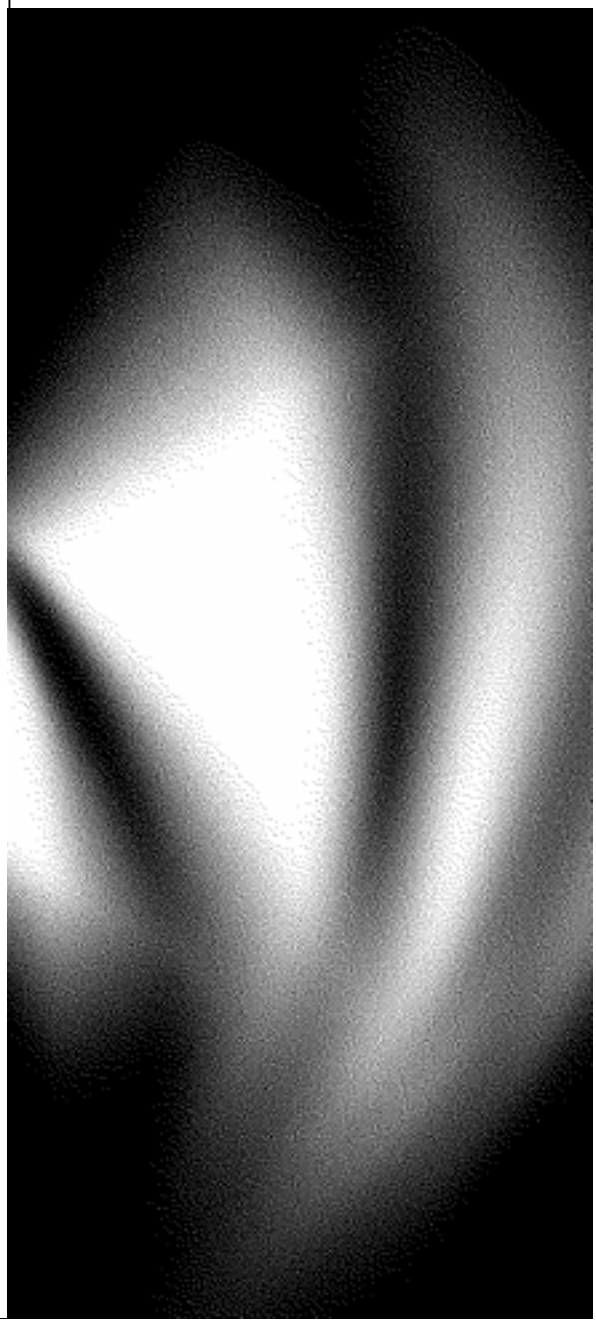
PRODUCTIVITY COMMISSION

International Benchmarking of Telecommunications Prices and Price Changes

International Benchmarking



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The Productivity Commission

The Productivity Commission, an independent Commonwealth agency, is the Government's principal review and advisory body on microeconomic policy and regulation. It conducts public inquiries and research into a broad range of economic and social issues affecting the welfare of Australians.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

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Foreword

In March 1999, the Commission published an international benchmarking study comparing Australia's telecommunications prices and regulatory arrangements with those in other OECD countries (PC 1999). The time taken to develop and refine the methodology in that study meant that the comparative data was a year old when published.

This study, drawing on the same approach, presents updated information as at June 1999 — two years after Australia's pro-competitive regulatory framework was implemented. Accordingly, this report should be read in conjunction with the previous one.

As well as providing updated price comparisons, the report also charts in a consistent way the price changes that have occurred in each country since February 1998. And it includes information on some key Asian countries not covered previously.

The report could not have been completed without the active cooperation of participants in the telecommunications sector, who either assisted the Commission directly or provided information to its consultants, Teligen and Ovum. The Commission is grateful to all those who took part.

This benchmarking study is part of a continuing program of research into the performance of economic infrastructure industries in Australia. The Commission welcomes further feedback on this report, consistent with its objective of improving the information base on key issues affecting Australia's economic performance and community living standards.

Gary Banks

Chairman
December 1999

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APPENDICES

Abbreviations

ABS	Australian Bureau of Statistics
ACA	Australian Communications Authority
ACCC	Australian Competition and Consumer Commission
ADSL	Asynchronous Digital Subscriber Line
AMPS	Advanced Mobile Phone System
AT&T	American Telephone and Telegraph
ATM	Asynchronous Transfer Mode
AUSTEL	Australian Telecommunications Authority
bps	Bits Per Second
BT	British Telecom
BTA	Basic Telecommunications Agreement
CAN	Customer access network
CBD	Central Business District
CBR	Constant Bit Rate
CDMA	Code Division Multiple Access
CIR	Committed Information Rate
CLECs	Competitive Local Exchange Carriers
CMC	Communication and Multimedia Commission (Malaysia)
CPI	Consumer Price Index
CRTC	Canadian Radio-Television and Telecommunications Commission
DoCITA	Department of Communications, Information Technology and the Arts (Australia)
DSL	Digital Subscriber Line
EC	European Commission
EU	European Union

FCC	Federal Communications Commission (US)
FT	France Telecom
GDP	Gross Domestic Product
GFIA	General Framework for Interconnection and Access (Malaysia)
GHz	GigaHertz
GSM	Global System for Mobile
GST	Goods and Services Tax
Hz	Hertz
IDD	International Direct Dialling
IP	Internet Protocol
IRS	Interconnect Related Services
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
ITU	International Telecommunications Union
JTM	Jabalan Telekomunikasi Malaysia
kbps	Kilo-bits per second
KCC	Korean Communications Committee
KDD	Kokusai Densin Denwa Co
KT	Korea Telecom
LATA	Local Access Transport Area
LEC	Local Exchange Carrier
Mbps	Mega-bits per second
MDF	Main Distribution Frame
MFJ	Modified Final Judgement
MHz	MegaHertz
MIC	Ministry of Information and Communications (Korea)
MPT	Ministry of Posts and Telecommunications (Japan)
NECG	Network Economics Consulting Group
NTT	Nippon Telegraph and Telephone
NZ	New Zealand

OECD	Organisation for Economic Cooperation and Development
OFTEL	Office of Telecommunications (UK)
PBTS	Public Basic Telecommunications Services
PC	Productivity Commission
PCS	Personal Communications Services
PCN	Personal Communications Networks
PDH	Pleisiochronous Digital Hierarchy
PoA	Point of Access
PoI	Point of Interconnect
PPP	Purchasing Power Parity
PSTN	Public Switched Telephone Network
PTS	National Post and Telecom Agency (Sweden)
RBOCs	Regional Bell Operating Companies
SDH	Synchronous Digital Hierarchy
SMP	Significant Market Power
SONET	Synchronous Optical Network
ST	Singapore Telecom
STD	Subscriber Trunk Dialling
TA 1991	*Telecommunications Act 1991*
TA 1997	*Telecommunications Act 1997*
TAS	Telecommunications Authority of Singapore
TCNZ	Telecom Corporation of New Zealand Ltd
TCP	Transmission control protocol
TDMA	Time Division Multiple Access
TFP	Total Factor Productivity
TMB	Telecom Malaysia Berhard
TPA	*Trade Practices Act 1974*
TSLRIC	Total Service Long-Run Incremental Cost
UK	United Kingdom
US	United States (of America)

USO	Universal Service Obligation
VAT	Value-Added Tax
WTO	World Trade Organisation

Glossary

Access line	Connection from the customer to the local telephone exchange for access to the telephone network.
Advanced Mobile Phone System	The analogue cellular mobile phone system in Australia and more than 35 other countries. AMPS cellular systems operate in the 800 to 900 MHz band.
Analogue	A signal for which the amplitude (strength) and frequency (tone) varies continuously.
Any-to-any connectivity	A network has this feature when subscribers to one network are able to call and receive calls from subscribers to an alternative network.
Asymmetric Digital Subscriber Line	An xDSL technology that supports high speed digital services over conventional telephone lines allowing subscribers to access multimedia-based applications such as video on demand. It has significantly greater capacity in one direction than the other.
Asynchronous Transfer Mode	An international packet switching standard using a cell based approach, in which each packet of information features a uniform size of 53 bytes.
Backbone	A central network that connects several other, usually lower bandwidth networks. The backbone network is usually composed of a high capacity communications medium, such as fibre optic or coaxial cable.
Bandwidth	The range of frequencies, expressed in Hertz (Hz), that can pass over a given transmission channel. The bandwidth determines the rate at which information can be transmitted through a circuit. The greater the bandwidth, the more information that can be sent through the circuit in a given amount of time.

Basic services	Services that provide the minimum carriage switching and routing functions necessary to establish and terminate a communications link.
Bits per second	Basic unit of measurement for serial data transmission capacity.
Broadband	A bandwidth greater than a voice grade telecommunications channel.
Carriage service provider	A business that uses network facilities to provide basic or value-added communication services.
Carrier	A business that is the owner of network facilities and operates under licence.
Carrier pre-selection	The system that allows subscribers of a carrier (usually the incumbent) to choose in advance another carrier for making particular types of calls (usually long-distance or international calls)
Cellular	A communication service in which voice or data is transmitted by radio frequencies. The service area is divided into cells each served by a transmitter. The cells are connected to a mobile switching exchange which is connected to the world wide telephone network.
Circuit switching	Temporary direct connection of two or more channels between two or more points in order to provide the user with exclusive use of an open channel with which to exchange information. A discrete circuit path is set up between the incoming and outgoing lines, in contrast to message switching and packet switching, in which no such physical path is established.

Code Division Multiple Access	A digital cellular phone technology that operates in the 1.9 GHz (along with digital GSM) and 800 MHz (along with analogue AMPS) bands. CDMA uses a spread spectrum technique that codes each digital packet and allows multiple calls to be placed on one channel, boosting caller capacity to 0 to 35 times that of the analogue network. CDMA phones are noted for their call quality and long battery life.
Committed Information Rate	The amount of bandwidth that a user can expect from a frame relay carrier on a particular virtual circuit.
Copper wire	The main transmission medium used in telephony networks to connect a telephone or other apparatus to the local exchange. Copper wires have relatively low bandwidth and so have limited ability to carry broadband services unless combined with an enabling technology such ADSL.
Customer access charge	Charge to retail customers for access to the PSTN.
Customer Access Network	The access network connecting customers to the local switch. In Australia, the CAN essentially comprises a fixed network of copper wire pairs.
Customer premises equipment	Terminal equipment on the customers premises (such as telephone handsets) that is connected to a network.
Digital	Communications procedures, techniques and equipment that encode information in discrete binary form, ‘1’ or ‘0’; discontinuous in time.
Digital Data Service	A digital transmission service supporting speeds up to 56 kbps.
Electronic commerce	The buying and selling of products and services by businesses and consumers over the internet. Also know as Ecommerce.
Frame relay	A high-speed (up to 45 Mbps) packet switching protocol used in wide area data networks.

Gateway	A device or program that connects two networks that use different protocols and translates between these protocols, allowing devices on the two networks to communicate with each other.
Global System for Mobile	A digital cellular phone technology based on TDMA (Time Division Multiple Access) that operates in the 1.8 to 1.9 GHz band, compared to 800 to 900 MHz for the analogue AMPS systems.
Integrated Services Digital Network	A communication standard enabling the interconnection of variety of mixed digital transmission services. ISDN is part of the physical layer of the Open Systems Interconnection reference model. A 144 kbps basic rate is defined in ITU-T 1.430, and a primary rate (1.544 Mbps) interface is defined in ITU-T L431.
Interconnection	The inter-working of two separate networks. Interconnection is used in reference to both the technical interface and to the commercial arrangements between the two network operators providing service.
International Direct Dialling	Cooperative service enabling subscribers to place international calls without operator assistance.
International Telecommunications Union	Telecommunications agency of the United Nations, established to provide standardised communications procedures and practices, frequency allocation and radio regulations on a worldwide basis. Parent body of the ITU-T (telecommunications), ITU-R (radio), and ITU-D (developing nations) committees.
Internet	A collection of packet switching networks interconnected by routers along with protocols that allow them to function logically as a single, large, virtual network.
Internet Protocol	Transmission Control Protocol and Internet Protocol are generic terms describing the protocols used on the Internet.
Internet service provider	A service provider who provides access to Internet services.

Intranet	A closed data network linking a number of sites using standard Internet protocols.
Leased line	A communication channel contracted for exclusive use from a common carrier, frequently referred to as a private line.
Local loop unbundling	Provision for interconnection downstream of the tandem switch or local exchange.
Local switch	Switching center in which subscribers' lines terminate.
Multiplexing	The process of interleaving or simultaneously transmitting two or more messages on a single channel using a device called a multiplexor.
Non-switched line	In data communication, a permanent connection between computers or devices that does not have to be established by dialling. Contrast with switched line.
Number portability	An arrangement that allows subscribers of a telecommunications service to change carriers without having to change their number.
Overlay network	A high performance digital network with its own lines, exchanges and often a separate international gateway that interconnects with the main public network.
Packet switched network	A network consisting of a series of interconnected switches that route individual packets of data over one of several redundant routes. Most commonly, packet switched networks refer to those operating the X25 protocol.
Packet switching	A method of transmitting messages through a communication network, in which long messages are subdivided into short packets. Each packet contains the data and a destination address and is passed from source to destination through intermediate nodes. At each node, the packet is received, stored briefly, and then passed on to the next node. The packets are then reassembled into the original message at the receiving end.

Permanent virtual circuit	A defined path that provides essentially a dedicated private line between users in a packet switching network.
Personal Communications Services	Refers to a variety of personal wireless communications services including cellular mobile and paging services.
Pleisiochronous Digital Hierarchy	An asynchronous multiplexing scheme from 1.5 Mbps to 565 Mbps, gradually being replaced by Synchronous Digital Hierarchy.
Port	A point of access into a communications switch, a computer, a network, or other electronic device.
Porting	The process of transferring a telephone number from one carrier to another.
Private network	A network based on leased lines or other facilities used to provide telecommunications services, within an organisation or within a closed user group, as a complement or a substitute to a public network.
PSTN network hierarchy	Describes the linkages between switches in the PSTN that determine the strategy for routing individual calls.
Public Switched Telephone Network	The infrastructure for basic telecommunications services (including telephones, switches, local and trunk lines, and exchanges).
Purchasing Power Parities	The rates of currency conversion that equalise the purchasing power of currencies. — that will buy the same broadly defined basket of goods and services in all countries.
Rebalancing	Adjusting the structure of prices between different services, classes of customer or between customer access charges and usage charges to achieve a more efficient pricing structure.
Resale service provider	A business that redistributes the services of a common carrier and retails the services to the public. Also called a reseller.

Service penetration	A measure of the number of subscribed lines or services within a geographic area per 100 population.
Spectrum	The bandwidth of a communications system, expressed in terms of the frequencies it can carry.
Switched line	A temporary connection between computers or devices.
Switching	The process of connecting circuits.
Synchronous digital hierarchy	A set of ITU-T standards doe synchronous digital transfer over optical fibre. The worldwide equivalent of the Sonet standard used in North America.
Synchronous Digital Hierarchy	An ITU-T standard for digital broadband communications.
Telephony	Generic term describing voice telecommunications.
Traffic	Messages sent and received over a communications channel. Also, a quantitative measurement of the total messages and their duration, expressed in call minutes or similar units.
Transmission	The carriage of electrical signals over electric wires, waveguides, or radio.
Transmission control protocol	See Internet Protocol.
Trunk Switch	A switching level above the local switch in a PSTN network through which long-distance and international call traffic are switched.
Value-Added Services	Services provided over a public or private network which, in some way, add value to the basic carriage services, usually through the applications of computerised intelligence. This includes services providing enhanced network features such as store and forward message switching, terminal interfacing and host interfacing.
Virtual circuit	Allows users to exchange packets of data across a network.

Virtual Private Network	A software defined network offered by telephone carriers for voice and data communications among multiple sites. The network provides the appearance of a private network, except that it makes use of the public switched network rather than physically dedicated leased lines.
X25	An ITU-T standard that defines the interface between equipment operating in the packet mode on public data networks.
xDSL	Generic term for Digital Subscriber Line Technologies (see Asynchronous Digital Subscriber Line).

Overview

This study compares price levels and price trends of Australian telecommunications services — both residential and business — with those of a number of countries in the Organisation for Economic Cooperation and Development (OECD). It updates to June 1999 previous telecommunications price comparisons for February 1998 (PC 1999). As with the previous study, this report contains a variety of findings about Australia's relative price performance (see box 1), but has no recommendations.

Box 1 **Key messages**

- Since the Commission benchmarked telecommunications prices in February 1998 there have been large price reductions for PSTN (Public Switched Telephone Network) and ISDN (Integrated Services Digital Network) services in Australia.
- Australian residential PSTN prices fell about 8 per cent between February 1998 and June 1999. PSTN and ISDN prices for many business subscribers fell at double this rate. However, mobile price reductions in Australia were less than in other countries.
- For residential customers, prices of long-distance calls in Australia and most other countries have declined in relation to prices for local service (including local calls and customer access rental).
- Overall, Australia's telecommunications prices were generally about average among the benchmarked countries at June 1999.
- Prices in the best performing countries in each market segment were generally 20 to 45 per cent below Australian prices, on a purchasing power parity basis.
- Regulatory arrangements, including those which support entry, vary among the countries benchmarked, with consequences for the extent of competition and the level of prices. However, it is very difficult to draw conclusions about the impact on prices of the regulatory environment relative to other causal factors in each country.

Approach

- Australia was benchmarked against Canada, Finland, France, Japan, South Korea, New Zealand, Sweden, the United Kingdom and the United States
  - these include countries regarded to be at best practice and having the lowest prices
  - they cover a range of regulatory and institutional environments.

- An extensive range of *voice and data communications services* sold by the major incumbent carrier(s) to residential and business customers in each country was examined
  - including PSTN (Public Switched Telephone Network) local service, long-distance and international calls and calls from fixed lines to mobile phones
  - as well as ISDN (Integrated Services Digital Network), mobile, leased lines, X25, frame relay and ATM (Asynchronous Transfer Mode) services.

- The provision of customer premises equipment (telephones, computer hardware and software) was not benchmarked.

- Teligen Ltd (formerly the Eurodata Foundation) was engaged to collect and analyse information on telecommunications prices as at June 1999
  - Eurodata worked with the OECD to develop standard 'baskets' of residential and business services to weight telecommunications prices into a single index.

- Information on regulatory arrangements was also updated
  - since regulation affects prices directly through retail price controls and indirectly by promotion of competition.

- Information on competitive conditions in telecommunications markets has also been provided using market share data (where available)
  - although data are scarce and need careful interpretation.

- Ovum Pty Ltd was engaged to collect information on growth and competitive conditions in telecommunications markets in the selected countries, and on changes in regulatory arrangements between February 1998 and June 1999.

Developments in telecommunications markets

- The telecommunications industry is diverse and changing rapidly
  - demands for services are growing and new technologies are being introduced.

- PSTN access lines are growing at around 2 to 5 per cent per annum in most OECD countries, driven by factors such as growth in numbers of households and Internet connections.

- Local traffic, measured in call-minutes, has been growing at moderate rates (for example, 3 to 4 per cent per annum in Australia)
  - driven partly by Internet usage.

- Long-distance traffic is growing more rapidly than local traffic
  - partly because of a more rapid decline in price.

- ISDN connections, which increase the capacity of the existing copper pair access lines, are currently growing at 70 to 80 per cent each year in the OECD and Asian regions
  - however, the outlook for ISDN is uncertain because of the emergence of new technologies.

- Growth in mobile markets has generally exceeded 20 per cent in each of the last two years in each OECD country, and reached 186 per cent in Japan in 1998
  - Australia has over 30 mobile services per 100 population, which is a higher penetration than the US and most of Europe but much less than Scandinavia (where penetration rates for mobiles are similar to those for fixed wire services).

- New switched data services such as frame relay and ATM (providing broadband networking) are expanding, substituting for leased lines (dedicated to one customer)
  - also, demand for broadband networking is growing because of new applications (for example, electronic commerce), enhanced performance requirements and reductions in cost per unit bandwidth.

Price comparison methodology

- Separate price comparisons were undertaken for PSTN, ISDN, mobile and various data services and for residential and several groups of business users for June 1999.

- For each comparison, indexes of the price of telecommunications services relative to the price of other goods and services in Australia were compared with the corresponding index in other countries.

- Each index was based on the expenditure over one year on a defined neutral 'basket' of services purchased by a representative user
  - the number of access lines and calls, and the distribution of calls made at different times of the day or week and distances, was specified for each basket.

- Inter-country comparisons were obtained by pricing, at June 1999 prices, the same basket of telecommunications services in each of the countries selected for this study
  - using the lowest-priced plan that is widely available in the relevant market
  - expressing the values in a common unit of account using purchasing power parities (PPP) (see appendix B).

- Indirect taxes associated with the production of telecommunications services, such as value-added taxes, have been included, as the aim is to compare the cost for the customer.

- Inter-country comparisons of the changes in telecommunications prices between February 1998 and June 1999 in each country were made using the same basket of services for the June 1999 price comparisons
  - with changes in prices measured in real terms by adjusting for general inflationary trends in each country.

Comparisons of prices and price changes

- The results of the price comparisons at June 1999 are summarised in figure 1
  - and Australia's relative performance is presented in table 1.

- A broad indication of relative prices can be obtained from the results over all markets
  - Finland and Sweden generally had the lowest prices across most services
  - Australia was more or less in the middle of the group of countries benchmarked for most services
  - residential and business prices in the best performing countries were between 20 and 50 per cent lower than in Australia.

- The international comparisons of price changes (in real terms) between February 1998 and June 1999 for services supplied to both residential and business customers are summarised in figure 2
  - Australian price changes are compared with those in countries with the largest price reductions in table 2.

- Prices fell in most countries for most services, notably
  - PSTN and ISDN price falls ranged between zero and 20 per cent, and were often larger for mobile services
  - Australian price falls were relatively large for PSTN and ISDN services, but were relatively small for mobile services
  - Finland generally had the smallest price reductions among the selected countries, which is consistent with their already low 1998 prices
  - price reductions were generally quite large for Japan and New Zealand.

Table 1 **Relative Australian telecommunications services prices, June 1999**

Service	*Country with lowest prices*	*Ranking of Australian price performance*	*Per cent by which best prices are below Australian prices*	*Per cent by which Finnish prices are below Australian prices*[a]
Residential services				
PSTN	Finland	6 of 10	22	22
ISDN	Korea	6 of 9	44	24
Mobile	Finland	10 of 10	49	49
Business services				
PSTN	Sweden	5 of 10	31	23
ISDN	Sweden	3 of 8	41	**na**
Mobile	France	7 of 10	32	21
Data services	Sweden	7 of 10	48	44

Note A ranking of 6 of 10 for Australia's price performance for residential PSTN services (for example) means Australia has the sixth lowest prices out of 10 countries included in the particular comparison (given all the specified assumptions). The business comparisons above are simple averages of relative prices obtained from the various business baskets.[a] Finland is used as the benchmark because its prices are the lowest or among the lowest for most services. **na** Not available.

Source: Productivity Commission estimates.

Figure 1 **Summary of price comparisons, June 1999**

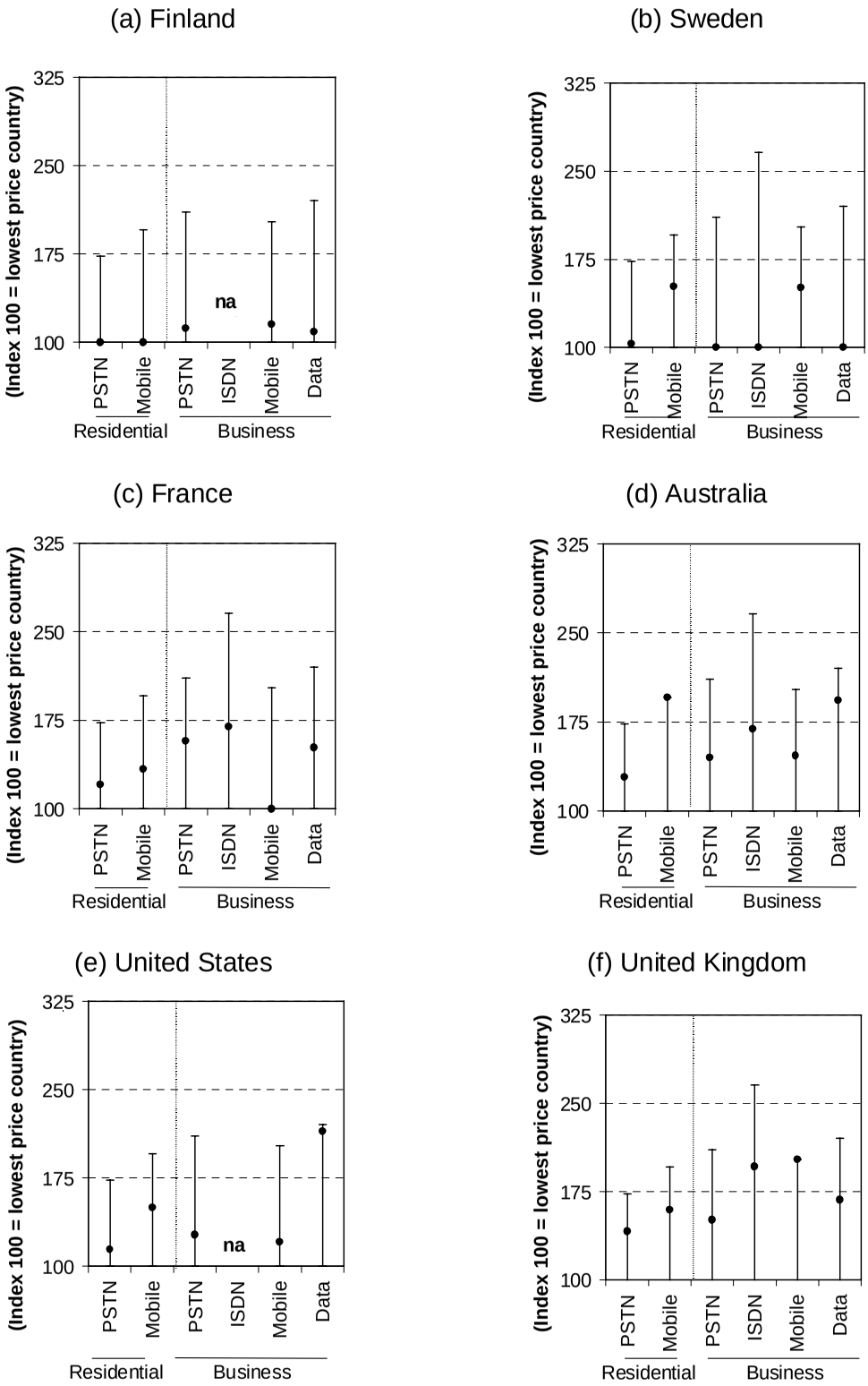

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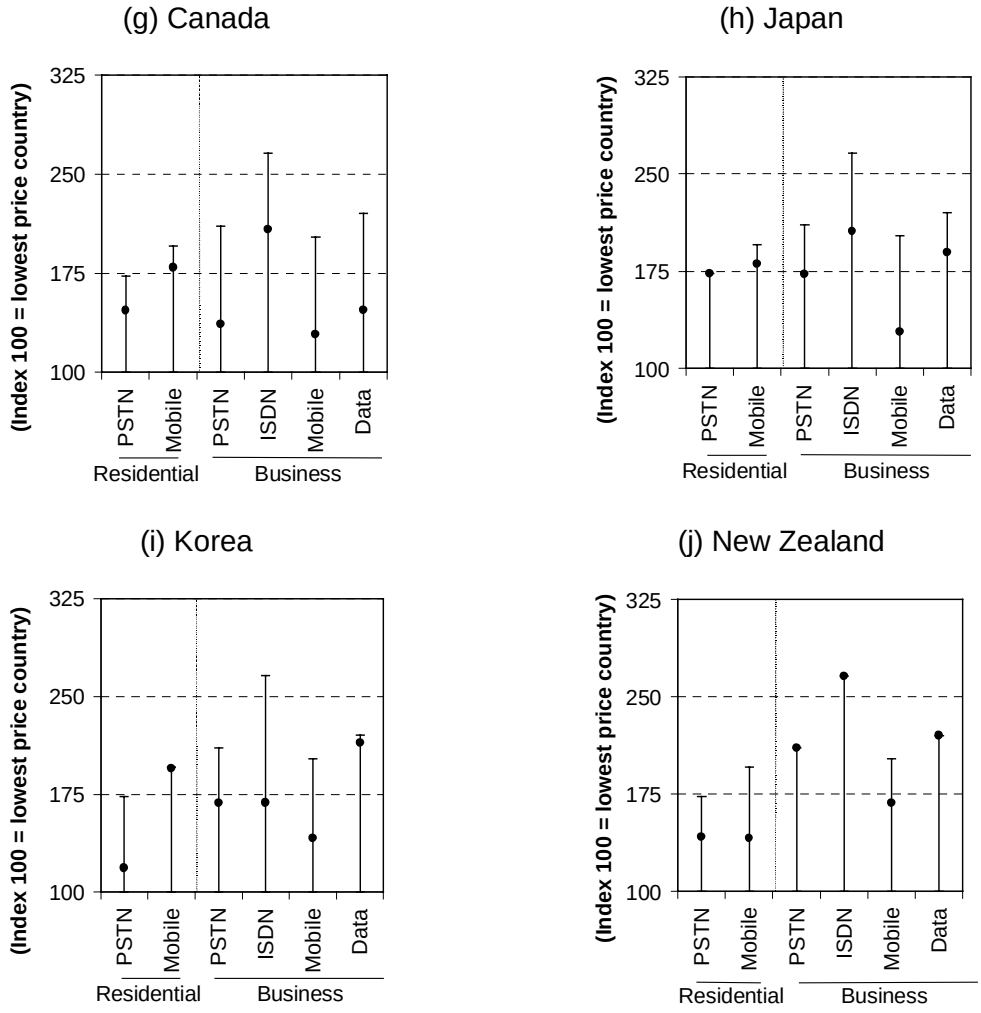
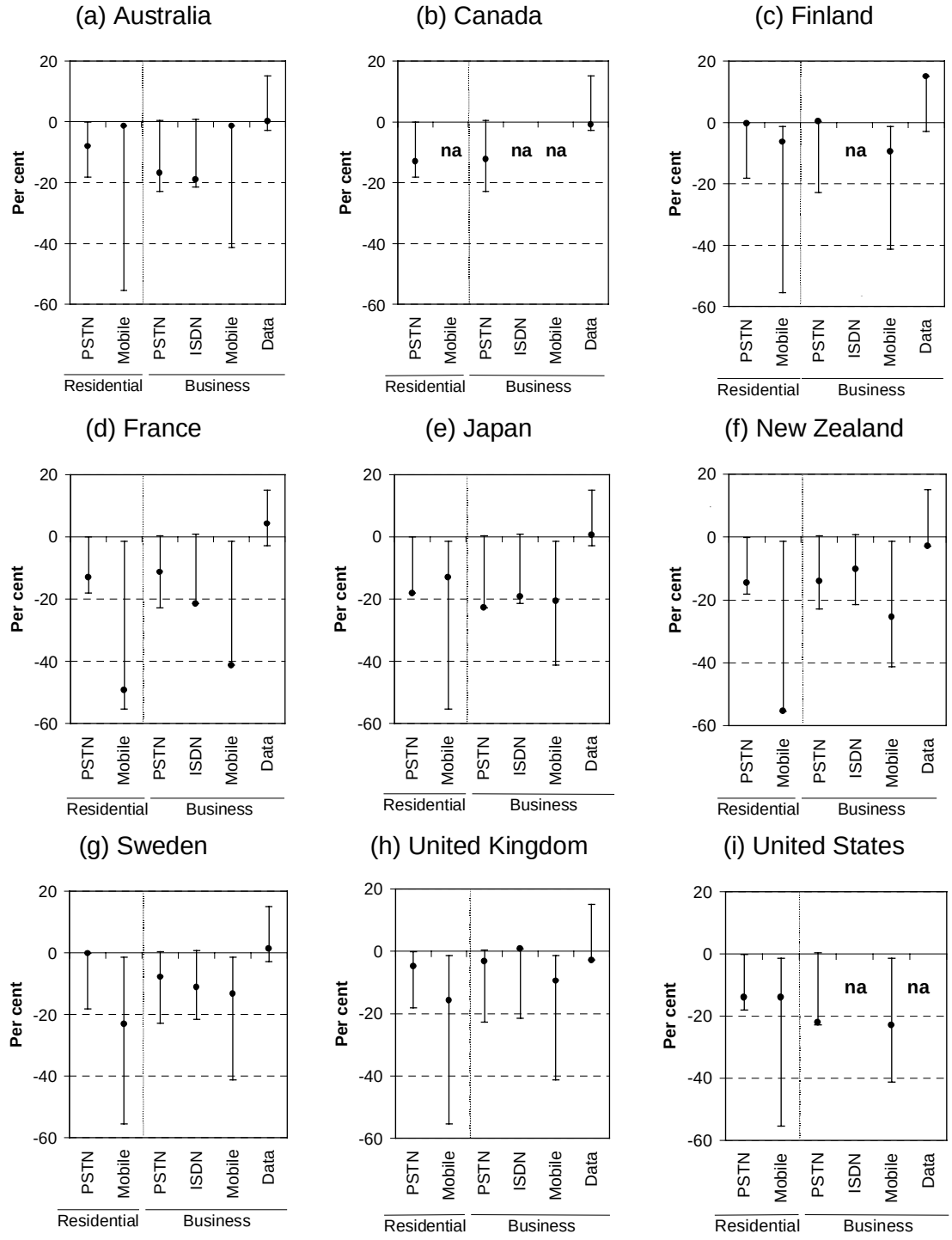
Figure 1 (continued) **Summary of price comparisons, June 1999**



Note The data underlying the above charts expresses the service price for each country as an index relative to the least expensive country. The price in the least expensive country corresponds to an index of 100. The bars represent the range of prices among all the selected countries for the particular service and are the same for each country. For each country, each dot indicates how much more expensive the price of the service is compared with the lowest-priced country, and how much less expensive it is than the highest-priced country. For example, Australia's business PSTN price lies approximately in the middle of the range of prices represented by the bar. Where necessary, price differences have been averaged to provide a basis for aggregate comparisons. **na** Not available.

Source: Productivity Commission estimates.

Figure 2 **Summary of real price changes, February 1998 to June 1999**



Note The data underlying the above charts expresses the percentage price changes, in real terms, for each country. The bars represent the ranges of price changes among all the selected countries for the particular service and are the same for each country as depicted. For each country, each dot indicates the price change of the relevant service. For example, Australia's residential PSTN price decreased by 8 per cent and is approximately in the middle of the range of price changes represented by the bar (between zero and –18 per cent). Where necessary, price changes have been averaged to provide a basis for aggregate comparisons.

Data source: Productivity Commission estimates.

Table 2 **Real changes in Australian telecommunications services, February 1998 to June 1999**

Service	*Country with largest price reductions*	*Largest price changes*	*Australian price changes*
		per cent	per cent
Residential services			
PSTN	Japan	-18	-8
Mobile	New Zealand	-55	-1[a]
Business services			
PSTN	Japan	-23	-17
ISDN	France	-21	-19
Mobile	France	-41	-1[b]
Data services	UK	-3	0

Note For business services, price changes for groups of customers and data services have been averaged. **a** Telstra introduced a new range of plans in July 1999, and it is estimated that for residential customers the price declined by about 10 per cent between February 1998 and July 1999. **b** It is estimated that the price declined by about 4 per cent between February 1998 and July 1999 for business customers as a result of the of the new plans introduced by Telstra in July 1999.

Source: Productivity Commission estimates.

Residential comparisons

- *PSTN prices in June 1999* — Scandinavian countries had the lowest and Japan the highest prices, with Australia in a group of countries with prices in the middle of the range.

- *PSTN price changes since February 1998* — the Scandinavian countries had the smallest price change and Japan the largest. The fall in the total service price in Australia of about 8 per cent (in real terms) is in the middle of the range of price changes.

- The price range was greater for long-distance PSTN services than for local services for the countries benchmarked
  - long-distance prices have generally declined more rapidly than local prices, reflecting changes in cost structures, rebalancing of price structures, and differences in competitive conditions.

- The specification of demand patterns used for the price comparisons had a relatively minor effect on the results
  - when baskets based on Australian or New Zealand demand patterns were used for the PSTN comparisons instead of a neutral basket, the ranking of the Australian price index changed by only one or two positions
  - and the gap between Finland's and Australia's total service price was reduced from 22 per cent to 20 per cent.

- *ISDN prices and price changes* — Australian ISDN prices were in the middle of the range in June 1999, but had the largest reductions since February 1998.

- *Mobile prices and price changes* — Australian mobile prices have fallen less than in other countries, and in June 1999 were relatively high among the countries studied. New plans introduced in July 1999 are likely to have had a small effect on relative prices.

Business comparisons

- *PSTN and ISDN prices in June 1999* — Scandinavian countries again had relatively low prices, with Australia in a group of countries with prices in the middle of the range.

- *PSTN and ISDN prices since February 1998* — Australian prices decreased by 17 and 19 per cent (in real terms), respectively, which was more than most countries.

- PSTN and ISDN price reductions were usually greater for businesses with a larger proportion of national rather than local calls.

- *Mobile prices and price changes* — Australian prices were around the middle of the range of prices observed at June 1999, but declined less than in other countries over the period since February 1998.

Regulation

- Government intervention in telecommunications markets can have significant implications for price outcomes.

- All of the countries studied, including Australia, retained some form of Universal Service Obligation (USO) following the introduction of competition
  - the USO usually involved the provision of basic services in higher-cost rural areas at prices comparable to those in urban areas
  - thereby increasing overall costs and urban prices if the cost of the USO was not directly funded by government.

- USO requirements and funding arrangements in the countries studied remained largely unchanged since February 1998
  - however, digital services have been included in the Australian USO which may affect Australian prices in the future.

- Retail prices of PSTN services are often directly regulated, as well as being affected by regulations that are intended to promote competition
  - only Finland had no retail price regulation
  - three of the OECD countries studied had price caps (CPI-X ceilings on price changes) on a broad basket of both local and long-distance services
  - five countries had price caps on local services
  - only Australia had a price cap on a broad basket of both local and long-distance services as well as sub-caps on individual services within that basket.

- Differences in the stringency of the USO and price caps can directly affect price relativities
  - and may militate against the introduction of more efficient charge structures that can reduce prices overall.

- Since the early 1980s, governments in all the benchmarked countries have sought to introduce competition
  - legislative barriers to entry have been, or are soon to be, removed
  - legislative provisions to facilitate access by new entrants to essential 'bottleneck' facilities owned by incumbents have been, or are being, established.

- In most countries, there are regulatory requirements for reasonable requests for inter-connection to be provided at cost.

- In Australia, the scope of access service declarations, which are expected to result in cost-based access, has been expanded by the Australian Competition and Consumer Commission since February 1998
  - including declaration of various data services, unbundling of the local loop, local call resale and rejection of Telstra's standard access price undertaking.

Competitive conditions

- Factors such as economies of scale and scope, sunk costs, brand loyalty, and any-to-any connectivity provide economic advantages to incumbents and can be barriers to entry for potential competitors.

- In local service PSTN markets, incumbents in most countries have lost very little market share
  - the UK is an exception, with competitors having been relatively successful in gaining market share from the incumbent

- merger activity in the US, for example between AT&T and the cable companies, may result in more competition for the Regional Bell Operating Companies.

- Incumbents have lost more market share, and prices have fallen more rapidly, in long-distance markets than in local markets
  - this is consistent with the widely held view that barriers to entry are lower in long-distance PSTN markets than in local service markets.

- Price controls may be hindering the competitive process in some countries, including Australia
  - price caps on local service may be reducing returns in this market, making entry unattractive
  - incumbents may be seeking high returns from long-distance services to offset low returns from local service, with entrants in the long-distance market following incumbents' prices.

- Mobile services markets are relatively concentrated, but the largest operator is usually less dominant than in PSTN markets
  - In France, the prices of both mobile and local PSTN services have fallen rapidly since February 1998, suggesting competition between them
  - In Australia, the government mandated the phasing out of the analogue network, but required equivalent coverage to the analogue network in rural areas with a digital system.

- Telecommunications is a dynamic and increasingly competitive industry. Generally, consumers are benefiting from this through substantial price reductions.

1 Introduction

This study forms part of a series of international benchmarking studies conducted by the Productivity Commission (PC). A detailed comparative study of telecommunications services, as at February 1998, was published by the Commission in March 1999 (PC 1999). The current study updates the information on prices and regulatory arrangements to June 1999.

1.1 Objective

The chief aim of this study is to compare price levels and price trends of Australian telecommunications services with those of other countries. A subsidiary aim was to provide information on the regulatory arrangements and market environments in Australia and overseas.

Prices are compared at June 1999, two years after the introduction in Australia of the current regulatory regime of open competition. Most of the other countries benchmarked have also opened their telecommunications markets to competition in recent years. However, the specific implementation arrangements and the timing of measures to encourage competition have varied, leading to possible variations in their impacts on prices.

Price changes since February 1998 have been influenced by the progressive implementation of new switching and transmission technologies, changing industry structures and improving efficiency. To some extent, these changes have been driven by regulatory decisions primarily aimed at increasing competition. The interactions of these factors are complex, and vary among the countries examined.

1.2 Approach

The current study focuses on price comparisons and the regulatory and market environment, with an emphasis on changes since February 1998. Information on the significance of telecommunications services in the Australian economy and the structure of the industry in Australia, and quality of service in nine Organisation for Economic Cooperation and Development (OECD) countries is contained in the Commission's earlier study (PC 1999).

Price comparisons

The current study adopts the same general approach for comparing prices used for the February 1998 comparisons. This has allowed comparisons of changes in prices between February 1998 and June 1999 among the countries being benchmarked.

Telecommunications prices are compared on the basis of their level relative to the prices of other goods and services in each country. Telecommunications prices are considered to be lower in Australia than in another country if the ratio of an index of telecommunications prices to the index of general prices (GDP deflator) is lower. Similarly, the rate of improvement in Australian telecommunications prices is higher if the rate of decline in this ratio is greater in Australia.

The price indicator used is an index of the annual expenditure by customers on fixed baskets of telecommunications services. This broadly follows methodology initially developed by the OECD (OECD 1990). However, the 'discount' price that minimizes the cost of each basket was used rather than the standard price used by the OECD.[1] The Commission also examined prices for a greater range of services and business customers.

Changes in the calling patterns of residential telecommunications customers have affected the price index used in the comparisons. Consequently, the residential basket was updated for the June 1999 comparisons. In order to measure the change in price, the same basket was valued at February 1998.

Comparison of regulatory and market environment

Government involvement in the telecommunications industry has significant implications for benchmarking comparisons. Price controls and access regulation affect the degree of competition and incentives for efficient outcomes. Differences in regulation can therefore be expected to result in price variations among the countries, other things being equal.

In the previous study, Australia's regulatory arrangements were discussed in detail and compared with the approaches used in the benchmarked countries. These arrangements included universal service obligations, retail price controls, interconnection or access arrangements between new entrants and incumbent operators, number portability, carrier pre-selection and accounting separation.

The regulatory arrangements current at June 1999 are presented in this report, noting changes since February 1998. Market share information is provided to help

[1] The OECD is considering the adoption of a similar approach.

readers assess the extent of competition in the various markets and countries. The potential influence of the regulatory and market environment in each country on prices and price changes is raised.

Limitations of benchmarking

There are a range of factors affecting the usefulness of benchmarking. These include:

- the accuracy and integrity of the assumptions and data used in the analysis;
- the need to ensure that comparisons are being made in like-with-like circumstances; and
- difficulties in interpreting benchmarking results and in particular, identifying reasons for performance differences.

Considerable effort has been made to minimise deficiencies in the data and analysis. However, inter-country price comparisons depend on factors such as the method of conversion to a common unit of account, customer usage patterns (and hence the weights given to the components of the price baskets) and choice of discount plan. Decisions and assumptions regarding these factors, and their implications for relative prices, are considered when presenting the results.

Prices are affected by internal and external factors. Internal factors include managerial performance, corporate culture and regulatory environment and interventions. External factors are beyond the control of the industry and government authorities, and include the impact of differences in population densities on costs and prices (see PC 1999).

1.3 Study scope

The countries benchmarked were selected to cover a range of regulatory or institutional environments and include countries generally regarded to be at 'best practice'.

The Australian telecommunications industry is benchmarked against those in Canada, Finland, France, Japan, Korea, New Zealand, Sweden, the United Kingdom and the United States. These countries were chosen from among the members of the OECD which have been used in previous benchmarking studies (including those conducted by the Bureau of Industry Economics and the OECD Secretariat).

For this study, Korea, Malaysia and Singapore were added to the list of countries included in the Commission's previous study. However, only limited analysis was possible for Malaysia and Singapore because of data limitations.

Only the incumbent carriers — in most cases, the original monopoly provider — were benchmarked because they remain the most important suppliers of telecommunications services and provide similar products.

The services considered were chosen from among the extensive range of *voice and data communications services* on the market. The provision of customer premises equipment (telephones, computer hardware and software) and broadcasting services were not included.

1.4 Data collection

Teligen Ltd (formerly the Eurodata Foundation) was engaged by the Commission to collect information and develop spreadsheets for the purpose of international comparisons of telecommunications prices. Teligen performed this task for the Commission's earlier study, and has worked for many years with the OECD to develop the 'baskets' of services reflecting the telephone call patterns of residential and small-business customers on which the OECD bases its price comparisons.

Teligen was required to collect and analyse prices for Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), mobile services, leased lines, X25, frame relay and (where possible) Asynchronous Transfer Mode (ATM) services. Information on the prices was obtained from the major telecommunications carriers in the selected countries.

Ovum Pty Ltd was engaged to collect information on growth and competitive conditions in telecommunications markets in the selected countries, and on changes in regulatory arrangements since February 1998.

1.5 Consultation

At the commencement of the study, the Commission convened a workshop of government and industry representatives and other interested parties to obtain their views on study-specific methodological issues.

Further information and comment was received from Telstra and other industry participants as the study progressed. Telstra and Telecom New Zealand were invited to examine the price comparison models used and their input data.

A list of the organisations represented at the workshop and contacted by the Commission in the course of the study is provided in appendix A.

1.6 Structure of the report

Characteristics of the main telecommunications markets, including demand trends, are described in chapter 2. This provides background for the comparisons of prices and regulatory arrangements.

Comparisons of prices and price changes for residential and business customers are reported in chapters 3 and 4. The price indexes and other assumptions used to compare prices are specified. The impact of call pattern assumptions and exchange rates on the residential PSTN price relativities are examined. Methodological issues related to these comparisons are covered in appendix B. The price plans used in the comparisons are listed in appendix C.

Information on current government regulations, and recent changes, in Australia and the other countries is presented in chapter 5, appendix D and appendix E. Also included is information on market structure.

2 Developments in telecommunications markets

The telecommunications industry is diverse and changing rapidly. The emergence of new technologies and services and the continued liberalisation of the telecommunications sector have implications for how operators manage their networks and respond to the increasing expectations and demands of customers.

Developments in the underlying market environment influence market outcomes, such as pricing and the price relativities, presented in chapters 3and 4. The economic significance of the telecommunications industry in Australia and the structure of the industry are discussed in chapter 2 of the Productivity Commission's previous study (PC 1999).

The Commission engaged Ovum Pty Ltd to collect information on the market environment in the benchmarked countries. Drawing on the work undertaken by Ovum, this chapter considers some of the developments in the Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), mobile and data service markets.

2.1 Local and long-distance PSTN services

The PSTN provides the basic infrastructure for telecommunications services (including local and trunk lines and exchanges). It was originally designed to carry analogue voice traffic and is now used for a range of services.

The PSTN can be divided into a number of sub-networks:

- customer access network (CAN) — the local loop that connects homes and offices to the local switch;
- transit networks — short distance carriage and basic switching; and
- long-distance networks — country trunks, interstate fibre cables and microwave bearers, international submarine cables and satellites.

Gateway switches interconnect fixed, wireless voice and data networks, and domestic and international networks.

Local PSTN services

Local PSTN services include both customer access and local call services. The coverage of local services varies with the network topography and regulatory requirements of each country. For capital and major cities, a local call area with a radius of 20-30 kilometres is considered typical.

Access services connect the customer's premises to the nearest point of the local network. Traditionally, the point of connection has been on the customer side of the main distribution frame in the local exchange. With the introduction of new technologies into the local access network, the point of connection may be a remote access unit or switching stage, which will concentrate customer lines back to the exchange.

The growth in access services (see table 2.1) is influenced by:

- *Regulatory measures* — aimed at making services available to parts of the population facing economic or geographic disadvantage. This is especially the case in developing economies where the penetration of service is less than 30 per 100 population, or less than 80 per cent of households.
- *Population growth and new household and business formation* — in most developed countries this is a modest driver of growth in access lines.
- *Growth in second lines in the residential market* — a new and important source of growth, as householders access the Internet or operate on a small home-office basis.

In developed countries, a major driver of local service market development is the increasing demand for higher speed delivery of data. The copper local loop is more than adequate for voice telephony, but is too slow for data transmission. Conventional PSTN modems support speeds of up to 56 kilo-bits per second (kbps). New multimedia applications required by business and residential users, such as audio and video streaming, are contributing to increased demand for higher speeds for local services.[1]

Worldwide however, it is demand for voice telephony that still dominates the local service market. The developed markets of western Europe, North America and Asia–Pacific have relatively high penetration rates of 40-50 lines per 100 population. Worldwide the fixed service penetration level is approximately one-

[1] Multimedia applications combine one or more of the mediums of voice, data and video. Making use of streaming technologies, audio and video traffic is transmitted across the Internet in real time as the data is received. Applications for streaming technologies are varied including radio broadcasts, teleshopping, video on demand and interactive games.

quarter of the developed market level. To increase the world average to that of the developed countries would require the installation of around 1.5 billion telephone lines.

Table 2.1 **Telephony access lines — market growth (1998 and 1999) and penetration for selected countries**

Country	*Growth*		*Penetration in 1999*[a]
	1998	*1999*	
	per cent	per cent	per cent
Australia	3	3[b]	57
Canada	**na**	**na**	60
Finland	2	2	55
France	**na**	**na**	56
Japan	0	**na**	49
Korea	4	5	41
Malaysia	9	8	17
New Zealand	6	**na**	51
Singapore	5	4	54
UK	3	3	51
US	4	4	63

Note Per cent figures represent growth over the previous year. Information for Sweden was unavailable. [a] Penetration is measured by total access lines per 100 population. [b] Estimate. **na** Not available.

Source: Ovum (1999).

Local call pricing can vary widely with flat rate charging remaining as an option in some countries (New Zealand and some States in the US for example), untimed charging in other countries (Australia for example) and timed calls in the UK and most of Europe.

The growing use of the Internet has had a significant impact on local call patterns. This has been most obvious in terms of an increase in the length of local calls (call holding time) rather than increased numbers of calls.

In Australia, Telstra claims that average call holding time is now 6 minutes, compared with 3 minutes at the beginning of the decade. Other non-voice applications, such as facsimile and dial-up data services, are also contributing to increased average local call duration. This is creating incentives for operators to divert Internet and other data traffic away from circuit-switched voice operations to new high speed Internet access services for both business and residential customers.

Information on growth in local call traffic was not available for many countries because of the bundled or other local service arrangements that apply

(see table 2.2). These measures do not reflect the impact of increased average local call holding time.

Table 2.2 **Growth in local call traffic, 1998 and 1999**

Country	*1998*	*1999*
	per cent	per cent
Australia	2.7	4
Malaysia	8.5	8.1
Singapore	18	6
United Kingdom	**na**	3

Note Growth rates measured in call minutes. **na** Not available.

Source: Ovum (1999).

Long-distance PSTN

In many countries, new fixed network service providers have entered long-distance and international call markets. The barriers to entry in these markets were relatively lower than in the local service market, growth rates were high and potential profits were also high.

Consequently, it is in the liberalised national long-distance markets that the impact of competition on prices has been most noticeable. Competition in long-distance markets has been accompanied by increased demand in some countries, although traffic growth rates fluctuate from year to year in response to general economic conditions as well as specific market factors (see table 2.3).

Table 2.3 **Growth in long-distance and international call traffic, 1998 and 1999**

Country	*1998*	*1999*
	per cent	per cent
Australia	15	15
Malaysia		
long-distance	15	13
international	10	6
Singapore		
international	23	0
United Kingdom		
long-distance	**na**	8
international	**na**	5

Note Growth rates measured in call minutes. **na** Not available.

Source: Ovum (1999).

In many countries, such as Australia and the US, there has been a significant rationalisation of the service provider segment of the market, with the takeover and elimination of lower level providers adding little value other than price arbitrage.[2]

2.2 ISDN services

ISDN encompasses a variety of integrated end-to-end digital services. ISDN increases the capacity of the copper pair by providing for the simultaneous operation of a telephone and a 64 kbps Internet service. In most countries ISDN services were provided as an overlay network in a predominantly analogue switching and transmission environment.

In the early to mid 1990s, the take up and use of ISDN was regarded as a sign of an advanced information economy. In Europe, ISDN is beginning to challenge the PSTN, less so in North America. ISDN services have had little impact on the residential market in Australia, but are used by business both as dial-up services and as semi-permanent circuits.

A basic ISDN service provides more capacity than a single PSTN service, but customer access costs (including installation and rental) are higher. Consequently, the performance advantage of ISDN over PSTN modems has been insufficient to attract residential users at current prices.

Service populations are currently growing strongly, particularly in North America and Europe, but this is expected to change in the near term (see table 2.4). Ovum (1999) forecasts that growth should begin to level out in 2001 or 2002. In many countries, the outlook for ISDN is uncertain because of the emergence of new technologies.

The successor to ISDN for digital and user connectivity is expected to be the family of Digital Subscriber Line (xDSL) services. These emerging services provide much faster speeds by using more sophisticated modulation schemes. Several protocols fall under this description, the slowest being Asymmetric Digital Subscriber Line which runs over existing twisted pair lines.

In Australia, growth in business use of ISDN services is maturing. In the range of data services widely available to business, ISDN is now complemented by the

[2] Falling prices in long-distance call markets have reduced the viability of just re-selling services without adding further value. The profit margins from exploiting price differences in the market have been reduced leading to a rationalisation of service providers.

competitive roll out of switched data services such as Asynchronous Transfer Mode (ATM) and Frame Relay services.

Table 2.4 **Forecasts of ISDN connections — January 1998 to January 2003**

	1998	*1999*	*2000*	*2001*	*2002*	*2003*
	000's	000's	000's	000's	000's	000's
Business Connections						
North America	1 090	1 530	2 070	2 480	2 730	2 860
Europe	3 450	6 030	8 140	8 960	9 400	9 400
Asia-Pacific	937	1 590	2 390	3 110	3 730	4 100
Total	**5 480**	**9 160**	**12 600**	**14 500**	**15 900**	**16 400**
Residential Connections						
North America	616	924	1 290	1 680	2 020	2 220
Europe	961	2 310	3 920	5 100	7 650	10 300
Asia-Pacific	16	80	360	512	614	675
Total	**1 590**	**3 310**	**5 580**	**7 290**	**10 300**	**13 200**
All connections						
North America	1 710	2 460	3 360	4 160	4 750	5 080
Europe	4 410	8 340	12 100	14 100	17 100	19 700
Asia-Pacific	953	1 670	2 750	3 620	4 340	4 780
Total	**7 070**	**12 500**	**18 200**	**21 800**	**25 200**	**29 600**

Source: Ovum (1999).

2.3 Mobile services

Mobile telecommunication services are provided over both analogue and digital networks. Some carriers, for example Telstra and France Telecom, are moving to or have closed their analogue networks. In Japan, carriers were required to cease further investment in their analogue systems from April 1997. In the US and New Zealand there has been less regulatory pressure to migrate customers to digital services. Consequently, most subscribers have remained on TCNZ's analogue network in New Zealand. In the US, 88 per cent of mobile customers are connected to analogue networks.

Growth in mobile telecommunications services has been a significant feature of telecommunications markets in the 1990s. A number of factors have contributed to this growth.

Technology — Improvements in the underlying technology resulting in reduced drop-out rates and improved roaming capabilities have contributed to improved service. Improvements in battery technology and handset design have reinforced the

convenience of mobile services by enabling customers to conveniently carry phones on their person.

Improved service levels — There have been improvements in coverage (both in terms of population and transport corridors) which have increased the perceived accessibility of mobile services. The rollout of digital networks has also facilitated the introduction of a number of value-added services, such as voice mail and message services.

Falling prices — Prices have fallen significantly in most countries as a result of cost reductions and competition. In many cases, there is little sustainable differentiation in the service provided by competitors, and carriers have to date competed heavily in terms of price. This has resulted in price innovations, such as handset and service packages and pre-paid services, which in turn have increased the affordability and accessibility of mobile services.

Cultural changes — a culture of mobile calling has developed over the decade with increasing expectations of instant access. Mobile phones are seen as a status symbol in some countries. Also, mobile services are increasingly displacing fixed services in some countries. For example, in Finland mobile penetration has exceeded fixed service penetration and is forecast to reach 91.3 services per 100 population by 2002 (Ovum 1999).

Table 2.5 **Mobile services market growth and penetration 1998 and 1999**

Country	*Services in operation*	*Market growth*		*Penetration*[a]
	1998	*1998*	*1999*	*1998*
	million	per cent	per cent	per cent
Australia	6.0	17	30	32
Canada	5.7	21	33	33
Finland	3.0	39	49	59
France	11.1	118	90	19
Japan	39.0	186	30	31
Korea	14.0	136	95	30
Malaysia	2.3	24	6	11
New Zealand	0.7	80	21	20
Singapore	1.0	75	25	33
Sweden	4.3	32	34	50
United Kingdom	13.0	30	50	23
United States	68.6	16	24	26

[a] Penetration is measured as the number of total active services per 100 population.

Source: Ovum (1999).

Worldwide market growth is currently very high, but varies significantly from country to country and from one year to the next (see table 2.5). The different rates of growth reflect the degree of competition, maturity of service, affordability, the migration of pre-existing customers from analogue to digital systems, the degree of service innovation and cultural factors resulting in fixed-mobile convergence or mobile displacement of fixed services.

2.4 Data services

Leased broadband circuits have been available for data transmission for many years.

Before liberalisation in Australia and many other countries, the use of leased lines to reduce telecommunications costs was important, particularly for larger corporations. With the introduction of competition this has become less important and the emphasis is now on virtual private network features and the quality of service available through switched data services such as ATM.

Switched broadband services have been slow to develop. These services have not been widely taken up by users to date partly because of the high cost involved and partly because there have been no 'killer applications' driving service adoption.

New transmission technologies such as optic fibre have enabled backbone or inter-exchange transmission capacity to be increased at relatively low incremental cost. This in turn has enabled bandwidth-intensive applications such as video and high-speed data transfer to become affordable and commercially viable. The result is that the capacity available for a given price is increasing.

The development of corporate 'Intranets' and electronic commerce is having a significant impact on business demand for data services. The demand for broadband networking is now increasing largely because of:

- the need to speed up popular applications, such as web browsing — because users are not willing to wait extended periods to download graphics and multimedia;
- the dramatic growth in traffic volumes from applications such as e-mail — not only has the use of e-mail increased, but the size of e-mails have also expanded; and
- the reducing cost of bandwidth, particularly for long-distance services.

As a result of the increase in demand for broadband data services, carriers and service providers must address new issues:

- the development of broadband infrastructure using Synchronous Digital Hierarchy (SDH);[3] and
- the choice of protocol at the customer interface or how the service is accessed by the customer.

The need for capacity is fuelling a movement from Pleisiochronous Digital Hierarchy (PDH) to SDH networks.[4] The adoption of SDH by new entrants is likely to encourage incumbents to hasten their transition to the new technology.

There are a variety of protocols available to customers to support broadband traffic. These include existing voice protocols (such as primary rate ISDN) and data protocols (such as frame relay). There are also new developments such as ATM and Transmission Control Protocol/Internet Protocol (TCP/IP).[5] Each of these will have some role in broadband networking by the end user.

Ovum (1999) forecasts that the world market for ATM switched data services will grow by 100 per cent per annum for the period 1998 to 2003. For recent and forecast aggregate broadband capacity using ATM see table 2.6.

Table 2.6 **Broadband ATM capacity to 2003 (Mbps)**

Country	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*
Australia	186	3 160	6 800	12 500	23 500	42 500
Europe						
France	498	5 290	12 400	24 100	46 600	85 300
Germany	834	12 000	29 000	56 500	107 000	190 000
Italy	215	1 820	4 690	9 320	16 800	31 000
Spain	185	1 570	4 040	8 020	14 400	26 700
UK	331	5 610	12 000	22 000	41 300	74 700
Rest of western Europe	628	5 301	13 600	26 900	48 300	89 200
Hong Kong	32.6	423	1 070	2 000	3 420	6 180
Japan	923	9 860	23 400	454 800	89 300	165 000
Singapore	32.4	275	706	1 400	2 520	4 670
US	3 200	51 500	109 000	217 000	401 000	664 000
Total	**7 060**	**96 900**	**217 000**	**425 000**	**793 000**	**1 380 000**
Growth (per cent)	**na**	**1284**	**124**	**96**	**87**	**74**

na Not available.

Source: Ovum (1999).

[3] A set of standards for synchronous digital transmission over optical fibre.

[4] PDH is an asynchronous multiplexing scheme from 1.5 Mbps to 565 Mbps. This technology is being superseded by SDH (known as Sonnet in North America) which is a set of International Telecommunications Union standards for synchronous digital transmission (see Glossary for definitions of terms).

[5] TCP/IP is the general name given to the protocols used on the Internet.

3 Residential price comparisons

The telecommunications industry is diverse and changing rapidly. New technologies and services are emerging and competing with established services. There are differences in the regulatory frameworks applying across countries. Also the process of regulatory change in telecommunications markets is encouraging increased competition and new pricing strategies.

In this chapter, Australian residential telecommunications prices at the end of June 1999 are compared with those in other countries. The change in prices in these countries since February 1998 — when previously compared — was also examined.

The services examined include the Public Switched Telephone Network (PSTN), the digital mobile network and the Integrated Services Digital Network (ISDN). Calls from fixed lines to mobile phones, calls to Internet Service Providers (ISPs) as well as voice calls within the networks are included in the comparisons.

The price comparisons are based on many assumptions related to the specifications and pricing of the services provided to customers. The effect on the comparisons of changing the most significant assumptions was investigated.

3.1 Methodology

An index of the price of telecommunications services *relative to the price of other goods and services* in Australia was compared with the corresponding index in other countries. A detailed explanation of methodological issues in the international benchmarking of prices is presented in appendix B.

Price information for many telecommunications services was aggregated into 'indexes' to provide a practical means of comparing overall prices. Each index was based on the expenditure over one year on a defined neutral 'basket' of services purchased by a residential user.

Inter-country comparisons for June 1999 were obtained by pricing the same basket of services in each of the countries selected for this study, and using purchasing power parities (PPPs) to express the values in the same unit of account. This results in the index used in the price comparisons.

Inter-country comparisons of the changes in telecommunications prices between February 1998 and June 1999 in each country were made using the same basket of services defined for the June 1999 price comparisons. Real (rather than nominal) price changes were measured by adjusting for general inflationary trends.

The countries selected for analysis (listed in chapter 1) are among the better performing Organisation for Economic Cooperation and Development (OECD) countries, with relatively low prices. Therefore, Australia's relative position among *all* OECD countries can be expected to be better than among the countries studied.

Telecommunications prices in the non-OECD Asian countries of Malaysia and Singapore were also examined. There were difficulties in comparing their prices with those of OECD member countries. Nevertheless, some comparative information is presented on PSTN price structures.

As for its previous international price comparisons (PC 1999), the Commission engaged Teligen Ltd (formerly the Eurodata Foundation) to assemble the price indexes utilised in this study.

Telecommunications carriers

The prices of incumbent carriers in each country were used (see table 3.1). The incumbent carriers are the traditional suppliers of fixed line telephony services usually operating as monopolies before the liberalisation of telecommunications markets in recent years. In most countries, they remain dominant. In some countries, several incumbents operate, each being dominant in a particular part of the country or in a particular market (for example, local service, long-distance calls, or international calls). It was sometimes necessary to combine an incumbent local service provider with the major long-distance or international carrier.

The largest mobile service operators were usually subsidiaries of the PSTN incumbents. Incumbents' prices were used in most cases.

Table 3.1 **Carriers used for the price comparisons**

Country	*Carrier*
Australia	Telstra
Canada	BC Tel
Finland	Sonera, Finnet
France	France Telecom
Japan	NTT, KDD
Korea	Korea Telecom
New Zealand	TCNZ (Telecom Corporation of New Zealand)
Sweden	Telia
United Kingdom	British Telecom
United States	AT&T, Nynex, PacBell

Residential price baskets

Separate baskets are used for PSTN, ISDN and mobile services supplied to residential customers.

For example, price comparisons for the total service provided by the PSTN were based on an index which includes the price of access to a line and the prices for a representative basket of domestic and international calls. Within the PSTN 'total service' basket, there are sub-baskets for local service, long-distance, fixed-to-mobile and international calls.

Each basket or sub-basket of national (domestic) calls included calls made at six different times during the week and over 14 different distances. This captured the main elements of the price structures in the benchmarked countries — as prices tend to vary with distance and time-of-day and day-of-week. The baskets were based on those used by the OECD. The weighted average of the prices of calls to the various destination countries, weighted by relative call volumes, were used for the price indexes of international calls.

In developing the basket assumptions, the OECD's objective was to ensure demand or usage patterns were broadly representative of member countries and, as far as possible, neutral in their impact on the measurement of prices.[1] It is recognised that a basket that reflects the demand patterns of any one country would tend to influence the price comparisons in favour of that country.

[1] Sets of assumptions for both residential and small business customers were originally established in the late 1980s by the OECD Secretariat and a working group consisting of representatives from a number of OECD member countries. They are currently being updated with the assistance of Teligen Ltd.

The actual distributions call traffic in any particular country depend on the structure of prices in the country, as well as geographic factors such as population distribution. The sensitivities of these assumptions were assessed.

Conversion to a common unit of account

In this study, GDP purchasing power parities (PPPs) for 1999 were used for the conversion of June 1999 local currency telecommunications prices into a common currency (US dollars).

PPPs are calculated by pricing a specified broadly-defined basket of goods and services in each of the relevant countries. The OECD has published PPPs for 1998, constructed using a basket of goods and services representative of the average final expenditure patterns throughout OECD member countries. The rates for 1999 used in this study (table 3.2) were derived from the OECD's 1998 rates by adjusting for differences in general inflation among the countries.

Table 3.2 **Purchasing power parity exchange rates used for the price comparisons, 1999**

Country	*Unit of local currency*	*US dollar equivalent of one unit of local currency*
Australia	Australian dollar	0.7610
Canada	Canadian dollar	0.8628
Finland	Markka	0.1652
France	Franc	0.1539
Japan	Yen	0.0062
Korea	Won	0.0015
New Zealand	New Zealand dollar	0.6869
Sweden	Krona	0.1044
UK	Pound (sterling)	1.5001
US	US dollar	1.0000

Source: Productivity Commission estimates using data from OECD (1999b and 1999c).

Prices

Comparisons published by the OECD in the past were based on standard prices. The robustness of such comparisons has been affected by the widespread emergence of 'discount' price plans, resulting in prices much lower than 'standard', or 'list', prices.

Price plans generally take the following forms:

- percentage reductions in usage charges, once customer expenditures have achieved a specified level;
- higher customer access or fixed charges and lower usage charges (including specified amounts of free call value), which are attractive to high volume users;
- usage discounts (including capped prices for long-duration calls) in off-peak periods; or
- lower usage charges to a limited number of specified destinations (such as family and friends packages) or for a limited period.

For this study, the prices used in the comparisons were intended to reflect the actual cost to the user. The specified baskets of services were priced in each country using the lowest-priced plan widely available in the relevant market and consistently offered by the incumbent operator(s) in that country.

Plans involving limited destinations or periods were not used, because there is no information on the extent of their use. Also some plans which target narrowly defined groups of customers (for example, students) are excluded for the same reason. (It should be noted that New Zealand has many such plans.)

Where price plans changed between February 1998 and June 1999, it was generally assumed that customers switched to the lowest priced available discount plan that satisfied the specified usage pattern. In some countries, marketing strategies and discount plans changed significantly over this period.

The plans used for the June 1999 price comparisons and for the analysis of price changes between February 1998 and June 1999 are identified in appendix C.

A few adjustments were made to price indexes originally generated for the February 1998 comparisons, and published in PC 1999, so that the estimates of price changes between February 1998 and June 1999 were based on consistent data.

Regional price variations

In countries such as Canada, Finland and the US, there are significant regional variations in prices within the country. Variation occurs within the operational area of the same incumbent (for example, rural and urban areas), and between incumbent carriers operating in different parts of the country.

In Canada and the US, different incumbent carriers operate in different parts of the country. The prices for the incumbent carriers used in this study do not necessarily reflect the prices of other incumbents operating in other parts of these countries.

In Finland, the Finnet group is a federation of many companies providing local services in different regions and other companies providing mobile, long-distance or international services. In the context of historically separate local service companies, prices were not required to be uniform across the country.

Although some averaging of different regional prices was undertaken, it was not possible to take into account all the complexities of the regional pricing structures in these countries. The Commission is unaware of any studies that have fully addressed this issue.

Taxes

Indirect taxes imposed by governments differ between countries and so influence the relative prices of services in those countries. The indirect taxes associated with the production of telecommunications services, including value-added taxes, have been included in the price comparisons because the aim is to compare the cost to the consumer. This issue is discussed in appendix B and also in the Commission's previous report (PC 1999).

3.2 PSTN services

The residential PSTN customer access service supplied to an average household consists of a single connection to the fixed telephone network. The annual expenditure by the household covers customer charges for access to this network and usage charges for the calls made over the year.

Customer access charges include line rental and installation and registration charges associated with setting up a telecommunications service amortised over five years. They are independent of the amount of usage by the customer.

Usage charges accrue on a per call or per call-minute basis. Call charges include charges for national (local and long-distance) voice calls, international voice calls, calls to mobile telephones and calls to ISPs, but exclude fees charged by ISPs.

Assumptions for the benchmarks

The assumptions about the numbers and average duration of calls for a single line residential PSTN customer used to define the residential basket are summarised in table 3.3. The assumptions are similar to those previously adopted for the February 1998 price comparisons. However, the duration of weekday evening long-distance calls was increased to 30 minutes (from 7 minutes for the February 1998 comparisons). This accommodates the impact of charge caps or discounts on certain long-duration calls in some countries.

Table 3.3 **Key assumptions of the residential PSTN basket**

		Call Durations	
Type of call	*Quantity of calls*	*Peak*[a]	*Off-Peak*[b]
	(No.)	(Minutes)	(Minutes)
Local voice[c]	970	2.5 to 3.5	3.5 to 6.0
Long-distance	158	3.5 to 6.0	6.0 to 30.0
Calls to mobiles	60	3.0	3.0
Fax	0	**na**	**na**
Calls to ISPs	150	20.0	30.0
International	12	3.0	5.0

a Peak period calls in the basket are assumed to be made at 11:00am and 3:00pm on weekdays in all countries. **b** Off-peak calls are assumed to be made at 8:00pm and 3:00am on weekdays, and 11:00am and 3:00pm on weekends. **c** Local calls are those made to destinations up to and including 27 kilometres distance from the caller. **na** Not applicable.

Source: OECD, Teligen Ltd, Productivity Commission.

Countries tend to have different definitions of local calls. Accordingly, a common definition of local calls was established for local service price comparisons. According to this definition, calls up to and including 27 kilometres in distance were regarded as local calls — a distance related to the estimated maximum distance of Australian local calls.

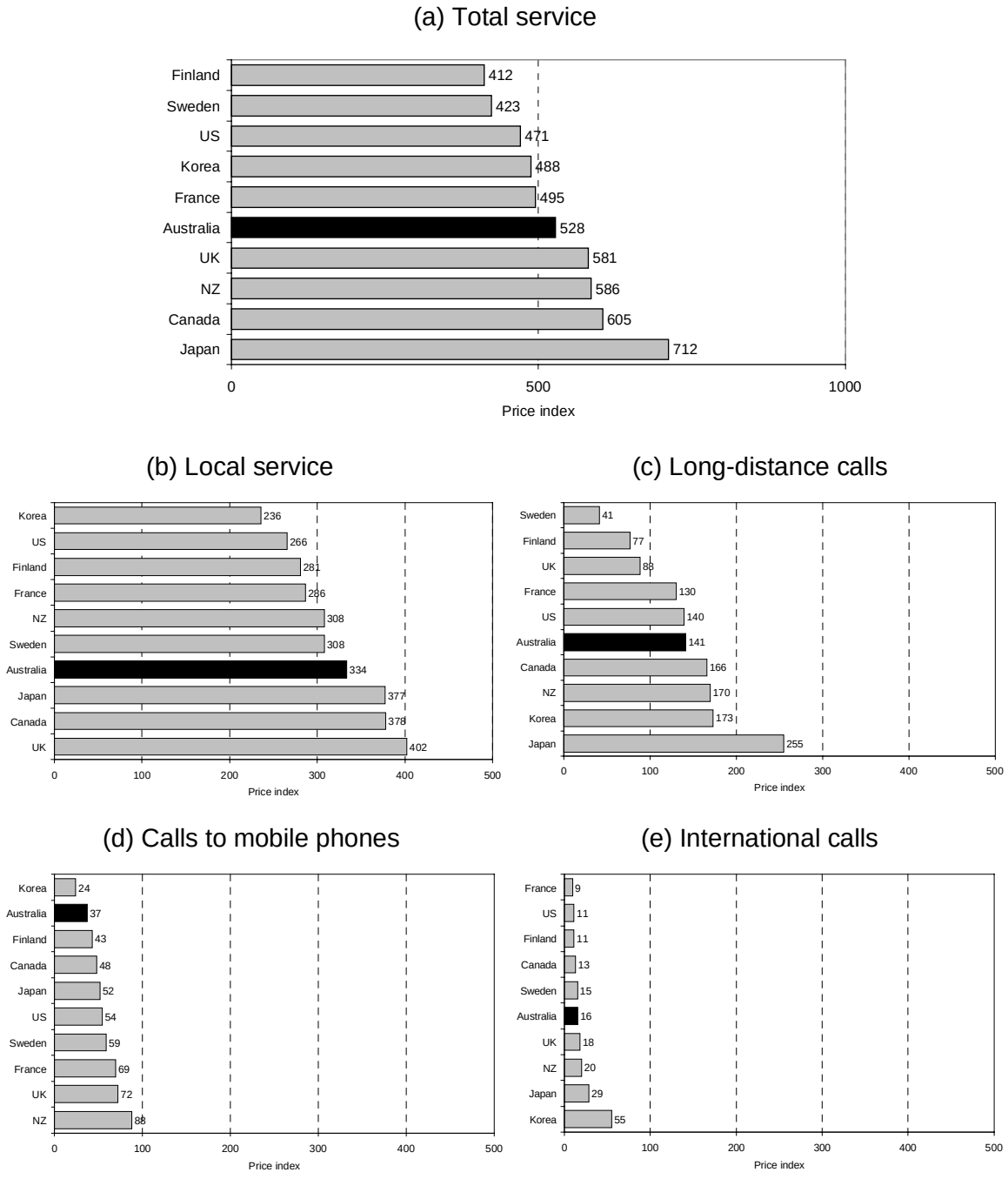
ISPs were assumed to be located within the local call area as defined in each country. This is a reasonable assumption for Australia which has relatively large local call areas. However, for countries with small local call areas, some calls to ISPs may be charged as long-distance calls.

Residential price comparisons at June 1999

The price indices for the ten selected OECD countries are presented in figure 3.1. For the total residential PSTN basket of services, Australian price levels are in the middle of the 10 countries benchmarked (see figure 3.1, chart (a)).

Comparisons of the prices of local service (including access, local voice calls and calls to ISPs), long-distance calls, calls to mobile phones and international calls are given in figure 3.1, charts (b) to (e).

Figure 3.1 **International comparisons of residential PSTN prices, June 1999**



Note The price index is the expenditure in each country (in US$ using PPP exchange rates) on a fixed basket of Public Switched Telephone Network services. The expenditures are valued at June 1999 prices, based on the widely available plan that minimises the cost of the basket.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

As noted, each price index in figure 3.1 represents the expenditure in each country on a defined fixed basket of services, at June 1999 prices, relative to the spending on a broadly-defined basket of final goods and services in that country. The Finnish index of 412 is 22 per cent below Australia's index of 528, which means that the ratio of the price of the defined total residential service to the general price level in Finland is 22 per cent below the same ratio in Australia (see appendix B for a detailed explanation and interpretation of the measures of price comparisons).

Since the US is the numeraire in the comparisons in figure 3.1, a residential customer in the US would pay US$471 for the total basket of services (defined in table 3.3), including US$266 on local services, US$140 on domestic long-distance calls, and so on.

Australian prices in relation to other countries were higher for local service than for the other components of residential PSTN service. Local voice calls are relatively expensive in Australia if they are of short duration. However calls to ISPs, which are normally of long duration, are relatively cheap.

Local services typically include charges for:

- customer access — connection fees and line rental, which may vary between business and residential customers and between regions (for example, urban and rural);
- call set-up — a fee per call; and
- call time — a fee per unit of time (varying with the time-of-day, day-of-week or call distance).

Retail price controls and incumbent pricing strategies have resulted in a variety of local service price structures. For example, local calls are sometimes free, though access charges are then relatively high. Australia has a fixed charge per call. Other countries have timed local calls.

Relative price levels in the benchmarked countries are shown separately for local service and long-distance voice calls in figure 3.2. The countries are ordered by prices in the long-distance market so that the marked difference in the pattern of relative prices in the two markets is clearly evident.

Sweden has the lowest long-distance prices, but its local service prices are in the middle of the 10 countries. Sweden has a relatively high local service to long-distance price ratio which is an indication that it has gone further than other countries in 'rebalancing' its prices to achieve a more efficient structure.[2] On the

[2] Rebalancing is discussed in chapters 3 and 8 of the Commission's previous study (PC 1999).

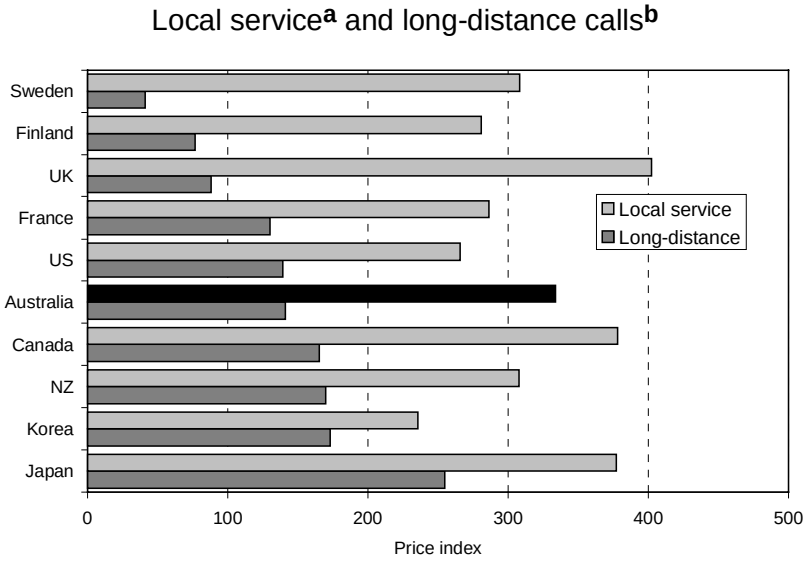
other hand Korea has relatively high long-distance and low local service prices. Australian long-distance and local service prices are both more or less in the middle of the benchmarked countries.

Competition has been much slower to develop in the local service market than in the long-distance voice market. Consequently, local service prices are more likely to reflect government price controls than competitive forces.

In some countries, there are regional variations in local service prices, particularly access rents. It was not possible to investigate the extent of this variation which affects Canada, the US and Finland. The reported results may not necessarily be representative of all regions in these countries.

The wide dispersion of national long-distance prices among the benchmarked countries — a six to one ratio of most expensive to cheapest — suggests differences in the effectiveness of policies that facilitate competition in this market. This is consistent with a wide variety of approaches to and timing of initiatives aimed at increasing competition. However, it may also reflect a stronger tradition of low prices in some countries. For example, Telia, the government-owned Swedish carrier, has long been recognised as having among the lowest prices among OECD countries (as indicated, for example, by OECD comparisons since 1989).

Figure 3.2 **Price comparisons for local service and domestic long-distance PSTN services, June 1999**



Note The price index is the expenditure in each country (in US$ using PPP exchange rates) on a fixed basket of Public Switched Telephone Network services. The expenditures are valued at June 1999 prices, based on the widely available plan that minimises the cost of the basket. **a** Local service includes customer access, Internet calls and voice calls to destinations up to and including 27 kilometres distance from the caller. **b** Long-distance includes domestic (national) calls to destinations 40 kilometres or greater from the caller.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Comparisons of residential price changes

Residential PSTN prices fell in most countries between February 1998 and June 1999 as illustrated in figure 3.3, which presents the percentage rates of change in prices, in real terms, for Australia and eight other countries. The countries are ordered according to their June 1999 relative price. Korea was excluded because Korean prices for February 1998 were unavailable.

The Australian price for a fixed basket of services including line access, and local, long-distance and international calls, fell by about 8 per cent in real terms (6.8 per cent in nominal terms) over the 16 month period. Prices in the US, France, New Zealand, Canada and Japan fell by more than 10 per cent. Prices in Sweden and Finland were already low in comparison with other countries.

There were many changes over the period in the structure of the price plans offered to residential customers in the countries studied. Sometimes, volume discounts were removed and replaced by lower individual call prices (for example, Australia and France). The number of distance categories was reduced in Canada (British Columbia) and increased in France. Some rentals were increased and call set-up fees reduced in Finland (in nominal terms).

In Japan, discount plans became much more attractive (compared with standard prices) and more widely available. NTT's Time Plus service, which offers discounts on long-duration local calls, was extended nationwide and was therefore used in these price comparisons instead of standard prices (which had been used in the Commission's February 1998 comparisons).[3]

In most countries, long-distance and international prices fell much more than local service prices, consistent with policies of rebalancing PSTN prices (PC 1999). Indeed, local service prices rose in four of the nine countries.

Technological developments and increasing competition are likely to be the main reasons for the price reductions. Both of these factors are particularly powerful in the long-distance and international markets.

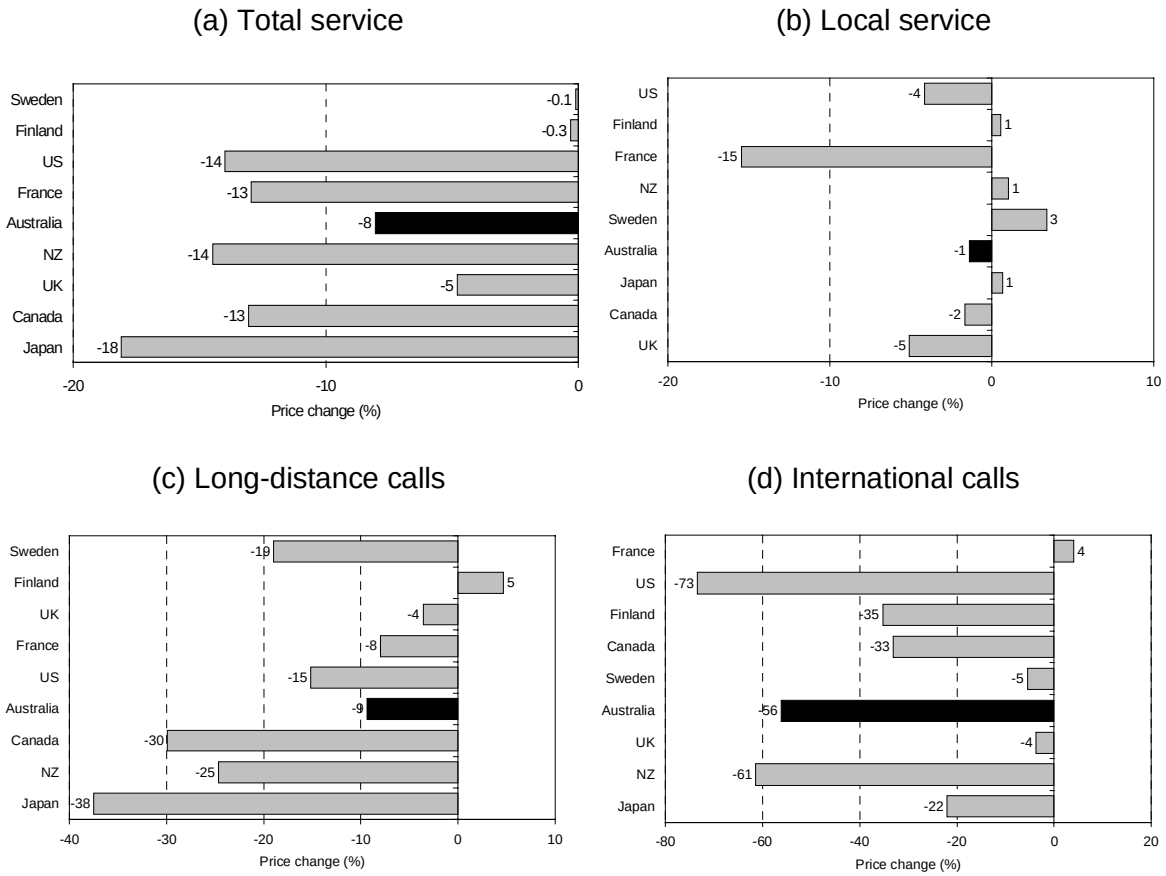
Price changes to calls from fixed phones to mobiles were not included in figure 3.3 because of measurement difficulties for some of the countries. However, it is estimated that this price fell by about 12 per cent in Australia — large price falls also occurred in Sweden, UK and Japan. The scope for reductions in the prices of

[3] Standard prices for Japan were used for the February 1998 price comparisons and the TJ2000+Time Plus+T&S plan for the June 1999 comparisons. However, standard prices at both times were used for measuring the price change over the period.

fixed-to-mobile calls is substantial because these prices are relatively high in most countries, compared with other types of calls.

Changing call patterns affect the relative price performance of countries. For example, the increase in the average call duration of local calls (resulting from growth in Internet usage) combined with untimed local calls tends to reduce Australian residential telecommunications prices compared with other countries. Also, the rapid increase in the number of fixed-to-mobile calls (driven by the large increase in mobile phone use worldwide) reduced Australia's total service price in relation to other countries because of Australia's relatively low fixed-to-mobile prices. The effects of these factors are not reflected in figure 3.3(a).

Figure 3.3 **International comparisons of changes in residential PSTN prices, February 1998 to June 1999**



Note The price change in each country (in per cent) is measured in real terms and for a fixed basket of Public Switched Telephone Network (PSTN) services. Price is based on the widely available plan that minimises the cost of the basket. Calls from fixed phones to mobiles are not included.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Impact of different call patterns

Telstra and Telecom New Zealand provided commercial-in-confidence information on the numbers, distributions and durations of calls for typical Australian and New Zealand residential customers. Internet calls were not separately identified from voice calls. The Telstra data satisfied the input requirements of the Teligen Ltd model. Further assumptions were necessary to fit the Telecom New Zealand data into the Teligen Ltd model.

Price comparisons using the Australian and New Zealand call patterns are contrasted in figure 3.4 with the comparison presented earlier based on the neutral basket broadly representative of OECD countries.

The Australian basket has fewer local calls and more long-distance calls than the neutral OECD basket used for price comparisons in this study. There are also differences in the pattern of call duration. The Australian basket has longer local call duration and shorter overall long-distance call duration than in the neutral basket. The New Zealand basket has much larger numbers of calls (especially local calls which are free in New Zealand) than the neutral and Australian baskets.

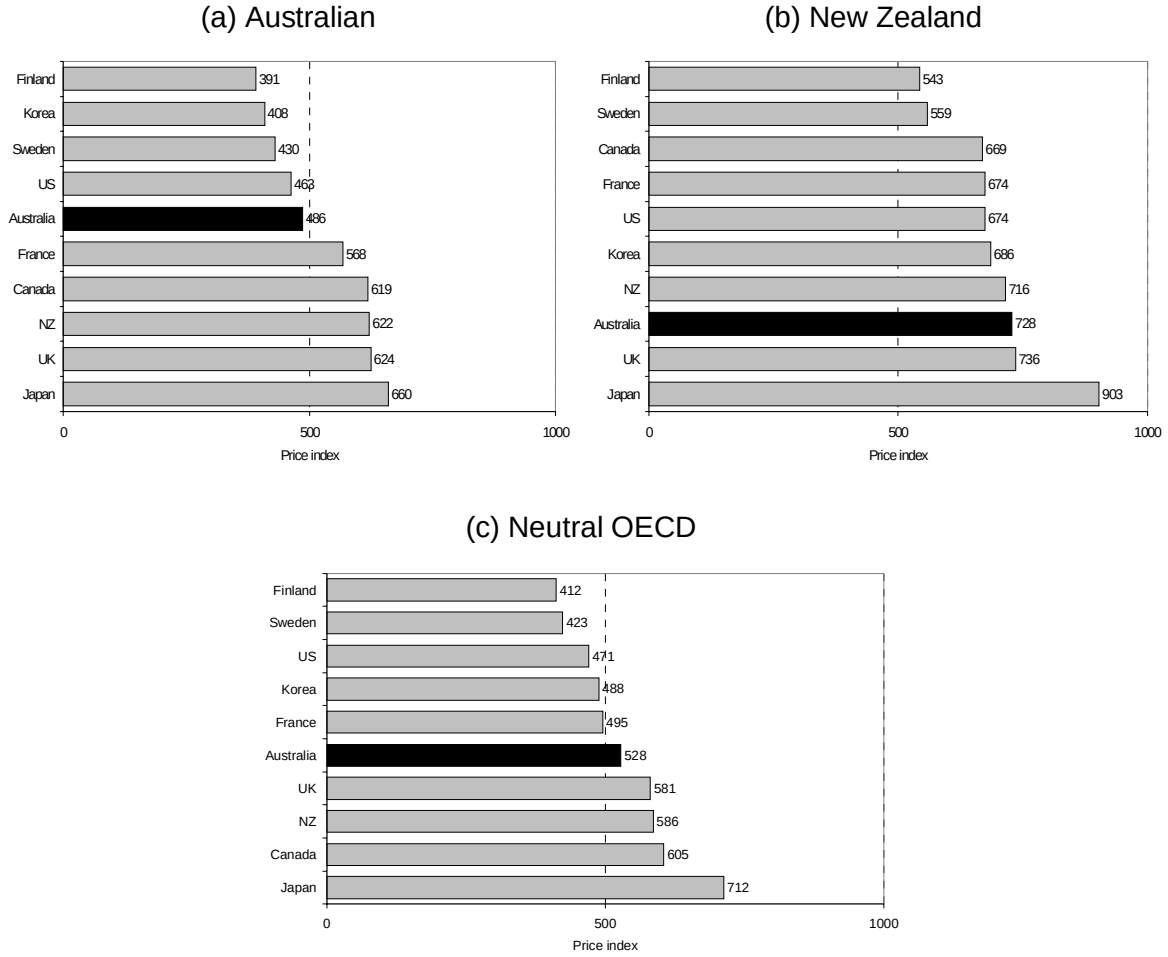
The effect of using the Australian basket for all countries benchmarked was to improve Australia's relative price index from sixth lowest to fifth lowest for residential domestic services. With the neutral basket, the Finnish price index was 22 per cent below the Australian price index. With the Australian basket, the Finnish index was 19 per cent below the Australian index.

The effect of using the New Zealand basket was to improve New Zealand's relative prices from eighth lowest to seventh lowest among the countries benchmarked. Canada improved dramatically from ninth to third when the New Zealand basket was used. This is because of the importance of off-peak call-minutes in New Zealand's calling pattern and the relatively low price for these calls in Canada.

Australia's price performance deteriorated when the comparisons were based on the New Zealand basket. This is mainly because of the importance of local calls in the New Zealand basket combined with the relatively high price for local calls in Australia. The Australian price index was less than 2 per cent higher than the New Zealand index in this comparison. When the Australian basket was used, the Australian price index was more than 20 per cent below New Zealand's.

Use of the neutral basket reduces the risk of biasing the comparisons in favour of any one country. However, when baskets reflecting Australian or New Zealand demand patterns were used, they had only a relatively moderate impact on Australia's prices compared with the better performing countries.

Figure 3.4 **Impact of different call patterns for residential PSTN services on prices, June 1999**



Note The price indices are the expenditures in each country (in US$ using PPP exchange rates) on fixed baskets of Public Switched Telephone Network services. The expenditures are valued at June 1999 prices, based on the widely available plan that minimises the cost of the basket. The baskets for charts (a) and (b) reflect call patterns in Australia and New Zealand. The basket for chart (c) reflects average OECD call patterns. The $3 charge cap for off-peak calls in Australia leads to some very long duration calls which may not be properly accounted for in the price comparisons model. Telstra has provided information which suggests that the estimated price index for Australia using the Australian basket is over-estimated by between 4 and 5 per cent. The price indexes for any other countries with discounts on long duration calls could be similarly over-estimated.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

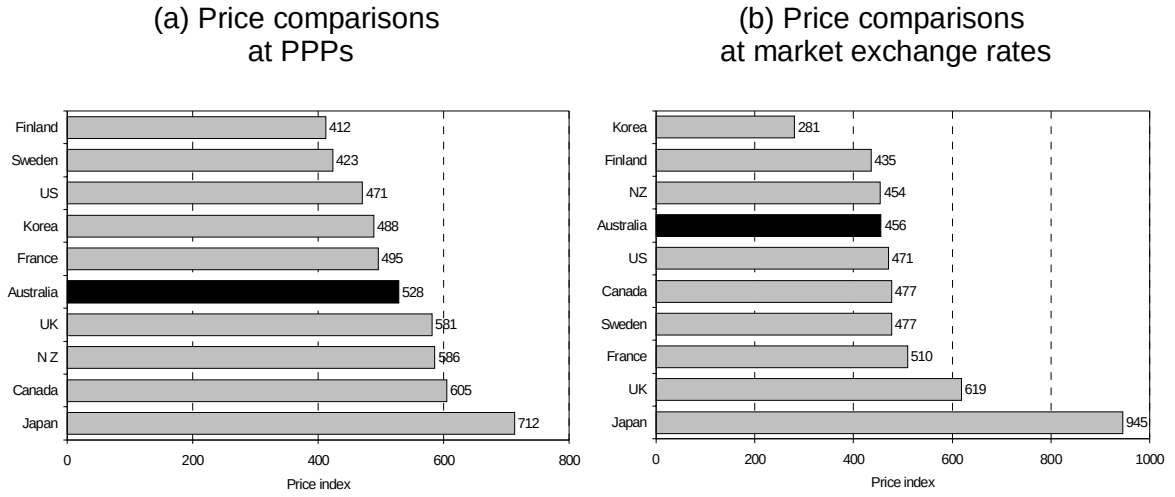
Impact of exchange rate assumptions

The use of market exchange rates instead of PPPs for the June 1999 price comparisons improved Australia's position against six of the nine other

benchmarked countries. Korea and Japan were most affected, Korea favourably and Japan adversely (figure 3.5).[4,5]

A problem with using market exchange rates is the volatility of these rates. For example, between February 1998 and June 1999, the monthly average value of the New Zealand dollar fell by about 8 per cent against the US dollar while the value of the Japanese Yen rose by 4 per cent against the US dollar.

Figure 3.5 **Impact of exchange rate assumptions on total PSTN service price, June 1999**



Note The price index is the expenditure in each country on a fixed basket of Public Switched Telephone Network services. Expenditures are expressed in US$ purchasing power parity (PPP) terms (chart (a)), and US$ at average market exchange rates in June 1999 (chart (b)).

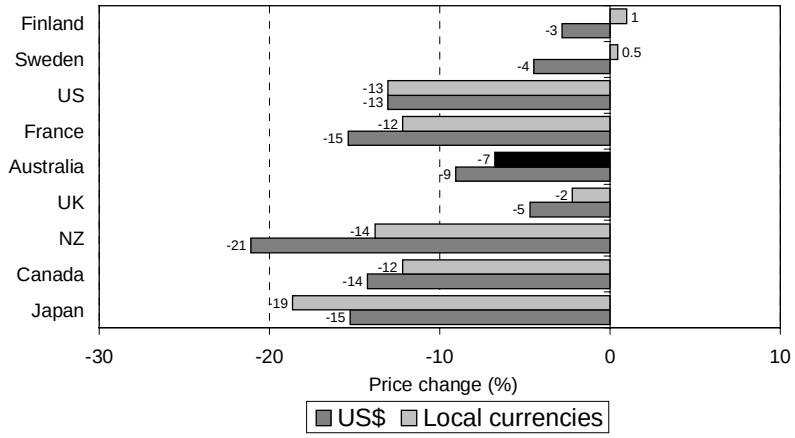
Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

The nominal change in residential telephone prices between February 1998 and June 1999 in local currency terms was compared with the change in prices in US dollar terms (using market exchange rates) for each of the selected countries (except Korea). The impact of market exchange rates on the residential PSTN price changes is illustrated in figure 3.6.

4 Korea's market exchange rate has been depressed for several years and was 42 per cent below its PPP in June 1999.

5 The market exchange rates used in figure 3.5 were the average rates for the month of June 1999.

Figure 3.6 **Impact of changes in market exchange rates on price changes for residential PSTN services, February 1998 to June 1999**



Note The changes in the price of the fixed total service basket are in local currencies and in US$ terms using average market exchange rates in February 1998 and June 1999.

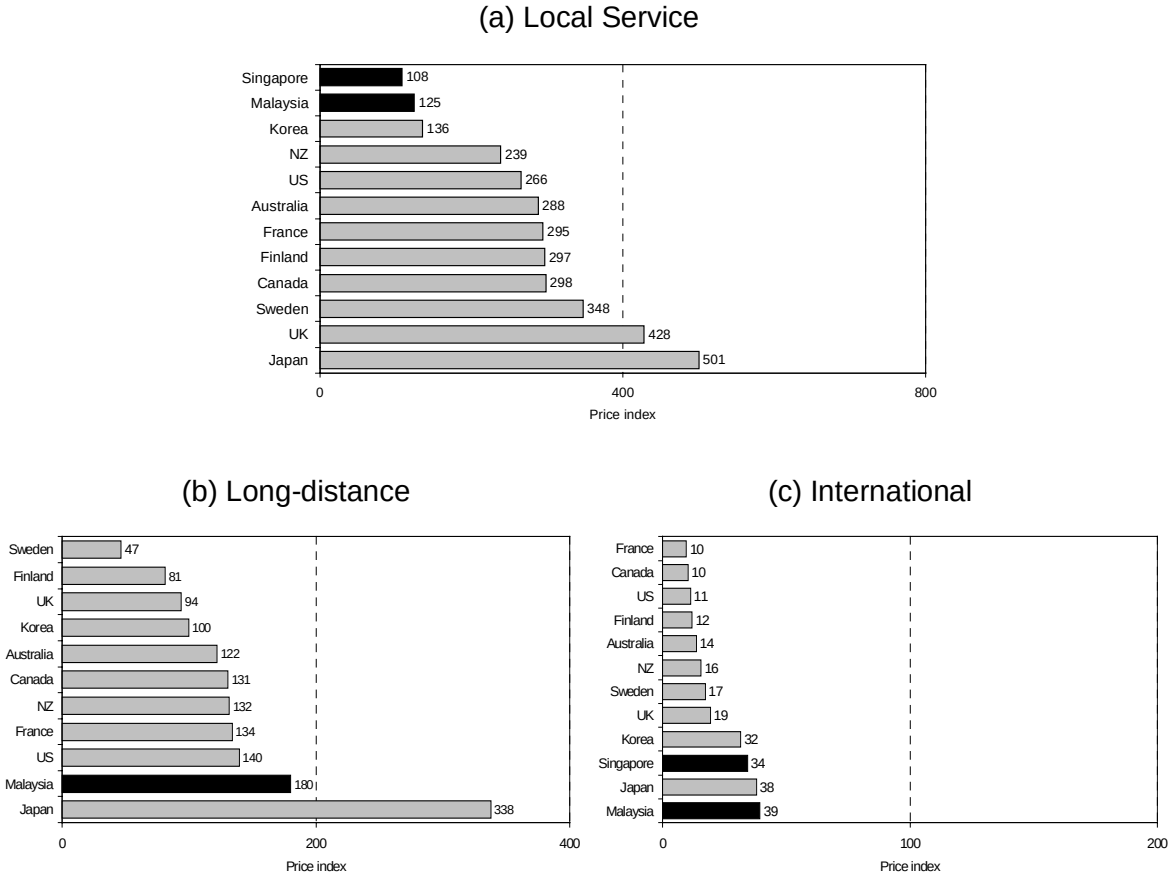
Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Malaysia and Singapore

Comparisons of Australian telecommunications prices with those of neighbouring Asian countries are of interest. However, suitable PPPs for these countries were not available. The difficulties of using market exchange rates, as discussed earlier, are particularly relevant for Asian countries, where exchange rates have been highly volatile in recent years.

Comparisons of overall prices (total service) were not possible for the reasons given above. However, price comparisons (using market exchange rates) of the components of total service are presented to show differences in the price structures of Malaysia and Singapore (see figure 3.7). The contrast between the relatively low price of local services and the relatively high long-distance and international prices for residential customers suggests that rebalancing of the price structure has not progressed as far as in the OECD countries.

Figure 3.7 **Residential price comparisons — Malaysia, Singapore and OECD countries, June 1999**



Note The price index is the expenditure in each country on a fixed basket of Public Switched Telephone Network services. Expenditures are expressed in US$ at average market exchange rates in June 1999. Because of its small size Singapore does not distinguish between local and long-distance calls.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

3.3 ISDN services

ISDN is a technology which brings both voice and data digital communications into the home and office. It can increase the capacity of a standard copper line by providing for simultaneous operation of a telephone and a 64 kilo-bit per second Internet service.

The price index used was the annual expenditure on the service by a representative residential customer, and included customer access charges for installation and access to ISDN, and usage charges for voice calls and calls to ISPs. Assumptions for call numbers and call distributions over time and distance for the ISDN basket were similar to those for the residential PSTN basket.

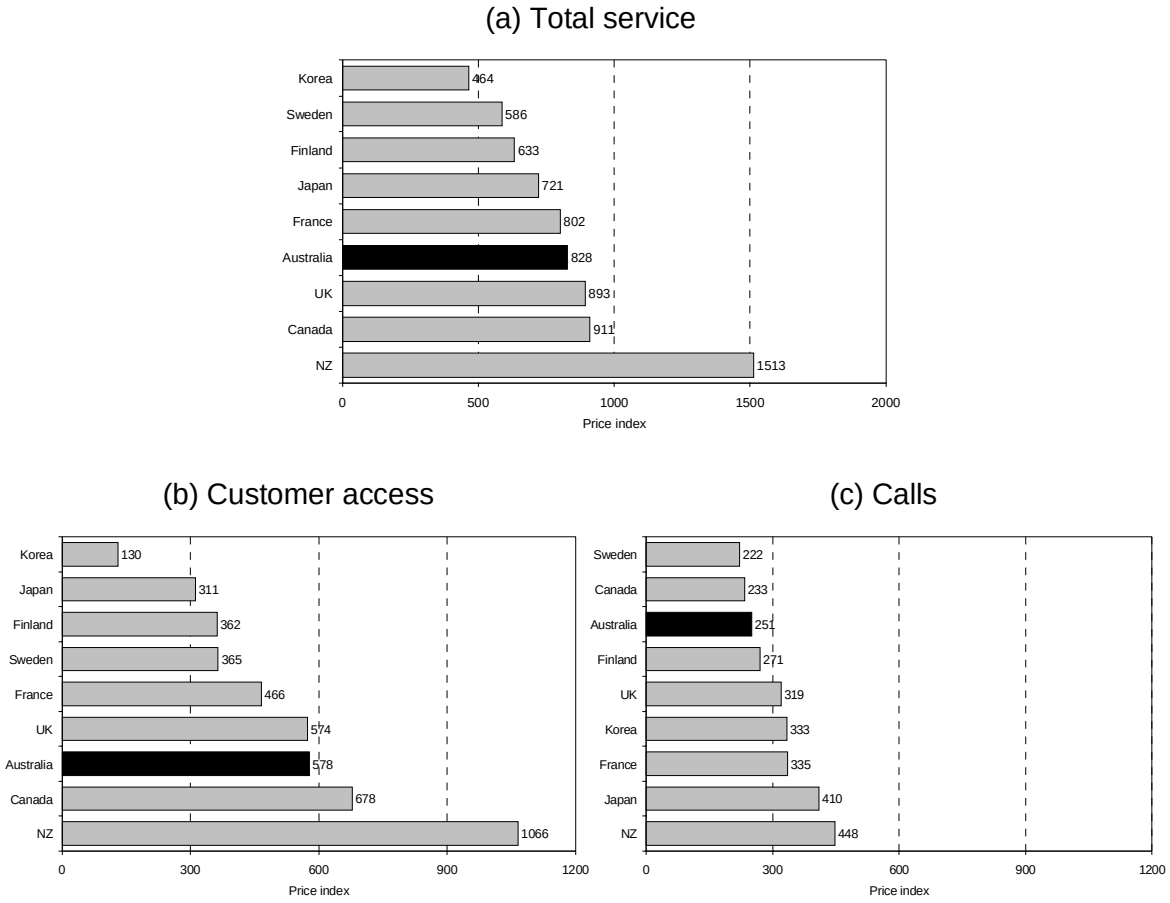
The ISDN service is a potential alternative to the PSTN service for households. However, only small numbers of residential customers have acquired the service, particularly in Australia and North America. There has been a greater uptake of ISDN services by residential customers in Europe.

A basic ISDN service provides more capacity than a single PSTN service but has much higher customer access costs (including installation and rental). The call volumes and Internet usage of most households are currently insufficient for ISDN to be more cost-effective than PSTN.

Residential price comparisons at June 1999

ISDN price comparisons are presented for nine of the benchmarked countries (see figure 3.8). Price information was not available for the US.

Figure 3.8 **International comparisons of residential ISDN prices, June 1999**



Note The price index is the expenditure in each country (in US$ using PPP exchange rates) on a fixed basket of Integrated Services Digital Network services. The expenditures are valued at June 1999 prices, based on the widely available discount plan that minimises the cost of the basket.

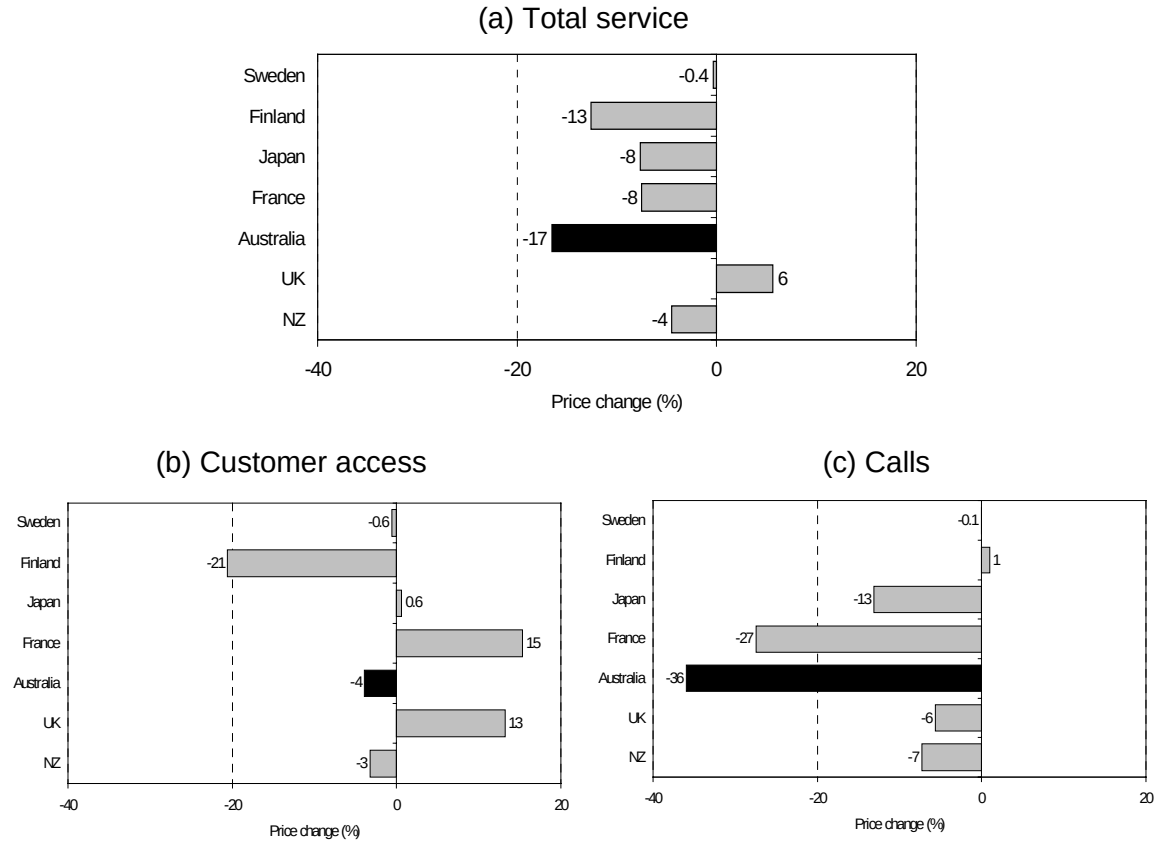
Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

The Australian price for the total ISDN service is around the middle of the nine countries for which price information was available. Korean and Scandinavian ISDN prices were relatively low — 24 to 44 per cent lower than the Australian price.

Fixed charges tended to be relatively large for the ISDN compared with the PSTN. The customer access charge for ISDN is high in Australia relative to most of the other benchmarked countries. The Australian usage charges, on the other hand, are relatively low. Australian ISDN access charges are not subject to a price cap.

Residential ISDN prices fell, in real terms, in most countries between February 1998 and June 1999 (see figure 3.9). The percentage fall in the total service price was greater in Australia (17 per cent) than in the other countries for which information was available. The reduction in usage charges was much larger than the reduction in access rental in Australia.

Figure 3.9 **International comparisons of residential ISDN price changes, February 1998 to June 1999**



Note The price change in each country (in per cent) is measured in real terms and for a fixed basket of Integrated Services Digital Network services. Price is based on the widely available plan that minimises the cost of the basket.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

3.4 Mobile services

The basket used to compare residential mobile prices included access to a single digital mobile service, and local and long-distance calls from a mobile phone to fixed phones and to other mobile phones. International calls from mobile phones are excluded.

Annual fixed expenditure included rental and amortised connection charges. Annual usage expenditure included charges for 366 calls with destinations and durations indicated in table 3.4.

Table 3.4 **Key assumptions of the residential mobile basket**

Type of call	*Quantity of annual calls*	*Call duration*
	(No.)	(Minutes)
Local[a]	285	3.5 to 6.0
Long-distance	44	6.0 to 7.0
Calls to mobiles	37	3.5

[a] Local calls are made to destinations up to and including 27 kilometres distance from the caller.

Source: OECD, Teligen Ltd, Productivity Commission.

Operators offer plans with differing pricing structures, allowing users to choose a plan which best suits their circumstances. Residential users of mobile services are likely to have low usage. Therefore plans with relatively low customer access charges and higher usage charges (per minute call charges) tend to be popular. Typically these plans have low levels of free call allowances.

Marketing strategies such as subsidised handsets, pre-paid tariffs (giving the user more cost control) and free calls to a specific telephone number could not be accommodated in the price comparisons because of their complexities. For example, there are many different types of handset which may be supplied at reduced prices in arrangements established by individual retail outlets. Discounts on handsets tend to be linked to contract periods and to particular plans.

Price comparisons at June 1999

Overall, Australian prices were at the high end of the 10 countries included in the comparisons (see figure 3.10). Australian customer access charges were below the average of all the countries, while its call charges (after allowing for the value of free calls) were the highest of the countries included in the study.

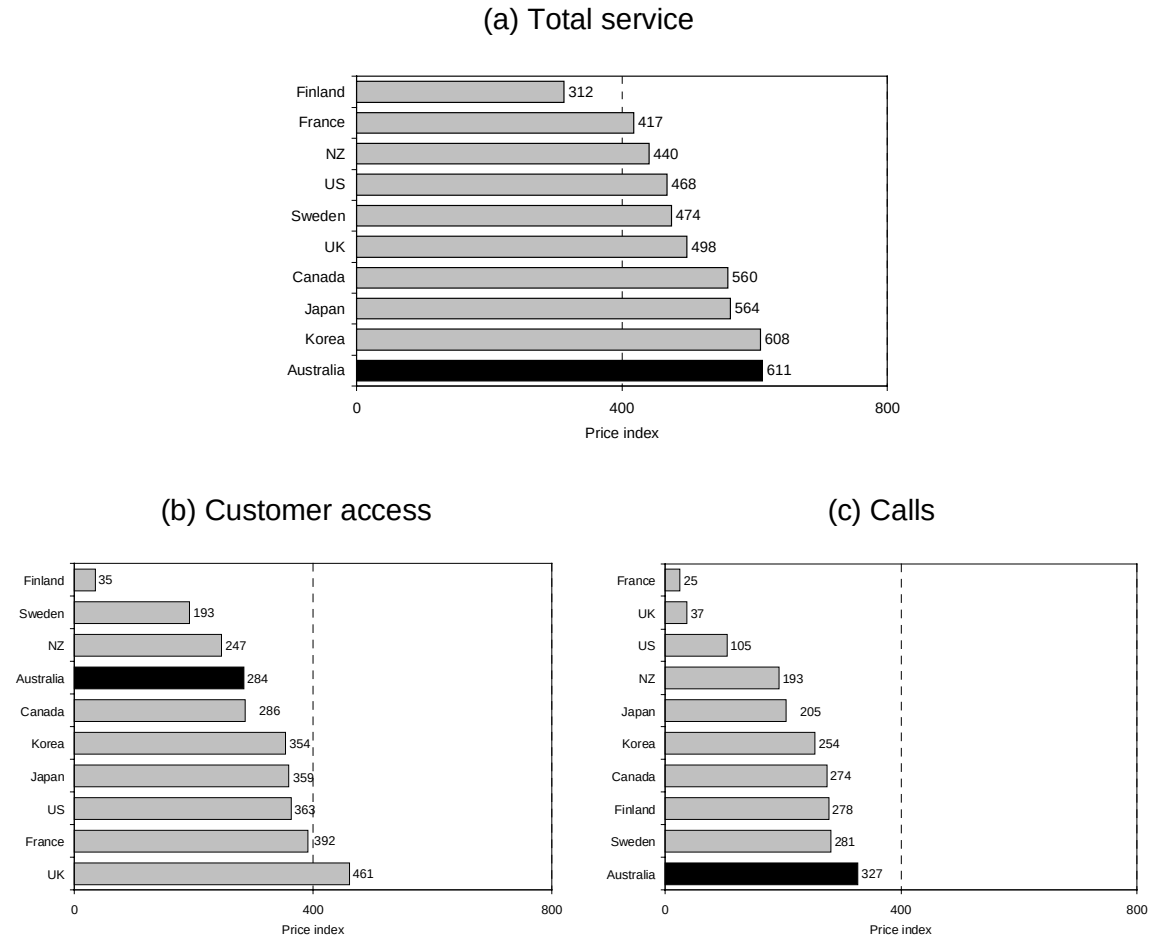
There was substantial variation between countries in total charges for residential mobile users and an even greater variation in the structure of charges.

For residential mobile users in the UK and France, over 90 per cent of the expenditure on the total mobile service represented customer access charges. The low usage charges in these countries reflect the impact of free call allowances. For example, the '2h plan' gives French mobile users 2 hours of free calls every month.

In each of Australia, Canada, New Zealand and Korea, expenditures on access and usage are relatively similar.

For Finnish residential mobile users only 11 per cent of total mobile charges are fixed. The low fixed charges may reflect the absence of any handset subsidy, which is prohibited.

Figure 3.10 **Relative prices for residential mobile telephone services, June 1999**



Note The price index is the expenditure in each country (in US$ using PPP exchange rates) on a fixed basket of cellular mobile services. The expenditures are valued at June 1999 prices, based on the widely available plan that minimises the cost of the basket. Telstra introduced a new range of plans in July 1999, and the total service price index in chart (a) for the relevant plan is 550 which is 10 per cent below the June price.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

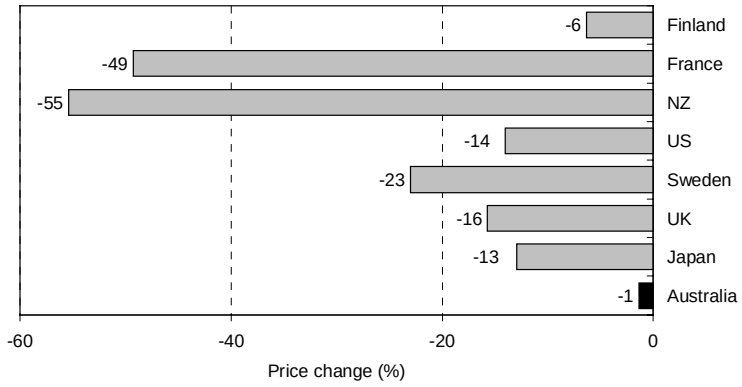
Comparisons of price changes

Operators typically offer a range of mobile price plans and these plans are constantly changing to meet customer needs. The introduction of new plans, the discontinuation of plans and the re-structuring of existing plans make comparisons over time difficult.

Prices for residential mobile services fell for all countries for which comparable data are available (see figure 3.11).[6] The significant falls in New Zealand, France and Sweden reflect the introduction or extension of free call allowances.

In New Zealand, Vodafone introduced new tariffs in June 1999. Compared to the plan used for the February 1998 comparisons, the June 1999 plan had lower customer access charges and 200 minutes of free call time a month.

Figure 3.11 **International comparisons of residential mobile price reductions, February 1998 to June 1999**



Note The price change in each country (in per cent) is measured in real terms and for a fixed basket of mobile services for a residential user. Price is based on the widely available plan that minimises the cost of the basket. The countries are ordered according to their relative position in the June 1999 comparisons. Telstra introduced a new range of plans in July 1999, and it is estimated that the total service price index declined by about 11 per cent between February 1998 and July 1999.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

In France, Itineris (owned by France Telecom) introduced the Loft range of plans in April 1998. The free call allowances available under these plans more than offset the higher customer access charges. The plan used for the February 1998 comparisons had no free call allowance.

Australian prices hardly changed over the period. However, it should be noted that Telstra introduced a new range of plans in July 1999. As well as broadening the

6 Price information at February 1998 was unavailable for Canada and Korea.

range of plans, usage charges were no longer based on distance and there is no distinction between the price of the first 30 seconds and subsequent 30 second periods in the duration of a call. Also, the treatment of calls to other mobiles was changed.

The above changes in Australian prices are not reflected in the comparisons presented in figures 3.10 and 3.11. Access rent remained the same, the value of free calls increased, and the prices of some calls increased and others decreased. The Commission estimated that their net impact was to reduce the overall price of the residential basket by about 10 per cent (compared with the June 1999 price).

3.5 In summary

International price comparisons of the kind reported in this chapter are inevitably based on many assumptions. Although these introduce an element of statistical variability into the price comparisons, nevertheless the following broad conclusions are likely to hold:

- *PSTN prices in June 1999* — Scandinavian countries had the lowest and Japan the highest prices, with Australia in a group of countries with prices in the middle of the range.
- *PSTN price changes since February 1998* — the Scandinavian countries experienced the smallest price fall and Japan the largest. The total service price in Australia fell by about 8 per cent (in real terms).
- *ISDN prices and price changes* — Korea had the lowest and New Zealand the highest prices, with Australian prices around the middle of the range. Australia had the largest price reductions since February 1998.
- *Mobile prices and price changes* — Australia had among the highest prices, and the smallest price falls among the countries studied (prior to July 1999 price reductions).

There was a wide dispersion in the relative prices of the countries studied. For the total PSTN service, Japanese prices were 73 per cent above Finnish prices. The dispersion was much greater for long-distance prices — Japanese prices were six times Swedish prices.

The PSTN price comparisons were not changed greatly by altering the assumptions about call patterns. The ranking of the price index of most countries either stayed the same or changed by one when the Australian or New Zealand basket was used instead of the neutral OECD basket. The Australian rank improved by one position

with the Australian basket but deteriorated by two positions with the New Zealand basket (which has a heavy weighting of local calls).

Australia's relative price performance for the PSTN service did not change much between February 1998 and June 1999, with prices in most countries, including Australia, declining. However, Australia's relative price performance for mobiles declined over this period — Australia's mobile prices changed very little between February 1998 and June 1999, although with the introduction of a new range of plans in July 1999, prices fell by about 10 per cent.

Most countries have continued to rebalance their residential PSTN price structures since February 1998, with the price of long-distance and international calls falling at a greater rate than the price of local services, the latter actually increasing in some countries (including Australia). Domestic long-distance prices in six of the ten countries benchmarked fell by 15 per cent or more — Australian long-distance prices fell by 17 per cent.

4 Business price comparisons

Business demand for telecommunications services vary with the nature of the business, including its size, the geographical scope of its operations and the industry in which it operates. The prices paid by businesses for telecommunications services are in part affected by these factors.

Australian business telecommunications services' prices at June 1999 were compared with those in other Organisation for Economic Cooperation and Development (OECD) countries. Price changes since February 1998 were also examined. The services examined included leased lines, packet switched data, frame relay and Asynchronous Transfer Mode (ATM) services, as well as Public Switched Telephone Network (PSTN), digital mobile and Integrated Services Digital Network (ISDN) services.

Prices were compared for usage levels and patterns typical of small and medium-sized businesses in the same way as for the previous study (PC 1999). Large corporations have not been included because of the practice of large businesses negotiating confidential price agreements with telecommunications carriers.

4.1 Methodology

As for the residential price comparisons reported in chapter 3, the price index for each of the business comparisons was based on the annual expenditure in each country on a specified neutral basket of services.

The telephony prices as at June 1999 were compared with the prices collected in February 1998 and reported previously by the Commission. Comparisons of the real (inflation adjusted) changes in prices between February 1998 and June 1999 for each country and each type of service were made.

Teligen Ltd (formerly Eurodata Foundation) collected the price data and developed spreadsheets for calculating the various price indexes.

Business price baskets

Separate price comparisons were developed for PSTN and ISDN services, for each of six representative businesses.

The range of business baskets specified reflect the diversity of requirements for telecommunications services. The business baskets were primarily defined in terms of the numbers of users of fixed voice telephony and the traffic distribution by distance — local, long-distance and international (see table 4.1). For many business baskets, the number of telephone users is less than the total number of employees. Also, the number of external PSTN lines from the business to the local exchange is usually less than the number of users for medium-sized businesses.

Table 4.1 **Representative business baskets included in the study**

Class	*Code*	*Description*
Small business	S1	One user, mainly local traffic
	S2	Three users, mainly local traffic
Medium business	M1	30 users, mainly local traffic
	M2	100 users, mainly local traffic
	M3	30 users, mainly long-distance traffic
	M4	100 users, mainly long-distance traffic

Source: Teligen Ltd (1999).

The baskets were assumed to be typical of businesses using the PSTN or ISDN for fixed network voice communications, as well as fax and access to Internet Service Providers (ISPs) (except for S1). Each of the six baskets was used for both PSTN and ISDN price comparisons, giving 12 different inter-country price comparisons and a further 12 different comparisons of price changes.

Two baskets of mobile voice communications services were priced for businesses. They reflect usage patterns for small businesses and medium businesses, respectively.

Separate price comparisons are presented for leased lines, X25, frame relay and ATM. Two baskets for each of these services were specified for medium businesses. These data services are not commonly used by small businesses.

The assumptions underlying the price comparisons for each of the various types of businesses and services are summarised later in the chapter.

Prices

As with the residential comparisons, the price (discount) plan used was the one that minimised the cost to the customer of the specified basket in June 1999. The discount plans used in the study are given in appendix C.

Taxes

Indirect taxes associated with the production of telecommunications services were included in the business price comparisons. In most overseas countries, the prices of final goods and services include value-added tax (VAT) or goods and services tax (GST) on telecommunication services used in their production. Australian telecommunications providers pay various indirect taxes (for example, payroll taxes) which are embedded in the prices for telecommunications services paid by businesses, and hence in the prices of final goods and services (see appendix B for further explanation).

Currency conversion

As for the residential price comparisons, purchasing power parities (PPPs) were used to compare business telecommunications prices in a common unit of account. The international comparisons indicate how telecommunications prices varied across countries in relation to the general price level in each country.

Market exchange rates might be useful for business price comparisons in situations where businesses can easily switch their demand for telecommunications between countries. However, most businesses are unable to do so without also relocating to the other country. Telecommunications services typically comprise only a small component of most businesses' overall costs. Consequently, in most industries, they generally have little bearing on location decisions.

4.2 Small business

Relative prices were estimated for two baskets, S1 and S2. These baskets are broadly representative of the small businesses outlined in table 4.1.

The annual expenditure used as the price index included the fixed charges for access to the services and usage charges for the calls made. The fixed charges were those associated with the installation, amortised over five years, and rental of each telecommunications service. The baskets were based on those used by the OECD, which are broadly representative of usage patterns of member countries.

Business basket S1 represents a business which has only one telephone user who is assumed to make 3260 voice calls a year. Basket S2 is typical of a business with three users, each of whom is assumed to make 4000 voice calls per year, 80 per cent of which are made in the peak-period (that is, during the day on weekdays). The assumed number of calls and average call duration for each basket are summarised in table 4.2.

It was assumed that the majority of calls are local. International calls and calls to mobile phones were included in both baskets. Fax calls and calls to ISPs were included only in the S2 basket.

Voice calls and calls to ISPs can be made using either PSTN or ISDN services offered by carriers. The price comparisons for each of these services were based on the same assumptions about the number of users and calls. However, the PSTN and ISDN are different technologies and represent different price–quality combinations.

Table 4.2 **Small business baskets of PSTN and ISDN services**

	Annual calls per user[a]		
Type of call	*S1*	*S2*	*Call durations*
	(No.)	(No.)	(Minutes)
Local[b]	2 335	2 801	2.5 to 3.5
Long-distance	565	679	3.5 to 4.5
International	35	120	5.0
To mobiles	325	400	30.0
To Internet Service Providers	**na**	230	40.0 or 60.0
Fax	**na**	575	3.0
Total	3 260	4 805	

a The S1 basket assumes one user, the S2 basket, three users. **b** Local calls are made to destinations up to and including a 27 kilometre radius from the caller. **na** Not applicable.

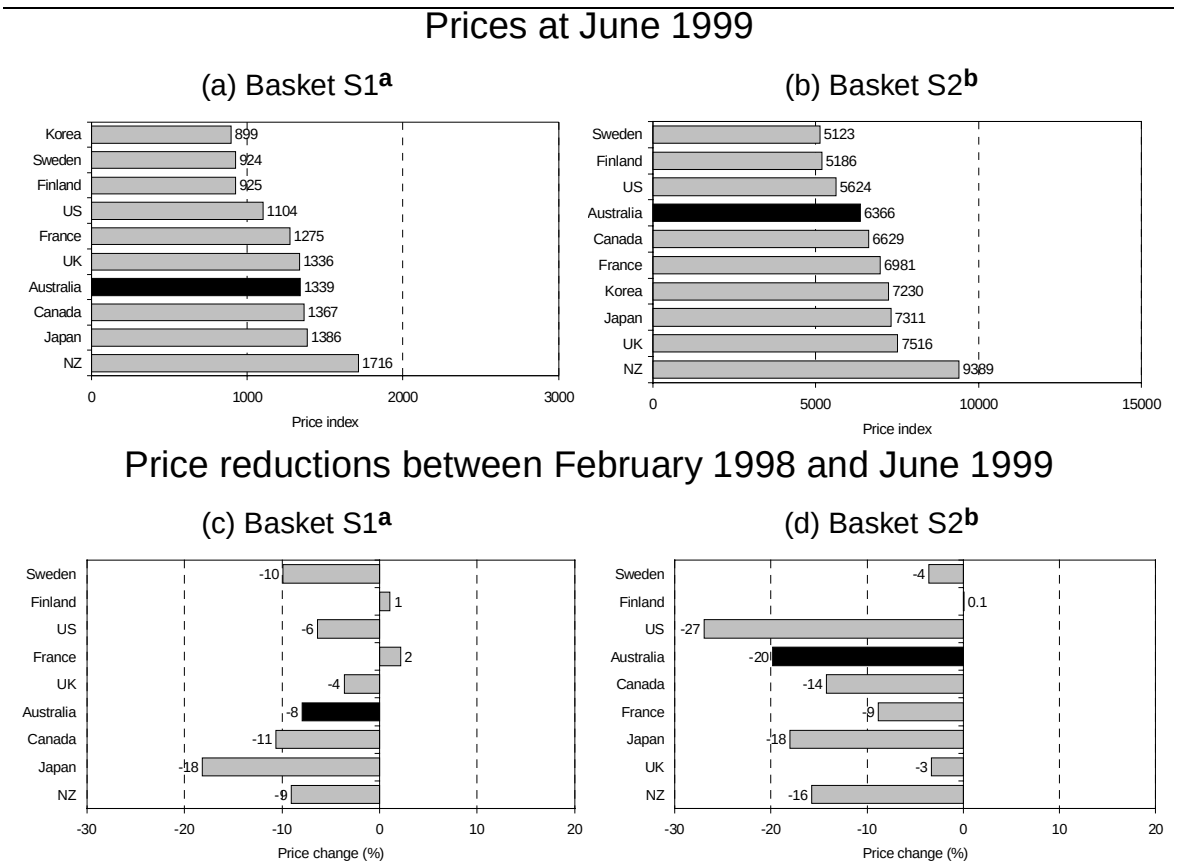
Source: Eurodata (1998).

PSTN services

The PSTN customer access service for representative small business basket S1 was specified as having a single telephone line, and S2 having three telephone lines (one for each user), a fax line and a modem line.

Comparisons of Australia's PSTN prices for small businesses with the nine other OECD countries at June 1999 are shown in charts (a) and (b) of figure 4.1.

Figure 4.1 **International comparisons of small business PSTN prices and price changes**



Note The price indexes in charts (a) and (b) are the expenditures in each country (in US$ using PPP exchange rates) on fixed baskets of Public Switched Telephone Network (PSTN) services. The expenditures are valued at June 1999 prices, based on the widely available plan that minimises the cost of the basket. The price changes between February 1998 and June 1999 in charts (c) and (d) are measured in real terms. **a** S1: A small business with one user. **b** S2: A small business with three users, and one fax line and one modem line.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Australia's relative prices were better for the S2 basket than for S1. This can be explained partly by calls to ISPs being excluded from the S1 basket and included in the S2 basket. Internet calls are relatively cheap in Australia because, unlike a number of other countries, Australia has untimed charges for Internet calls, which were assumed to be long duration local calls.

Comparisons of the real rates of change in PSTN prices for small businesses between February 1998 and June 1999 are shown in charts (c) and (d) of figure 4.1. The countries are ordered according to their June 1999 relative price. Price changes for Korea could not be included.

Generally, prices fell substantially over the period. For example, Australian prices for the S2 basket fell by nearly 20 per cent. Prices in Finland, which were already relatively low, did not change much.

ISDN services

ISDN services are increasingly being used by small businesses. A basic ISDN service over one twisted copper pair can achieve the functionality of at least two PSTN lines.

The ISDN service baskets for small business were specified as follows:

S1 Basic access connection, which is equivalent to two 64 kilo-bits per second (kbps) channels available for use for voice calls; and

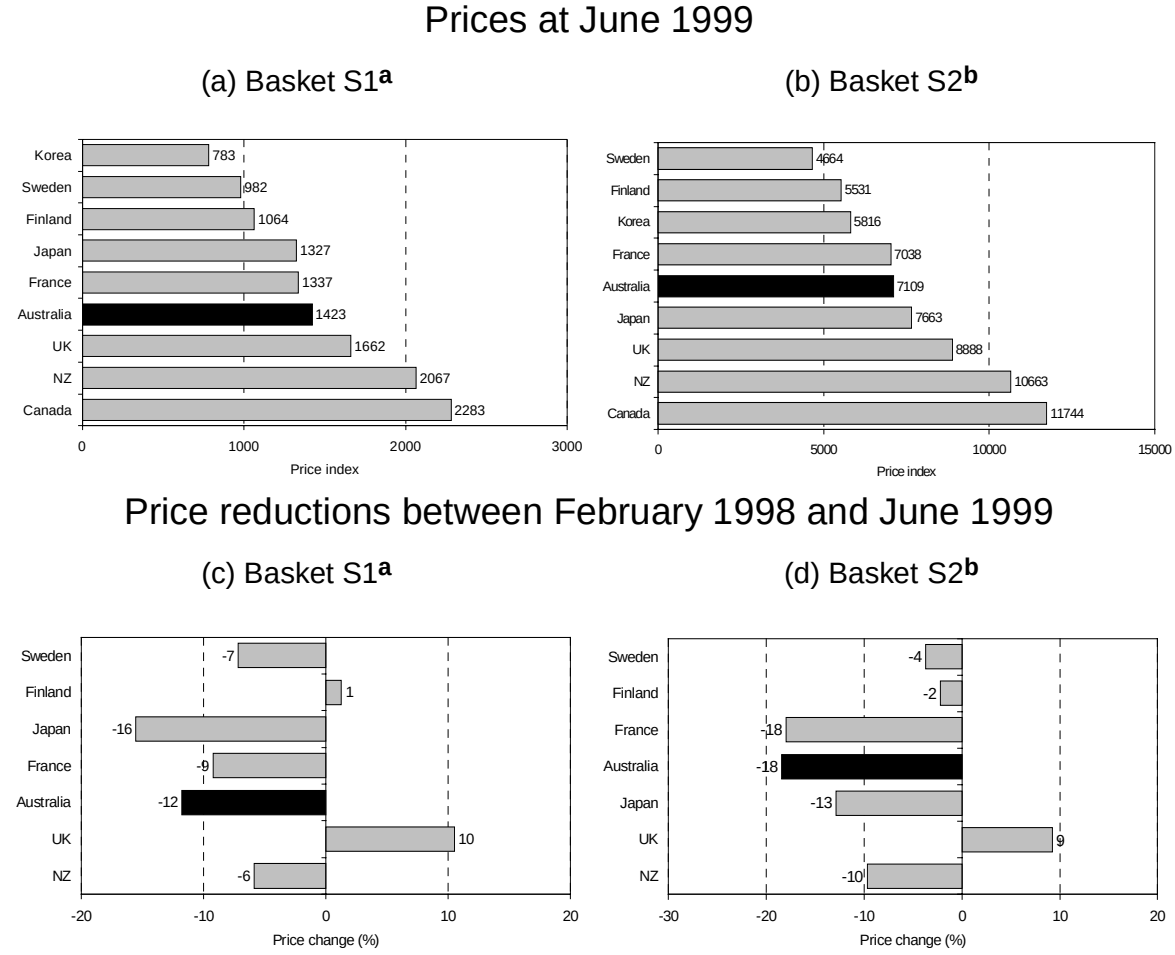
S2 Three basic access connections, equivalent to at least six 64 kbps channels, of which one is used for fax, another for an Internet connection and the other four are available for voice calls.

The relative prices at June 1999 for ISDN services for these baskets are shown in charts (a) and (b) of in figure 4.2. As with residential ISDN, prices for the US were not available.

The real rates of change in ISDN prices between February 1998 and June 1999 are shown in charts (c) and (d) of figure 4.2. The countries are ordered according to their June 1999 relative price. Price changes for Canada and Korea could not be included.

In most countries, ISDN prices for small business have fallen substantially, as they have for PSTN. A notable exception is the UK where BT discontinued its 2e Fast Start plan which contained a free call value feature attractive to small businesses. Australian price reductions were greater than most other countries.

Figure 4.2 **International comparisons of small business ISDN prices and price changes**



Note The price indexes in charts (a) and (b) are the expenditures in each country (in US$ using PPP exchange rates) on fixed baskets of Integrated Services Digital Network services. The expenditures are valued at June 1999 prices based on the widely available plan that minimises the cost of the basket. The price changes between February 1998 and June 1999 in charts (c) and (d) are measured in real terms. **a** S1: A small business with one user. **b** S2: A small business with three users, and one fax line and one modem line.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Mobile services

Small business users were assumed to make 920 mobile calls per year (four per working day), 86 per cent of these being made in the peak period (during the day on weekdays). International calls were excluded. The numbers of different types of calls and average call durations are summarised in table 4.3.

Business users of mobile services are able to choose from a range of plans with different pricing structures. Business users would be looking for plans with relatively low usage (per minute) charges and higher customer access charges (compared with residential users) because they are likely to make relatively large

numbers of calls. Consequently, relatively large free call allowances would be attractive to business customers.

Table 4.3 **Key assumptions for small business mobiles basket**

Type of call	*Quantity of annual calls*	*Call duration*
	(No.)	(Minutes)
Local calls[a]	645	2.5
Long-distance calls	110	3.5 to 4.5
Calls to mobiles	165	3.5

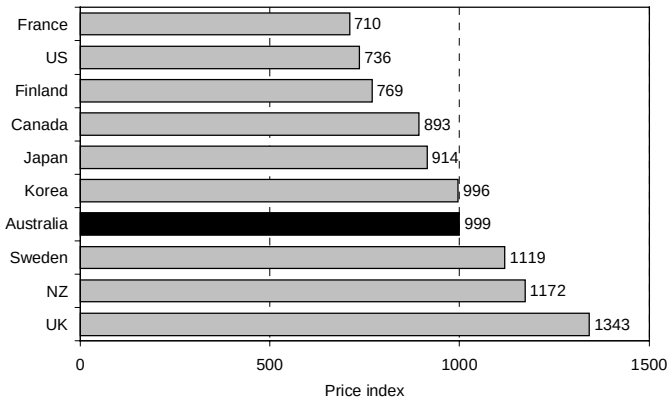
a Local calls are made to destinations up to and including a 27 kilometre distance from the caller.

Source: OECD, Teligen Ltd (consultant), Productivity Commission.

Australian mobile prices in June 1999 (when compared to prices in other countries) were better for small business than for residential users, as can be seen by comparing figures 4.3 and 3.10.

In comparison to the other countries in the study, Australian mobile prices for small business were at the high end of a middle group of countries including Canada, Korea and Japan. Australia had the lowest call charges and the highest customer access charges. Call charges accounted for 8 per cent of total charges. In contrast, in a low priced country such as Finland, call charges accounted for 84 per cent of total charges. The low fixed charges in Finland may reflect the absence of handset subsidies (see discussion on mobiles in chapter 3).

Figure 4.3 **International comparisons of small business mobile prices, June 1999**



Note The price index is the expenditure in each country (in US$ using PPP exchange rates) on a fixed basket of cellular mobile services. The expenditures are valued at June 1999 prices, based on the widely available plan that minimises the cost of the basket. Telstra introduced a new range of plans in July 1999, and the price index for the relevant plan is 971 which is about 3 per cent below the June price.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Since February 1998, prices fell for all countries for which there is comparable data (see figure 4.4). Price changes for Canada and Korea could not be included.

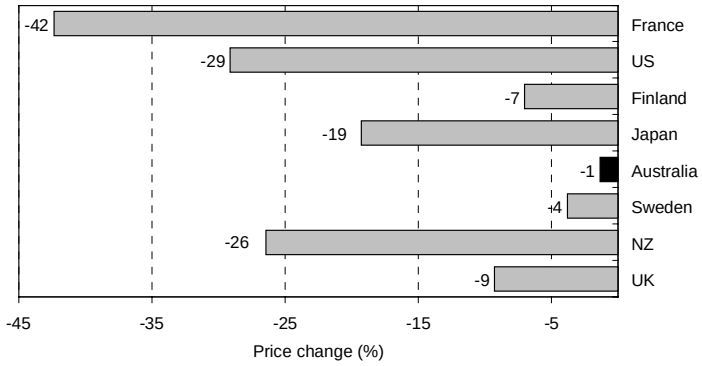
The countries with the most significant falls — New Zealand, France and the US — have all introduced new plans with greater free call allowances. For example, in New Zealand's case, the price plan valid from June 1999 has higher access charges, offset by lower peak and off-peak charges and 65 minutes of free call time a month. This change resulted in a 26 per cent price reduction.

Free call allowances in France not only resulted in a significant fall in the price of the specified total service over the period, but also significantly improved France's relative position against the other countries in the study. Compared to the plan used for the February 1998 comparisons, the June 1999 plan (introduced in April 1998) had lower customer access charges and higher per minute call charges, offset by 4 hours of free call time every month.

Falls in Japan and the UK over the period reflect some restructuring of existing plans. In Japan's case, increased peak and off peak call charges were offset by lower customer access charges. In the UK's case, there was a reduction in both peak and off-peak call charges.

Australian prices hardly changed over the period. However, it should be noted that Telstra introduced a new range of plans for business users in July 1999 which are not included in figures 4.3 and 4.4. As with the new plans aimed at residential users (discussed in chapter 3), per minute usage charges are no longer based on distance and do not change with call duration. The price of calls to Telstra mobiles are also reduced. The net impact was to reduce the overall price of the small business basket by 2.8 per cent (compared with the June price).

Figure 4.4 **International comparisons of small business mobile price changes, February 1998 to June 1999**



Note The price change in each country (in per cent) is measured in real terms and for a fixed basket of mobile services for a residential user. Price is based on the widely available plan that minimises the cost of the basket. The countries are ordered according to their relative position in the June 1999 comparisons. Telstra introduced a new range of plans in July 1999, and it is estimated that the price declined by about 4 per cent between February 1998 and July 1999.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

4.3 Medium-sized businesses — dial-up services

The prices of dial-up PSTN and ISDN services were estimated for the four medium-sized business baskets (M1 to M4) identified in table 4.1. M1 and M2 would represent businesses such as real estate or manufacturing companies of different sizes with mainly local calling patterns. M3 and M4 would represent organisations such as a government office or finance company having calling patterns with an emphasis on long-distance calls and some overseas calls.

As with the small business price comparisons, expenditure on annual fixed and usage charges in each country was calculated for the baskets of services defined for each of the four business types (demand patterns) and for each of the types of telecommunications services.

In each business, the average user was assumed to make 4000 voice calls, 230 Internet calls and 460 fax calls per year, using either the PSTN or ISDN. The distribution of these calls by time-of-day and the call duration assumptions were the same as for the small business comparisons.

For M1 and M2, 80 per cent of national voice calls and for M3 and M4, 33 per cent of national voice calls were assumed to be less than 40 kilometres. The proportion of voice calls which are international were assumed to increase from zero for M1 to 11 per cent for M4. For all the medium-sized business baskets, 42 per cent of fax

calls were assumed to be less than 40 kilometres and all Internet calls 3 kilometres or less.

PSTN services

The number of PSTN lines assumed to be required to carry voice calls, fax and Internet services, and the number of users of these services, are given in table 4.4 for each of the four types of medium businesses. Users were assumed to share the available telephone lines connecting the company site to the public network.

Table 4.4 **PSTN services for medium-sized businesses**

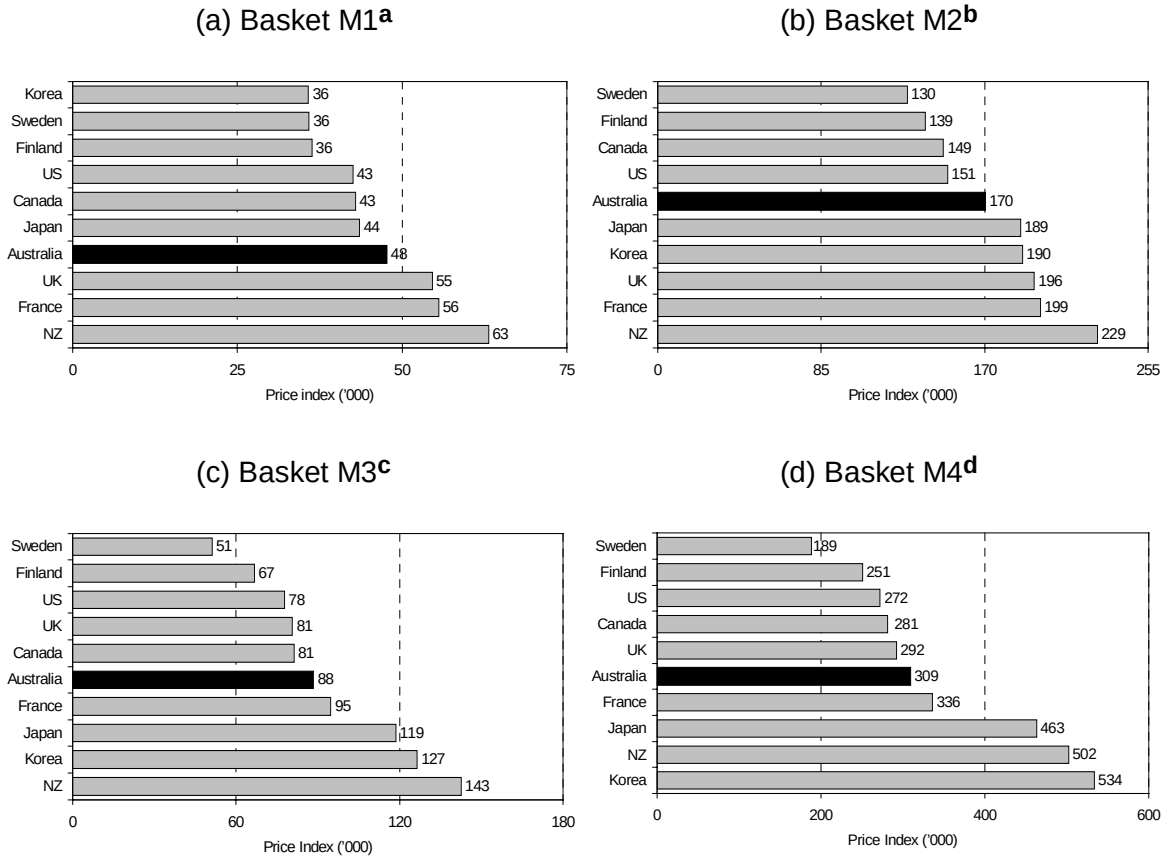
	Medium business baskets			
	M1	*M2*	*M3*	*M4*
National calling profile	Local	Local	Long-distance	Long-distance
International calling profile	None	Minimal	Moderate	Heavy
Users (No.)	30	100	30	100
Voice lines (No.)	10	30	10	30
Fax lines (No.)	2	4	2	4
Internet lines (No.)	3	9	3	9

Source: Eurodata (1998).

For the PSTN services specified for the four medium-sized businesses, Australian prices were around the middle of the price range for the nine countries studied (see figure 4.5). The Scandinavian countries usually had the lowest prices.

Comparisons of the real changes in PSTN prices for medium-sized businesses between February 1998 and June 1999 are shown in figure 4.6. The countries are ordered according to their June 1999 relative price.

Figure 4.5 **International comparisons of medium-sized business PSTN prices, June 1999**

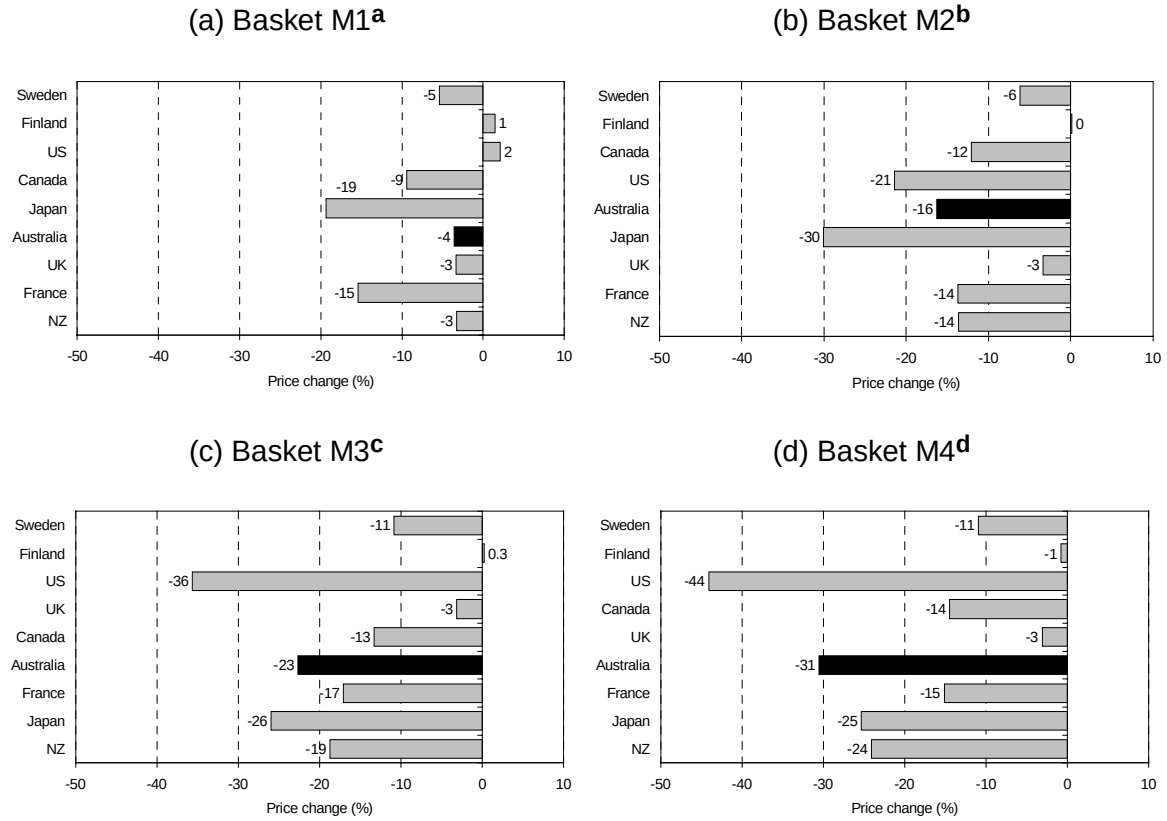


Note The price index is the expenditure in each country (in US$'000 using PPP exchange rates) on a fixed basket of Public Switched Telephone Network services. The expenditures are valued at June 1999 prices, based on the plan that minimises the cost of the basket. **a** M1: Business with 30 users and mainly local traffic. **b** M2: Business with 100 users and mainly local traffic. **c** M3: Business with 30 users and national traffic. **d** M4: Business with 100 users and national traffic.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Mostly, prices fell substantially over the period. For example, Australian prices for the larger businesses fell by 20 to 30 per cent, which is greater than in most other countries. Prices in Finland, which were already relatively low, did not change much.

Figure 4.6 **International comparisons of medium-sized business PSTN price changes, February 1998 to June 1999**



Note The price change in each country (in per cent) is measured in real terms and for a fixed basket of Public Switched Telephone Network services. Price is based on the widely available plan that minimises the cost of the basket. **a** M1: Business with 30 users and mainly local traffic. **b** M2: Business with 100 users and mainly local traffic. **c** M3: Business with 30 users and national traffic. **d** M4: Business with 100 users and national traffic.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

ISDN services

The numbers of ISDN channels required to satisfy the specified profiles of voice calls, fax and Internet services for the four medium-sized businesses, and the number of users generating the voice traffic, are given in table 4.5. It was assumed that each channel carries 64 kbps with channels shared by users and that the businesses use primary rate service. Therefore, the number of channels for each type of business is a multiple of 30.

Although the number of users in each type of business was assumed to be the same as those used in the PSTN comparisons, the capacity provided by the ISDN service exceeds that of the specified PSTN service (especially for M1 and M3). Therefore,

it may be misleading to make direct comparisons between the prices of ISDN and PSTN services.

Table 4.5 **Specification of ISDN services for medium-sized businesses**

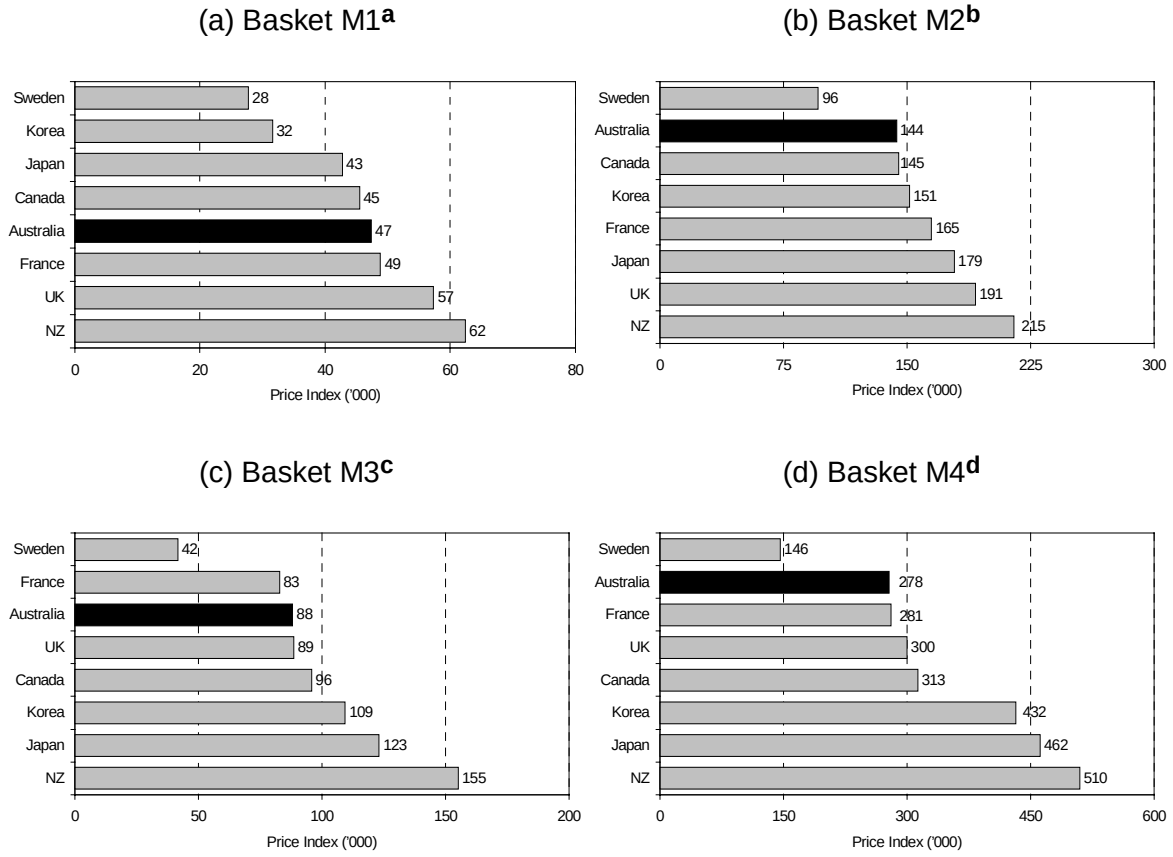
	Medium business baskets			
Service	*M1*	*M2*	*M3*	*M4*
National calling profile	Local	Local	Long-distance	Long-distance
International calling profile	None	Minimal	Moderate	Heavy
Users (No.)	30	100	30	100
Voice lines (No.)	26	55	26	55
Fax lines (No.)	2	3	2	3
Internet lines (No.)	2	2	2	2

Source: Eurodata (1998).

Australian prices for ISDN services for medium-sized businesses were relatively low among the benchmarked countries, apart from M1; only Swedish prices (in the sample of countries considered in this study) were consistently lower (see figure 4.7).

The prices of Internet calls using ISDN were relatively low for Australian medium-sized businesses. Australian businesses tend to rent ISDN semi-permanent circuits for purposes of Internet access instead of paying timed local call rates for dial-up ISDN services. Businesses pay a monthly or annual rent for a channel with continuous Internet access with no usage charge. The option of timed local calls with dial-up ISDN Internet access would be more expensive given the assumptions about the number and duration of calls.

Figure 4.7 **International comparisons of medium-sized business ISDN prices, June 1999**



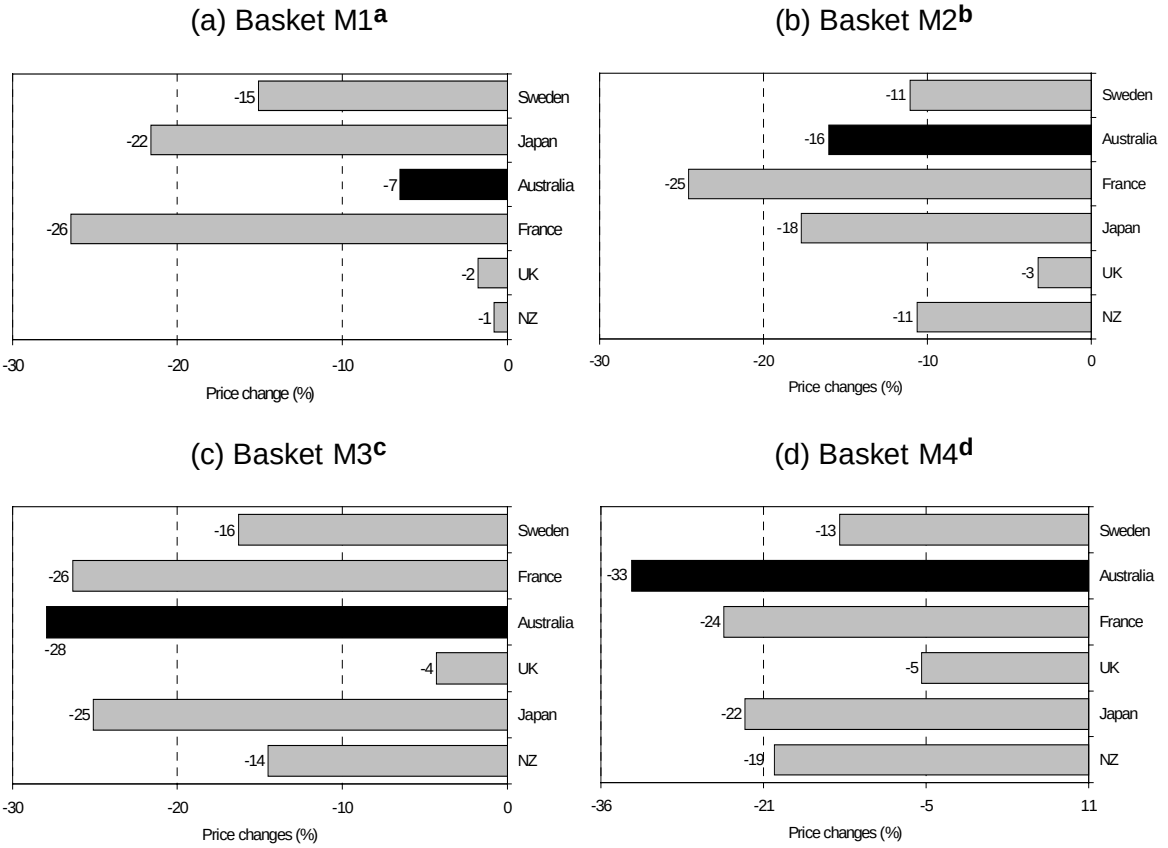
Note The price index is the expenditure in each country (in US$'000 using PPP exchange rates) on a fixed basket of Integrated Services Digital Network services. The expenditures are valued at June 1999 prices, based on the plan that minimises the cost of the basket. **a** M1: Business with 30 users and mainly local traffic. **b** M2: Business with 100 users and mainly local traffic. **c** M3: Business with 30 users and national traffic. **d** M4: Business with 100 users and national traffic.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

The real rates of change in ISDN prices between February 1998 and June 1999 are shown in figure 4.8. The countries are ordered according to their June 1999 relative price.

The price reductions for Australia were relatively large, especially for the businesses with high levels of long-distance traffic. Price reductions in the UK were small.

Figure 4.8 **International comparisons of medium-sized business ISDN price changes, February 1998 to June 1999**



Note The price change in each country (in per cent) is measured in real terms and for a fixed basket of Integrated Services Digital Network services. Price is based on the widely available discounting plan that minimises the cost of the basket. **a** M1: Business with 30 users and mainly local traffic. **b** M2: Business with 100 users and mainly local traffic. **c** M3: Business with 30 users and national traffic. **d** M4: Business with 100 users and national traffic.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Mobile services

Mobile users in medium-sized businesses were assumed to make 1840 calls per year (8 calls per day). The number and average duration for each type of call in the basket are summarised in table 4.6.

As with the other mobile price comparisons, only the digital service was considered, and plans with pre-paid tariffs and subsidised hand-sets were excluded from the basket to ensure consistent tariff comparisons.

Table 4.6 **Key assumptions for medium-sized business mobiles basket**

Type of call	*Quantity of annual calls*	*Call duration*
	(No.)	(Minutes)
Local calls[a]	1214	2.5
Long-distance calls	313	3.5 to 4.5
Calls to mobiles	313	3.5

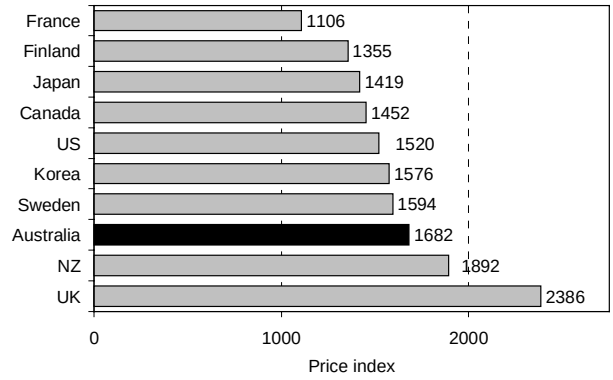
[a] Local calls are made to destinations up to and including a 27 kilometre distance from the caller.

Source: OECD, Teligen Ltd, Productivity Commission.

Users in medium-sized businesses typically rely heavily on mobiles and have high call usage patterns. These users are likely to prefer plans with very low usage charges and higher customer access charges. Their usage patterns also mean that they receive significant benefits from any free call allowances.

As for small businesses, Australian prices were third highest among the countries studied, but in the middle group of prices (see figure 4.9). Of the countries included in the study, Australia had the highest customer access charges (representing 82 per cent of total charges) and the second lowest call charges behind France.

Figure 4.9 **Relative mobile prices for medium-sized businesses, June 1999**



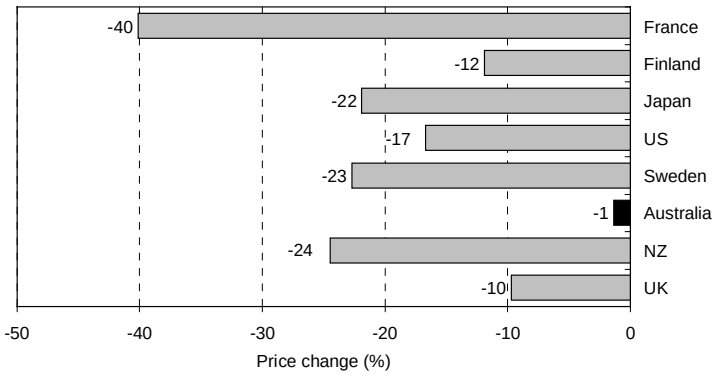
Note The price index is the expenditure in each country (in US$ using PPP exchange rates) on a fixed basket of cellular mobile services. The expenditures are valued at June 1999 prices, based on the widely used discounting plan that minimises the cost of the basket. Telstra introduced a new range of plans in July 1999, and the price index for the relevant plan is 1626 which is about 3 per cent below the June price.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Over the February 1998 to June 1999 period, prices fell for all countries for which there are comparable data (price information for Canada and Korea was unavailable for February 1998) (see figure 4.10). As for small business users (in many cases the same plan is used for the comparisons), the significant falls in New Zealand,

France, Sweden and the US were achieved through the introduction or extension of free call allowances.

Figure 4.10 **International comparisons of medium-sized business mobile price reductions, February 1998 to June 1999**



Note The price change in each country (in per cent) is measured in real terms and for a fixed basket of mobile services for a residential user. Price is based on the widely available discounting plan that minimises the cost of the basket. The countries are ordered according to their relative position in the June 1999 comparisons. Telstra introduced a new range of plans in July 1999, and it is estimated that the price declined by about 4.5 per cent between February 1998 and July 1999.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

In Australia's case, there was little change over the period. The effect of the new July 1999 plans (not included in figures 4.9 and 4.10) was to reduce the price of the medium business basket by about 3 per cent below the June price.

4.4 Medium-sized businesses — data services

Price comparisons for data services were undertaken for leased lines and various switched data services including X25, frame relay and ATM. Demand assumptions were specified for two baskets for each of the above types of service. Price data were more readily available for leased lines and X25 than for frame relay and ATM, which are more recent developments.

Leased lines

The leased lines included in the price comparisons were assumed to be used for digital data communications and dedicated to one customer.

Carriers charge rental fees only — there are no usage charges. Carriers in some countries charge separate fees for access circuits (connecting businesses to the main

network) and trunk circuits. The charges for a leased line vary with bandwidth (transmission capacity) and distance. In order to undertake the international price comparisons, two specified baskets of lines were constructed. These baskets were assumed to represent the requirements of two different types of business.

One of the leased lines baskets (LL1) consisted of 64 kbps circuits for national services only. The other basket (LL2) consisted of 64 kbps and 2 Mega-bits per second (Mbps) circuits for national services, and 64 kbps circuits for international services (see table 4.7). National circuits of 2 kilometres, 50 kilometres and 200 kilometres in length were included in the baskets.

The Australian price index in June 1999 was relatively lower for LL1, which uses lower bandwidth lines, than for LL2 (see figure 4.11, charts (a) and (b)).

Table 4.7 **Specification of leased lines for medium-sized businesses**

	Leased line baskets	
Facilities	*LL1*	*LL2*
	(No. of lines)	(No. of lines)
64 kbps national lines	10	18
2 Mbps national lines	**na**	6
64 kbps international lines	**na**	6

na Not applicable.

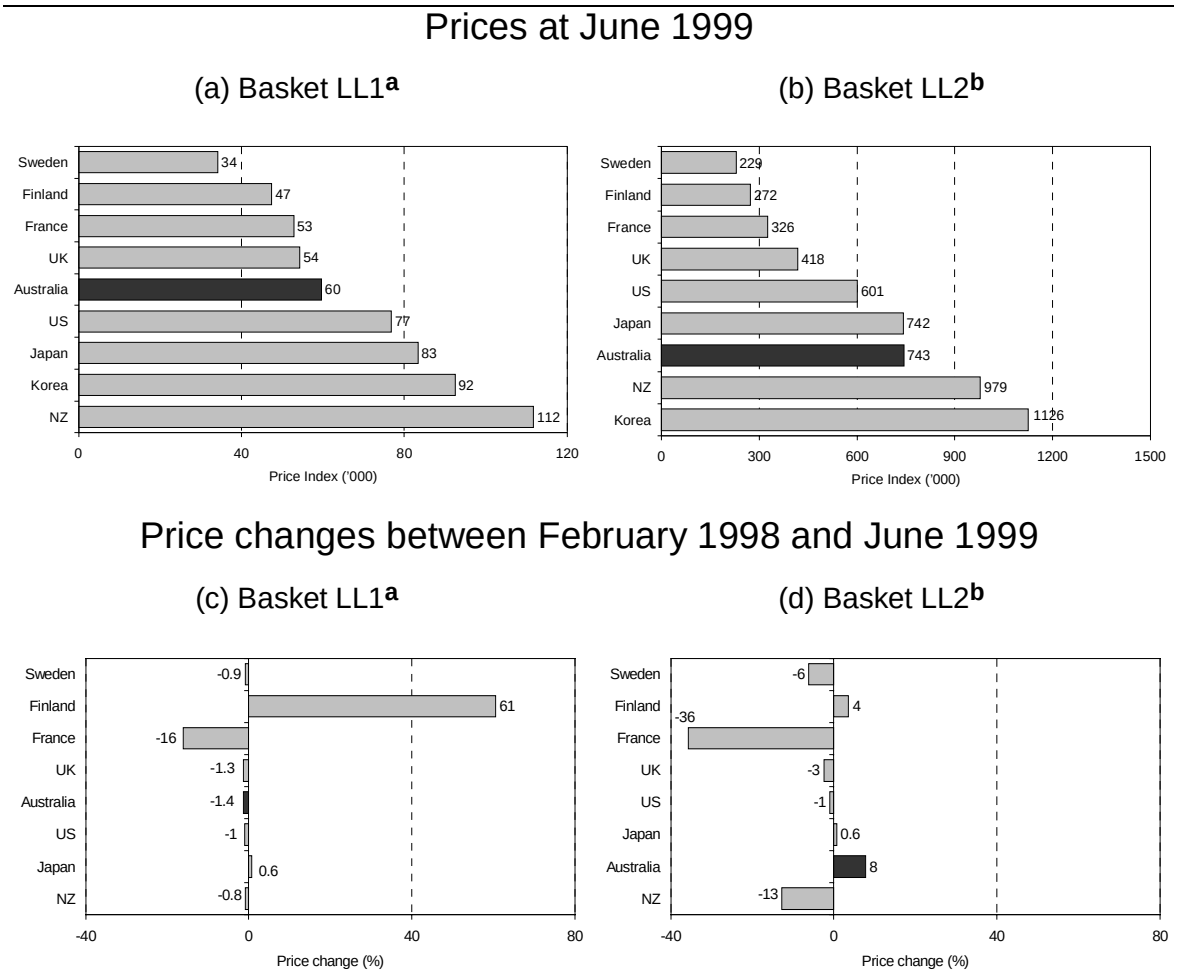
Source: Teligen Ltd (1999).

The Australian price for LL1 fell slightly in real terms (nominal price remained unchanged) between February 1998 and June 1999. Prices for LL2 increased by approximately 8 per cent — due to a substantial increase in the rental of international lines (see figure 4.11, charts (c) and (d)).

Finnish prices increased significantly for LL1 (61 per cent), but only by a small amount for LL2 (4 per cent). This was associated with a shift in the Finnish pricing structure between 1998 and 1999, which involved the introduction of separate charges for access circuits and less significant reductions in some trunk charges.

France had the largest price reductions in both LL1 (16 per cent) and LL2 (36 per cent). Price decreased more for the LL2 basket because prices for 2 Mbps lines and 64 kbps international lines fell more than prices for 64 kbps national lines.

Figure 4.11 **International comparisons of leased line prices and price changes for medium-sized businesses**



Note The price indexes in charts (a) and (b) are the expenditures in each country (in US$'000 using PPP exchange rates) on fixed baskets of leased line services. The expenditures are valued at June 1999 prices. The price changes between February 1998 and June 1999 in charts (c) and (d) are measured in real terms. **a** LL1: Business with 10 lines. **b** LL2: Business with 30 lines.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Switched data services

Switched data services allow businesses to exchange data across a range of locations without leasing dedicated data lines. Businesses in industries such as financial services, transport, wholesaling and retailing have increasing requirements for transmission capacity and flexibility which can be met using switched services.

There are various established and emerging public networks providing data transmission services using packet-switching techniques, in contrast to the ISDN networks discussed earlier which provide circuit-switched voice and data services.

Packet switching technology is more suitable for data transmission than for voice, and utilises network facilities more efficiently. Packet-switching data networks using the X25 protocol have been in use for many years. Frame relay services are a more recent development and are likely to progressively replace X25 services and the leasing of dedicated data lines. ATM is a new high-speed service.

International price comparisons for switched data services were based on a number of price baskets developed for X25, frame relay and ATM services. Separate price baskets were specified for each of these services because they offer widely different capabilities based on different generations of technology, and are available at different prices.

Tariffs were not publicly available for each service in all of the countries studied. Consequently, gaps in the price comparisons imply that prices for the service were not disclosed by carriers, rather than the unavailability of the service in that country.

X25

X25 services usually have rental charges for the connection, and usage charges for traffic carried. In most countries, usage is paid per unit volume of traffic measured in data segments or kilo-bits — sometimes there is a further charge per minute of access for each call.

X25 prices were compared for two baskets of X25 services, designated PS1 and PS2. Both baskets are typical of businesses with a national profile but PS2 has a much larger demand for data transmission than PS1 (see table 4.8). PS1 was assumed to have access to a 9.6 kbps X25 service and PS2 access to a 64 kbps service. Only one port (interface) was assumed for each business. It was assumed that 60 per cent of data calls are long-distance, and 75 per cent of calls are made during the working day. Further, each call has between 5000 and 9000 segments of data.

Customer premises equipment costs and the costs of leasing a line from the customer premises to the X25 network were excluded from the analysis.

Table 4.8 **Specification of X25 services for medium-sized businesses**

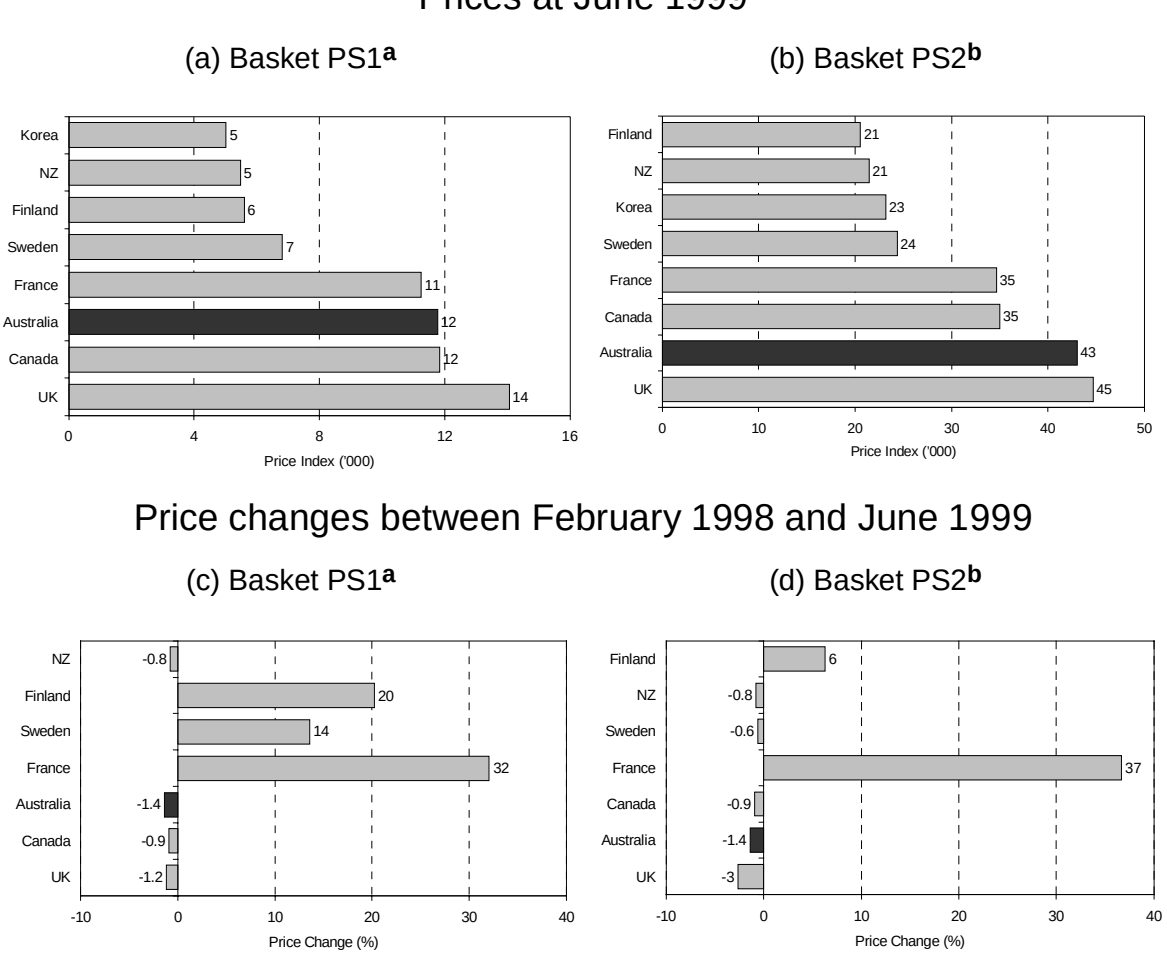
	X25 service baskets	
	PS1	*PS2*
Calls per year (No.)	1150	4600
Port bandwidth (kbps)	9.6	64

Source: Teligen Ltd (1999).

X25 services were found to be relatively expensive in Australia for both PS1 and PS2, as illustrated in figure 4.12. Prices in Australia for both baskets remained constant in nominal terms and dropped marginally in real terms (by 1.4 per cent) between February 1998 and June 1999.

The French price index for both PS1 and PS2 increased 30 to 40 per cent during the period. The price surge was in national long-distance usage fees. Prices also increased in Finland (20 per cent for PS1, 6 per cent for PS2), due to increases in local usage fees. The 14 per cent price increase for PS1 in Sweden reflected increased rental fees.

Figure 4.12 **International comparisons of X25 prices and price changes for medium-sized businesses**



Note The price indexes in charts (a) and (b) are the expenditures in each country (in US$'000 using PPP exchange rates) on fixed baskets of X25 services. The expenditures are valued at June 1999 prices. The price changes between February 1998 and June 1999 in charts (c) and (d) are measured in real terms. **a** PS1: Business with 1150 data calls per year. **b** PS2: Business with 4600 data calls per year.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Frame relay

Frame relay services are normally permanent virtual circuits, and customers pay installation charges and an annual rental but no usage charges. There are two rental components — the port rental, which varies with the port bandwidth (capacity) and a rental for the committed information rate (CIR). CIR is a guaranteed bandwidth of the circuit, which was assumed to be half of the port bandwidth.

A feature of frame relay is that short unpredictable bursts of traffic at speeds greater than the CIR can be transmitted. Consequently, a CIR can be specified at lower bandwidth than that necessary for a leased line to handle occasional bursts of high volume traffic. Businesses with sharply fluctuating demands for data transmission increasingly find frame relay more cost-effective than the leasing of dedicated lines.

The assumed numbers of ports and bandwidth per port are given in table 4.9 for the two baskets, FR1 and FR2. The line connecting the customers' premises to the frame relay network was not included in the baskets. Frame relay services were assumed to be used only for national traffic, within the coverage area of the national service. It was assumed that each service is supplied for use over a distance of 200 kilometres.

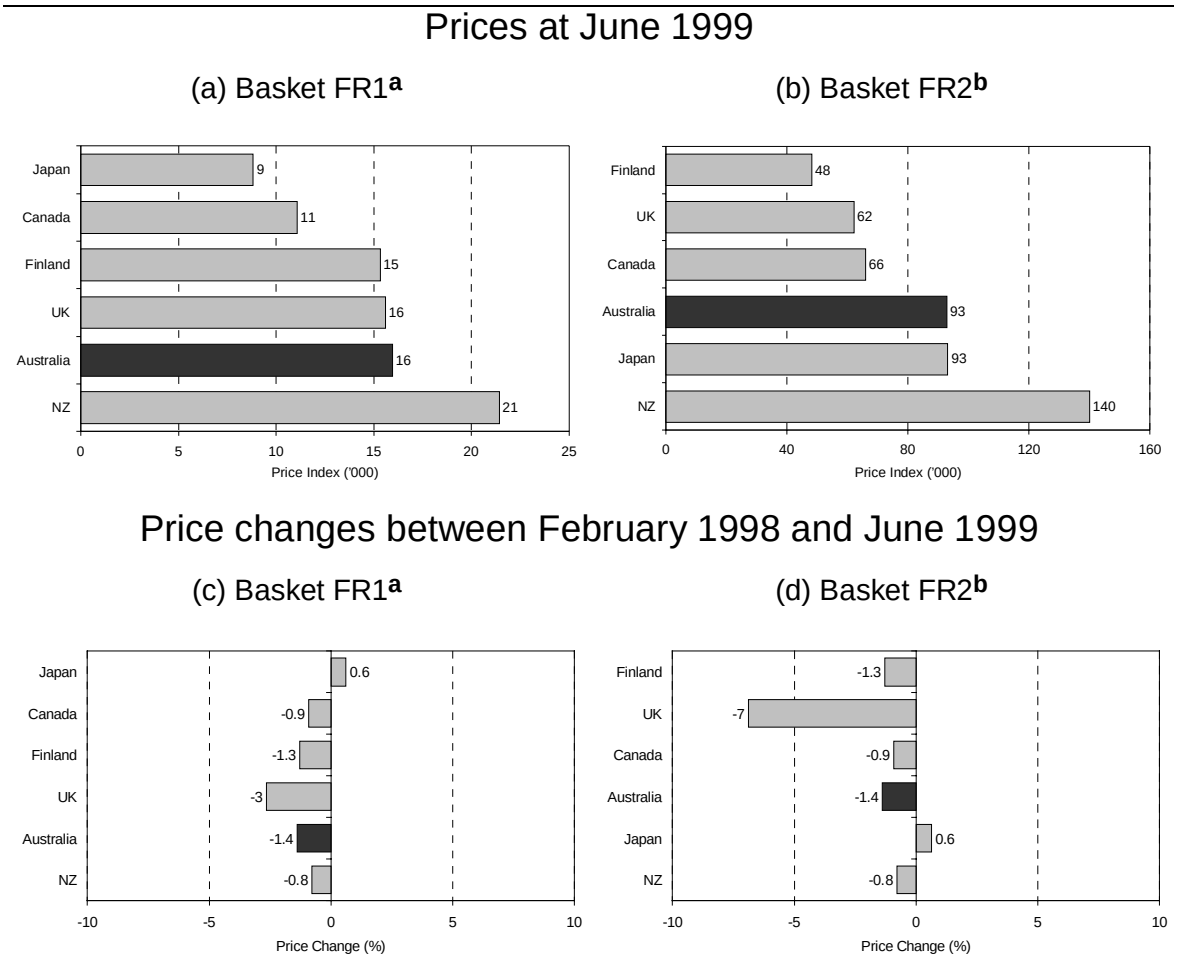
Table 4.9 **Specification of frame relay services for medium-sized businesses**

	Frame relay service baskets	
	FR1	*FR2*
Frame relay ports (No.)	2	4
Bandwidth per port (kbps)	64	256
Committed Information Rate (CIR) per port (kbps)	32	128

Source: Teligen Ltd (1999).

The Australian frame relay prices were in the middle of the range of prices for the limited number of countries for which data were available (see figure 4.13, charts (a) and (b)). There was little change in the price indexes for both FR1 and FR2 in most countries between February 1998 and June 1999. The only exception was the UK, which had a 7 per cent price reduction for FR2 (see figure 4.13, charts (c) and (d)).

Figure 4.13 **International comparisons of frame relay prices and price changes for medium-sized businesses**



Note The price indexes in charts (a) and (b) are the expenditures in each country (in US$'000 using PPP exchange rates) on fixed baskets of Frame Relay services. The expenditures are valued at June 1999 prices. The price changes between February 1998 and June 1999 in charts (c) and (d) are measured in real terms. **a** FR1: Business with two ports and 64 kbps per port. **b** FR2: Business with four ports and 256 kbps per port.

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

ATM

ATM is a relatively new technology currently used only by businesses transmitting very large amounts of data with high bandwidth requirements.

ATM services are normally provided by permanent virtual circuits. As with frame relay, customers pay installation charges and an annual rental but no usage charge. There are two rental components — rental for each port, and rental for each virtual circuit. Both rental charges vary with bandwidth. The costs of access circuits between company sites and the ATM network were not included in the price comparisons.

Price comparisons were made for businesses with relatively large demands for data transmission, using two baskets, ATM1 and ATM2. The baskets differed in the relationships between ports and virtual circuits. The numbers and bandwidth of ports and virtual circuits assumed for the two ATM baskets are given in table 4.10. The virtual circuits were assumed to be national and vary in length from 2 kilometres to 50 kilometres to 200 kilometres. A constant bandwidth service was assumed. The large number of ports for ATM2 implies a number of separate sites linked by virtual circuits (with a port at each end). ATM1 on the other hand has more circuits than ports indicating data transfer to external locations.

Table 4.10 **Specification of ATM services for medium-sized businesses**

	ATM baskets	
	ATM1	*ATM2*
ATM ports (No.)	2	15
Bandwidth per port (Mbps)	34	34
Virtual circuits (No.)	4	11
Bandwidth per virtual circuit (Mbps)	10	10

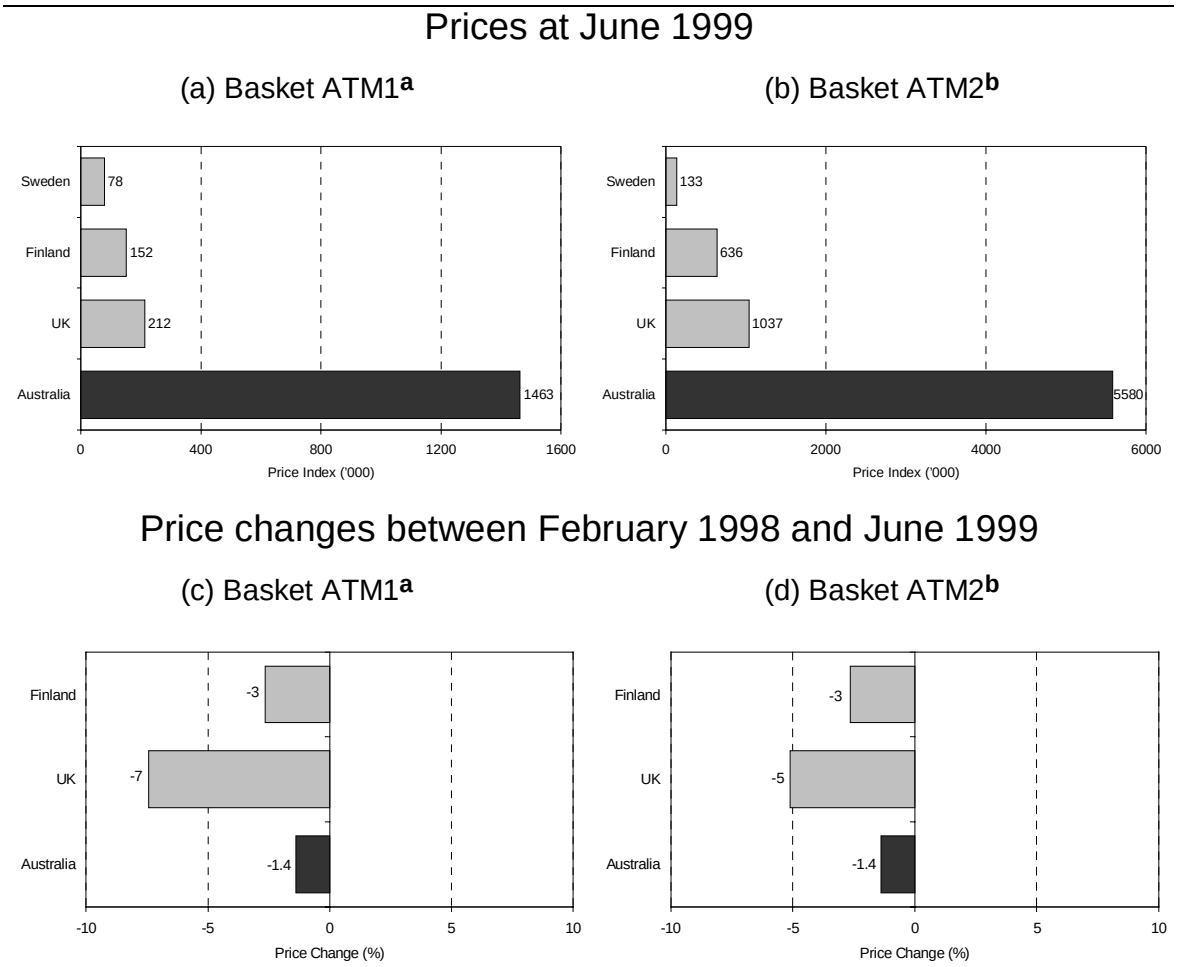
Source: Teligen Ltd (1999).

ATM services could only be priced in three countries. Carriers usually considered ATM prices either to be commercial-in-confidence, or negotiated on a case-by-case basis.

Among the benchmarked countries, Australian ATM services were by far the most expensive (see figure 4.14, charts (a) and (b)).

According to the limited available evidence, there was little change in prices for ATM services between February 1998 and June 1999 (figure 4.14, charts (c) and (d)).

Figure 4.14 **International comparisons of ATM prices and price changes for medium-sized businesses**



Note The price indexes in charts (a) and (b) are the expenditures in each country (in US$'000 using PPP exchange rates) on fixed baskets of ATM services. The expenditures are valued at June 1999 prices. The price changes between February 1998 and June 1999 in charts (c) and (d) are measured in real terms. **a** ATM1: Business with 2 ports (34 Mbps per port) and 4 virtual circuits (10 Mbps per circuit). **b** ATM2: Business with 15 ports (34 Mbps per port) and 11 virtual circuits (10 Mbps per circuit).

Data source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

Summary — data services

Prices for most of the data services in the selected group of countries did not change significantly between February 1998 and June 1999 (see table 4.11). The prices for the newer frame relay and ATM services declined slightly in real terms. However, the prices of leased line and X25 services (which have been in use longer) changed substantially in some cases.

Australian prices for all data baskets except LL2 fell marginally by 1.4 per cent in real terms (unchanged in nominal terms). The price for LL2 increased 8 per cent in real terms, due to a substantial increase in the rental of international circuits.

Actual prices paid by business users for data services are typically less than published tariffs because service and price agreements tend to be negotiated between carriers and individual businesses. These arrangements are increasingly common and their impact on price relativities and price changes have not been captured in this study.

Table 4.11 **Percentage price changes for data services in the selected countries, February 1998 to June 1999**

	LL1	*LL2*	*PS1*	*PS2*	*FR1*	*FR2*	*ATM1*	*ATM2*
Australia	-1.4	8	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4
Canada	**na**	**na**	-0.9	-0.9	-0.9	-0.9	**na**	**na**
Finland	61	4	20	6	-1.3	-1.3	-3	-3
France	-16	-36	32	37	**na**	**na**	**na**	**na**
Japan	0.6	0.6	**na**	**na**	0.6	0.6	**na**	**na**
NZ	-0.8	-13	-0.8	-0.8	-0.8	-0.8	**na**	**na**
Sweden	-0.9	-6	14	-0.6	**na**	**na**	**na**	**na**
UK	-1.3	-3	-1.2	-3	-3	-7	-7	-5
US	-1	-1	**na**	**na**	**na**	**na**	**na**	**na**

na Not available.

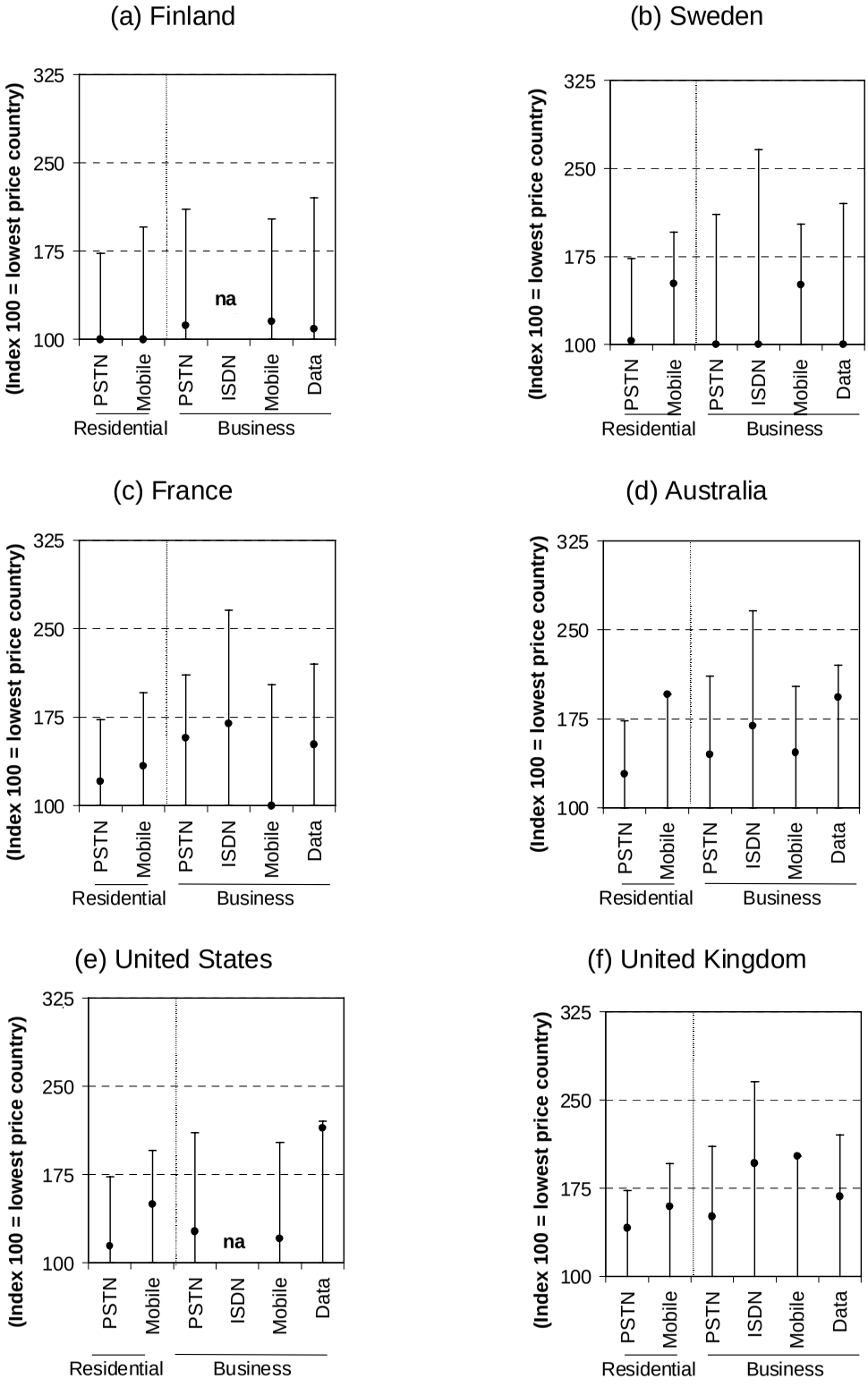
Source: Productivity Commission estimates based on Teligen Ltd (consultant) data.

4.5 In summary

The comparisons of prices at June 1999 for services supplied to business customers (presented in this chapter), and for services to residential customers (presented in chapter 3), are summarised in figure 4.15.

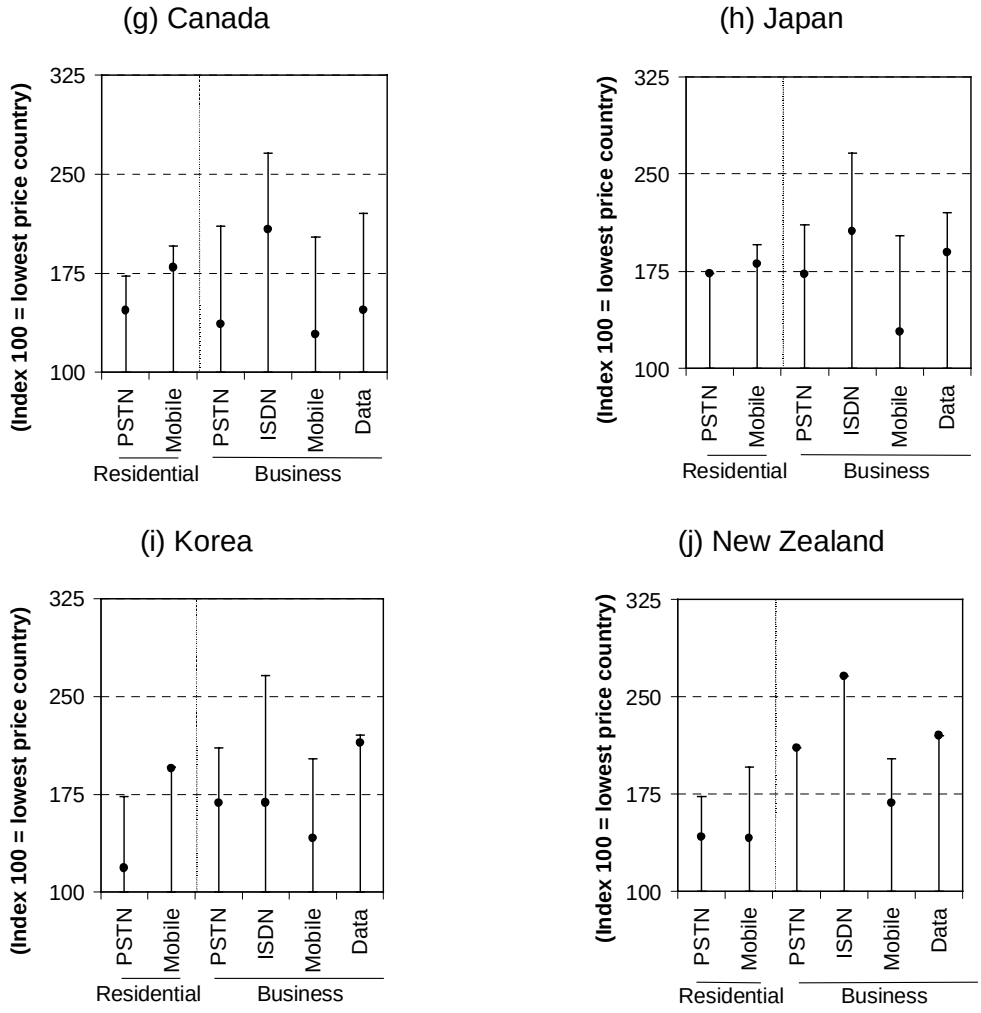
The dispersion of prices among the benchmarked countries was generally greater for business services than for residential services. The dispersion was least for residential PSTN services, which could be related to the existence of price controls on these services.

Figure 4.15 **Summary of price comparisons, June 1999**



(Continued on next page)

Figure 4.15 (continued) **Summary of price comparisons, June 1999**



Note The data underlying the above charts expresses the service price for each country as an index relative to the least expensive country. The price in the least expensive country corresponds to an index of 100. The bars represent the range of prices among all the selected countries for the particular service and are the same for each country. For each country, each dot indicates how much more expensive the price of the service is compared with the lowest-priced country, and how much less expensive it is than the highest-priced country. For example, Australia's business PSTN price lies approximately in the middle of the range of prices represented by the bar. Where necessary, price differences have been averaged to provide a basis for aggregate comparisons. **na** Not available.

Source: Productivity Commission estimates.

There was a reasonable degree of consistency in the relative prices of most countries for different customer groups and product groups. Finland and Sweden generally had the lowest prices across most services. Japan and New Zealand had relatively high prices. Australia was more or less in the middle of the group of countries benchmarked for most services. However, Australia had relative higher prices for residential mobile services.

The Commission has learned that one of the price plans used for New Zealand in the business price comparisons was withdrawn in April 1999, which may affect the results.

Residential and business prices in the best performing countries were between 20 and 50 per cent lower than in Australia (see table 4.12).

Table 4.12 **Relative Australian telecommunications services prices, June 1999**

Service	*Country with lowest prices*	*Ranking of Australian price performance*	*Per cent by which best prices are below Australian prices*	*Per cent by which Finnish prices are below Australian prices*[a]
Residential services				
PSTN	Finland	6 of 10	22	22
ISDN	Korea	6 of 9	44	24
Mobile	Finland	10 of 10	49	49
Business services				
PSTN	Sweden	5 of 10	31	23
ISDN	Sweden	3 of 8	41	**na**
Mobile	France	7 of 10	32	21
Data services	Sweden	7 of 10	48	44

Note A ranking of 6 of 10 for Australia's price performance for residential PSTN services (for example) means Australia has the sixth lowest prices out of 10 countries included in the particular comparison (given all the specified assumptions). The business comparisons above are simple averages of relative prices obtained from the various business baskets.[a] Finland is used as the benchmark because its prices are the lowest or among the lowest for most services. **na** Not available.

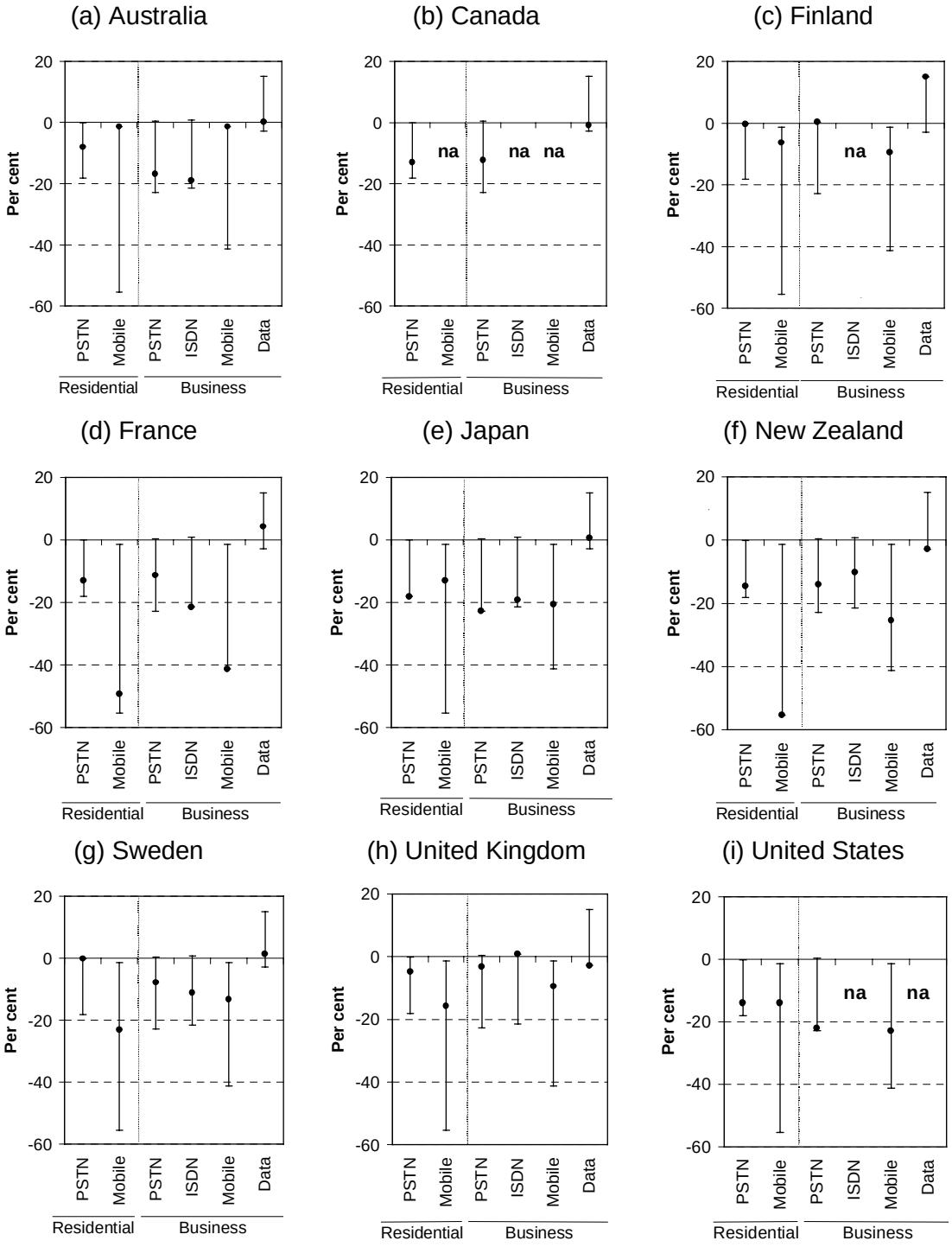
Source: Productivity Commission estimates.

The international comparisons of price changes (in real terms) between February 1998 and June 1999 for services supplied to both residential and business customers are summarised in figure 4.16.

Real prices declined in most countries for most services. PSTN and ISDN price declines ranged between zero and 20 per cent. The largest price declines were for mobile services. Finland seems to have had the smallest price reductions among the selected countries. This is consistent with 1998 prices being already closer to efficient competitive levels. Price reductions were generally quite large for Japan and New Zealand.

Australia had fairly small real price reductions for mobile services. However, the Australian prices for business PSTN and ISDN services fell significantly relative to other countries, by 17 and 19 per cent respectively (see table 4.13). The price fall for residential PSTN services was in the middle of the range of the benchmarked countries, at 8 per cent.

Figure 4.16 **Summary of real price changes, February 1998 to June 1999**



Note The data underlying the above charts expresses the percentage price changes, in real terms, for each country. The bars represent the ranges of price changes among all the selected countries for the particular service and are the same for each country as depicted. For each country, each dot indicates the price change of the relevant service. For example, Australia's residential PSTN price decreased by 8 per cent and is approximately in the middle of the range of price changes represented by the bar (between zero and –18 per cent). Where necessary, price changes have been averaged to provide a basis for aggregate comparisons.

Data source: Productivity Commission estimates.

In contrast to other telecommunications services, the price of some data services appeared to have increased. Australia generally had small reductions in real terms. However, off-tariff agreements may have resulted in significant price falls to some business customers. Also, some businesses have migrated from leased lines and X25 services to new technology switched data services which may meet their needs more cost-effectively. These developments have not been captured in the analysis.

Table 4.13 **Real price changes in Australian telecommunications services, February 1998 to June 1999**

Service	*Country with largest price reductions*	*Largest price changes*	*Australian price changes*
		per cent	per cent
Residential services			
PSTN	Japan	-18	-8
Mobile	New Zealand	-55	-1
Business services			
PSTN	Japan	-23	-17
ISDN	France	-21	-19
Mobile	France	-41	-1
Data services	UK	-3	0

Note For business services, price changes for groups of customers and data services have been averaged.

Source: Productivity Commission estimates.

In June 1999, Australian prices for most telecommunications services remained more or less in the middle of the range of prices for the benchmarked services, as they had been in February 1998. However, Australian prices for mobile services were towards the higher end of the price range in June 1999, compared with relatively low prices in February 1998.

5 Regulation and competitive conditions

Regulatory arrangements affect prices directly through retail price controls and indirectly through market interventions that influence the extent and development of competition.

All of the benchmarked countries have or are in the process of liberalising their telecommunications markets by removing legislated barriers to entry. In most cases these markets were previously characterised by a publicly-owned and regulated monopoly. Liberalisation has occurred at different times and in different ways — resulting in different degrees of reform progress.

In most cases, governments have also intervened to encourage competition by facilitating access by new entrants to network services. Existing regulatory arrangements influence entry and exit decisions, the choice of services provided, investment decisions and pricing strategies — all of which have implications for the nature of competition.

The impact of regulation is likely to vary across the different telecommunications services markets. Other factors such as the strength of regulatory and legal institutions and the impact of social policies on prices also have implications for market development and the extent of competition.

The time taken for competition to develop depends on the effectiveness of policy design and its implementation. Consequently, it has not been possible to assess, at any one point in time, the outcomes of different policy mixes that have been in effect for varying periods of time.

The regulatory arrangements, as at June 1999, in each benchmarked country are reported in this chapter. Changes to regulation between February 1998 and June 1999 are identified and their potential effect on competition and price movements are discussed.[1] The regulatory and institutional arrangements in the benchmarked countries as at June 1999 are summarised in appendix D of this report.

[1] The regulatory arrangements in place at February 1998 are reported in the Commission's previous report (see PC 1999).

Information on market share is also provided to assist readers to gauge the current extent of competition among operators already in the market and its likely influence on prices. Market growth also has implications for the way competition develops. Growth in telecommunications markets is discussed in chapter 2.

The Commission engaged Ovum Pty Ltd to report on regulatory arrangements as at June 1999 and to collect information on the market environment in each of the benchmarked countries.

5.1 Regulatory arrangements

Governments regulate telecommunications industries for social policy reasons and to correct perceived market failures. Social policies are typically aimed at facilitating broad community access to telecommunications services at affordable prices. The principal instruments used are Universal Service Obligations (USOs) and retail price controls on local services.

Price controls are used to prevent abuse of market power such as monopoly pricing, so that the benefits of reform are passed on to consumers. Increasingly, however, regulation of retail prices is being supplanted by regulation aimed at promoting competition — that facilitates access to network facilities and services at reasonable prices — and supervision of market conduct under general trade practice law.

Universal service

In most of the countries covered by this study, basic telephony services are considered essential services. USOs were traditionally a condition for the incumbent's retention of its monopoly, with the costs of providing universal service borne by the incumbent.

All of the countries studied, including Australia, retained some form of USO requirement following the introduction of competition.[2] However, not all provide a mechanism for funding this obligation.

The costing and funding of the USO has implications for the development of the market environment. For example, loading all the costs of providing the USO onto one carrier would hinder its ability to compete effectively in a market that has been opened to competition.

[2] In Singapore, Singapore Telecom will retain monopoly provision of fixed telecommunications services until April 2000. Singapore Telecom is required to provide service to all who require it.

For most of the benchmarked countries, USO requirements (see table D.1) remained largely unchanged between February 1998 and June 1999. The most notable change was the inclusion of digital services (mainly Integrated Services Digital Network (ISDN)) in the Australian universal service regime.

USO funding arrangements (see table D.2) also remained largely unchanged. The Australian Government imposed a limit on the total cost of providing standard telephone services for 1997–98 and the following two years.[3]

The change in the scope of the Australian USO may affect the relative price of ISDN in the future — slowing down the rate of price reduction relative to other countries as the service grows in high cost areas. However, changes to price relativities for ISDN and other data services would have an insignificant impact on total residential price relativities. The effect on business prices would be larger, but still relatively minor.

In Canada, an obligation on international carriers to contribute to USO funding was imposed in April 1999. This is not expected to have affected prices significantly.

Retail price controls

Retail price controls are prevalent in the Public Switched Telephone Network (PSTN) market. Most price controls are maximum charges or maximum rates of increase to charges, referred to as *price caps*.

Price caps are mainly applied to local service prices, but are sometimes applied to a broader basket of services. Australia is the only country among those studied to have a cap on a basket of local and long-distance services, as well as controls on line rental and local calls within that basket, commonly referred to as *price sub-caps*.

The price controls on PSTN services in the countries studied are summarised in table 5.1 (see table D.3 for further detail). Differences in the stringency of retail price controls are likely to affect relative prices. They may also have the effect of distorting price structures so that they do not reflect costs or demand pressures. When this occurs, comparisons of capped PSTN local service prices are questionable. It is more meaningful to compare total service prices because distortions are netted out across the total range of services consumed.

[3] As the nominated USO provider, Telstra lodges a claim for the net universal service cost with the Australian Communications Authority (ACA). The ACA assesses the claim and determines the levy amount (based on eligible revenue shares) that each participating carrier is required to make as their contribution towards the cost of fulfilling the USO in respect of that financial year.

There were only minor changes to price cap arrangements over the period examined. In Australia, new caps were introduced for Telstra, from 1 July 1999 (see Table D.3 for further detail).[4] In France, the price cap under a new formula for basic voice telephony services was relaxed from CPI–9 to CPI–4.5 per cent. In Japan, price caps were introduced on specific NTT services in November 1998.

These changes are expected to have had little effect on the relative prices presented in this report. The relaxation of the price cap in France does not appear to be binding in light of the observed recent price declines (see chapter 3).

Table 5.1 **Retail price controls on PSTN services, June 1999**

Country	*Year current price cap began*	*Cap on local services*	*Cap on line rental*	*Local calls*	*Cap on local and long-distance basket*
		(per cent per annum)	(per cent per annum)		(per cent per annum)
Finland	-	-	-	-	-
Sweden	-	-	CPI	-	-
US	-	**a**	**a**	**a**	-
Korea[b]	-	-	-	-	-
France	1999	-	-	-	CPI-4.5
Australia[c]	1996	-	CPI-1	25 cents	CPI-7.5
UK	1997	-	-	-	CPI-4.5[d]
					CPI[e]
NZ	1989	-	CPI	**f**	-
Canada	1998	CPI-4.5	10	-	-
Japan	1998	**na**	**na**	**na**	**na**
Malaysia[b]	-	-	-	-	-
Singapore[b]	-	-	-	-	-

Note Countries are listed in order of increasing PSTN total service price. Malaysia and Singapore are added at the end. There are no price caps in Finland, and operators can set prices without prior government approval. **a** Local service is regulated principally by State authorities with some Federal involvement. Regimes vary State by State. **b** Approval of prices by government or regulator. **c** New price controls came into force from 1 July 1999 (see table D.3). **d** Applied to residential services. **e** Applied to a small-business basket. **f** Telecom New Zealand must provide the option of free local calls for residential customers. **na** Not available. - Not applicable.

Source: PC (1999) and Ovum (1999).

4 The revised price caps allow greater scope for Telstra to rebalance its rental and call charges.

Competition policy

Prior to deregulation, telecommunications services in most countries were provided by a telecommunications carrier that was government-owned and protected from competition by legislation. There were, however, privately owned telecommunications carriers in Finland, Canada and the US.

Since the early 1980s, governments have sought to introduce competition by permitting access to new entrants on a controlled or licensed basis. Increasingly, entry into telecommunications markets has been on an 'open' basis with the market determining the number of carriers that can be sustained. Approaches to liberalisation have differed across countries (see table 5.2 for changes to the PSTN market (see table D.4 for further detail)).

In most countries, operators still require a licence to offer telecommunications services, although application conditions tend to be general. For example, in Australia under the *Telecommunications Act 1997*, a person may apply to the Australian Communications Authority for a carrier licence, so long as the person is a constitutional corporation, an eligible partnership, or a public body.

Apart from Canada, there were few changes to PSTN licensing arrangements between February 1998 and June 1999. In Canada, the Canadian Radio-Television and Telecommunications Commission (CRTC) determined that Teleglobe's monopoly over international telecommunications facilities would cease from October 1998. As a part of the decision, a new liberalised licensing regime for providers of basic services was introduced effective from 1 January 1999.

In other markets, such as mobile telephony, competition has been more readily achieved (see table 5.6). In data markets, where entry is fairly open, competition is being influenced by the implementation of new services such as frame relay and Asynchronous Transfer Mode (ATM) and by the rapid growth in business demand. However, the terms and conditions of access by other service providers to the originating and terminating digital data services of incumbents affects the extent of competition in smaller business markets.

Table 5.2 **Major developments in the regulatory environment affecting competition in PSTN markets**

Country	*Dates*	*Initiatives affecting the development of competition*
Australia	1991	Protected duopoly and regulated interconnection.
	1997	Open competition. Current regulatory arrangements for interconnection.
Canada	1992	Introduction of competition in long-distance market. Regulations to facilitate local competition.
	1997	Current regulatory arrangements for interconnection and opening up local competition.
Finland	1994	Open competition in all telecommunications markets.
	1997	Current regulatory arrangements for interconnection.
	1998	Carrier pre-selection.
France	1998	Open competition. Current regulatory arrangements for interconnection.
Japan	1985	Restricted competition.
	1998	Current regulatory arrangements for interconnection.
	1999	Restructure of NTT.
Korea	1990	Introduction of international service competition.
	1992	Open radio paging competition.
	1994	Open cellular mobile competition.
	1995	Open national long-distance competition.
	1997	Open service-based competition
Malaysia	1996	Establishment of access regime, with interconnection requirements on all carriers.
	1999	Establishment of independent regulatory agency (CMC), separated from Ministry.
NZ	1989	Open competition in all telecommunications markets.
Singapore	1997	Licensing of second public fixed network operator, to commence on 1 April, 2000.
Sweden	1992	Telia's first voluntary interconnect agreement with a competitor.
	1997	Current regulatory arrangements for interconnection.
UK	1984	Protected duopoly and regulated interconnection.
	1991	Open competition in all telecommunications markets.
	1997	Current regulatory arrangements for interconnection. Access prices subject to price cap.
US	1983	Divestiture of AT&T. Open competition in long-distance market.
	1996	Legislation to encourage competition in local services. Current regulatory arrangements for interconnection.

Source: PC (1999) and Ovum (1999).

Even with the removal of legislation restricting entry into telecommunications markets, potential entrants might still face barriers to entry in the form of:

- incumbent cost advantages arising from economies of scale or scope;
- incumbent control of essential or bottleneck facilities;
- sunk costs — some investments made by incumbents may have no alternative use and the cost of these investments may not be factored into incumbent pricing; and
- first mover advantage — incumbents may have advantages that are costly for new entrants to overcome in order to compete on an equal footing (these might include brand loyalty, control of standards, control of existing telephone numbers, network externalities or any-to-any connectivity).

Governments have attempted to reduce the significance of potential barriers to entry by regulating access to 'bottleneck' facilities controlled by incumbents or operators with significant market power (see table 5.3 and table D.5 for further detail) and by mandating carrier pre-selection and number portability.

Access to incumbent facilities

Most countries have put in place legislative provisions to facilitate access by new competitors to the incumbent's 'bottleneck' facilities. These regimes include processes for establishing the terms and conditions on which new entrants obtain access to incumbent services. Such arrangements typically involve ongoing supervision and arbitration by regulatory agencies. The notable exception is New Zealand, where reform was initially confined to the removal of legislative barriers to competition.

There was little change to access arrangements in most of the benchmarked countries between February 1998 and June 1999. In Australia, the number of access services declared was increased by the Australian Competition and Consumer Commission (ACCC), although the requirement for local loop unbundling did not come into effect until July 1999.[5]

Appropriate terms and conditions are required if entrants are to compete with the incumbent, and with each other. Particularly significant is the location of the point of interconnection and the agreed price of access.

[5] The ACCC may declare a service where such a declaration would promote the long-term interests of end-users. Upon declaration, all carriers and carriage service providers supplying the declared service become subject to standard access obligations.

Table 5.3 **Overarching characteristics of competition policy in selected countries, June 1999**

Access rights	*Scope of access rights*	*Standard offers*[a]	*Terms and conditions*
Australia			
Interconnection for basic services mandated, others subject to public interest test.	Subject to a public interest test. Potentially all 'eligible services'.	Voluntary, approved by ACCC.	Arbitration by ACCC available.
Canada			
Interconnection mandated.	Incumbent determines point of interconnect. Unbundling of local loops required.	No.	Arbitration by government available.
Finland			
Interconnection mandated.	Carrier with SMP must accept all reasonable interconnection requests.	Carrier with SMP must lodge standard reference offer.	Standard reference offers approved by government. Arbitration available.
France			
Interconnection mandated.	Carrier with SMP must accept all reasonable interconnection requests.	Carrier with SMP must lodge standard reference offer.	Standard reference offers approved by government. Arbitration available.
Japan			
Interconnection mandated.	Designated carriers required to provide interconnection wherever technically feasible.	Designated carriers must lodge standard reference offer.	Regulated for designated carriers. Arbitration available.
Korea			
Interconnection mandated.	Negotiated. Access seeker sets points of interconnect.	In effect, for dominant operators.	Negotiated, subject to regulatory mediation and intervention.
Malaysia			
Interconnection mandated.	Negotiated within guidelines set by regulator.	No.	Negotiated, subject to regulatory mediation and intervention.
NZ			
Negotiated.	Negotiated.	No.	Court resolution of disputes.
Singapore			
Interconnection mandated.	Determined by regulator and negotiation.	No.	Arbitration of disputes in negotiation by regulator.
Sweden			
Interconnection mandated.	Carrier with SMP must accept all reasonable interconnection requests.	Carrier with SMP must lodge standard reference offer.	Standard reference offers approved by regulator. Arbitration available.

(Continued next page)

Table 5.3 (continued) **Overarching characteristics of competition policy in selected countries, June 1999**

Access rights	*Scope of access rights*	*Standard offers*[a]	*Terms and conditions*
UK			
Interconnection mandated	Operator determines point of interconnect. Unbundling the local loop specifically excluded.[b]	Carrier with SMP must lodge standard reference offer.	Price caps in place. Arbitration by government available.
US			
Interconnection mandated	Incumbent local exchange carriers required to interconnect wherever technically feasible. Includes unbundling the local loop.	Defacto.[c]	Approved by government and arbitration by government available.

[a] A standard offer is a set of terms and conditions upon which an incumbent carrier will offer access or interconnection. These terms and conditions are normally approved by government or a regulator. Parties may negotiate upon these terms and conditions on a voluntary basis. [b] OFTEL is currently in the process of assessing the desirability of unbundling the local loop. [c] Defacto when terms and conditions are filed. SMP Significant market power

Source: PC (1999) and Ovum (1999).

Details of the method of determining access terms and conditions in benchmarked countries are presented in table D.6. Accounting separation is essential to such determinations because it facilitates the resolution of the true cost of access (see table D.7 for requirements).

Competition from carriers in the long-distance market critically depends on access to services for originating and terminating PSTN calls. The access price affects their ability to compete because it feeds into their service cost.

Agreements between entrants and incumbents are in place in all the countries studied (see table 5.4). The price of access to essential services is usually based on the cost of providing that service (most countries are moving towards using total service long run incremental cost). Most regimes encourage negotiation but require reference offers to be made.

New entrants are better able to compete where interconnection or access prices reflect costs. This has sometimes been achieved through regulatory requirements mandating standard reference offers and through regulatory approval of negotiated

agreements.[6] Requirements for disclosure of the terms and conditions of agreements may also be a factor by hastening convergence on cost-based prices.

Table 5.4 **Terms of interconnection, June 1999**

Country	*Arrangements for establishing terms of interconnection*			*Carrier pre-selection*
	Requirement for cost-based standard reference offers	*Regulator approves negotiated agreements against costs*	*Publication of negotiated agreements*	
Sweden	yes	yes	no	**a**
Finland	yes	yes	yes	**a**
UK	yes	**b**	yes	**nr**
France	yes	yes	yes	yes
US	yes	yes	yes	yes
Australia	**nr**	**nr[c]**	**nr**	yes
Canada	**nr**	**nr[d]**	**na**	**na**
NZ	**nr**	**nr**	yes	**nr**
Korea	yes	yes	no[e]	yes
Japan	yes	yes	yes	**a**
Malaysia	no	yes	**na**	**a**
Singapore	no	yes[f]	**nr**	no

Note Countries are listed in order of increasing PSTN long-distance service prices. Malaysia and Singapore are added at the end. **a** Being introduced. **b** As an interim approach, access prices were assessed against fully distributed costs. Now access prices are subject to a CPI-X cap. **c** Yes, if the agreement is arbitrated. **d** Price and related terms determined by regulator. **e** Information available in unclassified form from regulator. **f** Regulator determines key access charges. **na** Information not available. **nr** Not required.

Source: PC (1999) and Ovum (1999).

Local loop unbundling

Local loop unbundling is the term used for providing access to the local loop downstream of the local switch. Unbundling increases the contestability of the local service market because it gives service providers the opportunity to interconnect as close to the customer as commercially viable.[7]

[6] A standard reference offer sets out the terms and conditions upon which an incumbent carrier will offer access or interconnection. These terms and conditions are normally approved by government or a regulator.

[7] Even if few carriers exercise their right to connect into the copper wires below the local exchange.

The US, Canada, Sweden, Finland, France and Japan have recently provided regulatory encouragement for local loop unbundling (see table 5.5).[8]

Local loop unbundling may also increase the contestability of long-distance services and, thereby, influence prices through actual or potential competition. Notionally, service providers have greater discretion over the technology they use. Furthermore, a greater portion of the overall service cost is under the control of the provider requiring access.

Table 5.5 **Regulation affecting competition in the local service market, June 1999**

Country	*Unbundling of local loop required*	*Local call resale at wholesale prices*	*Number portability*
Korea	no	no	**a**
US	1996	1996	yes[b]
Finland	1997	**nr**	yes
France	1998	**nr**	**a**
NZ	**nr**	**nr**	yes
Sweden	1997	**nr**[c]	**a**
Australia	**a**	**a**	yes
Japan	1998	1998	**a**
Canada	1997	**nr**	yes
UK	**nr**	**nr**	yes
Malaysia	no	no	no
Singapore	no	no	yes

Note Countries listed in order of increasing PSTN local-service prices. Malaysia and Singapore are added at the end. **a** Being introduced. **b** Progressively introduced for fixed telephony services. **c** Provided by Telia voluntarily. **nr** Not required.

Source: PC (1999) and Ovum (1999).

Implications of access arrangements for competition

It is unclear to what extent the regulation of access to incumbent facilities has facilitated the entry of new operators. Some of these arrangements have only been in place for a short while and some are yet to be fully implemented. Recent developments in some countries are likely to encourage further the development of competition.

8 In Australia, the ACCC declared various local service elements in July 1999, including the unbundling of the local loop, resale of local calls at wholesale rates and interconnection at local exchanges.

In Australia, all new entrants rely on established carriers, and particularly Telstra, to provide interconnection to their existing customer base. The finalisation of access agreements through negotiation, which encourage competitive entry, has taken more time to develop in Australia than in some of the other benchmarked countries. However, three access decisions by the ACCC since early 1998 have major implications for competition.

First, in November 1998, the ACCC declared ISDN, data and high capacity transmission services — the latter covering all inter-capital routes other than Sydney-Melbourne. This decision should assist new entrants in negotiating access to these services at cost based rates. Ovum (1999) estimated that the cost of wholesale bandwidth on heavily trafficked routes has fallen significantly.[9]

Second, the ACCC rejected Telstra's draft access 'undertaking' of November 1997 in which Telstra proposed a standard set of per minute PSTN access charges.[10] In doing so, the ACCC noted that Telstra's proposed price was well above those in other countries, and argued that, on a cost basis, the figure should be about half the rate quoted by Telstra. The result of this decision has been to provide negotiating leverage to access seekers from both Telstra and Optus.

According to an Ovum study (Lewin and Kee, 1997) British Telecom's call termination interconnect price was the lowest among the 11 countries studied by Ovum. Telstra's price in its undertaking to the ACCC was the highest, which includes five of the nine countries benchmarked for this study. However, Telstra's interconnect price, like those of a number of the US local exchange carriers, included a component to help meet subscriber access costs at the time prices were measured.

Third, in late 1998, the ACCC released a discussion paper proposing declaration of various local service elements, including the unbundling of local loops and the resale of local calls at wholesale rates (as a temporary measure). The decision was finalised on 22 July 1999, but the impact on the market is likely to have been factored into operators' infrastructure plans and strategies.

This decision is likely to impact on plans to build infrastructure by other carriers, particularly in high cost areas served only by Telstra. If new operators can get

9 There is a significant gap between wholesale and retail prices. For example, the retail annual rental for a 2Mbps service between Sydney and Melbourne is A$206 000 in Telstra's Standard Form of Agreement. The wholesale price (taking account of volume effects) was around A$130 000 in early 1998. It is now estimated to be between A$30 000 to A$40 000 (Ovum 1999).

10 'Undertakings' are filed and approved agreements on the terms and conditions of access.

access to Telstra's network at cost-based wholesale rates it is unlikely that they will duplicate facilities in such areas. The opportunities for new entrants to extend their operations to markets outside the large Central Business District (CBD) and metropolitan areas of the eastern seaboard should have increased also.

In New Zealand, the absence of a specific telecommunications industry regulator means that new carriers must rely on general competition law to resolve disputes over access prices. The resolution of disputes through court processes has been protracted and costly.

In the US, regulatory reform, pursuant to the *Telecommunications Act 1996* (the 1996 Act), has been delayed through legal action taken by local carriers and State regulators. The 1996 Act provided the local exchange carriers with an incentive to liberalise their markets. The Federal Communications Commission (FCC) would not authorise their entry into long-distance and international service markets unless the incumbent carriers had opened their own markets to competition.[11] This required incumbent carriers to provide for interconnection at any technically feasible point, including the unbundling of network elements, and local call resale at wholesale rates.

In January 1999, the US Supreme Court upheld the FCC's authority to make orders in relation to local competition pricing, and the unbundling of network elements to enable competitive access. This outcome signals the prospect of a substantial increase in competition at the local level.

Carrier pre-selection and number portability

Carrier pre-selection and number portability facilitate competition between carriers and carriage service providers by promoting consumer choice and reducing transactions costs for subscribers. With carrier pre-selection, subscribers can change carriers without dialling extra digits each time they want to make a call. Number portability allows subscribers to change carriers without having to change telephone numbers.

Carrier pre-selection is likely to be important to developing competition in long-distance markets and number portability can be expected to promote competition in local and mobile services markets. The requirement for carrier pre-selection and number portability will reduce incumbent first mover advantages.

[11] The FCC only has jurisdiction to regulate interstate and international telecommunications services. Intrastate telecommunications services are regulated by State Commissions.

The requirements for carrier pre-selection and number portability in the benchmarked countries are presented in tables 5.4 and 5.5 (see table D.8 for further detail).

Carrier pre-selection in Finland was introduced in September 1998 and was extended to international calls in January 1999. Carrier pre-selection was also recently introduced in France.

In Malaysia, the first stage of carrier pre-selection was introduced in January 1999. This stage involves subscribers of Telekom Malaysia obtaining access to other operators and making calls using a three-digit code. In anticipation, Telekom Malaysia has introduced loyalty programs to retain its existing customer base. The level of discounting that Telekom is permitted to offer to retain customers under equal access has been reduced to 5 per cent. Equal access carrier pre-selection, where customers will be able to choose their long-distance provider without dialling extra digits, is to be implemented nationally by 2001.

The earlier introduction of these reforms in some countries could be expected to have influenced prices. However, it is difficult to assess the full impact of these arrangements on relative prices. For example, Australia was one of the first countries to require the incumbent to provide carrier pre-selection. In contrast, Sweden and the UK, which have low long-distance prices, do not have carrier pre-selection.

There were few changes to number portability requirements between February 1998 and June 1999. Over this period number portability has been introduced in the US. In Australia, the ACCC decided in June 1999 that the incentives for cost reduction and greater efficiency would be best served if all carriers were to bear their own costs associated with establishing systems for porting and for conducting the porting process (reversing an earlier draft position in April 1998).[12]

In the UK, the four mobile operators were required to introduce number portability in January 1999. This is likely to increase the leverage of customers and put pressure on price. Price competition is likely to increase further with the early introduction of third generation services.[13]

[12] Porting is the process of transferring a telephone number from one carrier to another.

[13] Third generation mobile systems will provide enhanced multimedia services, such as high speed access to the Internet.

5.2 Market structure

Competitive discipline is placed on a market where there is ease of entry and exit — that is, the market is contestable. Some of the factors affecting the ease of entry into telecommunications markets are discussed in the previous section.

In this section, numbers of carriers and market shares are reported, including how much of the market remains under incumbent control. This information provides a tangible indication of market contestability because it reveals the level of entry that has occurred since liberalisation.

Interpretation

In interpreting market structure information it is important to define the market appropriately. For example, the market can be defined broadly as the market for telecommunications services, or more narrowly as the market for local PSTN services or even more narrowly as the market for business local PSTN services.

Generally, the more competitors in a market the greater is the scope for competition. However, the number of competitors within a market needs to be considered with other factors like market share. For example, it could be expected that the extent of competition will be less in a market comprising two competitors, together having a 95 per cent share of the market, and ten sharing the remaining 5 per cent, than in a market with shares distributed more evenly amongst the 12 competitors. Also, the 12 operators might be regionally based with limited scope for competition between them.

Assessments of the extent of competition are difficult to make where market share information is aggregated. Market shares based on a broad definition of the market may reveal little about the extent of competition, because they may include businesses not actually competing in the same sub-markets. Nor will national market shares reveal much about the extent of competition if markets at the regional level are dominated by a single carrier.

Changes in market share over time may provide some indication of the extent of competition. In a competitive market it would be expected that market shares would fluctuate over time as competitors compete to gain market share from each other.

In some cases, market shares might reflect the impact of social policies rather than the underlying market environment. For example, an incumbent operator might have a high share of the subscriber access market because USO and price cap regulation makes entry into that market unattractive to other operators.

Market shares — PSTN markets

In a number of countries competition has been introduced in phases. For example, in the UK and Australia, the first phase involved establishing carrier duopolies and subsequent phases involved the removal of legislated barriers to entry and the introduction of pro-competitive regulation. In other countries, such as Canada and the US, competition was first introduced into long-distance markets.

Competition has generally been much slower to develop in the local service market than in the long-distance market. The available market shares (based on 1998 revenue shares, except where noted) for the local PSTN market (see table 5.6) indicate that in most countries the incumbent still controls nearly all of the market.

Generally across countries, the inherited price structure tended to yield higher returns for the incumbent from long-distance calls than from customer access and (possibly) local calls. With high profit margins and growth rates and relatively low barriers to entry, the market for long-distance calls has accordingly been more attractive to new entrants than the market for customer access and local calls. In most countries, the price of long-distance and international calls has fallen at a greater rate than the price of local services. This reflects the impact of competition as well as technology driven cost reductions.

Price controls that distort prices so that they do not reflect costs and demand conditions have the potential to impede competition, and hence market disciplines on prices. If set below the cost of providing local services, price controls could inhibit entry into the market. Moreover, incumbent carriers will be compelled to offset the low returns from local service by charging higher prices in other markets — traditionally the long-distance voice market — if they cannot improve productivity sufficiently. Under these conditions, entrants in the long-distance market can follow the incumbent's price and earn a higher rate of return than would be achievable through vigorous competition.

Table 5.6 **Market participants and shares for selected telecommunications services, 1998**

Country	*Local PSTN*	*Long-distance and international PSTN*	*Mobile*
	Carrier (per cent)	Carrier (per cent)	Carrier (per cent)
Australia	Telstra (97) Optus (2.5) AAPT (0.1)	Telstra (80) Optus (15) Others (5)	Telstra (52) Optus (31) Vodafone (17)
Canada	Stentor (**na**)[a] CLECs[b]	AT&T Canada (18) Others (**na**)	Mobility Canada (60) Cantel (40)
Finland	Finnet Group (70) Sonera (30)		Sonera (67.1)[c] Finnet Group (32.5) Telia (0.4)
France	France Telecom (98) Omnicom (**na**) Cegetel (**na**) Bouygues Telecom (**na**) Siris (**na**)		France Telecom (50.2)[d] Cegetel (37.9) Bouygues Telecom (11.9)
Japan	NTT (92.9)[f] New carriers (7.1)	NTT (59.4)[e,f] New carriers (40.6)[f] KDD (63.5)[g] New carriers (36.5)[g]	NTT (52.3)[h] DDI/DDI Pocket (19.4) Digital Phone (7.4) IDO (7.4) Tu-Ka (6.4)
Korea	Korea Telecom (99) Dacom (**na**) Hanaro (<1)	Korea Telecom (92)[f] Dacom (8)[f] Onse (**na**)[f] Hanaro (**na**)[f] Korea Telecom (68)[g] Dacom (25)[g] Onse (7)[g]	Korea Telecom (18) SK Telecom (41) Shinsegi Telecom (15) LG Telecom (17) Hansol PCS (11)
Malaysia[i]	Telekom Malaysia (98) Time Telekom (0.6) Binariang (0.6)	Telekom Malaysia (93) Time Telekom (2.5) Mutiara (1) TRI (3.5)	Celcom (54) Mobilkom (17) Binariang (11) Time Telekom (7) Mutiara (6) Telekom Malaysia (5)
New Zealand	TCNZ (98) Clear (**na**) Other (**na**)	TCNZ (78) Clear (18) Other (4)	TCNZ (79.5) Vodafone NZ (20.5)

(Continued next page)

Table 5.6 (continued) **Market participants and shares for selected telecommunications services, 1998**

Country	*Local PSTN*	*Long-distance and international PSTN*	*Mobile*
	Carrier (per cent)	Carrier (per cent)	Carrier (per cent)
Singapore	SingTel (100)[j]	SingTel (100)[j]	SingTel (74.6)[k] MobileOne(25.4)
Sweden	Telia AB (90) Tele 2 (<10) Telenordia (**na**)	Telia AB (88) Tele 2 (12) Telenordia (**na**)	Telia AB (62) Tele 2 (13) Europolitan (25)
UK	British Telecom (81.2)[l] Kingston (0.4) CWC (6.8) Cable (9.1) Other (2.5)	British Telecom (71.4)[f,l] Kingston (0.5)[f] CWC (10)[f] Cable (5.3)[f] Other (12.8)[f] British Telecom (52.8)[g] Kingston (0.2)[g] CWC (14.2)[g] Cable (5.4)[g] Other (27.4)[g]	Cellnet (BT) (32.4) Vodafone (37.7) One2One (14.2) Hutchison (15.8)
US[m]			AT&T Wireless (10.6)[n] Ameritech (4.1) AirTouch (12.4) Bell Atlantic (9.4) Bell South (7.2) GTE (7.6) SBC (9.6)

Note The market share for each service appears in brackets besides each market participant. Except where noted, market shares are based on 1998 revenue shares. [a] 50 per cent owned by Bell Canada, with equity from other provincial incumbent local exchange operators. [b] In 1998, there were 22 competitive local exchange carriers (CLECs). Of these AT&T Canada (formerly Metronet Communications) had an estimated 200 000 lines; Gateway Telephones had 70 000 and Optel Communications had 70 000. [c] Mobile market shares as at January 1999. [d] Mobile market shares as at November 1998. [e] Market shares based on 1997 financial year revenues. [f] Long-distance market shares. [g] International market shares. [h] Mobile market shares as at October 1998. [i] Market shares estimated at mid 1998. [j] Fixed service monopoly ends in March 2000. [k] Mobile market shares as at June 1998. [l] PSTN market shares as at second quarter 1998-99. [m] As at April 1999, CLECs accounted for 3 per cent of access lines and incumbents the rest. 5 Regional Bell Operating Companies and GTE accounted for 156.3 million access lines or 89.5 per cent of the market. [n] Mobile market shares as at July 1998. **na** Not available.

Source: Ovum (1999).

Market share — data and mobile markets

In many countries, the liberalisation of the telecommunications industry tended to coincide with the emergence of mobile service markets. Consequently, the largest

operator is usually less dominant than in PSTN markets (see table 5.6). For example, in Japan six cellular operators have provided services since 1994 and three Personal Communication Services (PCS) operators have been licensed since 1995. There is also an active interest across the industry in the early roll out of third generation (broadband) mobile services.

Reliable and consistent information on market shares for ISDN and data services was unavailable for all the benchmarked countries. In Australia, Telstra has over 50 per cent of the ISDN market. As at January 1999 there are 20 providers of Frame Relay services and 17 providers of ATM services in Australia. Most of these operate in cities on the eastern seaboard and on inter-capital trunk routes. In Japan, NTT controlled 67.5 per cent of the international leased circuit market and new carriers controlled 32.5 per cent (based on 1997 financial year revenues). Singapore Telecom controls 100 per cent of the leased line and switched data markets — however, the fixed service monopoly will cease at 31 March 2000.

Number of carriers — PSTN markets

Over the last year, there has been an increase in the number of licensed carriers in a number of the benchmarked countries. In Australia, for example, the number of licensed carriers grew from approximately 20 in February 1998 to 30 at the end of June 1999. In France, a number of operators received licenses to operate fixed network services. The four mobile operators are also licensed to provide the full range of services — to date none have chosen to compete in the local loop.

In Canada, the Stentor members ceased co-ordinating engineering, research and development and marketing activities from January 1999. This is expected to increase competition between established participants for long-distance traffic.

The entry of new operators should increase the scope for competition, although this will vary between markets as new entrants might choose to concentrate on competing in only certain segments of the market or geographical areas.

In Australia, for example, new entrants are concentrating on city markets on the eastern seaboard and heavily trafficked trunk routes. Powertel has substantially completed its roll out in the Sydney CBD and along the Sydney–Brisbane route and has commissioned cable roll out on the Sydney–Melbourne route. MCI WorldCom has rolled out its Sydney CBD fibre cable system, and is progressively rolling out similar systems in other capital cities.

In the US, since the passage of the *Telecommunications Act 1996*, there has been significant merger and acquisition activity. The Modified Final Judgement (1982)

separated the industry into competitive and non-competitive elements. AT&T retained the parts of the business expected to be competitive (long-distance services and equipment manufacturing) and 7 Regional Bell Operating Companies (RBOCs) were allowed to only offer basic local monopoly services.

The RBOCs have been seeking ways of entering long-distance markets and providing competitive services beyond their regional operating territories. With the erosion of margins through competition in the long-distance and equipment manufacturing markets, AT&T has been seeking to enter local markets and to have direct access to customers. Mergers and acquisitions have provided one way for the RBOCs and AT&T to do this (see table 5.7 and box 5.1).

Table 5.7 **Major merger and acquisitions announced in the US**

Date	*Merger and Acquisition parties*	*Price paid*	*Comment*
		($US billion)	
April 1997	SBC and Pacific Telesis	16.7	Merger of 2 Regional Bell Operating Companies for increased operational efficiencies.
April 1997	WorldCom and MCI	37	Merger of long-distance and local operating companies.
August 1997	Bell Atlantic and Nynex	25.6	Merger of 2 Regional Bell Operating Companies for increased operational efficiencies.
May 1998	SBC and Ameritech	62	Merger of 2 Regional Bell Operating Companies for increased operational efficiencies.
June 1998	AT&T and TCI (Tele-communications Inc)	48	Acquisition by long-distance operator of major cable company. Acquisition completed March 1999. TCI is now called AT&T Broadband and Internet Services.
July 1998	AT&T and Teleport Communications Group (TCG)	11	Acquisition by long-distance operator of major local operator in business sector.
July 1998	Cable and Wireless and MCI Internet	1.75	Acquisition of Internet company by long-distance operator.
July 1998	Bell Atlantic and GTE	53	Acquisition of major independent operator by a Regional Bell Operating Company.
May 1999	AT&T and MediaOne group	58	Merger between long-distance operator and the 4th largest cable company in the US.

Source: Ovum (1999).

A consequence of the mergers between RBOCs is that control of 'bottleneck' facilities may be becoming more concentrated, reducing the scope for effective competition from new entrants. Such a development reinforces the need for the reforms introduced by the 1996 Act — reforms aimed at facilitating access to these 'bottleneck' facilities. Emerging technologies and the convergence of

communications industries will also facilitate the dismantling of some of the barriers to entry faced by new entrants.

The implications of these mergers for the extent of competition across telecommunications markets is unclear at this stage. While mergers between RBOCs may concentrate the control of 'bottleneck' facilities and reduce the scope for potential competition, the entry of long-distance operators into local markets, through merger and acquisition, may be stimulating competition and contributing to lower prices (see figure 3.3).

Box 5.1 **AT&T's merger and acquisition strategy**

Following the Modified Final Judgement (1982), AT&T retained its long-distance and equipment manufacturing businesses. Over the years, AT&T has steadily lost market share to competitors in these markets and has through a series of mergers and acquisitions sought to enter new markets.

Rather than rely on indirect access to its customer base through agreements with local exchange carriers, AT&T has strategically acquired operators with direct access to customers in attractive target groups. The acquisition of Teleport Communications Group gave AT&T direct access to high volume and high margin business customers in over 80 metropolitan and CBD locations and the acquisition of TCI offered AT&T broadband access to 11 million residential customers.

AT&T has also entered into a number of strategic relationships:

- with British Telecom for the provision of international and global services; and
- with Time Warner — in February 1999 AT&T announced that it would offer AT&T branded cable telephone services to Time Warner customers in 33 States.

AT&T is now able to offer bundled packages of local, long-distance, international, content and Internet access services to its customers. It has substantially increased its means of leveraging its service range to retain customers. As a purely long-distance and international telephony company it was vulnerable to shrinking customer margins and customer churn.

Source: Ovum (1999).

Number of carriers — mobile markets

Most countries have two or three major competing network operators in the mobile market. Finland, with two competitors, has the lowest prices in both residential and business markets. France, with three major competitors, also has relatively low prices, especially in the business market.

A significant issue determining the ease of entry into mobile markets is the availability of spectrum. Spectrum availability will determine the number of carriers that can be licensed. In some countries the limited availability of analogue spectrum has contributed to the migration to digital services. France Telecom has closed its analogue network and in Japan carriers were required to cease investment in their analogue networks from April 1997.

In Australia, the Federal Government has mandated that Telstra close its analogue network by December 1999.[14] Consequently, Telstra is in the process of completing the roll out of a second digital network, which will extend coverage to over 95 per cent of the Australian population when completed. The mandated move to digital may have resulted in the roll out of the Code Division Multiple Access (CDMA) network ahead of commercial timetables resulting in Telstra operating two digital networks, thereby potentially increasing costs. However, CDMA offers additional features compared with the analogue network and new market opportunities are being created.

In the US, there are no national licences for mobile service provision, although some operators can now offer near national coverage using cellular and PCS licences. Competition is therefore regionally based, with potential for up to eight operators in some areas. The introduction of PCS has stimulated the use of innovative pricing packages and services such as bundled air-time and pre-paid cards, and decreasing price per usage time.

In many countries, for example the United Kingdom, Australia and Korea, operators offer a similar service with similar coverage, so competition tends to be price based. In New Zealand, competition is based on technology differentiation, with Telecom New Zealand offering both analog services (using Advanced Mobile Phone System (AMPS)) and digital services (based on Digital–AMPS technology). In New Zealand, Vodafone offers a digital Global System for Mobile service only. Both operators have introduced a range of value-added services. In the past, Telecom New Zealand offered superior coverage, but by November 1998 Vodafone had caught up and its network now covers 95 per cent of the New Zealand population.

In France, the launch of Bouygues Telecom's mobile service prompted a price war. Bouygues undercut the two existing operators, in order to achieve market share, forcing them to drop their prices in response.

In Singapore, StarHub was licensed to provide both fixed and mobile services in 1998. The licences permit operation from April 2000. Singapore Telecom has

[14] The analogue service will continue to operate in some regional areas, in Tasmania and the Northern Territory until some time in 2000.

already experienced robust service and price based competition in mobile markets and has been positioning itself to compete effectively when the next tranche of liberalisation takes affect.

A Participants

Organisations and individuals contacted by the Commission in the course of the study are listed below.

Arthur Andersen

Australian Communications Authority

Australian Competition and Consumer Commission

Australian Telecommunications Users Group

BIS Shrapnel Pty Ltd

Boland and Associates

Canadian Radio-Television and Telecommunications Commission (Canada)

Centre for Efficiency of Productivity Analysis, University of New England

Centre for International Research on Communications and Information Technologies, RMIT

Communications Law Centre

Department of Communications, Information Technology and the Arts

Federal Communications Commission (United States)

Ministry of Commerce (New Zealand)

Ministry of Transport and Communications (Finland)

National Post and Telecommunications Agency (Sweden)

Netcom Consultants (UK) Ltd

Network Economics Consulting Group Pty Ltd

Network Strategies Ltd

New Zealand Institute of Economic Research Inc.

Office of Telecommunications (United Kingdom)

Optus Communications

Organisation for Economic Co-operation and Development

Ovum Pty Ltd

PA Consulting Group

Telecom New Zealand Pty Ltd

Teligen Ltd

Telstra Corporation

A workshop was convened on 11 May 1999 to discuss methodological issues. The organisations which were represented are listed below.

Australian Telecommunications User Group

Department of Communications, Information Technology & the Arts

Network Economics Consulting Group Pty Ltd

OPTUS Communications

Telecom New Zealand Pty Ltd

Telstra Corporation

This study also benefited from consultations with a wider group of organisations during the preceding telecommunications benchmarking study (PC 1999).

Teligen Ltd (formerly the Eurodata Foundation) and Ovum Pty Ltd contacted Australian and overseas organisations in the course of their studies for the Commission.

B Methodological issues in benchmarking prices

Many theoretical and practical issues must be addressed in the process of developing international comparisons of telecommunications prices. Decisions must be made about how to aggregate a very large number of individual prices into a limited number of measures (indexes) that give a reliable representation of the overall price relativities among the countries being benchmarked.

Prices in aggregate were compared by calculating a weighted average of the prices of the individual services purchased by various users. This was necessary because price structures vary across countries. For example, short-duration local calls may be cheaper in country 'A' compared with country 'B', whereas long-duration local calls or long-distance calls may be more expensive in 'A'.

Baskets of services consumed by what might be regarded as typical users were devised to simplify comparisons given the diversity of services and prices. The expenditure on a particular basket in each country represents a weighted average price index which varies across the countries.

The specification of customer usage baskets as well as the treatment of discounting, taxes and currency conversion are considered briefly in chapters 3 and 4. Some of the issues are explored further in this appendix, which includes a model to show how some factors affect prices across countries and over time.

B.1 Demand patterns

Separate price indexes were developed for residential and business customers and for major services such as the Public Switched Telephone Network (PSTN), Integrated Service Digital Network (ISDN) and mobile services. In each case, the price index was generated by defining a basket of services and pricing the basket in each country.

The overall comparisons made are affected by the weights given to each service within a basket because price structures vary across countries. As discussed in chapter 3, retail price controls of local residential services have produced disparate

price structures. The value of an aggregate price index for residential telephone services will therefore depend on the relative importance of each service in the index.

The comparisons in this study relied heavily on baskets developed by Teligen Ltd (formerly Eurodata Foundation) and the Organisation for Economic Cooperation and Development (OECD).[1] Their approach to comparing telecommunications prices is to use a neutral international basket rather than the demand patterns of any one country, which would tend to influence the price comparisons in favour of that country. The baskets take into account demand patterns in OECD countries and are agreed on by a panel of representatives from member countries.

The specification of the basket for the residential PSTN customer has been reviewed by the Commission following the previous benchmarking study (PC 1999). The main result of this review was to increase the duration of weekday evening long-distance calls to reflect changes occurring in a number of the benchmarked countries.

In the course of this review, Telstra and others suggested that the price index should be based on the current pattern of demand in the home country (for example, Australia) in order to establish whether the customers in that country (Australia) would be better or worse off with the prices in another country.

Using a basket based on demand patterns of one country biases comparisons. Those services with relatively low prices are expected to be relatively more in demand. Consequently, costing a basket in which these services are given a greater weight would lead to a more favourable comparison of aggregate prices than would be the case if the weights reflected the demand pattern of another country. Australia's fixed price (untimed) local calls are of much longer duration than European local calls which are priced on a per minute basis. Therefore, use of the average Australian duration for local calls in the price basket can be expected to lower the price index vis-à-vis European countries.

The volume of local calls per residential line is much greater in New Zealand where local calls are free, than in other countries that charge for local calls. A price basket based on New Zealand's call patterns could be expected to lower the measure of its total service price compared with countries which charge for local calls.

[1] The Commission extended the OECD's work by modifying the baskets (for example, including calls from fixed lines to mobiles and calls to Internet Service Providers) and examining more services and a wider range of business demand patterns.

Multilateral indexes which use the demand patterns of each country for comparing prices in a number of countries, are designed to address the above limitations of baskets and have some theoretical appeal (Selvanthan and Rao 1994). Based on restrictive assumptions about consumer preferences, some of these indexes (for example, the Caves-Christensen-Diewert or CCD index) can be used to provide a very good approximation of the consumer welfare effects of price differences.[2] However, they require more data than are available.

The Commission examined the sensitivity of the price comparisons to demand patterns. To do this, information on residential usage patterns for Australia and New Zealand was obtained, on a commercial-in-confidence basis.

B.2 Currency conversion

International comparisons of the prices of a specified basket of services and at a specified date involves the following steps:

- valuation of the basket in the local currencies of the selected countries; and
- conversion from the local currency values to a common unit of account, such as the US dollar.

Purchasing power parities (PPPs) were used in this study for the conversion of local currency telecommunications prices into a common unit of account.

PPPs are rates of conversion that are designed to equalise the internal purchasing power of currencies by eliminating differences in general price levels between countries. A given sum of money, converted into other currencies at PPP rates, should buy a similar broad and representative basket of final goods and services in each country.

The use of PPPs rather than market exchange rates is consistent with the objective of determining the extent to which Australian telecommunications prices are high or low, relative to Australia's general price level, when compared with other countries.

[2] Some multilateral indexes (for example, the CCD index) are capable of providing a local second order approximation to the true but unknown 'economic' price index when all consumers have identical homothetic preference maps. In the case of a sub-index (for example, an index for telecommunications services prices — where the index applies only to a subset of all goods) the sub-index must be also be aggregable. This means that there are further restrictions on the type of utility function that the price index can represent (Diewert 1987; Blackorby, Primont and Russell 1978).

This approach is also consistent with the other objective of the study, which was to compare the real rates of change in telecommunications prices across countries. This required measuring changes in telecommunications prices in relation to changes in the general level of prices in each country.

Algebraic formulation for conversion of telecommunications prices to a common unit of account

Purchasing power parity rates (designated PPP_{GDP}) are obtained by pricing a broad economy-wide basket of final goods and services in the local currency of each country. These rates are expressed in terms of local currency units per US$.

The PPP_{GDP}, for any country, can be interpreted as follows:

$$PPP_{GDP} = P_{GDP}/P_{GDP(US)}$$

where P_{GDP} is the price of a broad economy-wide basket of final goods and services in that country in terms of the local currency,

and $P_{GDP(US)}$ is the price of a broad economy-wide basket of final goods and services in the US in terms of US dollars.

When the local currency price of a basket of telecommunications services in a country (P_{OT}) is expressed in terms of US dollars using PPP rates, then:

$$P_{OT}/PPP_{GDP} = (P_{OT}/P_{GDP})\ P_{GDP(US)}$$

Therefore,

$$P_{OT}/P_{GDP} = (P_{OT}/PPP_{GDP})/P_{GDP(US)} = k\ (P_{OT}/PPP_{GDP})$$

since $P_{GDP(US)}$ is constant at a point in time (while P_{OT}/PPP_{GDP} is different for different countries).

This means that for comparisons between countries, the per cent difference (%Δ) in the ratios of the price of telecommunications services to the general price level in each country is the same as the per cent difference in telecommunications prices converted using PPPs.[3]

[3] Note that for comparisons of telecommunication price changes (relative to the general price level) within a country over time, $P_{GDP(US)}$ is not constant. For this purpose, taking US inflation into account, the formula becomes: $\%\Delta(P_{OT}/P_{GDP}) \cong \%\Delta(P_{OT}/PPP_{GDP}) - \%\Delta(P_{GDP(US)})$. That said, in this report the changes over time in each country were calculated directly in local currency terms.

That is:

$$\%\Delta(P_{OT}/P_{GDP}) = \%\Delta(P_{OT}/PPP_{GDP})$$

B.3 Prices

In the past, international comparisons of telecommunications prices have generally used standard or 'list' prices. In recent years, 'discount' price plans have become more common in the industry and need to be taken into account in the price comparisons.

The approach adopted in this study was to use the lowest widely available price plans that met the specified customer requirements for the relevant markets. Since the total market was segmented into various sub-markets, the number of plans taken into account was considerable.

Some sub-markets targeted by price plans could not be included in the analysis. To do so would require data on the market shares of the individual plans that is unavailable. However, the widely used plans chosen for the comparisons are considered to be indicative of telecommunications prices in the relevant markets.

It was suggested at the workshop to review methodology that aggregating all the price plans, as well as calls at different times and to different destinations, could be achieved by using revenue yield (revenue per line or per call or per call-minute) as a proxy for price.

However, this approach has two problems. The first is a theoretical difficulty. Two countries with identical price structures but different demand distributions would have different yields. In other words, the link between yield and price does not hold when usage patterns differ. The second is a practical difficulty. Revenue yield data for the relevant sub-markets is very difficult to obtain or not available for most countries.

B.4 Taxes

From the perspective of the consumer, it is desirable to include all taxes in the international comparisons because they are included in the prices consumers pay. This applies to price comparisons for business as well as for residential customers.

In countries where indirect taxes take the form of value-added taxes (VAT) or goods and services taxes (GST), businesses may not pay tax on the

telecommunications services they purchase. Alternatively, they may pay tax and receive a rebate for the tax paid. However, a tax on the value of these services is ultimately included in the prices paid by the consumers of final goods and services. Such taxes therefore affect the demand for final goods and services and hence the demand for telecommunications inputs used in their production.

If international price comparisons were being used to draw inferences about differences in productivity, it may be preferable to exclude all taxes so that the prices reflect the costs of the factors used in the production of the service. However, removal of all taxes (direct and indirect) from the telecommunications operators in all countries would be difficult. For example, direct (income) taxes included in the cost base (through gross wages) of telecommunications companies, and hence in the prices of telecommunications services, would have to be evaluated.

Countries differ in the share of the tax burden met through indirect taxes and through direct (income) taxes. If indirect taxes were excluded from the price comparisons, countries that raise more of their tax through indirect taxes and less through income taxes would be favoured.

In most of the benchmarked countries, VAT or GST taxes tend to be applied at uniform rates across different goods and services. However, these rates vary across countries. The VAT/GST rates on telecommunications services vary between 10 and 25 per cent for 8 of the 10 countries.

Currently, the rate of indirect taxation on telecommunications services in Australia, as imputed from input–output tables, is approximately 4 per cent while the average for all industries is around 12 per cent. This suggests that telecommunications bears less of the tax burden than other industries.[4] With the implementation of the GST, Australian telecommunications prices will increase relative to the general price level and become less favourable in international comparisons.

B.5 Measurement of price changes

Changes in telecommunications prices may occur in response to general inflationary pressures in the economy or because of industry-specific factors causing changes in unit costs. The latter may be stimulated by developments in technology or restructuring and cost-cutting initiatives by the carriers.

This study has focussed on telecommunications prices relative to the general level of prices. This means that the actual (nominal) price changes observed in each

[4] Indirect tax rates estimated using ABS (1997).

country must be deflated by the general level of inflation in each country in order to derive the real rates of change in telecommunications prices.

The price comparisons across countries at February 1998 and June 1999 involved conversion of the local currency telecommunications prices to a common unit of account. In most cases, the conversions were done using PPP rates. The PPPs for each country change from year to year according to the differences in the rates of general inflation between each country and the US (since the US$ is the reference currency for expressing the PPP of the other currencies). Inter-country *price comparisons* at different points in time, converted to a common unit of account using PPPs, are consistent with inter-country comparisons of inflation-adjusted *price changes* for each country measured directly in local currency terms.

Comparisons of price changes over relatively short periods may be affected by the timing of large price adjustments. Therefore, measured price changes may be misleading if there are large price changes around the end points of a fairly short period. For example, if there were large reductions in a country's prices for mobile telephone services in July 1999, the price change observed between February 1998 and June 1999 would not correctly represent the price trends in that country. This issue was taken into consideration when interpreting the price changes reported in chapters 3 and 4.

The timing problems of the kind mentioned above diminish as the time period over which trends are being observed increases.

B.6 Interpretation of price differences and price changes

Telecommunications prices are affected by the productivity of the telecommunications industry and the economy generally, by the prices of inputs purchased by telecommunications companies and by the financial performance of these companies.

The greater the productivity of the telecommunications industry, then the lower telecommunications prices will be (for a given financial performance). An improved level of productivity in the industry (generated by technological innovation or more efficient use of resources) may be partially absorbed by higher input prices. The remaining benefit is available to lower telecommunications prices or to increase returns to shareholders.

The relationships between productivity, prices and financial performance can be explored algebraically, using simplified definitions of these concepts. The

decomposition of price changes in this way provides some insight into the underlying reasons for the price differences observed in chapters 3 and 4 by identifying the various factors that could be causing the differences.

Algebraic formulation for the interpretation of price comparisons

Total factor productivity (TFP_T), for a telecommunications enterprise may be estimated as the quantity of its output (Q_T) per unit of quantity of input (I_T), with quantities measured by appropriate indexes. Outputs include customer access lines and telephone and data calls. Inputs include labour, materials and other services.

Because revenue is price times output, the quantity index for outputs may be estimated by the revenue (R_T) earned from the output divided by a price index for output (P_{OT}). Similarly, the quantity index for input is equal to expenses (E_T) incurred in producing the outputs divided by a price index for inputs (P_{IT}).

Therefore, for the telecommunications industry in any country:

$$TFP_T = Q_T/I_T = (R_T/P_{OT})/(E_T/P_{IT}) = (R_T/E_T)/(P_{OT}/P_{IT}) = (R_T/E_T)\,(P_{IT}/P_{OT}).$$

In terms of percentage differences ($\%\Delta$) between carriers or percentage changes over time:

$$\%\Delta TFP_T \cong \%\Delta(R_T/E_T) - \%\Delta(P_{OT}/P_{IT})$$

$$\%\Delta(P_{OT}/P_{IT}) \cong \%\Delta(R_T/E_T) - \%\Delta TFP_T$$

The above equation implies that differences in carrier output to input price ratios are equal to differences in financial performance (measured by the ratio of revenue to expenses) less differences in productivity. But estimates of $\%\Delta(P_{OT}/P_{IT})$ were not obtained because price indexes for telecommunications inputs were unavailable.

Nevertheless, this relationship may be used to obtain an expression for the differences in relative telecommunications price levels ($\%\Delta(P_{OT}/P_{GDP})$) in terms of underlying factors.

As discussed earlier, P_{GDP} was designated as the price of a broad economy-wide basket of final goods and services in each country. Now let P_{IGDP} be the price of a broad economy-wide basket of business inputs in each country. By substitution, TFP_T may then be decomposed as follows:

$$TFP_T = (R_T/E_T)\,(P_{IGDP}/P_{GDP})\,(P_{IT}/P_{IGDP})/(P_{OT}/P_{GDP})$$

Further substitution is possible by noting that the total factor productivity for the whole economy (TFP_{GDP}) is given by:

$$TFP_{GDP} = P_{IGDP}/P_{GDP},$$

where the provision of capital and entrepreneurial skill is included among the business inputs.

Therefore:

$$TFP_T = (R_T/E_T)\ TFP_{GDP}\ (P_{IT}/P_{IGDP})/(P_{OT}/P_{GDP})$$

Or in percentage terms:

$$\%\Delta TFP_T \cong \%\Delta(R_T/E_T) + \%\Delta TFP_{GDP} + \%\Delta(P_{IT}/P_{IGDP}) - \%\Delta(P_{OT}/P_{GDP})$$

Yielding:

$$\%\Delta(P_{OT}/P_{GDP}) \cong -\%\Delta TFP_T + \%\Delta(R_T/E_T) + \%\Delta(P_{IT}/P_{IGDP}) + \%\Delta TFP_{GDP}$$

The above formulations can be used in the interpretation of productivity and price changes over time in each country as well as differences between countries at a point in time.

The last identity indicates that high telecommunications prices in a country (compared with another country) could be attributable to:

- low productivity in the telecommunications industry;
- high profits for the enterprise;
- high input prices for the telecommunications industry (compared with input prices in other sectors of the economy); or
- high economy-wide productivity (which results in higher wages and other factor prices in that country).[5]

The first two circumstances are more likely to occur when the extent of competition in a country's telecommunications industry is relatively low. While the third — high input prices — may also be encouraged by less competition in the telecommunications industry, it is more likely that these prices will be held in check to some extent by competition among the supplying industries which occurs in all developed countries. The last circumstance (high economy-wide productivity) is associated with generally more well endowed and developed economies.

[5] Or any combination of the above. In fact, a country could perform well in one or more areas but the benefits could be more than offset by performance in other areas.

One final point should be made. As discussed in box B.1, TFP_T (measured by Q_T/I_T) is affected not only by the efficiency of the telecommunications industry, but also by environmental factors outside the control of the industry. Both of these influences are likely to vary between countries.

Box B.1 **Line density, costs and prices**

There are a number of factors outside the control of the telecommunications industry which affect the costs of providing services and hence the price comparisons. These factors include:

- line densities;
- geology and topography;
- scale; and
- inherited technologies.

These factors impact on unit costs because of their effect on productivity — as measured by the reciprocal of the quantity of resources used to produce each unit of output (Q_T/I_T) in each country.

Telecommunications cost modelling shows unambiguously that one of the most important influences on unit costs between different localities within a country is line density (see, for example, Guldmann 1991, Gabel and Kennet 1994).

Economies of line density exist because a shorter average length of line (per subscriber) is required in areas where subscribers are more densely located. In addition, if there are more subscribing lines in a particular area, the cost of laying the cables linking this area to others changes little and again the cost per line decreases.

Average line densities (total lines divided by land mass) vary substantially between countries and this might suggest that costs will vary in a similar manner. For example, Australia's country-wide line density is very low and this might suggest that Australia is at a cost disadvantage.

However, this need not be the case and whether there is a disadvantage has been the subject of debate (see, for example, NECG 1999, Ovum 1998). Although broad aggregates would provide a guide to cost impacts if the population in each country was uniformly distributed, they may be misleading where a large proportion of a population is urbanised or living in a relatively small part of a large country.

To resolve the issue, detailed information on the distribution of line densities within each country is required to accurately assess the impact of variations in line density across countries.

C Price plans used for the price comparisons

The tables below include the names of the price or discount plans for Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN) and cellular mobile services used in the February 1998 and the June 1999 price comparisons. The lowest price plan that is widely available in the relevant market was chosen for the comparisons.

In some cases, the price plans used contained several elements relating to different parts of the market (for example, local, long-distance or international services which may be supplied by different carriers). Also, in the case of Finland and the US, an average of two plans was used for most markets.

In New Zealand, Business PSTN and ISDN tariffs have been restructured during 1999. It is understood that the *Brilliant* plan was withdrawn before June 1999 with customers migrating to other discount plans.

The selection of plans with the same name for the February 1998 and June 1999 comparisons does not signify that the prices were the same. There may have been substantial changes in prices and price structures over the period.

The PSTN price plans, for both residential and business markets, are presented first, followed by the ISDN plans and lastly the plans for mobile services. In all the tables, **na** signifies 'information not available'.

Table C.1 **Residential PSTN**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Residential Smart Saver and Easy Saver 15	Easy Saver 15
Canada	BC Tel	Affinity and Real Plus	No Limits LD
Finland	HTC	HTC Plus	HTC Plus
	Tele/Sonera	Tele (Standard)	Standard
France	FT	Local Plan	Local Plan
Japan	NTT and KDD	Standard	TJ2000 and Time Plus (both NTT); T&S (KDD)
NZ	TCNZ	F&F Home	$3 Weekend and night
Sweden	Telia	Standard	Standard
UK	BT	Option 15	Option 15
US	Nynex (NY) and AT&T	Standard	One-rate (fixed rate per minute for international calls)
	PacBell (LA) and AT&T	Standard	One-rate

Table C.2 **Small Business PSTN — S1**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Business Saver Plus and Local Saver	LD Saver 4 and Local Saver
Canada	BC Tel	Advantage	Advantage Optimum
Finland	Tele/Sonera	Tele (standard)	Standard
	HTC	HTC Plus	HTC Plus
France	FT	Avantage Duree	Avantage Duree
Japan	NTT and KDD	NTT and KDD, Standard	NTT and KDD, Standard
NZ	TCNZ	Brilliant	Brilliant
Sweden	Telia	Standard	Standard
UK	BT	Choice 1	Choice 1
US[a]	Nynex (NY) and AT&T	Standard	One-rate
	PacBell (LA) and AT&T	Standard	One-rate

Note S1 is defined in table 4.1 in chapter 4.

Table C.3 **Small Business PSTN — S2**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Business Saver Plus and Local Saver	LD Saver 4 and Local Saver
Canada	BC Tel	Advantage	Advantage Optimum
Finland	Tele/Sonera	Tele	Standard
	HTC	Standard	Standard
France	FT	Avantage Duree	Avantage Duree
Japan	NTT and KDD	NTT and KDD, Standard	NTT Tw 10 and Time Plus
NZ	TCNZ	Brilliant	Brilliant
Sweden	Telia	TeleBonus 5+6	Standard
UK	BT	Choice 3	Choice 1
US	Nynex (NY) and AT&T	Standard	One-rate
	PacBell (LA) and AT&T	Standard	One-rate

Note S2 is defined in table 4.1 in chapter 4.

Table C.4 **Medium Business PSTN — M1**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Business Saver Plus and Local Saver	LD Saver 4 and Local Saver
Canada	BC Tel	Advantage	Advantage Optimum
Finland	Tele/Sonera	Tele	Standard
	HTC	Standard	Standard
France	FT	Avantage Duree	Avantage Duree
Japan	NTT and KDD	NTT and KDD, Standard	NTT Tw 10 and Time Plus
NZ	TCNZ	Connect	Connect
Sweden	Telia	TeleBonus 5+6	TeleBonus 5+6
UK	BT	Choice 3	Choice 3
US	Nynex (NY) and AT&T	Standard	One-rate
	PacBell (LA) and AT&T	Standard	One-rate

Note M1 is defined in table 4.1 in chapter 4.

Table C.5 **Medium Business PSTN — M2**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Business LD Saver 4 and Local Saver	LD Saver 4 and Local Saver
Canada	BC Tel	Advantage	Advantage Optimum
Finland	Tele/Sonera	Tele	Standard
	HTC	Standard	Standard
France	FT	Avantage Duree	Avantage Duree
Japan	NTT and KDD	NTT and KDD, Standard	NTT Tw 10 and Time plus
New Zealand	TCNZ	Connect	Connect
Sweden	Telia	TeleBonus 5+6	TeleBonus 5+6
UK	BT	Choice 3 (CWC by mistake)	Choice 3
US	Nynex (NY) and AT&T	Standard	One-rate
	PacBell (LA) and AT&T	Standard	One-rate

Note M2 is defined in table 4.1 in chapter 4.

Table C.6 **Medium Business PSTN — M3**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Business LD Saver 4 and Local Saver	LD Saver 4 and Local Saver
Canada	BC Tel	Advantage	Advantage Optimum
Finland	Tele/Sonera	Tele	Standard
	HTC	Standard	Standard
France	FT	Avantage Duree	Avantage Duree
Japan	NTT+KDD	NTT Tw 15 and volume Saver II	NTT Tw 10 and Time Plus
New Zealand	TCNZ	Connect	Connect
Sweden	Telia	TeleBonus 5+6	TeleBonus 5+6
UK	BT	Choice 3	Choice 3
US	Nynex (NY) and AT&T	Standard	One-rate
	PacBell (LA) and AT&T	Standard	One-rate

Note M3 is defined in table 4.1 in chapter 4.

Table C.7 **Medium Business PSTN — M4**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Business LD Saver 4 and Local Saver	LD Saver 4 and Local Saver
Canada	BC Tel	Advantage	Advantage Optimum
Finland	Tele/Sonera	Tele	Standard
	HTC	Standard	Standard
France	FT	Avantage Duree	Avantage Duree
Japan	NTT and KDD	NTT Tw 15 and volume Saver II	NTT Tw 10 and Time Plus
New Zealand	TCNZ	Connect	Connect
Sweden	Telia	TeleBonus 5+6	TeleBonus 5+6
UK	BT	Choice 3	Choice 3
US	Nynex (NY) and AT&T	Standard	One-rate (internl AT&T)
	PacBell (LA) and AT&T	Standard	One-rate (internl AT&T)

Note M4 is defined in table 4.1 in chapter 4.

Table C.8 **Residential ISDN**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	OR2 Smart Saver	OR2 Light CP Data
Canada	BC Tel	**na**	ISDN@Home
Finland	Tele/Sonera	Tele, Voice	Sonera, Standard
France	FT	Local	Standard
Japan	NTT and KDD	Voice	Voice
NZ	TCNZ	Voice	Voice
Sweden	Telia	TeleBonus 6	TeleBonus 6
UK	BT	ISDN 2e Fast Start	ISDN 2e Home Highway

Table C.9 **Small Business ISDN — S1**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	OR2 LD Saver 4 and Local Saver	OR2 LD Saver 4 and Local Saver
Canada	BC Tel	**na**	MicroLink
Finland	Tele/Sonera	Tele, Voice	Standard
France	FT	Voice	Standard
Japan	NTT and KDD	NTT and KDD, Voice	NTT and KDD, Voice
NZ	TCNZ	Voice, Brilliant	Voice, Brilliant
Sweden	Telia	Standard	Standard
UK	BT	BT ISDN 2e Fast Start	BT ISDN 2e Low Start (also called Business Highway)

Note S1 is defined in table 4.1 in chapter 4.

Table C.10 **Small Business ISDN — S2**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	OR2 LD Saver 4 and Light CP Data	OR2 LD Saver 4 and Light CP Data
Canada	BC Tel	**na**	MicroLink
Finland	Tele/Sonera	Tele, Voice	Standard
France	FT	FT Duree	Standard
Japan	NTT and KDD	NTT and KDD, Voice	NTT and KDD, Voice
NZ	TCNZ	Voice, Brilliant	Voice, Brilliant
Sweden	Telia	Telia, TeleBonus 6	Telia, TeleBonus 5 and 6
UK	BT	BT ISDN 2e Fast Start	BT ISDN 2e Low Start

Note S2 is defined in table 4.1 in chapter 4.

Table C.11 **Medium Business ISDN — M1**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	OR30 LD Saver 4 and Semi Permanent Connection	OR30 LD Saver 4 and SPC
Canada	BC Tel	**na**	MegaLink
Finland	Tele/Sonera	Tele, Voice	**na**
France	FT	FT Duree	FT Standard
Japan	NTT and KDD	NTT and KDD, Voice	NTT and KDD, Voice
NZ	TCNZ	Voice, Brilliant	Voice, Brilliant
Sweden	Telia	TeleBonus 6	TeleBonus 6
UK	BT	BT ISDN 30	BT ISDN 30

Note M1 is defined in table 4.1 in chapter 4.

Table C.12 **Medium Business ISDN — M2**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	OR30 LD Saver 4 and Semi Permanent Connection	OR30 LD Saver 4 and SPC
Canada	BC Tel	**na**	MegaLink
Finland	Tele/Sonera	Tele, Voice	**na**
France	FT	FT Duree	FT Standard
Japan	NTT and KDD	NTT and KDD, Voice	NTT and KDD, Voice
NZ	TCNZ	Voice, Brilliant	Voice, Brilliant
Sweden	Telia	TeleBonus 6	TeleBonus 6
UK	BT	BT ISDN 30	BT ISDN 30

Note M2 is defined in table 4.1 in chapter 4.

Table C.13 **Medium Business ISDN — M3**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	OR30 LD Saver 4 and Semi Permanent Connection	OR30 LD Saver 4 and SPC
Canada	BC Tel	**na**	MegaLink
Finland	Tele/Sonera	Tele, Voice	**na**
France	FT	FT Duree	FT Standard
Japan	NTT and KDD	NTT and KDD, Voice	NTT and KDD, Voice
NZ	TCNZ	Voice, Brilliant	Voice, Brilliant
Sweden	Telia	TeleBonus 6	TeleBonus 6
UK	BT	BT ISDN 30	BT ISDN 30

Note M3 is defined in table 4.1 in chapter 4.

Table C.14 **Medium Business ISDN — M4**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	OR30 LD Saver 4 and Semi Permanent Connection	OR30 LD Saver 4 and SPC
Canada	BC Tel	**na**	MegaLink
Finland	Tele/Sonera	Tele, Voice	**na**
France	FT	FT Duree	FT Standard
Japan	NTT and KDD	NTT and KDD, Voice	NTT and KDD, Voice
NZ	TCNZ	Voice, Brilliant	Voice, Brilliant
Sweden	Telia	TeleBonus 6	TeleBonus 6
UK	BT	BT ISDN 30	BT ISDN 30

Note M4 is defined in table 4.1 in chapter 4.

Table C.15 **Residential Mobile**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Communicator 30	Communicator 30
Canada	BC Tel	**na**	BC Tel Mobility, Freedom 100
Finland	Tele/Sonera	Tele Privat	Sonera Privat
France	France Telecom Itineris	FT Reference	Itineris 2H
Japan	NTT	DoCoMo A	DoCoMo A
NZ	Bell South/Vodafone	Bell South Adv 1	Vodafone Talk 200
Sweden	Telia	Pott	Pott
UK	BT Cellnet	Cellnet Regular Caller	Cellnet Regular Caller
USA	US West	US West Avanced 60	US West Standard 60
	Sprint	Sprint Spectrum Talk	PCS Free and Clear

Table C.16 **Small business mobile**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Digital Flexiplan 100	Digital Flexiplan 100
Canada	BC Tel	**na**	BC Tel Mobility, Freedom 100
Finland	Tele/Sonera	Tele Classic	Sonera Classic
France	France Telecom Itineris	FT Affaire	Itineris 4H
Japan	NTT	DoCoMo A	DoCoMo A
NZ	Bell South/Vodafone	Bell South Adv 1	Vodafone Daytime 65
Sweden	Telia	Volym	Volym
UK	BT Cellnet	Cellnet Regular Caller	Cellnet Regular Caller
USA	US West	US West Advanced 60	US West Business 150
	Sprint	Sprint Spectrum Talk	PCS Free and Clear

Table C.17 **Medium business mobile**

Country	*Operator*	*February 1998*	*June 1999*
Australia	Telstra	Digital Flexiplan 150	Digital Flexiplan 150
Canada	BC Tel	**na**	BC Tel Mobility, Freedom 100
Finland	Tele/Sonera	Tele Classic	Sonera Classic
France	France Telecom Itineris	FT Affaire	Itineris 7H
Japan	NTT	DoCoMo A	DoCoMo A
NZ	Bell South/Vodafone	Bell South Adv 1	Vodafone Daytime 65
Sweden	Telia	Volym	Volym
UK	BT Cellnet	Cellnet Regular Caller	Cellnet Regular Caller
USA	US West	US West Advanced 60	US West Business 150
	Sprint	Sprint Spectrum Talk	PCS Free and Clear

D Regulatory arrangements — June 1999

The regulatory and institutional arrangements in the benchmarked countries as at June 1999 are summarised in this appendix. Information on the evolution of arrangements in Australia and all the benchmarked countries — except Korea, Malaysia and Singapore — can be found in the Productivity Commission's previous telecommunications benchmarking study (PC 1999). Detailed information on the arrangements in Korea, Malaysia and Singapore is contained in appendix E of this report.

Ovum Pty Ltd was engaged by the Commission to collect information about changes to regulatory and institutional arrangements between February 1998 and June 1999.

Table D.1 **USO requirements in the selected countries, 1999**

	USO requirements
Australia	Requires that standard telephone services, including services for the disabled, public payphones and prescribed carriage services are reasonably accessible to all people in Australia on an equitable basis, wherever they reside or carry on business. USO has been extended to provision of digital data service to all who require it (without retail price controls).
Canada	Requires that telephone services be provided to all who can pay for it, but customer access and usage charges are not required to be maintained at a uniform level across the country.
Finland	Dominant operators must serve all customers in their territory.
France	Obligation to provide a quality telephone service at an affordable price.
Japan	The USO requires uniform and regulated charges for local calls and customer access. In high-cost areas these charges are cross-subsidised by customer access charges in more populated and therefore less costly areas, and by long-distance charges.
Korea	Obligation on Korea Telecom to provide standard telephony services.
Malaysia	All carriers are required to contribute to USO delivery. Fixed network operators have a requirement to install a specified number of payphones per head of population, but there is no specification about the location of such services.
New Zealand	The Kiwi Share Obligation on TCNZ: • mandates maintenance of the option of free local calls for residential customers, but tariff packages incorporating charges for local calls may be offered as an optional alternative; • prohibits real increases in residential customer access charges, subject to no 'unreasonable impairment' of the overall profitability of the TCNZ's subsidiary regional operating companies; • requires the ordinary residential telephone service to be made as widely available as it was at 11 September 1990; and • obliges TCNZ to maintain rural customer access charges at rates no higher than the standard residential rental. The Obligation does not extend to public payphones.
Singapore	The monopoly fixed network operator until April 2000, Singapore Telecom is required to provide service to all who require it.
Sweden	Telia is obliged to provide telephony services between fixed points to all regardless of where they live at an affordable price.
United Kingdom	• a connection to the fixed network able to support voice telephony and low speed data and fax transmission; • the option of a more restricted service package at low cost; and • reasonable geographic access to public call boxes across the UK at affordable prices.
United States	Local Exchange Carriers (LECs) must average call prices for a given distance across their entire service areas, regardless of differences in costs. They must give customers in remote areas access to telecommunications services that are 'reasonably' comparable to services provided in urban areas at charges which are 'reasonably' comparable. Services must be provided at concessional rates to libraries, educational and health facilities and low-income customers. There is no legal requirement for LECs to install and maintain public payphones.

Source: PC (1999) and Ovum (1999).

Table D.2 **Funding USOs, June 1999**

	Funding mechanism
Australia	The costs of the USO must be shared among carriers so that no one carrier is disadvantaged. To this end, the costs of the USO are shared in proportion to carriers' shares of 'eligible revenue'. After obtaining the consent of participating carriers, the Minister may specify another cost-sharing mechanism. A cap has been placed by legislation on the total net levy credit for standard telephone services for 1997–98 and the subsequent two financial years. The provision of digital data services under USO conditions attracts no contribution from other carriers.
Canada	Carriers are required to contribute to the USO requirement through a Portable Contribution Subsidy. The Subsidy is an explicit toll levied on all long-distance traffic carried on the local telephone network. The funds are distributed to all local carriers based on subsidy requirements per residential Network Access Services or equivalent by rate band. Carrier contributions were established on the basis of a per minute contribution by long distance service providers in 1996. This basis of determining contribution was extended to international service providers in April 1999.
Finland	Incumbent local operators must provide service but are not required to charge uniform prices. Their tariffs may reflect costs. Directly targeted low income assistance is provided by the Ministry of Social Affairs.
France	A national universal service fund was established in 1997. Net costs of overall geographic supply will be compensated by interconnection surcharges until 31 December 2000 at the latest.
Japan	Designated carriers must bare the cost of the USO's provision. Funding of the USO is to be reviewed in 2000.
Korea	Korea is looking to introduce a form of Universal Service fund.
Malaysia	An USO agreement signed by all carriers sets out how much each will contribute to a central fund. The overall amount is determined by the Government.
New Zealand	Kiwi Share Obligation is met by TCNZ. One contributing source is through inbuilt surcharges to interconnection rates.
Singapore	Universal service funded by SingTel from overall revenues.
Sweden	There is no specific universal scheme and as such universal service costs are not borne by other market players. Incumbent must meet all universal service costs.
United Kingdom	BT is responsible for the provision of the universal service obligation but the cost of the obligation is not reimbursed.
United States	Each telecommunications carrier that provides interstate or intrastate telecommunications services must contribute, on an equitable and non-discriminatory basis, to the provision of universal service.

Source: PC (1999) and Ovum (1999).

Table D.3 **Retail price regulation in selected countries**

	Start date	*Price control*	*Services covered*
Australia	1989	CPI-4%	Line rentals, local calls, STD and IDD calls.
		Sub caps CPI	Local calls and residential rentals.
		Notifiable and disallowable	Connection fees, payphone calls, calls to directory assistance.
	1991	Notifiable and disallowable	008 services, leased line charges, mobile services.
	1992	CPI-5.5%	Connections, line rentals, locals calls, STD calls, IDD calls, domestic leased lines, international leased lines, mobile services.
		Sub cap CPI-2%	Connections, rentals and local calls.
		Sub caps CPI-5.5%	STD calls; IDD calls.
		Capped at CPI	Increases in prices for connections, rentals, local calls and STD calls
		Notifiable and disallowable	Payphone calls, calls to directory assistance, connections for resellers.
	1996 to 1998[a]	CPI-7.5%	Connections; line rentals; local, long-distance and international calls; leased lines; mobile telephone services.
		Sub caps CPI-1%	Residential connections, line rentals, long-distance calls and international calls.
			Before increasing any charge subject to these price control arrangements by more than the CPI during a calendar year, Telstra is required to obtain the prior consent of the ACCC.
			There is a direct price control of 25 cents on local calls from fixed phones and 40 cents on local calls from payphones.
		Notifiable and disallowable	Directory assistance.
	1999 to 2001[b]	CPI – 5.5%	Connections, line rentals, local, trunk and international calls, domestic and international leased lines and digital cellular mobile telephone services
		CPI	Line rentals and local call services (sub-basket)
		CPI	Connection services (sub-basket)
		CPI-1%	Connections, line rentals, local, trunk and international call services consumed by the average of the bottom 50% of Telstra's pre-selected residential customers by bill size.

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Table D.3 (continued) **Retail price regulation in selected countries**

	Start date	*Price control*	*Services covered*
Australia (cont'd)			ACCC consent required to increases in line rentals applicable to the bottom 10% of Telstra's pre-selected residential customers by bill size, such consent to be based on ensuring that such bills will not increase in real terms.
			Revenue-weighted untimed local call for non-metropolitan Australia for 1999/2000 and 2000/2001, not to exceed that in metropolitan Australia for the previous year, in each case.
		Cap of 25 cents	Untimed local calls.
		Cap of 40 cents	Calls made from a public payphone.
		Notifiable and disallowable	Directory assistance.
Canada	1994	Direct price control	Three regulated increases proposed for 1996, 1997 and 1998 to bring residential services rates in line with costs.
	1995	Rate of return	Utility segment (the non-competitive part of the industry).
	1998 to 2002	CPI-4.5%	Utility segment.
		CPI	Basket of basic local residential services. No individual local residential or business charge will increase by more than 10 per cent any year.
Finland			No retail price controls.
France	1995	CPI-4.5%	Basic voice telephony services without discount schemes, comprising access, line rental, calls (local, national, international and payphone).
	1996	CPI-5.5%	Basic voice telephony services, as defined above.
	1997	CPI-9%	Basic voice telephony services, as defined above.
	1999	CPI-4.5%	Basic voice telephony services, as defined above.
Japan	1998		Rate of return price regulation.
	1998	Caps	Advanced notification of changes. Price caps apply to NTT in relation to telephone services, ISDN services and leased circuit services – each being a separate basket of services.
Korea	1998	Direct controls	From 1998, only dominant operators (KT in fixed service, SK Telecom in mobile service) are required to have prior approval of local service tariffs and changes. Other operators set their own prices. From 2000, the dominant operators will be given more scope to set prices.
Malaysia	1950	Direct controls	Control of maximum prices, access rentals, leased lines, local and long distance calls.

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Table D.3 (continued) **Retail price regulation in selected countries**

	Start date	*Price control*	*Services covered*
New Zealand	1989	CPI	Line rentals; customer access charges for residential customers in rural areas not to be higher than in the cities.
		Direct price control	Local free calling to remain a tariff option available to all residential customers.
Singapore		Direct controls	Approval of tariffs and changes by regulator.
Sweden	1993	CPI-1%	Basket of telephony services supplied to households and smaller companies.
		Light user scheme	Users with low consumption offered reduced subscription fees.
	1997	CPI	Customer access charges - customer line connection and rental.
United Kingdom	1984	CPI-3%	Line rentals; local and long-distance calls.
		Indiv. cap CPI+2%	Line rentals. This sub-cap remained with the same X until 1997.
	1989	CPI-4.5%	Line rentals, local and long-distance calls.
	1991	CPI-6.25%	Basket extended to include international calls.
	1992	CPI-7.5%	Line rentals; local and long-distance calls; international calls. In addition to the cap on this basket, some individual price caps were place on certain services.
	1997-2001	CPI-4.5%	Single basket of line rental, connection, and call (local, long distance and international) charges for small to medium usage households (light user scheme).
		CPI	Line rentals for small business. Low usage small business service packages must be as good as for residential segment.
United States			Rate of return regulation on LEC services in some States; price cap regulation in some States on line rentals and local call rates.

a Extended to 30 June, 1999. **b** Effective from 1 July, 1999.

Source: PC (1999) and Ovum (1999).

Table D.4 **Major competition reform initiatives in Australia and the selected countries**

	Date	*Major reform initiatives*
Australia	1989	*Telecommunications Act 1989* begins liberalising the industry. Competition restricted to the provision of value-added services, private networks, customer equipment and cable installation. AUSTEL created and charged with the economic and technical regulation of the industry and the introduction of a new system of price regulation based on a CPI–X price cap.
	1991	*Telecommunications Act 1991* establishes a general, fixed network carrier duopoly and a three mobile carrier market. AUSTEL given the power to behave as an arbitrator in access disputes.
	1997	*Telecommunications Act 1997* introduces open competition and revises the definition of universal service obligations and the mechanism for funding it.
		The *Trade Practices Amendment (Telecommunications) Act 1997* establishes an industry-specific access regime and anti-competitive conduct framework.
	1999	*Telecommunications (Amendment) Act 1999* revises universal service definition. Powers of regulator to issue Competition Notices and intervene earlier in access disputes strengthened in amendments to the Trade Practices Act.
Canada	1979-1981	CNCP permitted to compete in the provision of certain interconnected private line voice services and interconnected data services in Bell Canada's territory. Decision extended to allow CNCP to operate in B.C. Tel's territory.
	1982	CRTC sets out the terms and conditions governing the attachment of subscriber-provided terminal equipment to the networks of all federally regulated telecommunications carriers.
	1984	CRTC sets out terms and conditions for interconnection by cellular mobile radio systems with federally regulated telephone companies following a decision by the Department of Communications to establish two cellular radio systems in each of the major markets in Canada.
	1986	CRTC allows Telesat Canada to offer interconnected private line services like those permitted in 1979.
	1987	Resale and sharing of the private line services of the federally regulated companies permitted.
	1992	CRTC sets out the terms and conditions for competition in the provision of public long-distance voice services.
	1994	CRTC establishes a new regulatory framework for the federally regulated Stentor-member companies. New framework establishes a transitional period for a move toward the implementation of price cap regulation for these companies' utility segments.

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Table D.4 (continued) **Major competition reform initiatives in Australia and the selected countries**

	Date	*Major reform initiatives*
Canada (cont'd)	1997	CRTC sets out the terms and conditions of local competition in the territories of certain of the Stentor-member companies as well as establishing the parameters of the price cap regime. The new regime obligated incumbent operators to interconnect. Other key features required incumbent telephone companies to: unbundle 'essential facilities' and allow for co-location on the same terms as are used by the incumbents themselves; provide access to their local networks at prices consistent with established access pricing rules; and provide for the resale of local residential services (at retail rates).
	1998	CRTC removes restrictions on the joint marketing and bundling or wireless and wireline services for all telephone companies. Incumbents must still file tariffs for bundled services. CRTC allows competition in local pay telephone market.
Finland	1987	*Telecommunications Act 1987* introduces first steps towards liberalisation by defining the responsibilities and duties of telecommunications operators and the rights of users of the telecommunications services.
	1988	Competition in corporate networks and data transmission partially liberalised.
	1990	Free competition in data networks and GSM networks.
	1991	Corporate networks become subject to free competition.
	1994	Local, long-distance and international telecommunications markets become subject to free competition
	1996	Amendments to the *Telecommunications Act 1987* made: • Telecommunications operators obliged to lease telecommunications connections to each other. • Whole field of telecommunications no longer subject to licences granted on the basis of discretion. • Customer fees become free of regulation.
	1997	*Telecommunications Market Act 1997* aims at further stimulating competition, particularly in the local call market. Fixed network operators are obliged to interconnect. Those with significant market power must accept all reasonable requests for interconnection. Charges must be non-discriminatory and reasonable. Those with significant market power must publish standard reference offers and separate their accounts.
France	1996	*Telecommunications Act 1996* set out principles for the liberalisation of the telecommunications market on 1 January 1998.
	1998	Telecommunications industry liberalised. Fixed network operators are obliged to interconnect. Those with significant market power must accept all reasonable request for interconnection. Charges must be non-discriminatory and reasonable. Those with significant market power must publish standard reference offers and separate their accounts.

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Table D.4 (continued) **Major competition reform initiatives in Australia and the selected countries**

	Date	*Major reform initiatives*
Japan	1985	New entrants permitted to operate in the national or international markets but the incumbents in each of these markets (NTT and KDD) are not permitted to compete with each other. Interconnection terms and conditions are negotiated between parties and agreements must be authorised by the MPT.
	1998	Proposed restructure of NTT into a long-distance supplier and two local call suppliers. The two regional companies not permitted to compete in long-distance market. New interconnection requirements introduced:
		Type I network operators obliged to interconnect. Access must be provided at wholesale rates and authorised interconnect agreement must be made public.
		Designated carriers (NTT) required to provide interconnect at any technically feasible point. Tariffs must be cost-based and annually submitted to Minister for approval. Essential facilities must be provided to other carriers on conditions equal to those the designated carrier provides itself.
		Designated carriers become subject to accounting separation requirements.
		Type I carriers subject to prior notification procedures for tariffs, replacing prior approval arrangements.
Korea	1998	Amendments to the Telecommunications Business Law to permit service based competitors to provide Internet telephony and service resale, as well as facilities based operators. The licensing of facility-based operators has been streamlined and made more transparent.
Malaysia	1994	Fixed network and cellular mobile competition. Licences issued to new operators.
	1996	Interconnection arrangements established by regulator (JTM)
	1999	The regulatory agency, Communication and Multimedia Commission, established as an independent agency.
	1999	Call by call carrier selection introduced.
New Zealand	1987	*Telecommunications Act 1987* removes competitive restrictions on the supply of customer premises equipment.
	1988	*Telecommunications Amendment Act 1988* removes restrictions on the supply of telecommunications services of all kinds.
	1989	*Radiocommunications Act 1989* reforms the management of the radio spectrum to facilitate competitive entry into the industry.
	1990	*Telecommunications Amendment Act 1990* establishes information disclosure requirements on TCNZ. TCNZ required to publish prices, terms and conditions for the supply of certain prescribed telecommunications goods and services.
Singapore	1992	Establishment of TAS as an independent regulator
	1994	Licensing of second value added network data operators
	1995	Licensing of second public cellular mobile operator

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Table D. 4 (continued) **Major competition reform initiatives in Australia and the selected countries**

	Date	*Major reform initiatives*
Singapore (cont'd)	1997	Commencement of operations of second cellular mobile operator
	1998	Licensing of a second Public Basic Telecom Services operator Licensing of two additional cellular mobile operators. Extension of TAS powers to promote competition, require interconnection, and require sharing of access and facilities Open competition for Internet access services.
Sweden	1992	Telia negotiates Sweden's first interconnect agreement with Tele2.
	1993	*Telecommunications Act 1993* establishes an independent regulator (PTS) and opens the industry to competition.
	1997	Amendments made to the Telecommunications Act 1993 leading to the attainment of the Government's objectives through legislation rather than through State ownership of Telia and the imposition of special obligations regarding interconnection on operators with significant market power (such as Telia).
United Kingdom	1984	BT privatised and a duopoly policy initiated, regulated by the newly-formed OFTEL, which limited entry into the sector until 1991. BT's retail prices controlled by a price cap covering quarterly rentals and connection charges and national and local call charges. BT required to interconnect with Mercury. Two mobile network operators (Cellnet and Vodafone) licensed. Network operators not permitted to sell directly to customers. Mobile services must be marketed through service providers.
	1991	Entry into the telecommunications market liberalised. BT's prices remain under price caps except that the controls extended to international calls. Accounting separation requirements imposed upon BT. The mobile duopoly ended and two further operators licensed.
	1997	Third wave of deregulation removes regulatory controls from what OFTEL considers to be competitively provided services. Certain network charges also become subject to a price cap regime and a Fair Trading Condition inserted into carrier licences. As with other EU countries the next major change in regulation in the UK awaits the European Commission's 1999 regulatory review.
United States	1982	Modified Final Judgement results in AT&T divesting its local exchange carriers and all areas of the industry opened to competition with the exception of intraLATA services.
	1996	*Telecommunications Act 1996* introduces competition into intraLATA services. Obligation to interconnect placed on LECs. Unbundling of local loop and local call resale at wholesale prices required.
	1999	US Supreme Court upheld FCC's authority to make orders in relation to local competition pricing, interconnection obligations of local exchange carriers, and unbundling of network elements, pursuant to the 1996 Act on a nationwide basis.

Source: PC (1999) and Ovum (1999).

Table D.5 **Access arrangements, June 1999**

	Access arrangements
Australia	Access or interconnection must be negotiated with existing operators. Provision for mandatory access requirements through declaration following self-regulatory processes or an ACCC inquiry. A declaration may apply to any market sector (ie fixed or mobile) and applies to all carriers and carriage service providers. Certain services were declared under transitional arrangements on 1 July 1997. Resale of retail services at wholesale rates requires negotiation with existing operators although declaration may force cost-based pricing. Services which have been declared include PSTN and Mobile originating and terminating access, inter-capital transmission on most routes, local loop unbundling, and data and ISDN services. Resale of local services at wholesale rates has also been declared.
Canada	All local exchange carriers in a local call area must be interconnected. Each carrier is required to designate a point of interconnect as a gateway for the interchange of traffic. Only those local loops considered 'essential' by the regulator must be unbundled. Other local loops must also be unbundled, with prices based on the rating principles for essential facilities, for a period of five years from 1 January 1998. Resale of retail services only permitted at retail rates.
Finland	Requirements apply to fixed network services only as there is no operator with significant market power in the mobile sector. All operators must provide for interconnection. Operators with significant market power must accept all reasonable interconnection requests. This may require the network operator to lease connections even where it does not normally provide them, including the unbundling of the local loop. There is no requirement for the resale of retail services at wholesale rates.
France	Requirements apply to fixed network services only as there is no operator with significant market power in the mobile sector. All operators must provide for interconnection. Operators with significant market power must accept all reasonable interconnection requests. There is no requirement for the resale of retail services at wholesale rates.
Japan	Requirements apply to fixed network services. All carriers are required to interconnect. Designated carriers (own >50 per cent of subscriber lines in a market) are obliged to provide a minimum number of interconnection points. There are seven minimum points of interconnection and, subject to technical feasibility, designated carriers are required to unbundle other facilities on request. Resale of retail services required at wholesale rates (based on cost).
Korea	Common carriers with essential facilities are obliged to interconnect to requesting service providers. Agreements with Korea Telecom are regulated.. New entrants are responsible for nominating points of interconnect. Resale of services is permitted.
Malaysia	All carriers are required to have clear, stable and transparent interconnect arrangements in place. TMB is required to provide terminating, transit and (since January 1999) originating access for fixed and mobile operators. Interconnection is at trunk level, and there are one or two PoIs at this level in each State. Operators negotiate interconnect, with the regulator intervening if there is no agreement after 90 days.

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Table D.5 (continued) **Access arrangements, June 1999**

	Access arrangements
New Zealand	No formal access arrangements. To interconnect with the networks of existing carriers or gain access to retail services, competitors must negotiate with the carrier and take recourse for unfair dealings through general competition legislation.
Singapore	Requirements apply to both mobile and fixed network services, and have been included in licence conditions.
Sweden	Requirements apply to fixed network services only as there is no operator with significant market power in the mobile sector. All operators must comply with requests for interconnection. Those with significant market power must comply with special interconnection requirements. In particular, this requires that the incumbent comply with all reasonable interconnection requests. There is a legislated requirement for the incumbent to unbundle its local loop, however it is unclear whether this has in fact occurred. There is no requirement for the resale of retail services at wholesale rates.
United Kingdom	Requirements apply to fixed network services only. Mobile market is considered competitive. Carriers with significant market power are required to connect their networks with other network operators. Regulations do not extend interconnection rights to unbundling of the local loop. There is no requirement for the resale of retail services at wholesale rates.
United States	Requirements apply to fixed network services where incumbents have significant market power. All operators have a right to interconnect. Incumbent local exchange carriers required to provide interconnection at any technically feasible point. The regulator prescribes seven minimum points of interconnect, including unbundling of the local loop. Resale of retail services required at wholesale rates (based on avoided cost).

Source: PC (1999) and Ovum (1999).

Table D.6 **Determination of access terms and conditions, June 1999**

	Method of determining access terms and conditions
Australia	Negotiation with provision for the application of approved undertakings and ACCC arbitration. Either party may refer the matter to the ACCC for arbitration. Arbitration decisions may be appealed in the Australian Competition Tribunal and, ultimately, in the Federal Court.
Canada	Basic charges are subject to CRTC determination. Other terms agreed through negotiation, although call termination charges must be based on the principle of reciprocity or mutual compensation. CRTC may act as an arbitrator in disputes.
Finland	Operators with significant market power must publish standard interconnection offers specifying the technical conditions and tariffs applicable for interconnection. Offers must be approved by the regulator against cost-based pricing principles. The technical and financial terms offered to other operators must be the same as what the operator provides itself. Operators must not refuse to negotiate where certain interconnection conditions are not provided for in the standard offer. Standard offers do not preclude negotiated agreement between interconnecting parties so long as they are objectively justified and transparent. The Ministry may arbitrate in a dispute. It is unclear whether arbitration decisions are binding.
France	Access terms and conditions determined as per Finland. France Telecom must offer access charges on a non-discriminatory basis to all requesting carriers, but other carriers need not offer reciprocal rates to France Telecom. Regulator may arbitrate in a dispute. It is unclear whether arbitration decisions are binding.
Japan	Negotiation with non-designated carriers is required. Ministry regulates the tariffs set by designated carriers. Designated carriers must submit tariffs and any proposed changes to the Ministry for authorisation. Tariffs must be at least equal to those for comparable services provided to itself. Tariffs set by designated carriers are reviewed annually by the regulator on the basis of interconnect accounting data. Designated carriers may only provide interconnection by individual agreement after obtaining Ministerial authorisation. The Ministry may arbitrate in a dispute. Parties also have a right of appeal to the courts under administrative procedures.
Korea	Negotiated interconnect prices require regulatory approval before implementation. Conditions of agreements are negotiated between the parties and subject to MIC mediation or, if negotiations extend beyond 90 days, intervention. Interconnect charges are based on traffic-sensitive and non-traffic-sensitive components, the latter reflecting a contribution to access deficits. The rates are based for KT are based on fully allocated costs plus 10% return on investment.
Malaysia	From the beginning of 1999 access charges are cost-based, with the standard being direct costs plus a rate of return. Charges are established through negotiation in accordance with regulatory guidelines.
New Zealand	Negotiation. Private arbitration available with ultimate resort to the Courts.

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Table D.6 (continued) **Determination of access terms and conditions, June 1999**

	Method of determining access terms and conditions
Singapore	Regulator determines key charges, and other terms are negotiated between the parties, with regulatory intervention in the event of failure. TAS has set the key charges for access to the fixed network for the three years 1997 to 2000, for interconnection of mobile operators to SingTel. Other terms are negotiated between the parties, with TAS intervention if required. TAS will set charges for fixed network interconnection for the period 2000 to 2003 in advance.
Sweden	Access terms and conditions determined as per Finland. At the request of either party to a negotiation, the regulator may set a time limit for negotiations and the regulator may mediate if the time limit is not met. The regulator may arbitrate in the event of a dispute. Its decisions may be appealed in a general administrative court.
United Kingdom	Negotiation with BT subject to price caps on certain of its network services. BT is required to give notice of changes to a charge covered by the price caps. Call termination charges must be based on the principle of reciprocity. OFTEL may act as an arbitrator in disputes and its decisions are binding.
United States	Preference for incumbent local exchange carriers and new entrants to come to privately negotiated interconnection agreements. However, call termination and transport charges must be based on the principle of reciprocity. RBOCs may (but are not required to) file general offers of interconnect services and prices with the relevant State Commission. Commercially negotiated agreements must also be approved by the relevant State Commission. State Commissions may act as a mediator or as an arbitrator where negotiations fail. Mediation is not binding while arbitration is.

Source: PC (1999) and Ovum (1999).

Table D.7 **Accounting separation requirements, June 1999**

	Accounting separation requirements
Australia	The ACCC has the authority under Part XIB to issue other account keeping rules which specify the manner and form in which records must be kept. New record keeping rules for the telecommunications industry, which provide for accounting separation arrangements, were issued by the ACCC in April, 1999.
Canada	No longer required as of January 1998.
Finland	Operators with significant market power are required to separate out their accounts for interconnection. Interconnection accounts must show the main categories into which costs are divided (ie direct costs and common costs) as well as the rules used for the allocation. Cost accounting descriptions must be forwarded to the Ministry. The accounting method must be approved by the Ministry.
France	Operators with significant market power must keep a separate accounting system for their interconnection activities, the specifications of which are set out under a decree of the Ministry. In particular, the system must allow for the identification of the following costs: general network costs; costs specific to interconnection services; costs specific to the operator's services other than interconnection; and common costs. The cost accounting systems are independently audited. Publication is not required although the operator is required to publish a statement of compliance.
Japan	Designated carriers' accounting reports must be separated between the management and operation of essential facilities and the provision of services to users utilising essential services. A report on their interconnection accounting must be forwarded each year to the Ministry and published. A certification of the results authorised by a certified public accountant must be attached. Accounting standards are defined by the government.
Korea	Not known
Malaysia	Not required
New Zealand	TCNZ required to publish separate financial statements for its principal operating subsidiary, Telecom New Zealand. The Government has issued a Discussion Paper which proposes separate financial statements be produced by TCNZ prepared on an avoidable cost allocation methodology for local service and other telecommunications businesses.
Singapore	Required. Regulatory accounting guidelines, including accounting separation requirements, are set out as licence conditions.
Sweden	Operators with significant market power are obliged to keep the accounting of revenue and expenses for interconnection separate from other accounts. Further details of the accounting separation system are unavailable.

(Continued next page)

Table D.7 (continued) **Accounting separation requirements, June 1999**

	Accounting separation requirements
United Kingdom	BT is required to separate its accounts for its retail services, core network services and access network services. BT is also required to publish statements of incremental costs for the network business. These will show the attribution of costs to each network component and part and provide incremental cost floors and stand-alone cost ceiling for all services. There is also a requirement for BT to publish its current cost accounting statements annually. All accounts are independently audited to tight audit standards and reconciled to statutory annual accounts.
United States	Federal and State regulators require separate accounting services subject to each jurisdiction, according to tightly defined accounting rules.

Source: PC (1999) and Ovum (1999).

Table D.8 **Requirement for number portability and carrier pre-selection, June 1999**

Country	*Number portability*	*Carrier pre-selection*
Australia	Number portability required for fixed services. Moving to extend to 1800, 13, 1300 and mobile services. Carriers to bear their own costs (in practice, mostly borne by donor carriers).	A basket of national long-distance, international direct dial, operator assistance, and international ringback calls.
Canada	Yes	Required by all LECs in relation to service providers in their territories by virtue of CRTC decision May 1997.
Finland	Yes	Preselection for national long distance calls from 30 September 1998, and for international calls from I January 1999.
France	Number portability due by 1 Jan. 2001.	Yes, offered by France Telecom.
Japan	Moving towards its introduction in 2000–01.	Introducing carrier pre-selection, in 2000–01.
Korea	Planned	Implemented.
Malaysia	Not available	Available from 1 January 1999. Call by call carrier (code) selection is operating from January 1999.
New Zealand	Number portability based on call forwarding has been introduced. Cellular number portability is under negotiation.	Carrier pre-selection is available pursuant to agreement between individual carriers.
Singapore	Available for fixed and mobile service numbers.	No. Call-by-call code access to for international calls planned.
Sweden	Regulator desires the deployment of number portability by 1 July 1999. However, regulator has also allowed 1 January 2003 in the event of technical or costing difficulties.	Introducing carrier pre-selection by September 1999.
United Kingdom	Introduced in 1996 for fixed and in 1999 for mobile services.	No. Currently only indirect access is available. Users directly connected to a particular carrier have no right of access to other operators' long-distance services.
United States	Local number portability implementation commenced in October 1987 for completion in 1999. Only applies to fixed telephony.	Yes.

Source: PC (1999) and Ovum (1999).

E Regulatory and institutional arrangements — Korea, Malaysia and Singapore

In this appendix, the regulatory and institutional arrangements of Korea, Malaysia and Singapore are described in detail. The Commission did not consider these countries in its earlier study (PC 1999). For a summary of the arrangements in all the benchmarked countries see appendix D.

In response to requests to extend the benchmarking to Asian countries (in addition to Japan), Ovum Pty Ltd was engaged by the Commission to collect information on the regulatory and institutional arrangements that applied in Korea, Malaysia and Singapore at June 1999. The material in this appendix is sourced from the report submitted by Ovum (Ovum 1999).

E.1 Korea

Korea has a population of almost 45 million. In 1999, Korea had 41 fixed line services per 100 population and 30 mobile services per 100 population.

Competition was first introduced into the Korean telecommunications market in 1990. DACOM was granted a licence to compete with the government-owned incumbent, Korea Telecom, in the provision of international calls. The industry was regulated through the *Telecommunications Basic Act 1991* and *Telecommunications Business Act 1991.*

Korea Telecom remained the monopoly supplier of other services until 1992, when the Ministry of Information and Communications (MIC) extended competition into the radio-paging market. This was followed by the introduction of competition in the cellular market in 1994, and the long-distance market in 1995. Additional new service provider licences, including personal communications services (PCS), were issued in 1996 and 1997.

Korea's regulatory arrangements were brought into line with the World Trade Organisation's Basic Telecommunications Agreement (BTA) on 1 January 1998.

The new arrangements were implemented through a review of the *Telecommunications Basic Act 1991* and *Telecommunications Business Act 1991*.

National information infrastructure

The Korean Government has embarked upon a Korea Information Infrastructure (KII) initiative, which will be implemented throughout Korea in two stages, ending in 2010.

The first stage comprises the Korean Information Infrastructure-Government (KII–G) project — a test bed project. In the second stage, the Korea Information Infrastructure–Public (KII–P) project will proceed on the basis of experience gained in the establishment and operation of KII–G.

Advanced local loops will be built under KII–P. The aim is to provide high-speed information and communications services to 7.5 million online service subscribers by 2002 (75 per cent of all subscribers), and advanced information services to 30 million subscribers by 2010 (90 per cent of all subscribers).

In commercial and densely populated areas the network will be based on fibre optic cables, while networks extending to subscriber premises will be built partly with optic cables, and partly by digitising and enhancing the speed of existing telephone lines, wireless local loops and cable television networks.

Licensing arrangements

The MIC is responsible for regulating the telecommunications sector. It issues licences, approves tariff changes and generally oversights the industry.

The MIC's regulatory functions are performed by the Korea Communications Committee (KCC), which was reorganised in 1997 to meet World Trade Organisation (WTO) requirements and is likely to become a separate body from the MIC. KCC has approximately 20 full-time members and is responsible for interconnection and the technical aspects of anti-trust issues.

Licences are granted through a two-tier process. The first stage involves applicants committing themselves to the funding of technological development programs. The second stage encompasses a technical review of the applicants.

Under the new arrangements, there are three categories of service provider licensed to operate in Korea — facilities-based, special and value-added (see table E.1).

Operators are classified according to whether they control essential facilities, provide facilities-based services or provide value added services.

Table E.1 **Classification of operators — Korea**

License categories	*Classification criteria*	*Types of services*	*Condition of entry*	*Number*[a]
Facilities based service provider	Own essential facilities and provide facilities based services.	Wire telephone, cellular telephone, personal communication services, radio paging, leased line services.	Approval.	36
Special service provider	No essential facilities, provide facilities based services.	Internet phone, international call-back, premises communications, voice resale.	Registration.	20
Value added service provider	No essential facilities, provide value added services.	PC online, Internet, e-mail and voice mail services.	Notification.	1005

a Number of service providers as at March 1998.

Source: Ovum 1999

The number of licences that can be granted is unrestricted. From 1 January 1998, foreign ownership restrictions for fixed and wireless facilities-based telecommunications service providers were relaxed to a maximum of 33 per cent of each service provider. These will be relaxed further to a maximum of 49 per cent from 1 January 2001. Since January 1998, foreign ownership of Korea Telecom has been limited to 20 per cent and is scheduled to move to 49 per cent from January 2001.

Individual shareholding of any legal entity is limited to 10 per cent for fixed network service providers, 33 per cent for wireless service providers, and 3 per cent for Korea Telecom.

Prior to January 1999, foreign ownership in voice resale services using interconnection with public switched telecommunications networks was not permitted. Foreign ownership up to 49 per cent will be permitted from January 1999 and all such restrictions will be removed on 1 January 2001.

Universal service obligation

The approach to funding the Universal Service Obligation (USO) is currently under discussion, although nothing has been decided. The Korean Government is

reportedly looking at the possibility of adopting the US model of a centralised USO fund.

Price controls and rebalancing

Since 1998, local telephone services provided by Korea Telecom and cellular services provided by SK Telecom have been subject to price controls. Tariffs for all other telecommunications services are not subject to any price controls. The Ministry of Finance conducts pricing reviews in consultation with the MIC.

The Korean Government has been reluctant to allow tariff rebalancing despite the MIC's support for this to occur. A recent cost analysis of Korea Telecom's charges indicated that local services recovered 87 per cent of fully distributed costs, long-distance services 117 per cent and international call services 145 per cent. The Government has been concerned over the potential inflationary effects of rebalancing following the recent economic downturn in Korea.

Interconnection and local loop unbundling

There is an obligation on carriers with essential facilities to provide interconnection to other service providers. The MIC must approve interconnection agreements between carriers with market dominance or that operate essential facilities and other carriers. There is no requirement for interconnection agreements to be made public, although unclassified information is available from the MIC.

The MIC is able to mandate interconnection at all technically feasible points within the network. The carrier seeking access is responsible for determining the location of the Points Of Interconnect (PoIs). In practice, interconnection occurs only at trunk switches.[1] Interconnection terms are established through negotiation between the parties, however, the MIC will mediate if agreement cannot be reached within three months.

The MIC determined the terms for interconnecting with Korea Telecom's network. The terms are based on unbundled network fully allocated costs plus a 10 per cent return on investment.[2] Information on interconnection rates is available through the MIC, but only in a very general form.

[1] A trunk switch is a switching level above the local switch in a PSTN network through which long-distance and international traffic are switched.

[2] Unbundled network costs are those costs associated with providing each element of the network.

The interconnection charge is broken up into traffic-sensitive and non-traffic-sensitive costs. The traffic-sensitive costs are classified according to elements of the network — local exchange, transmission from local exchange to toll exchange, toll exchange and transmission between toll switches.

In granting Hanaro a licence to provide local access services, the Korean Government hoped to encourage facilities-based competition rather than competition through resale or local loop unbundling.[3] Although some discussions have taken place between Hanaro, Korea Telecom and the MIC, no decision to allow or require unbundling of the local loop has been made.

Carrier pre-selection and number portability

Carrier pre-selection was introduced in November 1997. Customers can pre-select either Korea Telecom or DACOM as their long-distance service provider. Customers can also exercise choice on a call-by-call basis using a three-digit override code.

The Korean Government has acknowledged the importance of number portability for effective local service competition and the MIC is currently facilitating negotiations between carriers. As yet there have been no decisions on implementation or on who should bear the associated costs.

Korea Telecom expects to implement number portability within the next three to five years. However, technical issues related to the nature of Korea Telecom's local exchanges need to be overcome. Korea Telecom expects to lose up to 10 per cent of its market share with the introduction of number portability.

Anti-competitive conduct

In the event of an unfair practice being determined by the Korean Fair Trade Commission, a warning is issued and a symbolic fine levied, with a requirement for an apology to be advertised. Market dominance is defined under legislation as being where one business controls 50 per cent or more of the market or where two businesses together control 75 per cent or more of the market. Korea Telecom is deemed to be dominant in the fixed network market, and SK Telecom in the wireless market.

[3] Local call resale was previously prohibited but is now allowed.

E.2 Malaysia

In 1998, fixed line subscriptions reached 21.5 per cent of the population and 10.6 per cent of the population subscribed to mobile telecommunications services (DoCITA 1999). It is estimated that by 2000, 24.5 per cent of the population will subscribe to fixed line services and 16 per cent to mobile services (DoCITA 1999.

Prior to liberalistion, the previously government-owned Telekom Malaysia Berhad (TMB) was the sole provider of fixed telecommunications services. TMB and Celcom provided wireless services. In 1994, the Malaysian Government opened both markets to competition and as at June 1999 there were five service providers in the fixed market and six in the wireless market.

TMB still owns the majority of the fixed network, with its main competitors — Binariang and Time Telekom — operating around 40 000 access lines. Competitor lines are predominantly used to connect large businesses in Kuala Lumpar and the Klang Valley.

Competition in Malaysian wireless services is much stronger than in fixed network services. A mixture of technologies is used for wireless services. However, the market is dominated by two analogue networks — Celcom and Mobikom (which is owned by TMB).

There was some resistance in Malaysia to implementing the WTO's BTA on competition in telecommunications services. However, the Malaysian Government has indicated that it is prepared to open up its markets.

Regulatory agencies

Until April 1999, Jabatan Telekomunikasi Malaysia (JTM) regulated the telecommunications industry in Malaysia. It reported to and was directly funded by the Ministry of Energy, Posts and Telecommunications. The main functions of JTM were to:

- allocate the use of radio spectrum and geostationary orbital slots;
- co-ordinate the development of technical standards;
- monitor and control prices and quality of service;
- regulate market conduct and the running of telecommunication services in Malaysia;
- promote Malaysia as an international telecommunications hub; and
- promote research and development into telecommunications.

JTM applied an open regulatory regime and intervened only to resolve a dispute over matters, such as the conditions for terminating international traffic on the local network. Delaying tactics on the part of incumbents were countered by setting time limits on negotiations and establishing a framework code of conduct (Ovum 1999).

In establishing local service competition, JTM allowed carriers to determine when and where they rolled out their networks. That said, overall targets for connections have been set as part of licence conditions.

In April 1999, the Communications and Multimedia Commission (CMC) replaced JTM. With the new Commission, the Malaysian Government hoped to improve Malaysia's telecommunications environment and to further encourage and facilitate the development of the industry (DoCITA 1999).

CMC's role includes:

- managing and overseeing the communication technology, computing and broadcasting sectors;
- setting standards for the telecommunications equipment industry;
- ensuring a smooth transition from the existing practices to the new framework;
- issuing licences; and
- ensuring a transparent regulatory framework.

Universal service obligations

Under current arrangements, TMB is required to provide universal basic telephone services — at the same geographically averaged installation fee and line rental, regardless of location. There is also a requirement in the licences of the new entrants to provide service in high-cost areas.

Historically, there has been no specific universal service fund and TMB has met its obligation out of internal price cross subsidies. Hence, TMB's business customers and long-distance callers have funded the provision of the USO.

JTM proposed the establishment of a USO fund that would also fund the start-up costs associated with equal access pre-selection. Under the arrangements, each operator would contribute to the cost of meeting USOs via a charge on all interconnect traffic. These funds would be paid into a centralised USO fund. From 1 January 2001, operators will be compensated for new lines in under-served areas from the USO fund.

To date, few operators have provided services to meet the USO and have focused instead on the more attractive cellular and IDD markets. Virtually all new entrants have halted, temporarily at least, their fixed-line rollouts.

Increasing fixed-line penetration is a major policy objective of the Malaysian Government, which has set itself targets of 25 lines per 100 people by 2005 and 50 lines per 100 people overall by 2020. There is a sub-target of 25 lines per 100 people in rural areas by 2020. Malaysia is well on the way to meeting its first target.

Price controls and tariff rebalancing

JTM regulated prices for each tariff element (such as line rental, local calls, leased lines or long-distance calls) and every operator, including those of the new entrants. Operators were required to set prices at or below these regulated price ceilings. There were no price floors and all operators, including TMB, are free to determine their own corporate discounts.

Prior to April 1999, JTM was prepared to consider a price cap regime that facilitated tariff rebalancing. However, it is unclear how CMC intends to proceed on this issue.

To date, there has been little tariff rebalancing in Malaysia. In July 1996, the charging basis for local calls was changed from a per-call charge to a per-minute charge.

Interconnection

JTM established the following objectives in relation to interconnection:

- network operators should contribute to the expansion of telecommunications services in Malaysia;
- network operators should be encouraged to deploy high-quality and advanced telecommunications infrastructure;
- the deployment and optimum usage of the sector's infrastructure and resources should be directed towards the development of an economically efficient telecommunications industry, should minimise uneconomic duplication of infrastructure facilities and encourage the shared use of common infrastructure facilities;
- interconnect arrangements between carriers must display clarity, stability and transparency; and

- interconnection arrangements should be consistent with commercially sound operations and sustainable outcomes.

TMB provides both terminating and transit interconnection services to other fixed and mobile operators. It provides interconnection at the trunk-switching level, although the industry has agreed that the originating operator should decide on the routing of the call. While having a choice between near-end or far-end handover, most operators use far-end handover to maximise their share of the call revenue. A new entrant, with a partly-developed trunk network, might use near-end handover to TMB for certain routes until it has fully built its core network.

Operators providing termination and transit services recover their costs through revenue-sharing arrangements — they recover a fixed proportion of the regulated retail price level. The originating operator may choose to charge a lower price to its end customer, but this does not change the payment to the transit or terminating operator.

The revenue sharing split is negotiated on a bilateral basis between operators, with no *ex ante* guidelines for establishing shares. Revenue sharing arrangements are reciprocal, with both operators receiving the same payment for the same call termination service. While JTM had the power to determine revenue shares if the parties could not agree (it has not been required to use this power), it is not clear whether CMC has retained this power.

There are constraints on negotiated revenue shares. Operators are required, under their licences, not to discriminate in their interconnect prices. For example, TMB is required to offer the same revenue shares to all other operators for the same service.

The current revenue sharing arrangements advantage TMB. There is a general movement to introduce a cost-based allocation model.[4] As at June 1999, there has been no final decision from the regulator.

Interconnect agreements are confidential to the parties involved, although JTM could request copies of the agreements to check that they met licence conditions.

In 1996, following consultation with the industry, the JTM published a General Framework for Interconnection and Access (GFIA). The GFIA sets out the following rules for interconnection:

- Operators should interconnect with each other.

[4] TMB has been fighting for an historical cost base.

- Operators should negotiate interconnect agreements. If they cannot agree within 90 days JTM will determine the unresolved aspects of the agreement within a further 30 day period.
- Operators should charge for interconnect services on a reciprocal and non-discriminatory basis. This would lead to all operators charging the same price for the same interconnection service.
- Operators should offer unbundled interconnect service in accordance with the general practice in the industry.
- Operators should share infrastructure such as land, buildings, ducts, poles and in-building facilities. If operators cannot agree on commercial terms for such facilities sharing, they will be determined by JTM.
- Operators should continue to set commercial terms for interconnection based on revenue-sharing until the beginning of 1999. This was to give the industry time to rebalance prices and to develop appropriate mechanisms for funding access deficits and universal service.
- From January 1999, operators should use cost-based interconnection charges that are based on direct costs and a reasonable rate of return for an efficient operator. Charges for call termination and origination should include a specific contribution to the cost of local access.
- Operators should estimate the costs on which interconnection charges are to be based using a standard chart of accounts.

JTM did not conduct a post-implementation review of how successful the introduction of competition had been. Nor did it review the extent to which network rollout was supportive of competition.

However, JTM publicly noted that there were regional pockets where the number awaiting connection was unacceptable. For example, TMB was unable able to meet demand for services in Kuala Lumpur. Many new housing developments and office buildings have been connected to the network while established businesses and dwellings remain unconnected. There has been ministerial pressure to improve this situation.

The legal status of the GFIA is unclear as the GFIA is currently a set of non-mandatory guidelines for operators on how to interconnect. It is also unclear whether the GFIA will continue to apply in the future given that the regulator has been changed.

To date, there has been no formal industry discussion on the prospects for implementing local loop unbundling in Malaysia.

Carrier pre-selection and number portability

Equal access pre-selection is due for implementation by January 2001. In the meantime, TMB subscribers are required to dial extra digits on a call-by-call basis to access the services of TMB's competitors. Long-distance calls of TMB subscribers will be routed via TMB unless the subscriber dials the necessary access code to select another carrier.

When equal access pre-selection is introduced, subscribers will be able to choose which carrier they wish to use for long-distance services, without the need to dial extra digits.

The delay in introducing equal access pre-selection is designed to give TMB time to upgrade its billing system prior to the change over. TMB has recently embarked upon a major billing system upgrade.

TMB will be compensated for losses arising from the introduction of equal access pre-selection through a Local Access Funding mechanism. This will compensate TMB, in part at least, for its network costs, but not for any loss of market share.

Number portability is not available in Malaysia. JTM indicated that it was considering a number of issues associated with implementing number portability. JTM believed that, although it may be reasonably straightforward to implement number portability within a single exchange area, it will be much more difficult over long distances.

There has been growing pressure from new entrants for the introduction of number portability. However, TMB has argued that it is too early to introduce it. TMB claims that competition in directly-connected services is limited to large business sites and that such sites can switch their outbound lines to the new entrants without the need for a number change. In these circumstances, TMB concluded that the cost of number portability is likely to outweigh the benefits.

Pressure for number portability has been focussed upon PSTN services. However, some operators — notably the Personal Communications Networks (PCN) and smaller Global System for Mobiles (GSM) operators — are beginning to push for number portability between cellular networks. Given the highly competitive nature of the cellular industry in Malaysia, mobile operators argue that such a service offers greater economic benefits than operator number portability for PSTN services. However, there are significant technical problems that must be resolved.

Industry rationalisation

In 1995, the Malaysian Government acknowledged that it had issued too many licences for the market to support (DoCITA 1999). For example, in the mobile market, there are eight networks and seven operators but no network has nationwide coverage.

The Government intended to consolidate the market by limiting the number of basic telecommunications service providers to three — Telekom Malaysia, Binariang and TRI. However, the plan failed because of opposition from those operators, such as Time Telekom, that had already invested in infrastructure or did not wish to merge with other players (DoCITA 1999, p. 9–10).

Another possible impediment to industry rationalisation is the restriction upon foreign ownership. In 1998, the Malaysian Government raised the allowable foreign ownership level from 49 per cent to 61 per cent, with the understanding that foreign equity would be reduced back to 49 per cent in five years.

E.3 Singapore

Fixed service penetration is high in Singapore with over 95.5 per cent of homes having a fixed line. As Singapore is such a geographically small country, there is no distinction between local and long-distance calls.

Until April 1997, Singapore Telecom (ST) had a monopoly on the provision of telecommunications networks and services. Originally, ST was to retain its fixed services monopoly until 2007. However, liberalisation was brought forward to the year 2000, with the Singapore Government compensating ST for the early termination of its exclusive rights.

ST's monopoly on fixed network services includes six classes of service, both nationally and internationally:

- public switched telephone services;
- public switched message services;
- public switched ISDN;
- leased circuit services;
- public switched data services; and
- public radio communication services.

The process of licensing new fixed service providers began on 1 March 1997. The regulator, the Telecommunications Authority of Singapore (TAS), is in the process of licensing up to two public basic telecommunications services (PBTS) licensees.

The successful bidders will be licensed to provide all the services currently provided by ST. Licence obligations will include:

- provision of domestic and international basic telephone services to any person in Singapore who requests the provision of such services;
- compliance with Codes of Practice;
- price control arrangements;
- quality of service standards;
- interconnection with other public switched networks; and
- guidelines for fair practices conduct.

The TAS has been empowered to impose a fine or suspend or cancel the licence where a licensee breaches any of the licence conditions.

The Singapore Government is committed to a duopoly for public cellular telephone mobile services, at least until 31 March 2000. The two operators are SingTel Mobile (a subsidiary of ST) and MobileOne.

MobileOne began operations in April 1997 and subscribed 35 000 customers in the first month of service.

The paging market has four operators — SingTel Paging, MobileOne, Hutchison IntraPage and ST Messaging. There are more than 1 million paging subscribers in Singapore.

Interconnection arrangements

Interconnection arrangements in Singapore are negotiated between carriers with scope for regulatory intervention from TAS if agreement cannot be reached. Prior to licensing a second mobile operator, the TAS established guidelines for interconnection and access. The TAS was subsequently involved in facilitating and observing the negotiations between the parties.

The main principles for interconnection as set out by the TAS were that:

- arrangements should be economically, technically and administratively efficient;
- arrangements should be transparent to the telecommunications user;

- arrangements should be non-discriminatory between mobile networks in terms of overall functionality, price, quality, and performance of the interconnection they provide;
- negotiation among operators should be carried out with minimum mediation by TAS; and
- where feasible alternatives are available, market-based pricing should be used to determine prices for interconnection facilities — when there is no feasible alternative for the non-incumbent operator, cost-based pricing should be used.

Based on these principles, the TAS set the key access charge to the fixed network for the first three years of competition from 1997 to 2000. The charge was set at the same rate as previously existed between ST and its mobile subsidiary.

The interconnection services and access charges between ST and MobileOne are divided into four components.

- Interconnection charges — charges related to capital and other one-time costs necessary to establish interconnection. They are calculated based on directly attributable long run incremental cost principle and would be borne by the mobile operator wishing to interconnect to the PSTN.
- Access charges — these are the usage sensitive charges that the terminating operator imposes on the originating operator and are calculated based on a cost recovery principle.
- Link connection charges —charges borne by the mobile operator for leasing circuits to connect mobile service carrier to the PSTN. These charges must not be higher than the charges levied on other customers leasing similar volumes for the same services.
- Supplementary and ancillary charges — these cover the associated facilities required to complete the interconnection and access arrangement.

The interconnect agreement between ST and MobileOne was completed and filed with TAS eight months after the award of the new mobile licence.

In the tendering procedures for the new fixed network licence, TAS has identified four major classes of Interconnect Related Services (IRS) for interconnect charging purposes: physical interconnect; origination and termination services; unbundled network elements; and essential support facilities.

In the initial stages of competition, TAS will set interim benchmark interconnect charges for each IRS. Assets are to be valued on the basis of forward looking economic costs and usage charges based on long-run average incremental costs. The

interim charges will be released to shortlisted tenderers and will apply for three years from 1 April 2000. Thereafter, interconnect charges are to be commercially negotiated between the operators.

TAS has prescribed a comprehensive two stage negotiation framework. Preliminary discussions between tenderers and ST are to commence once the successful pre-qualification tenderers have been announced. After the successful tenderers are licensed, the main negotiation process will begin. In this phase, all administrative, commercial, technical and operational matters are to be resolved.

All PBTS licensees are required to produce commercial legally binding agreements with each other by the end of March 1999. Upon completion, the interconnect agreements are to be lodged with TAS.

TAS has identified two types of interconnection and access configuration to be adopted by the fixed network licensees.

- Interconnection at network gateways — these may be international gateways, trunks exchanges, tandem exchanges, local exchanges or dedicated interconnection gateways.
- Local loop access — access is possible at the exchange Main Distribution Frame (MDF), the building MDF, or the roadside cabinet.

Licensees may propose alternative configurations but they must be endorsed by TAS. Each licensee is required to ensure good end-to-end quality of service and that sufficient capacity is available at the PoI or Point of Access.

ST must provide access to unbundled network elements. Unbundled network elements are defined as the physical facilities and network equipment (including associated features, functions and capabilities) that may be required by new operators in the interim period until their own networks are fully deployed.

Carrier pre-selection and number portability

All PBTS licensees, including ST, will use the number range 000 as the default code for access to the international telephone service. In addition, each PBTS licensee will be assigned its own international service access code. A caller must use this code to over-ride the default access code and access the international services of another licensee. This means that every operator can use the 000 international access code for its own PSTN subscribers, while having another access code for ad hoc or call-by-call access by non-directly-connected local subscribers.

Singapore was the first country in the world to introduce number portability for mobile services. Number portability was made available at the start of competition in April 1997.

TAS requires number portability to be introduced for fixed networks by 1 April 2000. The TAS will set number portability charging principles to guide negotiations among licensees for additional requirements for network capacity and the administrative costs of porting numbers.

Accounting separation

Accounting separation will be imposed on those licensees most likely to engage in unfair practices or behaviour. This will occur in circumstances where there are opportunities for cross-subsidisation among different telecommunication services and among products, and where a company or entity has been granted more than one licence by TAS.

TAS has developed a set of Accounting Guidelines setting out the principles for compliance by licensees subject to accounting separation. The licensees must ensure that the accounting and reporting practices adopted enable the provision of detailed records for submission to TAS whenever necessary.

Anti-competitive conduct

The TAS has released a set of Fair Practices and Conduct Guidelines for Telecommunications Service Providers. A licensee is considered to be engaging in unfair practices or conduct if the conduct has the effect of unfairly:

- eliminating, deterring, reducing or damaging competition in the telecommunications market or in the provision of telecommunications services; or
- preventing or hindering the entry of new entrants into the telecommunications market.

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