to in-migrants or those who would have migrated out. Few jobs are lost to commuters.

Renkow (2003) also employs the LMA framework to explore the labour market adjustment process across both urban and rural counties in the USA over a period 1980-90. The motivation for his study is both the question of who secures new jobs created in a particular county, but also the public finance considerations, since 44 per cent of local public expenditures in rural North Carolina are funded by residential property taxes. He shows that changes in commuting patterns and the size of the labour force account for most of the labour market adjustment associated with employment change, rather than the unemployment rate, which is consistent with Owen *et al.* (1984). Significant differences in the pattern of labour market adjustment are found between rural and metropolitan counties. The significant take up of new jobs via in-commuting suggests that leakages associated with employment shocks may be substantial (Renkow, 2003: 510). The author concedes that the geographical unit chosen, namely counties, may influence the results with a larger unit leading to a smaller leakage.

Gordon (2003: 56) argues that few barriers to labour market adjustment exist at the small area level. While interactions between labour markets are strongest between proximate or neighbouring regions (Mitchell and Bill, 2004 and 2005a, 2005b for empirical application to Australia), adjustments to disequilibria travel across sub-markets relatively quickly. Such adjustments occur through commuting and migration; and the majority of migration is through small moves between neighbouring regions (Gordon, 2003: 59). Migration is likely to play a greater role in times of buoyant economic activity than recession (Gordon, 2003). Further, it is the unevenness in the distribution of employment opportunities which is likely to be the key motivating factor, rather than differentials in the rewards and risks of the destination region (Gordon, 2003).

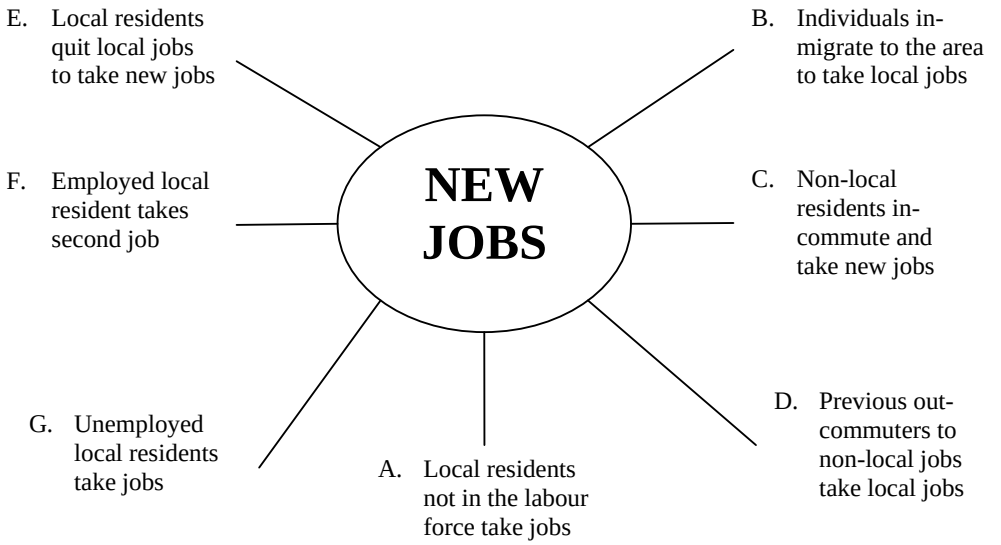
3. The labour market accounts (LMA) model

The LMA framework decomposes movements in working age population (*WAP*) and labour force (*LF*) for a particular area to determine who fills the jobs arising from

employment growth. The approach is also useful for analysing the extent to which a community enjoys higher incomes as a result of employment growth (Barkley *et al*., 2002) as well as providing the basis for measuring the shortfall of jobs in a local area (Bailey and Turok, 2000).

Figure 1 presents a stylised version of the LMA framework to show the seven sources of take-up of new local jobs. Following Barkley *et al*. (2002), local residents who are currently not in the labour force, may choose to become economically active (A) by increasing their labour force participation. Local unemployment residents may gain local employment (B). Local residents who are in employment (locally or not) may take additional jobs (C), or they may quit and take new local jobs (D, E). Residents from outside the local area may also in-commute (F) or 'in-migrate' (move into) the local area (G) and take employment there.

Figure 1 Allocation of new jobs among components of the labour force



Source: Barkley *et al*, 2002.

The system of labour market accounts used in this paper draws on the contemporary approach of Bailey and Turok (2000), which is consistent with the stylisation presented in Figure 1. Bailey and Turok (2000) note that employment change over time in an area gives rise to three interrelated changes, namely labour force variations, which incorporates the level of net in-migration, changes in the number of these residents who are unemployed and changes in net commuting flows.

Then:

$$\Delta E \equiv \Delta LF - \Delta U - \Delta C \qquad (1)$$

where E denotes local area employment, LF is the local resident labour force, C is the level of net out-commuting, U denotes the local resident unemployment and the symbol Δ denotes the change in levels.

In turn, the change in the LF can be separated into the component arising from the change in the working age population (WAP) arising from demographic processes (ΔLF_d) and the change associated with the change in the labour force participation rate ($\Delta LFPR$):

$$\Delta LF \equiv \Delta LF_d + \Delta LFPR \quad (2)$$

The first term can be decomposed into a natural increase component (ΔNI) and a net out-migration component (ΔNM):

$$\Delta LF_d \equiv \Delta NI - \Delta NM \quad (3)$$

Similarly Bailey and Turok (2000) note that changes in unemployment can also be broken down into the component associated with the change in the labour force and that arising from the change in the unemployment rate, so that:

$$\Delta U \equiv \Delta U_d + \Delta U_r \quad (4)$$

The final component of the accounts arises from the change in the net in-commuting associated with the local area (ΔC). It can be written as:

$$\Delta C \equiv \Delta E_r - \Delta E_l$$

where ΔE_l denotes the change in local employment and ΔE_r denotes the change in the level of employment of residents, some of which is local.

Then successive substitution of (2), (3) and (4) into (1) yields the following identity:

$$\Delta E \equiv \Delta NI - \Delta NM + \Delta LF_r - \Delta C - \Delta U_d - \Delta UR \quad (5)$$

4. Data sources and description

Statistical Local Area (SLA) data are drawn principally from ABS Census data taken from the Basic Community Profile (BCP), the Time Series Profile (TSP) and the Working Population Profile (WPP). While the Greater Metropolitan Sydney study area officially comprises 70 SLAs, only 55 SLAs which covered the Sydney metropolitan area, Newcastle, Blacktown, Sutherland Shire but omitted SLAs in the upper and northern Hunter, were used in the study. This smaller dataset was imposed by the restricted availability of 1996 Census data. The SLAs were Botany Bay, Leichhardt, Marrickville, South Sydney, *Sydney*, Randwick, Waverley, Woollahra, Hurstville, Kogarah, Rockdale, *Sutherland*, Bankstown, Canterbury, Fairfield, Liverpool, Camden, Campbelltown, Wollondilly, Ashfield, Burwood, Concord, Drummoyne, Strathfield, Auburn, Holroyd, Parramatta, Blue Mountains (C), Hawkesbury (C), Penrith (C), *Blacktown*, Hunter's Hill (A), Lane Cove, Mosman, North Sydney, Ryde, Willoughby, Baulkham Hills, Hornsby, Ku-ring-gai, Manly, Pittwater, Warringah, Gosford, Wyong, Cessnock, Lake Macquarie, Maitland, *Newcastle*, Port Stephens, Kiama, Shellharbour, Wollongong, *Shoalhaven*, Wingecarribee. Sydney and Newcastle consist of their respective Inner and Outer components. The other italicised SLAs represent SLAs which were disaggregated under the 2001 census and had to be consolidated in the study.

The TSP yields the resident populations of the SLAs by age (and sex) and hence the *WAP* for 1996 and 2001, that is workers 15 and over, the labour force participation rate and the levels of employment by industry and occupation and unemployment.

A simple comparison of the *WAP*s over the five years yields the natural increase in the *WAP* from individuals getting older minus any deaths in that age group plus the level of net in-migration. The natural change in the *WAP* can be obtaining from age

adjusting the 1996 *WAP*. SLA level death rates were devised using ABS *Demography NSW* (Cat. 3311.1), 2001 and *Deaths, Australia* (Cat. 3302.0), various issues. An estimate of deaths across the age distribution for men and women in each SLA over the 5 year period is obtained by calculating the implied deaths across the age distribution from age and sex specific NSW death rates and reconciling through pro-rata adjustment the implied total number of deaths in each SLA with total official recorded annual deaths in each SLA. The estimate of total deaths across the age distribution for males and females enables net in-migration by sex to be calculated.

The *WPP* for each census year yield the local (SLA) levels of employment by sex, which contribute to the computation of the change in net in-commuting over the 5 year period. Data does not permit complete disaggregation of labour market accounts by occupation. Complete analysis would require unemployment by occupation and gender for each spatial area.

For SLAs within the NSW Greater Metropolitan Region, a customised table of employees broken down by occupation minor group (3 digit) by sex was also obtained from the ABS for the purposes of calculating changes in commuting patterns. A further table of Journey to Work (JTW) data was supplied by the NSW Department of Planning, consisting of a matrix of commutes on the night of the 1996 and 2001 Census. It counts employees travelling from their home SLA to their work SLA, broken down by occupation and sex within the Greater Metropolitan Sydney Area.

Approximately 10 per cent of respondents to the JTW question in the Census failed to provide a clear indication of the location of their work. Since the local employment data from the WPP necessarily is based on known work locations, this introduces an inconsistency between the row sums of the JTW matrix (residents' employment) which include the unknown work locations, and the column sums (local employment). Accordingly using the figures for residents' employment by occupation as benchmarks, the entries in the rows of JTW data associated with specified work locations were adjusted proportionately to reconcile the JTW matrix with the figures for residents' employment. In addition, the JTW data for which occupations were not specified were allocated proportionately across the nine major occupations. This transformation of the data yielded new column sums (local employment by occupation and sex) for the JTW matrix.

5. Modelling labour market responses to employment growth

5.1 Overview of labour market responses

Table 1 presents the summary statistics of the labour market responses to employment change between 1996 and 2001 for men and women. The areas gained on average 8.6 per cent of their male labour force and 8.8 of their female labour forces over this period via demographic changes with net in-migration dominating (4.6 per cent for males and 5.3 per cent for females). In this growth period, changes in male labour force participation reduced the available labour force on average across the areas whereas female labour force participation increased. On average, employment growth has only had a muted impact on the unemployment of residents.

Changes in net in-commuting represented the dominant labour market response to the extra employment for both males (5.6 per cent on average) and females (4.5 per cent on average) for the study areas shown. This is the notable result from our study and warrants further analysis.

Table 1 Summary of labour market responses to employment change, 1996-2001

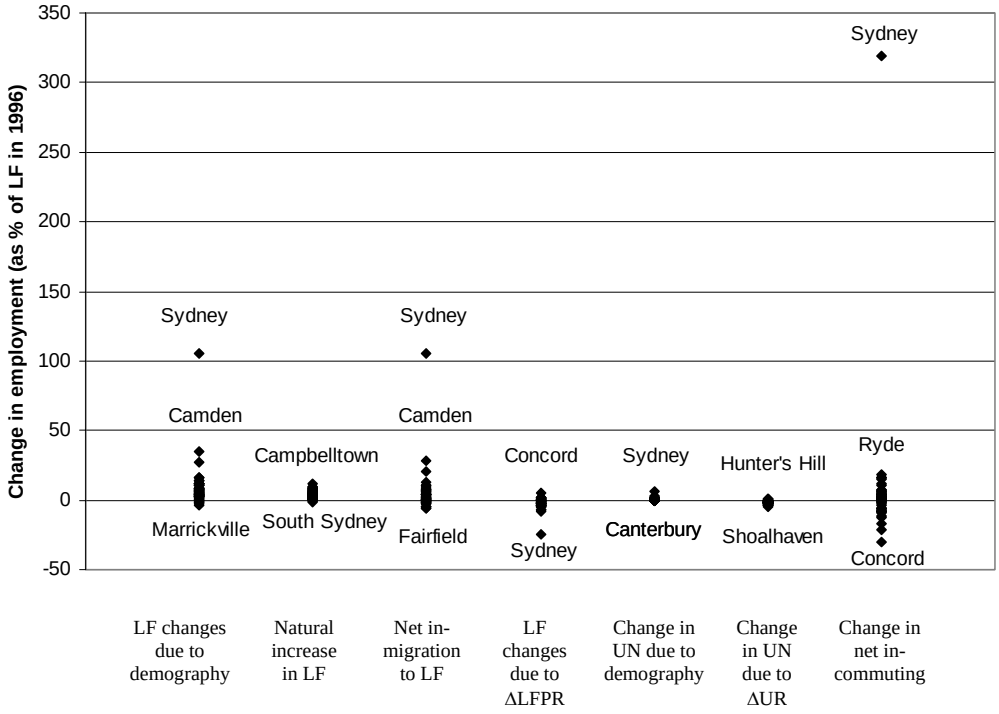
	Mean	Std. Dev.	Maximum	Minimum
Males				
LF changes due to demography	8.6	14.8	105.0	-3.6
Natural increase in LF	4.0	2.9	11.8	-1.6
Net in-migration to LF	4.6	15.1	105.2	-6.1
LF changes due to ΔLFPR	-2.1	4.0	4.6	-24.9
Change in UN due to demography	0.5	1.0	6.0	-0.6
Change in UN due to ΔUR	-1.6	1.1	0.4	-4.4
Change in net in-commuting	5.6	44.0	319.2	-30.1
Females	Mean	Std. Dev.	Maximum	Minimum
LF changes due to demography	8.8	16.5	118.8	-3.4
Natural increase in LF	3.4	3.0	10.5	-3.1
Net in-migration to LF	5.3	16.6	117.9	-5.4
LF changes due to ΔLFPR	1.6	3.6	8.3	-17.3
Change in UN due to demography	0.8	1.2	8.0	-0.4
Change in UN due to ΔUR	-1.4	1.2	0.2	-4.6
Change in net in-commuting	4.5	38.8	283.1	-19.6

Note: components are expressed as a percentage of 1996 labour force, for males and females, respectively. *LF* refers to the Labour Force, Δ*LFPR* is the change in the labour force participation rate, *UN* is unemployment and Δ*UR* is the change in the unemployment rate.

Figures 2 and 3 show the individual LMA components of the employment change between 1996 and 2001 for men and women, respectively. Clearly, Sydney dominates the other SLAs for both men and women. The muted response of unemployment revealed in Table 1 also translates in a lack of variation in the unemployment responses across the SLAs. Employment growth between 1996 and 2001 did not significantly reduce residents' unemployment, partly because it was not of a sufficient strength but also due to movements in workers (migratory or commuting).

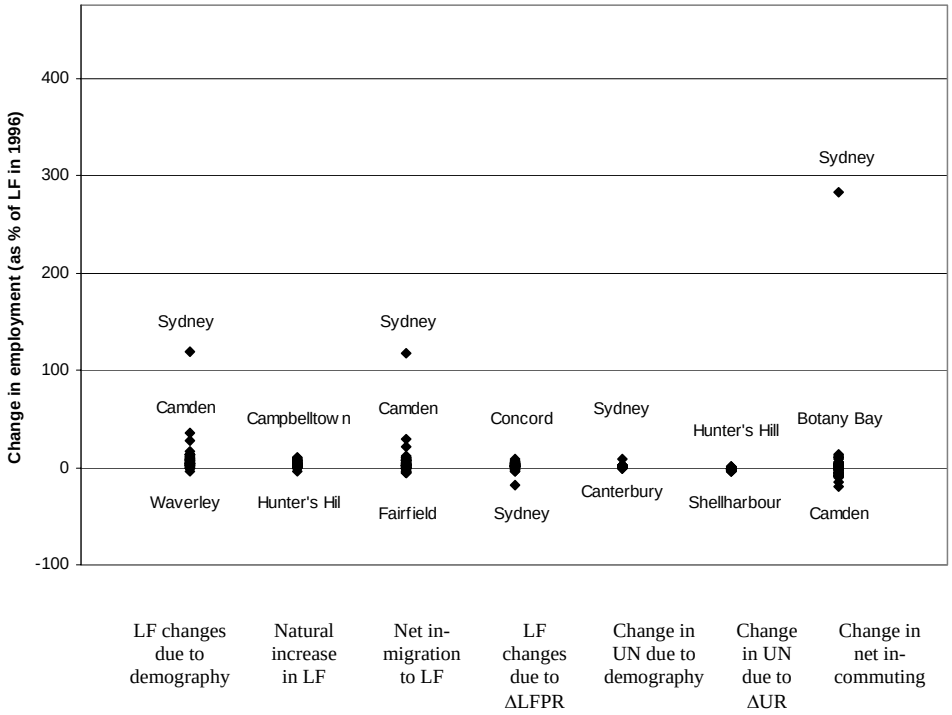
That the Sydney SLA emerges as an outlier in both Figures in terms of demographic changes, in-migration and commuting is hardly surprising. As a result of a considerable inner-city economic revival the workforce of Sydney has expanded by 16 per cent in the period 1996-2001. Most of this growth was in high-skill managerial and professional occupations in line with industrial shifts favouring the 'new economy' (Raskall, 2002: 284). Sydney's residential population almost doubled from 1991 to 1996 and again from 1996 to 2001. In August 2001 a workforce more than 16 times its residential population commuted to the city, well-educated and largely employed in high-skill occupations (Raskall, 2002: 285).

Figure 2 Change in employment by SLA, 1996-2001, Male residents



Source: Authors' own calculations from Equation (5).

Figure 3 Change in employment by SLA, 1996-2001, Female residents



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5.2 Regression analysis of labour market responses

Bailey and Turok (2000: 639) use regression models "to examine the relative strength of the relationships between employment change and each of the labour market adjustment variables." Several models were explored. The first male and female equations involve regressing each of the labour market components outlined in Section 3 expressed as a percentage of the 1996 labour force on total local employment change between 1996 and 2001 expressed as a percentage of the 1996 labour force. We also employed Seemingly Unrelated Regression estimation with the cross-equation restriction that the sum of the coefficients for % change in employment should sum to one being imposed. The restricted results (not reported) generally accord with the unrestricted results.

The slope coefficient measures the response of the particular labour market component to employment change. The constant term measures the labour market adjustments that are not attributable to employment change. We check the robustness of these results with a systems estimator. We also seek to determine whether the initial occupational structure of an area impacts on adjustment. It is expected that areas with higher proportions of manual workers (labourers and tradespersons) would experience lower rates of adjustment, so that the adjustment processes of men and women are different. While this arises partly due to occupational differences, women are more likely instrumentally attached to the labour force.

Male results

The male labour market adjustment responses to employment change are shown in Table 2. As noted above, the sample period was one of consolidated growth, following the 1991 recession. There was considerable adjustment to employment change in the form of net in-migration and net in-commuting with the latter dominating. Similar results were obtained by Bailey and Turok (2000). For every 1000 male jobs created in an area, net in-commuting by men rose by 846 and 274 economically-active men migrated into the same area. The goodness of fit measures (adjusted R^2) indicate that the relationships are strong (0.97 and 0.86, respectively for in-commuting and in-migration). So both out-migration and out-commuting occur in areas where employment losses arise.

Employment growth only had a small impact on unemployment however (1000 extra jobs reducing unemployment by 4 via reductions in the unemployment rate (although statistically this result is hardly significant) but increasing it by 15 as a result of demographic processes (including the hidden unemployed). For every 1000 jobs created, 61 workers dropped out of the labour force via participation rate changes. Given the surprising nature of this result, we explore the sensitivity of different age cohorts in Section 6.

The constant terms in each equation indicate that the labour force grew by 4.1 (on average) as a result of natural increase; by 1.1 per cent (on average) as a result of net

in-migration; and shrunk on average by 1.3 per cent due to declining labour force participation rates.

Bailey and Turok (2000: 642) suggest that "part of the explanation for these changes must lie in the changes for different occupational groups." With a rising proportion of jobs in the professional and other skilled occupations, it would be expected that a larger proportion of the employment opportunities would be taken by in-commuters. This reflects the fact that the more advantaged population cohorts have greater choice of housing and transport and as a result tend to commute longer distances than the more disadvantaged segments of the population. Equally, the declining participation rate for the resident populations is consistent with a smaller proportion of lower skilled job opportunities.

The regression models can thus be extended by adding more control variables to the right hand side to explicitly model occupational structure and metropolitan-non-metropolitan impacts. Accordingly, a metropolitan dummy which took the value of 1 for a metro region and 0 otherwise (based on the Sydney MSR geography) was added. Following Bailey and Turok (2000: 642), we also controlled for occupational structure as a "means for assessing the extent to which different occupational groups were able to adjust to employment change." (see also McCormick, 1997). We consider two occupational groups at opposite ends of the wage distribution – manual workers and professionals. In this regard, the percentage of manual male workers in total male employment and the percentage of professional male workers in total male employment for each area were added to the basic regressions. The occupational analysis allows us to examine different patterns and intensities of responses between areas with high manual employment shares and areas with high shares of professional employment. This result has been used to underpin an explanation of persistent regional unemployment differentials based on regional occupational structure.

Table 2 Labour market adjustment responses to employment change for males

Labour market adjustment component	Constant (%)	Coefficient for % change employment	*t*-statistic for % change employment	Adjusted R^2
Change in residents Labour Force				
Due to demographic processes	5.208	0.265	16.29	0.83
natural increase	4.067	-0.009	-1.18	0.01
net in-migration	1.141	0.274	18.05	0.86
Due to change in LFPR rate	-1.343	-0.061	-9.17	0.61
Increase in net in-commuting	-5.174	0.846	41.26	0.97
Change in unemployment				
Due to demographic processes	0.294	0.015	10.07	0.65
Due to change in unemployment rate	-1.536	-0.004	-1.41	0.02

The results of the regressions augmented with the occupational structure information are shown in Table 3. In all cases the fit of the regressions is improved, in some cases,

substantially. The labour market responses to employment growth are similar to those in Table 2. For every 1000 jobs created, net in-migration rises by 150 and net in-commuting rises by 966, other things equal.

The results also suggest that metropolitan regions have lower net in-migration and low unemployment due to demographic processes, other things equal than non-metropolitan areas. All other labour market responses are insensitive to this geographic distinction. We also tested the ABS Socio-Economic Index for Areas (SEIFA) value and found no significant relation.

Further, in areas where the manual employment share is higher the role of natural increase is stronger, but net in-migration responses, labour force participation responses and unemployment rate responses due to changes in the unemployment rate, other things equal, are lower. Bailey and Turok (2000: 642) also note a similar result for natural increase in the UK and drawing on the work of Armitage (1997) suggest that "this is likely to reflect the higher fertility rates which occur in areas with higher concentrations of manufacturing industry".

Areas with higher concentrations of professional employment exhibit significantly different responses to higher employment growth. In these regions natural increase plays a smaller role; but labour force participation and net in-migration responses are stronger, so that professional workers are more likely to relocate in search of employment opportunities than manual workers. These areas exhibit lower in-commuting responses but higher unemployment responses compared to those with high percentages of manual employment, probably due to supply side factors.

Table 3 Male labour market adjustment responses to employment change with occupational structure and metro dummy

Labour market adjustment component	Constant (%)	Coeff % change emp	*t*-stat % change emp	Coeff manual % total emp	*t*-stat manual % total emp	Coeff profs % total emp	*t*-stat profs % total emp	Coeff on metro dummy	*t*-stat metro dummy	Adj R^2
Change in residents Labour Force										
Due to demographic processes	3.97	0.173	6.90	-0.039	-0.14	0.362	4.59	-3.570	-1.74	0.88
natural increase	1.51	0.023	1.78	0.388	2.73	-0.111	-2.76	1.057	1.01	0.16
net in-migration	2.45	0.150	8.08	-0.427	-2.06	0.473	8.07	-4.627	-3.03	0.93
Due to change in LFPR rate	0.31	-0.085	-9.15	-0.443	-4.27	0.076	2.58	1.150	1.50	0.77
Increase in net in-commuting	-0.21	0.966	32.06	-0.167	-0.50	-0.480	-5.05	2.719	1.10	0.98
Change in unemployment										
Due to demographic processes	0.27	0.005	2.18	-0.021	-0.90	0.041	6.30	-0.388	-2.28	0.80
Due to change in unemployment rate	-0.20	0.002	0.61	-0.179	-4.00	-0.033	-2.60	0.589	1.79	0.42

Note: Adj R^2 is the adjusted R^2. Coeff refers to the estimated coefficient; emp is employment, profs is professionals.

Female results

The female results are shown in Table 4 and are in contrast to those for males (Table 2). Overall, the labour force responses due to demographic processes are smaller for women. Further, the prior expectation was that women would have a lower response to employment change through migration or commuting than men. However, while the net in-commuting response is lower for females (745 jobs per 1,000 extra jobs compared to 846 for males), the net in-migration coefficient (highly statistically significant) indicates that for every 1,000 jobs generated net female in-migration (on average) is 306 (compared to 274 for males). As in the male case, in-commuting is the main female response to employment change. Bailey and Turok (2000) found the main response for women was through changing participation rates. Given that our data is for a period of consolidated employment growth (in contrast to Bailey and Turok, who studied a period of employment loss) we would expect the cyclical labour force responses to be muted. The results confirm this expectation. For every 1000 jobs created 50 women leave the labour force.

The main picture to emerge from the results is that both men and women rely heavily on commuting across regions to gain income-earning opportunities in response to employment growth with migration being the second most significant response.

Similar to the male results, employment growth had only a small impact on the change in female unemployment however (1000 extra jobs reducing unemployment by 3 via reductions in the unemployment rate but increasing it by 20 as a result of demographic processes). Given the adjustments are over a 5 year period the response of unemployed females (in 1996) to employment growth has been extremely muted.

The notable difference in the constant terms for women is in the participation rate response with a 2.3 per cent (on average) labour force increase as compared to a decline in the male labour force.

Table 5 reports the results of the extended regressions. Again, the fit of the regressions is improved. Compared to the results in Table 4, the labour market responses to employment growth are similar. The impact of adding occupational controls is similar for females – reducing the net in-migration response and increasing the net in-commuting response. For every 1000 jobs created, net in-migration rises by 119 and net in-commuting rises by 909, other things equal. The adjusted results suggest that males have larger net in-migration and net in-commuting responses compared to females after controlling for occupational structure.

The results also suggest that, other things equal, females in metropolitan regions have lower net in-migration (similar to males), lower labour force participation rates (in stark contrast to males), higher net in-commuting (in accord with males but with a stronger relative impact), and overall lower unemployment, than in non-metropolitan areas.

Females in areas where the manual female employment share is higher have significantly higher natural increase responses, substantial reductions in net in-migration and moderate reductions in labour force participation responses, and lower unemployment responses due to changes in the unemployment rate, other things equal. The net in-commuting response is slightly lower.

Table 4 Labour market adjustment responses to employment change for females

Labour market adjustment component	Constant (%)	Coefficient for % change employment	*t*-statistic for % change employment	Adjusted R^2
Change in residents Labour Force				
Due to demographic processes	4.915	0.301	18.65	0.87
natural increase	3.488	-0.005	-0.61	-0.01
net in-migration	1.427	0.306	20.90	0.89
Due to change in LFPR rate	2.286	-0.050	-7.52	0.51
Increase in net in-commuting	-5.066	0.745	39.13	0.97
Change in unemployment				
Due to demographic processes	0.510	0.020	11.92	0.72
Due to change in unemployment rate	-1.397	-0.003	-0.96	0.00

Note: LFPR is labour force participation rate.

Females in areas with higher concentrations of professional female employment exhibit significantly different responses to higher employment growth. These areas have substantial increases in net in-migration. Again, this relocation behaviour appears to be in preference to in-commuting, as was the case for males. Regions with high percentages of female professional employment have reduced in-commuting responses compared to those with high percentages of manual employment. Further, regions with higher percentages of professional female employment experience rising unemployment compared to high manual employment proportions, again, as in the case of males, probably due to supply side factors.

The regressions also suggest that metropolitan areas experience less female in-migration; have lower participation responses and substantially higher female in-commuting. They also experience slightly lower female unemployment in response to employment growth than non metropolitan areas.

Table 5 Female labour market adjustment responses to employment change with manual occupational structure and metro dummy

Labour market adjustment component	Constant (%)	Coeff % change emp	*t*-stat % change emp	Coeff manual % total emp	*t*-stat manual % total emp	Coeff profs % total emp	*t*-stat profs % total emp	Coeff on metro dummy	*t*-stat metro dummy	Adj R^2
Change in residents Labour Force										
Due to demographic processes	0.53	0.119	5.42	-0.413	-2.25	0.580	9.45	-3.764	-2.82	0.95
natural increase	0.68	0.000	0.01	0.472	3.54	-0.003	-0.07	-0.210	-0.22	0.21
net in-migration	-0.14	0.119	7.03	-0.885	-6.27	0.583	12.33	-3.554	-3.45	0.97
Due to change in LFPR rate	2.70	-0.109	-9.05	-0.304	-3.02	0.184	5.46	-2.061	-2.81	0.68
Increase in net in-commuting	-6.20	0.909	25.54	0.972	3.27	-0.506	-5.08	4.579	2.11	0.98
Change in unemployment										
Due to demographic processes	0.36	0.004	1.84	-0.019	-1.08	0.052	8.65	-0.775	-5.97	0.91
Due to change in unemployment rate	-0.28	0.000	0.07	-0.205	-4.90	-0.017	-1.22	0.620	2.03	0.49

Notes: see Table 3.

6. Labour market adjustments by age

We also decomposed the regression analysis by age cohorts (15-19, 20-24, 25-34, 35-54, 55-64 years old). The results (not reported) suggest that changes in male resident labour force due to demographic processes are concentrated in the two 'prime-age cohorts', 25-34 years and 35-54 years and are driven by net in-migration. Male unemployment (in net terms) rises as a result of the extra jobs for all groups apart from the 55-64 years cohort as the changes arising from demographic processes are in most cases larger than the modest declines due to changes in the unemployment rate. The 20-24 year old males experience an increasing unemployment rate. For females the story is similar with net in-migration driving most of the demographically-motivated labour force changes and this component concentrated among the 'prime-age' females.

For both males and females the negative impact of employment growth on overall labour force participation is not the consequence of a changing age distribution over the sample period, but is found for each age cohort. It was not possible to analyse the impact of employment change on net in-commuting by age cohort, due to the absence of the required JTW data.

7. Conclusion

This paper is the first to apply the LMA framework to Australian data and yields two notable results. First, commuting, followed by migration, is the main labour market adjustment mechanism for both men and women in the late 1990s. Thus considerable leakages exist in local employment creation, and the effects of local employment shocks ripple out across the Greater Sydney Metropolitan region. Such leakages, in upturns and downturns, need to be considered by policy-makers when estimating the returns of local employment generation to local residents. Men rely more heavily on commuting across local areas than women to gain income-earning opportunities in response to employment growth. Second, employment growth had only a small impact on the change in unemployment for both males and females. While this may partly be due to increased job-competition from in-migrants and in-commuters it remains that the overall employment growth has not been sufficient to generate enough jobs to satisfy the desires of the workers.

By way of caution, the heavy reliance of both women and men on changes in commuting patterns may in part be a consequence of the choice of SLAs as the basic spatial analytical units. By contrast, Bailey and Turok (2000) examined 28 urban areas, so that intra-urban changes in the spatial pattern of commuting would be suppressed in their work.

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