Chapter 2

MODELLING THE BENEFITS OF STRUCTURAL REFORMS IN APEC ECONOMIES

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> - A general equilibrium model is used to assess the effects of a package of structural reforms, focused on the introduction of competition into markets for transport and energy.
> - APEC-wide, the projected gains are significant and almost twice as big as the gains from further liberalisation of merchandise trade.
> - At the sectoral level, the projected output gains tend to be in the services sectors undergoing reform, and in the sectors that use their services intensively.

2.1 INTRODUCTION

Structural reform in transport, energy and telecommunications is not synonymous with deregulation but with better regulation. Nor is privatisation the key. The critical aim of structural reform is to encourage as much competition as is appropriate in these sectors, while configuring the regulation targeted at other legitimate economic and social objectives so that it does least damage to that competition, and therefore to economic efficiency. Competition can be a powerful method of squeezing excess profits and driving producers to find lower cost ways of doing business. Ownership matters primarily to the extent that it affects the incentives of producers to respond in these ways to competitive pressures, and government-owned enterprises can respond quite adequately to private sector competition if they are adequately capitalised and operate under appropriate governance structures. As will be seen, there can be significant gains from structural reforms in some of these sectors, even when they continue to operate with current ownership structures.

The appropriate level of competition depends on the sector in question. Many of these activities involve networks – of railway lines, of electricity transmission and distribution lines, of gas transmission and distribution pipelines and of telecommunications transmission and distribution lines. At least some components of these networks have the characteristics of a 'natural monopoly', meaning that it is less costly for their operation to be carried out by a single producer using a single set of facilities, rather than having two or more operators with duplicate facilities.

The structural reforms in these sectors are typically aimed at introducing competition into those parts of the production chain that are not natural monopolies. This requires the competitive suppliers to have access to those parts of the network that are natural monopolies. Successful reform also requires that the restructuring be done in such a way that

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the benefits of competition in the competitive sectors outweigh the loss of any economies of scope that may have prevailed when the monopoly and competitive activities were operated together under single ownership.

In maritime and air transport, the natural monopoly elements are more likely to be at the ports or airports than in the transport operation *per se*. But maritime and aviation networks operate across national boundaries, and in both activities a degree of regulatory cooperation may be required to ensure safety and coordination along international routes. But such regulation should not unduly impede competition, nor should competition be unduly stifled in the interests of promoting or protecting 'national champions'.

This paper draws on studies in this report that have identified the types of regulatory structures that unduly impede competition and have quantified their first round impact on economic performance in the sectors in question. The purpose of the paper is to go one step further: to quantify the effects of reforming those regulatory structures, not just on the sectors in question but also on sectors that might use these services, on whole economies, and ultimately on the region as a whole. It also aims to quantify the adjustment costs that these prospective reforms might generate.

2.2 THE REFORM AGENDA

2.2.1 Air transport

International air services are governed by a system of bilateral air services agreements. While these agreements cover a wide range of topics that would be deemed legitimate targets of regulation (such as aviation security, incident investigation, immigration and control of travel documents), they also include seven key features that have been identified by the WTO Secretariat as restricting scheduled air passenger services (WTO 2006):

- *Designation*
  Governs the right to designate one (single designation) or more than one (multiple designation) airline from the home economy to operate the agreed services between the two economies.

- *Withholding*
  Defines the ownership conditions required for the designated airline(s) of the foreign economy to be allowed to operate the agreed services. The most restrictive conditions require substantial ownership and effective control to be vested in the designating economy or its nationals. The most liberal regime (principal place of business) removes the substantial ownership requirement but still requires the designated airline to be incorporated in the designating economy and to have its principal place of business there. This falls far short of the relatively generous 'rules of origin' typically written into services trade agreements. These would typically require only 'substantial business' in the designated economy, irrespective of ownership.

- *Grant of rights*
  Covers the rights to provide air services between two economies. The dimensions in which air services agreements are generally being liberalised is in the granting of the 5th, 6th and 7th freedoms and cabotage. The 5th freedom is the freedom to carry passengers between two economies by an airline of a third economy on a route with origin or destination in its home economy. The 6th freedom is the freedom to carry passengers between two economies by an airline of a third economy on a route that goes via its home economy. (Note that 6th freedoms can also be constructed via a

combination of the 3rd and 4th freedoms from different bilateral agreements, and so are rarely specified explicitly.) The 7th freedom is the freedom to carry passengers between two economies by an airline of a third economy on a route with no connection to its home economy. Cabotage is the freedom to carry passengers within an economy by an airline of another economy on a route with origin or destination in its home economy.

- *Capacity clause*
  Determines the capacity of an agreed service, where capacity refers to the volume of traffic, frequency of service and/or aircraft type.

- *Tariff approval*
  Refers to the fare setting regime. Under the most restrictive regime, the aeronautical authorities of both economies have to approve a fare before it can be applied. Under the most liberal regime, fares are not subject to the approval of either authority.

- *Statistics*
  Establishes rules on the exchange of statistics between economies or their airlines. If an exchange of statistics is or can be requested, it is a sign that the parties intend to monitor the performance of each other's airline and is thus viewed as a restrictive feature of an agreement.

- *Cooperative arrangements*
  Defines the rights of the designated airlines to enter into cooperative marketing arrangements such as code sharing and alliances. This right is considered a liberal feature because it provides a means to rationalise networks in the absence of liberalisation of the ownership clause.

These restrictive features of air services agreements have been shown to impose costs by raising international airfares and restricting international traffic. Gonenc and Nicoletti (2000) and Doove et al. (2001) found a positive and significant effect of the restrictiveness of air services agreements on passenger air fares. For example, Doove et al. (2001) estimated that the restrictive provisions of the agreements in place at the time had inflated international airfares from Indonesia and the Philippines by over 20%, and from Malaysia, Singapore and Thailand by 16–18%. Piermartini and Rousová (2008) found that an increase in the degree of liberalisation from the 25th to the 75th percentile would increase passenger traffic volumes between economies linked by a direct air service by about 30%. In particular, they found that the removal of restrictions on the determination of prices and capacity, cabotage rights and designation were found to be the most traffic-enhancing provisions.

The restrictive provisions of air services agreements also impose costs on air freight services. Most air freight is carried in the belly of passenger aircraft and is thus affected by exactly the same provisions as passenger traffic. Freight-only flights are generally also governed by the same provisions as passenger flights, although in some instances they are granted more liberal traffic rights. Grosso (2008) found a positive and statistically significant relationship between relaxing restrictions and the value of merchandise trade. Achard (2009) found a significant correlation between liberal air services agreements and the volume of air cargo.

In recognition of such costs, a growing number of economies are negotiating more liberal air services agreements. The typical 'open skies' agreement grants 3rd, 4th and 5th freedom rights and removes restrictions on designation, capacity, frequencies, code-sharing and fares. Open skies agreements typically do not grant cabotage rights or lift foreign ownership restrictions on domestic airlines. Seventh freedom rights are sometimes included, but often restricted to cargo-only traffic.

Increasingly, economies have also liberalised their domestic aviation services, which they can do on a unilateral basis. Such liberalisation has typically included allowing additional domestic and foreign entry on domestic routes, particularly by low cost carriers, and freeing up restrictions on domestic air fares. Sometimes, liberalisation has also included the full or partial privatisation of government-owned carriers.

The index of policy restrictions compiled by Zhang and Findlay (2010) covers some of the key measures affecting both domestic and international aviation: the privatisation of national airlines, foreign equity participation in domestic airlines, the existence of low cost carriers, the number of effective passenger airlines (indicating ease of entry), whether there is multiple designation on international routes, whether there are more than two open skies agreements and whether 7th freedom cargo rights are granted to at least some foreign carriers.

Table 2.1 shows the index and its components, where an index value of 1 indicates full restrictiveness, a value of 0 denotes no restriction, and intermediate values denote partial restrictions. (See the original paper for details, noting that the analysis is restricted to APEC members that have been included in the computable general equilibrium model, based on data available from the GTAP model database [Hertel 1997]. It therefore excludes Brunei and Papua New Guinea.)

The table indicates that China; Viet Nam; the Russian Federation; the Philippines; and Chinese Taipei currently have the most restrictive regulatory regimes among APEC economies. The United States of America; Australia; Singapore; Malaysia; and Thailand have the least restrictive regimes.

Table 2.1: Index of policy restrictions in air transport.

APEC member	Privatised	Foreign equity	Low cost airline	Effective competitors	Designation	Open skies	7th freedom	Total score
Australia	0	0	0	0.5	0.5	0	0	1
Canada	0	0.75	0	1	1	0	0	2.75
Chile	0	0	1	1	1	0	0	3
China	0.67	0.5	0.5	0	0.5	1	1	4.17
Hong Kong, China	0	0	0.5	1	1	0	1	3.5
Indonesia	1	0.5	0.5	0	0.5	0.5	0	3
Japan	0	0.75	0.5	0	0	0.5	1	2.75
Republic of Korea	0	0.5	0.5	0.5	0	0.5	1	3
Malaysia	0.67	0.5	0	0	0.5	0	0	1.67
Mexico	0	0.5	0.5	0.5	0	0	1	2.5
New Zealand	0.67	0	0.5	0.5	0.5	0	0	2.17
Peru	0	0.5	0.5	0.5	0.5	0	0	2
Philippines	0	0.5	0.5	0	0.5	1	1	3.5
Russia	0.67	0.75	0.5	0	0.5	0	1	3.42
Singapore	0.67	0	0	0.5	0	0	0	1.17
Chinese Taipei	0.67	0.5	1	0.5	0	0.5	0	3.17
Thailand	0.67	0.5	0	0	0.5	0	0	1.67
United States	0	0.75	0	0	0	0	0	0.75
Viet Nam	1	0.5	0.5	0.5	1	0.5	0	4

Source*: Zhang & Findlay 2010.
Note: 0 = no restriction, 1 = full restriction

2.2.2 Maritime transport

McGuire, Schuele and Smith (2000) surveyed the maritime policy regimes in several APEC, Latin American and European economies. They described the key restrictions affecting shipping services as follows:

- *Right to fly the national flag*
  Requires ships to be registered or licensed to provide maritime services on domestic and international routes. The conditions on registration may include legitimate requirements, such as meeting seaworthiness and safety requirements, but may also include restrictions, such as the ship having a commercial presence in the domestic economy and being built and/or owned domestically.
- *Cabotage restrictions*
  These restrict shipping services on domestic and coastal routes to vessels that meet certain conditions. Shipping services between domestic ports may be required to be carried out by domestically owned, operated, built and/or crewed ships.
- *Conferences*
  Private sector arrangements between shippers that are held out to facilitate the planning and coordination of shipping traffic but typically also include anti-competitive provisions. Governments that have enacted general competition laws usually permit the existence of conferences through exemptions from the price setting and collusion provisions of their domestic competition legislation.
- *UN Convention on a Code of Conduct for Liner Conferences (UN Liner Code)*
  Stipulates that conference trade between two economies can allocate cargo according to the 40:40:20 rule, whereby 40% of tonnage is reserved for the national flag lines of each economy and 20% is allocated to liner ships from a third economy.
- *Cargo sharing*
  Other types of arrangements that stipulate the allocation of cargo on particular routes between parties to bilateral and multilateral agreements.
- *Bilateral agreements*
  Agreements between two economies that primarily restrict the supply of shipping services and the allocation of cargo. Some bilateral agreements also restrict the use of port facilities.

Many developing economies do not have general competition laws or any legislative framework for regulating the behaviour of shipping conferences. However, in recent times conferences have been subjected to increasing competition. They no longer dominate shipping routes and are no longer regarded as the impediments to maritime performance that they once were. PDP Australia and Meyrick and Associates (2005) note that within ASEAN, cargo reservation measures have been very significantly reduced and in many cases completely abandoned. Similarly, a growing number of economies have 'open' ship registries, which means that local ship registration is no longer tightly tied to local ownership of the shipping company. This leaves cabotage restrictions, along with inadequate and aging infrastructure, as the main impediments to economic performance in shipping services in many economies.

These regulatory restrictions on shipping services have been shown to be costly, particularly to developing economies. Kang (2000) found that the maritime restrictions imposed by goods exporting economies appear to have a much greater impact on bilateral shipping margins (as measured by cif/fob ratios) than those imposed by importing economies. He also found that in exporting economies, lowering restrictions such as cabotage and port services restrictions had a greater effect on margins than reducing restrictions on the commercial presence of foreign suppliers. In several applications of these findings, the sum total of restrictions on shipping and port services was found to have inflated shipping costs by around 30% in Morocco (Dee 2006) and by around 26% in Indonesia (Dee 2008).

The index of regulatory openness compiled by Bertho (2010) covers some of the key measures affecting maritime transportation. Table 2.2 shows the index and its components, where an index value of 1 indicates full openness, a value of 0 denotes full restrictiveness and intermediate values denote partial restrictions (see the original paper for details). The index covers cabotage restrictions, cargo handling restrictions, quotas for private or government cargo, the availability of exemptions for carrier agreements from competition law and the existence of an independent regulatory authority. It also covers measures that fall squarely into the category of barriers to services trade – foreign equity limits, limits on the legal form of establishment (branches, subsidiaries) of foreign greenfield operations, whether foreign operators can take a controlling stake in existing private or public entities and whether there are nationality requirements on the employees or boards of directors of foreign companies.

The table confirms that cabotage restrictions are the predominant restrictions on maritime services among APEC economies. Hong Kong, China is the most liberal APEC member, followed by Chile; New Zealand; and Australia. The least liberal is Viet Nam, which does not have a deep sea port, so most goods are transported to Singapore and Hong Kong, China before going on to final destinations. Foreign firms usually provide cross-border services via a Vietnamese (wholly domestic) agency, which does everything on behalf of foreign suppliers in Viet Nam and earns a commission from the foreign partners (Dee 2010a).

2.2.3 Rail transport

Rail can be a very efficient means of transporting cargoes, especially bulky ones, once they are loaded onto the trains, but the loading and unloading is costly. By contrast, road freight transport may be less efficient in moving large cargos but it can operate door-to-door, often avoiding a cycle of loading and unloading. Similar tradeoffs apply in the economics of rail passenger transport. Furthermore, rail operating costs make it more economic than road for moving freight over longer distances, while over short distances road transport dominates. For these reasons, rail transport plays a surprisingly minor role in many economies' transport networks. For example, in Indonesia rail transport accounts for only 7% of passenger transport and less than 1% of freight transport (Dee 2008).

In rail services the natural monopoly elements are the track bed, while rolling stock (railcars) can be leased or bought by competitors and operated on the incumbent's rail tracks (subject to an adequate access regime, timetabling and safety standards). 'Horizontal separation' is the term given to competition in the market (e.g., via the free entry of freight operators) or for the market (e.g., via tendering or franchising arrangements for passenger services). However, to promote effective competition, it may be necessary to require the track operator to become a separate corporate entity without any interest in passenger or freight operations ('vertical separation'). Without such an interest, the track operator will have an incentive to maximise its revenue by maximising traffic. With such an interest, it may have an incentive to restrict the access of competitors to promote the profitability of its own passenger or freight operations.

Cantos, Pastor and Serrano (2010a) examined the effects of horizontal and vertical separation in European railways. They found that the reforms had been beneficial in terms of efficiency (allowing laggards to catch up to leaders) and productivity (also incorporating the benefits of technical change through innovation). Key drivers of both types of benefits were vertical separation and the free entry of new freight operators. No significant effects on either efficiency or productivity were found for the introduction of tendering systems in passenger traffic.

Table 2.2: Index of policy openness in maritime transport.

APEC member	Quotas	Competition law exemptions	Form of ownership	Percentage of ownership	Acquisition domestic entity	Nationality reqt employees	Nationality reqt BOD	Cabotage	Cargo handling	Independent regulatory authority	Simple average
Australia	1	0	0.5	1	1	0	1	1	1	1	0.75
Canada	1	1	0.5	1	1	0	0	0	na	1	0.61
Chile	1	1	1	1	1	na	na	0	na	1	0.86
China	1	1	0.5	0.49	0	1	1	0	1	0	0.60
Hong Kong, China	1	1	1	1	na	na	na	nr	1	na	1.00
Indonesia	0.5	1	0.5	0.49	1	1	1	0	1	0	0.65
Japan	1	0	0.5	1	1	na	0	0	1	1	0.61
Republic of Korea	1	0	0.5	1	1	0	1	0	na	1	0.61
Malaysia	1	1	1	0.3	0	na	na	0	na	1	0.61
Mexico	1	1	1	1	1	0	1	0	na	0	0.67
New Zealand	1	0	0.5	1	1	na	na	1	1	1	0.81
Peru	1	1	1	1	1	0	0	0	na	0	0.56
Philippines	0	1	0.5	0.4	na	1	0	0	0	1	0.43
Russia	0	1	0.5	1	1	1	1	0	1	0	0.65
Singapore	1	0	0.5	1	na	na	na	nr	1	na	0.70
Chinese Taipei	1	0	1	na	na	na	na	0.5	0	0	0.42
Thailand	0.5	1	1	0.49	0	1	0	0	0	0	0.40
United States	0	0	0.5	1	1	0	0	0	1	1	0.45
Viet Nam	1	1	0	0	0.5	0	0	0	0	0	0.25

Source: Bertho 2010.

Note: na = not available; nr = not relevant; 0 = close, 1 = open.

The index of policy openness compiled by Cantos, Pastor and Serrano (2010b) covers some of these elements of rail regimes in APEC economies. Table 2.3 shows their index components (some values available when this study was undertaken are provisional), where an index value of 1 indicates openness, and a value of 0 denotes restrictiveness. The index covers vertical separation, free entry into freight operations and franchising in passenger services.

The table indicates that Australia; Chile; Mexico; Peru; and Russia have regimes that are most conducive to competition in rail services. The most restrictive regulatory regimes are in many of the East Asian members of APEC.

Table 2.3: Index of policy openness in rail transport.

APEC member	Vertical separation of infrastructure and operations	Free entry in freight operations	Franchising in passenger services
Australia	1	1	1
Canada	0	0	1
Chile	1	1	1
China	0	0	0
Hong Kong, China	nr	nr	nr
Indonesia	1	0	0
Japan	0	1	1
Republic of Korea	1	0	0
Malaysia	0	0	0
Mexico	1	1	1
New Zealand	0	1	1
Peru	1	1	1
Philippines	0	0	0
Russia	1	1	1
Singapore	nr	nr	nr
Chinese Taipei	0	0	0
Thailand	0	0	0
United States	0	1	1
Viet Nam	0	0	0

Source: Cantos et al. 2010b.
Note: nr = not relevant; 0 = close, 1 = open.

2.2.4 Electricity

The production of electricity involves generation, transportation over high voltage lines (transmission), transportation over low voltage lines (distribution) and marketing to retail consumers (supply). Transport operations are considered to be natural monopolies and typically remain regulated, even after structural reform. But generation is seen as a competitive activity and is generally the first activity to be opened to competition, followed by wholesale trading and retail supply. However, retail prices may remain regulated in some economies, even after structural reform.

Doove et al. (2001) describe the broad outlines of the structural reform agenda in electricity as:
- structurally separating (unbundling) the competitive activities (particularly generation, but sometimes also retailing) from the natural monopoly elements (particularly transmission, but occasionally sometimes also distribution);
- dividing existing generation capacity among a number of different generation companies, who then compete with each other (horizontal separation);
- allowing new generators to enter the market;

- guaranteeing open and non-discriminatory access for all generators to the transmission grid (subject to available capacity), so they can sell directly to downstream suppliers or users rather than to the incumbent (third party access);
- establishing a wholesale price pool, or spot wholesale market, for electricity (either mandatory or optional), so that new entrants are not obliged to enter both the generation and retailing sector at the same time, thus lowering entry costs;
- regulating natural monopoly activities to prevent any abuse of market power;
- introducing a regulator that is independent of industry players and day-to-day influence, and typically separate from the system operator;
- enabling large customers (retailers and sometimes large industrial users) to buy electricity directly from the generator of their choice;
- introducing competition into metering and billing activities and contract terms, thus allowing retail customers the freedom to choose among different electricity suppliers;
- providing a full range of tradable financial instruments (e.g., futures contracts and options);
- undertaking partial or complete privatisation or corporatisation of publicly-owned assets;
- introducing cross-ownership restrictions, especially between competitive and natural monopoly activities;
- liberalising restrictions on foreign investment and ownership;
- mandating service quality standards; and
- allowing retailers to introduce innovative services (e.g., the ability to switch retailers over the Internet or providing electricity jointly with other services such as telephony and gas).

One of the first empirical assessments of the effects of electricity reform was Steiner's (2000) study of OECD members over the 1986–96 period. She found that unbundling of generation, third party access and the introduction of wholesale electricity markets were all associated with lower electricity prices. However, she found that private ownership was not necessarily associated with increased competition. Nevertheless, both private ownership and unbundling of generation and transmission were found to be associated with a higher rate of utilisation of existing generation capacity, and with reserve plant margins that were closer to optimal.

Two other recent studies have been less definitive. Hattori and Tsutsui (2004) undertook a similar study of OECD members over the slightly later period of 1987–99, although their measurement of variables (particularly prices) was different. They found that giving customers access to alternative suppliers (which they argue is highly correlated with third party access) was associated with lower prices. However, unlike Steiner, they did not find a significant effect of unbundling or the introduction of a wholesale spot market on prices. Nagayama (2007) undertook a broadly similar study of 83 economies over the 1985–2002 period. He found that neither unbundling nor the introduction of a wholesale pool market on their own would necessarily reduce electricity prices. In fact, contrary to expectations, there was a tendency for the price to rise. However, coexistent with an independent regulatory, unbundling could work to reduce prices. He also found that privatisation, the introduction of foreign independent producers and retail competition could lower electricity prices in some regions, but not all.

To some extent these mixed results are a sign that in some economies reforms may not have been taken far enough. Either the reforms were not taken far enough to have any real effect or there were not enough reforms in the chosen samples for econometric techniques to discern any significant effects. Dee (2010b) found more evidence of significant benefits from

structural reforms among OECD members, over a period of more active reform associated with the European Union's Second Electricity Directive.

The index of policy openness compiled by Dee (2010b) covers some key dimensions of electricity regimes in APEC economies. Table 2.4 shows the index components, where an index value of 1 indicates openness and a value of 0 denotes restrictiveness. The index covers unbundling, third party access and the existence of a deregulated wholesale electricity market.

APEC economies with regimes that are most conducive to competition in electricity generation are Australia; Chile; the Republic of Korea; New Zealand; the Russian Federation; and Singapore. The most restrictive regulatory regimes are in Indonesia; Hong Kong, China; Malaysia; Mexico; Chinese Taipei; and Viet Nam.

Table 2.4: Index of policy openness in electricity.

APEC member	Third party access	Wholesale price pool	Unbundling
Australia	1	1	1
Canada	1	1	0
Chile	1	1	1
China	0	1	1
Hong Kong, China	0	0	0
Indonesia	0	0	0
Japan	1	1	0
Republic of Korea	1	1	1
Malaysia	0	0	0
Mexico	0	0	0
New Zealand	1	1	1
Peru	1	0	1
Philippines	0	0	1
Russia	1	1	1
Singapore	1	1	1
Chinese Taipei	0	0	0
Thailand	0	0	0
United States	1	0	1
Viet Nam	0	0	0

Source: Dee 2010b.
Note: 0 = closed, 1 = open.

2.2.5 Gas

Natural gas is found in underground reserves, often in combination with oil and condensate products. Exploration and production is generally done by oil companies, and there are few synergies between this and other activities in gas markets. In economies without indigenous production, however, the primary supply activity is undertaken by importers, who may also be involved in downstream activities.

In many economies, gas importation, transmission and storage was traditionally undertaken by a single monopolist, or several companies with regional monopolies. Sometimes the monopoly importer also sold to end users, or else these sales were handled by downstream monopolies.

Like electricity, structural reform of gas markets involves allowing new entrants into the potentially competitive segments of the market, without requiring them to be vertically integrated. This can involve new companies producing gas or importing it from external sources, in competition with the incumbent(s). It can involve new shipper/suppliers buying gas on wholesale markets, arranging for its transportation with the network company and signing

retail contracts with consumers. It can also involve pure traders buying and selling on wholesale markets to take advantage of arbitrage opportunities (European Commission 2007).

These new activities rely on the development of functioning wholesale markets and on third party access to transmission and distribution networks. To reduce the possibility of incumbents using their control over pipeline or terminal facilities to thwart competition, both transmission and distribution can be unbundled into separate transmission system operators and distribution system operators. When such operators are sufficiently independent from incumbents, they have an incentive to maximise, rather than restrict, the amount of gas sold through their networks, thus facilitating competition.

Thus the broad features of structural reform in gas markets are similar to those in electricity markets, though the scope for competition in primary production/importing is somewhat more limited than in electricity generation.

There are relatively few studies of the effects of structural reform in gas markets. Jamasb, Pollitt and Triebs (2008) studied the effects of United States regulatory reform on productivity and found that encouraging competition has been rather successful in raising productivity. Hawdon (2003) found evidence that the types of reforms introduced in the United Kingdom are associated with higher levels of efficiency, good utilisation of labour and levels of underutilisation of capital sufficient to support the development of competitive markets. Nevertheless, Brakman, van Marrewijk and van Witteloostuijn (2009) warn that lack of competition and capacity constraints in gas production/import can prevent these gains being passed on to consumers.

The index of policy openness compiled by Dee (2010b) covers some of these key dimensions of gas regimes in APEC economies. Table 2.5 shows the index components, where an index value of 1 indicates openness and a value of 0 denotes restrictiveness. The index covers unbundling of production/import, unbundling of supply, third party access, the absence of entry restrictions and the presence of retail competition.

APEC economies with regimes that are most conducive to competition in gas markets are Australia; Canada; New Zealand; and the USA. The most restrictive regulatory regimes are in Hong Kong, China; the Republic of Korea; Malaysia; the Russian Federation; Chinese Taipei; and Viet Nam.

2.2.6 Telecommunications

As reflected in the WTO Reference Paper on telecommunications, the reforms of the 1990s recognised that efficiency gains could be had by introducing competition into those components of the telecommunications network that were not natural monopolies. However, competitors would need access to the monopoly elements (typically the 'last mile') in order to provide a full retail service. According to the Reference Paper, access regimes should provide competitors with access to essential facilities at access charges that were cost-based and non-discriminatory. The appropriate regulation of access charges is a complex issue, although sometimes made more complex than necessary when access charges (as a single policy instrument) are used to pursue multiple objectives (Dee & Findlay 2008).

A related requirement for promoting contestability was to ensure the general interconnectivity of the facilities of various competitors, whether or not they constituted essential facilities. This was required so the subscribers of one provider could make calls to subscribers of all other providers, irrespective of the ownership of the various network components involved. Various

Table 2.5: Index of policy openness in gas.

APEC member	Third party access	Retail competition	Absence of entry restrictions	Unbundling of production/import	Unbundling of supply
Australia	1	1	1	1	0
Canada	1	1	1	1	1
Chile	0	0	1	1	0
China	0	1	1	0	1
Hong Kong, China	0	0	0	0	0
Indonesia	1	0	1	1	0
Japan	1	1	0	0	0
Republic of Korea	0	0	0	0	0
Malaysia	0	0	0	0	1
Mexico	1	1	0	0	0
New Zealand	1	1	1	1	0
Peru	1	0	0	1	0
Philippines	0	0	0	0	0
Russia	0	0	0	0	0
Singapore	1	1	0	1	0
Chinese Taipei	0	0	0	0	0
Thailand	1	0	0	1	0
United States	1	1	1	1	1
Viet Nam	0	0	0	0	0

Source: Dee 2010b.
Noted: 0 = closed, 1= open.

regulatory principles were also developed to ensure that interconnection charges were not used by the incumbent to preserve network dominance (Economides, Lopomo & Woroch 1996, ITU 2000).

A further component of these reforms was ensuring number portability, so that retail subscribers could take their original phone number with them if they switched providers. This was necessary to reduce the cost of 'shopping around', and thus to increase the competitive pressures on providers.

A key supporting component of these pro-competitive reforms was to revise the ways in which universal service obligations were met. To that point these obligations had often been met by cross-subsidies built into the retail prices of telecommunications services that provided competitors with a chance to cherry-pick the lucrative long-distance parts of the market and left incumbents with fewer options to cover their fixed costs. Their response was often to inflate the wholesale access prices charged to competitors for access to the essential facility. Of course, this worked to defeat the introduction of competition. A key reform component of the 1990s, therefore, was to 'rebalance' retail prices to remove the cross-subsidies and ensure that fixed costs were covered, and to find other ways to fund universal service obligations – typically either directly from the government budget or through an industry levy imposed on all service providers.

Since then, a number of technological advances have in some ways radically transformed the industry. The first key development has been the phenomenal growth of mobile telephony. This technology has few natural monopoly elements, so it has allowed extensive entry by new providers. To the extent that mobile services provide a close substitute to fixed-line services, competition from this source can discipline the behaviour of fixed-line service providers and reduce the need for regulatory intervention or oversight. The two services are close substitutes for individuals and perhaps even households. But businesses of any size

typically also need fixed-line connections to meet the sheer volume of their voice and data needs. Most governments have therefore retained the kind of regulatory structures described in the WTO Reference Paper.

A second key development has been the growth of internet services, particularly broadband. These services, which combine developments in the size and nature of the 'pipe' with developments in switching and signal transmission technology, have made it technologically meaningless to distinguish voice from data traffic. This is the essence of 'convergence'. So now there is an imperative for regulatory structures to acknowledge this convergence. The key way in which this is happening is in the move from 'individual' to 'general' or 'class' licensing, not just for carrier licences but also for licences to access the spectrum required for mobile and fixed wireless technologies. Typically, individual licences were not only attached to a particular technology, they were also attached to a particular service. General licences are less tied to particular services, and will often allow both voice and data transmission, although most governments are not yet ready to include broadcasting services in the bundle.

The proliferation of delivery technologies for broadband services (such as ADSL, fibre optic, fixed wireless) has also provided an imperative for regulatory structures to be 'technology-neutral'. This is also facilitated by the move from 'individual' to 'general' or 'class' licensing, since general licences are typically no longer tied to a particular technology.

But there are limits on the extent to which regulatory structures can be completely technology-neutral. This is because a key rationale for regulatory intervention remains dealing with 'natural monopoly' components of the network, and the nature and extent of the natural monopoly problem depends on the particular technology in question. Thus, given the rapid development and proliferation of technologies, there may be no 'one-size-fits-all' best approach to regulation. The most recent ITU survey of trends in reform (ITU 2008) stresses the importance of ensuring interconnectivity across all technologies and all providers, in order to maximise the use that will be made of any particular facility. The report is subtitled 'Six Degrees of Sharing', and notes (p. 1):

> In a way, many regulatory practices can be viewed as sharing. What is new and innovative is their application to meet the needs of developing economies. What is the same is that they use time-tested, pro-competitive tools, such as the regulation of essential or bottleneck facilities, transparency, and the promotion of collocation and interconnection.

Nevertheless, there is considerable current uncertainty about which technologies may become dominant in the future, and as noted, the scope of such regulation depends on the technology. Economies may not necessarily be sure to 'pick the best winner' but they can at least ensure that their regulatory regimes are internally consistent. For example, economies making a serious commitment to fibre optic technologies could need to put more regulatory effort into access regimes than economies relying more on mobile and fixed wireless technologies.

As well as technological developments, services trade reform has also been an important vehicle for promoting the contestability of market, and the potential benefits have been shown to be significant. Mattoo, Rathindran and Subramanian (2001) estimated that economies with fully open telecommunications and financial sectors grow up to 1.5 percentage points faster than other economies. The analysis of Warren (2000) suggested that in the ASEAN 5, the regulatory restrictions then affecting domestic new entrants would have raised the prices of their services by an average of over 10%, while the additional discrimination (including foreign equity limits) against foreign-invested suppliers would have raised the cost of their services by more than 80%.

The overall coherence of regulatory regimes can ultimately be judged according to whether they have engendered a competitive market structure. An index of policy openness has been compiled for this paper, using information from Lee, Ure and Lee (2010) and ITU sources. It focuses mainly on market structure and is based on that used by Warren (2000). Tables 2.6 and 2.7 show the index components, where a higher value denotes more openness and a

Table 2.6: Index of policy openness in fixed-line telecommunications.

APEC member	Number of competitors	Comp. - local	Comp. - long dist.	Comp. - internat.	Comp. - data	Comp. - leased lines	Portion incumb. privat- ised	Max % FDI in comp. carriers
Australia	3	1	1	1	1	0.5	0.5	1
Canada	3	1	1	1	1	1	0.5	0.46
Chile	3	1	1	1	1	1	1	1
China	3	1	1	0.5	1	1	0.5	0.49
Hong Kong, China	3	1	1	1	1	1	1	1
Indonesia	3	0.5	0.5	0.5	1	1	0.5	0.3
Japan	3	1	1	1	1	1	1	1
Republic of Korea	2	1	1	1	1	1	1	0.49
Malaysia	3	1	1	1	1	1	0.5	0.49
Mexico	3	1	1	1	1	1	1	0.49
New Zealand	3	1	0.5	1	0.5	1	1	1
Peru	3	1	1	1	1	1	1	1
Philippines	3	1	1	1	1	1	1	0.4
Russia	2	0.5	0.5	0.5	1	0	0.5	0
Singapore	2	1	1	1	1	1	0.5	1
Chinese Taipei	3	1	1	1	1	1	0.5	0.6
Thailand	3	1	1	1	1	1	0	0.49
United States	3	1	1	1	1	1	1	1
Viet Nam	3	1	1	1	1	1	0.5	0

Source: Based on Chapter 7 in this report and ITU sources.
Note: 0 = close, 1 = open.

Table 2.7: Index of policy openness in mobile telecommunications.

APEC member	Number of competitors	Competition	Portion incumbent privatised	Max % FDI in competitive carriers
Australia	3	1	0.5	1
Canada	3	1	0.5	0.46
Chile	3	1	1	1
China	3	1	0.5	0.49
Hong Kong, China	3	1	1	1
Indonesia	3	1	0.5	0.3
Japan	3	1	1	1
Republic of Korea	3	1	1	0.49
Malaysia	3	1	0.5	0.49
Mexico	3	1	1	0.49
New Zealand	3	1	1	1
Peru	3	1	1	1
Philippines	3	1	1	0.4
Russia	2	1	0.5	0
Singapore	2	1	0.5	1
Chinese Taipei	3	1	0.5	0.6
Thailand	2	1	0	0.49
United States	3	1	1	1
Viet Nam	3	1	0.5	0

Source: Based on Lee, Ure & Lee 2010 and ITU sources.
Note; 0 = closed, 1= open.

lower value denotes less. The tables give the number of competitors in fixed and mobile markets (where more than three competitors receive a score of three). They record the state of competition in the mobile market and various segments of the fixed-line market, and record the portion of fixed and mobile incumbent operators that are privatised (where any type of partial privatisation receives a score of 0.5), and the portion of foreign ownership that is allowed in competitive carriers in fixed and mobile markets.

The results confirm that fixed and mobile markets in most APEC economies are now fully competitive. Despite this, there are residual restrictions on foreign ownership in most APEC economies. These are hard to rationalise, given the extent of competition that already exists.

2.3 QUANTIFYING THE FIRST ROUND EFFECTS OF REFORM

The policy indexes are arbitrary but they are not important by themselves. Instead, they provide inputs into econometric exercises that quantify the first round effects of policy restrictions on measures of economic performance in the sectors in question, while controlling for all the other factors that affect economic performance in those sectors. This methodology has been developed in the context of measuring and evaluating barriers to services trade (e.g., Findlay & Warren 2000), and can also be used to evaluate the effects of structural reforms. The performance measures used in the econometric exercises are often prices or price-cost margins, but sometimes quantities or costs.

The econometric estimates of the effects of policy indexes on these measures of performance can be used to construct the counterfactual – what economic performance would be in the absence of the regulatory restrictions, holding all other factors constant. This counterfactual comparison gives the first round effects of structural reform. It can be seen as a 'tax equivalent' if the restrictions have raised price-cost margins, or a 'productivity equivalent' if the restrictions have raised real resource costs. Ideally, the econometric exercises should include a rich enough menu of performance measures to be able to determine which of these applies (Dee 2005).

2.3.1 Air and maritime transport

In this paper the first round effects of structural reforms in air and maritime transport have been derived from the econometric study by Sourdin (2010). She estimated the effects of policy restrictions in these sectors using the policy indexes presented in the previous section. Her measure of economic performance was the *ad valorem* transport costs incurred in shipping goods internationally using air or sea transport. She made use of data from four APEC economies – Australia; Brazil; Chile; and the USA – that compile detailed (6-digit), consistent data on import values on both a fob (free on board) and a cif (cost, insurance, freight) basis. Her measure of *ad valorem* transport costs was the percentage difference between cif and fob valuations, calculated separately (by commodity and source economy) for imports transported by air and by sea. Her controls in the estimation were the value of total imports between the economy pairs, the distance between them, the value-to-weight ratio of the particular import shipment and a product-specific fixed effect. Her estimated semi-elasticity of air transport costs with respect to the air transport restrictiveness index was 0.055, meaning that a 0.1 unit reduction in the openness index would reduce transport costs by 0.55%. Her estimated semi-elasticity of maritime transport costs with respect to the maritime transport openness index was -0.487, meaning that a 0.1 unit increase in the openness index would reduce transport costs by 4.87%

Given further structural reforms in air and maritime transport in each APEC economy, it is assumed that the air restrictiveness indexes would all reach a value of zero, and the maritime openness indexes would all reach a value of unity. In air transport, this implies a range of reforms to air services agreements, to entry conditions for domestic and foreign carriers, and to ownership. In maritime transport, it implies the dismantling of any remaining entry restrictions, quotas or cargo sharing arrangements, and the granting of national treatment to foreign-owned carriers located domestically. The above semi-elasticities can be used to calculate the resulting percentage changes in air and maritime transport costs for each APEC economy.

One key question for modelling purposes is whether to interpret these prospective cost changes as coming about because the price–cost margins of transport operators would be squeezed or because the real resource cost of shipping goods by air or sea would fall. Should the first round effects be interpreted as 'tax equivalents' or 'productivity equivalents'? As will be seen, this difference in treatment can have a marked effect on the projected economy-wide effects of structural reform. By itself, however, Sourdin's (2010) econometrics does not resolve the issue.

The issue is decided on *a priori* grounds. Price–cost markups are only likely to be inflated for significant periods of time if regulatory restrictions prevent entry – otherwise the excess profits are likely to be eroded by the entry of new service providers. But many kinds of regulatory restrictions are likely to raise real resource costs, particularly regulations that lead to shipping delays or prevent transport operators from configuring their transport routes to achieve network economies. In air transport, restrictive designation provisions can limit the entry of any new carriers on international routes, but other provisions, such as restrictive traffic rights, can prevent the achievement of network economies. In maritime, cabotage restrictions limit foreign but not domestic entry on domestic routes. Quotas and cargo handling restrictions can lead to shipping delays that add significantly to shipping costs.

Overall, it is judged that the regulatory restrictions in air and maritime transport are likely to have raised transport costs rather than inflated the price-cost margins of international transport operators. So the first round effects of structural reform are interpreted as productivity improvements. They are shown for each APEC economy in Figures 2.1 and 2.2. Nevertheless, this assumption is subjected to sensitivity testing in the next section, by assessing the economy-wide effects of an alternative treatment whereby half the first round impact is assumed to fall on price–cost margins.

A second key question for modelling purposes is whether the first round impacts would fall only on the cost of shipping goods internationally or whether they would also affect the costs of domestic maritime and air services. Sourdin (2010) only measured the first effect. Nevertheless, the policy indexes for both air and maritime include regulatory restrictions that would also be expected to affect domestic services. Accordingly, in the modelling of the next section, the first-round productivity effects are assumed to fall on international air and sea transport margins, as well as on the domestic production of air and maritime transport services. Further, the effects are assumed to fall equally on domestically owned and foreign-owned service providers, even though a few components of the indexes would be expected to affect foreign-owned carriers more than domestic ones.
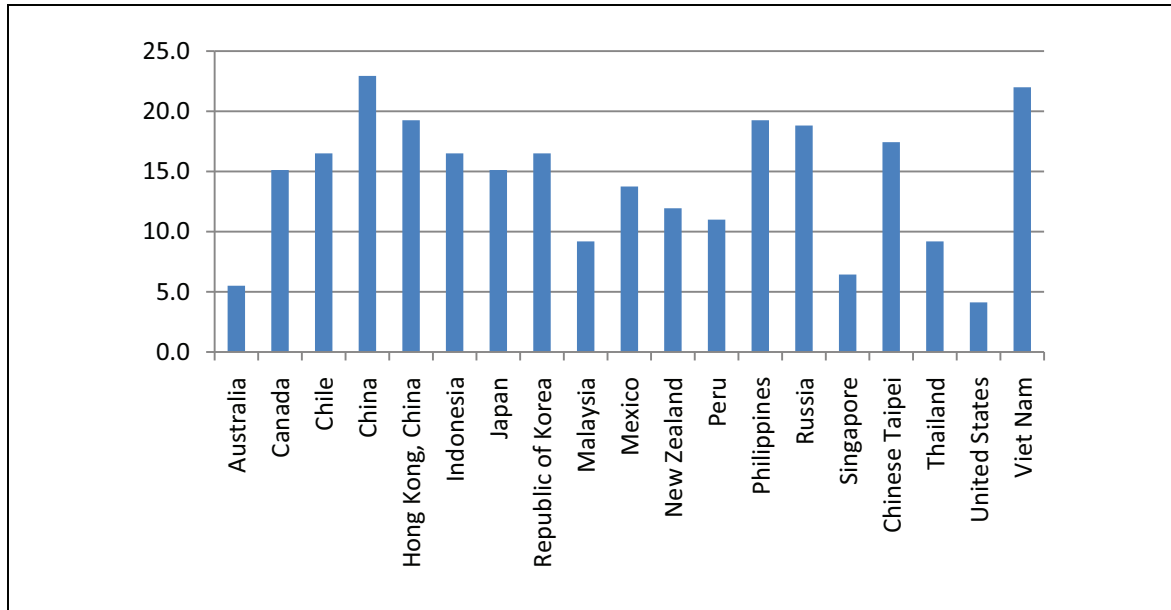
Figure 2.1: Productivity improvements from structural reforms in air transport (%). (Source: Table 2.1 and Sourdin 2010).
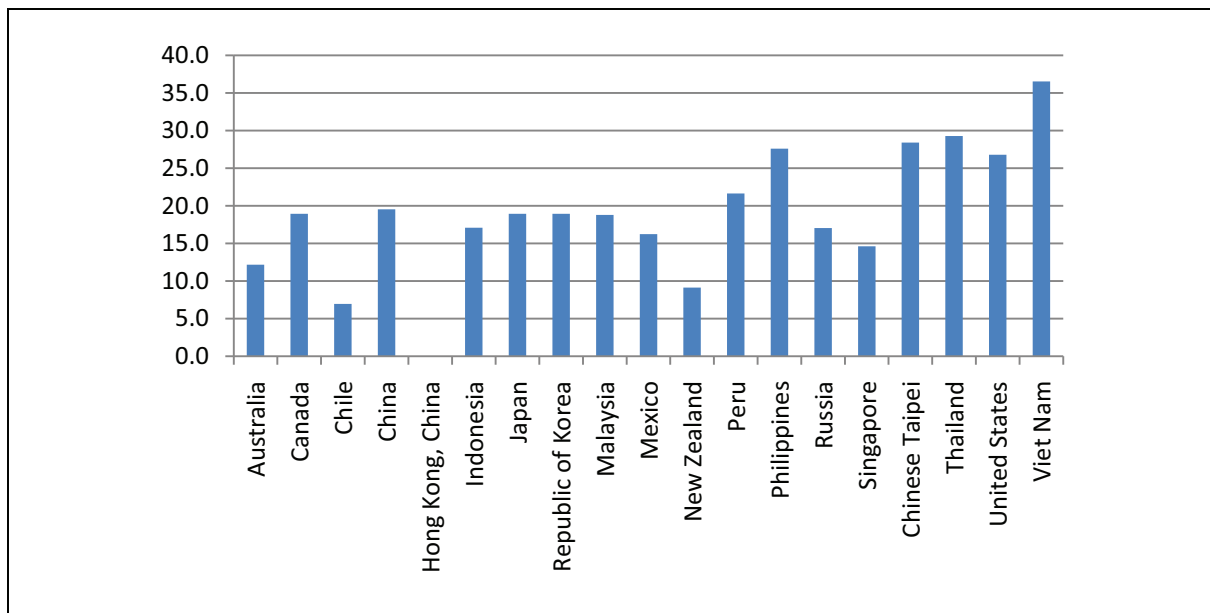

Figure 2.2: Productivity improvements from structural reforms in maritime transport (%). (Source: Table 2:2 and Sourdin 2010).

2.3.2 Rail transport

The first round effects of structural reform in rail transport have been derived from the econometric study by Cantos, Pastor and Serrano (2010a). They estimated the effects of horizontal and vertical separation on the efficiency and productivity of rail operations, using data on 16 European railway systems from 1985 to 2005. In measuring efficiency and productivity, they used a production structure that recognised two outputs (passenger and freight transport) and four inputs (employees, passenger train supply, freight train supply and railway infrastructure). In examining the determinants of efficiency and productivity, they controlled for the share of passengers in the total transport task, measures of the size and density of the network, measures of passenger and freight occupancy, and individual and time fixed effects.

Their measured impacts of structural reforms on efficiency indicate how structural reforms can encourage railway operators to move towards the production frontier from a point inside it (typically by making better use of existing infrastructure facilities). The measured impacts on productivity also show how structural reforms can encourage technical progress in rail operations, moving the production frontier outwards (typically by encouraging better infrastructure facilities). In the context of rail operations in contiguous European economies, one of the ways in which technical progress could be achieved is via investments that lead to more seamless international rail services. This option is less easily available to APEC economies, which are spread around the Pacific Rim. In recognition of this, the current paper only makes use of the estimates of the effects of structural reforms on efficiency. Cantos, Pastor and Serrano (2010a) estimate the semi-elasticity of efficiency with respect to vertical separation as 0.025 and the semi-elasticity of efficiency with respect to free entry in freight operations as 0.083. Thus, free entry has a greater effect on efficiency than vertical separation (the relative impacts on productivity are the reverse).

Given further structural reforms in rail transport in each APEC economy, it is assumed that the rail openness indexes would all reach a value of unity. This implies vertical separation and free entry in freight operations in those economies that do not yet have them. It does not necessarily imply any change in ownership.

The above semi-elasticities can be used to calculate the resulting percentage changes in 'productivity' (a term now used more broadly than by Cantos, Pastor and Serrano 2010a) in rail operations for each APEC economy. These are shown in Figure 2.3.
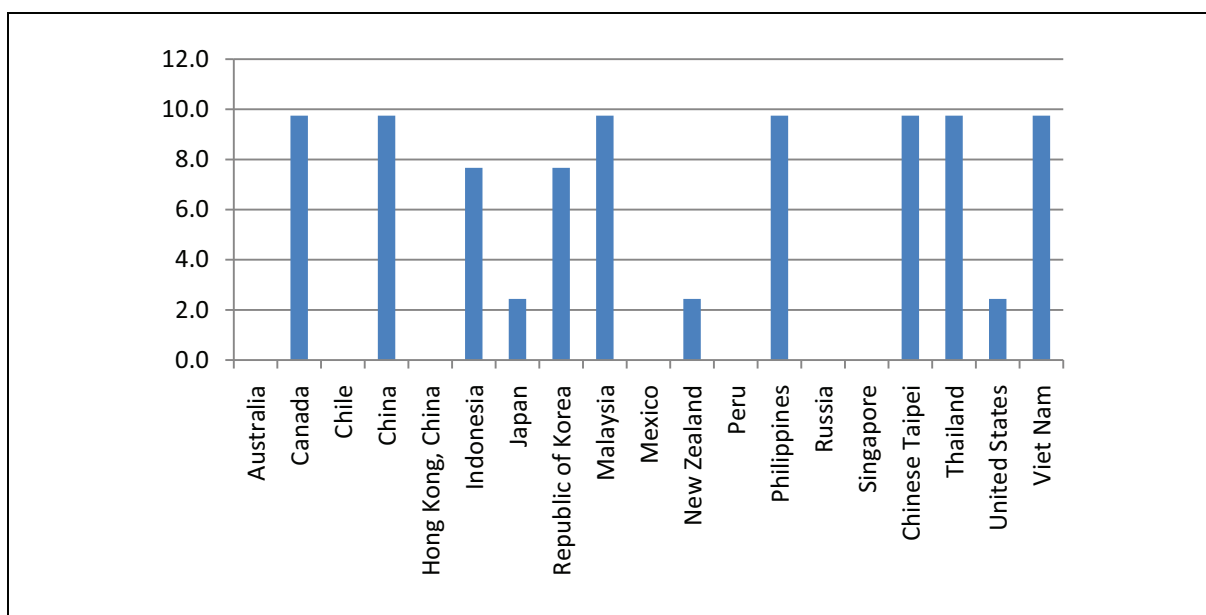
Figure 2.3: Productivity improvements from structural reforms in rail transport (%). (Source: Table 2.3 and Cantos, Pastor & Serrano 2010b).

2.3.3 Electricity and gas

The first round effects of structural reforms in electricity and gas have been derived from the econometric study by Dee (2010). She estimated the effects of policy restrictions in these sectors using the policy indexes presented in the previous section. Her measures of economic performance were electricity and gas prices to industrial users in OECD economies over the 1990–2008 period. Her controls for electricity prices were *per capita* GDP, the rate of urbanisation, the shares of hydro and nuclear in total generation and a linear time trend. Her

controls for gas prices were *per capita* GDP, the rate of urbanisation, pipeline length and a non-linear time trend (to capture the upward movement of gas input costs). Looking only at the policy coefficients that were significantly different from zero, the coefficients measuring the impact on electricity prices (measured in USD PPP/kWh) of third party access, a wholesale price pool and unbundling were -0.0032, -0.0049 and -0.0075 respectively. This means that the introduction of third party access, a wholesale price pool and unbundling would reduce electricity prices by USD0.32, 0.49 and 0.75 per kWh, respectively. The coefficients measuring the impact on gas prices (measured in USD PPP/10e+7 kcal) of retail competition and the unbundling of production/import were -30.446 and -47.5065 respectively. This means that the introduction of retail competition and unbundling would reduce gas prices by USD30.45 and USD47.51 per 10+e7kcal, respectively.

Given further structural reforms in electricity and gas in each APEC economy, it is assumed that the electricity and gas openness indexes would all reach a value of unity. This implies third party access, unbundling, wholesale markets and/or retail competition in economies that have not yet implemented these. It does not imply any change in ownership.

The above coefficients can be used to calculate the resulting percentage changes in electricity and gas prices. It remains to decide whether these price changes would come about through changes in price-cost margins or through changes in productivity, because the econometrics does not resolve the issue. Consistent with the presumption of Steiner (2000), and with anecdotal evidence in economies such as Australia that have undergone significant reform, it is assumed that structural reforms would manifest primarily as productivity improvements. The estimated improvements are shown in Figures 2.4 and 2.5. This assumption is tested later via sensitivity analysis.
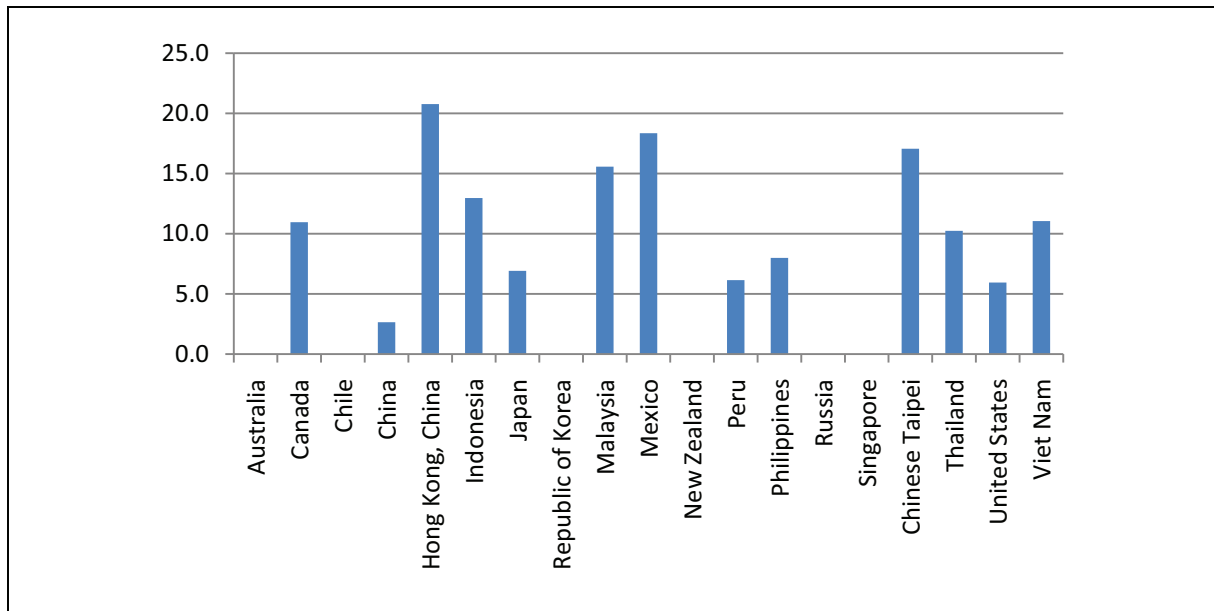
Figure 2.4: Productivity improvements from structural reforms in electricity (%) (Source: Table 2.4 and Dee 2010b)
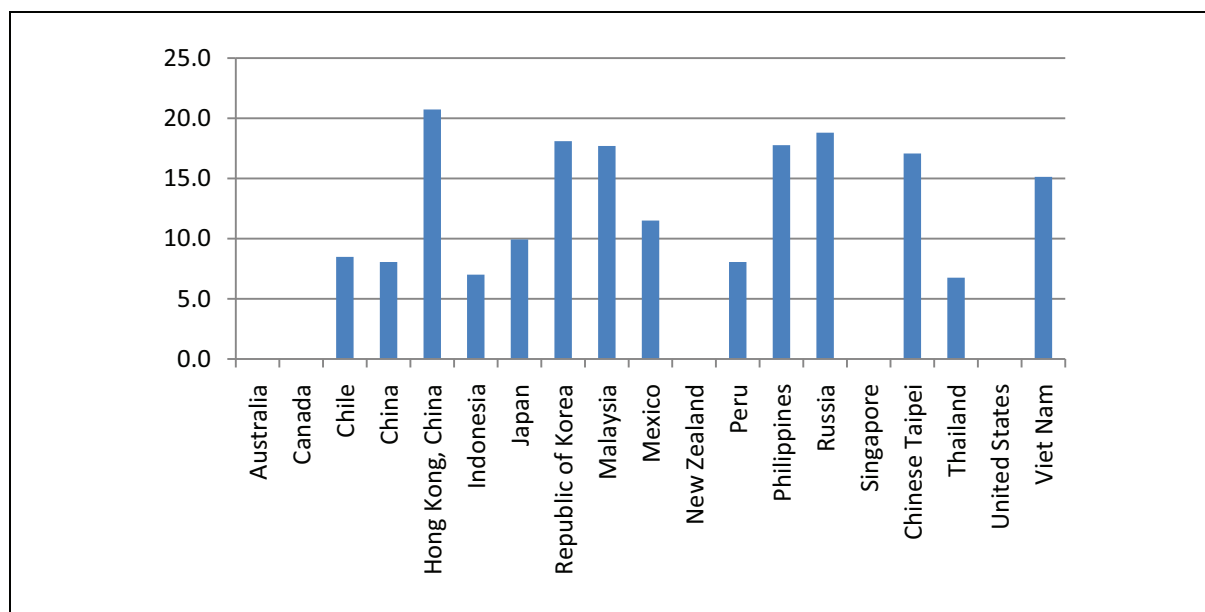
Figure 2.5: Productivity improvements from structural reforms in gas (%). (Source: Table 2.5 and Dee 2010b)

2.3.4 Telecommunications

The first round effects of structural reforms in telecommunications have been derived from an updated version of the econometric study by Warren (2000) (see Dee 2005). The main contribution of the updated study was to use a database with a slightly expanded coverage of economies, and to enter the subcomponents of the policy indexes separately into the econometric estimation. The database covered many more economies than just APEC members. The performance measures were the number of mainlines per 100 inhabitants and the number of cellular phones per 100 inhabitants. The controls in the fixed-line estimation were GDP *per capita*, household density, the percentage of mainlines connected to digital exchange and waiting lists as a percentage of mainlines. The controls in the mobile estimation were GDP *per capita* and population density. In both cases the relationship with *per capita* GDP was assumed to be cubic, to allow for 'saturation' levels of penetration. The policy variables were combinations of the indexes shown in Tables 2.6 and 2.7. Separate weighted average indexes of market access and national treatment for fixed and mobile telephony were calculated as in Warren (2000), where these indexes ranged between zero and one. The coefficients of fixed-mainline penetration with respect to market access and national treatment were 2.892 and 3.529 respectively, meaning that the full introduction of market access and national treatment would raise fixed-line penetration by 2.892 and 3.529 percentage points respectively. The coefficients of mobile penetration with respect to market access and national treatment were 1.898 and 1.075 respectively, meaning that the full introduction of market access and national treatment would raise mobile penetration by 1.898 and 1.075 percentage points respectively.

Given further structural reforms in telecommunications in each APEC economy, it is assumed that the telecommunications indexes of market access and national treatment would all reach a value of unity. These reforms would predominantly involve the removal of remaining foreign equity limits.

The above coefficients can be used to calculate the small percentage changes in fixed and mobile penetration. With the same price elasticity of -1.2 as assumed by Warren (2000), the

quantity effects can be converted to equivalent changes in price. It remains to be decided whether these changes would come about through changes in price–cost margins or through changes in productivity. In previous exercises, when strict licensing requirements limited entry, it was reasonable to assume that reforms would squeeze price–cost margins (e.g., Dee & Hanslow 2001). By now, most such entry requirements have been relaxed. Accordingly, the remaining small price reductions are assumed to accrue through changes in productivity, though once again this assumption is tested via sensitivity analysis. But as in previous exercises, the impact is assumed to be greater on foreign-invested than on domestic operators, because a greater portion of the limitations on market access and national treatment apply to them. The estimated improvements for foreign-invested operators are shown in Figure 2.6. The values for domestic operators are not shown, but are smaller.
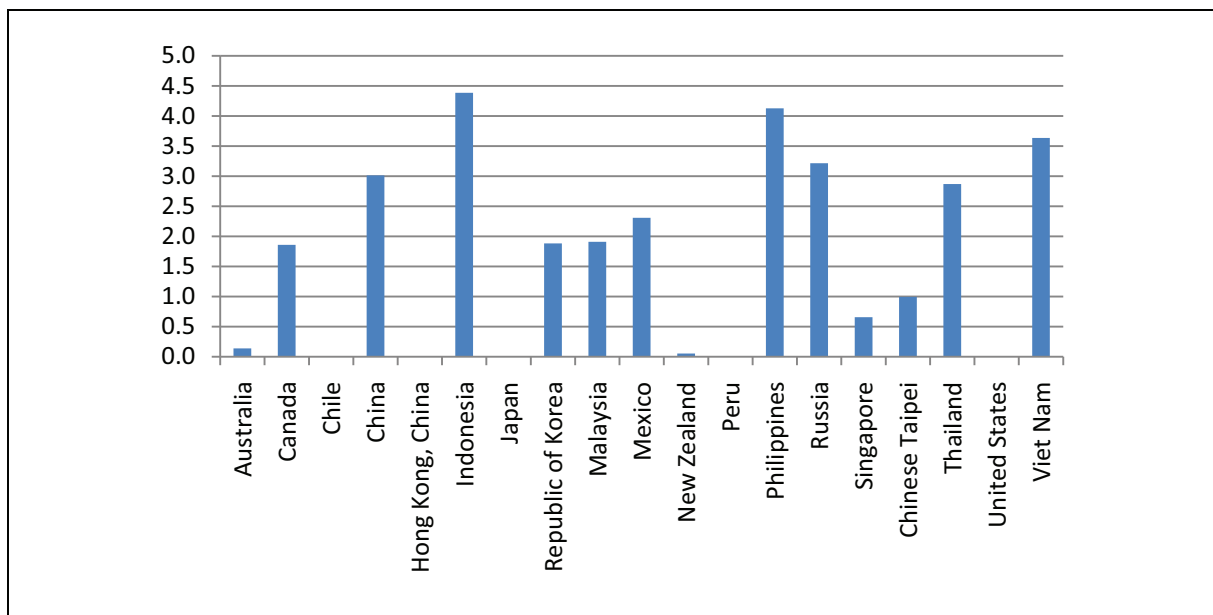
Figure 2.6: Productivity improvements from structural reforms in telecommunications (%). (Source: Tables 2.6–2.7 and Dee 2005).

2.3.5 Summary

In order to get an overall picture of the prospective reform task, Figure 2.7 presents an output-weighted average of the productivity improvements across all sectors in each APEC economy. The weighted average productivity improvements fall roughly in the range of 2% to 14%. The most extensive reform effort, and the largest resulting productivity gains (i.e., above 10%), are projected to occur in Indonesia; Malaysia; Mexico; the Philippines; Chinese Taipei; Thailand; and Viet Nam.

To put these projected first round impacts of structural reform in perspective, Figures 2.8 and 2.9 show the simple average tariff rates on agriculture and food and on manufacturing in each APEC economy. These would be the targets of further 'at-the-border' trade reforms. (Trade reform in agriculture and food would also target explicit subsidies on output and exports, and implicit subsidies on inputs, though these measures are not shown here.) The tariff estimates are derived from version 7 of the GTAP model database (Hertel 1997). The model's tariff estimates are import weighted when aggregating from GTAP's 57 sectors to the 25 sectors used in the current model. Simple averages are then taken when aggregating from 25 sectors to the two broad sectors shown in Figures 2.8 and 2.9. The average tariffs on manufacturing are in the same order of magnitude as the prospective productivity improvements from
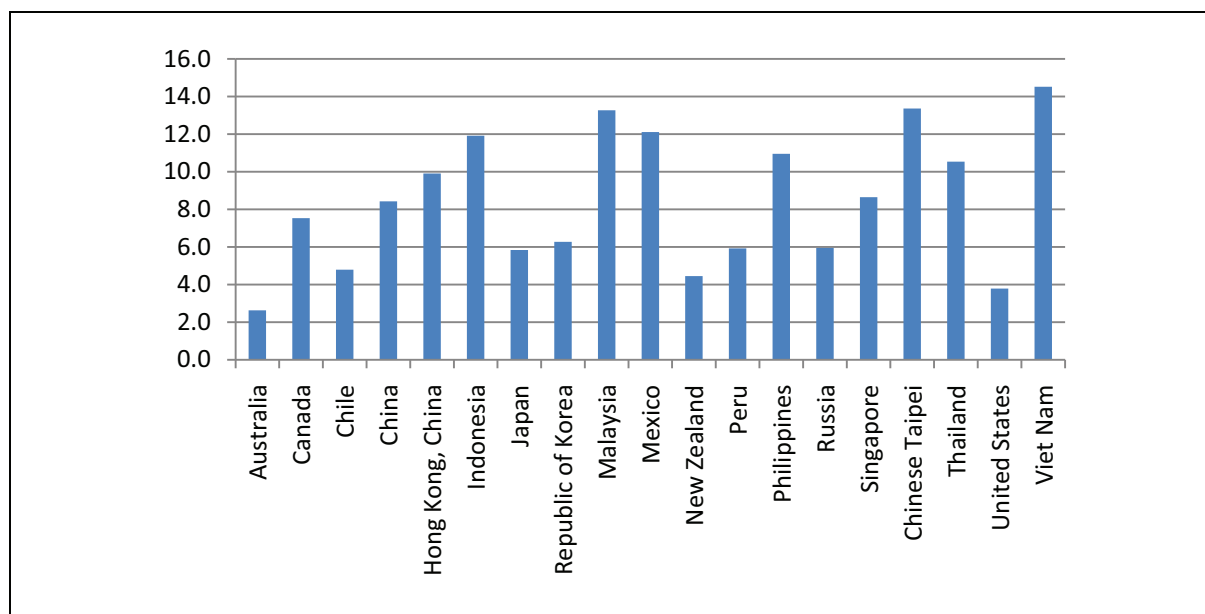
Figure 2.7: Weighted average productivity improvements from structural reforms in transport, energy and telecommunications (%). (Source*:* Figures 2.1–2.6 and GTAP model database, version 7 in Hertel 1997).

structural reforms – up to 13%. In strictly numerical terms, the average tariffs on agriculture and food in some economies are far higher – up to 45%.

The relative numerical magnitudes do not indicate relative economic significance, however. Tariffs induce large transfers from consumers to producers but much smaller welfare losses to the economy as a whole. By contrast, foregone productivity gains are a pure loss to the economy, so the welfare costs are much greater than those of a tariff of equivalent numerical size. The relative sizes are examined further in Section 2.4.
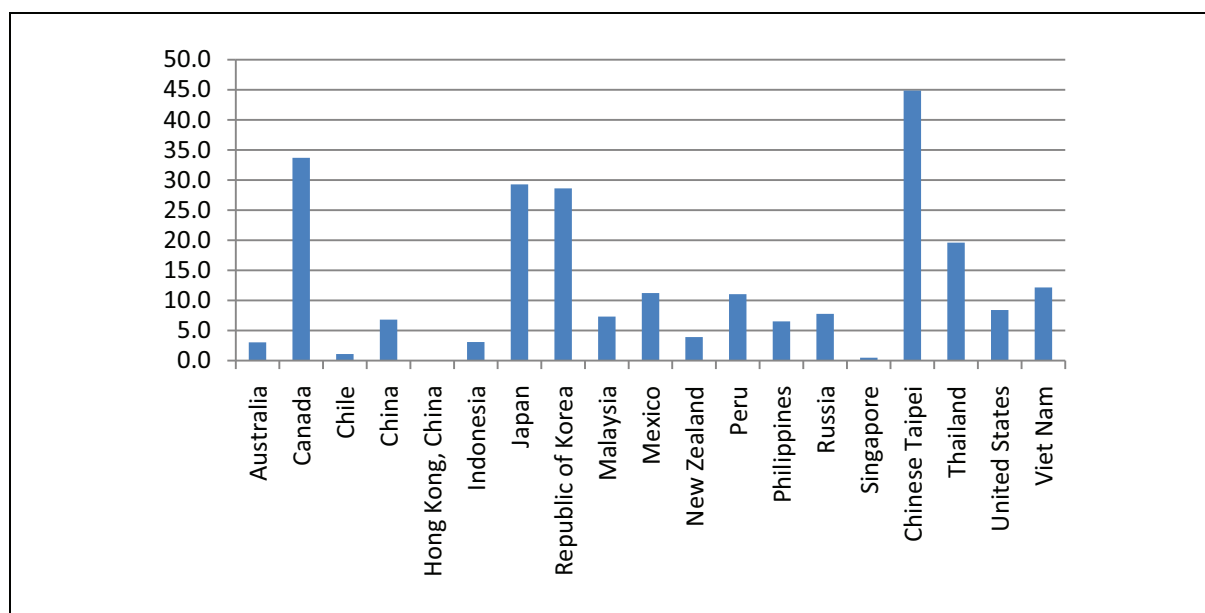
Figure 2.8: Simple average tariffs on agriculture and food (%). (Source: GTAP model database, version 7 in Hertel 1997)
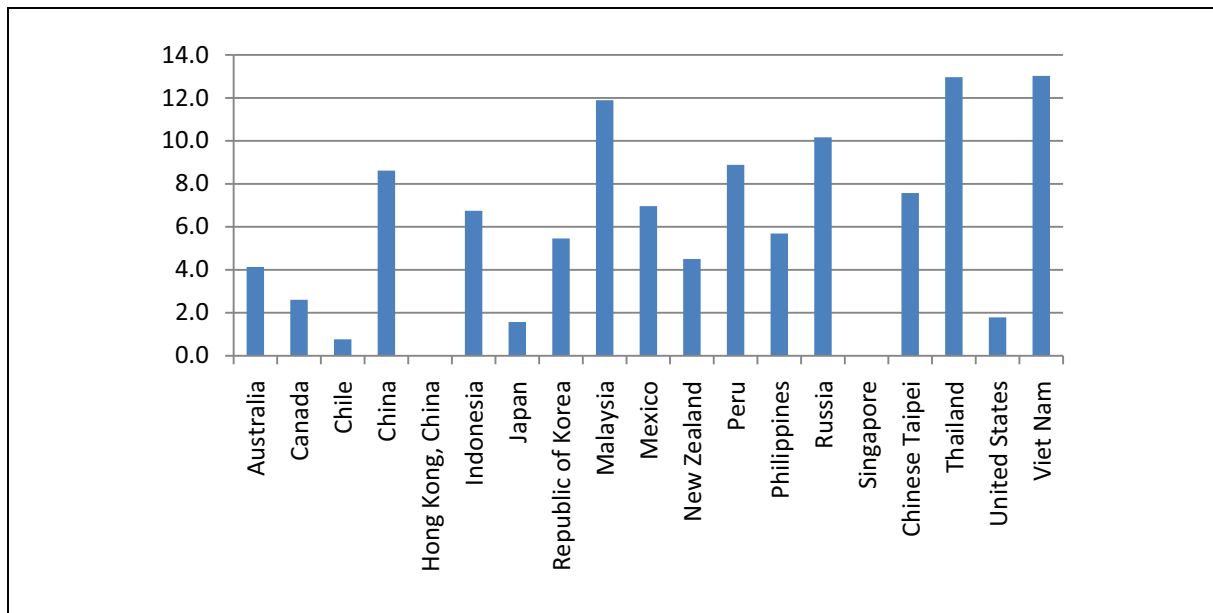
Figure 2.9: Simple average tariffs on manufacturing (%). (Source: GTAP model database, version 7 in Hertel 1997)

2.4 QUANTIFYING THE ECONOMY AND REGION-WIDE EFFECTS OF STRUCTURAL REFORMS

The economy and region-wide effects of structural reforms have been projected using FTAP, a computable general equilibrium model of the world economy that is described in Box 2.1, documented fully in Hanslow, Phamduc and Verikios (1999), and is available for download at http://www.crawford.anu.edu.au/staff/pdee.php. This model differs from the GTAP model (from which it is derived) by including a treatment of foreign direct investment, an important mode by which services are delivered.

The measure of welfare in the FTAP model takes into account not just changes in the level of activity generated in each economy but changes in the amount of income from that activity that is retained by the residents of each economy. The distinction is important in a long-run context. One of the possible impacts of productivity-enhancing reforms is that they make each economy a more attractive destination for foreign direct investment. Not all the income from that investment will necessarily stay in the economy. However, the model has a fully articulated treatment of savings, investment and capital accumulation, so it takes into account how much of the return on foreign investment is repatriated overseas, and how much is re-invested. Thus, the measure of economic well-being is related to the concept of gross national product (the income earned by residents of a region) rather than gross domestic product (the income generated in region). Hanslow (2000) has a good general treatment of welfare measures and welfare decomposition in computable general equilibrium models.

The version of FTAP used here contains 20 regions – 19 APEC regions (excluding Brunei and Papua New Guinea, which are not represented in the underlying GTAP database) and a single 'Rest of the world' region. It contains 25 sectors, shown in Table 2.8.

Box 2.1: The FTAP model – GTAP with foreign direct investment.

The FTAP model is a computable general equilibrium model incorporating services delivered via FDI. It was developed by Dee and Hanslow (2001). It differs in turn from GTAP (Hertel 1997), the 'plain vanilla' model from which it was derived, in three important respects.

Firstly, because many services are delivered primarily via commercial presence, the modelling framework includes foreign direct investment and covers the production and trading activity of foreign multinationals separately. In other words, GTAP, the conventional multi-economy model, is split out by ownership as well as location. In the current version of FTAP, foreign ownership shares are estimated in the following way. International data on FDI stocks by sector and source economy have been compiled and extrapolated where necessary by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Provisional estimates were kindly made available at the GTAP level of aggregation by Terry Walmsley. These data are scaled up from FDI stocks to the output of foreign affiliates, using FDI to sales ratios obtained from the United States International Trade Commission, and derived from the detailed statistics on the activities of foreign affiliates collected by the US Bureau of Economic Analysis. These estimates of the output of foreign affiliates by sector and source economy are then used to split out their costs and sales structures on a simple *pro rata* basis. Unfortunately, even the best statistics on the activities of foreign affiliates would not support a much more sophisticated derivation of costs and sales structures than this, and few economies collect such statistics.

Secondly, by virtue of foreign ownership, at least some of the profits of foreign multinationals will be repatriated back to the home economies. Thus the profit streams in the conventional multi-economy model have to be reallocated from the host to the home economy, after provision is made for them to be taxed in either the home or host economy. This reallocation leads to a distinction between GDP – the income *generated* in a region –and GNP – the income *received by residents* of a region. The latter forms the basis of (although is not identical to) the welfare measure in FTAP. The information on profit repatriation comes from the Balance of Payments Statistics of the IMF.

Finally, not all profits of foreign multinationals need be repatriated to the home economy. Some may be reinvested in the host economy. To account for this phenomenon and to allow for the effect that regulatory reform may have on both domestic and foreign direct investment more generally, the model makes provision for savings and capital accumulation. This is particularly important, since some regulatory barriers are aimed directly at limiting domestic or foreign equity participation. It is therefore important to capture how regulatory reform will affect not just foreign ownership *shares*, but also the *total amount* of productivity capacity available to an economy. National savings rates are derived from the macroeconomic data in the International Financial Statistics and Balance of Payments Statistics of the IMF. Government savings rates are derived from the Government Finance Statistics of the IMF. Household savings rates are calculated as a residual.

The FTAP model also differs from GTAP in other respects. In particular, it allows for firm-level product differentiation, economies of scale and large-group monopolistic competition. This is also important, since services tend to be highly specialised, being tailored to the needs of individual customers. In the current version, economies of scale are assumed to be regional for services and global for all other sectors (Dee 2003).

Source: Based on Dee & Hanslow 2001.

Table 2.8: FTAP model sectors.

Agriculture and food	Other primary	Manufacturing	Services
Grains	Forestry and fishing	Textiles and clothing	Electricity
Livestock and meat	Mining	Wood and paper products	Gas
Dairy		Chemicals	Construction
Other agriculture and food		Metals	Trade
		Fabricated metal products	Other transport
		Motor vehicles	Water transport
		Other transport equipment	Air transport
		Electronic equipment	Communication
		Other machinery and equip.	Other services
		Other manufacturing	

Source: FTAP model.

The first round impacts of prospective structural reforms in each economy are modelled via the productivity improvements to the transport, energy and telecommunications sectors shown in Figures 2.1 to 2.6. In each sector the productivity improvements are applied to domestic production, whether domestically owned or foreign invested, although as noted above the productivity shocks to domestic telecommunications firms are smaller than those to foreign-invested firms. In the case of rail transport, the productivity improvement can only be applied to a bigger 'Other Transport' sector, which also includes road transport and storage. Detailed input–output data available for the USA and Australia suggest that the rail industry could account for about 14% of this bigger aggregate, so 14% of the productivity improvements from Figure 2.3 is applied to the bigger sector.

In air and maritime transport the productivity improvements are also applied to the international air and maritime transport margins used to transport merchandise out of each economy. In the model, as in the real world, such transport margins could be provided by transport operators in the source economy, the destination economy or any third party. As the econometrics of Sourdin (2010) demonstrates, the regulatory restrictions in these sectors currently penalise all these transport providers.

In an alternative treatment of structural reform, half of the domestic gains are modelled as accruing in the form of productivity gains and half as reductions in the price-cost margins of domestically located service providers. This treatment is more in line with recent findings for the insurance sector, where licensing restrictions on entry still apply (Dee & Dinh 2008). It is not possible to provide a comparable 'split' treatment of the impact on international transport margins, because the FTAP model, like its GTAP source, does not allow for 'taxes' on international transport margins. In this alternative treatment, the initial 'tax equivalents' of regulatory restrictions on domestic producers are injected into the model's database in as neutral a fashion as possible while maintaining database balance (using an FTAP analogue of GTAP's Altertax procedure, Malcolm 1998), before being eliminated via a policy simulation. In the FTAP theoretical structure, the rents from such 'tax equivalents' in services accrue to producers rather than to the government.

The FTAP model provides a long-run snapshot of how different each economy would look about 10 years after the reforms, compared to the situation at that same point in time if the reforms had not taken place. During the 10-year adjustment period, many other changes would affect each economy but they are not taken into account in the current analysis. For this reason, the results should not be interpreted as indicating the likely changes that would occur over time – this would require all changes, not just those in regulatory restrictions, to be taken into account.

The distinction is important to keep in mind. Sometimes, to aid fluency, the results are couched as if key indicators 'rise' or 'fall'. This does not mean that the indicators would be higher or lower than they are now. It means that at some future time they would be higher or lower than they would otherwise be. In both cases, in a growing economy, they could be higher than they are now.

2.4.1 The economy and region-wide effects of structural reforms

The projected effects of the structural reforms, undertaken jointly, on each APEC economy are shown in Figure 2.10, where to normalise for economic size, the absolute welfare gain in each economy has been expressed relative to its initial GDP. As noted, welfare changes give the effects on the economic well being of the residents in each economy, while real GDP

measures the effects on its level of activity. Figure 2.11 also shows the projected effects on real GDP, measured as the percentage deviations from baseline, 10 years after the structural reforms.
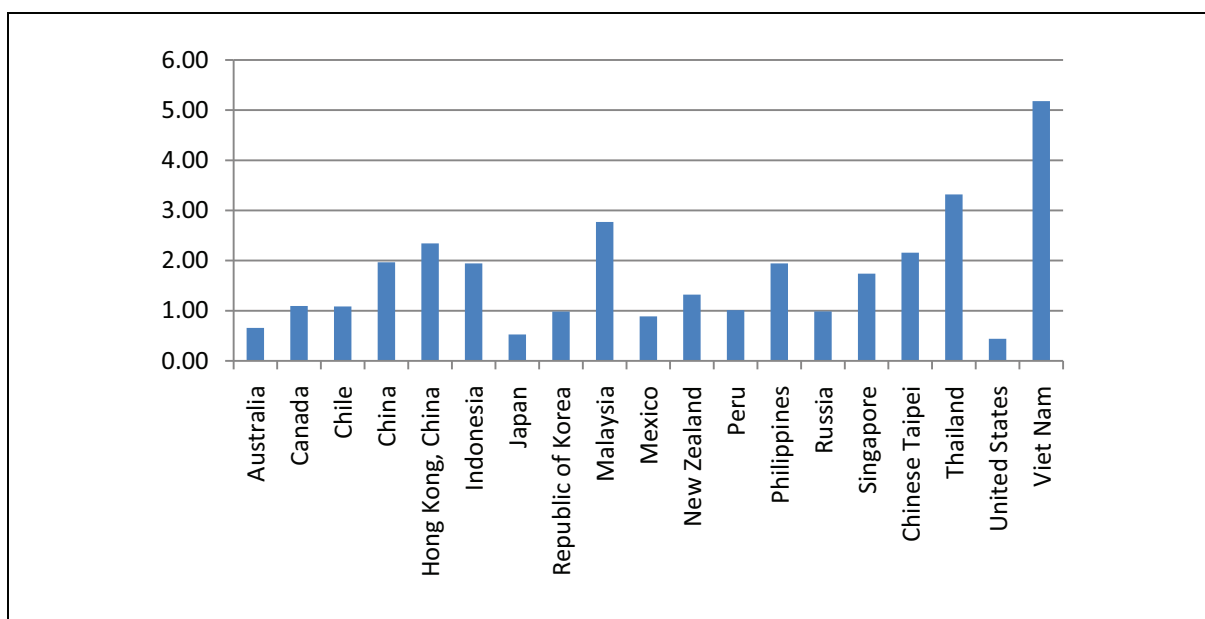

Figure 2.10: Welfare gains from structural reforms, relative to initial economic size (%). (Source: FTAP model projections)
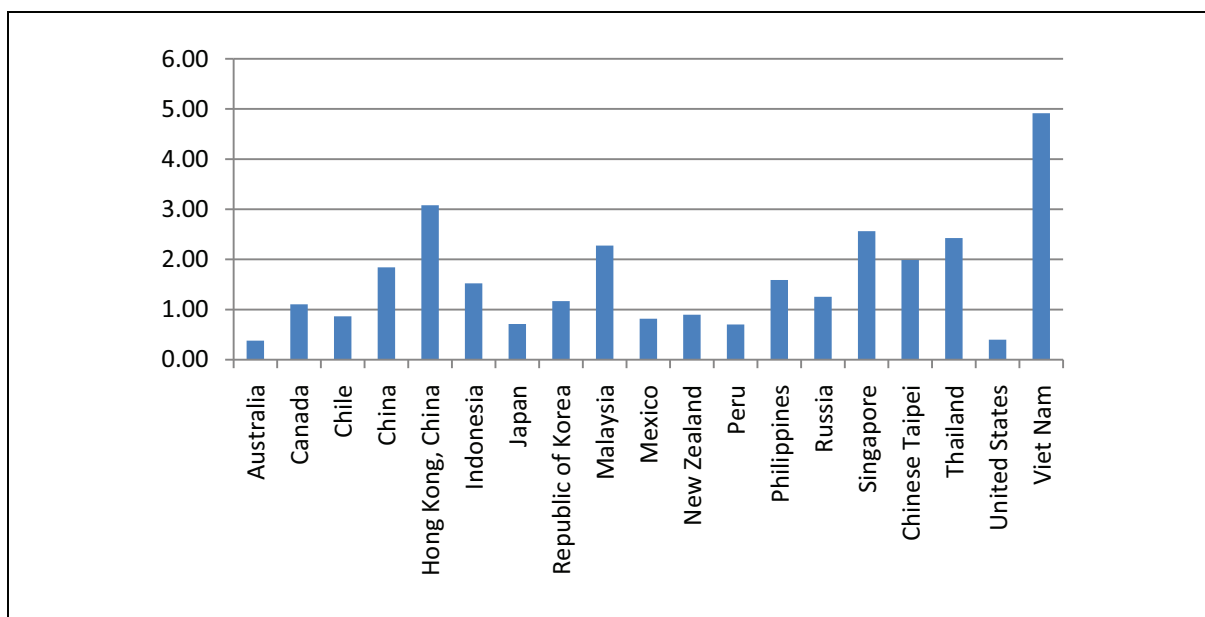

Figure 2.11: Gains in real GDP (% deviation from baseline). (Source: FTAP model projections)

In both cases, not surprisingly, there is a strong correlation between the gains from reform and the size of the reform task. The biggest gains in both welfare and real GDP, at about 5%, are projected to occur in Viet Nam, where the reform task is largest. Across all APEC economies, the simple correlation coefficient between the welfare gains in Figure 2.10 and the average productivity improvement in Figure 2.7 is 0.75. The correlation between the real GDP gains in Figure 2.11 and the average productivity improvements in Figure 2.7 is 0.71. The latter is slightly smaller than the former because economic activity in each economy is affected, more so than welfare, by reforms in other economies, not just reforms at home.

To get an initial indication of the extent of these 'cross' effects, Figure 2.12 shows the proportion of the welfare gain in each economy that is attributable to reforms at home, relative to reforms in all other APEC economies. The first observation is that, in all economies, an overwhelming proportion of the gains come from reforms at home rather than reforms in other economies. Thus, while the gains from joint reforms are considerable, there is no compelling reason for each APEC economy to wait for others to start.
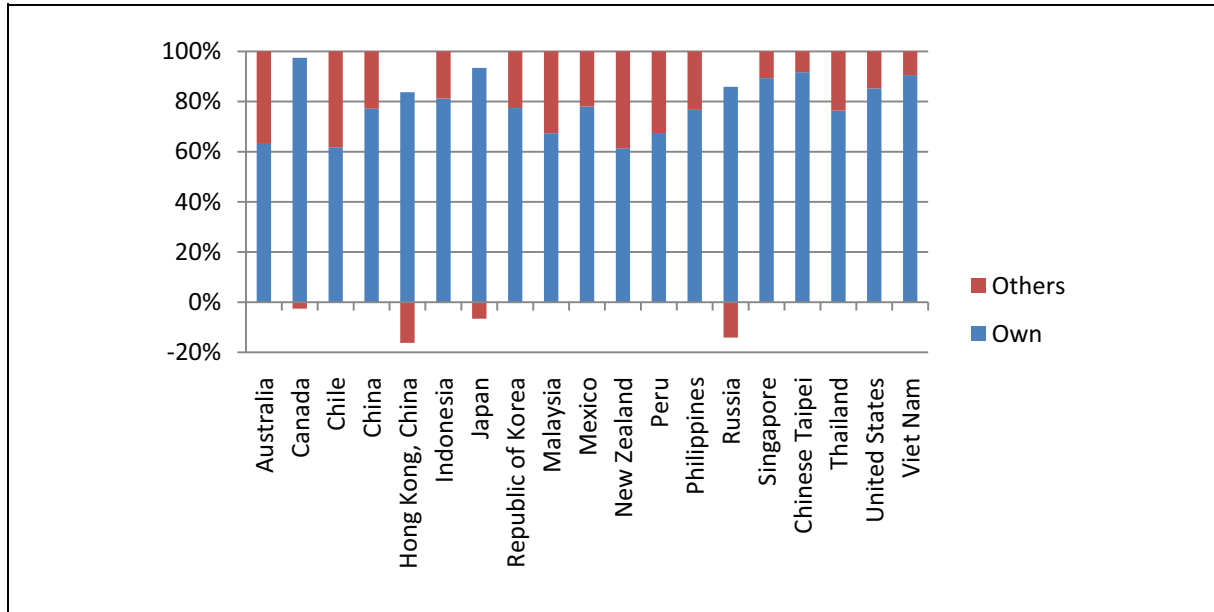
Figure 2.12: Contribution to welfare from own and others' structural reforms (% of total). (Source: FTAP model projections)

The second observation is that in most APEC economies there are small gains to be had from the reforms of others. This is not a foregone conclusion, because productivity improvements are typically a double-edged sword – while they increase incomes in other economies and can encourage them to buy more from the home economy, they also improve the price competitiveness of other economies and induce substitution away from the home economy. Typically in these types of simulations, the latter effects dominate. The difference here is that structural reforms in other economies also reduce the cost of transporting merchandise exports from the home economy, because in most APEC economies a large portion of that transport task is undertaken by foreign rather than domestic transport operators. So this restores the balance in favour of the home economy.

The three APEC economies that are not projected to gain from reforms elsewhere in the APEC region – Hong Kong, China; Japan; and the Russian Federation – all experience gains from their own reforms. Because Hong Kong, China is already an efficient and substantial supplier of maritime transport services to the rest of the region, it is projected to lose its relative position as others become more efficient in maritime services. Russia is already relatively efficient in electricity generation, having undertaken a virtual revolution in the organisation of its electricity sector in recent years, but it is projected to lose from more intensive competition in energy-intensive products as others become more efficient in electricity generation. Japan is also projected to lose from reforms in the gas sector in other economies. As will be seen later, one of the sectors that is often 'crowded out' in relative terms from these reforms is the motor vehicle sector, and Japan is a significant producer of motor vehicles, not only at home but also via its foreign direct investments elsewhere in the region. Figure 2.13 confirms these sectoral sources of loss to each of these economies.
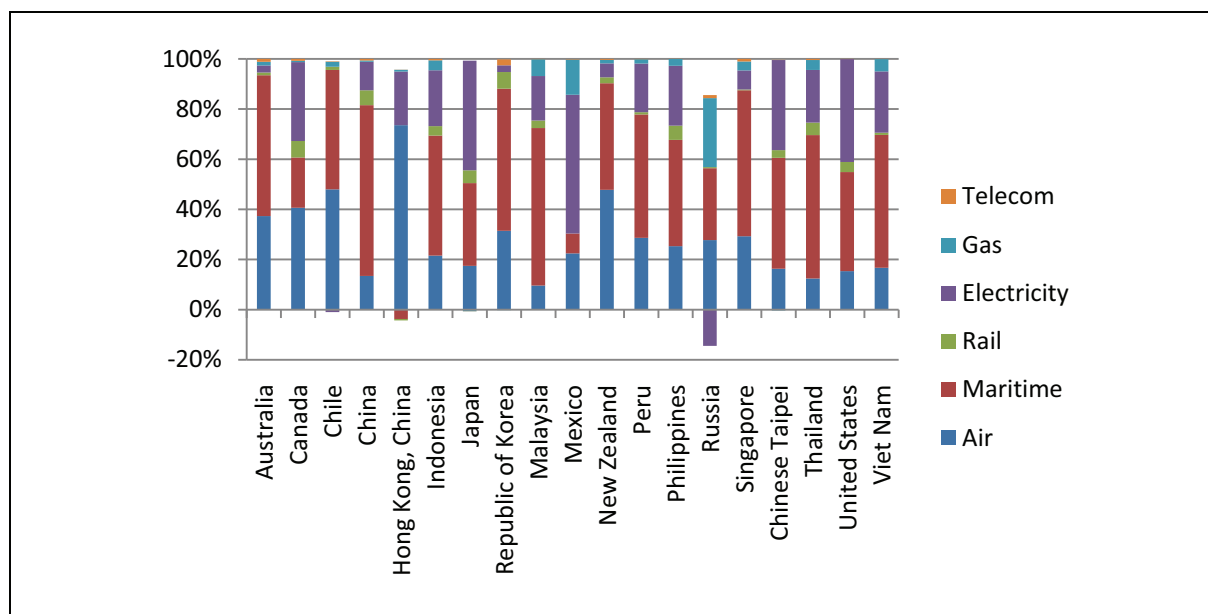
Figure 2.13: Contribution to welfare from structural reforms in each sector (% of total). (Source: FTAP model projections)

More broadly, Figure 2.13 gives the percentage contributions to the overall gains in each economy from the structural reforms in each sector. The biggest gains tend to come from reforms in air and maritime transport, because as Figures 2.1–2.6 demonstrate, this is where the biggest reforms tend to occur.

2.4.2 Putting the gains in perspective

Across the whole APEC region, structural reforms in transport, energy and telecommunications are projected to generate USD175 billion a year in additional real income (in 2004 dollars) relative to what would have accrued had no reforms occurred. This is a snapshot of the gains after a 10-year adjustment period.

These gains can be put in perspective by comparing them to the potential gains from further at-the-border trade reform. Complete liberalisation of all remaining trade barriers in agriculture and food, other primary products and manufacturing by all APEC economies is projected to generate real income gains of just over USD100 billion a year after about 10 years. These gains would be generated in sectors that currently produce about USD16 300 billion in output annually. This compares with the output of USD 3700 billion annually in the transport, energy and telecommunications sectors that are undergoing the structural reforms.

APEC-wide, therefore, the projected gains from the structural reforms are almost twice as big as the gains from liberalisation of merchandise trade. Yet the sectors where the structural reforms are occurring are less than a quarter of the size of those engaged in merchandise trade. When structural reforms lower real production costs rather than just squeeze profit margins, they can generate a 'bang for the buck' that is much greater than from trade reforms.

As noted, however, it is not always certain that the structural reforms considered here would have their first round effects on productivity levels rather than price–cost margins, although there are *a priori* arguments in favour of this treatment. As a sensitivity test, half of the domestic gains are modelled as accruing in the form of productivity gains and half as

reductions in the price–cost margins of domestically located service providers. For technical reasons, the impact on international transport margins continues to accrue as a productivity gain, as before. In this alternative treatment, the APEC-wide real income gains from structural reforms are smaller, at USD116 billion a year. Part of this accrues from the domestic impacts of reform, which are now about 60% of those previously (about USD86 billion a year rather than USD145 billion a year). The remaining gains accrue from the impacts on international transport margins, which are the same as before (about USD30 billion a year).

2.4.3 Adjustment costs

As the term suggests, structural reforms cannot generate significant gains without also generating significant structural adjustments.

Computable general equilibrium models can help to identify and quantify the extent of structural adjustments, measured by the relative gains and losses to sectoral output and employment in each economy. However, in a model with 20 regions and 25 sectors, the amount of detail that could potentially be presented is considerable (full detail is available on request from the author). In an attempt to condense the detail, Figures 2.14 and 2.15 show the output-weighted average, across all APEC economies, of the projected deviations from
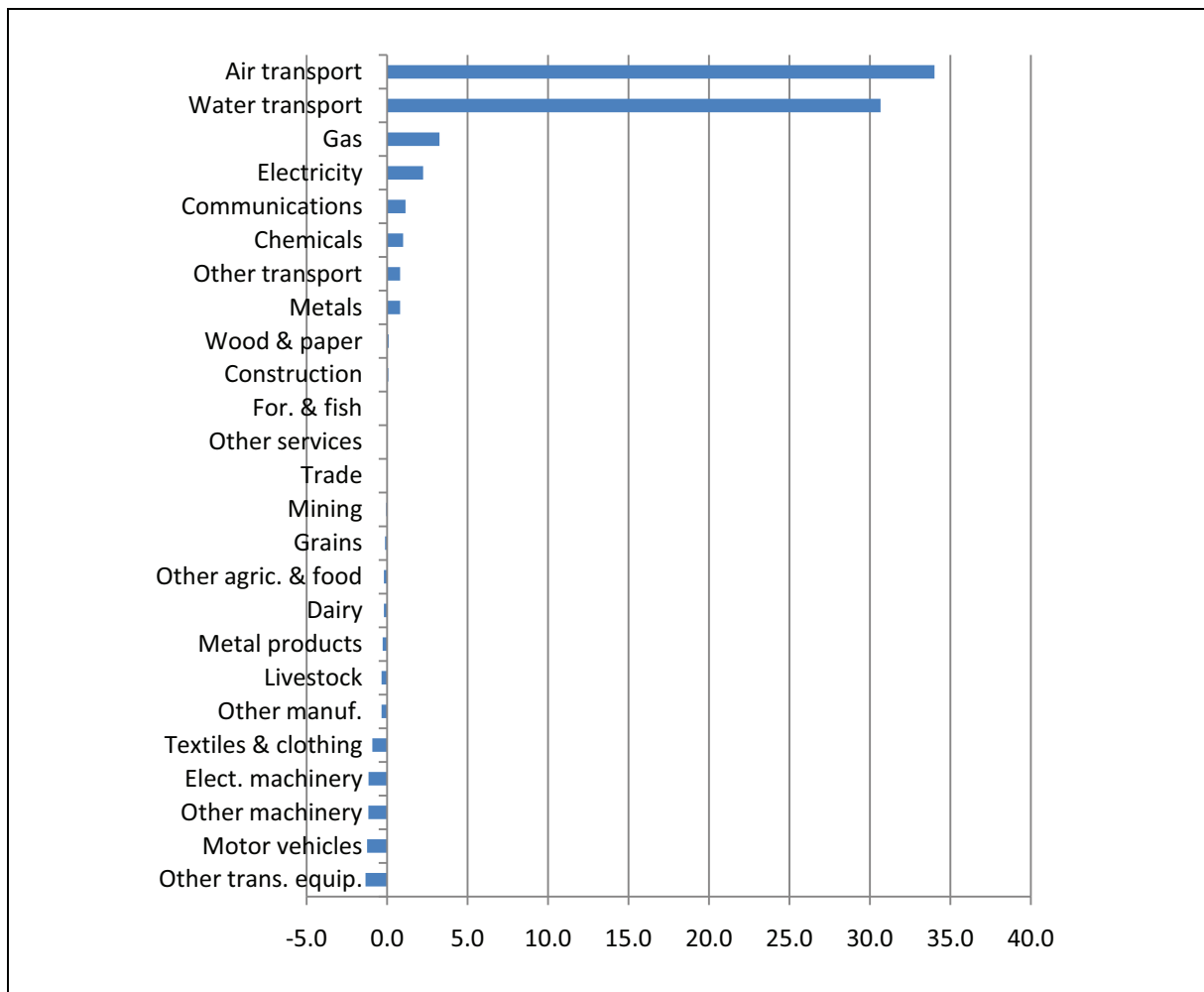

Figure 2.14: Deviation from baseline in sectoral output from own structural reforms – weighted average of all APEC economies (%). (Source: FTAP model projections)

baseline in sectoral output in each economy. Figure 2.14 shows the 'typical' (in this sense) sectoral response to an economy's own reforms. Figure 2.15 shows the 'typical' response in one economy to reforms by all APEC economies. Obviously, the percentage deviations from baseline in at least some individual economies are more severe than the weighted averages. The extremes are examined shortly, in the context of employment changes rather than output changes.
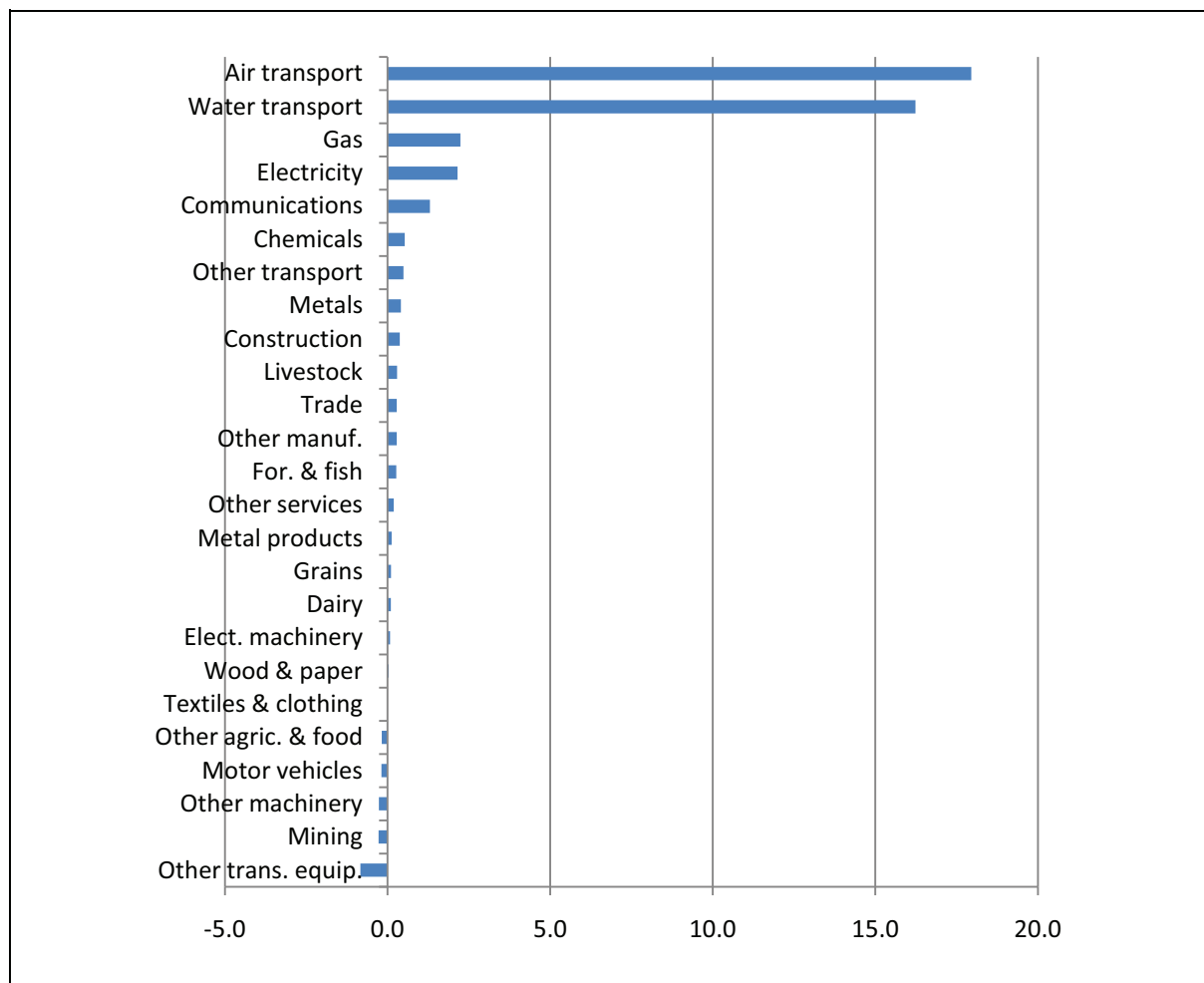

Figure 2.15: Deviation from baseline in sectoral output from all structural reforms – weighted average of all APEC economies (%). (Source: FTAP model projections)

In the typical response to 'own' reforms, the sectors with output higher than otherwise are the services sectors undergoing the reforms. Their output deviations tend to be in direct proportion to their reform effort. Other sectors to gain in relative terms are those that are heavy users of these services. They tend to be metals (an intensive user of electricity), chemicals (an intensive user of gas) and wood and paper products (an intensive user of domestic transport services). Construction also typically gains slightly from the additional impetus given to industry investment.

The sectors projected to lose in relative terms from an economy's own structural reforms are typically those that do not fall into the above categories. They suffer indirectly from higher wages and rates of return, effects that are induced primarily by expansions in overall activity. Industries typically losing in this way include textiles and clothing, motor vehicles, other transport equipment, electronic equipment and other machinery and equipment. The relative losses in industry output in these sectors are relatively minor, however.

When reforms in other APEC economies are taken into account, the deviations from baseline in sectoral output are typically smaller than for 'own' reforms. Thus structural reforms in other APEC economies can play a useful role in helping to cushion the adjustment costs of reforms at home, even if they do not add greatly to the overall gains from reform.

Furthermore, a slightly wider set of industries are projected to gain in relative terms, including sectors that are intensive users of international transport margins and that benefit from transport reforms elsewhere. They can include meat and livestock, forestry and fishing, grains, dairy and other manufacturing. The relative output losses are therefore concentrated in a smaller set of industries, but are typically not as severe as with own reforms because of the gains from reforms elsewhere.

Figures 2.14 and 2.15 give an indication of the typical industry output responses to reforms. But they do not show the full extent of adjustment costs. They show average responses rather than extreme ones and in sectors undergoing productivity improvements the employment effects can be much more severe than the output effects. The essence of productivity improvement is that an industry can produce more with less and, as a result, input usage can fall even as output rises.

To capture the full extent of adjustment costs, Figure 2.16 shows, for each industry, the biggest relative gain and the biggest relative loss in sectoral employment of unskilled labour projected in any of the APEC economies. In air transport, for example, Figure 2.16 shows that the biggest relative gain in unskilled employment is projected to be about 150% (Hong Kong, China) while the biggest relative loss in unskilled employment is projected to be about 10% (the USA). In water transport the biggest relative gain is shown to be about 90% (Thailand), while the biggest relative loss is almost 50% (Hong Kong, China). In dairy the biggest projected gain is over 70% (Malaysia, from a very small base), while the biggest relative loss is around 4% (Chinese Taipei). As the examples show, the particular economies in which the minimums and maximums occur can vary from sector to sector. The corresponding diagram showing the minimum and maximum changes in employment of skilled labour is similar, so is not shown here.

By far the biggest relative losses in unskilled employment are projected to occur in the gas industry in Singapore (67%), the water transport industry in Hong Kong, China (46%) and the electricity industry in Chinese Taipei (34%). The first two cases are where substantial reform in the home economy has already taken place. These sectors lose employment, not as a result of their own productivity improvements but because the electricity or gas using industries in these economies lose their position as other economies reform.

These relative employment losses need to be kept in perspective. If unskilled employment in maritime transport in Hong Kong, China is projected to be 46% lower than otherwise after 10 years, then annual economic growth of 6.2% a year over each of those 10 years would ensure that the relative loss did not translate into an absolute one. Such a growth rate is not unreasonable for Hong Kong, China's economy, particularly with the added boost to economic activity arising from reforms in other sectors. Similarly, if unskilled employment in electricity in Chinese Taipei is projected to be 34% lower than otherwise after 10 years, then annual economic growth of just over 4% a year would ensure that the relative loss did not translate into an absolute one. Perhaps the only sector that might experience an absolute employment loss as a result of the reforms considered here would be the gas industry in Singapore (where annual growth of over 9% would be required to prevent this outcome).
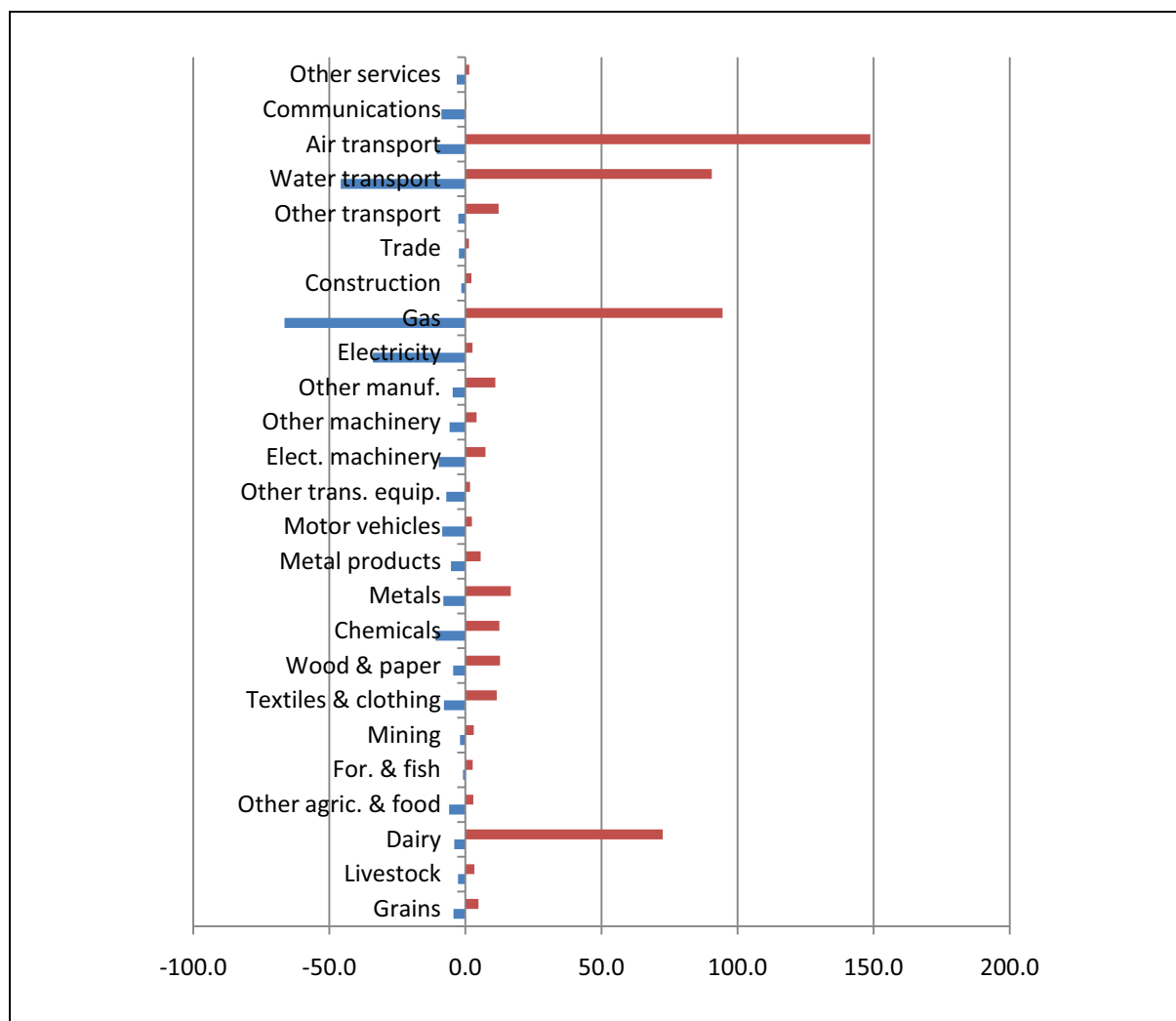
Figure 2.16: Deviation from baseline in unskilled employment from all structural reforms – APEC minimum and maximum (%). For clarity of presentation, the biggest relative employment gains in water and air transport, which are projected to occur in Viet Nam, are suppressed. If the more than four-fold increase in unskilled employment in these sectors were shown, it would unduly compress the results for other sectors. (Source: FTAP model projections)

A further consideration is that while structural reforms may require significant reallocations of unskilled labour between sectors, they also generate higher real wages for unskilled workers. Figure 2.17 shows projected increases in real wages of unskilled labour of up to 6% as a result of structural reforms throughout the APEC region (the increases in skilled wages are similar).

One of the best ways that APEC economies can guard against the adjustment costs associated with structural reforms is to maintain healthy underlying rates of economic growth. To some extent, structural reforms provide their own reward, in terms of stimulating activity and increasing the resilience of the economy, but prudent macroeconomic management is also crucial.

For the particular structural reforms considered here, there is not much prospect that adjustment costs could be cushioned by accompanying the structural reforms with trade reforms. The reasons were hinted at earlier – the sectors that tend to lose in output terms from these structural reforms include textiles and clothing and motor vehicles, sectors that would also be penalised in at least some economies from trade reforms. However, there are prospects that a wider set of structural reforms could be more complementary with trade

reforms, in terms of cushioning adjustment costs. Such offsets are more likely if reforms targeted at the traded goods sectors are combined with reforms in sectors that cater more to the needs of households (e.g., Dee 2008).
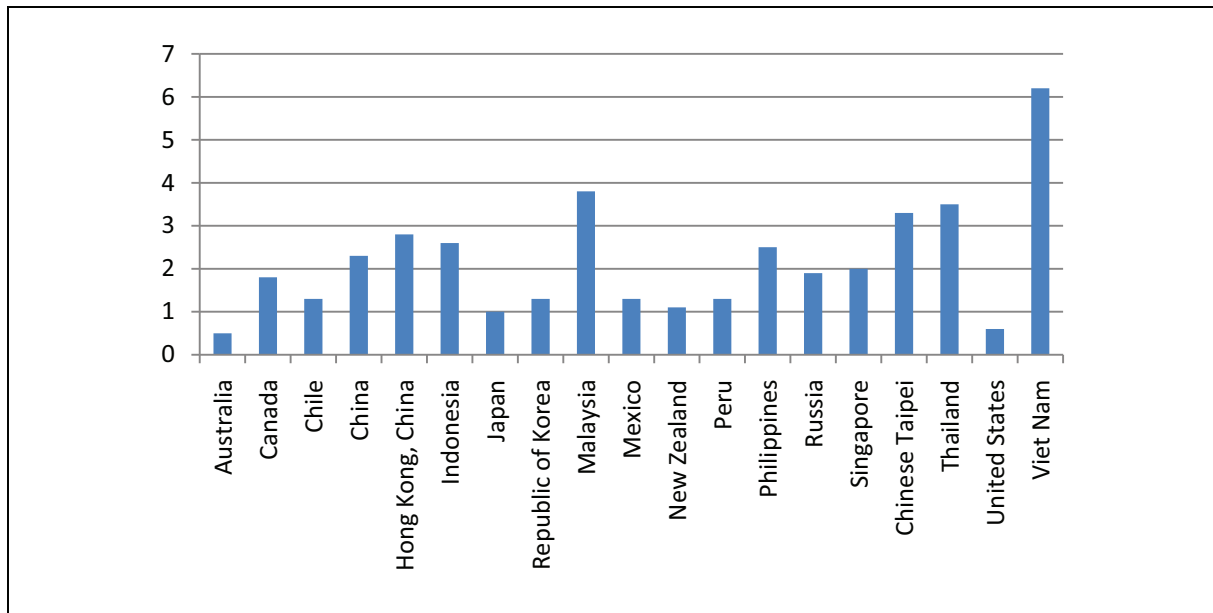

Figure 2.17: Deviation from baseline in real wages of unskilled labour arising from all structural reforms (%). (Source: FTAP model projections)

2.5 CONCLUSION

This paper has examined the economy- and region-wide effects of prospective structural reforms in the transport, energy and telecommunications sectors of APEC economies. Key to these reforms is the introduction of additional competition into each sector.

In air transport this implies a range of reforms to air services agreements, to entry conditions for domestic and foreign carriers and to ownership. In maritime transport it implies the dismantling of any remaining entry restrictions, quotas or cargo sharing arrangements and the granting of national treatment to foreign-owned carriers located domestically. In rail transport it implies vertical separation and free entry in freight operations in those economies that do not yet have them. In electricity and gas it implies third party access, unbundling, wholesale markets and/or retail competition in economies that have not yet implemented them. Note that no privatisation of incumbents is assumed in rail, electricity or gas. In telecommunications, the reforms predominantly involve the removal of remaining foreign equity limits.

The estimated first round impacts of these reforms suggest that they could lead to weighted average productivity improvements in the range 2% to 14% across the sectors involved. The most extensive reform effort, but the largest productivity gains (i.e., above 10%), are projected to occur in Indonesia; Malaysia; Mexico; the Philippines; Chinese Taipei; and Viet Nam.

There is strong correlation between the sizes of the reform tasks and the economy-wide gains they generate. Furthermore, in all economies, an overwhelming proportion of the gains come from reforms at home rather than in other economies. Thus, while the gains from joint reforms are considerable, there is no compelling reason for each APEC economy to wait for others to start.

Nevertheless, most APEC economies are also projected to reap small gains from reforms elsewhere. This is not a foregone conclusion, because productivity improvements elsewhere are a double-edged sword. The income and price effects on the home economy work in opposite directions, and very often the adverse price effects dominate. The difference here is that structural reforms in other economies also reduce the cost of transporting merchandise exports from the home economy. In most cases, this restores the balance in favour of the home economy.

Across the whole APEC region, structural reforms in transport, energy and telecommunications are projected to generate USD175 billion a year in additional real income (in 2004 dollars), relative to what would have accrued had no reforms occurred. This is a snapshot of the gains after a 10-year adjustment period.

APEC-wide, the projected gains from these structural reforms are almost twice as big as the gains from further liberalisation of merchandise trade. Yet the sectors where the structural reforms occur are less than a quarter of the size of those engaged in merchandise trade. When structural reforms lower real production costs, even by half as much as is estimated here, they generate a 'bang for the buck' that is much greater than from trade reforms. The findings of this paper therefore vindicate the decision of APEC leaders to move beyond a 'border' agenda to one that focuses on behind-the-border reforms.

Yet structural reforms cannot generate significant gains without also generating significant structural adjustments. This paper has also examined the expected size and extent of those adjustments.

At the sectoral level, the projected output gains tend to be in the services sectors undergoing reform and in the sectors that use those services intensively. These can include metals (intensive users of electricity), chemicals (intensive users of gas), wood and paper products (intensive users of domestic transport services), and a range of industries (meat and livestock, forestry and fishing, grains, dairy, other manufacturing) that are intensive users of international transport services. Construction is typically also projected to gain slightly from the additional impetus given to industry investment.

The sectors projected to lose in relative terms are typically those that do not fall into the above categories. They suffer indirectly from higher wages and rates of return, effects that are induced primarily by the expansions in overall activity. Industries typically losing in this way include textiles and clothing, motor vehicles, other transport equipment, electronic equipment and other machinery and equipment.

The relative losses in industry output in these sectors are relatively minor, however, and they are even smaller when reforms in other APEC economies are taken into account. Thus, structural reforms in other APEC economies can play a useful role in helping to cushion the adjustment costs of reforms at home, even if they do not add greatly to the overall gains from reform.

The employment effects of structural reforms can be significant. The essence of a productivity improvement is that an industry can produce more with less. As a result, input usage can fall, even when output rises. Sectors which according to the modelling lose employment to a relatively large extent do so not as a result of their own productivity improvements but because the home industries that use their services lose their position as other economies reform.

In extreme cases, modelling indicates that relative losses in unskilled employment in a particular sector after 10 years can accumulate to upwards of 30%. But this modelling result needs to be kept in perspective. Employment changes occur over time and can be addressed through targeted structural assistance measures. Secondly, as long as an economy grows overall employment will increase, so the modelling shows that structural reforms may require significant relative shifts of labour across sectors over time. Thirdly, the model projects higher real wages for all workers in all economies. Modelling and real world examples demonstrate that displaced workers earn higher real wages in their new occupations.

To reiterate, employment opportunities overall depend on the growth of an economy. Thus, one of the best ways that APEC economies can guard against any adverse employment effects of structural reform is to maintain healthy underlying rates of economic growth. Structural reform itself makes a contribution to this goal, since it adds to productivity, stimulates activity and increases the resilience of the economy, but prudent macroeconomic management is also crucial.

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