Output and Productivity Comparisons of the Transport and Communication Sectors of South Korea and Australia, 1990 to 1998†

Boon Lee‡
School of Economics and Finance
Queensland University of Technology

William Shepherd
School of International Business
Griffith University, Nathan Campus

Abstract

This paper examines the output and productivity performance of the Transport and Communication sector in South Korea and Australia, from 1990 to 1998. The aim of the paper is two-fold. First, the paper is the first in a series which compares the performance of various industries within the service sector. Second, it introduces a method for derivation of appropriate currency converters or purchasing power parities (PPPs) to enable quantification of output and productivity at various disaggregated levels. This method is based on the industry-of-origin approach as refined by the International Comparisons of Output and Productivity (ICOP) project based at the University of Groningen.

1. Introduction

The service sector has become a major contributor towards economic growth largely due to its growing share of GDP contribution and the rising levels of employment in services. This is noticeable within the Asian economies, principally in Japan, Korea, Hong Kong and Singapore. This trend is also clear in the Australian economy. In 1990, Australia's service sector accounted for 64 percent of total GDP (World Bank, 1992). This rose to 68 percent of total GDP in 1997 (World Bank, 1998/99). In Korea, the contribution to total GDP rose from 46 per cent in 1990 (World Bank, 1992) to 51 percent in 1997 (World Bank, 1998/99). Services have become an important exports as witnessed by the increasing proportions of international trade in producer services, especially in areas of education, tourism and finance. Consequently, the comparative productivity performance of the service sector has a direct impact on the trade balance of each country. Furthermore, the information technology revolution (IT) is at an early stage of development which suggests that the growth in services should rise rapidly.

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‡ Corresponding author: Dr. B.L. Lee, School of Economics and Finance, Queensland University of Technology, GPO Box 2434, Brisbane, QLD, 4001. Tel: (07) 3864 5389; Fax. (07) 3864 1500; email: bl.lee@qut.edu.au

This paper is the first in a series of South Korea-Australia comparisons intended to cover major parts of the service sector, namely wholesale and retail trade, finance, health, education, etc. When a comparative analysis involves services, two major problems are encountered. First is the difficulty in distinguishing prices, quantities and quality of services. Hill (1977) noted that the quantity of a service is difficult to capture as it often represents a process by which a consumer or consumer good is changing. Furthermore, unlike manufactured goods, services are characterised by a greater degree of heterogeneity, which makes aggregation difficult. This is discussed below in analysing the quantification of output for the transport and communications industry. Second, meaningful real output and labour productivity comparisons are difficult since each country's output and productivity is expressed in its own currency unit and has to be converted into a common currency. Direct comparisons further require the use of approximate currency converters. The use of exchange rates is not suitable since they are heavily influenced by capital movements and exchange rate adjustments and do not reflect real price differences between countries. Several well-known studies (see Kravis, Heston and Summers, 1982, and OECD, 1992) have derived PPPs from the expenditure side of national accounts. However, these are inappropriate currency converters as industry output comparisons are expressed in terms of producer prices. As a result, purchasing power parities (PPPs) from the production side must be derived and used as currency converters in an attempt to develop real output and productivity comparisons.

The aim of this paper is two-fold. First, the paper introduces a method for derivation of appropriate currency converters or purchasing power parities (PPPs) for quantification of output and productivity at various disaggregated levels within the transport and communications industry. Second, the paper compares real output and labour productivity of the transport and communications industry between South Korea (henceforth Korea) and Australia for the period 1990-98. This method is based on the industry-of-origin approach as refined by the International Comparisons of Output and Productivity (ICOP) project (see Maddison and van Ark (1988), Pilat (1994), Mulder (1994), and Van Ark, Monnikhof and Mulder (1999)).

The paper is divided into 4 sections. Following the introduction, section 2 describes the sources and methodology used in the paper. Section 3 presents the results of real output and productivity comparisons for the benchmark year 1995 and productivity trends from 1990 to 1998. The paper concludes with some brief comments.

2. Sources and Methodology

The ICOP approach primarily uses disaggregated or detailed data from relevant census publications or survey reports. Disaggregated or detailed data refers to the four-digit level of the international standard industrial classification (ISIC) for Australia and the five-digit level for Korea in their respective transport and communications sectors. In essence, detailed prices and quantity output for the benchmark year 1995 is required to enable the ICOP approach to be employed. Data sources used for the benchmark year for each country are listed in Table 1.

Table 1 presents the basic data necessary for the ICOP approach to be applied. For the time-series (1990-1998), value added figures were derived from each country's national accounts.

Table 1
Quantity and Value Output of Freight and Passengers, and Communications
Australia and Korea, 1995

	Quantities Produced (million)							
	Moving Services (tonne km or passenger km)			Terminal Services (tonnes or passengers)			Gross Value of Output (h)	
	Korea (1)	Australia (2)	Australia/ Korea (%) (3)	Korea (4)	Australia (5)	Australia/ Korea (%) (6)	Korea (million Won) (7)	Australia (million Aus$) (8)
Passenger Transport								
- rail	29,292	9,810 e	33.5	790	440.6 d	55.7	2,675,232	1,878
- road	72,324	258,000 f	356.7	11,282	1,061.8 g	9.4	13,069,500	2,974
- inland/coastal	502	464 f	92.4	8.68	15.1 f	174.1	114,418	125
- air (a)	69,019	64,407 f	93.3	35.5	33.5 f	94.4	5,711,672	9,818
Freight Transport								
- rail	13,838	102,019 b	737.2	57.3	393.9 b	687.0	776,115	3,943
- road	18,213	119,227 c	654.6	408.37	1,222.0	299.2	8,220,904	18,331
- inland/coastal	43,936	109,200 f	248.5	129.11	49.2 f	38.1	1,156,055	1,330
- air (a)	8,219	1,890 f	23.0	1.61	0.5 f	30.9	68,710	1,592
Communications ('000s)	Korea	Australia	Australia/ Korea (%)					
- Telephone Subs.	18,600	6,432 i	34.6	na	na	na	20,026,077	14,788
- Mobile Phone Subs.	1,641	3,060	186.4	na	na	na	na	na
- Mail handled	3,456	3,938	113.9	na	na	na	1,276,393	5,154

na - not applicable.
(a) Includes both domestic and international.
(b) Average of 1994-95 and 1995-96.
(c) Figures at 30 September 1995.
(d) Government railways only. Average of 1994-95 and 1995-96.
(e) June 1995 figure. Includes urban motorised and non-urban motorised passenger task.
(f) Figure refers to 1994-95.
(g) Consists of urban public transport. Private motoring not included.
(h) Gross value of output for Australia refers to year 1994-95.
(i) Number of subscribers is derived by multiplying the percentage of households (96.8%) with a connected telephone to the total number of housholds (6,645,000) owning/paying for the use of telephone. The estimate refers to February 1996 and is assumed to be representative for year 1995.
Column (7) gross value of output derived by adding Korean value added at factor cost to production costs (ie. intermediate consumption). Value output for passenger rail and freight rail derived by adding up each activity's value added with the production costs from NSO, *Report on the Transportation Survey, 1995*. The production cost figures were however at the aggregated level and had to be disaggregated into passenger and freight based on the value added share for each rail activity. The estimated gross value output for the rail transport in this table is very similar to the rail transport gross value output in the NSO report.
For air transport, value output for air transport as a whole was derived by summing the value added to the operating expenses. Disaggregated level (ie for passenger and freight transport) was not available. Hence, the estimated disaggregated values were derived by assuming that the proportion of operating expenses for the scheduled flights over total operating expenses is representative of the value output for passenger transport. This is assuming that scheduled flights indicate the timetable of passenger flights. The remaining value output represents the non-scheduled flights which is indicative of freight transport.
1995 value output for telecommunications at both aggregated and disaggregated level was not available. 1995 value added at the disaggregated level was taken from the Input-Output tables. Production costs were also not availble at the disaggregated level for 1995 but available for 1998. It is assume that the proportion of production costs over value added for 1995 is the same as 1998.
Column (8) gross value of output derived using values from the Australian Input-Output Tables. Values derived by summing the margins and non-margins. As for the value output of sea, only margin values were given for freight. As for non-margins, the value included both freight and passenger.It is assumed that the non-margin values for both freight and passenger values are in the proportions of 0.9 and 0.1. This is based on the assumption that almost 90% of the coastal shipping task is generated by bulk freight (see Apelbaum Consulting Group Pty Ltd, 1997, p. 66). Disaggregated levels in terms of inland/coastal and deep-sea were not available. Hence, the proportions were based on the number of ships that operated on the coastal routes over the total number of ships in the fleet. This was 61% (Figures from ABS, *Yearbook Australia ,1997*, p. 533).

Source: Australia from ABS, *Yearbook Australia, (various issues)*. ABS, *Australian Transport and the Environment 1997,* Cat. No. 4605.0. BTCE, *Transport and Communications Indicators, December Quarter 1996,* Australian Government Publishing Service, Canberra. Value output from ABS, *Input-Output Tables Product. Details, 1994-95,* (Cat. No. 5215.0). Apelbaum Consulting Group Pty Ltd 1997, *The Australian Transport Task, Energy Consumed and Greenhouse Gas Emissions,* Volume B - Report, Canberra. ABS, *Household use of Information Technology, Australia 1996* (February), Cat. No. 8128.0.
Korea from NSO, *Major Statistics of Korean Economy 1996,* p. 108-110. NSO, *Korean Statistical Information System 1999,* (KOSIS Computer Database), Seoul.

One of the major obstacles in transport and communications comparisons is the measurement of output. Some studies on transport measure output only in physical terms, for example, in tonnes-km and passengers-km (Girard (1958), and Gadrey, Noyelle and Stanback Jr. (1990)), or in the number of calls and access lines and the number of items of mail handled in communications (Rostas (1948), and Paige and Bombach (1959)). Other studies weight physical output in terms of relative prices (for example, revenue or value of output per passenger-km or tonne-km), and use this weighting system to derive Laspeyres and Paasche PPPs. These are then used to convert output into a common currency. If countries with very different average haul or passenger trip length are compared, the output measure must take separate account of loading and unloading services and costs which are more important, proportionately, in a country with shorter hauls or passenger trips. The activity of loading and unloading, termed as terminal services, is excluded in Rostas (1948), Girard (1958), and Pilat (1994), but included in total output estimations by Paige and Bombach (1959), and Smith, Hitchens and Davies (1982).

The current study employs the approach used by earlier ICOP studies (see Mulder (1994), and Van Ark, Monnikhof and Mulder (1999)). Essentially, the ICOP method aims to compare the production volume of each industry within a sector and for the sector as a whole. The volume of services requires quantification of service output, similar to that for manufacturing, which has physical output. In transport, "physical output" would therefore consist of two parts: (a) moving freight or passengers over a certain distance (ie. moving services), and (b) loading and unloading services (ie. terminal services). The first can be measured in tonne kilometres (tonne-km) or passenger kilometres (passenger-km) and the second by the amount of tonnes of freight or number of passengers. It must be noted however, that transport activity includes not only the movement of passengers and freight but also loading and unloading. The latter activity is significant in that it requires more labour input per unit of output than the movement of passengers and freight. Hence, any omission of terminal service would ultimately lead to either an overstatement or understatement of output.

Table 2, shows that Korea and Australia exhibit differences in the average distance of passenger and freight transport for particular transport modes. The terminal element increases in importance when the average haul distance is shorter (Van Ark, Monnikhof and Mulder 1999). The average road freight transport in Korea (45 km) is approximately half of that in Australia (98km). This implies that there are more loading and unloading activities in Korea than in Australia. This is to be expected due largely to the relative geographical structures of Korea and Australia. Van Ark et al. (1999) further noted that the shorter travelling distances and the greater terminal shares are also partly related to greater population density. This is clearly the case in Korea.

Table 2
Average Distance of Passenger and Freight Transport, and output index
Australia and Korea, 1995

	Australia (km) (H^{Aus}) (1)	Korea (km) (H^{Kor}) (2)	Australia/Korea (3)	α (4)	Output Index (Korea=100) (5)
Passenger transport:					
- rail	22	37	0.60	0.40	42.4
- road	243	6	37.91	0.97	18.6
- inland/coastal	31	58	0.53	0.47	130.7
- air	1,923	1,946	0.99	0.01	93.3
Freight transport:					
- rail	259	241	1.07	0.07	733.8
- road	98	45	2.19	0.54	461.7
- inland/coastal	2,220	340	6.52	0.85	70.4
- air	3,797	5,102	0.74	0.26	25.0

Note: α is the weight of terminal services in the composite index of Australia relative transport output, see text.

Source: Length of average passenger trip and freight haul simply derived by dividing passenger-km (tonne-km) by number of passengers (quantity of freight). Figures from Table 1.

As both physical outputs are essential, the Australian relative output, (Q^{Aus}) in equation (1), was estimated by a composite index, in which Korean output (Q^{Kor}) was set equal to 100. This composite index is the weighted average of (i) the relative amount of Australian passenger or freight moving services compared to Korea, and (ii) the relative amount of Australian terminal services compared to Korea.

$$Q^{Aus} = \left[(1-\alpha)\frac{M^{Aus}}{M^{Kor}} + \alpha \frac{T^{Aus}}{T^{Kor}} \right] \times 100; \qquad where\, Q^{Kor} = 100 \qquad (1)$$

The share of α is determined by the difference between the Korean and Australian average freight haul or passenger trip, as derived in equations (2a and 2b). H^{Aus} and H^{Kor} represent the average distance over which freight or passengers were transported in 1995 in Australia and in Korea, respectively (These data are given Table 1). The bigger the difference between H^{Aus} and H^{Kor}, the higher α will be (ie. the bigger the weight of terminal services in the composite index). With regard to the physical output of telecommunications, only the number of telephone subscriptions and number of items of mail handled were available.

$$\alpha = \left(1 - \frac{H^{Kor}}{H^{Aus}}\right) \quad if\ H^{Kor} < H^{Aus} \qquad (2a)$$

$$\alpha = \left(1 - \frac{H^{Aus}}{H^{Kor}}\right) \quad if\ H^{Kor} > H^{Aus} \qquad (2b)$$

A numerical example for road freight transport

The composite index for Australia (equation 1) is obtained by first deriving the value α, either using equation 2a or 2b. From Table 2, road freight transport shows H^{Kor} = 45 (18,213 / 408.37) which is less than H^{Aus} = 98 (119,227 / 1,222). Hence, equation 2a is used in order to derive α (ie. α = 1- (45/98) = 0.54). In equation 1, M^{Aus} / M^{Kor} is the ratio of moving services for Australia relative to Korea (119,227 / 18,213 = 6.546). T^{Aus} / T^{Kor} is the ratio of terminal services of Australia relative to Korea (1,222 / 408.37 = 2.992). Note that Korea is the reference country which thus indicates that its index will be 100 (see equation 1). Finally, the composite index for Australia gives (Q^{Aus}) = [(1 – 0.54)*(6.546) + (0.54)*(2.992)]*100 = 461.7.

Purchasing power parities (PPPs) for the benchmark year 1995 are derived in order to convert each countrys' value added and labour productivity into a numeraire currency value. Conversion of time-series value added figures involve a set of PPPs across time. These are derived by applying the ratio of Korea-Australia transport and communications GDP implicit deflators, with 1995 as base, to the 1995 transport and communications PPP. For the benchmark year alone, three levels of PPPs are calculated; sample industry PPPs, branch level PPPs and finally the transport and communications sector PPP.

The notation used in the study is as follows. Q and P refer to quantity and price, respectively. In the case of transport, Q refers to the composite output index shown in Table 2. Countries X and U are the alternate and base country, respectively. In the current study, X refers to Korea and U refers to Australia. Subscript i refers to item or product, j refers to the type of industry, and k refers to the type of branch. Lower-case s refers to the sample industry.

The sample industry PPPs are derived by aggregating all matched products within a sample industry. Matching of products is made at the 4-digit level of the international standard industrial classification (ISIC). The sample industry PPPs are expressed as follows.

$$PPP_j^{XU(X)} = \frac{\sum_{i=1}^{s} Q_{ij}^X \times P_{ij}^X}{\sum_{i=1}^{s} Q_{ij}^X \times P_{ij}^U} \quad \text{.....(3)} \qquad PPP_j^{XU(U)} = \frac{\sum_{i=1}^{s} Q_{ij}^U \times P_{ij}^X}{\sum_{i=1}^{s} Q_{ij}^U \times P_{ij}^U} \quad \text{..... (4)}$$

Expressions (3) and (4) are the Paasche and Laspeyres price indices, respectively, where $PPP_j^{XU(X)}$ is the purchasing power parity of the currency of country X against the currency of country U in industry j, at quantity weights of country X. $PPP_j^{XU(U)}$ is the purchasing power parity of the currency of country X against the currency of country U in industry j, at quantity weights of country U. i=1,…,s is the sample of matched items.

Branch level PPPs are obtained by a weighted averaging of the parities of the sample industries that belong to a given branch. The weights used in this paper are based on value added shares. The PPP for a given branch k is defined as

$$PPP_k^{XU(X)} = \frac{\sum_{j=1}^{b_k} VA_j^{X(X)}}{\sum_{j=1}^{b_k} VA_j^{X(X)} / PPP_j^{XU(X)}} \qquad (5)$$

at value added share weights of country X, and

$$PPP_k^{XU(U)} = \frac{\sum_{j=1}^{b_k} \left[VA_j^{U(U)} \times PPP_j^{XU(U)}\right]}{\sum_{j=1}^{b_k} VA_j^{U(U)}} \qquad (6)$$

at value added share weights of country U. In equations (5) and (6), VA_j refers to value output of the j-th sample industry and PPP_j represents the j-th sample industry purchasing power parity.

Finally, sectoral PPPs are derived by aggregating the branch level PPPs and using the weights of value added for each branch. The formulae are similar to expressions (5) and (6) and are expressed as follows.

$$PPP^{XU(X)} = \frac{\sum_{j=1}^{k} VA_k^{X(X)}}{\sum_{j=1}^{k} VA_k^{X(X)} / PPP_k^{XU(X)}} \qquad (7)$$

$$PPP^{XU(U)} = \frac{\sum_{j=1}^{k} \left[VA_k^{U(U)} \times PPP_k^{XU(U)}\right]}{\sum_{j=1}^{k} VA_k^{U(U)}} \qquad (8)$$

For the final comparisons of transport and communications gross value added and labour productivity, only the Fisher PPP is used. The Fisher PPP is derived by taking the geometric average of expressions (7) and (8), as shown below.

$$PPP^{Fisher} = \sqrt{PPP^{XU(X)} \times PPP^{XU(U)}} \qquad (9)$$

3. Results

3.1 Relative Size and Structure of the Transport and Communications Sector in Korea and Australia

Tables 3 and Table 4 and Charts 1 and 2 contain estimates of gross value of output, gross value added and employment, by branch, for Korea and Australia, in the benchmark year 1995. These data provide an indication of the size and structure of each country's transport and communications sector.

In terms of size, the gross value of output in Korean transport and communications, expressed in Australian dollars at the PPP rate (A$1.00 = 759 Won in Table 5) is $60,863 million and for Australia, $77,559 million, approximately 1.27 times the value of Korean output. Transport and communications gross value added, defined as gross output net of intermediate inputs, is $34,051 million in Korea, and in Australia, $39,591 million, some 1.16 times the gross value added of the Korean transport and communications sector. Gross value added is 56 percent of transport and communications gross output in Korea compared with 51 percent in Australia. This suggests that Australia uses relatively more intermediate inputs, probably from heavy fuel consumption in transport services. In terms of number of persons engaged, Korea has more than double the employment than Australia. Overall, the Korean transport and communications sector contributes 7.34 percent of total GDP and 5.2 percent of total employment, while for Australia the comparable figures are 8.34 percent and 6.54% percent.

Table 3
Gross Value of Output, Gross Value Added, Number of persons engaged by branch, Transport and Communications of Korea, 1995,

	Gross Value of Output at factor cost (mill. Won) (1)	Gross Value Added at factor cost (mill. Won) (2)	Share in Total Transport & Communications (% of Value Added) (3)	Number of Persons Engaged (thousands) (4)	Share in Total Transport & Communications (%) (5)
Transport	31,792,606	13,235,366 b	63.1	632	65.6
Railways	3,451,347	1,191,557	5.7	53	5.5
Road	21,290,404	9,736,263	46.4	550	57.1
Inland/coastal	1,270,473	511,925	2.4	9	0.9
Air transport	5,780,382	1,795,621	8.6	20	2.1
Communications	21,302,470	7,741,149 c	36.9	331	34.4
Telephone Subs.	20,026,077	7,221,037	34.4	n.a	n.a
Mail handled	1,276,393	520,112	2.5	n.a	n.a
Transport & Comms.					
Current Table	53,095,076 a	20,976,515 d	100.0	963 e	100.0
National Accounts'	46,197,200 a	25,845,801	-	-	-
ILO	-	-	-	1,068	-

n.a. - not available.
Notes: (a) Discrepancy in figures of gross value of output and gross value added between the current table and national accounts' is largely due to differences in concepts between the survey reports and national accounts. This discrepancy also exists in manufacturing whereby the survey report had a larger gross output and gross value added than the national accounts.
(b) Transport figure is the sum of railways, road, inland/coastal and air transport. This aggregated figure is lower than the national accounts' as it excludes deep-sea transport, services allied to transport, and pipeline figures.
(c) Communications figure is the sum of telephone subscriptions and mail handled. It is less than the national accounts' figure as it excludes other services within communications.
(d) GVA excludes services allied to transport and deep-sea transport.
(e) Current tables' figure differs to ILO due to exclusion of allied to services.

Source: Gross Value of Output from Table 1. Value Added from NSO, *Report on the Transportation Survey 1996* . pp. 116-299. Natrional accounts' GDP for Transport, storage and communications from Bank of Korea, *Economic Statistics Yearbook 1997* , p. 290. Number of persons engaged from ILO, *Yearbook of Labour Statistics 1996.*

In terms of structure, the largest contributors to gross output and value added in Australia also tend to be those that provide the bulk of employment, that is, road transport. This is to be expected since most freight in Australia is transported by means of heavy goods vehicles.

Furthermore, road passenger transport by use of buses is an important service industry in both interstate and intrastate services. Air transport has a larger gross output than railways, but the latter's share in value added and employment exceeds that for air transport. In Korea, road transport dominates the other branches in terms of gross output, value added and employment. Telephone subscriptions however, also contribute a considerable share of gross output and gross value added.

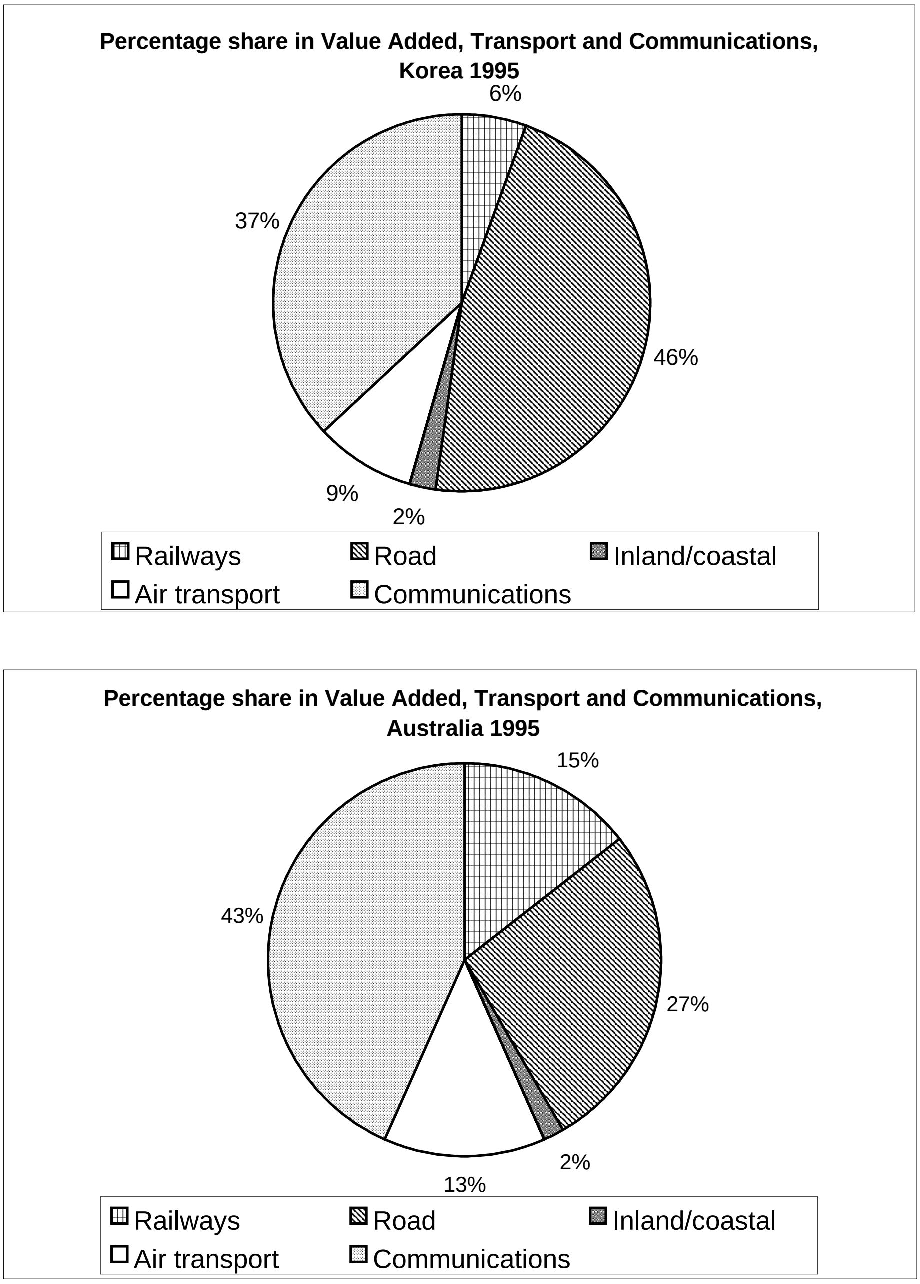
Table 4
Gross Value of Output, Gross Value Added, Number of persons engaged by branch, Transport and Communications of Australia, 1995,

	Gross Value of Output at factor cost (mill. $) (1)	Gross Value Added at factor cost (a) (mill. $) (2)	Share in Total Transport & Communications (% of Value Added) (3)	Number of Persons Engaged (thousands) (4)	Share in Total Transport & Communications (%) (5)
Transport	39,990	16,559 b	56.6	293	68.8
Railways	5,821	4,248	14.5	51	11.9
Road	21,304	7,947	27.2	186	43.7
Inland/coastal	1,455	443 c	1.5	10 f, g	2.3
Air transport	11,410	3,921	13.4	46 f, h	10.9
Communications	22,274	12,697	43.4	133	31.2
Telephone Subs.	3,943	n.a	n.a	n.a	n.a
Mail handled	18,331	n.a	n.a	n.a	n.a
Transport & Comms.					
Current Table	62,263	29,256	100.0	425 i	100.0
National Accounts'	77,559 d	39,591 e	-	-	-
ILO	-	-	-	537	-

n.a. - not available.
Notes: (a) Value added figures for each transport activity derived by multiplying the transport GDP implict deflator to each transport activity's value added at constant 1997-98 prices. It is assumed that each transport activity deflator is the same as the transport implicit deflator. Breakdown of GVA at current prices (ie. freight and passenger) derived by taking the proportions of GVO at current prices. It is assumed that proportions of freight and passenger for each transport activity at GVO is the same as at the value added level.
(b) Slight discrepancy with National Accounts figure as a result of exclusion of pipeline figures and deep-sea transport. Difference in total transport value added also due to derivation of estimated value added figures based on proportionate movements.
(c) Value added derived using proportions of value output of inland/coastal to deep-sea to the value added of sea transport.
(d) Gross value output derived from Input-Output Table. Discrepancy between current tables' and Input-Output figures is that the current table omits the value output of allied services to transport, pipelines and deep-sea.
(e) Gross value added from national accounts. Discrepancy between current tables' and national accounts figures is that the current table omits the value output of allied services to transport, pipelines and deep-sea. Discrepancy is also partly due to rough estimations using proportionate movements for various branches .
(f) Australian figure is average of Feb 1995 and Feb 1996, which thus gives the average at August 1995.
(g) Figure refer to water transport.
(h) Figure refer to air transport.
(i) Current tables' figure differs to ILO due to exclusion of allied to services.

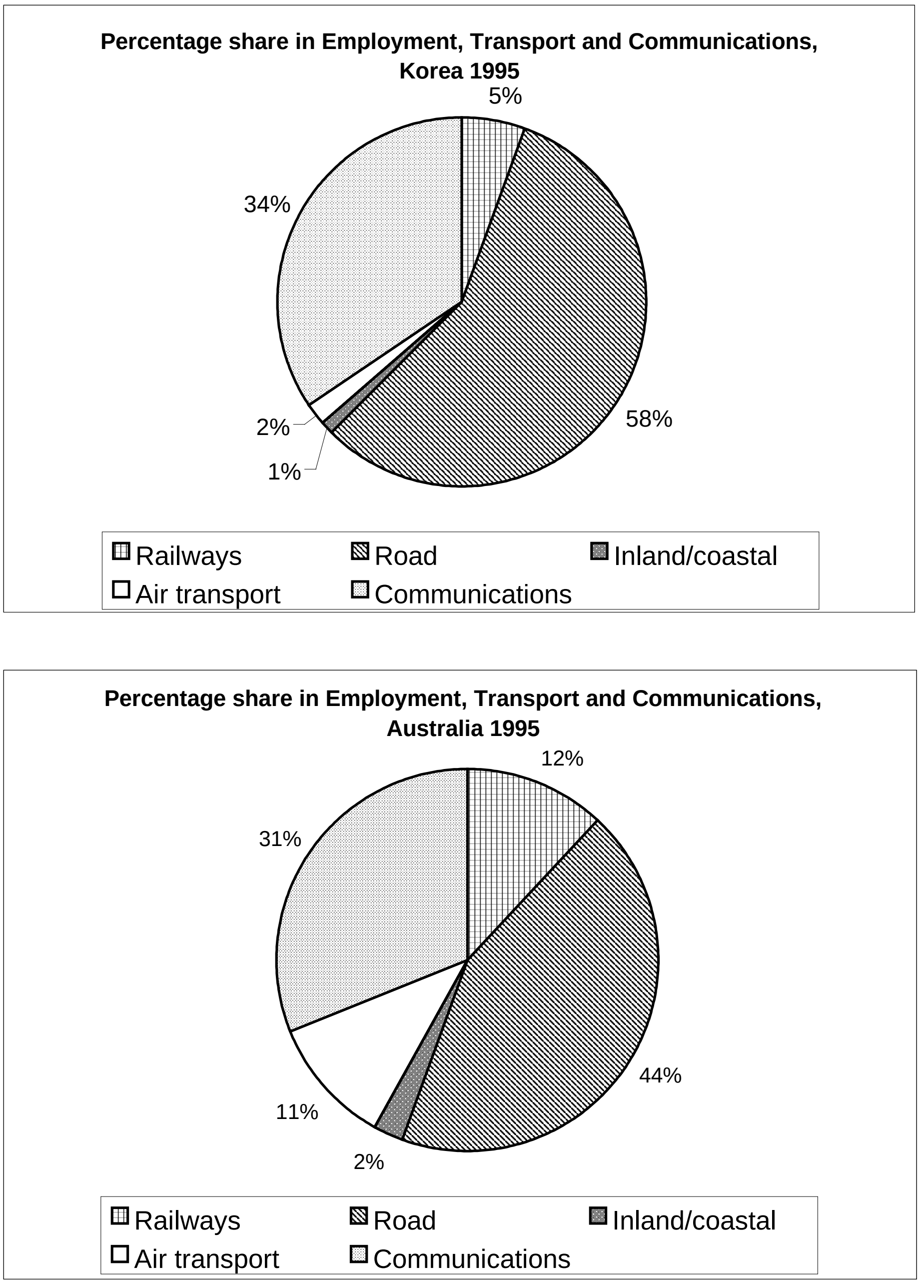
Source: Gross Value of Output from Table 1. Value Added from ABS, Input-Output Tables Product Details, *1994-95* , (Cat. No. 5215.0) and ABS, *Australian System of National Accounts, 1998-99* , (Cat. No. 5204.0). Number of persons engaged from ILO, *Yearbook of Labour Statistics 1996.*

Chart 1



Source: Tables 3 and 4.

Chart 2



Source: Tables 3 and 4.

3.2 Purchasing Power Parities and Comparative Price Levels

Table 5 shows the Paasche, Laspeyres and Fisher PPPs by branches and for overall transport and communications for the benchmark year 1995. Comparative prices level for each branch are also shown.

The branch PPPs in transport were larger at Australian quantity weights, but much the same, at both country quantity weights, for communications. The identical PPPs for each branch in communications is due to the fact that there is only one matched service. Within the transport service, transportation includes both passenger and freight activities. This aggregation results in different estimates using different quantity weights.

Table 5
Paasche, Laspeyres and Fisher PPPs for Transport and Communications, Australia and Korea, 1995

	At Korean quantity weights (Paasche PPP)	At Australian quantity weights (Laspeyres PPP)	Geometric Average (Fisher PPP)	Comparative Price Level (Aus = 100)
Transport:				
- rail	694.5	1,173.1	902.6	157.8
- road	1,065.6	1,895.5	1,421.2	248.5
- inland/coastal	639.9	662.0	650.9	113.8
- air	342.4	468.7	400.6	70.0
Overall Transport	764.6	1,329.8	1,008.3	176.3
Telecommunications				
- Telephone Subs.	468.3	468.3	468.3	81.9
- Mail handled	282.2	282.2	282.2	49.3
Overall Telecommunications	450.5	420.2	435.1	76.1
Transport & Communications	614.1	938.2	759.0	132.7
Exchange Rate	571.9	571.9	571.9	

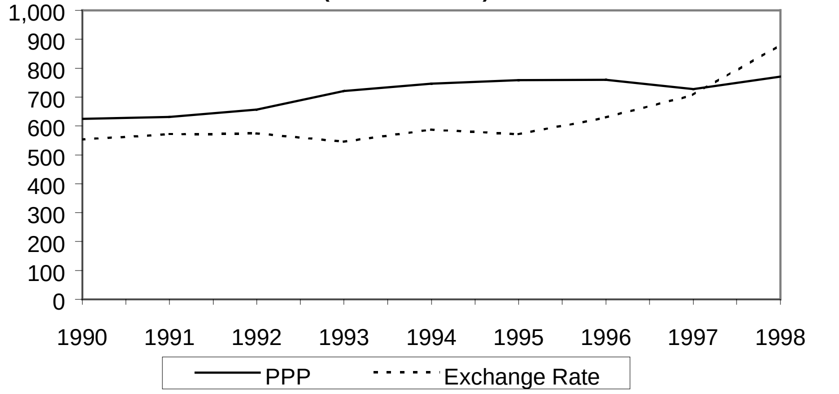
Paasche and Laspeyres PPPs for overall transport and communications were obtained by weighting the PPPs of separate branches using value added as weights.
Comparative price level calculated by dividing PPP by the exchange rate.
Source: Exchange rates from IMF, *International Financial Statistics, 1998*. Washington D.C.
Appendix Table A1 and Table 1.

The disparities between the PPPs at different country weights reflect the differences in each country's transport structure, relative price structure and output composition. To some extent this would also be expected given the different geographical structure of each country.

The geometric average of the PPP for transport and communications as a whole, in 1995, is 759 won to the Australian dollar, compared to an exchange rate of 571.9 won to the dollar. Dividing the geometric average of the PPPs by the exchange rate produces a relative or comparative price level for each branch and for the sector as a whole. Using Australia as the base country, a comparative price level greater (lower) than 100 indicates that prices in that particular branch or sector in Korea are higher (lower) than their counterparts in Australia. In Australia in 1995, the comparative price levels for rail, road and inland/coastal transport were lower than in Korea, which indicates that prices in Korean transport were relatively much higher than those in Australia. In the communications sector, Korean prices were relatively lower than Australia's largely because of the infrastructure costs associated with Australia's geographical size. The price level for the transport and communications industry in Korea, in 1995, was 132.7 percent of that in Australia.

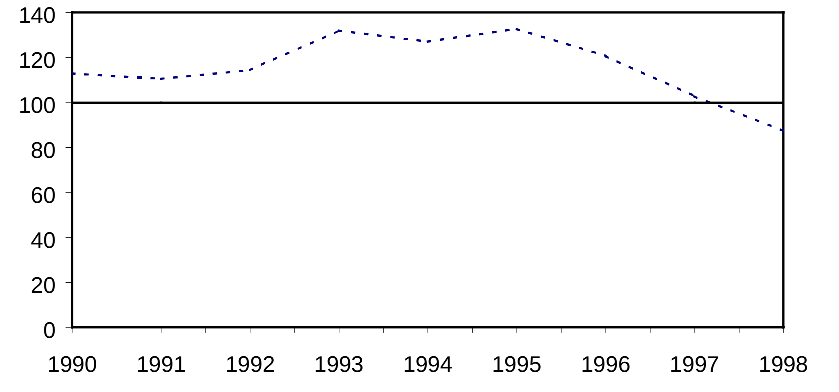
Trends in PPPs, exchange rates and comparative price levels for Korea and Australia provide an interesting perspective on the transport and communications structure and price levels in both countries. These are shown in Figures 1 and 2.

Figure 1
PPP vs Exchange Rate, 1990-1998
(Korea/Australia)



Source: GDP deflators for Korea from NSO, *Economic Statistics Yearbook, 1996, 1997 and 1999,* Seoul. Bank of Korea, *National Accounts 1999,* Seoul.
GDP deflators for Australia from ABS, *Australian System of National Accounts 1998-99*, Cat No.5204.0, pp. 20 and 63. 1995 PPP from Table 5.

Figure 2
Comparative Price level (Australia=100), 1990-1998



Note: Comparative Price Level derived by dividing PPP by the exchange rate. Time series PPPs derived by first calculating the ratio of Korean transport and communications GDP deflator by the Australian transport and communications GDP deflator. Deflators are derived by taking the ratio of current over constant (at 1995 prices) transport and communications GDP. After which this value is multiplied to the 1995 geometric average PPP fromTable 3.

Source: Australian transport and communications GDP from ABS, *Australian System of National Accounts* (various issues), Cat No.5204.0. Korean GDP from NSO*, Economic Statistics Yearbook* (various issues), Seoul. Bank of Korea, *National Accounts 1999*, Seoul.

Figure 1 shows that the overall transport and communications sector PPP for Korea exceeded the exchange rate from 1990 to 1997. The opposite position since 1997 reflected the depreciation of the won following the onset of the Asian financial crisis. From 1990 to 1995, the exchange rate was fairly constant. However, the PPPs increased, which suggests that the real value of the Korean won declined during this period. In 1997, the Korean won depreciated against the Australian dollar thus leading to a fall in the PPP value of the won. Figure 2 shows the relative price levels for Korea against Australia from 1990 to 1998. Prior to 1997, transport and communication prices were relatively higher in Korea than in Australia, but the crisis-induced depreciation of the won produced a decline in the Korean comparative price level.

3.3 Gross Value Added in the Benchmark Year, 1995

Table 4 shows the value added figures at branch level for both Australia and Korea for 1995. The Korean figures are, in turn, converted into 1995 Australian dollars. Examination of the value added share of each branch in the transport and communications industry output shows that Australian rail and road transport contributed a significant proportion This outcome stems from the importance of freight transport in Australia. Korea has had a larger value added contribution than Australia in inland/coastal transport, the result of efficiencies in freight shipment and loading and unloading of cargo at ports. Air transport shares are more or less the same in both countries.

Table 6
Labour productivity in Transport and Communications, Australia and Korea, 1995 (at Aus$)

	Value Added per person		Korea/ Australia
	Korea	Australia	(%)
Transport	20,784	56,609	36.7
Railways	25,008	83,875	29.8
Road	12,466	42,761	29.2
Inland/coastal	89,502	45,861	195.2
Air transport	219,826	84,582	259.9
Communications	53,733	95,826	56.1
- Telephone Subs.	n.a.	n.a.	n.a.
- Mail handled	n.a.	n.a.	n.a.
Transport & Comms.			
Current Table (a)	28,708	68,835	41.7
National Accounts (b)	31,883	73,740	43.2

n.a. - not available.
Notes:
(a) Value added per person engaged derived using Tables 3 and 4 value added (converted into Australian 1995 dollars) and number of persons engaged.
(b) Value added per person engaged derived using national accounts' value added and ILO's employment figures.

Source: Tables 3 and 4. PPPs from Table 5.

Table 6 contains estimates of gross value added per person employed. In 1995 the level of labour productivity in the Korean transport and communication industry was 41.1 per cent of that in Australia. Labour productivity in the Korean transport sector was 35.8 per cent of the Australian level and the communications sector was 56.1 per cent of that in Australia. However, labour productivity varied across branches, with inland/coastal and air transport branches registering significantly higher levels of labour productivity in Korea than in Australia. These differences may be readily explained in terms of the efficiency of coastal transport and by the fact that the Korean air transport sector employed approximately half of the numbers employed in Australia, and by the much greater volume of moving services provided by the Korean air-freight transport branch (see Tables 1, 3 and 4). Nevertheless, it is clear that a significant productivity gap existed between the transport and communication sectors in the two countries in 1995.

3.4 Trends in Labour Productivity, 1990-1998

Table 7 and Figure 3 show trends in labour productivity from 1990 to 1998, derived by applying indices of real value added and employment in each country to the benchmark productivity comparison of Table 6. Despite the fact that Figure 4 shows some catch-up in Korean transport and communication output, there was very little improvement in labour productivity over the period. Korean labour productivity improved from 35.5 per cent of the Australian level in 1990, peaked at 41.5 per cent in 1997, then declined with the onset of the financial crisis to 38.7 per cent of the Australian level in 1998. Clearly, there was no meaningful catch-up in labour productivity in the Korean transport and communication sector throughout the 1990s.

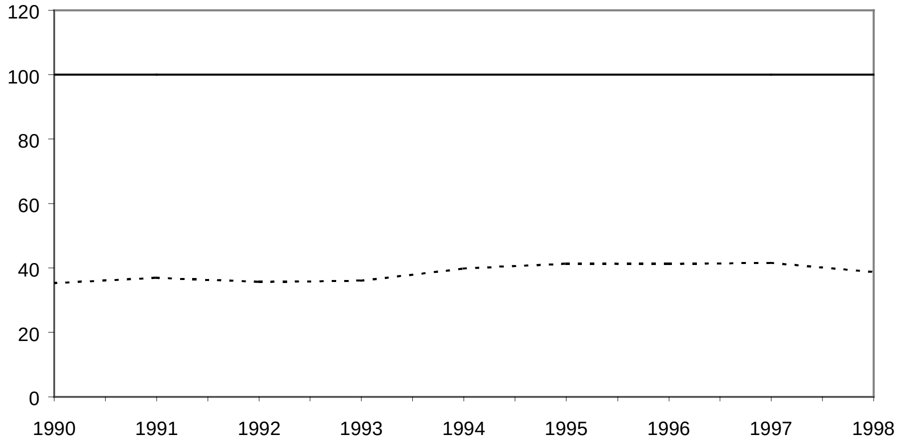
Table 7
Trends in Labour Productivity
(GDP per person engaged) in Transport and Communications, 1990-1998 (at 1995 Aus$)

	Korea	Australia (a)	Korea/ Australia (%)
1990	21,939	62,172	35.3
1991	22,936	62,085	36.9
1992	24,580	68,847	35.7
1993	26,554	73,716	36.0
1994	29,862	75,061	39.8
1995	31,883	77,165	41.3
1996	32,559	78,882	41.3
1997	35,210	84,781	41.5
1998	34,841	89,982	38.7

Note: (a) 1995 figure differs to Table 6 as the GDP for transport and communications used in the time-series comparisons is an average of 1994/95 and 1995/96 and it includes services allied to transport and deep-sea transport.

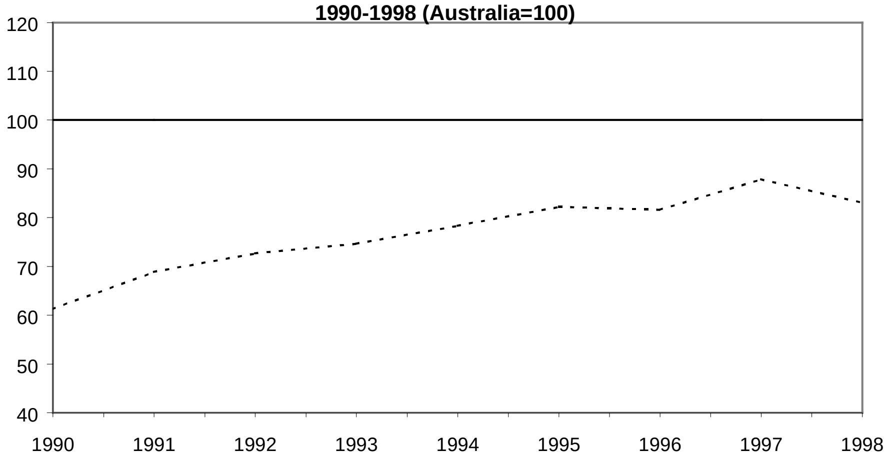
Source: Australian transport and communications GDP from ABS, *Australian System of National Accounts* (various issues), Cat No.5204.0. Korean GDP from NSO, *Economic Statistics Yearbook* (various issues), Seoul. Bank of Korea, *National Accounts 1999*, Seoul. ILO, *Yearbook of Labour Statistics, 1999*. Geneva.

Figure 3
Trends in Labour Productivity in Transport and Communications, GDP per person engaged, Korea/Australia 1990-1998, (Australia=100)



Source: Australian transport and communications GDP from ABS, *Australian System of National Accounts* (various issues), Cat No.5204.0. Korean GDP from NSO, *Economic Statistics Yearbook* (various issues), Seoul. Bank of Korea, *National Accounts 1999, Seoul.* ILO, *Yearbook of Labour Statistics, 1999*. Geneva.

Figure 4
Comparative Output of Transport and Communications, Korea/Australia, 1990-1998 (Australia=100)



Note: Korean transport and communications GDP converted into Australian 1995 prices using geometric average PPP from Table 3.
Source: Australian transport and communications GDP from ABS, *Australian System of National Accounts* (various issues), Cat No.5204.0. Korean GDP from NSO, *Economic Statistics Yearbook* (various issues), Seoul. Bank of Korea, *National Accounts 1999,* Seoul.

4. Conclusion

This study provides a comparative estimate of real output and labour productivity in the transport and communication industries in Korea and Australia. For the benchmark year 1995, value added in the Korean transport and communication sector was approximately 82 per cent and labour productivity 41 per cent of the Australian levels. Over the period 1990 to 1998, the Korean transport and communication sector operated, on average, at approximately 39% of the Australian level, although marginally higher relative productivity levels were evident in the mid 1990s, just prior to the onset of the Asian financial crisis. The results over the period suggest that Korea did not experience meaningful catch-up on Australian transport and communication labour productivity levels. Similarly, for the benchmark year 1995, the Korean transport and communications price level was 133 per cent of that in Australia, although a sharp decline occurred in the run-up to the crisis in 1997. By the end of 1998 the Korean transport and communications price level had declined to 87 per cent of the Australian level, the lowest level recorded throughout the 1990s.

This paper draws on the ICOP industry-of-origin approach to international comparison to provide the first in a series of papers comparing output and productivity in the service sectors in Korea and Australia. The paper has concentrated on transport and communication sectors primarily to build on the methodological approach to service sector comparisons pioneered by Mulder (1994) and van Ark, Monnikhof and Mulder (1999). Although caution should be exercised in drawing strong conclusions from the productivity estimates – given the nature of the available data – the approach adopted here will be used to develop, over time, more comprehensive analyses of service sector comparisons between Korea and Australia.

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Appendix Table 1 - Matching of Product Items, Australia-South Korea, Transport and Communications, 1995

SIC Code	Australia Service Item	Unit	Australia Quantity (million)	Australia Gross Value (mill. Aus$)	Australia Dollar Unit Value	Australia Quantity valued at Korean unit Values (mill. Won)	Unit Value Ratio Won/Aus$ Australia Quantity Weights (Laspeyres)
6201	**RAIL TRANSPORT**						
	Adjusted for differences in average haul (see text)						
	- Passenger traffic	output-index	42.4	1,878.1	44.32	1,133,561.9	603.57
	- Freight traffic	output-index	733.8	3,943.1	5.37	5,695,253.3	1,444.36
	TOTAL MATCHED			5,821.2		6,828,815.2	1,173.09
6101	**ROAD TRANSPORT**						
	Adjusted for differences in average haul (see text)						
	- Passenger traffic	output-index	18.6	2,973.6	160.10	2,427,504.9	816.35
	- Freight traffic	output-index	461.7	18,330.5	39.70	37,955,164.0	2,070.60
	TOTAL MATCHED			21,304.1		40,382,668.9	1,895.54
6301	**INLAND/COASTAL TRANSPORT**						
	Adjusted for differences in average haul (see text)						
	- Passenger traffic	output-index	130.7	124.7	0.95	149,575.8	1,199.31
	- Freight traffic	output-index	70.4	1,329.8	18.90	813,371.7	611.63
	TOTAL MATCHED			1,454.6		962,947.4	662.02
6401	**AIR TRANSPORT**						
	Adjusted for differences in average haul (see text)						
	- Passenger traffic	output-index	93.3	9,817.8	105.20	5,330,310.5	542.92
	- Freight traffic	output-index	25.0	1,591.9	63.64	17,187.5	10.80
	TOTAL MATCHED			11,409.7		5,347,498.0	468.68
7101	**POSTAL AND TELECOMMUNICATIONS**						
	Telephone Subscriptions	number	6,432,360.0	14,787.7	0.002	6,925,458.6	468.33
	Mail handled	number	3,937,550.0	5,154.4	0.001	1,454,445.3	282.18
				19,942.1		8,379,903.9	420.21

Source: Tables 1 and 2.

Appendix Table 1 - continued

SIC Code	Korean Service Item	Unit	Korean Quantity (million)	Korean Gross Value (mill. Won)	Korean Won Unit Value	Korean Quantity valued at Aus. Unit Values (mill. Aus$)	Unit Value Ratio Won/Aus$ Korean Quantity Weights (Paasche)
60100	**RAIL TRANSPORT**						
	Adjusted for differences in average haul (see text)						
	- Passenger traffic	output-index	100.0	2,675,232.1	26,752.3	4,432.4	603.57
	- Freight traffic	output-index	100.0	776,114.9	7,761.1	537.3	1,444.36
	TOTAL			3,451,347.0		4,969.7	694.48
60212-60235	**ROAD TRANSPORT**						
	Adjusted for differences in average haul (see text)						
	- Passenger traffic	output-index	100.0	13,069,500.0	130,695.0	16,009.6	816.35
	- Freight traffic	output-index	100.0	8,220,904.0	82,209.0	3,970.3	2,070.60
	TOTAL			21,290,404.0		19,979.9	1,065.59
61101, 61102,	**INLAND/COASTAL TRANSPORT**						
	Adjusted for differences in average haul (see text)						
	- Passenger traffic	output-index	100.0	114,418.0	1,144.2	95.4	1,199.31
	- Freight traffic	output-index	100.0	1,156,055.0	11,560.6	1,890.1	611.63
	TOTAL			1,270,473.0		1,985.5	639.87
62100-62200	**AIR TRANSPORT**						
	Adjusted for differences in average haul (see text)						
	- Passenger traffic	output-index	100.0	5,711,671.8	57,116.7	10,520.2	542.92
	- Freight traffic	output-index	100.0	68,710.2	687.1	6,364.0	10.80
	TOTAL			5,780,382.0		16,884.2	342.35
64100, 64201 64202, 64203	**POSTAL AND TELECOMMUNICATIONS**						
	Telephone Subscriptions	number	18,600,203.0	20,026,077.0	1.08	42,761.0	468.33
	Mail handled	number	3,455,518.0	1,276,393.2	0.37	4,523.4	282.18
				21,302,470.2		47,284.4	450.52