

# ECONOMIC PERFORMANCE ANALYSIS OF THE AUSTRALIAN PROPERTY SECTOR USING INPUT-OUTPUT TABLES

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## ABSTRACT

*The property sector has played an important role with its growing contribution in the national income and employment in the Australian economy. There is an increasing research need in measuring and analysing the economic performance of the Australian property sector at a country level and input-output tables are considered as an appropriate tool. This paper aims to analyse and measure the performance and sectoral linkages of the Australian property sector using the five latest input-output tables compiled by the Australian Bureau of Statistics. Findings suggested that the Australian residential property sector had played a more important role than the commercial sector in the economy. The backward linkage of the residential property sector showed a decreasing economic pull, while that of commercial property presented an upward pattern. Moreover, the Australian property sector showed a medium economic push to the national economy over the examined period. Findings can aid policy makers, the property sector and researchers in evaluating the competitive ability of the property sector in Australia.*

**Keywords:** Input-output tables, property sector, sector linkages

## INTRODUCTION

With its growing share in the national economy, the property sector has been considered a vital contributor of economic development (Liu et al., 2005). Improved country studies are needed in order to gain a better comprehension of the specificities of the property sector and its role in economic development, and then the structural characteristics and development trend of the property sector in Australia can be well described. However, the consistent studies in the importance of Australian property sector at a macro level are hindered due to the lack of usable input-output tables after the 1980s. Over the 1990s, Australia experienced a recession at the beginning of 1990s and a boom at the end of 1990s (Bodman and Crosby, 2002). According to the Australian Bureau of Statistics, Australian Gross Domestic Product (GDP) growth increased from \$5,753 to \$8,121 per capita at current prices during the same period. The Australian property sector accounted for an average of 12.47% of GNP, and employed on average 1.3% of the work force in the

1990s (ABS, 2000). Given the important role of the property sector in the Australian economy, it is necessary to explore the new development of the property sector and understand the new relationship of the sector with other economic sectors during the 1990s.

Input-output analysis focuses on how inter-sector trading influences the overall demand for labor and capital within an economy (Leontief, 1966). The input-output model is an adaptation of the neo-classical theory of general equilibrium to the empirical study of the quantitative interdependence between different economic sectors of the economy. The input-output table is a system of accounts which record the supply and disposal of goods and services produced within an economic system in value terms over a given time period. This is achieved by disaggregating the products produced in the economy according to industry groups or sectors, and recording the transactions flows among these sectors in a tabular format. Based on an input-output table, the input-output analysis describes the flow of goods and services between different sectors in the given time period. By displaying all flows of goods and services within an economy, the input-output technology may describe the relationship between the property services sector and other industries, and reflect the importance of the property sector in the national economy.

The Australian Bureau of Statistics (ABS, 2004) has recently released the 1998-99 input-output table. It has to be mentioned that due to the complex estimation procedures and massive data sources that must be incorporated, the input-output table can not be usually compiled for each successive year, but for every few years. Combined with previous publications (ABS, 2001), five input-output tables are investigated over the 1990s: 1992-93, 1993-94, 1994-95, 1996-97, 1998-99 in this paper. The tables compiled according to the Australian input-output methodology reflected the structure of the Australian economy for the years in respect of which they were compiled. The paper structure first provides a review of the input-output analysis for the property sector. The property sector is then examined in terms of their share in gross national product (GNP), gross national income (GNI) and gross domestic product. Furthermore, the composition and nature of linkages of the property sector including pull and push effects are analysed and tested respectively. Finally, a concluding comment summarises the paper.

## **INPUT-OUTPUT ANALYSES FOR THE PROPERTY SECTOR**

Input-output tables provide detailed information about the supply and disposition of products in an economy and about the structure and inter-relationships between sectors. The rows of an input-output table illustrate the distribution of a producer's output throughout the economy, while the columns describe the composition of inputs required by a particular sector to produce its output. The input-output analysis breaks the economy into sectors and focuses on how inter-sector trading influences the overall demand for labor and capital within an economy. A sample input-output table can be found in Figure 1.

**Figure 1: A sample input-output table**

		Production sector					Total intermediate output	Total final demand	Total output
		1	...	j	...	n			
Production sector	1								
	...								
	i			$X_{ij}$			$X_{i\cdot}$	$Y_i$	$X_i$
	...								
	n								
Total intermediate input				$X_{\cdot j}$					
Total valued added				$V_j$			$Y=V$		
Tax				$T_i$			$T$		
Subsidies				$S_i$			$S$		
Total input				$X_i$					

The symbol  $X_{ij}$  represents the intermediate flow from sector  $i$  to sector  $j$ . The total output of the sector is divided into intermediate output  $X_{i\cdot}$  and final demand  $Y_i$  for its goods and services (consumption, investment, government expenditures, etc.). The total input of the sector is divided into intermediate input  $X_{\cdot j}$  and value added  $V_j$ , which represents the supply of primary inputs or factors of production needed by the sector (labour, capital, land, etc.).  $T_j$  and  $S_j$  represent the tax and subsidies on products respectively. The total output  $X_i$  equals total intermediate output plus final demand, and the total input  $X_j$  equals total intermediate input plus valued added and tax minus subsidies.

Using an input-output approach, the role of the property sector in national economies has been explored widely by several writers and the relationship between the construction sectors and the economic maturity has been studied for Australia, Finland, Italy, Japan, Turkey, UK and USA, from the 1960s to 1980s (Bon, 2000; Lopes, 2003; Su et al., 2003). The findings revealed that the more developed an economy, the smaller the construction sector, namely, so-called inverted U-shaped relationship. In the area of property service, it is argued that the property service is a consumption concept whereas the property capital stock is an investment concept and different ways to measure service consumption will give different interpretations and results (Tse, 1994). Roulac (1996) examined the property financial input-output relationships and Pagliari et al. (1997) compared commercial property output in Australia, Canada, the United Kingdom and the United States over the period 1985-1995 by analysing separately office, retail and warehouse sectors. Furthermore, Roulac (1999) addressed the application of the value chain concept to how property facilitates the connection of inputs to the value creation process to deliver

goods and services to consumers. In the context of the input-output tables, Li et al. (2003) analysed the property sector based on the Chinese input-output table. Liu et al. (2005) and Song et al. (2005) performed a multinational input-output analysis on the property sector based on the Organisation for Economic Co-operation and Development (OECD) input-output database before the reference year 1990. Using the same input-output table, Song et al. (2004) described the linkage differences between the property and construction sector for Australia and the other six OECD countries. However, due to the date limitation, the role of property sector is not explored sufficiently using the input-output tables in the 1990s.

## **AUSTRALIAN INPUT-OUTPUT TABLES**

With the release of tables for 1998–1999 in June 2004, the ABS has published 18 input-output tables for Australia. Previous tables are for reference years 1958–59, 1962–63, 1968–69, 1974–75, for each year from 1977–78 to 1983–84, 1986–87, 1989–90, 1992–93, 1993–94, 1994–95 and 1996–97. This paper uses five Australian input-output tables in the 1990s. The five tables include input by sector and output by product group; sector-by-sector flow matrices; direct and total requirement coefficients matrices, margins matrices and employment by sector. Selected tables are available at the 35 and 106-industry level. These tables have been compiled using the input-output methodology introduced for the compilation of the 1974–1975 tables. It includes estimating from basic data sources the summary aggregates (sector output, primary inputs and final uses) and then estimating intermediate inputs from the preceding tables in the series using a mathematical estimation technique involving a combination of clerical and mathematical estimation techniques to satisfy optimally the accounting constraints imposed by the summary aggregates (for details, see ABS, 2004).

This paper adopts the 106-sector indirect-allocation-of-imports input-output tables based on the basic prices. The property sector is divided into two sub-sectors in the 106-sector table, namely ownership of dwelling and other property service. The former represents the residential property services. The latter mainly represents the commercial property services (ABS, 2004). The indirect-allocation-of-imports method records all imports as adding to the supply of the sector to which they are primary and then allocating this supply along the corresponding row of the table to using sectors. According to ABS, this method better reflects the technological input structure of the sector and better reflects the product composition of final use (ABS, 2004). Moreover, the basic price is chosen because it is the most common valuation convention. The basic price means that the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, on that unit as a consequence of its production or sale (ABS, 2004).

This paper analyses seven indicators proposed by Bon (2000) and further developed by Liu et al. (2005) for the Australian property sector. The share of the general property

sector in GNP and share of the property sector in GNI and GDP are adopted to explore the weight of the property sector in the economy. The backward indicators, and direct property sector inputs from other sector indicators are used to analyse the pull effect. The forward indicators and direct property sector outputs to other sector indicators are chosen to investigate the push effect. The formulas of the seven indicators are shown as below:

- The share of sector  $i$  in gross national product =  $Y_i / Y$
- The share of sector  $j$  in gross national income =  $V_j / V$
- The share of sector  $j$  in gross national income =  $V_j / (V+T-S)$
- The direct forward linkage indicator =  $X_i / X_i$
- The direct output indicator =  $X_{ij} / X_i$
- The direct backward linkage indicator =  $X_{.j} / X_j$
- The direct input indicator =  $X_{ij} / X_j$

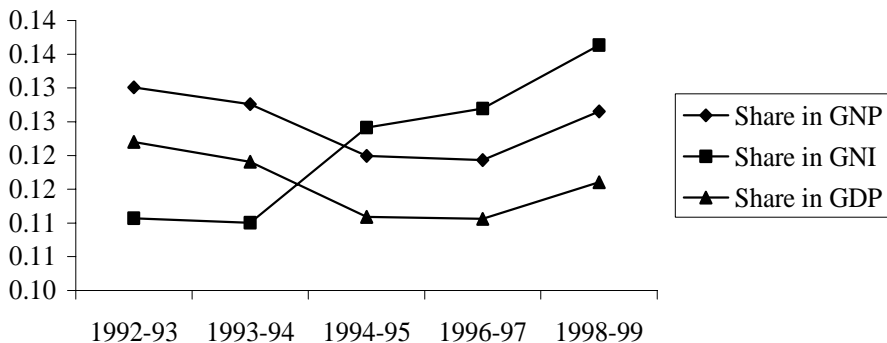
## **THE WEIGHT OF THE PROPERTY SECTOR IN THE ECONOMY**

The share of the general property sector in GNP, GNI and GDP can measure the importance of the property sector in the entire economy. In terms of national product and income accounting conventions, total final demand represents GNP, total value added represents GNI (Bon, 2000), and GDP records the value created through the process of production and is the sum of the total value added by sectors plus taxes less subsidies on products. A higher value implies larger contributions of the property sector to the national economy. Figure 2 shows the share of Australian property sector in GNP, GNI and GDP respectively. The different values of the indicators represent the different developing levels of the property sector and the higher shares in GNP and GDP report a higher developing level. Moreover, a higher share in GNI indicates a higher proportion of the sectoral value added in total value added, and reflects the importance of the property sector from an output point of view.

The development pattern of property sector share in GNP can be divided into two stages, one is from the reference year 1992-93 to 1996-97, and another is 1998-99. The decrease in the first stage may result from the recession at the beginning of 1990s in Australia (Bodman and Crosby, 2002). The increase in 1998-99 was mainly due to the income increase of the private sector businesses in the property services industry. Over the study period, the share in GNI increased from 11.07% to 13.63%. According to the 1998-99 property services industry survey (ABS, 2000), during 1998-99, private sector businesses in the property services industry generated \$3903 million in income, which was a 19% increase on the industry income generated in 1996-97 and 64% of income was generated from property sales and leasing commissions, a marginal increase from the 61% recorded

in 1996-97. Interestingly, the share of GDP show a parallel pattern with GNI, given a fixed rate of tax and subsidies.

**Figure 2: The weight of the general property sector in the economy**



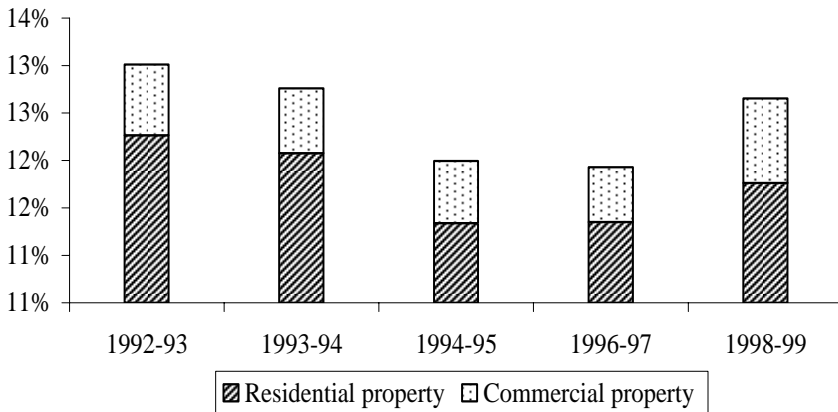
The residential and commercial property services are the two main sub-sectors of the property sector in the Australian input-output industry classification. Figure 3 presents the shares of the residential and commercial property sectors in GNP.

Similarly, a decreasing tendency can be found in the share of residential and commercial property services, which was a consequence of the recession at the beginning of 1990s. The boom at the end of 1990s resulted in an increasing share in 1998-99. In Australia, the share of the residential property sector in the GNP was larger than that of the commercial property sector. It implies that the residential property sector has played a more important role than the commercial sector in the economy.

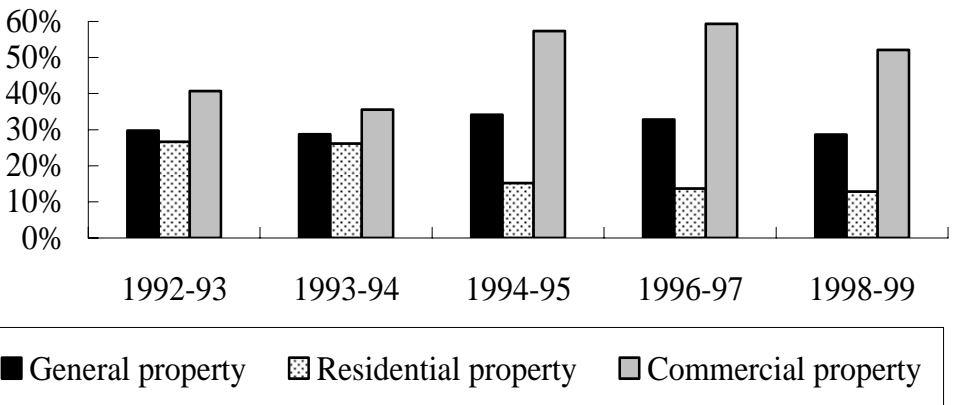
## THE PULL EFFECT OF THE PROPERTY SECTOR

The backward indicator shows the proportion of the property sector's inputs that comes from other sectors, rather than from primary inputs—land, labour, capital, etc. It indicates the degree of the industrialisation and technical level of the property service process, because it is generally agreed that input-output tables reflect a general equilibrium model of the economy where inputs are allocated according to technological availability. More importantly, it represents the strength of the property sector's economic pull. The larger the value, the higher is the national technologies level of the intermediate inputs and the stronger is the pull of the property sector. Figure 4 shows the backward linkage indicators of the general property, residential property and commercial property sectors in Australia over the 1990s.

**Figure 3: The shares of property sector in GNP**



**Figure 4: Backward linkage indicators**



The value of the general property backward linkage was stabilizing at a value between 28% and 35%. Compared with the backward linkage indicator of the construction sector, the value suggests a relatively lower industrialization level of the property sector than the construction sector (Pietroforte and Gregori, 2003). In other words, the property sector's ability to pull the rest of the economy was weaker than that of the construction sector (Liu et al., 2005). Due to the fact that property plays a fundamental connecting role in the value chain (Roulac, 1999), the relatively lower technologies level is reasonable. Interestingly, while the backward linkage of residential property sector showed a downward trend, that of commercial property presented an upward trend. This pattern derived from a dramatically decline in the demand of the banking and residential building sectors and a considerable growth in the demand of commercial property itself. The recession in the Australian economy in the 1990s resulted in the decline in private demand.

In order to investigate the input compositions of the property sector, the inputs from other sectors to the property sector are ranked as shown in Table 1. On average, the property and business service, manufacturing, finance and insurance and electricity, gas and water service were ranked top five in all sectors over the 1990s. Then, a nonparametric test is conducted. Because of a relatively small sample, a two-tailed test is conducted. The Spearman correlation is selected to test whether the input structure change is considerable or not. The significance level is 0.05 (2-tailed). Table 2 presents Spearman rank correlation coefficient analysis results of property inputs. As expected, the results accept the hypothesis and suggest the rankings are significant to the 99% level (*probability*<0.01), namely, the change in the input compositions is not considerable. Over the 1990s, the input compositions to the property sector were kept stable relatively. The stable input structure on the one hand represented the relatively mature economy. On the other hand, it also describes the inactive Australian property sector, especially on the technical progress aspect.



**Table 1: Rank of direct inputs from the other sectors to property agent sector**

<b>Sector</b>	<b>1992-93</b>	<b>1993-94</b>	<b>1994-95</b>	<b>1996-97</b>	<b>1998-99</b>
Agriculture, Forestry and Fishing	17	17	14	15	15
Mining	14	14	15	14	16
Manufacturing	3	3	2	2	2
Electricity, Gas and Water Supply	4	4	6	7	7
Construction	8	7	7	8	10
Wholesale Trade	9	9	9	9	8
Retail Trade	13	13	16	16	14
Accommodation, Cafes and Restaurants	12	12	8	6	6
Transport and Storage	7	6	5	4	4
Communication Services	5	5	4	5	5
Finance and Insurance	2	2	3	3	3
Property and Business Services	1	1	1	1	1
Government Administration and Defence	11	11	12	11	11
Education	16	16	13	13	12
Health and Community Services	15	15	17	17	17
Cultural and Recreational Services	6	8	10	10	9
Personal and Other Services	10	10	11	12	13

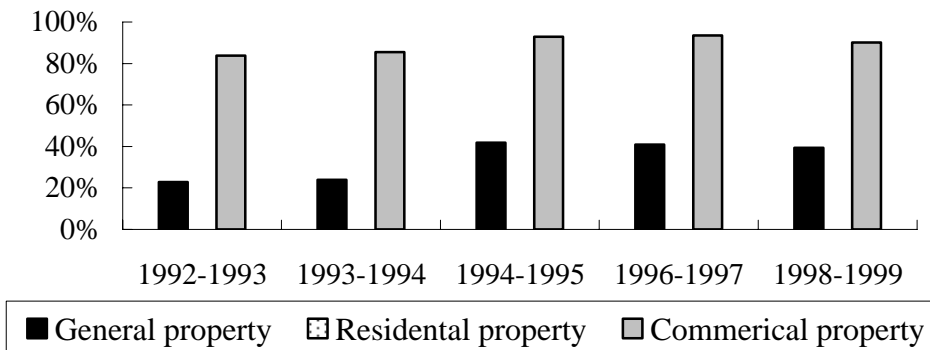
**Table 2: Spearman rank correlation coefficient analysis results of the input of property sector**

		<b>1992-93</b>	<b>1993-94</b>	<b>1994-95</b>	<b>1996-97</b>	<b>1998-99</b>
	Sample Number	17	17	17	17	17
1992-1993	Correlation Coefficient	1.000	.993	.904	.875	.868
1993-1994	Correlation Coefficient	.993	1.000	.924	.895	.877
1994-1995	Correlation Coefficient	.904	.924	1.000	.985	.963
1996-1997	Correlation Coefficient	.875	.895	.985	1.000	.980
1998-1999	Correlation Coefficient	.868	.877	.963	.980	1.000

## **THE PUSH EFFECT OF THE PROPERTY SECTOR**

The direct forward linkage indicator shows the strength of the property sector's economic push. It represents the intermediate use to total output ratio of the property sector. A higher value implies that the push of the property sector is larger. Figure 5 shows the forward linkage indicators of the general property, residential property and commercial property sectors in Australia over the 1990s. It can be noticed that direct forward linkage indicators of general property have a medium value between 22 and 42 percent compared with the construction sector, which means a medium economic push. Also, the value of the indicator reflects that the proportion of final demand of the property sector is larger than its intermediate demand. In Australia, all residential property services and most of the commercial property services flowed into final demand; that is, private domestic consumption and government consumption. The forward linkage of the private property sector was zero, because all outputs of private property contribute to the final demand (Roulac, 1999). The forward linkage of the commercial property sector reflected the whole property sector's value with a higher value around 90%. The main reason seems to be that the property sector has a major role in creating demand and attracting the buyer to the distribution system (Roulac, 1999). Furthermore, it represents the medium push strength to the economic development.

**Figure 5: Forward linkage indicator**



The outputs from the property sector to other sectors are ranked as shown in Table 3. On average, the outputs of property contributed to the property and business service, manufacturing, wholesale trade, retail trade and construction sectors, which are ranked top five in all sectors. Similarly, in order to investigate the output compositions of the property sector, a nonparametric test is conducted. Table 4 presents Spearman rank correlation coefficient analysis results of property outputs. As expected, results suggest the rankings are significant to the 99% level; namely, the change in the output compositions are not sizeable. Over the 1990s, the output compositions of the property sector were stable. A stable output structure indicates the Australian property sector had a steady propulsive role in the economy. However, a secular change in the construction rank can be found, which increased from number eight to number five.

**Table 3: Ranks of the direct outputs of the property sector to the other sectors**

<b>Sector</b>	<b>1992-93</b>	<b>1993-94</b>	<b>1994-95</b>	<b>1996-97</b>	<b>1998-99</b>
Agriculture, Forestry and Fishing	13	14	15	16	16
Mining	10	9	11	11	11
Manufacturing	2	2	3	3	2
Electricity, Gas and Water Supply	15	15	13	15	15
Construction	8	5	6	6	5
Wholesale Trade	5	4	2	2	3
Retail Trade	3	3	4	4	4
Accommodation, Cafes and Restaurants	11	10	8	7	8
Transport and Storage	6	7	5	5	6
Communication Services	16	16	16	13	14
Finance and Insurance	7	11	10	9	7
Property and Business Services	1	1	1	1	1
Government Administration and Defence	4	6	7	8	9
Education	17	17	17	17	17
Health and Community Services	9	8	9	10	13
Cultural and Recreational Services	12	12	12	12	12
Personal and Other Services	14	13	14	14	10

**Table 4: Spearman rank correlation coefficient analysis results of property sector outputs**

		<b>1992-93</b>	<b>1993-94</b>	<b>1994-95</b>	<b>1996-97</b>	<b>1998-99</b>
	Sample Number	17	17	17	17	17
1992-1993	Correlation Coefficient	1.000	.956	.936	.912	.885
1993-1994	Correlation Coefficient	.956	1.000	.966	.939	.904
1994-1995	Correlation Coefficient	.936	.966	1.000	.978	.929
1996-1997	Correlation Coefficient	.912	.939	.978	1.000	.956
1998-1999	Correlation Coefficient	.885	.904	.929	.956	1.000

## CONCLUSIONS

This paper aims to analyse and measure the economic performance and sectoral linkages of the Australian property sector in the 1990s. Findings suggested that the Australian residential property sector had played a more important role than the commercial sector in the economy. While the backward linkage of residential property sector showed a decreasing economic pull, that of commercial property presented an upward trend. The Australian property sector had the medium economic push strength because all residential property services and most of the commercial property services flowed into final demand. Over the study period, the input and output compositions of the property sector were stable. Findings can aid policy makers, property agencies and researchers in evaluating the competitive ability of property agents in Australia.

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