PSTN OTA rate structures

A report for Optus

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1. Summary

1. The Australian Competition and Consumer Competition (ACCC) released its discussion paper, Public inquiry to make final access determinations for the declared fixed line services ("the Discussion Paper"), in April 2011. This report focuses on one aspect of the Discussion Paper, i.e. the appropriate structure of charges for the public switched telephone network (PSTN) originating and terminating access services (PSTN OTA).

2. The ACCC considers two alternatives for the charge structure for PSTN OTA:

   - Option 1 - an updated version of the existing charge structure in which charges differ by geographic area and there is both a timed usage charge as well as a flagfall charge paid when a call is successfully connected; and
   - Option 2 - a nationally uniform timed usage rate, with no flagfall component.

3. We have assessed the choice of charge structure with regard to the ACCC's statutory criteria. We conclude that a nationally uniform single usage charge for PSTN OTA (with no flagfall charge) will best promote efficiency and competition while also being consistent with the legitimate business interests of the access provider. Following is a summary of the reasons for our conclusion.

   Should PSTA OTA prices be geographically averaged?

4. A key finding of economic theory is that charges should be based on the marginal costs of the service, i.e. the change in total costs resulting from a small change in the volume of the service supplied, together with a mark-up to ensure that the firm is also able to recover its fixed and common costs.[1] The efficient level of the mark-up should be determined with regard to how sensitive customer demand is to changes in the price of that service, that is, the price elasticity of demand.

5. The implication of economic theory is that geographically differentiated prices will only be efficient if there are significant differences in marginal costs and/or elasticities between geographic areas.

6. We have analysed the marginal costs of PSTN OTA by reference to the network elements used in the supply of the services as well as by examining the costs that vary with traffic in the Analysys Cost Model prepared for the ACCC. We found that the costs of the network elements that comprise the

[1] A service-specific fixed cost is a cost that is incurred to initially supply a service but which does not vary with

marginal costs do not vary materially between geographic areas. Further, there is likely to be significant excess capacity in Telstra's actual PSTN network because traffic is declining and this also supports the conclusion that actual marginal costs will be unlikely to vary by geographic area.

7. We have also found no reliable evidence that elasticities of demand for PSTN OTA differ between geographic areas. Given that there is no evidence of material differences in marginal costs or demand elasticities between geographic areas we conclude that a nationally uniform charge would best support efficiency.

8. We have also examined how the structure of prices would impact competition. Our analysis showed that uniform pricing would minimise the risk of competitive distortions including in relation to competition between the access provider and access seekers and in terms of the choice of access service.

Should PSTN OTA prices include a flagfall charge?

9. We also applied the efficient pricing principles to the question of whether there should be a flagfall charge in the PSTN OTA prices or instead whether a single timed charge should be set.

10. We conclude that a single timed charge would be efficient because:

- there is no material marginal cost of call connection given the very large processing capability of modern switches;
- there is no reliable elasticity evidence on which to determine an efficient wholesale flagfall charge; and
- the absence of a flagfall charge in wholesale PSTN OTA prices would provide the maximum flexibility for access seekers to structure their retail prices so as to efficiently meet customer demand.

11. A single timed charge would also promote competition because it would enable access seekers to compete on a level playing field with Telstra which does not face material marginal costs of call connection.

12. We conclude that a uniform timed PSTN OTA charge should be set rather than a two-part tariff with a flagfall component, as it would promote efficiency and competition.

13. We also find that a nationally uniform, single timed usage charge would protect the legitimate business interests of the access provider because prices will be set that covers both the marginal cost of the services as well as the access provider's fixed and common costs.

2. Efficient pricing principles

14. In this section, we review the principles of efficient pricing which are based on well-established economic theory and that we regard as uncontroversial.[2] These principles provide the conceptual framework that we apply to determine the efficient structure of PSTN pricing in the later sections of this report.

2.1. Allocative efficiency and marginal cost pricing

15. Allocative efficiency is generally promoted where customers face prices that reflect the value of society's resources used in the supply of each service. Such cost-reflective pricing will lead customers to purchase services so long as they expect to obtain at least as much benefit from those services as the value of the resources used in their supply, i.e. the benefit that could be generated by an alternative use of those resources. In other words, it is socially optimal for customers to consume a service up to the point where the cost to society of providing an additional unit of the service is equal to the benefits received by the consumer from that unit. Customers will rationally consume the service until the benefits they receive from an additional unit is equal to the price they are charged for that unit. Therefore, unless prices reflect the marginal cost to society of the service, customers will not have the right incentive to consume at the socially desirable level.

16. If prices are set below marginal cost, too much of the service will be likely to be consumed (i.e., the benefits customers derive will be less than the cost of providing for that consumption). If prices are set above marginal cost, too little of a service will be consumed relative to the allocatively efficient level. The implication of this is that marginal costs should form the basis for allocatively efficient pricing.

17. Even more precisely, the allocatively efficient price of a service should be set equal to the short run marginal costs of supplying that service. The short run marginal cost of a service is equal to the change in the firm's total costs in response to a small change in the volume of the service supplied when the firm's capital stock is held constant. Where a firm has excess capacity, short run marginal costs will be relatively small and limited to any change in operating costs. In such a case, pricing at the level of short run marginal costs would send the right signals for efficient consumption. On the other hand, if there is insufficient capacity to support even a small increase in output then the short run marginal cost of a unit of output may be relatively high. In particular, short run marginal cost will need to reflect the opportunity cost of supplying an

[2] While we consider that the theory of efficient pricing to be uncontroversial, we note that the issue of the extent to which the theory can be precisely implemented in actual regulatory pricing is often a source of controversy. In particular, information on costs and elasticities is often imperfect. We discuss the implications of imperfect information when we come to identify what pricing approach is both efficient and practical to implement in the later sections of this report.

additional unit to one customer which would mean less of the service can be supplied to other customers. Accordingly, whether or not there is excess capacity is a critical issue for the determination of the short run marginal cost.

2.2. Efficiently recovering total cost

18. Where short run marginal cost pricing is insufficient to allow an operator to recover its overall costs, then prices will need to be raised above marginal costs so as to ensure the operator's ongoing viability.[3] The economic theory on the efficient approach to the recovery of fixed and common costs is well established. The theory is known as Ramsey pricing (or Ramsey-Boiteux pricing). In the absence of differences between the elasticities of demand for the different services, Ramsey pricing requires that the services should make the same proportionate contribution to the recovery of common costs. In particular, the price of each service should be raised above the short run marginal cost of each service until the uniform percentage mark-up over marginal costs is sufficient to recover the overall level of common costs. The desirability of uniform mark-ups follows from the fact that the efficiency loss of raising a price above marginal cost increases exponentially the greater the divergence between prices and marginal costs.[4]

19. Where services that share the common costs have different demand elasticities then the mark-ups over short run marginal costs should vary in inverse proportion to the elasticities of demand. In particular, it would be better to recover relatively more of the costs from the less price elastic service because doing so has less of an impact on overall demand than to raise prices on the more price sensitive services. That said, as recognised previously by the ACCC and other regulators, robust information on elasticities differences is often lacking so that uniform mark-ups are maintained because of the uncertainty of whether customer demand is more sensitive to some prices than others.[5]

20. In general, regulators have tended to apply uniform percentage mark-ups to services. In addition, the ACCC's traditional Total Service Long Run Incremental Cost (TSLRIC) approach was based on applying mark-ups for common costs to the long run incremental cost of the services. Thus the

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[3] We assume that a firm is required to fund its total costs itself, rather than by receiving a subsidy from the government.

[4] In particular, the size of the efficiency loss (or dead weight loss triangle) will depend on both the mark-up over marginal cost and the reduction in demand resulting from that mark-up. For the simple case of a demand curve of slope of -1, the efficiency loss will be equal to 0.5*(Mark-up). This can be used to illustrate why it is better to apply a uniform mark-up, say of $4 each on two products (with a total efficiency loss of $16) than to recover the same level of common costs by a mark-up of $2 on one product and a mark-up of $6 on the other product (with a total efficiency loss of $20).

[5] For instance, the ACCC identified the limited information on elasticities and on the costs of all relevant services as part of its reasoning as to why Ramsey pricing is not applicable in its Mobile terminating access service – final decision, June 2004, p.170.

ACCC's traditional approach differs to efficient pricing principles in several key ways: (i) being based on the average incremental cost of supplying an entire service rather than the cost of a small change in the volume of the service supplied; (ii) being based on the long run incremental cost rather than the short run cost; and (iii) being based on uniform percentage mark-ups for common costs rather than varying the size of the mark-ups to reflect differences in elasticities.

21. The traditional TSLRIC approach has no *a priori* efficiency claims. Whether or not such an approach is reasonably efficient in practice depends on a number of assumptions holding. One key issue is whether the long run average cost of supplying an entire service are close to the short run marginal cost of supplying a small increase in the volume of that service or the short run costs that would be avoided by decreasing the volume of the service supplied by a small amount. In addition, in terms of the allocation of costs between the different services, the following assumptions would also need to hold for the traditional approach to be reasonably efficient:

    - that there are no significant differences in the level of the marginal costs of the different services;
    - that there are no significant differences in the elasticities of the different services.

22. These last two assumptions are particularly relevant to the question of whether prices should be differentiated between different geographic areas. Before specifically addressing the question of the efficient structure of prices for PSTN OTA, we first need to examine the cost structure of the services which we do in the next section.

3. Cost structure of PSTN OTA services

23. The purpose of this section is to analyse which costs vary with the number of calls and volume of minutes of PSTN OTA services supplied by Telstra. In particular, we wish to distinguish between the marginal costs of the services and the fixed and common costs that do not vary with traffic levels.

24. Ideally, we would have access to detailed information on Telstra's PSTN in order to estimate the variation in costs to serve a small increase (or decrease) in traffic. However, we do not have access to the detailed information that is required to model Telstra's existing network capacities so as to determine precisely the costs that would be marginal to the number of calls or volume of minutes and how the resulting marginal costs vary across geographic areas.

25. Instead we progress in three stages:

    i. First, we identify the key network elements within the PSTN to understand how the volume of calls and minutes impacts on the dimensioning of the network as a whole;

    ii. Second, we use the Analysys Model to estimate the proportion of costs that vary with a change in traffic. This should provide an upper bound estimate of the cost of an additional increment of traffic. This is because the model optimally configures each network element to serve the assumed demand with the minimum number of network elements (assuming reasonable engineering tolerances). An increase in traffic will be more likely to require additional costs in this optimised network than in an actual network where there is likely to be greater slack (i.e. less than optimal utilisation);

    iii. Third, we consider publicly available information on Telstra's PSTN to see whether it provides an indication of the extent of the utilisation of the actual PSTN on which the regulated service is provided. Low utilisation would suggest that fewer costs would need to vary to meet a change in traffic volumes.

26. On the basis of this analysis, we then turn to the key question of whether the marginal costs are expected to vary between different geographic areas.

27. Finally, we investigate whether there are significant call connection costs in terms of the costs that vary with the number of PSTN calls separately to the costs that vary with the number of call minutes. This issue is important to the determination of whether there should be a flagfall charge.

3.1. Network elements within the PSTN

28. PSTN OTA comprises two services: an originating service and a terminating service provided using the PSTN. The PSTN originating service involves the carriage of calls from a calling party to a point of interconnection (POI) with an access seeker's network. The PSTN originating service is used by access seekers to offer pre-selected long-distance, international and fixed to mobile services to customers. It is typically purchased in combination with the wholesale line rental and local calling services.

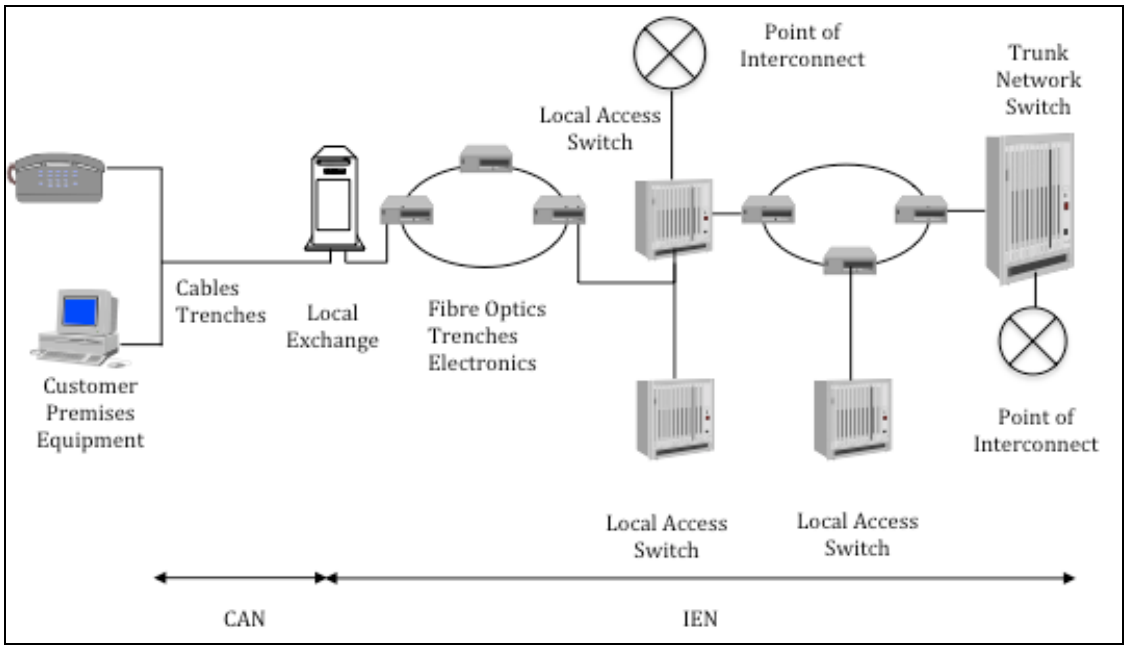
29. The PSTN terminating service is the carriage of calls from a POI to the party receiving the call. This is used by access seekers to provide calls to customers connected to Telstra's PSTN from their own fixed and mobile networks.

30. The services comprise a number of different elements including: access, call barring for PTSN origination, POI location, forwarding a call beyond the POI where applicable, signaling, Customer Line Identification (CLI) provision,

provision of switchports, network conditioning, fault handling, inter Carrier/Carriage Service Provider (C/CSP) billing and signaling. POIs are usually located at a trunk switch but can be located at a local access switch.

31. The following figure shows the architecture of a circuit-switched PSTN based on the public documents released by Telstra. The PSTN includes the customer access network (CAN) and the Inter-Exchange Network (IEN). PSTN OTA services are provided using elements in both the CAN and the IEN, however, the ACCC has determined that regulated PSTN OTA charges will recover only the costs associated with the IEN.[6]

Figure 1: Architecture of a circuit-switched PSTN



32. In addition to the provision of the PSTN services, elements within the IEN are also used to provide other services including local calls and data services.

33. The IEN is comprised of local exchanges, local access switches, local transmission and trunk network switches. Local and trunk switches route PSTN OTA services to their destination over the local transmission links. The local transmission links are those between POIs and the customer making or receiving the call (i.e., they do not include long-distance transmission links).

34. The following sections examine the cost structure of the elements of the IEN.

[6] The costs of the CAN are recovered from retail line rentals, unbundled local loop and wholesale line rental charges.

35. We find that much of the physical layer of the network (eg, land, buildings, trenches) is entirely unrelated to a particular level of demand on the network. We also find that many network elements are dimensioned based on (or ultimately a function of) the number of customer lines or Services In Operation (SIOs) regardless of the traffic profile of those customers. For example, this is the case for PSTN line cards.

36. For those elements that are found to be 'traffic related' we find that the dimensioning of those elements is not related to the total volume of traffic carried on the network (e.g., the number of calls or call minutes) but is related to the traffic carried on the network in peak periods.

37. As demand fluctuates in different periods of time (e.g., hours, days, weeks, months, seasons), some elements within telecommunications networks are configured to meet demand at peak periods. Generally, this is the 'average' demand across a period that is considered to be a peak.[7] This is known as the 'busy hour' demand and can be measured in a number of different ways (e.g., the average of the busiest quarter or full hour demands from each of a number of consecutive days). Busy hour demand is generally expressed as Busy Hour Erlangs (BHE) as the erlang is a measure of the volume of traffic carried. If demand exceeds the dimensioned capacity of the PSTN, calls will be disconnected and/or call attempts will be blocked.

38. In considering a change in costs in response to a small change in traffic we must make an assumption about the extent to which that change in traffic affects the busy hour traffic demands on the network.

3.1.1. Local exchanges

39. Local exchanges aggregate traffic before it is sent to the local access switch. Typically no switching is undertaken at the local exchange level. In modern networks, switching is becoming increasingly centralised. This trend reflects the declining cost of transporting traffic over larger distances on fibre transmission networks so that fewer switches can efficiently be provided.

40. The following table shows the major network elements used in local exchanges. While there are many types of equipment that make up these network elements we are particularly interested in the major drivers of costs.

[7] It is unlikely to be cost effective to dimension a network to meet a peak in demand that rarely occurs.

Table 1: Key elements for voice switching in Local Exchange

Element	Components	Dimensioning
Exchange building	Land, building, site preparation, maintenances	Per site
Concentrator	Processor Chassis, shelves, racks	Number of line cards (including PSTN, xDSL, ISDN)
	PSTN line cards	Number of voice SIOs, Busy hour voice demand
Switch-facing ports	PDH/SDH	Busy hour voice demand (in E1s)

41. Telstra is estimated to have in excess of 5,000 exchange buildings.[8] Housed within the exchange buildings is electronic equipment that interfaces with the CAN (the last part of the CAN is the main distribution frame). Voice services are carried from the CAN to the IEN by connecting copper wires connected to PSTN line cards. The line cards convert the analogue signal coming over the copper wire to a digital signal. Line cards have a capacity to connect a certain number of customers or, more precisely, SIOs.

42. Physically, the line cards sit in a rack that can handle multiple line cards (e.g., the Ericsson AXE10 rack can handle 16 (64kbps) line cards for a total of 128 lines). The AXE10 concentrator can stack 16 racks, giving it a total capacity of 2,048 voice SIOs. Each rack has its own processor.

43. The concentrator is provisioned to handle a particular level of busy hour traffic demand.[9] Each rack has capacity for an E1 circuit of busy hour traffic (i.e. 32 voice timeslots or channels although two of these are used for signalling and network management if this is done remotely). The concentrator may be provisioned with some additional capacity to meet busy hour demand but this will be limited.

44. The dimensioning of the concentrator is therefore primarily a function of the number of customers to which the exchange is connected. However, as each rack is only provisioned for one E1 of transmission a greater number of racks will be required for higher levels of busy hour traffic.

3.1.2. Local transmission

45. The network elements used in local transmission are shown in the following table. We understand that local transmission is primarily over fibre optical

[8] Analysys User Guide/Documentation

[9] In a circuit-switched network, voice traffic is kept separate from data traffic (ISDN, xDSL). In a next generation network, all traffic can be concentrated.

cable, although in very rural and remote areas microwave and satellite is used for local transmission.

Table 2: Key elements of local transmission

Element	Components	Dimensioning
Fibre	Fibre optical cable Ducts Trenches	Distance
Microwave		Distance, busy hour traffic
Satellite		Busy hour traffic
Multiplexing	Transmitters and receivers Ports and aggregation line cards	Busy hour traffic

46. The capacity of fibre optical cable is primarily dependent on the optical transmitters and receivers attached to the fibre cable, although the capacity is also dependent on the cable gauge and length. The architecture of the fibre network also affects its capability. A fibre network may have point-to-point, linear, mesh or ring architecture between local exchanges, local access and trunk network switches.

47. For a given network architecture, the capacity of the fibre network can be upgraded by improving the multiplexing technology and/or adding additional ports to the multiplexor. Additional E1s of busy hour traffic requires additional ports. It may also require an upgrade in multiplexing technology.

48. Microwave transmission would be expected to have a lower proportion of costs that are dependent on distances. In addition, the steps in capacity to meet increasing levels of busy hour demand are expected to be smaller. Satellite transmission may have an even lower proportion of costs that are independent of busy hour traffic demands.

49. It is worth noting that regardless of technology, local transmission will require some channel capacity being dedicated to call set-up (including signalling and network synchronisation/management). This will typically be a small proportion of the channel capacity.

3.1.3. Local access and trunk network switches

50. The local access and trunk network switches are elements of the IEN. Both may be co-located with concentrators in a local exchange or they may be housed in their own buildings.

51. A modern circuit switch is made up of a central processing unit, signalling equipment and switching blocks. Interconnect facing ports are also needed.

52. The processor consists of hardware and software. The processor has a significant role to play in setting up and terminating a call.[10] As soon as a call is attempted the processor determines the routing of that call and whether a connection can be established. It does this by looking up the routing table stored in its memory and sending signals (via the signalling equipment) to determine the availability of a voice channel. When a call is terminated, the processor clears the voice channel.

53. The processor is largely configured based on call attempts in the busy hour (BHCA) rather than busy hour traffic. This is because once a call is set up it has less to do. Modern processors have very large capacities. As discussed below, Analysys reports that each Ericsson AX10 switch processor has a capacity of 800,000 BHCA.

Table 3: Key voice elements of circuit switches

Element	Components	Dimensioning
Exchange building	Land, buildings, air conditioning, security, etc.	Per site
Switch	Processor	Busy hour call attempts
	Chassis	Number of switchblocks
	Switchblocks	BHE/traffic
	Signalling	Busy hour call attempts
Interconnect facing ports	Switch ports	BHE

54. When a call is made a circuit switch makes available a time slot on a digital channel for a call to be made. This slot must be held open for the duration of the call. The capacity of a switch to hold open calls is determined by the number of E1 equivalent line cards in its switchblock.[11] The provisioning of switchblock capacity will be a function of busy hour traffic coming up from the local exchange. The number of line cards that each switchblock can hold is determined based on the vendor's specifications.

55. Switches use significant amounts of power. Switches also require back up power systems (e.g., generators) to ensure continuity of services. They also need to be housed in rooms with sufficient heating, cooling and ventilation systems. These costs vary to some extent with the utilised capacity of the switch but are largely fixed.

[10] The processor has other functions including keeping call data records used for billing and network management.

[11] The technology (typically TDM) determines the number of slots available for calls versus signalling and network management/synchronisation.

3.2. What costs varies with traffic in an optimised network?

56. We have used the Analysys Cost Model to identify the costs which are assumed to change as the volume of PSTN OTA is increased. The Model provides for the examination of costs for two major network technologies: (i) a fully modern network and (ii) a Next Generation Network (NGN).

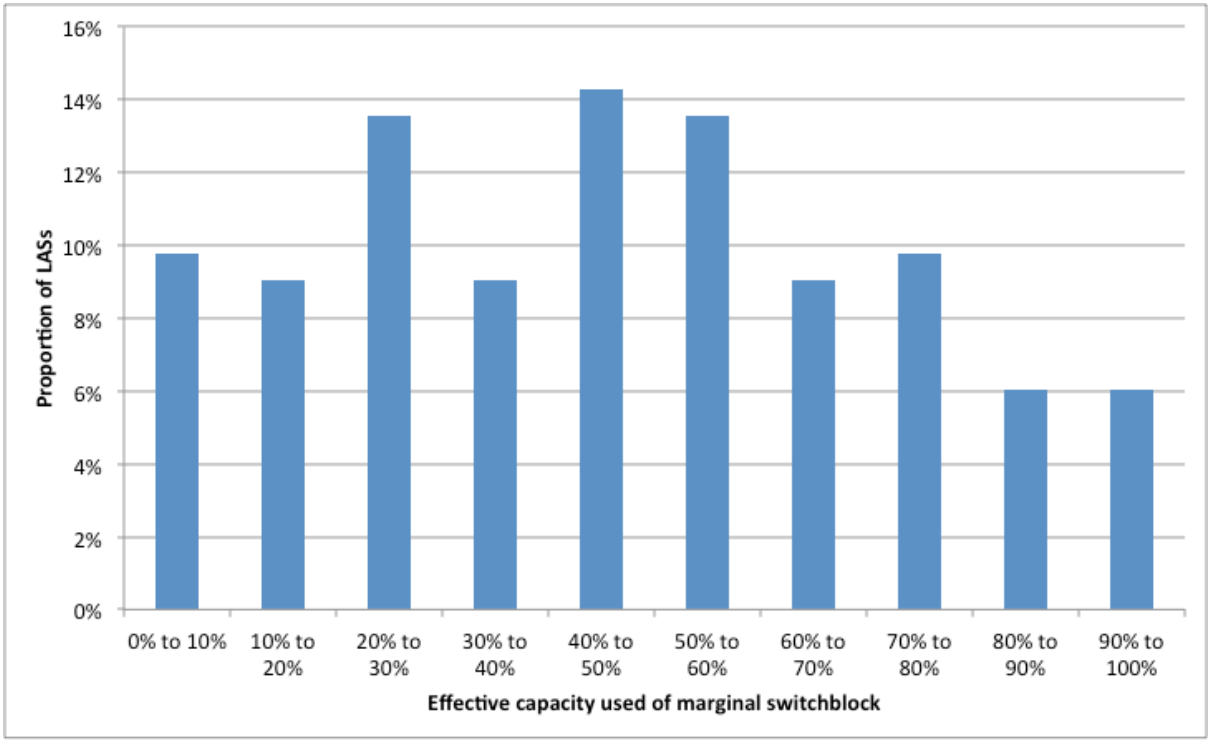
57. Consistent with the discussion above, the following table shows the PSTN traffic-related cost categories for the modern network scenario of the Analysys model. This examination is based on increasing the busy hour traffic by 20%. Details on the model and the terminology can be found in Analysys' Model documentation for the ACCC – Fixed LRIC cost model user guide and Fixed LRIC cost model documentation.

Table 4: Variation in costs in response to 20% increase in busy hour traffic in the Analysys Cost Model

Network	Element	Nature of change	Change in annualised cost
Local exchange	Building	Nil	
	Concentrator	Nil	
	Ports	Substitute SDH STM-0 and STM-1 ports. Additional PDH 8 Mbps ports	-0.34%
Local transmission	Fibre, ducts, trenches	Nil	
	Multiplexer	Upgrade of SDH units including additional deployment of STM-1 and STM-16 units across transmission layers.	
		- LE to LAS transmission	5.65%
		- LAS ring	3.13%
		- Additional regenerators.	-1.25%
	Microwave	Additional E2 links. Substitute STM-0 for STM-1 SDH units.	-5.84%
	Satellite	Nil	
Local switch	Building	Nil	
	Chassis	Additional switchblocks	10.73%
	Processor	Nil	
	Switchblocks	Additional line cards/switchblock units	10.73%
Trunk switch	Building	Nil	
	Processor	Nil	
	Switchblocks	Additional line cards/switchblock units	23.8%
	Ports	Addition SDH STM-1 ports	19.1%

58. The table above shows some fairly significant increases in annualised costs for some network elements. In particular, the large percentage increase in switchblock demand is because this network element is highly dependent on busy hour erlang demand. This is despite the fact that in the Analysys model more than 55% of local area switches are less than half utilised in terms of their busy hour capability (see Figure 2). Indeed, Figure 2 shows that only 6% of switches have 90% or more of their targeted maximum capacity being used (and their targeted maximum capacity is only 80% of their actual capacity).

Figure 2: Effective capacity used of marginal switchblock in Analysys Cost Model



59. Nonetheless, as a percentage of total annualised costs for the PSTN the percentage increase in costs for a 20% increase in busy hour erlang traffic is less than 1% (0.21%).[12] Thus a very low proportion of PSTN costs vary with traffic.

60. We have also examined the PSTN traffic-related costs for the Next Generation Network (NGN) scenario of the Analysys Cost Model. It shows that even a greater proportion of costs are not marginal to additional call minutes in the

[12] The decrease in annualised cost due to a 20% reduction in traffic is slightly larger at 0.28%.

busy hour. Indeed, the model shows that annualised costs increase around 0.08% in response to a 20% increase in busy hour erlang traffic.

61. Finally, we also investigate whether costs are marginal to the number of calls. If they were, it could go some way to justifying a flagfall charge for PSTN OTA. In order to model the marginal cost of additional calls, we have adjusted the number of call attempts per successful call in the model. To ensure we are isolating the effect of more calls rather than call minutes we need to adjust the model to remove the effect of unanswered call duration.

62. Once this is done we find that a 20% increase in call attempts per call has no effect on annualised costs. This result is not surprising given that Analysys models a switch capability of around 800,000 BHCAs. No switch in its modelled network gets close to this.

3.3. What evidence is there that cost are variable with the number of calls and the volume of minutes in Telstra's actual network?

63. The ACCC has observed that:[13]

> …there is evidence that Telstra's switching equipment is over-provisioned and there is generally excess switching capacity.

64. This suggests that there are very low marginal costs in the network (including very little prospect of congestion even if charges were reduced).

65. It is also the case, that PSTN traffic appears to be in long-term decline. In particular, in a statement to the Australian Stock Exchange on 12 August 2010, Telstra noted that:

> During the fiscal year, PSTN revenues fell by 7.4% to $3,498 million. The decline accelerated during the second half with PSTN revenue down nearly 10% as the shift continued to ULL and wireless only households. In addition, there has been an acceleration in the decline in usage over the period. PSTN SIOs also fell by 257 thousand or 4.7% during the year. Some of these factors also impacted fixed internet with revenues declining by 1.0% to $1,261 million.

66. The decline in PSTN traffic is apparent from Telstra's historical data (see Table 5). Analysys has also reported figures showing that declining access lines and declining voice usage per line for the years from 2007 and is forecasting further

[13] The Discussion Paper, p.148.

reductions going forward (i.e. for 2011 and 2012).[14] Thus, excess capacity appears likely to characterise Telstra's PSTN across all geographic areas.[15]

Table 5: PSTN line usage and revenue

	1H07	2H07	1H08	2H08	1H09	2H09	1H10	2H10	1H11
Retail lines			7,820	7,865	7,829	7,733	7,545	7,407	7,298
Wholesale lines			1,730	1,496	1,341	1,285	1,263	1,253	1,235
Total lines									
PSTN Revenue	3,463	3,423	3,391	3,275	3,219	3,118	2,996	2,837	2,743
PSTN Minutes	12,334	11,769	11,499	10,766	10,233	9,902	9,296	8,561	8,336

Source: J.P. Morgan

3.4. Would marginal costs be expected to vary across geographic area?

67. The next step in our analysis is to identify whether the marginal costs of PSTN OTA are likely to vary by geographic area. In particular, we are interested in whether there are likely to be significant cost differences between exchange serving areas located in Band 1 (CBD areas), Band 2 (metropolitan areas), Band 3 (regional areas) and Band 4 (rural areas).

68. The ACCC has noted that while there are geographic differences in costs for ducts and pipes and copper cables, it did not consider that there were significant differences for other asset classes.[16]

69. Our analysis of network elements[17] within the PSTN suggests that in the long run the costs that could vary with the number of busy hour minutes carried on the network are primarily related to:

- Switchblock capacity within switches;
- Multiplexing of traffic on local transmission links; and
- Ports at the local exchange, local switch and trunk switch.

[14] Analysys, Fixed LRIC model documentation – Version 2.0, August 2009, Figures 3.2 and 3.3.

[15] If this was not the case, we note that ongoing excess capacity would be more likely to characterise rural areas if there is minimum equipment capacity that is not reached in those areas

[16] The Discussion Paper, p.140.

[17] In addition to network equipment, there will also be electricity used although we believe that the cost of electricity is unlikely to vary significantly across the core network.

70. We note that these elements do not include those that are typically understood to vary between geographies (e.g., fibre cable, ducts and trenches). This is because difference in the costs of fibre, ducts and trenches is irrelevant to the identification of the marginal costs of greater traffic on the network. These costs are fixed and whilst the average costs may differ across areas, this is not key to determining an efficient charge for PSTN OTA.

71. For the marginal costs of carrying additional traffic to vary across geographic bands (such that rural areas had higher costs), either of the following would need to hold:

    iv. There is some systematic relationship between the cost of these elements and geography, such that the incremental costs of expanding these elements is higher in rural areas than in urban areas; or

    v. That the utilisation of these elements is such that in rural areas it is more likely that for a given incremental increase in traffic it is more likely that this would trigger greater dimensioning of these elements (than would be the case in urban areas).

72. We have no evidence that either of these is likely to be true. The only exception to this is the use of microwave transmission in very rural parts of the PSTN for local transmission. Microwave transmission appears to have higher incremental costs of expansion to the next capacity level.

73. In addition, we note that many of these network elements have quite large step ups in capacity (e.g., the multiplexing capacity increase between STM-1 to STM-4 to STM-16 capacities are very large) such that the generally lower traffic in rural areas means that for an equivalent percentage increase in traffic it is less likely that one of these steps would be required. It should be noted that this observation contradicts the general (but incorrect) proposition that because there is lower utilisation in rural areas the average costs are higher and that unit prices should therefore also be higher. It is marginal costs that form the basis of efficient pricing.

74. On the basis of our analysis, we conclude that there are unlikely to be significant differences in the overall marginal cost of PSTN OTA between different geographic areas.

3.5. Call connection costs

75. The ACCC has also raised the issue of whether or not a flagfall charge would be efficient. As discussed in the previous section, a key question to help determine this issue is whether there are significant PSTN call connection costs separate to the costs that vary with call minutes.

76. We investigated what costs vary with an increase in the number of calls on the PSTN (while holding the number of call minutes constant). In particular, our examination of the Analysys Cost Model shows that there was no change in network dimensioning (and hence costs) for an increase in call attempts per call. As discussed, this was not surprising given the large processing capability of modern switches.

77. In the Analysys NGN model, busy hour call attempts use the softswitch, however, this is again a fixed cost which did not vary with the volume of call attempts. Accordingly, both the Analysys modern network and NGN model scenarios did not show any material marginal costs of call attempts that are separate to the costs driven by call minutes. Further, the declining demand in Telstra's actual network is likely to mean excess capacity in the switches and hence strengthen the conclusion that marginal costs of call connection are unlikely to be material.

78. The ACCC has traditionally incorporated the cost of unsuccessful calls in flagfall charges. However, this is simply the particular allocation approach imposed by the regulator rather than implying that the cost of unsuccessful call attempts form part of the actual marginal cost of connecting successful calls.

79. Finally, even were there evidence of significant call set-up costs, there would be no reason to vary these set-up costs between geographic areas unless evidence was provided that the marginal set-up costs varies geographically. On this point, we have found no evidence that the cost of processing units or the utilisation of processors systematically varies across geographic areas.

4. Is geographically uniform pricing efficient?

80. The previous section found that based on the limited information available on Telstra's network as well as our *a priori* expectation, there are unlikely to be significant differences in the marginal costs of PTSN OTA between geographic areas. On the basis of this understanding of the cost structure of PSTN services, we now address the question of whether efficiency is best promoted by geographically uniform charges or whether charges should be differentiated by geographic band.

81. If marginal costs do not vary between geographic areas, then PSTN OTA prices should be set at a uniform level unless it would be efficient to vary the mark-ups required for the recovery of fixed and common costs. In particular, the insight of Ramsey pricing is that differentiated mark-ups can be efficient if it would result in less distortion to demand compared with applying uniform mark-ups.

82. It is important to note that while PSTN OTA prices are wholesale prices, the demand for PSTN OTA services is a derived demand from the demand for the retail services for which originating and terminating access are inputs. Thus, it is useful to consider whether the demand elasticities for the retail services are likely to vary between geographic areas. If it is found that the demand elasticities do differ at the retail level, there would then remain the question of how differences in wholesale prices are passed through to differences in retail prices. In particular, geographically differentiated wholesale PSTN prices would only promote efficiency if there were both:

    i) significant differences in demand elasticities between geographic areas; and

    ii) the structure of wholesale prices could be set so as to achieve the efficient Ramsey structure of retail prices.

83. We investigate each of these conditions in turn.

Differences in demand elasticities between geographic areas

84. We were unable to identify any studies examining the elasticity of demand for PSTN services in Australia by geographic area. Without direct information on any elasticity differences by geographic area, we consider whether there are *a priori* reasons to expect elasticities to differ between geographic area. We note that Australian and international studies have found that the elasticity of demand for long distance calls is higher than for local calls.[18] International studies have also shown that national long distance calls tend to become more elastic the longer the distance of the call.[19] Thus to the extent that customers in rural areas tend to make more long distance calls and calls of greater distance then demand for PSTN services in rural areas might be expected to be more elastic than demand in the capital cities. Other factors may also operate to make demand in rural areas more elastic. For example, average incomes are lower in rural areas so that telecommunications expenditure will tend to account for a higher proportion of incomes in those areas.[20] This will tend to make customers more price sensitive to telecommunications prices. Further, there are fewer businesses in rural areas that are large telecommunications users.[21] An earlier Access Economics study indicated that

[18] A comprehensive survey of studies is provided in the Vodafone submission to New Zealand Commerce Commission, "Review of price elasticities of demand for fixed line and mobile telecommunications services, August 2003.

[19] For instance, see H. Ouwersloot and P. Rietveld, "On the distance dependence of the price elasticity of telecommunications demand; meta-analysis, and alternative theoretical backgrounds", Tinbergen Institute Discussion Paper.

[20] Lower average incomes in rural areas is reported in ABS, 1376.0 - Local Government and ABS, Mar 2010.

[21] Fewer large business telecommunications users in rural areas is noted in ACIL Tasman, Spend/Demand – Telecommunications in Regional and Rural Victoria, June 2004, p. vi.

residential customers' demand for local and long distance calls is more elastic than the demand of business customers.[22]

85. There are however factors that go in the other direction of tending to make demand for PSTN services in urban areas relatively more elastic. In particular, there are likely to be better quality substitutes available on average in urban areas including ULLS-based supply substitutes, better average broadband quality to support higher quality VoIP services and better mobile network coverage and service quality.

86. Given the absence of direct elasticity estimates and the presence of factors operating in opposite directions, it is not possible to conclude whether or not demand in rural areas is likely to be more or less elastic than in urban areas. On this basis, uniform pricing across geographic areas is likely to be the best approach to promote efficiency. A danger of implementing differentiated charges is that they might end up pushing prices in the opposite direction to what is actually required for efficiency. The desirability of uniform charging follows from the fact that the further prices are away from their efficient level, the disproportionately greater will be the welfare loss. In particular, at the efficient structure of prices, the welfare loss of decreasing or increasing the mark-ups on different services is balanced. As such, relatively small departures from Ramsey prices by increasing the mark-up on one service and decreasing the mark-up on another service do not create significant overall efficiency losses. However, this does not hold for larger departures from the Ramsey price structure. In this regard, it would be better to set uniform charges even with the risk of being slightly different to the efficient Ramsey structure than to impose differentiated charges with a 50% chance of being closer to the Ramsey levels but a 50% chance of being substantially different to the Ramsey structure.

Relationship between retail and wholesale prices

87. The second assumption, regarding the need to consider the relationship between the wholesale PSTN price structure and the retail structure of prices, arises from the fact that demand for the wholesale PSTN services derives from the demand for the retail call services. Thus any efficiency argument for differentiating wholesale prices would also need to demonstrate how the wholesale price structure impacts the retail price structure.

88. Currently, prices for the wholesale PSTN OTA services are differentiated by geographic band. However, an inspection of the call prices published on the websites of Australia's major fixed and mobile operators did not show that this geographically differentiated price structure is being reflected in retail prices. For example, mobile operators set retail prices for calls to fixed phones which

[22] The Access Economics study is reported in the Vodafone submission to New Zealand Commerce Commission, "Review of price elasticities of demand for fixed line and mobile telecommunications services, August 2003.

do not vary with the geographic Band the customer being called is in. In addition, fixed-to-fixed call prices are not distinguished by geographic band but generally by the distance of the call, i.e. there are different prices for local calls, wide area calls (for STD calls up to 50 km^2), regional calls (for STD calls up to 80 km^2) and STD calls. The lack of relationship between the wholesale price structure and the retail price structure suggests that the current geographic differences in wholesale prices are serving no efficiency purpose, i.e. they are not affecting retail demand.

Conclusion on the efficiency of geographically uniform prices

89. Our analysis finds that, on the basis of the limited available information on costs and elasticities, geographically uniform prices will best promote efficiency. This conclusion reflects that:

(i) there is no evidence of marginal cost differences in the supply of PSTN OTA services between geographic areas;

(ii) there is no reliable evidence on differences in the elasticities of demand for PSTN OTA services between geographic areas; and

(iii) existing wholesale differences in PTSA OTA prices between geographic areas is not being reflected in retail prices for the services for which PSTN OTA are inputs.

5. Is a flagfall charge efficient?

90. Another issue raised by the Discussion Paper is whether there should continue to be a two-part tariff (i.e. a timed charge and a flagfall charge) or instead a single timed charge for PSTN OTA (albeit with the ability of access seekers themselves to negotiate disaggregated pricing). In line with Ramsey pricing principles, a flagfall charge could be justified if:

- there are significant marginal costs of call connection different to the ongoing cost of supplying more call minutes;
- clear evidence of a demand for calls distinct from the demand for call minutes; and
- a wholesale flagfall charge was necessary for such a flagfall charge to be imposed at the retail level so as to promote efficient demand for the services.

Marginal cost of call connection

91. Our examination of the Analysys Cost Model indicated that costs did not increase for an increase in busy hour call numbers separate to the cost of busy hour erlangs. This is in line with the expectation that the processor costs of call connection are fixed in nature and that the marginal costs of call connection are negligible.

92. The absence of significant call connection charges itself suggests that flagfall charges may be inefficient. A flagfall charge would risk inefficiently deterring relatively short calls. In particular, some customers may choose not to make a short call because of the flagfall charge even though they would have obtained value from those calls greater than the actual network costs of making them.

Elasticity of demand for calls versus call minutes

93. Whether a flagfall would actually be inefficient also requires taking into account information on the elasticity of demand. In particular, despite no marginal costs of call connection, a flagfall charge might still be efficient where the demand for short calls was relatively inelastic while the demand for longer calls was relatively elastic. In this case, recovering some of the fixed and common costs through a flagfall charge might not deter many short calls while it would enable lower ongoing per minute call prices and this might lead to an expansion in overall call minutes.

94. While such a structure of demand might potentially exist, we have not identified any robust empirical elasticity estimates demonstrating that such a structure of demand does exist. We also note that the ACCC has previously stated reasons including the absence of robust information on elasticities as to why it believes that Ramsey pricing may not be practical to apply in relation to flagfall charges. In particular, the ACCC noted that "…*the new empirical evidence which underlies Telstra's efficiency case is not compelling*."[23] The ACCC also went on to dismiss Telstra's qualitative arguments as unsupported assertions. Thus, we have found no empirical evidence on elasticities that would support the imposition of a particular flagfall charge.

Relationship between retail and wholesale price structures

95. The third element that we identified as relevant to the question of whether it would be efficient for a flagfall charge to be imposed is the extent to which the retail price structure is dependent on the wholesale pricing structure. In particular, we note that a flagfall charge imposed at the wholesale level is likely to require access seekers to also impose a flagfall charge at the retail level so

[23] ACCC, Final Determination for model price terms and conditions of the PSTN, ULLS and LCS services, October 2003, p.57-58.

that they can ensure they recover the cost of relatively short calls. Thus a wholesale flagfall charge constrains the structure of retail prices. If the wholesale charge is set too high, then access seekers may have no choice but to impose an inefficiently high retail flagfall charge.

96. If no flagfall charge is imposed at the wholesale level, then access seekers would be given the flexibility of whether or not to impose a flagfall charge in their retail prices. An access seeker might choose to offer only timed charges but they would also have the option to impose a flagfall charge and then lower timed charges. The benefits of a similar type of flexibility can be seen with reference to AAPT's retail price plans for its fixed telephone service. AAPT's price plans range from its PAYG plan in which customers pay a monthly charge for line rental and then pay for all calls to plans involving higher monthly charges with lower call prices up to its Anytime Unlimited plan offering unlimited local and national calls as well as capped charges for calls to mobiles and international calls up to particular durations. Being able to offering a range of plans can enable a provider to meet diverse customer demand and is likely to lead to higher overall demand and efficiency than a single tariff structure.

97. By not imposing a flagfall charge at the wholesale level, the ACCC can avoid the problem of forcing an inefficient price structure to be implemented at the retail level. Instead, access seekers will have the flexibility to offer a range of retail prices. For instance, customers who generally make shorter calls could be catered for by plans with no flagfall charge while customers who make longer calls would be able to opt for other plans with flagfall charges but lower timed charges. This flexibility is thus likely to promote efficiency and lead to higher overall call numbers and call minutes than the imposition of a more restrictive retail price structure.

98. In summary, we have found no evidence that would support a flagfall charge being imposed for PSTN OTA prices. In fact, by not imposing a flagfall charge at the wholesale level, the ACCC can provide the flexibility for operators to offer a range of tariffs that would best match the structure of retail demand. By allowing this flexibility, the ACCC can promote the efficient price structure while avoiding the risk of setting a uniform flagfall charge at the wholesale level which inefficiently deters shorter calls.

6. Would uniform pricing impact competition?

99. As well as the effect on efficiency, the ACCC is also tasked with determining whether particular terms and conditions for the services would promote competition.

100. In terms of the structure of prices, there are two main risks for competition:

- Whether the structure of access prices matches the structure of the access provider's costs. If there are differences in the structure of prices and costs, access seekers may not be able to compete on a level playing field against the access provider's own operations.
- Whether the structure of access prices is consistent with the structure of prices for related services. Inconsistent pricing of substitutes would risk distorting competition as well as harming efficiency and the legitimate interests of the access provider.

Competitive distortions from differences between access prices and costs

101. In terms of the first risk, we have discussed in the previous sections that there is no evidence to suggest that the marginal cost of PSTN OTA differs between geographic areas. If marginal cost pricing was sustainable this would support uniform pricing also being imposed so as to ensure that access seekers can compete efficiently with the access provider. However, as the prices for PSTN OTA will need to be raised significantly above marginal costs in all areas to enable Telstra to recover its fixed and common costs, access seekers will be forced to face higher effective marginal costs (based on the access price they face) than the actual marginal costs faced by the access provider. As a consequence, access seekers will inevitably be disadvantaged in competing with the access provider to some extent. This might suggest that the structure of prices is irrelevant to this first type of competitive distortion.

102. It is the case, however, that Telstra itself will need to recover some of its fixed and common costs through the prices for its own retail services. In the absence of significant differences in elasticities between different geographic areas, we would expect Telstra to face incentives to maintain geographically uniform prices for its own services. In this regard, we believe that geographically uniform prices for PSTN OTA will be desirable on competition grounds as they would minimise the risk of competitive distortions arising from access seekers facing differing incentives to the access provider.

103. A single timed wholesale charge is also likely to minimise risks to competition compared with a two-part tariff with a flagfall charge. In particular, the imposition of a flagfall charge when actual call connection costs are neglible would risk harming competition as Telstra alone would be able to set its retail prices based on its lower actual call connection costs. The ACCC has previously accepted this reasoning:

> "Attempting to move only access seekers towards a greater reliance on flagfall is unlikely to improve efficiency, as they will need to compete with Telstra in downstream markets on its terms — i.e., a much lower flagfall component in its pricing. Effectively forcing access seekers to

adopt a pricing structure different from Telstra's is likely to be unsustainable."[24]

Competitive distortions from inconsistent pricing of substitutes

104. Competitive distortions may also arise where access prices are set inconsistently with prices for competing services. For example, if nationally averaged prices were set for one access service but not another then access seekers may 'cherry pick' the service with nationally averaged prices in high cost areas while choosing the other service in lower cost areas. Competition would be distorted where the choice of access service is based on regulatory-created price differences rather than any difference in underlying costs. Further, such 'cherry picking' may lead the access provider to be unable to recover its overall costs as access seekers would only be acquiring the nationally averaged priced service in the high cost areas where the access provider is compelled to offer the service at prices below cost.

105. In terms of the prices for competing access services, we note that nationally uniform prices will exist for wholesale line rental (WLR), local call service (LCS) and the line sharing service (LSS). Further, Telstra's local call prices and line rental charges, in addition to the prices of other competing services such as mobile and VoIP, are set at nationally uniform levels.

106. The Unconditioned local loop service (ULLS) prices for the geographic Bands 1-3 will also be averaged. This would create a distortion if PSTN OTA prices were not also averaged. This is because ULLS and PSTN originating access are substitutable 'access options' and the access seeker's choice between the two would be distorted if the access prices were averaged for one but not for the other. For example, if the price for PSTN originating access was set at a relatively low level in Band 1, this might encourage access seekers to rely more on PSTN originating access in this Band and discourage them from instead using ULLS.[25]

107. While it is the case that ULLS charges for Band 4 will be set at a higher level than for the other Bands, there is not a concern with distorting access seekers' choices for Band 4 as the ACCC acknowledges that ULLS-based entry is not feasible in this Band.[26] Moreover, there is little risk of inefficient entry being encouraged in the current context where the National Broadband Network is being rolled out. Such investment would not be expected to take place in any event.

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[24] ACCC, Final Determination for model price terms and conditions of the PSTN, ULLS and LCS services, October 2003, p.58.

[25] However, the case of deaveraged ULLS prices and averaged PSTN OTA prices will not encourage 'cherry picking' because the ULLS requires DSLAM infrastructure investment with high entry costs and the need for cost recovery is affected by the imminent migration to the NBN.

[26] For instance, see the Discussion Paper, p. 143.

Summary

108. Our analysis of the likely competition impacts of different price structures supports the adoption of uniform pricing to minimise the risk of competitive distortions arising from differences in terms of both the costs faced by Telstra and the structure of prices for competing services.

7. Would uniform pricing impact the legitimate business interests of the access provider?

109. The ACCC is also required to consider the legitimate business interests of the access providers and this criteria is also relevant to determining the best structure of PSTN OTA prices.

110. The Discussion Paper recognises that the access provider's legitimate business interests will be met where regulation enables it to earn a commercial return on its prudent investments.

111. Setting PSTN OTA prices so that they recover overall the average costs of supplying PSTN OTA services will generally provide for the access provider to earn a commercial return on its investments. In particular, such pricing would recover the marginal costs as well as the fixed and common costs of supplying those services. This is the case because the prices will be set to recover the costs of a single Regulatory Asset Base under the ACCC's Building Block Model, rather than separate asset bases for each geographic area.

112. Under the ACCC's pricing approach, the only potential exception where averaged pricing would fail to protect the legitimate interests of the access provider is in the case where access seekers are encouraged to 'cherry pick' the access provider's services by acquiring services where prices are below cost but not in areas with prices above cost. However, as discussed in the previous section, it is uniform pricing of PSTN OTA that best minimises the risk of 'cherry picking' because it aligns those prices with the structure of prices for the other access services. Moreover, there is no material risk of new ULLS-based entry given the roll-out of the NBN.

8. Conclusions

113. Our analysis in this report has found that uniform prices for PSTN OTA will best promote efficiency and competition while also being consistent with the legitimate business interests of the access provider for the following reasons:

- Efficiency will be promoted because there is no reliable evidence of differences in marginal costs or demand elasticities between different geographic areas.
- Efficiency will also be promoted by a single timed charged as this will give the maximum flexibility for access seekers to offer a range of tariff plans so as to best meet the demands of retail customers.
- Uniform charging will also promote competition because it minimises the risk that access seekers will be unable to compete against the access provider and it reduces the risk that access seeker's choice of entry will be distorted.
- Finally, the legitimate interests of the access provider will be protected because prices will be set at a level that covers both the marginal cost of the services as well as the access provider's fixed and common costs.