Chapter 7

QUANTIFYING THE IMPACTS OF STRUCTURAL REFORMS IN TELECOMMUNICATIONS MARKETS IN APEC ECONOMIES

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- All APEC member economies have implemented a market liberalisation policy in the telecommunications sector for over a decade: reforms are important, principally because of the network effects.
- Competition has produced benefits in terms of lower prices, innovation in networks and services (economic growth) and in the efficiency of the use of spectrum.
- For some APEC members, the availability of telecommunications network infrastructure to all citizens remains an issue, and a universal service regime is a valuable part of a reform program.

7.1 INTRODUCTION

The telecommunications sector stands out from all other networked industries for two reasons. Firstly, it is a mode of communications and therefore enters into every activity: cultural, which is a sensitive area that inevitably raises issues of morality, privacy, security etc.; economic, which involves wealth-generating activities; social, which has direct welfare implications; scientific and technological, which involves innovations that disrupt the existing *status quo*; and political, because better communications open the door to information and empowerment. No other networked industry can claim such ubiquitous influence over people's lives and livelihoods.

Secondly, no other networked industries, for example banks or airlines, have been subject to such transformative technological developments as telecommunications. When analogue networks gave way to digital networks in the 1980s, the beginnings of convergence between telecommunications and information technology (IT; computers) began. When Internet Protocol (IP) came along in the 1990s, convergence between telecommunications and web-based media services (TV, video, web downloads, etc.) began. When mobile cellular phones spread, especially pre-paid in low income societies, telecommunications became globally ubiquitous for the first time. When broadband came along in the 2000s convergence was raised to a higher level as networks grew in bandwidth capacity (higher speeds) and the phenomenon of social networking began. When smart phones, and especially Apple's iPhone, came along, convergence over mobile devices began, offering low-income societies their first real chance of widespread broadband access to the Internet. And the Internet itself offers a means to bypass many of the traditional revenue gateways of carriers and service providers, causing a major transformation of the business models that drive and sustain the industry.

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At the same time the sector has been highly regulated, because of the risks of significant barriers to entry and the consequences for competition of network externalities. Those regulatory systems are being reformed, and the primary objectives of this chapter are to quantify the benefits of telecommunications structural reform and to review the impact of telecommunications reforms on performance in APEC member economies. This requires an assessment of the current state of policy.

In a liberalised telecommunications market where entry restrictions are removed, new entrants often face a situation where a vertically integrated incumbent controls a ubiquitous network infrastructure. In addition, the incumbent often enjoys a significantly larger subscription base. Both network coverage and subscription lead to market dominance.

In generic competition policy, dominance itself is not of policy concern, as long as the potential threat of competition is able to discipline the dominant operator. Nevertheless, for the telecommunications sector, though entry restrictions are removed in light of market liberalisation, economies of scale and high sunk costs in the telecommunications networks, in particular in the local access network (in other words, the 'last mile'), create high entry barriers.

While sunk costs make potential entrants more sensitive to the level of post-entry profitability than the incumbent, economies of scale inherent in pre-established switching facilities enable the incumbent to take advantage of the low marginal cost to further degrade the prospect for post-entry profitability through strategies such as posing a high likelihood of price wars post-entry (Armstrong et al. 1995).

But potential entrants wishing to self-supply network infrastructure also face a more stringent environment. The pre-existing monopoly status enables the incumbent to establish an ubiquitous network infrastructure with ease. For most economies, the universal network coverage has often been funded through cross-subsidisation or direct public budget expenditure. Also, incumbents in most APEC economies were once part of the government and thus had little difficulty in obtaining right-of-way for infrastructure deployment. In a competitive context, not only does the technical issue of right-of-way become increasingly difficult for new private entrants to acquire but the removal of cross-subsidies and lack of market share often increases their hurdles in network construction.

For these reasons, even if facility based entry is allowed at the policy level – and in practice new entrants are willing to do so – entry is unlikely to reach a scale necessary to produce effective competition (Hausman & Sidak 1999). Regulation cannot change the commercial costs of network deployment but it can facilitate entry by enhancing the certainty of post-entry business viability and by providing a safeguard against the potential anti-competitive conduct of the incumbent.

Network externalities represent another impediment to entry. One of the major effects of network externalities is that networks with a larger subscriber size are more attractive to potential subscribers than smaller ones. This peculiar feature creates a constant competitive advantage for existing networks with an established subscriber base when different networks are not interconnected. Further, in a competitive environment both the incumbent and the new entrant have the incentive to interconnect. As failing to provide any-to-any connectivity might deter potential subscribers, the incumbent operator is still in a position to undermine a new entrant by setting high interconnection charges. Commercially agreed interconnection charges between networks of equal size are also likely to be above cost, due to the termination monopoly issue.

Section 7.2 reviews the state of play of the telecommunications sector in the APEC region, including some indicators of performance. The next step is to identify the key features of the regulatory regime. These regulatory features are then related to performance, both at the sectoral level and at the economy level.

7.2 STATE OF PLAY IN THE APEC TELECOMMUNICATIONS SECTOR

7.2.1 Overview

Raw data used throughout this report is supplied mainly by the ITU Telecom Database. Although every effort has been made to ensure that the data is up-to-date, the researchers understand that information for some member economies has not been updated. Given the speed of information and communications technology (ICT) development, some assessments made in this report might underestimate actual situations in some economies, especially in the broadband, Internet and mobile sectors. This nonetheless does not affect the report's ability to reflect the overall and general trend of development and performance in the region.

The accessibility of telecommunications infrastructure in APEC economies has improved significantly in recent years. The most remarkable development is the enormous expansion in mobile and Internet accessibility, particularly in economies with low penetration rates in the past. Table 7.1 reports a series of indicators.

In 2008 the average penetration for fixed-line PSTN network per 100 inhabitants in the APEC region exceeded 30%, which is well above the world average of 19%. Mobile penetration exceeded 90%, which is again significantly higher than the world average of 60%.

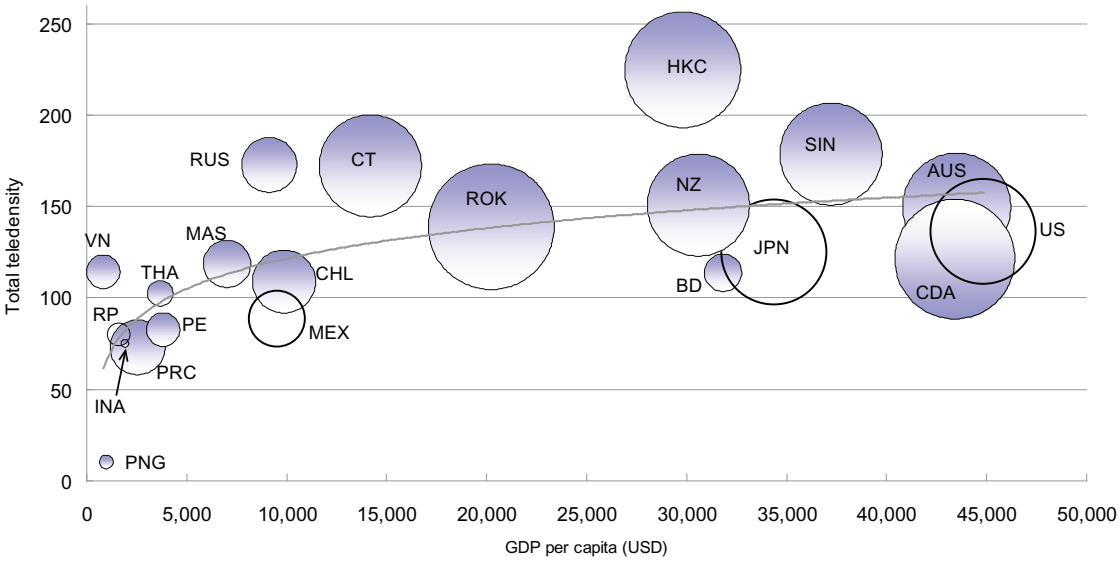
Table 7.1: Key telecommunications indicators of APEC member economies.

APEC member	Population (millions)	GDP capita (million; 2008)	Main telephone lines/100 inhabitants	Mobile phone subscribers/100 inhabitants	Fixed broadband subscribers/100 inhabitants
Australia	21.07	46,824.1	44.46	105.00	24.4
Brunei Darussalam	0.39	37,053	19.53	95.85	3.56
Canada	33.26	45,085.3	54.87	66.42	29.6
Chile	16.80	10,117	20.99	88.05	8.49
China	1337.41	3,259.46	25.48	47.95	6.23
Hong Kong, China	6.98	30,725.9	58.72	165.9	28.1
Indonesia	227.35	2,238.93	13.36	61.83	0.18
Japan	127.29	4,910.69	38.04	86.73	23.7
Korea	48.15	38,457.2	44.29	94.71	32.1
Malaysia	27.01	8,118.21	15.89	102.6	4.93
Mexico	108.56	10,199.6	19.04	69.37	7.00
New Zealand	4.23	30,030.1	41.37	109.2	21.6
Papua New Guinea	6.58	1,306.01	0.912	9.123	0.00
Peru	28.84	4,447.81	9.981	72.66	2.52
Philippines	90.35	1,845.17	4.512	75.39	1.16
Russia	141.39	11,806.9	31.75	141.1	6.56
Singapore	4.62	38,972.1	40.24	138.1	21.7
Chinese Taipei	23.04	1,6987.9	61.96	110.3	21.8
Thailand	67.39	4,116.32	10.42	92.01	1.41
United States	311.67	47,439.9	49.62	86.79	23.5
Viet Nam	87.10	1,042.39	33.98	80.37	2.35
APEC average	–	18,808.8	30.45	90.45	12.9

Source: ITU, 2009b; IMF, 2009.

Broadband is another area of growth: the fixed broadband subscription rate is also significantly higher than the rest of world.

Figure 7.1 presents the more specific relationship between total teledensity and the broadband penetration with GDP *per capita* of APEC economies as at 2008. Total teledensity is calculated by adding fixed telephone lines penetration rate and mobile penetration rate. Penetration rate used throughout this chapter, unless specified otherwise, refers to subscribers per 100 inhabitants as defined in ITU.[2]



Note: The size of the bubbles represents broadband penetration.

Figure 7.1: Teledensity, broadband penetration and GDP *per capita* as at 2008. (Source: ITU 2009b)

As a rule of thumb, APEC economies with higher income levels and teledensity tend to have a better broadband penetration rate, reliability underpinned by market demand and the availability of telecommunications infrastructure. Nonetheless, economies with relatively limited telecommunications resources are also catching up rapidly in terms of next generation broadband infrastructure development. Hong Kong, China; Korea; and Chinese Taipei are not only regional but also world leaders in broadband performance, and China; Chile; Malaysia; and Mexico are also performing well. Several factors might contribute to this outcome. Firstly, developed economies usually have a higher market demand for communications services. Secondly, lack of financial as well as technical support might result in delaying infrastructure developments in developing economies. Finally, the lacking of a predictable policy/regulatory environment affects investments in the telecommunications sector. The third factor underpins the importance of structural reform efforts.

7.2.2 Performance of the fixed-line telecommunications network

Although communications traffic has been shifting from voice to data and the fibre-optical network is phasing in as the broadband Next Generation Networks (NGN), traditional fixed-line Public Switched Telephone Network (PSTN) networks remain one of the most essential telecommunications infrastructures for the majority of APEC economies for the foreseeable

[2] For detailed discussions on the definition of telecommunications statistics, see ITU 2009, Technical Notes on World Telecom/ICT Indicators, available at http://www.itu.int/ITU-D/ICTEYE/Indicators/WTI_Technotes.pdf (23 October 2009).

future. The performance of fixed-line telecommunications network development, measured in penetration rate (accessibility) and price (affordability), affects not only the provision of traditional voice services such as local and long distance telephony but also other value-added services it supports.

With the advancement of broadband technologies such as Digital Subscribers Line (DSL) that have evolved based on PSTN configurations, the fixed-line telecommunications network plays a central role in the building of broadband infrastructure. This is equally relevant in the deployment of NGN. Despite the fact that the fibre-optical based and Internet-Protocol (IP) switched NGN is technologically different from the traditional PSTN, the diffusion of the latter requires the sharing of many critical network as well as ICT elements, including conduits, power supply units and users' information, with the existing telecommunications network.

Significant variations in access to fixed-line infrastructure still exist across the APEC region on a per capita basis. Performance in fixed-line telecommunications network accessibility among APEC economies is in general a function of the level of economic development (Figure 7.2). Accessibility conditions in some economies, in particular China; the Russian Federation; and Viet Nam, have been significantly improved over the last decade, and the gap in accessibility between developing and developed economies is rapidly reducing.

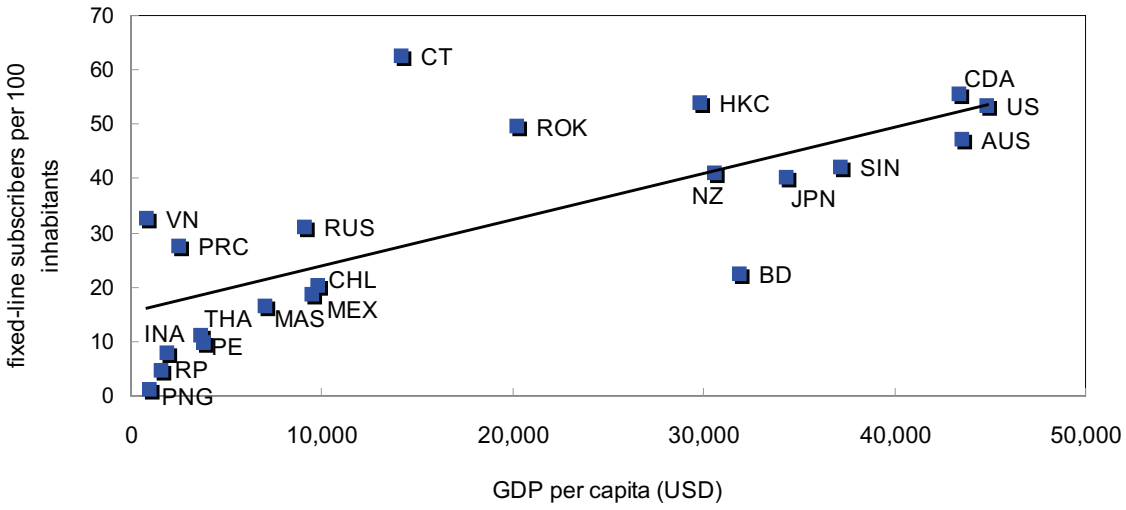


Figure 7.2 APEC economies' fixed-line penetration rate in 2008. (Source: ITU 2009b)

Figure 7.3 demonstrates the change of fixed-line accessibility in the APEC region between 2002 and 2008. Fixed-line networks in most developed APEC economies have reached saturation point. Competition from alternative networks – notably mobile telecommunications services and NGN – means the fixed-line penetration rate in many economies is actually declining rapidly. The penetration rate in Japan, for example, has reduced 28.6% between 2002 and 2008 and a 17.8% reduction is also recorded for the USA. A remarkable performance in Viet Nam is recorded where network penetration grew from a modest 5% to 34% over the review period, reaching close to the level of Japan.

The fixed-line penetration performance is most likely the result of technological advancement, competition and structural reform. For economies with declining fixed-line penetration, the likely explanations include the liberalisation of the mobile sector, the cost and technological

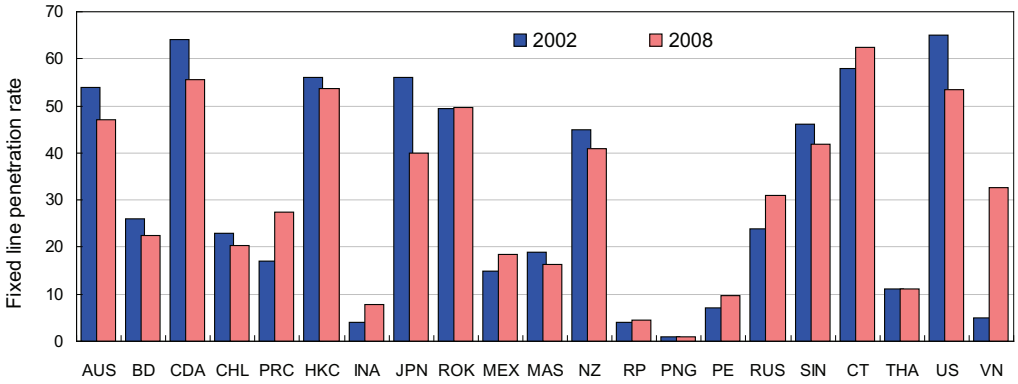


Figure 7.3: Comparison of fixed-line penetration rates between 2002 and 2008. (Source: ITU 2009b)

advantages of mobile network deployment, and in particular the development of fixed-mobile convergence (FMC). These developments underpin the shifting of consumers from traditional fixed-line subscription to mobile services. This development will be further analysed in the next section. The effect of cross-network competition is most evident in economies already enjoying a high level of fixed-line penetration.

Structural reform, at the same time, underpins the remarkable growth rate in developing economies. As already mentioned, penetration in Viet Nam grew rapidly over the last 6 years. This is also the period when Viet Nam was negotiating with trading partners for its WTO membership and had hence introduced substantial structural reform initiatives in light of its WTO accession process in both market access liberalisation and regulatory reform as set out in the case study focusing on telecommunications in Viet Nam. Viet Nam officially joined the WTO in 2008.

The most critical policy issue with fixed-line accessibility is perhaps the uneven distribution of infrastructure resources between urban and rural areas. In most circumstances, development is centred on metropolitan areas with a significantly higher than average penetration rate (World Bank 2003). PECC (2005) reports that Indonesia's fixed-line penetration rate was only 3 per 100 inhabitants at the end of 2001; but the penetration rate in the capital (also largest) city Jakarta is around 8.7 times higher than the national average, reaching 26 phone lines per 100 inhabitants. Several policy considerations are required to tackle the issue, the centrepiece of which is a well defined and effectively implemented universal service regime to bring forth a more balanced distribution of telecommunications infrastructure resources.

7.2.3 Performance in the mobile sector

The APEC region leads the world in mobile sector performance. Contributing factors include relatively low network deployment costs, less policy constraints, high market demand and an increasing variety of services (ITU 2006). With the launch of the 3G mobile service that promises an access speed of up to 3 Mbps, mobile services are fast shifting from voice to Internet access and multimedia applications.

Unlike fixed-line networks, the relationship between economic development and network accessibility performance in mobile network is less apparent. As shown in Figure 7.4, a large number of developing APEC economies enjoy an equal if not higher level of mobile

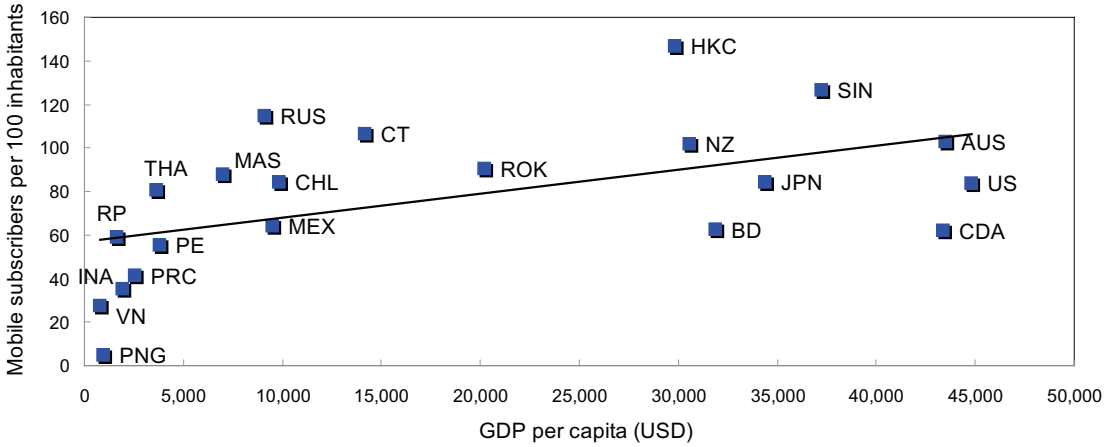


Figure 7.4: Mobile penetration rate and GDP *per capita* (2008). (Source: ITU 2009b)

penetration performance *vis-à-vis* their developed peers. As a matter of fact, the majority of APEC economies enjoy a mobile penetration rate of between 60% and 120% regardless of their respective levels of economic development.

The high growth rate in the mobile sector is occurring in both developed and developing APEC economies. This is particularly evident on a cross-year comparison approach. Figure 7.5 shows the change of mobile network accessibility in the APEC region between 2002 and 2008. It is evident that the mobile sector is expanding rapidly for all APEC economies without exception. Even Hong Kong, China, where the penetration rate was already reaching 100% in 2002, has a 50% increase in penetration over the 6-year period. The Russian Federation took off in 2002 from a penetration of less than 10% to reach 110% in 2008. This reflects the speed at which the mobile network is emerging as the most widely available telecommunications infrastructure in the region.

Table 7.2 shows that growth of penetration is 27% between 2003 and 2008, which is significantly higher than that of the fixed-line network (3%). All economies except Chinese Taipei enjoy a positive growth rate. Papua New Guinea (PNG) stands out with an average growth rate of 102.8%, and Indonesia reports 50%.

Unsurprisingly, extensive network and subscription roll-outs in the mobile sector have led to the mobile network becoming the most popular telecommunications infrastructure in the

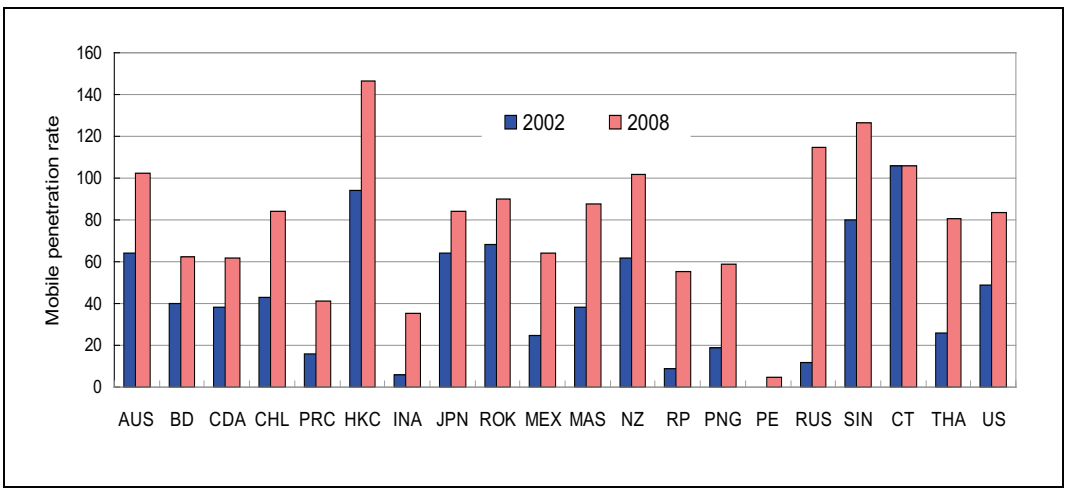


Figure 7.5: Comparison of change in APEC economies' mobile penetration rate. (Source: ITU 2009b)

Table 7.2: Growth rate for APEC economies' mobile sector.

APEC member	Mobile penetration rate, 2008	Compound Annual Rate Growth(%; 2003-2008)	Percentage of total telecommunications subscribers
Australia	105	9.0	70.2
Brunei Darussalam	96	16.2	83.1
Canada	66	10.7	54.8
Chile	88	15.3	80.8
China	48	18.6	65.0
Hong Kong, China	166	9.5	73.9
Indonesia	62	50.0	82.2
Japan	87	5.0	69.5
Korea	95	4.92	68.4
Malaysia	103	20.1	86.6
Mexico	69	20.1	78.5
New Zealand	109	12.2	72.5
Papua New Guinea	9	102.8	90.9
Peru	73	48.2	87.9
Philippines	75	24.8	94.4
Russia	141	40.7	81.6
Singapore	138	12.3	77.4
Chinese Taipei	110	-0.3	64.0
Thailand	92	23.2	89.8
United States	87	11.0	63.6
Viet Nam	80	91.2	70.3
APEC Average	90.43	27	76.9

Source: ITU 2009b.

APEC region. As illustrated in Table 7.2, at 2008 the number of mobile subscribers in the majority of APEC economies has overtaken that of fixed-line subscribers to become the most commonly used infrastructure. An average of 76.9% of telecommunications subscribers subscribed to mobile services. In PNG and the Philippines, the very high share of mobile subscribers in total subscribers has led to the observation that the mobile network appears to be the only telecommunications infrastructure available to the public.

7.3 DEVELOPMENT IN BROADBAND ACCESSIBILITY

Technically speaking, the Internet is an inter-networking system connecting more than 50 000 sub-networks worldwide. By virtue of this character, and with the rapid expansion of Internet-based applications and cloud computing architecture, the Internet has emerged undoubtedly as one of the core telecommunications infrastructures.

A growing number of Internet-based applications require a flexible bandwidth which cannot be provided through the traditional dial-up access service with its maximum speed of 56 Kbps. Not surprisingly, demand for broadband Internet access has been extremely robust in recent years and it is rapidly becoming the mainstream Internet access method: assessments and surveys on Internet accessibility are not complete without the inclusion of broadband accessibility. Specific attention will be given to the analysis of broadband performance in the following sections. (There are various definitions on the minimum speed of the qualification for broadband services. Commonly quoted are ITU's 128 Kbps, FCC's definition of 200 Kbps, OECD's 256 Kbps downstream. Due to the fact that the ITU database is used in this document and the fact that 128 Kbps will be able to support the minimum bandwidth requirement for many applications, broadband is thus defined in this report as any access speed above 128 Kbps.)

Internet accessibility performance will be measured in two dimensions. The first is Internet user penetration rate (i.e., Internet user per 100 inhabitants) and the second is Internet subscription penetration rate. The Internet is accessible through various channels, many of which require no prior subscription arrangements. In addition to Internet access provided in work places and public institutions such as public libraries and schools, free Internet hot spots are also widely available in many economies. Internet kiosks that are popular in many APEC economies also require no subscription between user and access provider. Yet the user penetration rate reflects the on-the-ground accessibility of Internet services that are also part of the outcome of structural reforms in the telecommunications sector.

7.3.1 User penetration performance

Figure 7.6 shows the total penetration of Internet users at 2008 across APEC economies. Economies with higher economic development tend to have a higher penetration rate. Korea; New Zealand; Malaysia; and Chile performed well above the average of their GDP level. This outcome is linked with the accessibility of other telecommunications infrastructures discussed previously. Policy, however, also plays an important role in promoting Internet accessibility. Thus economies with a similar level of economic development varied substantially in terms of Internet accessibility. For example, Internet user penetration in Malaysia significantly outperformed its peers with similar levels of economic development. Viet Nam is another good example of above average performance within its counterparts.

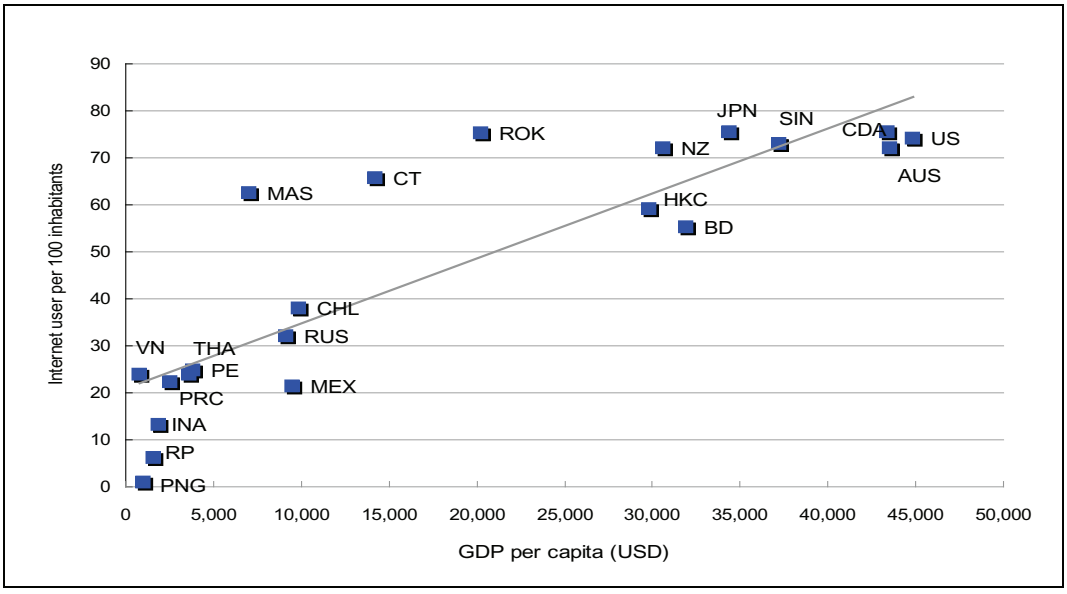
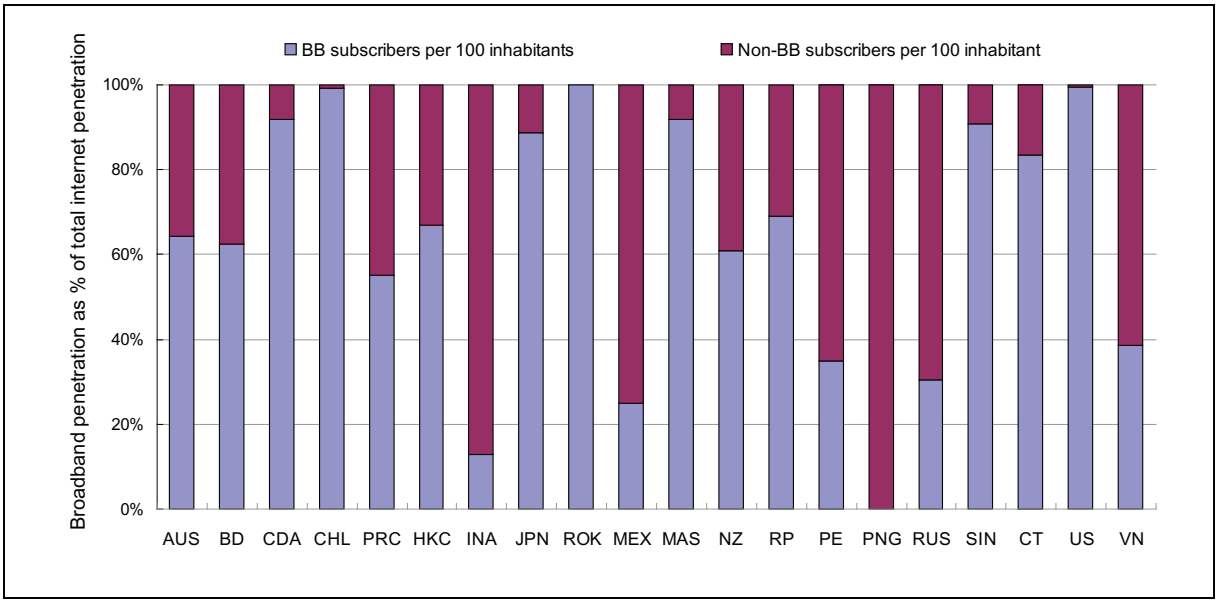


Figure 7.6: Internet user penetration rate and GDP *per capita* (2008). (Source: ITU 2009b)

7.3.2 Subscriber penetration performance

The subscriber penetration rate is not directly connected to the level of economic development. As illustrated in Figure 7.6, a large group of APEC economies shares a close level of Internet subscriber penetration with varying levels of GDP per capita. Malaysia and the Russian Federation are two good examples: they share a similar level of subscriber penetration rate to the USA and Singapore. Korea; Hong Kong, China; and New Zealand are also out-performing some of the more advanced economies.

With respect to the diffusion of broadband access, dial-up has been phased out and broadband has became the only Internet access technology in Korea and Japan in 2008 (Figure 7.7).

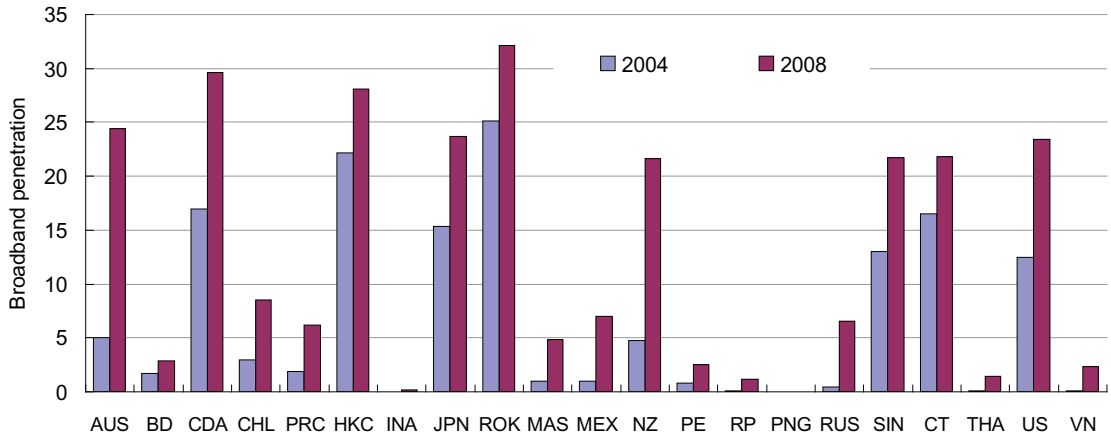


Note: data not available for Thailand

Figure 7.7: Broadband subscribers as a percentage of total Internet subscribers (2008). (Source: ITU 2009b)

Other economies with mass conversion include Canada; Chile; Hong Kong, China; Mexico; Singapore; Chinese Taipei; and the USA. Dial-up remains the primary access service for Indonesia; Malaysia; the Philippines; the Russian Federation; and Viet Nam.

As broadband access is a recent development, we use the year 2004 as the basis to observe the change of broadband penetration rate. As shown in Figure 7.8, it is evident that access among APEC economies is one of the areas where significant development has taken place. Australia; Canada; and New Zealand, for example, are catching up rapidly over the period with leading broadband APEC economies. To a lesser degree, broadband expansion in other economies such as Chile; China; Malaysia; and Mexico, is also a major development.



Note: Broadband is not available in PNG as at 2008.

Figure 7.8: Comparison of change in APEC economies' broadband penetration (Source: ITU 2009b)

Nonetheless, it is equally notable that the gap between economies with advanced broadband access and those with the limited access is increasing. Status in access for Indonesia; the Philippines; and PNG was virtually at a standstill over the period. While less market demand might be partly responsible for this, it is also likely that there exist structural impediments that prevent broadband access development.

7.4 MARKET STRUCTURE AND ACCESS CONDITIONS

7.4.1 The fixed-line telecommunications sector

Entry restrictions have been removed by the majority of APEC member economies as the preferred structural reform tool to attract infrastructure investment and to achieve better performance in fixed line services. The main measures taken are the opening of market entry and the privatisation of the state-owned incumbents. Yet it is a common practice among APEC economies to liberalise the fixed-line sector in a much-delayed sequence compared to mobile and Internet services.

With the introduction of liberalisation policies since the late 1980s, the market structure (i.e., the number of operators) has been moving from monopoly to competition in the APEC region. Considerable improvements are observed, especially since the WTO–GATS agreement on basic telecommunications service came into effect in 1998. Since 2000 a large number of economies started to adopt a market opening policy (Figure 7.9). Compared to market access conditions in 2003, when China; Indonesia; Russia; and Thailand were restricting entry under a duopoly structure, a competitive structure was dominant in 2009, with only Brunei and PNG maintaining a monopoly market structure and Indonesia a duopoly structure.

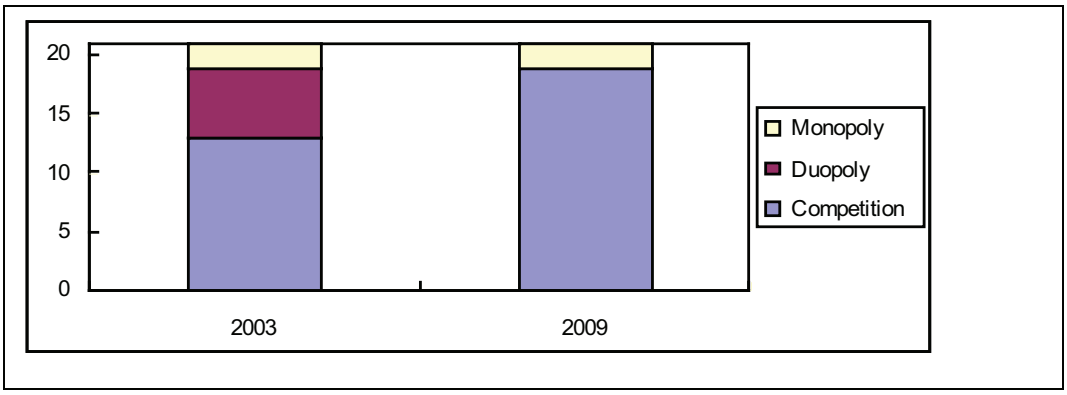


Figure 7.9: Fixed network market structures in the APEC region, 2003–09.

In many circumstances market structure does not always reflect actual market access conditions. The number of operators is affected by many non-policy considerations, including market size, services maturity and state of competition. Thus, there might be, as in the case of Singapore, a duopoly structure yet market access restrictions are completely liberalised. In contrast, multiple existing players do not indicate that future entry is possible, as in the case of Thailand. In Viet Nam only state-owned enterprises are allowed to apply for new licences.

Different forms of market access restrictions are applied across the APEC region. Aside from the licensing regime, some economies such as Thailand and Russia adopted BOT-style concession arrangements that often require new entrants to establish revenue sharing schemes with the incumbent. As of 2009, all APEC economies except Brunei and PNG have adopted full market entry liberalisation, with no predetermined numeric restrictions. Actual market entry conditions among APEC economies are summarised in Table 7.3.

Due to the nature of telecommunications infrastructure, establishing a commercial presence is the most common and feasible mode of supply. Foreign suppliers can set up a commercial outlet, with or without domestic partners, only through foreign investment. Hence, restrictions on foreign investment are also a major market access barrier. There are two major

categories of restriction on foreign investment. The first is the limitations on the percentage of foreign ownership and the second is the requirement to adopt particular legal forms.

As of 2009, there are eight APEC economies that allow 100% foreign ownership for fixed-line operators: Australia; Chile; Hong Kong, China; Japan; New Zealand; Peru; Singapore; and the USA. These economies impose no restrictions on legal forms. Australia; Japan; and New Zealand, together with Korea and Chinese Taipei, have retained foreign investment restrictions on existing operators. The Philippines offers higher ownership allowances for fellow ASEAN member economies. Brunei; PNG; the Russian Federation; and Viet Nam do not allow foreign investment in the fixed-line networks at all. Most APEC economies limit foreign investment from gaining dominant positions in fixed-line operations. Restrictions on foreign investment among APEC economies are summarised in Table 7.4.

Table 7.3: Market access conditions of fixed-line networks in APEC economies (2009).

Economies	Market structure	No. of new entrants	Access conditions
Australia	C	3^	Full liberalisation; entry based on merits of application
Brunei Darussalam	M	0	Entry prohibited. Review policy 10 years after privatisation of incumbent JBT. Timetable for privatisation unclear
Canada	C	3^	Full liberalisation; new entrants do not need to be licensed
Chile	C	3^	Full liberalization; entry based on merits of application
China	C	3^	Short-term policy: two major and two minor operators Long-term policy: unclear
Hong Kong, China	C	3^	Full-liberalisation; entry based on merits of application
Indonesia	C	3	Early 2008 the government awarded the third International Operators which is expected to offer services before end of the year. Current government has announced tender for the third operator for domestic long distance services, as well as additional local and long distance services.
Japan	C	3^	Full liberalisation; entry based on merits of application
Korea	C	3^	Full liberalisation; entry based on merits of application
Malaysia	C	3^	Market-oriented approach; entry based on necessity test and merits of application
Mexico	C	3^	Market-oriented approach; entry based on necessity test and merits of application
New Zealand	C	3^	Full liberalisation; entry based on merits of application
PNG	M	0	Entry prohibited. Future policy: unclear
Peru	C	3^	Market-oriented approach; entry based on necessity test and merits of application
Philippines	C	3^	Based on granting of legislative franchise from Congress and Certificate of Public Convenience and Necessity from regulator
Russia	C	2	Concession with incumbent. Short-term policy: duopoly. Long-term policy: unclear
Singapore	C	2	Full liberalisation; entry based on merits of application
Chinese Taipei	C	3^	Full liberalisation; entry based on merits of application
Thailand	C	3^	Full liberalisation; entry based on merits of application
United States	C	3^	Full liberalisation; entry based on merits of application
Viet Nam	C	3^	Limited: based on necessity test. Only state-owned enterprises allowed.

Notes: C = competition; D= duopoly; M= monopoly. 3^ denotes more than 3 operators.
Sources*:* APEC Telecom Regulatory Updates and other sources.

Table 7.4: Restrictions on fixed-line network foreign investment in APEC economies (2009).

APEC member	Direct investment ceiling	Legal form required
Australia	100% except: ▪ 35% of Telstra's shares ▪ Majority Australian ownership of Vodafone	None
Brunei Darussalam	Not allowed	Not allowed
Canada	Facilities based telecommunications service suppliers: 46%	None
Chile	100%	None
China	49%	Joint venture only
Hong Kong, China	100%	None
Indonesia	30% (40% for ASEAN member)	Joint venture only
Japan	None except no more than 33% is allowed for NTT	
Korea	General: 49%; Incumbent (KT): 33%	None
Malaysia	49%	Only through acquisition of shares of existing operators
Mexico	49%	None
New Zealand	100% except 49.9% for Telecom NZ	None
Papua New Guinea	Not allowed	Not allowed
Peru	100%	None
Philippines	40%	None
Russia	Not allowed	Not allowed
Singapore	100%	None
Chinese Taipei	General: 60%; existing operator: 49%	None
Thailand	49%	Joint venture
United States	None after passing public interest test	None
Viet Nam	Not allowed	Not allowed

7.4.2 The mobile telecommunications sector

As of 2009, all APEC economies have liberalised, albeit to different degrees, their mobile sector. Multiple new entrants are allowed to compete with incumbent operators in APEC economies, except in Brunei with its duopoly structure. All new licences are granted based on market-oriented approaches unless limited by the availability of spectrum. Brunei; PNG; and China are the exceptions: there the number of operators is regulated in line with their telecommunications development master plans underpinned by phased-in liberalisation policies. This reflects a significant refinement in market access policy across the APEC region. In 2003 mobile sectors in Brunei and PNG where still monopolised by state-owned incumbents, and China was maintaining a duopoly structure. Market entry conditions among APEC economies are summarised in Table 7.5.

Restrictions on foreign investment in the mobile sector in the APEC region are in general governed by the same regime that applies to the fixed-line sector. The exceptions are Mexico and the USA (Table 7.6), but Mexico allows 100% foreign ownership for mobile operators while the USA applies a 20% foreign ownership ceiling for mobile operators (PSC licensees) unless the FCC approves otherwise, based on case-by-case evaluations.

A major issue remaining in mobile market accessibility is the assignment of radio spectrum. In accordance with the WTO Reference Paper on Basic Telecommunications, which all APEC members have undertaken as their respective GATS commitments, the allocation process should be carried out in an objective, timely, transparent and non-discriminatory manner. The spectrum allocation among APEC members can be assessed when more data becomes available. But some general comments drawn from a background paper prepared for this project (Ure 2010) are worthwhile.

Table 7.5: Market access conditions of mobile networks in APEC economies (2009).

APEC member	Market structure	No. of operators	Access conditions
Australia	C	3^	Market-oriented approach; evaluate applications based on merits and availability of spectrum
Brunei Darussalam	D	2	Second mobile operator (Bmobile) began in 2006
Canada	C	3^	Market-oriented approach; evaluate applications based on merits and availability of spectrum
Chile	C	3^	
China	C	3^	Three licences were issued for 3G operations
Hong Kong, China	C	3^	Market-oriented approach; evaluate applications based on merits and availability of spectrum
Indonesia	C	3^	
Japan	C	3^	
Korea	C	3^	
Malaysia	C	3^	
Mexico	C	3^	
New Zealand	C	3^	
Papua New Guinea	C	3	Two mobile carrier licences were issued on 27 March 2007. The licences have a validity of 10 years.
Peru	C	3^	Market-oriented approach; evaluate applications based on merits and availability of spectrum
Philippines	C	3^	
Russia	C	2	
Singapore	C	2	
Chinese Taipei	C	3^	
Thailand	C	2	Market-oriented approach; evaluate applications based on merits and availability of spectrum. Concessions with incumbent operator
United States	C	3^	Market-oriented approach; evaluate applications based on merits and availability of spectrum
Viet Nam	C	3^	Limited based on necessity test and availability of spectrum. Only state-owned enterprises allowed

Notes: C = competition; D= duopoly; M= monopoly. 3^ denotes more than 3 operators.

Table 7.6: Restrictions on mobile network foreign ownership in Mexico and the USA.

Economy	Investment ceiling	Legal form	Fixed-line ceiling
Mexico	100%	None	49
United States	20% unless otherwise approved	None	100

The allocation of radio spectrum by national regulatory authorities for different categories of use such as broadcasting, mobile phones, satellite etc. usually follows the recommendations of the ITU-organised World Radio Conference. This ensures the harmonisation of frequencies across regions of the world, permitting services such as mobile roaming, and preventing cross-border radio interference. Once allocated, the frequency bands are subdivided into frequency bandwidths for assignment to individual users, either by administrative means ('command and control') or by a market mechanism, such as auctions. In cases where spectrum is in plentiful supply and demand for it is unlikely to cause interference between users, it is usually available unlicensed. For example, no-one needs a licence for a microwave oven. But where demand is competitive, spectrum is a valuable scarce resource.

Reforms therefore straddle both licensed and unlicensed spectrum: the former to improve the efficient use of a scarce resource by placing a price on frequencies; and the latter to increase welfare by facilitating the use of the resource, for example, making it easier for populations in remote areas to access wireless networks and the Internet. Reforms in spectrum management can be seen as falling into three categories:

- Transparency – including conforming with the WTO's Basic Agreement on Telecom regulatory guidelines, by making spectrum management a more open process, by providing national spectrum plans for investors to estimate the risks and opportunities, by providing databases for the public to check spectrum usage and licences, by engaging the industry and the public in the consultation process behind proposed changes to spectrum policies, by speeding up response times and reducing administrative processes and by maintaining easy-to-navigate websites.
- Licensing – including making clear distinctions between property rights, with appropriate constraints such as limits on the power of emissions, on spectrum sharing, on the right to transfer ownership, on the right to trade spectrum and on the rights to change spectrum usage ('refarm' etc.) and spectrum availability for common usage – which may or may not require a licence or the registration of usage – and spectrum reserved for use by government; by speeding up the licensing process (see 'Transparency' above) and by the introduction of market mechanisms or shadow price mechanisms (where prices are based on opportunity cost) to assist in a more efficient use of the scarce resource. Market mechanisms and shadow mechanisms can include, *inter alia*, spectrum usage fees (SUFs) where demand is competitive, auction prices and administrative incentive pricing schemes where assignments are non-competitive (e.g., to government agencies etc.).
- Convergence – including an adaptation of existing policies, rules and regulations to take account of convergence between telecommunications, IT (e.g., the Internet) and new media (e.g., web-server based services), measures to enable and encourage investment and innovation in converged services, and increasingly a trend to merge the regulatory agencies responsible for telecommunications and broadcasting, thereby providing the industry and the public with a single point of contact.

7.4.3 Summary

This section reports the latest progress of APEC member economies in refining market access conditions. As far as market entry policy is concerned, most APEC members which had not adopted a liberalisation policy in 2003–04 have now aligned with more liberal policy considerations. While advances in liberalisation policy for the mobile sector is more encouraging than that for the fixed-line sector, structure reform through market opening has became the primary policy setting in the APEC region.

Despite the emergence of new technologies and communications convergence, the telecommunications sector is expected to remain highly regulated. Thus, the results surveyed in this section indicate that in order to deepen the benefits of market liberalisation and, consequently, structure reform efforts, regulatory reform that adheres to world best practices is necessary. Given the complexity and dynamic advancement of the telecommunications sector, regulatory reform will be a challenge that requires regional cooperation and capacity-building initiatives.

7.5 REGULATORY REFORM UNDERPINNING STRUCTURAL REFORM

Regulation is a double-edged sword. Market access and the treatment of foreign operators were discussed in Section 7.4. Regulation in this section refers to regulatory measures other than market entry and foreign investment restrictions. Often regulation is required to preserve the outcome of liberalisation. Firstly, due to both historical and technical reasons, to prevent an incumbent operator from misusing its market dominance. Secondly, to ensure that public interest objectives (e.g., sector development, any-to-any connectivity, service quality, pricing

and universal service) are accomplished. But without proper design it can also be the major source of restrictions, especially in a sector where the dynamics of improving technologies and innovation produce rapid change.

The greatest challenge of designing and implementing a pro-competitive regulatory framework is that it must be flexible enough to allow national consideration and at the same time be not so abstract that it fails to provide meaningful guidelines for pro-competitive regulatory approaches. Based on this understanding, 18 APEC economies reached a consensus in the APEC Leader's Los Cabos Statement to Implement APEC Policies on Trade and the Digital Economy (2002) to adopt the regulatory principles inscribed in the WTO Reference Paper as the underlying guideline for implementing a pro-competitive regulatory regime in the APEC region (Box 7.1).

That said, the state of APEC economies' implementation of the aforementioned core regulatory principles is summarised in Table 7.7.

7.6 QUANTIFYING THE IMPACT OF REFORM

The impact of reform is assessed at two levels: in the sector itself, where the performance indicators are penetration rates, and on the economy as a whole.

7.6.1 Impact at the sectoral level

Following the work of Warren (2000), performance in penetration for fixed, mobile and broadband services are modelled as being affected by a set of structural reform initiatives, with additional non-policy variables such as housing or population density and income level (GDP per capita).

Policy initiatives concerning telecommunications structural reform can be divided into two primary categories:

- *Market access policies*
  Market access policies represent restrictions on market entry by either domestic or foreign new entrants.
- *Pro-competition regulatory regimes*
  Telecommunications services are particularly sensitive to the regulatory environment. The WTO Telecom Reference Paper, which all APEC WTO members undertook as part of their Los Cabos commitment, provides a set of multilaterally agreed regulatory principles to guard against the potential manipulation of a dominant operator and to ensure that *de facto* competition can take place. These include, *inter alia*, safeguards to prevent major operator(s) from engaging in or continuing anti-competitive practices, cost-based pricing rules for access to essential infrastructure, an independent regulator and a number portability regime.

Based on this understanding, a composite set index that captures both market entry and regulatory undertakings has been developed. The index has been split into two categories: 'market entry and non-discrimination' and 'pro-competition regulations'. The market entry category reflects market entry and investment conditions, with the assumption that competition through competitive entry by both foreign and domestic new entrants impact on performance. The pro-competition regulations category captures measures that are the prerequisite elements for a competitive market. Policy measures included in the calculation of the index have been split into five components, according to their primary impact.

Box 7.1 Regulatory principles included in the WTO Reference Paper.

- **Non-discrimination**
  Non-discrimination is to ensure that domestic regulation does not discriminate between foreign services (most-favoured nation treatment) and between foreign and national services and service suppliers (national treatment).
- **Good governance**
  The aim of good regulatory governance is to ensure that domestic regulation is administered in a transparent and fair manner for all parties involved. This concerns the notification and publication of regulatory rules and procedures, as well as the independence of the regulator.
- **Competitive safeguards**
  Appropriate measures are to be maintained for the purpose of preventing suppliers, who, alone or together are a major supplier, from engaging in or continuing anti-competitive practices. Besides state rules and regulations, anti-competitive practices carried out by suppliers, in particular the incumbent who has market power, pose a major barrier to competition. For example, the practice of cross-subsidisation, by offering services below cost in competitive markets and making up for the loss from another service where competition is absent, can foreclose competition. The problem is particularly acute in the telecommunications sector, where there are bottleneck facilities, giving rise to monopolies. In this regard, the economy should have a competition regime in place to ensure that competition in the telecommunications market is 'fair' for all suppliers.
- **The establishment of an interconnection regime**
  While a mandatory non-discriminatory interconnection regime is established in many economies, it is not necessarily cost based, and a dispute settlement mechanism is often absent. A sound interconnection regime ensures that interconnection and access to bottleneck facilities are provided in a fair and transparent fashion.
- **Access to essential facilities**
  As provided in the WTO Reference Paper, access to essential facilities controlled by a major supplier will be ensured at any technically feasible point in the network. It should also be provided under non-discriminatory terms and conditions, in a timely fashion and subject to charges that are cost based. To ensure transparency of the access regime, the procedures for interconnection to a major supplier should be made publicly available, and major suppliers should make publicly available either their access agreements or a reference access offer. Service suppliers requesting access with a major supplier should have recourse to an independent body to resolve disputes.
- **Universal service obligations**
  Each member economy should have the right to define the kind of universal service obligations it wishes to maintain. These obligations will not be regarded as anti-competitive *per se*, provided they are administered in a transparent, non-discriminatory and competitively neutral manner and are not more burdensome than necessary for the kind of universal service defined by the particular economy. Universal service requirements can have anti-competitive effects. Many economies in the past allow the incumbent to use a cross-subsidy to finance universal service. For example, profits from long distance are used to compensate for losses in local fixed line services. In such a situation, competition in the long distance would have to be restricted in order to sustain the high profits for the incumbent. In many economies the state operator alone undertakes the obligation to provide universal services. But the actual cost of providing the service is rarely available, and as a result, the state operator may be over or under compensated for shouldering the responsibility. Over compensation would provide the state operator with unfair financial advantage. Under compensation, however, may undermine the universal service goals, since the state operator would be unwilling to carry out loss-making activities.

Table 7.7: Summary of APEC economies' implementation of the WTO regulatory principles.

Regulatory Elements	APEC Performance
1. Competitive safeguards 1.1 Preventing major supplier from engaging in anti-competitive cross-subsidisation; 1.2 Preventing major supplier from using information obtained from competitors with anti-competitive results; 1.3 Preventing major supplier from not making available to other service suppliers on a timely basis technical information about essential facilities and commercially relevant information which are necessary for them to provide services.	***Interconnection regime*** ▪ Implemented: 14 economies ▪ Not yet implemented: 4 economies ▪ Regulatory proposals under consideration: 3 economies ***Access to essential facilities*** ▪ Implemented: 13 economies ▪ Not yet implemented: 7 economies
2. Interconnection 2.1 Interconnection with a major supplier is under non-discriminatory terms and conditions (including technical standards and specifications) and rates and of a quality no less favourable than that provided for its own like services or for like services of non-affiliated service suppliers or for its subsidiaries or other affiliates; 2.2 Interconnection with a major supplier is provided in a timely fashion, on terms, conditions (including technical standards and specifications) and cost-oriented rates that are transparent, reasonable, having regard to economic feasibility, and sufficiently unbundled so that the supplier need not pay for network components or facilities that it does not require for the service to be provided; 2.3 Interconnection with a major supplier is provided on request, at points in addition to the network termination points offered to the majority of users, subject to charges that reflect the cost of construction of necessary additional facilities; 2.4 The procedures applicable for interconnection to a major supplier are made publicly available; 2.5 It is ensured that a major supplier will make publicly available either its interconnection agreements or a reference interconnection offer; 2.6 Dispute settlement.	▪ Implemented: 12 economies ▪ Not yet implemented: 4 economy ▪ Regulatory proposals under consideration: 3 economies ▪ Partial implementation (e.g. non cost-based rules and/or no dispute settlement): 2
3. Public availability of licensing criteria Where a licence is required, the following is made publicly available: 3.1 All the licensing criteria and the period of time normally required to reach a decision concerning the application; 3.2 The terms and conditions of individual licences. The reasons for the denial of a licence will be made known to the applicant upon request.	▪ Implemented: 13 economies ▪ Partial implementation: 8 economies (failure to provide timeline for licensing and reasons for denial)
4. Independent regulators 4.1 The regulatory body is separate from, and not accountable to, any supplier of basic telecommunications services; 4.2 The decisions of and the procedures used by regulators shall be impartial with respect to all market participants.	▪ Implemented: all APEC economies
5. Allocation and use of scarce resources 5.1 The procedures for the allocation and use of frequencies are carried out in an objective, timely, transparent and non-discriminatory manner; 5.2 The procedures for the allocation and use of numbers are carried out in an objective, timely, transparent and non-discriminatory manner; 5.3 The procedures for the allocation and use of rights of way are carried out in an objective, timely, transparent and non-discriminatory manner; 5.4 The current state of allocated frequency bands is made publicly available.	▪ Implemented: 20 economies ▪ Not implemented: 1 economy

Source: ITU, *World Telecommunication Regulatory Database*; APEC Tel, *Regulatory Updates*, 2007 and 2008. USTR, *2009 Section 1377 Review of Telecommunications Trade Agreements*.

7.6.1.1 Market entry and non-discrimination category

The market entry and non-discrimination category captures measures affecting the ability of a telecommunications operator to establish a physical operation. Four index variables are included in this category:

- licensing of new fixed-line local service licences;
- licensing of new mobile operation licences;
- direct foreign investment regime;
- foreign investment, which includes the following sub-items:
    - general: the maximum direct foreign equity participation in any licence; and
    - incumbents: the maximum direct foreign equity participation allowable for incumbent operators.

'New licensee' means a licensed operator other than the incumbent. Given the fact that most APEC economies allow fixed-line service operators to provide a basket of integrated fixed-line services (i.e., the bundling of provision of local, domestic and international long distance and broadband access services), we therefore do not further distinguish separate licensing regimes that might be available for individual services.

7.6.1.2 Pro-competition regulation category

The pro-competition regulation category measures policies that are deemed essential for the establishment of a pro-competition regulatory regime after market opening. Index components included under this category are:

- *Competitive safeguard*
  After market opening it is also essential to ensure that all anti-competitive activities undertaken by the major operator in the telecommunications sector are regulated and prevented.
- *Interconnection rules*
  For networked industries such as the telecommunications sector, the security of interconnection with other networks, in particular, interconnection with the major operator's network, is a prerequisite for service provision.
- *Independent regulator*
  In many economies the legacy of state-owned monopolist PTOs has led to a structure where the incumbent PTO is also the sector regulator. This referee–player structure affects the creation of a level playing field in a competitive market place.
- *Access to essential facilities*
  Based on WTO Reference Paper on Basic Telecommunications, essential facilities are defined as 'facilities of a public telecommunications transport network or service that (a) are exclusively or predominantly provided by a single or limited number of suppliers; and (b) cannot feasibly be economically or technically substituted in order to provide a service'. This element captures rules that enable new entrants access to essential facilities managed by the major operators.
- *Number portability*
  Number portability (NP) is an additional policy indicator. When subscribers decide to change their existing telecommunications operators to another, they face switching costs. High switching costs often prevent subscribers from changing operators and therefore deter competition. NP is identified as an effective measure to address non-pecuniary switching costs. In general, an NP regime allows subscribers to retain the same telephone numbers when they switch between operators.

A weighting and scoring methodology is developed to give scores to each of the policy variables to produce an aggregated index, with a zero given to an economy that maintains no restrictions on entry and investment and has implemented the full set of regulatory measures included in the index. Partial liberalisation and/or implementation of regulations will be scored accordingly, with a score of one for restrictive regimes. Weighting of each variable is based on the judgment of the importance of each policy variable to maximise the correlation between the individual components and their weighted averages (Sidorenko 2001). The index system and the results of the index measurement are provided in the Annex of this chapter. Only current policy information is included in this index and the models are estimated for only one point of time (2009).

Information on market access and regulatory measures are collected mainly from the ITU World Telecom Regulatory Database, with additional inputs from the individual economy's Regulatory Updates reported to the APEC Telecommunications and Information Working Group (TEL) meetings.

In the following part we examine the impact of the policies included in the index on the performance of network development (fixed and broadband penetration) and mobile penetration. Drawing from Warren (2000), the estimated equations also include non-policy explanatory variables, such as GDP, housing density (population density in the case of mobile penetration) and the two policy index categories. It could be expected that an economy with limitations on the introduction of the policy regimes defined (resulting in higher index scores) will show a lower penetration rate, allowing for the influence of the other non-policy variables.

Tables 7.8 and 7.9 show the results of the analysis for fixed-line and mobile penetration in APEC economies. Contrary to the findings of Warren (2000), none of the models found a significant relationship between the two policy index categories and penetration rates, controlling for GDP and density. There are several possible explanations behind this. Firstly, fixed-line and mobile liberalisation policies have been implemented for an extended period of time. For the fixed-line market, that process started around 1997 when the WTO telecommunications commitments came into effect for most APEC economies, and mobile sector liberalisation in most economies was even earlier than that. In addition, despite varying levels of implementation, all APEC economies have agreed to adopt the WTO regulatory principles.

As such, the establishment of a pro-competition regulatory regime plays a much less critical role in refining market performance by 2009. Instead, technology advancements, innovative services and growing market demand for communications services perhaps are the main reasons underpinning the considerable performance that is observed. The reduction in costs for both service provision and consumer devices, and the advancement in wireless technologies, might be more important factors affecting development in the telecommunications sector. This is not to say that the traditional regulatory policy is without influence; rather it suggests a shift in policy directions and priorities. Policy initiatives that facilitate technology development, innovation and the development of intellectual property protection (and harmonisation) will play an increasingly important role. Regulations ensuring the quality of services are also important in light of the diversified and innovative modes of services provisions.

For the relatively new development of broadband, the impact of policy is more direct and obvious. Table 7.10 shows the result of the regression analysis on fixed-line broadband penetration for APEC economies. With strong explanatory power, all regression models

Table 7.8: Results of fixed-line penetration models.

Variable	Mode1-1 (Policy1)	Mode1-2 (Policy2)	Mode1-3 (average)
Policy1	-10.62762 (12.02183)	–	–
Policy2	–	-18.75779 (10.92538)	–
Policy average	–	–	-16.10337 (11.9413)
Y	0.0015399 (0.000917)	0.0014696 (0.0008631)	0.0015143 (0.0008896)
Y^2	-0.0000000196 (0.000000019)	-0.0000000202 (0.0000000179)	-0.0000000201 (0.0000000184)
HD	0.0037694 (0.0064281)	0.003167 (0.0059265)	0.0031934 (0.0061874)
Constant	16.29225** (7.454765)	19.98039** (7.216838)	18.57443** (7.444616)
R-squared	0.5596	0.6100	0.5852

Notes: Reported figures are coefficient estimates; figures in parentheses represent standard errors;*= coefficient estimates are significant at the 90% level; **= coefficient estimates are significant at the 95% level.

Table 7.9: Results of mobile penetration models.

Variable	Mode2-1 (Policy1)	Mode2-2 (Policy2)	Mode2-3 (average)
Policy1	-9.81373 (22.09086)	–	–
Policy2	–	-0.0350171 (21.94072)	–
Policy average	–	–	-5.224837 (22.86316)
Y	0.0064254** (0.0018034)	0.0064998** (0.0018107)	0.006467** (0.0018099)
Y^2	-0.000000123** (0.0000000376)	-0.000000123** (0.0000000378)	-0.000000123** (0.0000000377)
Population	0.0615315 (0.081313)	0.0632053 (0.0822061)	0.0637684 (0.0816567)
Constant	47.84828** (17.81047)	44.06617** (17.58578)	45.99976** (17.86413)
R-squared	0.5166	0.5103	0.5120

Notes: Reported figures are coefficient estimates; figures in parentheses represent standard errors;*= coefficient estimates are significant at the 90% level; **= coefficient estimates are significant at the 95% level.

Table 7.10: Results of broadband penetration models.

Variable	Mode3-1 (Policy 1)	Mode3-2 (Policy 2)	Mode3-3 (aggregate)
Policy1	-13.4699(5.9441)**	--	--
Policy2	--	-18.00711** (4.822528)	--
Policy aggregate	--	--	-17.17051** (5.519789)
Y	0.0008281** (0.0004534)	0.0007531* (0.000381)	0.0007959* (0.0004112)
Y^2	-0.00000000864 (0.0000000094)	-0.00000000877 (0.00000000789)	-0.00000000889 (0.00000000852)
Household Density	0.0010802 (0.0031783)	0.0010242 (0.002616)	0.0008078 (0.0028601)
Constant	6.470009* (3.68595)	8.860321** (3.185556)	8.150823** (3.441227)
R-squared	0.7219	0.8037	0.7711

Notes: Reported figures are coefficient estimates; figures in parentheses represent standard errors;*= coefficient estimates are significant at the 90% level; **= coefficient estimates are significant at the 95% level.

establish a significant and negative relationship between the policy index categories and the broadband penetration rate, controlling for GDP and household density. This outcome supports our expectation that limitations on market entry, investment and shortcomings in pro-competition policy regimes hinder broadband development.

There are still uncertainties in the market demand for fixed-line broadband, and competition from wireless broadband technologies (e.g., 3.5G, LTE and Wimax) worsens the investment risk. Given the fact that fixed-line broadband requires significantly higher investment that is sunk, these investment uncertainties make it particularly sensitive to policy environment. Among the models, the relatively high coefficient for the aggregate index model (Model 3-3) highlights the significance of developing a holistic approach for structural reform.

7.6.2 Economy-wide effects

The research literature on the impact that investment in telecommunications has upon economic growth is extensive, pioneered by studies such as Hardy (1980) and reviewed by Negash and Patala (2006). These have been followed by numerous studies on the importance of market reforms in opening the sector to greater investment – see Sridhar and Sridhar (2004) for an analysis and overview; for case studies see Petrazzini (1995) and for an overview of reforms across the Asia–Pacific see Ure (1995, 2008). Some general comments are drawn from a background paper prepared for this project (Ure 2010).

The economic gains from the spread of access to telecommunications networks are generated mostly through the network effects ('externalities') of linking hundreds of thousands of businesses and residential subscribers, and through reduced transactions costs, including reduced costs of market information, reduced travelling times, faster responses to changing markets etc. The growth of the telecommunications sector itself adds to GDP but the initial impact of liberalisation or competitive market entry is often a contraction of the workforce – see review by Ure and Vivorakij (1997). This is partly a response to competitive pressures by the incumbents becoming more efficient; and more important over time, it is a response by the incumbents to accelerate the adoption of new digital technologies which are far less labour intensive. New technologies are associated with innovation in services through more effective delivery channels, such as digital subscriber line (DSL) and IP-based mobile cellular etc., and through new services such as converged services like IPTV and mobile TV. As new entrants make their mark and users become more aware of the benefits and availability of telecommunications, the elasticity of demand tends to rise (i.e. demand becomes less responsive to price changes). For this reason, it was common in the 1990s in many low income economies immediately following liberalisation for waiting lists to grow rather than shrink, as potential subscribers realised there was, for the first time, a realistic opportunity to register for a telephone line. And as new services create new markets, so employment in the sector grows again.

The evidence from econometric studies on the impact of investment in fixed line telephony growth has varied according to the methods employed. Hardy (1980) found that investment in telecommunications had a higher impact on developing rather than developed economies, while the ITU studies referred to above tended to imply quasi-linear relationships between teledensity and *per capita* GDP. In 1996 an influential study by Roller and Waverman challenged these results by finding that across the OECD economies the impact of investment in telecommunications on GDP growth was higher at higher levels of *per capita* GDP.[3]

[3] For other studies see, for example, http://www.nipfp.org.in/working_paper/wp04_nipfp_014.pdf.

The approach of Roller and Waverman is to be preferred because it tackles several estimation problems not handled by earlier studies.[4] When these are accounted for, most of the growth attributed to investment in telecommunications in previous studies disappears. Having revised the earlier view, they then test for network effects or network externalities by a regression of economic growth not simply on each economy's teledensity but also its teledensity squared to reflect network effects.[5] Their findings show clearly that as teledensities, and therefore the network effects, rise, so the impact of investment in telecommunications rises. This finding is also intuitively appealing. Table 7.11 summarises the results.

Table 7.11: Teledensity and the impact of telecommunications investment – developed economies.

OECD economies	Teledensity	Impact of 10% investment
OECD average	30%	2.8% increase in GDP
USA	40%	7.8% increase in GDP

Independent estimates for GDP elasticity with respect to investment in telecommunications were made for Hong Kong, China by Ure (1997) in a study for PECC which found a much lower impact of investment on GDP. This might be expected of a small open economy such as Hong Kong, China, where many of the benefits of the multiplier effects of investment will be leaked overseas through the import of equipment.

The findings of Roller and Waverman (1996) have implications for developing economies because they suggest that the economic return on investment in telecommunications in lower income economies will be less than in their more developed counterparts, although for individual telecommunications companies the financial returns may, of course, be high. However, the findings also suggest that in developing economies there should be increasing returns to telecommunications investment as the network effects become progressively more widespread, and therefore policies and regulations should be tailored to promote the spread of network effects in developing economies. This objective would be consistent with APEC's concept of inclusive growth. While these results only relate to fixed-line telephones, the network effects of mobile are increasingly strong, and by 2010 the substitution of mobile for fixed lines is well established in almost all economies, as already noted.

Research into the impact of investment in the mobile cellular sector on economic growth has given important insights into the way in which the lives and livelihoods of people in developing economies have improved due to access to wireless networks. The research cited here is academic in nature and some of it is sponsored by a vendor, Vodafone. Table 7.12 summarises the findings of three studies, each of which uses econometrics to derive results: Waverman et al. (2005) appeared separately as a Vodafone research paper, and there is a similar study to that of Sridhar and Sridhar (2004) on the impact of mobile phones in India (Kathuria, Uppal & Mamta 2009).

Table 7.12: Teledensity and the impact of telecommunications investment in mobile.

Developing economies	Teledensity	Impact of 10% investment
Torero et al. (2002)	5–15%	0.3% increase in GDP
Waverman et al. (2005)	10%	5.9% increase in GDP
Sridhar & Sridhar(2004)	<20%	7% increase in GDP

[4] The first is the problem of simultaneity, i.e., a growth in telecommunications can cause economic growth and economic growth can cause a growth in telecommunications. Secondly, economic growth can be caused by the accumulation of fixed assets, such as R&D, to which telecommunications investment is closely correlated.

[5] The number of possible connections in a network is n(n-1) or n2-n.

Two notable features emerge from these studies. Firstly, the elasticity of GDP growth is mostly higher when teledensities are higher, replicating the findings of Roller and Waverman (1996). Secondly, the impact mobile network investment has on economic growth of developing economies is higher at lower levels of teledensity than for comparable levels of investment in fixed lines in developed economies. There is intuitive appeal in this result. The mobile function offers 'anytime, anywhere' networking opportunities, and the opportunity cost measured in terms of the cost and duration of travelling times and the loss of business and social opportunities arising from difficulties in accessing information make the mobile phone an ideal communications and networking tool. The implication is that policies and regulations should be designed to encourage further investment in, and wider usage of, mobile networks (e.g., by encouraging the spread of services such as mobile banking, mobile payments, mobile search, location-based services etc.).

The latest wave of technology to engulf the telecommunications sector is broadband. Because it is rather new, research into the impact of broadband remains nascent. Work includes studies by Atkinson, Castro and Ezell (2009) and Crandall, Lehr and Litian (2007) which find significant effects on employment and productivity. Although these studies are for the USA, the impact of broadband is likely to be very high in other developed economies and strategically important in the main metropolitan centres of developing economies to attract foreign investment. The competitive advantage of 'world cities' will be influenced by their level of broadband access, but equally important is the growing phenomenon of social networking in developing economies. For example, Indonesia is the world's fourth largest market for Facebook. For most people in developing economies their first use of broadband will most likely be through wireless access.

There are, therefore, three aspects to policy making and regulation with respect to broadband: enabling the demand side, promoting the supply side and providing sufficient radio spectrum. On all three issues it is worth noting the conclusions of Crandall, Lehr and Litian (2007):

- *Demand side*
  '[G]iven that the demand for broadband is price elastic, the most effective policies are likely to be those that contribute to lower prices. The surest route to lower prices is provided by increasing competition in the delivery of broadband services'.
- *Supply side*
  '[G]overnments should actively seek to remove barriers to new infrastructure investment by incumbents and new entrants. The growth of Internet traffic, especially video traffic associated with such services as YouTube and file sharing traffic associated with a variety of P2P sharing applications, is straining current infrastructure. Providers will need to continue to invest substantially to meet this growing demand without quality-reducing congestion occurring … more investment in facilities risks being derailed if the firms investing in such infrastructure cannot reasonably expect to recover their economic costs, including earning a fair, risk-adjusted return on investment. Regulatory rules which unduly restrain provider pricing and service offerings threaten carriers' ability to recover their costs and hence the viability of on-going investment in infrastructure'.
- *Spectrum management*
  'Finally, there is one important way in which federal policy makers can and should expand both demand and supply of broadband services. That is to continue the process of increasing the amount of radio spectrum available for commercial uses and subject to flexible market allocation'.

Spectrum trading refers to the right to trade ownership of part or all of spectrum assigned to a user, or to lease part or all of spectrum. For example, in the USA utility companies often sit on under-utilised radio spectrum assigned to them in past years, and they can lease part of it to other users, which generates revenue for them and provides a scarce resource to others who can use it productively. Liberalisation is a more radical measure. It means giving the owners of spectrum the right to change its usage, in effect using a market mechanism to change spectrum allocation. This can threaten regional harmonisation of usage, so its application is usually reserved for cases not requiring strong harmonisation measures. An intermediate step is refarming of spectrum, where frequencies assigned to support a service such as a 2G mobile network are re-assigned to support a 3G or a 4G network

There have been various studies on the likely economic benefits or impact of spectrum liberalisation and trading (see Ure 2010). One example is from the UK regulator Ofcom, who commissioned a study by Europe Economics (2006). The survey did not report on consumer price responsiveness for 2006 but based its assumptions upon a survey carried out in 2002, using four different methods of extrapolation. However, it found that most of the benefits of trading spectrum will arise in the provision of public mobile services (51% in 2006 in the UK report) and broadcasting (29% in 2006). Eighty-seven per cent of the benefits from public mobile services accrued as consumer surplus rather than producer surplus, and 82% of the benefits from broadcasting services. These findings are not surprising given the value users place on public mobile phone and broadcasting services, and these results are very much in line with similar studies from other regions such as Analysys et al. (2004) for the European Union.

Trading, however, is still limited. The following economies, together with dates of introduction, have categories of licences that may be traded: New Zealand (1989), Australia (1992), El Salvador (1996), Guatemala (1996), the USA (1997), Norway (2003) and the UK (2003, 2006). The evidence from El Salvador and Guatemala is not overwhelming but a study by Hazlett, Ibarguen and Leighton (2006) does show that trading is consistent with higher than average radio spectrum deployment *per capita* GDP across 16 South American economies, and for minutes of usage per GDP *per capita*. In other words, whether due to spectrum trading or not, both economies compared well with their neighbours.

Successful trading requires transparency and low transactions costs. Where auctions have already assigned frequencies efficiently, trading tends to be low in volume. The most commonly traded frequencies in Australia, the UK and the USA are those supporting personal communications services (PCS) and broadband fixed wireless access services (BFEA). In other economies publicly available information is insufficient to make an analysis, which is a future issue for data availability and research yet to come.
At regional level, however, one potential drawback that might undermine the development of mobile services (and possibly the 2000 Brunei Goal and regional economic integration) is the issue of international roaming charges. It became apparent that international roaming charges for both voice and data services are in many if not all cases unreasonably high globally. The European Commission has found, for example, that international mobile roaming prices were on average 4 times higher than national mobile calls in the EU region (ITU 2008). OECD (2009) also reported that in some extreme cases in the OECD region, it can be 20 times more expensive to make a call back to the home economy whilst roaming in the host economy than for users in the host economy to make an international call to the roamer's home economy.

Recent studies undertaken by ITU (2008) and OECD (2009 and 2010) recommended that, as the high roaming charges could not be explained by the underlying costs, there exists significant market failure in this area. Regulatory interventions are therefore required as a

primary measure to resolve the issue. As international roaming involve at least one foreign partner, this implies that regulatory cooperation and coordination at regional (or even international) level is required because price regulation by national regulator can only manage half of the roaming loop; the rest is beyond the jurisdiction of a single economy. APEC initiatives therefore are needed to examine this issue from a regional perspective and to explore the possible regional framework for regulatory cooperation.[6]

7.7 CONCLUSION

The considerable development of the telecommunications sector in the APEC region in recent years reflects the structural reform efforts by APEC economies. While some of the APEC economies are taking a world leadership role in telecommunications development, more recent starters are also catching up rapidly and reducing the gap.

This chapter reviewed the quantitative impact of telecommunications structural reform in the APEC region. It found that, as all APEC economies have already implemented a market liberalisation policy for over a decade, structural reform and pro-competition regulations played a less critical role in refining market performance in 2009. The results of the quantitative analysis on broadband penetration, however, also suggest that structure and regulatory reform still have a direct impact on new investment. For new investment such as broadband access, while each of the policy components has its own unique value and purpose, the implementation of a full set of rules appears to be the most desired policy.

In addition, the results also suggest that, as far as the telecommunications sector is concerned, policy initiatives to promote technology development and innovation will play an increasingly critical role in the future. Still, for some APEC economies, the availability of telecommunications network infrastructure to all citizens remains a critical issue. To achieve this goal, a good universal service regime is a prerequisite as market failure restricts the size of network. Yet the effective implementation of the universal service regime also requires political commitment to encourage investment and a sound regulatory environment that removes policy uncertainties.

This chapter also reviewed some of the evidence of recent research on the impact of reforms in terms of more open policies and regulations that spur greater competition, access and innovation in telecommunications service markets. Chronologically, reforms have taken place in the fixed line, cellular mobile wireless and broadband markets, and concomitantly in spectrum management. In all cases the evidence indicates what intuitively sounds right, namely, that competition produces benefits in terms of lower prices, innovation in networks and services (economic growth) and in the efficiency of the use of spectrum. Reforms are important in telecommunications, principally because of the network effects. The benefits are spread throughout the economy because telecommunications is a major productive input into just about every sector of industry and commerce. Potential shortcomings, such as the international roaming pricing issue, warrant that further regional regulatory cooperation is required.

[6] APEC Telecommunications Working Group (APEC TEL) recently held the first workshop on international roaming charges during APEC TEL 41 (2010) meeting. Member economies shared their experiences in consumer information provisions as a measure to address the issue.

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ANNEX 7 POLICY INDEX

Table A7.1: Policy index.

Category weight	Score	Categories
Market entry and non-discrimination (total score=1 for least performing economy)		
0.30		**Licensing of new fixed network operation licences**
	1.00	Issues no new licences
	0.75	Issues 1 new licence
	0.50	Issues up to 3 new licences
	0.25	Issues more than 3 new licences
	0.00	No limitation on the number of new licences
0.30		**Licensing of new mobile network operation licences**
	1.00	Issues no new licences
	0.75	Issues 1 new licence
	0.50	Issues up to 3 new licences
	0.25	Issues more than 3 new licences
	0.00	No limitation on the number of new licences except for technical reasons
0.40		**Direct investments**
0.20		General
		The score is inversely proportional to the maximum direct equity participation permitted in an existing domestic telecommunications operator. Issues no new licences. For example, equity participation to a maximum of 75% would be given a score of 0.25.
0.20		Incumbents
		The score is inversely proportional to the maximum direct equity participation permitted in a specific domestic telecommunications operator.
Pro-competition regulations (total score=1 for least performing economy)		
0.20		**Anti-competition rules against major operators** [c]
	1.00	No anti-competition rules
	0.50	Proposals for anti-competition rules are developed and/or under consideration
	0.00	Existence of anti-competition rules
0.20		**Interconnection rules**
	1.00	No interconnection rules
	0.50	Partial application and/or proposals for interconnection rules are developed and/or under consideration
	0.25	Existence of interconnection rules that are not consistence with WTO
	0.00	Existence of WTO-consistent interconnection rules
0.20		**Independent regulator**
	1.00	Regulators is not separated from services provisions
	0.00	Regulator is separate from services provisions
0.20		**Access to incumbent's facilities**
	1.00	No regulatory regime available
	0.50	Partial application and/or proposals for access rules are developed and/or under consideration
	0.00	Regulatory regime available for competitors to seek access
0.20		**NP**
	1.00	No NP regime
	0.50	Partial application and/or proposals for interconnection rules are developed and/or under consideration
	0.00	NP regime implemented

Table A7.2 Policy index values.

Category 1: Establishment and non-discrimination																				
Policy component	**AUS**	**BD**	**CDA**	**CHL**	**PRC**	**HKC**	**INA**	**JPN**	**ROK**	**MAS**	**MEX**	**NZ**	**PNG**	**PE**	**RP**	**RUS**	**SIN**	**CT**	**THA**	**US**	**VN**
Licensing of new fixed-line licences	0	1	0	0	0.5	0	0.5	0	0	0	0	0	1	0	0	0.5	0	0	0.5	0	0.25
Licensing of new mobile licences	0	0.75	0	0	0.5	0	0.25	0	0	0	0	0	0.25	0	0	0	0	0	0.25	0	0.25
Inv-General	0	1	0.54	0	0.51	0	0.7	0	0.51	0.51	0.51	0	1	0	0.6	1	0	0.4	0.51	0	0.51
Inv-Incumbents	0	1	0.54	0	0.51	0	0.7	0.67	0.67	0.51	0.51	0.501	1	0	0.6	1	0	0.51	0.51	0	0.51
Total-policy 1	0	0.925	0.216	0	0.504	0	0.505	0.134	0	0.204	0.204	0.1002	0.775	0	0.24	0.55	0	0.182	0.429	0	0.354
Category 2: Pro-competition regulation																					
Policy component	**AUS**	**BD**	**CDA**	**CHL**	**PRC**	**HKC**	**INA**	**JPN**	**ROK**	**MAS**	**MEX**	**NZ**	**PNG**	**PE**	**RP**	**RUS**	**SIN**	**CT**	**THA**	**US**	**VN**
Anti-competition rules	0	1	0	1	0	0	0.5	0	0	0	0.5	0	1	0.5	0.5	1	0	0	0.5	0	0.5
Interconnection rules	0	1	0	1	0.5	0	0.5	0	0	0	1	0	1	0.5	0.25	1	0	0	0.5	0	0.25
Independent regulator	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Access to incumbent's facilities	0	1	0	0	1	0	1	0	0	0	0.5	0	1	0	0.5	1	0	0	1	0	1
NP	0	1	0	0.5	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0.5	0	0.5
Total--policy 2	0	0.8	0	0.5	0.5	0	0.6	0	0	0	0.4	0	0.8	0.2	0.25	0.8	0	0	0.5	0	0.45
Aggregate (P1+P2)	0	1.725	0.216	0.5	1.004	0	1.105	0.134	0	0.204	0.604	0.1002	1.575	0.2	0.49	1.35	0	0.182	0.929	0	0.804