UNDERSTANDING CHANGE IN RESIDENTIAL PROPERTY MARKETS: MAPPING RESIDENCY OF EMPLOYMENT DATA

RICHARD REED
University of Melbourne

and

CHRISTOPHER PETTIT
RMIT University

ABSTRACT

The changing nature of residential housing markets is due to a large number of influences, although some have a larger effect than others do on house values. Whilst it is extremely difficult to completely disaggregate all influencing factors, it is possible to highlight areas that have a strong relationship with property – one of these is residency of employment.

This research investigates these links between residential housing markets as measured by the level of house prices and residency of employment as measured by industry sector employment. It focuses on Local Government Areas in the State of Victoria, Australia and examines change over a ten year period between 1991 and 2001 using census and house price information. It is supported by data sourced from the Australian Bureau of Statistics and the Victorian Government's Valuer General's Office. The analysis also considers changes in these employment sectors from Australia's overall perspective, as well as comparison with changes in Victoria's overall residency of employment trends. It is assisted by a spatial representation of three 'shift-share' components and property values with the support of a geographical information system (GIS).

Keywords: Residential property, residency of employment, shift-share analysis, GIS.

INTRODUCTION

Residential housing markets form an integral part of society as a whole and are of interest to governments, housing providers, owner-occupiers, investors and tenants. It has been argued that a satisfactory theory of residential location and city structure still remains elusive (Dear and Flusty, 1998; Phe and Wakely, 2000). In contrast to other economic goods and alternative forms of investment such as shares, cash and bonds, the heterogeneous nature of residential housing markets provides a unique

challenge when seeking to identify the supply and demand characteristics (Rosenburg and Watkins, 1999). An identified driver is affordability, which is clearly influenced by the level of interest rates at any given time, as well as employment trends.

This paper details research undertaken to identify links between residency of industry sector employment and residential house prices. The employment data is taken from census data sourced by the Australian Bureau of Statistics (ABS) and describes the type of work (or employment) carried about by each worker and is based on the area where each worker lives (not the location of the employer). The residential house price data is based on the average sale price of homes in a particular location. Using this process, the research introduces an innovative methodology for testing the relationship between residency of employment trends and property trends in Victoria, Australia. A case study approach is used, based on data acquired from Victoria's 77 local government authorities between 1991 and 2001. The results of the shift-share analysis and property prices will be analysed, and the paper will outline future directions for research.

BACKGROUND TO HOUSING MARKET RESEARCH

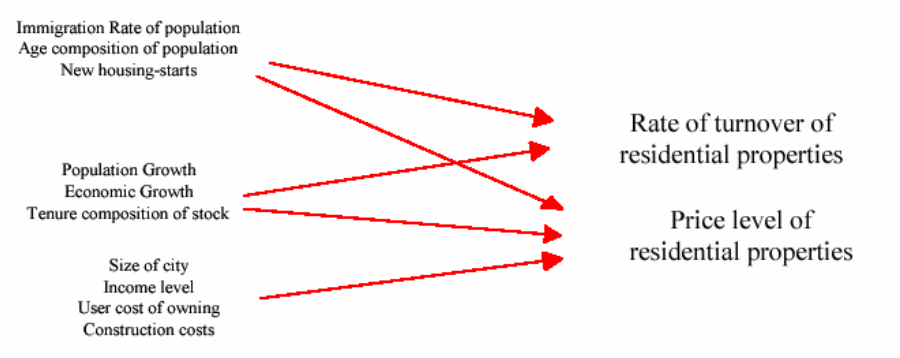
The level of house prices in an area has a direct and indirect effect on wider society, especially in regards to priority areas such as affordability for new households. If a region has higher property values, this may act as a disincentive to relocate there due to the perceived higher costs that are associated. This is further complicated by the lack of difference between wage rates in most areas, so a cheaper house may provide additional surplus in the weekly budget and perhaps a better quality of life. On the other hand, if house prices continue to rise, then households on low incomes may not be able to afford suitable housing, which in turn places additional pressure on the government system to provide affordable housing. Yet, if such areas begin to attract higher income earners, then a positive effect may be brought about from the perspective of greater diversity of employment opportunities.

A recent study linked employment status with complex social problems, and demonstrated that joblessness and homelessness went together in the London property markets (Watt, 2003). In the US, it has been shown that changes within the labour market were prime drivers behind variations in the property market (Knight and Eakin (1997) as cited by Hargreaves, 2002). Whilst generally agreed that there is a relationship between housing and labour markets, the effect of tenure (i.e. ownership versus renting) can arguably be disadvantageous to labour markets due to decreased mobility (Oswald, 1996, 1997, 1999 as cited by Coulson and Fisher, 2002).

Nevertheless, the cost of housing, whether purchasing via a mortgage or renting, must be met by a series of regular payments that represents either mortgage

repayments or rent payments. With the exception of homeowners that have 100% equity in their home and therefore no ongoing commitment to payments, a large proportion of the Australian housing market falls within this bracket (Reed and Greenhalgh, 2002). Hence, the ability of the household to meet this regular monetary commitment would normally be possible through employment that produces a regular income, and accordingly employment becomes a priority issue when attempting to understand the housing market. Furthermore, many workers will live within commuting distance to their place of employment. On this basis, breaking down the employment type will highlight differences in labour markets that are associated with variations in property values. Although different workers may be part of the same household, such as a retail and construction worker living together, it is the aggregate trends and the change over time that is of most importance.

Figure 1: General factors influencing residential sub-markets



Source: Based on Dieleman et al. (2000).

Whilst it is accepted that other general factors may influence residential housing markets as demonstrated in Figure 1, such 'external factors' remain outside the scope of this research. For example, this study does not take into consideration differences in the size of housing or the land, amenities and services in the local area, public transport availability or the median age of the population. The research focus was placed on two selected variables and analysed the relationship between them, namely residency of employment and house prices. The emphasis was placed on 'income level' and is closely related to the type of employment and the level of remuneration that is received. For example, retail workers are typically remunerated at a lower level than a professional person, and this difference can affect the regular commitment of funds to providing a housing product. This study is concerned with established house prices in the short to medium term, as opposed to implications from global economic issues that increase in importance when extremely long term predictions are required (Winger, 1997).

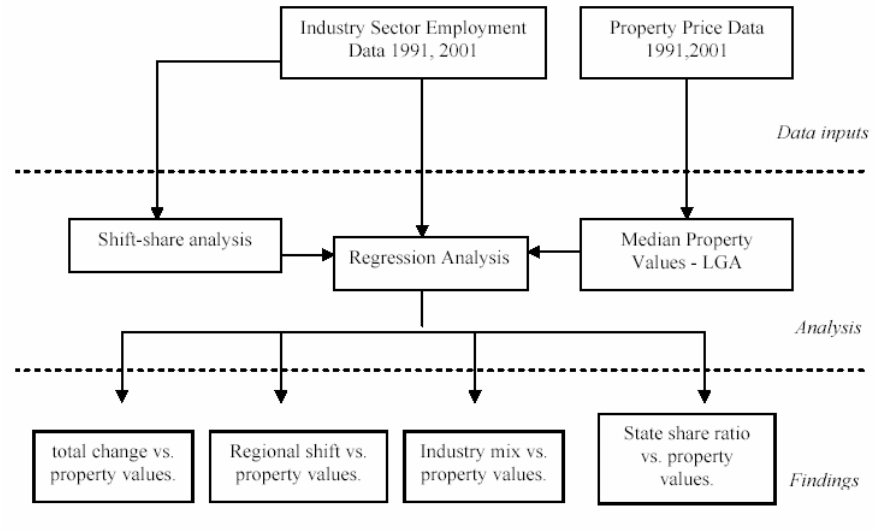
METHODOLOGY

The research was undertaken to identify and examine the relationship between industry sector employment trends and residential property values. An integrated approach to analysing these relationships has been applied, as shown in Figure 2. The primary data inputs are industry sector employment and property price data for 1991 and 2001. In order to test whether any of the three shift-share components better described the relationship (correlation) between residential property values, an analysis of the correlation between employment growth (decline) change and property values was conducted involving the following steps:

1) A regression of change in total change employment growth (decline) between 1991 – 2001 with change in residential property values;

2) A regression with each of the three shift-share components between 1991-2001 with change in residential property values.

Figure 2: Integrated approach to understanding dynamics between industry sector employment and property value trends



Thus, we can determine if one or more components of the shift-share analysis account for the changes in property values. By undertaking a regression analysis, we can also investigate the relationship between individual industry sectors and the change in property values. The next section provides background information on the shift-share process and outlines the analysis used to examine the relationships

between the total change, regional shift, industry mix and state share employment trends and changes in property values.

Shift-share approach

Dunn (1960) has been credited with developing the classical shift-share methodology. Simply explained, shift-share analysis is a useful means of examining regional differences in employment growth and decline (Haynes and Dinc, 1997). Typically economists, geographers, regional scientists and development analysts use the shift-share analysis technique for modelling economic change in a region (Haynes and Dinc, 1997). The two key factors that shift-share analysis is based upon are labour and capital. According to the shift-share analysis technique as noted by Stimson and Davis (1999), there are three components for each region:

1. *State share*: indicates what the employment growth in a local government area (LGA) for each industry would have been if it had grown at the same total employment growth rate for all industries for all of the State
2. *Industry mix*: indicates what the employment growth in a LGA for an industry would have been if it had grown at the employment growth rate for each individual industry for all of the State
3. *Regional shift*: indicates the employment growth (or decline) for each industry attributable to the LGA's own natural advantages or disadvantages.

Equation 1 has been used to calculate the total change in employment. In the research, the total change is used as a benchmark in which to compare the state share, industry mix and regional shift components. The underlying equations for the three shift-share components are shown in equations 2, 3 and 4.

Though it has been stated that shift-share analysis is a powerful and useful technique for analysing changes in the structure of the local economy in reference to the state or nation (Blakely, 1994), there has been some valid criticism of the technique. Knudsen and Barff (1991) focus their criticism of the technique on such issues as temporal, spatial and industrial aggregation, theoretical content and predictive capabilities. It is noted by both Stimson and Davis (1999) and Haynes and Dinc (1997) that traditional shift-share analysis does not consider other influential variables, such as labour force participation, demographic change and most importantly, productivity in the analysis of a region's employment change.

Total Change: $$TC = Et_{ir} - E_{ir} \quad (1)$$

State Share: $$NS = E_{ir} g_n \quad (2)$$

Industry Mix: $$IM = E_{ir}(g_{in} - g_n) \quad (3)$$

Regional Shift: $$RS = E_{ir}(g_{ir} - g_{in}) \quad (4)$$

where E_{ir} is the observed employment in industrial sector i in region r for the initial time (1991), Et_{ir} is the observed employment in industrial sector i in region r for the current time (2001), g_{ir} is the growth (decline) in the employment sector i in region r, g_n is the growth rate for all industry of reference area n, and g_{in} presents the growth or decline for the reference area n.

In order to address these criticisms, there have been a number of extensions made to the traditional shift-share approach. Building on the productivity extension to the shift-share model developed by Rigby and Anderson (1993), Haynes and Dinc (1997) put forward a model that separates labour and capital as well as utilising the dynamic shift-share modification proposed by Barff and Knight (1988). Again, it has been noted by Stimson and Davis (1999) that this approach represents a major advance from previous shift-share approaches, but requires considerable data, which generally is difficult to obtain. As this additional data is not readily available for the State of Victoria, the shift-share analysis carried out is based upon the traditional methods as developed by Dunn (1960). An example of the results from such an approach is published in the form of the on-line Wide Bay Burnett Regional information system (Pettit et al., 2002). The results of the baseline total employment change and three shift-share components can be represented using a GIS to determine spatial employment effects. Results can also be tabulated, which enables us to perform a regression analysis with the temporal property values dataset.

Regression analysis approach

It has been argued that the analysis of property markets can lack factual information and decisions can be based on opinion and judgment, where divergent opinions can vary (Abboud, 1985). Only recently are statistical approaches such as multiple regression analysis (MRA) being increasingly used to organise and interpret large volumes of property-related data (Antwi, 1997). In this process, the ordinary least squares (OLS) regression technique has remained the most widely used statistical technique. This approach has repeatedly proven its ability to reliably assess the relationship between a dependant variable and multiple independent variables in property markets (Ling et al., 2005).

During the MRA analysis, it was critical for each model to conform to the assumptions of MRA as expanded in standard econometric theory (Gujarati, 1995). Thus, if a MRA model failed to comply with a number of assumptions, the results would be rendered ineffective and unreliable and inferences relating to the significance of regression parameters invalid (Tabachnick et al., 2001). The analysis was conducted using a two-stage approach, where the first model included change in all variables over the corresponding period. Then stepwise regression was used to identify variables that had a significant overall contribution.

RESULTS

Total change in employment

The results from the baseline employment change data (1991 – 2001) reveal that most of the employment growth has occurred in and around Greater Metropolitan Melbourne. Local government authorities (LGAs) that experienced the greatest employment growth included Casey, Mornington Peninsula, Knox, Melbourne, Brimbank, Hume and Wyndam, and Port Phillip. In total, 15 shires, all located in rural Victoria experience some level of total employment growth, with the lowest of these being the LGAs of Greater Dandenong and Latrobe. The spatial distribution of these patterns of residency of employment growth and decline are shown in Figure 3. [Note: see Appendix A for locality maps of Greater Metropolitan Melbourne LGAs and non-metropolitan LGAs].

Shift-share components

A shift-share analysis technique has been used to establish the performance of various industry sectors on a LGA basis using the State of Victoria as the total share. The three main components used for analysing each of the industry sectors for each of 77 LGAs in Victoria include:

1) state share ratio;
2) proportionality shift (industry mix); and
3) differential (regional) shift.

State share ratio

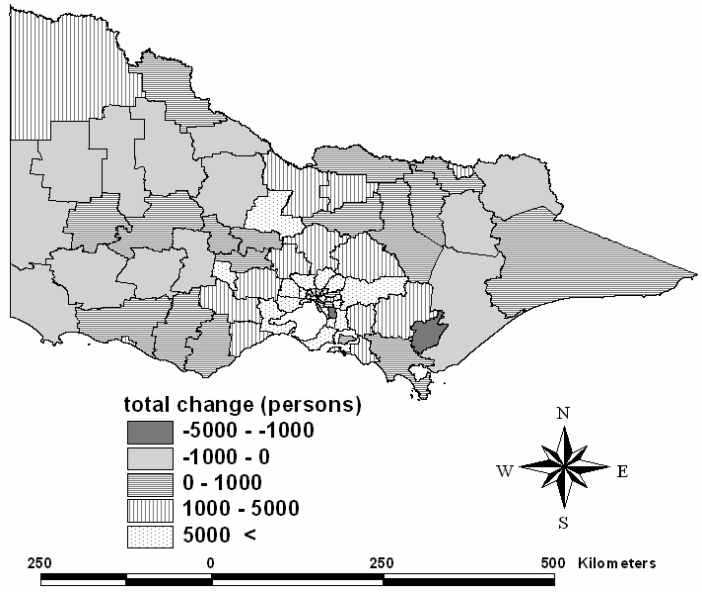
According to Deming (1996) the best way to examine the natural growth component of the shift-share analysis is by comparing it to actual employment growth, as shown in equation 5.

$$SSR = {}^{TS}\!/_{SS} \qquad (5)$$

where SSR is the State share ratio, TS is the total shift, and SS is the State share.

The State share ratio is based on the national share ratio developed by Stimson and Davis (1999) for analysing socio-economic change in Queensland LGAs, based upon work carried out by Haynes and Dinc (1997). In this research, we develop our state share ratio for the State of Victoria using 1991 and 2001 census data. The State share ratio, as is in this instance, provides an identification of the growth of employment in the industry sector if it had grown at the rate of the Victorian economy. With this ratio, any values greater than 1 indicates that the employment grew at a greater rate than the State average and factors other than the State-wide employment growth need to be examined to explain the area's employment growth. LGAs with a ratio less than 1 have not had employment growth at the State average.

Figure 3: Total change in employment 1991-2001



The results from the State share ratio component reveal that most of the LGAs that have a State share ratio less than 1 are situated in the outer eastern and western regions of the State as shown in Figure 4. However, there is a small band of LGAs within the Greater Metropolitan Melbourne region which experience growth less than the State average; these include Moonee Valley, Moreland, Darebin, Banyule, Manningham, Whitehorse, Monash and Greater Dandenong. Most of the LGAs that experience employment growth above the State average are located in and around Greater Metropolitan Melbourne with the best performing LGAs being Melbourne, Casey, Melton, Wyndham and Surf Coast.

Industry mix

The industry mix effect for the LGAs comprising Victoria shows the number of jobs that can be attributed to the industry structure of an area. Those LGAs which have an extremely poor industry mix in Victoria are Latrobe, Mitchell and Wodonga. The results of the industry mix shown spatially in Figure 5 show that there is a cluster of LGAs situated in the outer north-west and far south-east and south-west parts of the State experience a poor industry mix. Those LGAs situated in around Greater Metropolitan Melbourne experience a positive industry mix, especially those LGAs comprising the inner south-east of the State including Whitehorse, Manningham, Monash, Stonnington and Booroondara.

Figure 4: State share ratio for LGAs in Victoria 1991 –2001

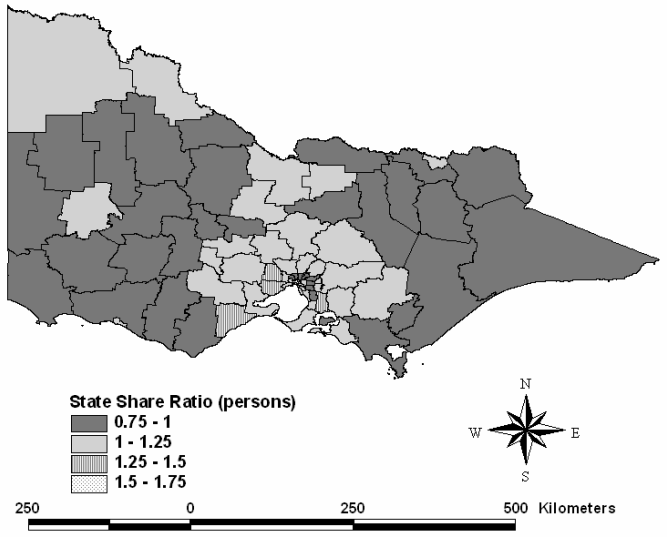
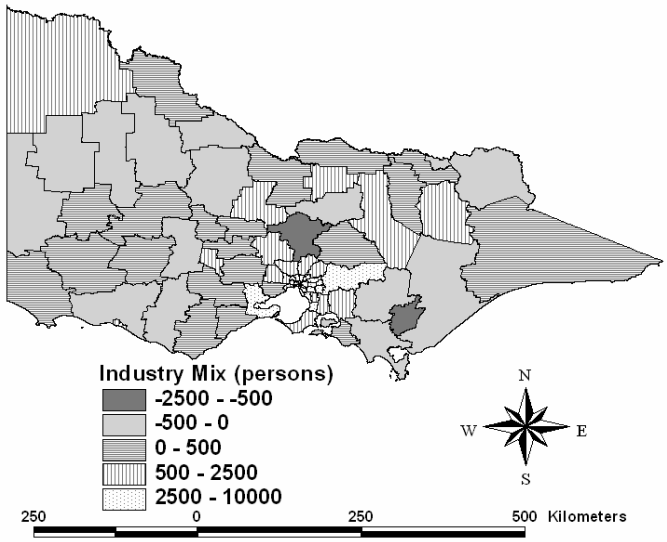


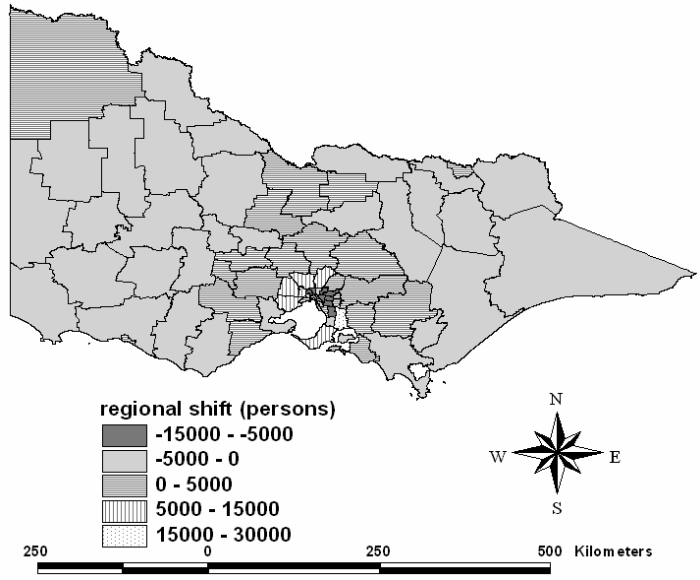
Figure 5: Industry mix component for LGAs in Victoria 1991 – 2001



Regional effect

The regional effect represents the number of jobs explained by an area's own advantages or disadvantages and is a good indicator of endogenous growth. The spatial distribution of LGAs as shown in Figure 6 reveals that like the results of the total change of employment, those located outside the Greater Metropolitan Melbourne area experience a decline. However, there is a spatial cluster of LGAs contained with the south and south-east section of Greater Metropolitan Melbourne that experience the greatest number of job loss contributed to the regional effect; these include Monash, Manningham, Greater Dandenong, Whitehorse, Banyule, Booroonda, Moreland and Moonee Valley. Those LGAs who are experiencing strong residency of employment growth from their area's own advantages include Whitlesea, Brimbank, Hume, Mornington Peninsula, Melton, Wyndham, Melbourne and Casey.

Figure 6: Regional shift component for LGAs in Victoria 1991 –2001



Property values

The property valuation information was sourced from the Valuer General of Victoria, which is the statutory body responsible for collecting and recording property related data. The data was restricted to the value of established detached residential housing in each LGA in Victoria, and this was undertaken using the relevant land use codes. It was considered that established housing was a reliable indicator of property values, whereas newly constructed housing may be subject to

bias due to the lack of homogeneity and often has an additional price premium that is attached to a new house. In addition, using only detached housing allowed a reasonably even comparison between LGAs, especially those with little medium or high density residential accommodation. To remove the influence of long-term inflation, the house prices for each LGA were deflated using house price indexes (ABS, 2004).

Table 1: Total change and residential property values

Variable	Co-efficient	Std	Beta	t Statistic	P Level
Ag Fish	0.00011	0.000	0.046	0.555	0.581
Mining	0.00033	0.000	0.095	1.210	0.231
Manufacturing	0.00006	0.000	0.030	0.156	0.877
Elec.	0.00001	0.000	0.020	0.249	0.804
Construction	0.00022	0.000	0.602	2.113	0.039
Wholesale	-0.00026	0.000	-0.355	-1.825	0.073
Retail	-0.00026	0.000	-1.096	-3.106	0.003
Accommodati	0.00018	0.000	0.271	1.278	0.206
Transport	0.00019	0.000	0.223	1.369	0.176
Commerce	0.00003	0.000	0.024	0.135	0.893
Financial	0.00019	0.000	0.246	1.499	0.139
Property	0.00003	0.000	0.203	0.743	0.460
Government	0.00021	0.000	0.346	2.869	0.006
Education	0.00002	0.000	0.023	0.110	0.913
Health	-0.00006	0.000	-0.154	-0.637	0.526
Cultural	0.00061	0.000	0.769	2.526	0.014
Personnel	0.00011	0.000	0.090	0.414	0.680
Intercept	1.143	0.029		39.058	0.000
N	77				
R^2	0.761				
Adjusted R^2	**0.692**				
Std. Error	0.1386				

Regression of employment trends and property values

The analysis commenced with an examination of the relationship between Total Change and residential property values over the period between 1991 and 2001, with the results listed in Table 1. Although the model produced an adjusted R^2 of 0.692, a large number of the variables proved to be relatively unreliable. To

improve the model, the analysis was rerun using backward stepwise regression, which then produced the model listed in Table 2.

Whilst the adjusted R^2 has only improved slightly to 0.709, the remaining variables have a higher level of reliability in the interpretation. There is evidence that labour types associated with a relatively low wage rate, such as *Retail* and *Wholesale*, are more likely to be linked to LGAs with lower priced housing. In other words, a *Retail* worker has limited financial resources and is restricted in the ability to pay regular rent or mortgage payments after meeting other financial demands. Occupations with comparatively higher remuneration, such as *Mining* and *Construction*, appear to be associated with more expensive house prices in the same regions. Overall, the model in Table 2 provided a useful aggregate insight into changes that are occurring in the labour and property markets, and confirmed that labour markets have a relationship with property values at the LGA level in Victoria.

Table 2: Total change and residential property values

Variable	Co-efficient	Std	Beta	t Statistic	P Level
Mining	0.00040	0.000	0.113	1.722	0.090
Construction	0.00020	0.000	0.529	2.259	0.027
Wholesale	-0.00024	0.000	-0.330	-2.267	0.027
Retail	-0.00015	0.000	-0.654	-2.265	0.009
Financial	0.00028	0.000	0.361	2.959	0.004
Government	0.00015	0.000	0.240	2.384	0.020
Cultural	0.00068	0.000	0.860	5.828	0.000
Intercept	1.145	0.024		48.383	0.000
N	77				
R^2	0.736				
Adjusted R^2	**0.709**				
Std. Error	0.1348				

Table 3 supports this general trend at the LGA level, illustrating the contrasts between two urban areas (Cities of Stonnington and Manningham) with a rural centre (Wangaratta) and a Shire (Latrobe). Both cities recording higher house prices, with more residents employed in *Construction* and *Cultural* industries but fewer employed in the *Wholesale* industry. Both Wangaratta and Latrobe returned lower house prices and were home to comparatively fewer *Mining* and *Financial* workers, but had a marked increase in *Retail* workers. When comparing changes between LGAs, there are vast differences in the population size for each region that should also be considered in the analysis. For example, a slight increase in *Retail* workers in the City of Melbourne would have a negligible effect on house prices,

Table 3: Changes in Selected LGAs between 1991-2001

LGA (Region)	Change in House Prices (deflated)	Mining	Construction	Wholesale	Retail	Financial	Government	Cultural
City of Stonnington (Urban centre)	$192,765	10	333	-208	634	576	-728	643
City of Manningham (Urban centre)	$55,963	-20	64	-376	-139	-297	-757	322
Latrobe (Shire)	-$6,510	-244	-167	146	476	-109	-132	116
Wangraratta (Rural centre)	-$7,473	-17	100	-38	305	-68	-116	53

Table 4: State share and residential property values

Variable	Co-efficient	Std	Beta	t Statistic	P Level
Ag Fish	0.077	0.086	0.114	0.888	0.378
Mining	0.022	0.031	0.057	0.716	0.477
Manufacturing	-0.160	0.101	-0.163	-1.576	0.120
Elec.	0.083	0.102	0.076	0.811	0.421
Construction	0.466	0.137	0.470	3.394	0.001
Wholesale	-0.081	0.125	-0.076	-0.647	0.520
Retail	-0.850	0.221	-0.685	-3.843	0.000
Accommodati	0.114	0.083	0.157	1.382	0.172
Transport	-0.008	0.163	-0.006	-0.048	0.962
Commerce	0.018	0.130	0.023	0.142	0.888
Financial	0.531	0.182	0.533	2.912	0.005
Property	0.005	0.086	0.006	0.055	0.956
Government	0.020	0.187	0.001	0.011	0.992
Education	0.198	0.217	0.149	0.916	0.363
Health	-0.024	0.153	-0.019	-0.160	0.873
Cultural	-0.001	0.059	-0.002	-0.021	0.984
Personnel	-0.311	0.151	-0.221	-2.056	0.044
Intercept	1.316	0.196		6.712	0.000
N	77				
R^2	0.714				
Adjusted R^2	**0.632**				
Std. Error	0.152				

although in Wangaratta, a similar rise would have a larger influence due to the smaller population base. At the same time, there was a widespread decrease in *Government* workers in most regions, although LGAs with a smaller decrease were linked to a higher house prices. Thus, the model was relatively successful for each LGA, although to varying degrees, possibly due to the effect of external factors such as location to access and proximity to the ocean.

The regression model in Table 4 was based on State share and produced an adjusted R^2 of 0.632. A large number of the variables proved to be unreliable, with the model rerun using stepwise regression. The improved model is listed in Table 5 with an adjusted R^2 of 0.663. In a similar manner to Total Change, the model in Table 4 highlighted a negative relationship between change in *Retail* employment and house prices. On the other hand, areas with an increasing proportion of *Financial* workers were linked to higher house prices, followed by the *Construction* and *Accommodation* sectors. It appears that if a region could increase these labour markets, then there would most likely be an increase in residential property values as well.

Table 5: State change and residential property values

Variable	Co-efficient	Std	Beta	t Statistic	P Level
Ag – Fish	0.123	0.060	0.183	2.046	0.045
Construction	0.431	0.113	0.435	3.822	0.000
Retail	-0.893	0.165	-0.720	-5.430	0.000
Accommodati	0.172	0.063	0.235	2.704	0.009
Financial	0.647	0.098	0.649	6.590	0.000
Personal	-0.325	0.115	-0.231	-2.231	0.006
Intercept	1.221	0.132		9.264	0.000
N	77				
R^2	0.690				
Adjusted R^2	**0.663**				
Std. Error	0.145				

The model in Table 6 focussed on Industry Changes and produced an adjusted R^2 of 0.578. Again, a large number of unreliable variables were identified, although this improved in Table 7 after undertaking stepwise regression with an adjusted R^2 of 0.608 as shown in Table 7. However, the contribution of the individual variables in Table 7 again highlights the negative correlation between *Retail* and property values. The remainder of the variables were positively linked to higher house prices, and this was especially apparent with the *Financial, Property* and *Commerce* labour markets. *Mining* and *Cultural* appeared to have a negligible overall contribution, although slightly positive.

Table 6: Industry change and residential property values

Variable	Co-efficient	Std	Beta	t Statistic	P Level
Ag Fish	0.00034	0.000	0.148	1.411	0.163
Mining	0.00120	0.001	0.191	1.825	0.073
Manufacturin	0.00026	0.001	0.223	0.497	0.621
Elec.	-0.00003	0.000	-0.054	-0.494	0.623
Construction	-0.00027	0.000	-0.328	-0.756	0.453
Wholesale	-0.00070	0.001	-0.475	-0.681	0.499
Retail	-0.00077	0.001	-1.088	-1.514	0.135
Accommodat	0.00297	0.000	0.281	0.883	0.381
Transport	-0.00054	0.001	-0.204	-0.950	0.346
Commerce	0.00898	0.005	1.063	1.904	0.062
Financial	0.00208	0.001	1.843	2.219	0.030
Property	0.00220	0.000	1.232	1.730	0.089
Government	0.00041	0.000	0.085	0.471	0.639
Education	0.00114	0.002	0.336	0.650	0.518
Health	-0.00340	0.000	-0.406	-0.995	0.324
Cultural	0.00298	0.000	0.298	0.710	0.481
Personnel	0.00247	0.003	0.622	0.761	0.450
Intercept	1.174	0.046		25.420	0.000
N	77				
R^2	0.672				
Adjusted R^2	**0.578**				
Std. Error	0.1623				

Table 7: Industry change and residential property values

Variable	Co-efficient	Std Error	Beta	t Statistic	P Level
Mining	0.00136	0.000	0.217	2.800	0.007
Retail	-0.00062	0.000	-0.873	-3.271	0.002
Commerce	0.01077	0.003	1.275	3.814	0.000
Financial	0.00203	0.001	1.802	2.977	0.004
Property	0.00027	0.000	1.513	2.886	0.005
Cultural	0.00056	0.000	0.555	1.992	0.050
Intercept	1.135	0.029		39.457	0.000
N	77				
R^2	0.639				
Adjusted R^2	**0.608**				
Std. Error	0.156				

Based on the Regional Shift, the model in Table 8 produced an adjusted R^2 of 0.587, although many of the variables again proved to be unreliable. The subsequent stepwise regression analysis produced a better model in Table 9 with an adjusted R^2 of 0.618, which then allowed an interpretation of the results. With the exception of *Wholesale, Retail* and *Personal,* all of the employment types were positively associated with change in residential property values. The largest contribution was from *Financial*, which was followed by the *Construction, Accommodation* and *Health* sectors.

Table 8: Regional shift and residential property values

Variable	Co-efficient	Std	Beta	t Statistic	P Level
Ag Fish	0.00032	0.000	0.149	1.723	0.090
Mining	0.00044	0.000	0.092	1.028	0.308
Manufacturing	-0.00001	0.000	-0.054	-0.248	0.805
Elec.	-0.00067	0.000	-0.035	-0.389	0.669
Construction	0.00019	0.000	0.349	1.382	0.172
Wholesale	-0.00042	0.000	-0.593	-2.476	0.016
Retail	-0.00014	0.000	-0.463	-1.391	0.170
Accommodati	0.00028	0.000	0.260	1.800	0.077
Transport	0.00004	0.000	0.005	0.023	0.981
Commerce	0.00022	0.000	0.117	0.824	0.413
Financial	0.00055	0.000	0.680	3.434	0.001
Property	0.00004	0.000	0.011	0.071	0.943
Government	0.00027	0.000	0.171	1.904	0.062
Education	0.00009	0.000	0.103	0.654	0.516
Health	0.00012	0.000	0.256	1.501	0.139
Cultural	-0.00002	0.000	-0.014	-0.096	0.924
Personnel	0.00036	0.003	0.622	0.761	0.450
Intercept	1.123	0.018		67.206	0.000
N	77				
R^2	0.680				
Adjusted R^2	**0.587**				
Std. Error	0.1605				

CONCLUSION

This research has presented an insight into the changing relationship between residential property values and residency of employment, incorporating the added

dimension of change over time between 1991 and 2001. The analysis has been somewhat successful in identifying the strengths of the varying relationships between property values and labour types. The emphasis was placed on the relationship between residency of employment and residential house prices in Victoria based on 77 regions or LGAs, rather than a specific LGA and changes within that LGA. The main advantage of using four different shift-share models, namely Total Change, State Share, Industry Change and Regional Shift, was the ability to compare changes in residency of employment with property values. All models returned an adjusted R^2 of between 0.578 and 0.709, although Total Change was clearly more efficient than Regional Shift in the process of explaining variations in house prices. However, the relationship between house prices and individual employment types remained relatively unchanged across all shift-share types.

Table 9: Regional shift and residential property values

Variable	Co-efficient	Std	Beta	t Statistic	P Level
Ag. Fish	0.00035	0.000	0.163	2.004	0.049
Construction	0.00023	0.000	0.415	2.107	0.039
Wholesale	-0.00039	0.000	-0.554	-2.871	0.005
Retail	-0.00016	0.000	-0.541	-2.095	0.040
Accommodati	-0.00033	0.000	0.306	3.056	0.003
Financial	0.00066	0.000	0.833	7.635	0.000
Government	0.00029	0.000	0.182	2.231	0.029
Health	0.00014	0.000	0.301	2.248	0.028
Personal	-0.00042	0.000	-0.314	-1.962	0.054
Intercept	1.123	0.018		69.875	0.000
N	77				
R^2	0.663				
Adjusted R^2	**0.618**				
Std. Error	0.154				

Overall, the findings confirmed there are clear links between where different types of workers live and the value of the housing that they live in. It appears that lower paid occupations such as *Retail* and *Wholesale* are associated with less expensive areas as would be expected, and accordingly, higher paid workers such as *Financial* and *Construction* workers live in more expensive areas. Although housing affordability is clearly related to how much a worker earns in the workforce, it is also related to where a worker chooses to live (as opposed to where industry is located). These initial findings support higher house price trends in major urbanised cities, which also have developed labour markets that include

concentrations of *Financial* and *Construction* industries. In contrast, smaller cities and towns such as in rural areas with cheaper housing predominantly have employers in *Retail* and *Personal* Services industries, although limited employment exists in other industries such as *Construction*. Based on this study, if an LGA could attract industries that need higher paid workers such as *Financial* and *Construction* workers, there would be a general increase in house prices due to the higher level of housing affordability. On the other hand, workers in lower paid industry would require cheaper housing to live in. When attracting industry and planning long term land use in an LGA, policy makers should now consider the affordability levels of workers that live nearby and their housing requirements.

However, this analysis was limited to residency of employment types, namely the region where the workers actually lived, and there may be differences between regions depending on other factors. For example, if there is close proximity to factors such as scenic amenities (for example, coastal areas), there may be a higher proportion of the population who are not in the workforce i.e. retired. Still, it remains that a large proportion of the population are employed in the workforce and due to the links between housing affordability and employment, this analysis is useful and should be developed further.

Future directions

Clearly, there is more work needed in developing the research further following these insightful results. Attention should be given to using different influencing factors, such as employment rates and remuneration levels, which would provide an insight into the links between labour and property markets. In addition, rather than use the larger local government area (LGA), it would be useful to examine the data at statistical local area (SLA) level, or at an even more detailed level. Such an analysis should examine employment and housing prices in relation to transportation networks, social infrastructure, regional commercial centres and existing land uses.

REFERENCES

Australian Bureau of Statistics. 2004. *6416.0 House Price Indexes*, Canberra.

Abboud, S. 1985. The real estate appraiser serving the public: a specialised real estate counsellor, *The Canadian Appraiser*, 29, pp. 19-23.

Antwi, A. 1997. Multiple regression in property analysis. *Readings in Property Economics, Australian Institute of Valuers and Land Economists,* pp. 177-182.

Barff, R. A. and Knight, P. L. 1988. Dynamic shift-share analysis. *Growth and Change,* 19, pp. 1-10.

Blakely, E. J. (ed.) 1994. Planning local economic development: theory and practice. Newbury Park, California, Sage.

Coulson, N.E. & Fisher, L.M. 2002. Tenure choice and labour market outcomes. *Housing Studies*, 17 (1), pp. 35-49.

Dear, M. and Flusty, S. 1998. Post modern urbanism. *Annuals of Association of American Geographers*, 88, pp. 50-72.

Deming, W. G. 1996. A decade of economic change and population shifts in U.S. regions. In *Monthly Labor Review November*, pp. 3-14

Dieleman, F.M., Clark, W.A.V. and Deurloo, M.C. 2000. The geography of residential turnover in twenty-seven large US metropolitan housing markets, 1985-95. *Urban Studies*, 37, pp. 223-245.

Dunn, E. S. 1960. A statistical and analytical technique for regional analysis. *Papers of the Regional Science Association,* 6, pp. 97-112.

Hargreaves, R. 2002. To rent or buy: that is the question. *New Zealand Property Journal*, March, pp. 21-26.

Haynes, K. E. and Dinc, M. 1997. Productivity change in manufacturing regions: a multifactor/shift-share approach. *Growth and Change*, 28, pp. 201-221.

Gujarati, D.N. 1995. *Basic Econometrics*. 4th Edn. McGraw-Hill, New York.

Knudsen, D. C. and Barff, R. 1991. Shift-share analysis as a linear model. *Environment and Planning A,* 23, pp. 421-431.

Ling, D.C. and Archer, W. R., 2005. *Real Estate Principles – A Value Approach*. McGraw-Hill, New York.

Pettit, C. Shyy, T. and Stimson, R., 2002. An on-line planning support system to evaluate urban and regional planning scenarios. *Planning Support Systems in Practice*, (ed.) Geertman, S. & Stillwell, J. London, Springer-Verlag, pp. 331-348.

Phe, H. H. and Wakely, P. 2000. Status, quality and the other trade-offs: towards a new theory of urban residential location. *Urban Studies*, 1, pp. 7-35.

Reed, R. G. and Greenhalgh, E.S. 2002. Factors influencing the rent vs. buy decision – implications for housing markets. *Papers of the Australia and New Zealand Regional Science International Association Conference,* 29/9 – 2/10/02, Fremantle.

Rigby, D. L. and Anderson, W. P. 1993. Employment change, growth and productivity in Canadian manufacturing: An extension and application of shift-share analysis. *Canadian Journal of Regional Science,* XVI, pp. 69-88.

Rosenburg, L. and Watkins, C. 1999. Longitudinal monitoring of housing renewal in the urban core: reflections on the experience of Glasgow's merchant city. *Urban Studies*, 36, pp. 1973-1996.

Stimson, R. J. and Davis, R. 1999. Social and economic change in Queensland local government areas over the decade 1986-1996. *Western Regional Science Association Conference,* 38th Annual Meeting, 21-24 February, Ojai California.

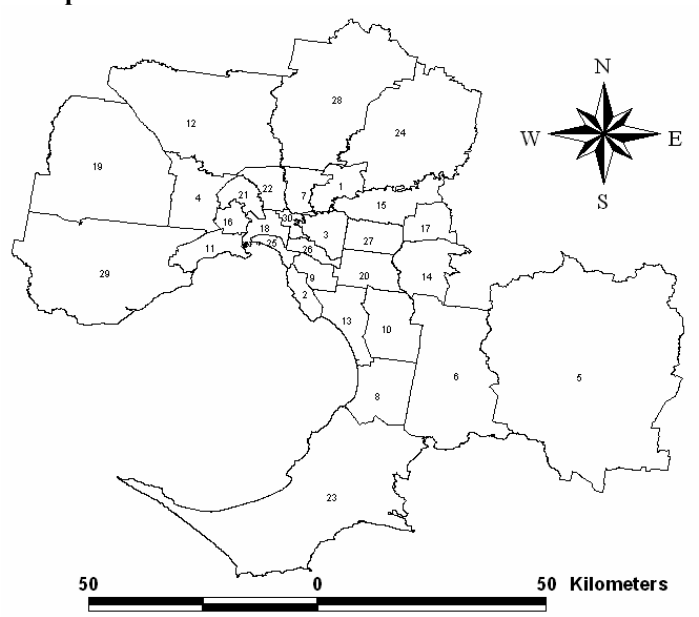
Tabachnick, B.G. and Fidell, L.S. 2001. *Using Multivariate Statistics.* Allyn and Bacon, Boston.

Watt, P. 2003. Urban marginality and labour market restructuring: local authority tenants and employment in an inner London Borough. *Urban Studies*, 40(9), pp. 1769-1789.

Winger, A. R. 1997. Local real estate demand in a globalizing world., *Real Review Estate*, 27, pp. 100-103.

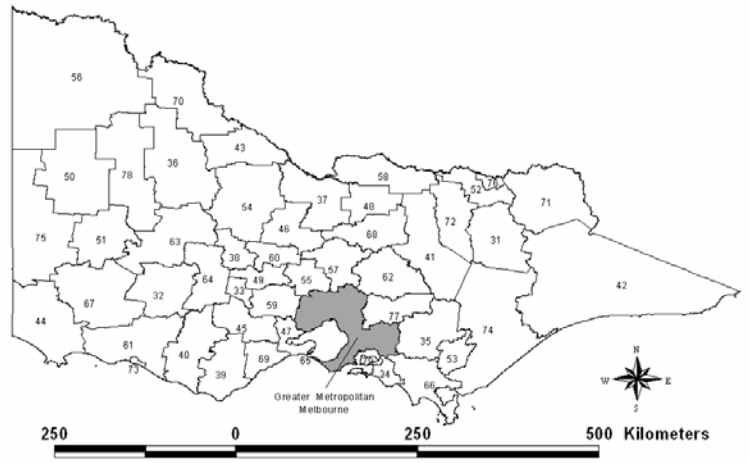
APPENDIX A – MELBOURNE LGA LOCALITY MAPS

Greater metropolitan Melbourne - LGAs



LGA	Index No.	LGA	Index No.	LGA	Index No.
Banyule	1	Hobsons Bay	11	Moonee Valley	21
Bayside	2	Hume	12	Moreland	22
Boroondara	3	Kingston	13	Mornington Peninsula	23
Brimbank	4	Knox	14	Nillumbik	24
Cardinia	5	Manningham	15	Port Phillip	25
Casey	6	Maribyrnong	16	Stonnington	26
Darebin	7	Maroondah	17	Whitehorse	27
Frankston	8	Melbourne	18	Whittlesea	28
Glen Eira	9	Melton	19	Wyndham	29
Greater Dandenong	10	Monash	20	Yarra	30

Non-metropolitan Melbourne - LGAs



LGA	Index No.	LGA	Index No.	LGA	Index No.
Alpine	31	Greater Geelong	47	Northern Grampians	63
Ararat	32	Greater Shepparton	48	Pyrenees	64
Ballarat	33	Hepburn	49	Queenscliffe	65
Bass Coast	34	Hindmarsh	50	South Gippsland	66
Baw Baw	35	Horsham	51	Southern Grampians	67
Buloke	36	Indigo	52	Strathbogie	68
Campaspe	37	Latrobe	53	Surf Coast	69
Central Goldfields	38	Loddon	54	Swan Hill	70
Colac-Otway	39	Macedon Ranges	55	Towong	71
Corangamite	40	Mildura	56	Wangaratta	72
Delatite	41	Mitchell	57	Warrnambool	73
East Gippsland	42	Moira	58	Wellington	74
Gannawarra	43	Moorabool	59	West Wimmera	75
Glenelg	44	Mount Alexander	60	Wodonga	76
Golden Plains	45	Moyne	61	Yarra Ranges	77
Greater Bendigo	46	Murrindindi	62	Yarriambiack	78
				Unincorporated VIC	79