Comments on Discussion Paper

Vodafone's Undertaking in relation to the Domestic Digital Mobile Terminating Access Service

A report prepared by Marsden Jacob Associates
for Allens Arthur Robinson

Final: 16 August 2005

Marsden Jacob
Associates

This report has been prepared in accordance with the scope of services described in the contract or agreement between Marsden Jacob Associates Pty Ltd ACN 072 233 204 (MJA) and the Client. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client and Marsden Jacob Associates accepts no responsibility for its use by other parties.

CONTACT: Mr. Jasper Boe Mikkelsen: jasper.mikkelsen@marsdenjacob.com.au

Marsden Jacob Associates

Financial & Economic Consultants

Level 3, 683 Burke Road, Camberwell, Victoria 3124
Tel: (03) 9882 1600 Fax: (03) 9882 1300
Email: economists@marsdenjacob.com.au

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

1. Introduction

1. Marsden Jacob Associates (**MJA**) has been requested by Allens Arthur Robinson (**AAR**) to address certain questions related to the Australian Competition and Consumer Commission's (hereafter the Commission) discussion paper related to Vodafone's undertaking in relation to the Domestic Digital Mobile Terminating Access Service.

2. The comments and opinions expressed in this paper are those of MJA and do not necessarily reflect those of AAR and Hutchison. No part of this submission is confidential to MJA.

3. The 34 questions/issues addressed in this report are:

   (a) The Commission seeks the views of interested parties as to the reasonableness of the proposed target Usage Charge as an estimate of the efficient forward-looking costs of providing MTAS. (Parties should comment on the (original) target Usage Charge and the revised Usage Charges).

   (b) The Commission seeks the views of interested parties as to the reasonableness of the proposed adjustment path for Vodafone's MTAS prices.

   (c) The Commission invites interested parties to comment on whether the modelling approach employed by PwC is appropriate for estimating the forward-looking efficient economic costs of providing the MTAS on Vodafone's network?

   (d) The Commission seeks the views of interested parties as to whether the PwC modelling approach of using cost inputs for Vodafone is appropriate, or whether an alternative approach, such as the use of an industry average or a 'hypothetical operator' is more appropriate.

   (e) In the event that an alternative modelling approach was undertaken, do interested parties believe this would change the estimate of the forward-looking efficient economic costs of providing the MTAS?

   (f) Is the PwC model's use of 2002-03 as a base year appropriate given the proposed Undertaking and the period of time for which it will operate (if the Commission were to accept the Undertaking)?

   (g) Is the modelling approach of reconciling 'optimised' cost inputs with actual operating costs and actual traffic volume a

reasonable/appropriate approach for estimating the forward-looking efficient economic costs of supplying the MTAS in Australia?

(h) In the view of interested parties, should the model input data have been audited prior to being included in the PwC model?

(i) The Commission seeks the views of interested parties as to whether the approach undertaken to calculate depreciation costs in the PwC model is appropriate and/or reasonable? Why or why not?

(j) Do interested parties agree with Vodafone's view that that the use of the 'tilted annuity formula' is likely to understate annual capital costs of Vodafone's GSM network? Why or why not?

(k) Do interested parties agree with the view that a number of cost allocation assumptions in the PwC model are likely to underestimate capital costs? Please provide reasons.

(l) In the view of interested parties, is it appropriate that two different methods for calculating depreciation have been used in the PwC model? Please provide reasons.

(m) The Commission invites comment from interested parties on whether the assumption of SMS being the stand alone service (as opposed to voice being the stand alone service) is appropriate?

(n) The Commission seeks interested parties' views on the appropriate WACC estimate to use when attempting to estimate the forward-looking efficient cost of providing the MTAS?

(o) The Commission also seeks interested parties' views on the appropriate parameter values (for parameters that are typically included in a WACC calculation) that should be used when attempting to estimate the forward-looking efficient economic cost of supplying the MTAS.

(p) The Commission seeks views of the interested parties as to whether the methodology used in the PwC model to calculate FCC's is appropriate?

(q) The Commission seeks the views of interested parties as to whether the inclusion of non-network FCCs, as specified in the PwC Report, is appropriate for estimating the forward-looking efficient economic costs of providing the MTAS?

(r) The Commission seeks the views of interested parties as to whether an adjustment/mark-up to account for working capital is appropriate when seeking to model the efficient costs of providing MTAS?

(s) The Commission seeks the views of interested parties as to whether the methodology used in the PwC model to estimate and allocate working capital is appropriate.

(t) The Commission seeks the views of interested parties as to the reasonableness of Frontier's estimated range of the welfare-maximising level of MTAS charges for Vodafone.

(u) The Commission seeks views of interested parties on whether the methodology used to calculate the various cost, price and demand inputs is appropriate.

(v) The Commission seeks view of interested parties on whether the calculated input values for cost, price and demand are appropriate.

(w) The Commission seeks the views of interested parties on, specifically, which categories of costs should be covered by Ramsey mark-ups when applying a TSLRIC+ model to access pricing.

(x) The Commission seeks information on where regulators in other jurisdictions have applied Ramsey principles in access pricing.

(y) The Commission seeks the views of interested parties as to the appropriateness of the elasticities used in the Frontier model.

(z) The Commission also seeks the views of interested parties as to whether the Ramsey mark-ups proposed by the Frontier model are reasonable.

(aa) The Commission seeks information on whether interested parties are aware of alternative estimates of own-price elasticities of demand and cross-elasticities of demand for key services in a Ramsey model.

(bb) The Commission seeks comments from interested parties on the appropriateness of the efficient cost of providing the MTAS being supplemented with a surcharge to reflect the existence of network externalities.

(cc) The Commission seeks comments from interested parties on the appropriateness of the magnitude of the mark-ups on cost, suggested by the Frontier model, to reflect network externalities.

(dd) The Commission seeks the views of interested parties on the RG factor of 1.5 used in the Frontier model.

(ee) The Commission seeks the views of interested parties on whether there are other kinds of externalities (relating to fixed-line, mobile and other networks and calls) that may be relevant to the decision about the imposition of a network externality surcharge.

(ff) The Commission is interested in receiving views and evidence on the relationship between external value placed on new subscribers and the level of population penetration of mobile telecommunications. Can the Rohlfs-Griffin factor be regarded as a constant?

(gg) The Commission seeks views on the trade-off between possible efficiency costs from a surcharge on mobile termination and the possible efficiency gains from subsidising mobile subscription.

(hh) The Commission seeks views on ways of analysing the increase in welfare that may flow to fixed-line callers as a result of additional subscription to a mobile network.

4. In the following section we answer each question/issue in turn.

2. Vodafone Questions

2.1. Price related terms and conditions –target charge

The Commission seeks the views of interested parties as to the reasonableness of the proposed target Usage Charge as an estimate of the efficient forward-looking costs of providing MTAS. (Parties should comment on the (original) target Usage Charge and the revised Usage Charges.)

5. To answer this question it is necessary to consider the definition of forward-looking costs in the context of the MTAS.

6. Costs can be backward-looking, forward-looking, or a mixture of the two. A typical example of a backward-looking cost system is one based on historic costs. Historic costs include inefficiently incurred costs reflecting, for example, the labour costs required to maintain outdated technologies. Forward-looking costs, on the other hand, reflect the costs that a network operator, building a network today, looking forward, would incur. Costing measures should be forward-looking to reflect true economic costs.

7. In practice, there is often considerable debate about the precise definition of forward-looking. For example, some argue that current costs will be a reasonable proxy of forward-looking costs. This may be true but will depend critically on the methodology used to re-value the assets. Because networks evolve over time, networks built even a few years ago may look very different from the network design that would be used if starting from scratch today.

8. PwC's current cost valuation approach is "*based upon the actual deployment of Vodafone's network (in terms of existing quantities in the network)*"[1]. In practice, we understand that PwC takes the existing quantities of equipment items as given and multiplies these quantities with the unit cost of each item consistent with Vodafone's Global Price Book.

9. PwC claim that:

> *"...such an approach – where the outputs from an "optimised' model are reconciled to actual operational data – is consistent with the*

[1] PricewaterhouseCoopers (2004), *The Fully allocated Cost (FAC) of services on Vodafone Australia's GSM network*, 24 November, p.5.

approaches being adopted by NRAs (for example, the PTS in Sweden) in arriving at estimates of the efficient costs of service provision."

10. We are surprised by this comment. Clearly, PwC has not taken an approach even similar to that adopted by the NRA in Sweden to determine the cost of mobile termination. In Sweden, a bottom-up model was reconciled with actual operational data. The final costs where not based on actual data but on an adjusted version of the bottom-up model (also called a hybrid model).

11. The objective of reconciliation is not to replace the costs and quantities in a bottom-up model with those of a top-down model. It is to identify and explain the differences between the two approaches. Reconciliation should therefore reveal important information on the two approaches, for example, where the bottom-up model has neglected essential cost components and/or where an operator's data reflects over-investment and inefficiencies.

12. On the basis of a reconciliation exercise, the regulator should be in a better position to make informed decisions about the design and input parameters of the model used (typically bottom-up model) in the final cost calculations.

13. The approach taken by PwC is therefore not consistent with the approach taken in Sweden, nor with similar approaches in other jurisdictions. In our view, the approach taken by PwC will only in exceptional circumstances reflect efficient forward-looking costs.

14. The PwC approach also suffers from the following weaknesses:

- no consideration of how equipment may be optimised seems to have occurred. A current cost approach must consistently consider how the network may be optimised to form a view on the modern equivalent asset.
- it is problematic that there is no relationship between the fixed assets in the model and associated operating costs. Assets are simply re-valued with no consideration of the potential effect on operating costs. However, we acknowledge that the methodology used by PwC may be appropriate in the short term as a short cut for estimating operating costs.
- No or limited information has been provided on the the utilisation ratios used in the model. Within a forward-looking framework, it is important to ensure that the utilisation ratios reflect those of an efficient operator. If utilisation ratios are too low, costs will be overestimated.

15. It is well recognised in a regulatory framework that TSLRIC is the appropriate benchmark for forward-looking economic costs. In particular as noted by PwC:[2]

> *"In most countries where NRAs are actively examining the issue of mobile termination rates, they have opted to determine the costs of all network services, including call termination, by developing a Long-Run Incremental Cost (LRIC) model.*

16. Further, PwC admit that their own model: [3]

> *"…does not conform in detail to models that have been produced in other jurisdictions for the purpose of setting mobile termination rates, which are typically Bottom-Up Long-Run Incremental Cost ("BU-LRIC") models."*

17. We agree that a bottom-up TSLRIC model is the most appropriate benchmark for evaluating efficient forward-looking costs of the MTAS.[4] In particular, a bottom-up approach is more likely to accurately capture the relevant cost structure and cost drivers required to predict the economic cost of the MTAS than costs that are derived using a top-down approach. That said, it is important to discuss the restrictions that a TSLRIC framework puts on the interpretation of forward-looking costs. For example, to make no allowance for the starting position of an operator could result in cost estimates, and therefore a MTAS charge, that is so low that it might not provide the right incentives for operators to invest in, and maintain, their networks. Therefore, it is common to place certain restrictions on the optimisation through the scorched node assumption and choice of technology.

18. In practice the choice of technology and optimisation are overlapping issues and are dependent on each other. If the choice of technology is given, optimisation and is conducted within this constraint and the scorched node

---

2 PricewaterhouseCoopers (2004), ibid, p.4.

3 PricewaterhouseCoopers (2004), ibid, p.3.

4 It is sometimes argued (see for example, Competition Commission (1999), Cellnet and Vodafone: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Cellnet and Vodafone for terminating calls from fixed-line networks, para 5.25, p 202.) that a price based on TSLRIC (including a mark-up for forward-looking common costs) is not appropriate in the mobile sector, since it is characterised by high levels of investment and rapid technological change. Likewise, it also argued that TSLRIC was originally developed to apply to the fixed networks of incumbents, which were mature, used stable, predictable technology and had established usage patterns and that this is in direct contrast to mobile technologies that may operate on different technology platforms that are constantly evolving and have more volatile demand patterns. If implemented appropriately, however, the TSLRIC approach will address all these issues.

assumption. If the choice of technology is not a given, the scorched node constraint may effectively rule out specific technology choices.

19. In the following sections we discuss the scorched node assumption and the choice of technology.

2.1.1. Scorched Node vs. Scorched Earth

20. A key issue when using a bottom-up TSLRIC framework to estimate the cost of a service is the degree of optimisation. That is, the degree to which the modelled network differs from that of an existing network.

21. A question is, to what degree can the number and location of network nodes in a cost model differ from the existing network? At the extreme is the scorched earth assumption, where there are no constraints on the number and location of the network nodes; the existing network is assumed 'burned' away. A scorched node approach, on the other hand, places restrictions on the degree of optimisation as the location and functionality of key elements in the existing infrastructure are taken as given. Because less optimisation may be undertaken under a scorched node assumption, such an approach will generally produce a higher estimate of cost than a scorched earth approach (assuming the same level and quality of service).

22. The degree of optimisation can also be looked at from the point of view of whether the cost model should incorporate any legacies from the operator's network and hence past investment decisions (whether they be technology, architecture, location of nodes etc.). A scorched earth approach will result in no such legacies being included. On the other hand, if some legacies are incorporated, it could be argued that a scorched node approach is applied.

23. On what basis should the choice between these methods be made? The rationale for optimisation is the key to answering this question.

24. When costs are optimised, incentives are provided to limit investments to those that are prudent to guard against inefficient investmentthat might otherwise exist. However, it is also important to ensure that adequate levels of investment are maintained, and a scorched node approach is more likely to serve this objective than a scorched earth approach. To date, international experience suggests that a scorched node approach is favoured. To our knowledge no regulator has built a cost model using the scorched earth approach.

25. However, there is no universally agreed definition of the scorched node assumption, indeed international experience shows that there are many hybrid forms of the scorched node assumption depending on the definition of a node and degree of optimisation.

Application to Fixed Networks

26. In a fixed network, the scorched node approach normally implies that the operator's existing number and location of its nodes are taken as given. However, to ensure that an operator has incentives to migrate to a more efficient architecture, the scorched node assumption is often modified to allow for certain optimisations, the most common being changes to the nodal hierarchy, for example replacing a local exchange with a remote concentrator.

27. The Commission's TSLRIC approach for a fixed network applies a forward-looking model of the network topology, which is based on the Telstra's proposed network design. As noted by NERA:[5]

> *"…we have essentially adopted a scorched node approach, but based on Telstra's proposed forward looking network, which is not currently fully in place …. We have taken as given estimates for the number of remote units, local switch and tandem switch sites in Australia on a forward looking basis. With regards the numbers of transmission links, we have made estimates based on our understanding of Telstra's forward looking network plan and planning principles."*

28. The Commission's bottom-up model for fixed network services thereby takes account of the fact that networks evolve over time and that operators as a result always will be somewhat constrained by their existing network topology. Further, we note that at the time of modelling, the node locations used in the Commission's model did not reflect the actual location in Telstra's network, but rather the planned location of nodes. The Commission therefore apply the scorched node assumption for its fixed network modelling although the specific approach taken seems fairly light-handed.

29. A strict interpretation of the scorched node assumptions requires that a node is defined. In the fixed network the term 'node' is usually understood as a node that performs switching (although this is not always clearly specified).

[5] NERA (1999), p.4

Application to Mobile Networks

30. In mobile networks there are only a limited number of Mobile Switching Centres. Hence, a strict interpretation of the scorched node assumption may allow considerable room for optimisation. If the scorched node alternatively is also taken as the Base Transceiver Station or mast position, the degrees of freedom in optimisation are reduced considerably.

31. As stated above, a more general interpretation of the scorched node assumption is that some legacies are included in the modelled network. In other words, 'reality' is built into the cost estimate. Mobile network design and dimensioning involves a large number of complex engineering judgements subject to a number of constraints including for example local planning rules. To accurately capture the peculiarities and details of network design in a cost model a 'scorched node data' assumption or 'scorched node calibration' may therefore be regarded as reasonable. This would mean that optimisation did not necessarily have to take account of the number and distribution of nodes in an operators network, but rather more generally have a view to network design characteristics of incumbent operators, for example in-building coverage and cell splitting. This was the approach adopted in Sweden and explained as follows:[6]

> *"The scorched-node calibration process considers all parameters in the model which influence the points being calibrated (including all implicit effects which are not explicitly modelled), and assesses to what extent those parameters are certain or less certain. Highly certain parameters would not be adjusted in the scorched-node calibration process. Less certain parameters would be 'tuned' within their expected uncertainty range until the model is suitably representative of the actual Swedish operators."*

32. In principle, scorched node calibration and the output of reconciliation between top-down and bottom-up model (as discussed above and in more detail in section 2.7) may be regarded as similar. The key difference however, is that a scorched node data assumption is an *ex ante* decision which will affect the optimisation approach, while reconciliation may result in *ex post* decisions on the appropriate modelling approach.

33. So far we have not discussed the choice of technology. However, the adoption of a scorched node assumption may put restrictions of the type of network model (if not explicitly then implicitly). In a fixed network business

6 PTS (2003), p.8

for example, there is currently a clear migration path from circuit-switched technology to more efficient packet-switched technology. However, in a packet-switched world the optimum number of nodes is likely to be less than the number in a circuit-switched network. Therefore if the scorched node assumption requires equipment at every node (no empty sites) it may not be optimal to deploy a packet-switched network.

34. In a mobile network, migration from 2G to 3G would not seem to suffer the same limitations under the scorched node assumption. We discuss the different technology options below.

2.1.2. Technology

35. While there is a wide range of technology options available for fixed and mobile operations, the choice for a fixed network is usually simplified by the fact that only one operator is modelled (i.e. the incumbent fixed network operator) and there is no dependence on spectrum allocations and choice over different mobile standards.

36. The type and nature of spectrum available to the operator will affect the way in which the network can be used to support services, and the resulting costs of that network. Similarly, the technologies considered as part of the costing calculation, for example, GSM, CDMA or W-CDMA, will influence costs.

37. In order to derive costs, consideration must be given to the underlying technology that is used to support the MTAS. This includes:

- the type and nature of the spectrum available to the operators; and
- the technology considered as part of the costing calculation.

38. With regard to the available spectrum there exists a negative relationship between spectrum frequency and radio propagation: the higher the frequency, the smaller the maximum cell radius for a given cell. This means that, in order to provide coverage of a given area, more cells will be required, and hence, the higher the fixed common costs of coverage. Consequently, in a 2G context, operators with exclusively or largely 900 MHz spectrum will tend to have lower fixed common costs than their 1800 MHz counterparts.[7,8]

[7] Although 3G uses a higher frequency than 2G, 3G is regarded to be a more cost-efficient technology and hence leading to lower unit costs.

[8] In areas where there is high subscriber density, each cell will approach full utilisation and hence the cost difference for different spectrum bands is likely to be negligible.

39. Further, the greater the spectrum allocation, the lower the incremental cost, since a given cell can deploy a greater number of traffic channels and hence carry a greater amount of traffic. Therefore, for a given amount of traffic, an operator with a greater spectrum allocation will be able to deploy fewer sites, and hence incur lower cost.

40. Finally, the quality of spectrum is also important, since contiguous spectrum may be used more efficiently and at a lower cost.

41. Therefore spectrum allocations and individual use of spectrum result in different costs.

42. Telstra, Optus and Vodafone operate GSM networks using 900 MHz spectrum. In the 1800 MHz band are Telstra, Optus, Vodafone and Hutchison. Telstra and Hutchison also use the 800 MHz spectrum for CDMA. Spectrum allocations therefore differ slightly between the operators, although Vodafone and Optus deploy services using the same bands. All active operators have access to 3G frequencies.

43. Given that all operators have access to 2G and 3G spectrum (regardless of whether they use it or not) there are no physical restrictions on choice of spectrum benchmark for forward-looking costs. Hence a number of different configurations exist for the forward-looking costs benchmark:

- a 2G only network;
- a 2.5G only network;
- a 2G/2.5G network where some account of future developments in 3G is taken;
- a 2G/2.5G and 3G network; or/and
- a 3G only network.

44. Generally, mobile networks are characterised by different generations of technology. The latest evolution is 3G (although statements regarding 4G are already being made). The question in relation to TSLRIC is therefore which generation of technology and assets best reflects the efficient forward-looking operator.

45. In the Commission's general guide to access pricing principles it notes that:[9]

[9] ACCC (1997), *Access Pricing Principles, Telecommunications – a Guide*, July, pp 21-22

> *"TSLRIC is based on forward-looking costs. These are the on-going costs of providing the service in the future using the most efficient means possible and commercially available. In practice this often means basing costs on the best-in-use technology and production practices and valuing inputs using current prices."*

46. Hence in practice forward-looking costs may be based on best-in-use technology and production practices. However, it is not clear if "best-in-use" should be interpreted as the most efficient technology available or should be limited to comprise only technology that has been tested and implemented by operators in practice (i.e. best-in-commercial-use).

47. In our view, the choice of technology should be that an efficient operator would use if it were to build or upgrade the network today. An efficient operator would use the best productive technology available for its business. This entails finding the right balance between the technology that is proven and reliable and represents more or less the current state of the art, and the technology that is new, promising great cost savings, but has not yet demonstrated conclusively its strengths.

48. It would seem that the "best-in-use" technology definition allows for the inclusion of 3G within the framework for estimating the TSLRIC for MTAS. 3G networks are currently being deployed worldwide and currently at the top of the mobile migration path. Indeed it seems unlikely that operators would make this transition if it did not provide a lower cost in the long run.

49. From the viewpoint of technology we therefore see no restrictions in applying TSLRIC to a 3G network to calculate the cost of the MTAS and hence regard 3G as falling within the definition of efficient forward-looking costs.

50. In reality operators such as Vodafone, Optus and Telstra are likely to combine the use of 2G and 3G technologies over a period of time (much like the combination of analogue and digital systems in the late nineties). However, this transition path and the timing issues associated with it are irrelevant to the discussion of best-in-use technology.

2.1.3. Conclusion

51. Forward-looking efficient costs are best proxied (or modelled) in a bottom-up TSLRIC framework. Such an approach typically puts some constraints on the degree of optimisation, including the scorched node assumption and choice of technology.

52. The costing approach by Vodafone is based on data that reflects their actual network. As a matter of principle, such a costing approach will tend to be inconsistent with the competitive market standard underlying TSLRIC. Nevertheless, it is unclear if there is scope for additional optimisation within that constraint, but we would regard it as unlikely that no adjustments would be made to the existing deployment if a new network were rolled out today.

53. More important is the choice of technology. As we have discussed above, there does not appear to be any constraints to assuming the most efficient forward-looking technology is 3G. Clearly, Vodafone's data does not reflect 3G technology. In our view, a 3G network is likely to lead to the lowest cost estimates over time. A 2G only network would not represent the best-in-use technology and is also likely to result in the most conservative cost estimate. As such we do not regard that the current cost estimate provided by Vodafone to represent efficient forward-looking costs.

54. However, it also important to recall that that 3G and 2G (900 MHz) differ in terms of ability to provide coverage. TSLRIC of the MTAS should reflect the cost minimising estimate (over the long term) given the information and forecasts we can make today and the constraints affecting optimisation. Depending on the constraints for the analysis it may for example be the case that some 2G technology (using the 900 MHz band) is unavoidable or a hybrid solution is optimal.

55. Nevertheless, the introduction of 3G in existing networks would be expected to result in lower costs (due to lower unit costs and economies of scope and scale in 3G). For example as noted by one industry analyst "*in theory a fully loaded 3G network is 25% more efficient than a 2G network*".[10] Given that this is the case a cost model based purely on 2G technology would provide a cost ceiling for the forward-looking cost of MTAS.

56. Finally, we have argued that the approach adopted by PwC is far from consistent with approaches adopted by regulators in other jurisdictions. The efficient forward-looking cost benchmark is that is that of a bottom-up TSLRIC model. Reconciliation of a bottom-up model with operator data is a process that is intended to reveal where the bottom-up model has neglected essential cost components and/or where the operator's data reflect over-investment and inefficiencies.

[10] Citigroup (2004), p 46

57. Clearly, this is not the approach adopted by PwC. As such no confidence is provided that the cost estimate provided by PwC is representative of efficient forward-looking costs (even if it was assumed that 2G technology was an appropriate forward-looking benchmark). This conclusion is further supported by a comparison to the charges proposed by the Optus model that are considerably lower than those suggested by Vodafone.

2.2. Price related terms and conditions – adjustment path

The Commission seeks the views of interested parties as to the reasonableness of the proposed adjustment path for Vodafone's MTAS prices.

58. In both adjustment paths (original and revised) Vodafone applies a methodology of equal decrements at the start of each year. In the revised proposal the decrement is approximately 1.62 pm per year.

59. Assuming one accepts that an adjustment path is needed, there are two issues that may be discussed: the length of the adjustment period and the size the annual decrements.

60. With regard to the size of decrements, we are not aware of any arguments that would suggest larger or smaller decrements in earlier years or later years, or any other more advanced reduction profiles over time. One possible option could be to consider equally large percentage changes over time instead of equal absolute proportions. This would increase the reduction in early years and reduce it in later years. We do not have a strong preference for either method.

61. Regarding the adjustment period there are three of options: *i*) accepting Vodafone's three year adjustment, *ii*) increasing it or *iii*) decreasing it.

62. The main argument for having a rather long adjustment period is that any one-off changes may have disruptive effects on the market. However, the magnitude of the total reduction suggested by Vodafone is small, indeed the original suggestion by Vodafone amounts to a reduction of 3.51 cpm which is only slightly above the yearly decrement of 3 cpm in the Commission's proposed adjustment path. Hence based on this observation alone we suggest that Vodafone's three year adjustment is excessive.

63. In addition, evidence on the cost the MTAS suggests that current prices are far above cost and have been for some time and that mobile operators have been earning economic profits. In such a situation it is imperative that any

phasing in of changes be reduced to an absolute minimum to ensure the LTIE.

64. To summarise, we suggest that any MTAS price adjustment that is as minor as that proposed by Vodafone be implemented as a one-off adjustment.

2.3. PwC modelling – the approach

The Commission invites interested parties to comment on whether the modelling approach employed by PwC is appropriate for estimating the forward-looking efficient economic costs of providing the MTAS on Vodafone's network?

65. There are basically three approaches that can be used to establish the cost of the MTAS. These are:

- a top-down approach, where an operator's existing accounts are modified or adapted.
- a bottom-up approach, which starts from a network engineering model and assesses the optimal network design to meet a given subscriber and traffic profile.
- international benchmarking where charges in other jurisdictions are collected to inform on the likely cost of a particular service.

66. The Fully Allocated Cost (FAC) approach adopted by PwC falls within the top-down category. Such an approach can be based upon on a number of cost types, although it will tend to be backward-looking in that it relies on the records of the operator. There is no requirement in the FAC approach that cost be efficient or forward-looking. The FAC approach only specifies that all costs be allocated to services using some predefined allocation keys.

67. As a top-down costing approach, the FAC approach has a number of well known strengths and weaknesses.

68. The main strengths are:

- it is based on the Vodafone's actual costs of providing the MTAS as opposed to potentially unrealistic assumptions in a bottom-up model or corrections to national operating conditions in benchmark approaches;
- it provides an accurate measurement of the total amount of incurred costs; and

- it provides an audit trail with the possibility of cross checking with audited accounts.

69. The main weaknesses are:

- it does not take account of potential efficiency improvements as the approach is constrained by the historical network structure and operating practices of Vodafone. The approach is therefore static and backward-looking rather than forward-looking since it relies on actual records of investments and operating costs (one to two years old) used to support the MTAS;[11]
- it decreases objectivity and transparency since input data, assumptions, and calculations cannot not easily be scrutinised by the regulator or by other parties. If a top-down approach is to be fully transparent it is likely that problems of maintaining confidentiality will be encountered; and
- unless considerable effort is made to transform or adapt existing accounting practices the approach will have to rely heavily on allocations of joint and common costs among different services, that are subject to considerable judgement. This makes the results (service costs) prone to large variations depending upon the particular allocation rule used.

70. The result of the FAC approach adopted by Vodafone is that it will tend to err on the side of overstating the economic costs of providing the MTAS.

71. Further, we note that the FAC method inherently uses a short run view of costs, in that it only captures costs that are incurred at the same time as the output is produced. The appropriate costing benchmark TSLRIC (as we have discussed above) uses a long run view of costs.

72. As a modelling approach, it is therefore our view that the FAC approach is inappropriate for estimating the forward-looking efficient costs of providing the MTAS on Vodafone's network.

[11] No account is taken at all of plans and expectations concerning the future optimal expansion and operation and no attention is paid to examining how system development and hence costs would vary according to say traffic projections.

2.4. PwC modelling – operator benchmark

The Commission seeks the views of interested parties as to whether the PwC modelling approach of using cost inputs for Vodafone is appropriate, or whether an alternative approach, such as the use of an industry average or a 'hypothetical operator' is more appropriate.

73. As we have argued above we regard TSLRIC as the appropriate approach for costing of the MTAS. Within an efficient operator concept like TSLRIC, cost differences due to commercial decisions should be discarded.

74. As such we regard that there are only two major legitimate cost differences:

- spectrum allocation; and
- economies of scale.

75. As discussed in section 2.1.2, since operators on the Australian market have similar spectrum endowments (coupled with considerations on the interpretation of forward-looking costs) we do not consider that any one operator has a significant cost advantage over another based on spectrum allocation.

76. With regard to economies of scale, it is clearly recognised in network industries that larger operators will enjoy significant cost advantages over smaller operators. The question is whether should this be reflected in the cost of the MTAS.

77. In order to answer this question it is necessary to consider the source of the scale advantage. This source of the advantage may be gained in two distinct ways:

- by early entry in the market and exploitation of the potential first mover advantages and benefit of incumbency; or
- in head on competition with others;

78. If a mobile operator has established its scale advantage as a result of early entry into the mobile market, then the regulated MTAS should be based on the operator's actual market share. The operator's lower costs are a benefit of its incumbency and other operators should not pay a MTAS charge above the operator's cost.

79. If a mobile operator, on the other hand, has established its scale advantage in a fully competitive (retail) market then the regulated MTAS should not take

account of the economies of scale. In a competitive market, if one operator has achieved a market share larger than average it is a sign of greater efficiency. Conversely, if an operator has a smaller than average market share, this may be taken as a sign of inefficiency. In such circumstances it may be appropriate for the MTAS to be based on a market share equal to the average of all mobile operators. This rewards the efficient operator and provides incentives for smaller operators to become more efficient.

80. In Australia each of the main 2G / 2½G operators (Telstra, Optus and Vodafone) were granted digital licenses at the same time (although Telstra and Optus had the incumbency benefit of analogue services), so the primary source of scale economies may be argued to be the relative effectiveness and efficiency of their operations. A similar argument may be made for 3G.

81. It would therefore seem that the concept of an operator's notional efficient market share is appropriate. This concept is also useful to ensure that a mobile operator cannot derive an unfair competitive advantage from incumbency, while still allowing it to derive an advantage from efficiency gained in a competitive market.

82. By virtue of solely using cost data from Vodafone, it is therefore our view that PwC's modelling approach is inappropriate. An appropriate costing benchmark would be that of an industry average measured by a hypothetical new entrant to the market.

2.5. An alternative modelling approach

In the event that an alternative modelling approach was undertaken, do interested parties believe this would change the estimate of the forward-looking efficient economic costs of providing the MTAS?

83. Based on the discussion in the previous sections it should be clear that we believe that an alternative approach is likely to change the PwC estimate of the forward-looking efficient economic costs of providing the MTAS.

84. The appropriate forward-looking efficient economic cost concept is TSLRIC. The FAC approach used PwC is not an appropriate proxy for such a concept. Even if there was no need to make operator adjustments based on

(productive) efficiency considerations[12], the methodology employed by PwC is not appropriate. As we have discussed:

- the efficient forward-looking cost benchmark should be that of 3G – the cost inputs used by PwC are 2G / 2½G;
- the PwC approach will tend to err on the side of overstating the costs of the MTAS;
- there is very limited transparency in the cost allocations made by PwC; and
- there are strong arguments for using a hypothetical average operator approach when calculating the TSRLIC of MTAS.

85. It is therefore our contention that a bottom-up TSLRIC modelling approach is likely to provide a different and lower estimate of the forward-looking efficient economic costs of providing MTAS.

2.6. PwC modelling – base year

Is the PwC model's use of 2002-03 as a base year appropriate given the proposed Undertaking and the period of time for which it will operate (if the Commission were to accept the Undertaking)?

86. We would be surprised if 2002-03 unit costs were an appropriate reflection of the costs of 2007. International experience from the UK and Sweden clearly suggests that that the cost of mobile termination will decrease over time.

87. The use of 2002-03 is a consequence of the FAC methodology employed by Vodafone and its consultants, PwC. However, we note that it is normal that there is a time lag of typically one-year between prices and underlying cost data in cost models.

88. One way to overcome this would be to use forecasting techniques to estimate a cost for 2007. Under such an approach, costs would be calculated on the basis of the most recent available data which we presume in the case of Vodafone is 2002-03. The results could then be projected forward. For example, termination prices for 2006-07 could be estimated on the basis of costs for 2002-03 minus, say, 2% per year, reflecting for example an underlying assumption of falling equipment prices and increased traffic

[12] Examples of inefficient costs include using an asset which is not the Modern Equivalent Asset (MEA), inefficient processes or excessive labour and other inputs, even given efficient technologies and processes.

volumes. Alternatively, Vodafone could run the model for different historic years and estimate a trend based on these calculations.

89. We do not have access to data to make such an adjustment. However, based on our examination of the Swedish LRIC model we suggest that costs may be reduced by 10% by 2007.

2.7. PwC modelling – reconciliation of inputs

Is the modelling approach of reconciling 'optimised' cost inputs with actual operating costs and actual traffic volume a reasonable/appropriate approach for estimating the forward-looking efficient economic costs of supplying the MTAS in Australia?

90. As discussed above we believe that the appropriate forward-looking economic cost benchmark should be that of a bottom-up TSLRIC model. Such a model is more precise in enabling cost causation of capital assets to be identified, increases objectivity and transparency and takes account of all theoretically available efficiencies, both technical and operational. However, a bottom-up model suffers from a number of well-known weaknesses, for example:

- it cannot deal convincingly with operating costs;
- it may underestimate costs as essential cost components are neglected; and
- is typically based on a theoretically constructed network, which has not been tested in practice.

91. For these reasons it is not uncommon for a bottom-up model be reconciled with a top-down model. In particular, the strengths of the two approaches complement each other to a large extent. By combining the two, it is possible to draw on the benefits of both approaches while minimising their weaknesses.

92. The degree to which the actual reconciliation process is helpful will however, to large extent be determined by the top-down data (or models) that are used as part of the reconciliation process.

93. The objective of reconciliation is sometimes loosely described as "closing the gap" between two approaches. This means that the most important sources of difference between the two approaches need to be identified and quantified. Reconciliation will therefore:

- highlight the sources of difference;
- quantify the impact of the differences; and
- assist in verification of both approaches.

94. With regard to verification, reviewing the approaches taken and the assumptions used at a detailed level assists in testing the robustness of the approaches. In practice, this is particularly important in the case of a bottom-up model given that the model does not start from a fixed reference point and the large number of data assumptions required and the likely complexity of many of the algorithms.

95. The better the models are and in particular the more detailed the top-down approach is, the more effective reconciliation will be. The reconciliation process needs to be undertaken at the level of individual assets and ideally at a lower level of disaggregation. Further and ideally, the top-down model should be based on TSLRIC principles. In our view, the model delivered by Vodafone is inadequate in this respect.

96. An important aspect of (and time consuming step in building) a top-down model based on TSLRIC principles is the development of Cost Volume Relationships (CVRs).[13] In particular, CVRs:

- trace how individual costs vary with underlying cost drivers; and
- identify variable, fixed, common and joint costs.

97. In simple terms, a CVR is a curve which describes the relationship between the volume of a cost driver and its related costs. The two key characteristics of a CVR are the gradient of the curve describing the marginal cost for each value of the cost driver volume and the intercept with cost axis describing the fixed costs.

98. In some cases, the relationships may be based on existing engineering models or based on simulations undertaken by engineers. In other cases, the estimates may be based on regression analysis or examinations of the

[13] BT's top-down LRIC model for their fixed network in the UK include circa 500 different homogeneous cost categories (costs that have similar characteristics) each with their own CVR. There are CVRs for typical telecommunication assets but also different types of maintenance, network planning, overhead functions etc. Clearly, this type of detailed analysis has not been carried out by PwC.

processes underlying particular activities by conducting interviews and field research. [14]

99. In the absence of detailed TSLRIC top-down models, the models delivered by Vodafone may still be used to inform decisions made in bottom-up TSLRIC modelling context. However, the models ability to inform the process will be diminished.

2.8. PwC modelling – audit

In the view of interested parties, should the model input data have been audited prior to being included in the PwC model?

100. One of the main advantages of a top-down approach and indeed a FAC approach is that it should provide a strong audit trail: costs can be traced back to the audited accounts of Vodafone[15] and the models and methods used for re-valuation of assets can assessed to ensure that they result in accurate and fair reflection of costs.

101. One of the main disadvantages of a top-down approach is that it is non-transparent and introduces problems of confidential data if it is to be subjected to public scrutiny. Hence it may be difficult for third parties to properly evaluate the model. Where this is the case it is imperative that auditing be carried out by an independent party.

102. In the current case the PwC model as already been substantially revised once, leading to a significant downward adjustment of costs. Clearly, this does not provide confidence in the results.

---

[14] As noted above estimating CVRs may be resource intensive tasks. In some cases the benefit may not always exceed the costs of this estimation. It may therefore be sufficient to estimate accurately CVRs for the most important cost categories. This is especially the case given the use of broad increments. This pragmatic solution is reflected in the Swedish Model Reference Paper for the bottom-up and top-down cost analyses for the fixed network (p 73, Criterion TD 30):

> *"…the top-down model should estimate cost-volume relationships for the major cost categories (making up at least 75% of the total annual costs in the core and access network respectively), focusing on asset categories where the presence of fixed costs, scale economies and scope economies are likely to be most significant. For the remaining cost categories, the top-down model may assume that the CVR curve is a straight line through the origin."* (emphasis added)

We note that a CVR curve with a straight line through the origin (i.e. there are no fixed costs and no economies of scale or scope) effectively correspond to a FAC approach.

[15] Note that the asset revaluation methodology employed by PwC does not allow costs to be traced back to the accounts of Vodafone.

103. Based on the above we suggest that any cost estimates based on Vodafone input data be subject to independent audit. Based on an assessment of significance and risk, such an audit could include, but not necessarily be limited to (spot) checks of:

- the relationship between the network assets and underlying registers, key statistics, etc;
- valuation methodology;
- annualisation calculations;
- allocation methodologies and allocation keys; and
- volumes, traffic statistics, etc.

104. The purpose of the audit would be to ensure that the information and calculations provided are correct and provide confidence in the results.

2.9. Depreciation – appropriateness of approach

The Commission seeks the views of interested parties as to whether the approach undertaken to calculate depreciation costs in the PwC model is appropriate and/or reasonable? Why or why not?

105. The annualisation charge consists of two elements, namely a depreciation charge and a capital charge:

- the depreciation charge compensates for the diminution in the value of the asset over the course of time; and
- the capital charge is measured as the Net Replacement Cost (NRC) of the asset, i.e. the Gross Replacement Cost (GRC) less accumulated depreciation, multiplied by the cost of capital. It can be noted that since the NRC for a single vintage of an asset decreases over time so to does the capital charge.

106. PwC has used tilted annuities to estimate the annualised cost.

107. A standard annuity calculates the charge that, after discounting, recovers the asset's purchase price and financing costs in equal annual sums. In the beginning of an assets lifetime the annualisation charge will consist more of capital charges and less of depreciation charges; this reverses over time resulting in an upward sloping depreciation schedule. The increase in the depreciation charge over time exactly counterbalances the decrease in the

capital charge with the result that the annualisation charge is constant over time.

108. A tilted annuity calculates an annuity charge that changes between years at the same rate as the price of the asset is expected to change. This results in declining annualisation charges if prices are expected to fall over time[16].

109. From a theoretical point of view the correct deprecation charge is economic depreciation. In regulatory literature, the concept of economic depreciation is frequently referred to as determining the time path of revenue and prices for the services of an asset. The broader concept was developed by Hotelling (1925).

110. Economic depreciation measures the change in an asset's economic value. It takes account of all the underlying factors, influencing the annualisation charge and furthermore produces consistent annualisation charges.

111. Economic depreciation can be calculated as the estimated Net Present Value (**NPV**) of future cash flows at the start of a given year less the estimated NPV of future cash flows at the end of the year.[17] The depreciation profile will depend on a number of factors such as the expected development in annual operating costs, the revenue generated by the asset and the asset's price (acquisition cost).

112. Where operating costs, revenues, and asset prices are expected to remain constant, the annualisation charges will be constant in each year of the asset's lifetime. The depreciation charge will increase over time and this increase will precisely offset the fall in the capital charge which occurs as the NPV of the asset declines. Only in this circumstance will the economic depreciation plus capital charge be the same as the annuity charge.

113. Several examples can be constructed where the (tilted) annuity charge will differ from an economic depreciation profile:

- if operating costs are increasing with the age of the asset but the other assumptions are unchanged, the depreciation charge will need to be

16 For a large enough tilt the slope of the depreciation profile could also be negative.

17 Economic depreciation is the difference over a (each) year of the present value of a firm or asset's expected net revenue. Generally, market forces determine the expected net revenue path with the valuation of the entity adjusting to 'allow' normal profits over its life. An investor implicitly evaluates the earning potential against the cost of purchase. For a regulated firm, the earning path is not determined by the market but by the goal of a regulator to force it to earn a normal return over its life. The regulator sets a price path to allow the regulated firm to earn a normal return and recover its initial capital outlay. By defining the price and earning path, the regulator also defines the economic depreciation each year.

higher in the early years of the asset. Hence the total annualisation charge will be greater using economic depreciation compared to a tilted annuity approach in the early years of the asset's lifetime and less in the later years; or

- if revenue increases over time, but operating costs and asset prices are constant, less depreciation will be taken in early years and more in later years compared to a tilted annuity approach.

114. Ideally, the annualisation methodology used should be that which most closely approximates to economic depreciation. Whilst recognising that economic depreciation calculations are data intensive (and may take time to develop as noted by PwC), it should also be recognised that it has been done before in other markets. Notably, publicly available economic depreciation calculations (and spreadsheets) are available from the Swedish and UK LRIC processes for mobile termination.

115. Further, economic depreciation principles not only inform the annualisation process, but also inform the issue of the appropriate asset lives as well, since both of these are "outputs" of an economic depreciation calculation.

116. While it may be argued that a tilted annuity approach gives a reasonable proxy to the results of economic depreciation, this may not always be the case. PwC even suggest that their approach may overstate the annual costs and hence depart from the ideal. As we will discuss in the answer to the next question (section 2.10), a tilted annuity is likely to result in higher annualised charges than economic depreciation in early years but lower charges in later years resulting an average charge over the lifetime of the asset that is similar under the two methodologies. Hence for mature technologies (and multiple vintages of assets) the difference between the approaches is likely to be less pronounced. Where this is case we would regard titled annuities as a reasonable and pragmatic solution to the annualisation problem. However, that said, it is then important that asset lives and price trends are appropriately specified.

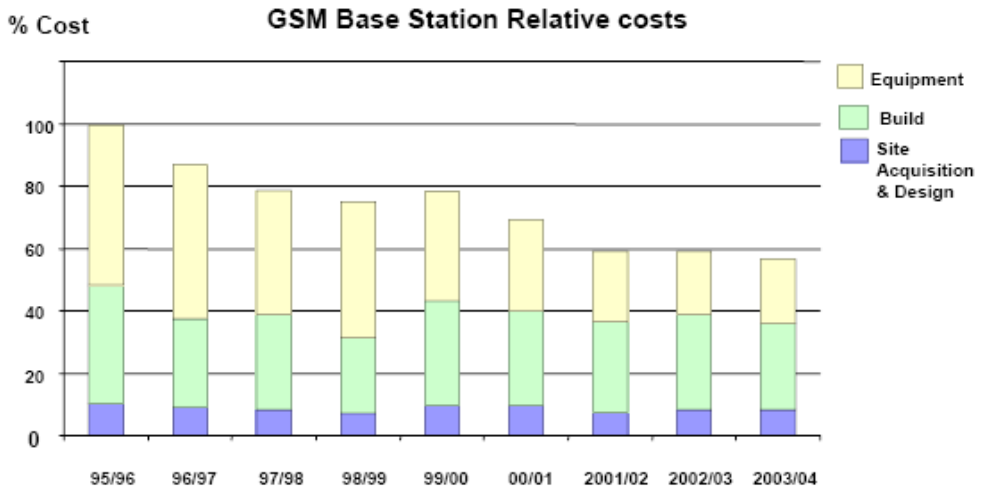
117. The asset lives used in the PwC model should correspond to the economic lifetime of the assets. In the annualisation formula quoted by PwC it is indicated asset lives correspond to the 'useful' lives.[18] It is unclear whether this is an economic asset life, book life or an alternative concept. Book asset lives are likely to be shorter than economic asset lives, due to conservative

[18] PwC (2004), op. cit., p. 10

accounting practices.[19] We have compared the asset lives in the PwC model with those in publicly available models. Our review indicates the asset lives in the PwC model are too short and hence will tend to overstate annualised costs.

118. With regard to price trends, a potential complicating issue is that these should not just reflect price changes to the assets, but also price changes for labour input. While prices for equipment are generally falling, this is not true of labour costs. This may be illustrated by the following figure from Optus.[20]

FIGURE 1: CHANGES IN BASE STATION COSTS OVER TIME



119. The figure illustrates that while equipment prices have tended to decrease, build and acquisition and design which we presume have a significant labour component have been more or less constant.[21] Further, it is interesting to note that build and acquisition costs constitute more than three quarters of base station costs today compared to approximately half 10 years ago. Hence, it would result in a significant overstatement of annual costs if "pure"

19 Another issue that has implications when the annualisation charge is calculated using straight-line depreciation (as PwC assumes for non-network costs) is the adjustment of book asset lives. If book asset lives are adjusted, it is also necessary to adjust the net asset values, as the assets would then be less (or more) depreciated than would appear from the accounts. Although a longer asset life would lead to a lower depreciation charge, it would also lead to a capital charge as the costs. It might be the case that the overall effect on annual capital costs might be limited. However, no indication of this has been provided by PwC.

20 Presentation by Dr. Michael Wang, General Manager Technology & Planning SingTel Optus, *Challenging the Future*, 4 July 2003. Available at:
http://www.gu.edu.au/conference/questnet2003/docs/Michael_Wagg.pdf

21 We note that in the Analysys models used in the UK and in Sweden, an assumption of no further reduction in the real cost per unit output after a number of years has been used in their economic depreciation model.

equipment price trends where used in the titled annuity formula to annualise the total cost of a base station.

120. In a modelling context such differences may be dealt with by estimating equipment installation costs separately from those of equipment costs. However, PwC seem to have bundled these costs together. No indication has been provided by PwC if such differences in price trends have been taken into account.

121. The tilted annuity formula recommended by PwC also includes a term for adjusting the investment cost for the period from payment to commencement of productive service. If the cost of capital is larger than the price trend and there is positive time lag between payment and commencement of productive service, the annualised cost will be increased compared to a situation where this adjustment was not made. While we accept that there is an opportunity cost of having paid for but not taken into service a particular piece of equipment, it is unclear if such a cost item would in fact constitute part of an efficient forward-looking operator/cost concept. An operator should have incentive to minimise such (work in progress) costs and make the appropriate arrangements and contracts with equipment suppliers to minimise the time of payment to the date of commencement of productive service. Indeed it may be the case that there are cases where equipment is used before it is paid for.

2.10. Depreciation – under- or over stated

Do interested parties agree with Vodafone's view that that the use of the 'tilted annuity formula' is likely to understate annual capital costs of Vodafone's GSM network? Why or why not?

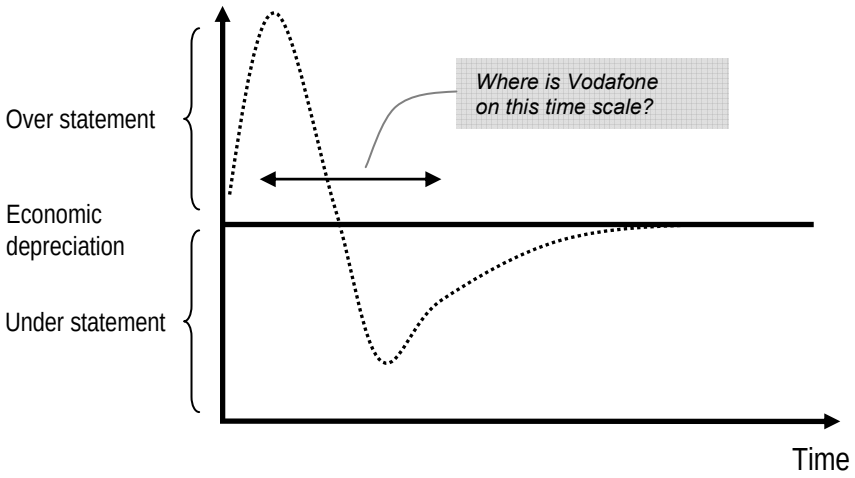
122. PwC state that the tilted annuity method may, in comparison to the ideal, economic depreciation, understate the annualised capital costs due to the lack of recognition of the changes in output profiles of assets over time.

123. While we do not necessarily reject the observation, we note that tilted annuities may also *overstate* the annualised capital costs.

124. The key observation to make is that any at given point in time annualisation profiles will differ. In general, we agree that experience from the countries quoted by PwC suggests that economic depreciation will tend to recover a greater proportion of costs in later years than other annualisation methods (including the tilted annuity). This deference from economic depreciation seems to occur due to lower output and higher equipment prices in earlier

years. The tilted annuity (and other annulation methodologies) will therefore tend to produce too high costs in early years and too low in later years. This is illustrated in the figure below.

FIGURE 2: COST RECOVERED USING TILTED ANNUITIES COMPARED TO ECONOMIC DEPRECIATION



125. In early years the tilted annuity will tend to overstate the annualised capital costs, while costs will be understated in later years. Hence in the case of new assets, tilted annuities will generally yield higher charges in the early years of an asset's lifetime than economic depreciation (except where operating costs are rising or where asset prices are falling rapidly).

126. Without detailed information on the age, mix and utilisation of Vodafone's assets it is difficult to evaluate where Vodafone (on average) would be on the cost recovery path. Indeed, no data has been provided by PwC to substantiate their claim. In our view, international experience suggests that Vodafone are broadly on a point on the cost recovery path where the annualisation charge derived from tilted annuities and economic depreciation would be fairly similar. Without further analysis we would therefore presume that tilted annuities did not overstate nor understate annual capital costs.

2.11. Depreciation – cost allocation

Do interested parties agree with the view that a number of cost allocation assumptions in the PwC model are likely to underestimate capital costs? Please provide reasons.

127. PwC note that customer care costs have been allocated to the subscription event, rather than being defined as a fixed common cost. They regard this as a potential conservatism. In our view, customer care costs are a retail cost category and therefore should be excluded from the cost of the MTAS. Hence there is no conservatism as suggested by PwC.

128. In this respect we also note that all costs related to the SIM-card should be allocated to the subscription event since the cost driver for these costs is the number of subscribers (no. of SIM cards) rather than the volume of traffic. The fact that outgoing and incoming calls use the SIM card is irrelevant. We have not been able to separately identify the cost of SIM-cards in the PwC model, but assume that it has been allocated to the subscription event.

129. More generally, the choice of cost allocation assumptions are important for the final outcome. However, the documentation received from Vodafone does not provided a detailed discussion of individual cost allocations. Further, there may be off-setting factors, for example no indication has been provided of whether revenues are received from, leasing masts or equipment to other operators. If this is the case these should be offset against the costs of network operation.

2.12. Depreciation – different methods

In the view of interested parties, is it appropriate that two different methods for calculating depreciation have been used in the PwC model? Please provide reasons.

130. As discussed in section 2.9, the choice of depreciation schedule should in theory reflect the one that most closely matches economic depreciation. In terms of non-network costs, PwC have opted for straight-line depreciation.

131. Where the rate of investment is even and has taken place for a period equal to the asset's lifetime, the difference between economic depreciation and straight line depreciation for multiple vintages will be significantly less than for a single vintage. For example, if annualisation Method A yields higher annualisation charges than Method B for relatively new assets, it follows that Method B will yield higher annualisation charges than Method A for relatively old assets. Hence, when the annualisation charge is based on a mix of vintages, Methods A and B are likely to be a lot closer than for a single vintage of equipment.

132. Consequently, it may be appropriate to use (tilted) straight line depreciation as the annualisation methodology in PwC's model for non-network costs, although we recommend that that this should be supported by indicative estimates of economic depreciation based on the best available information on price trends, operating costs etc. relating to the assets in question.

2.13. SMS as a stand alone service

The Commission invites comment from interested parties on whether the assumption of SMS being the stand alone service (as opposed to voice being the stand alone service) is appropriate?

133. As discussed elsewhere in this report, a substantial part of the costs in telecommunication networks are shared/common costs, reflecting the substantial economies of scale and scope inherent in constructing and operating a network.

134. Shared costs may be defined as those costs that are associated with services in the same increments whereas common costs are the costs that are shared between increments. We can define an increment for each service that uses the network or alternatively use a more broad definition of the increment (this is discussed in section 2.16)

135. Stand Alone Costs (SAC) are the theoretical costs an operator would incur if it were producing only a subset of the services provided. Voice or SMS are examples of this. Assume a mobile operator only produces voice and SMS services. Assume further that we define a separate SMS and voice increment. If a mobile operator only produced, say, the SMS service, it would still need all the trench used by the voice increment. Hence by costing SMS according to a standalone criterion, SMS services would be allocated all shared and common costs.

136. If we instead had costed the SAC of voice services, these services would have been allocated all shared and common costs. In both cases we have a cost ceiling for the service. The SAC criterion/ceiling is therefore useful in determining (and to avoid) anti-competitive pricing of individual services as well as to combinations of services. It is not appropriate for setting the price of a service. The appropriate approach is TSLRIC (see section 2.1).

137. We do therefore not regard SAC pricing of either service (SMS or voice) as appropriate in the current context.

2.14. WACC – appropriate estimate

The Commission seeks interested parties' views on the appropriate WACC estimate to use when attempting to estimate the forward-looking efficient cost of providing the MTAS?

138. In our view there are two issues that warrant special attention in determining the appropriate WACC estimate to use when attempting to estimate the forward-looking efficient costs of the MTAS:

- does the MTAS display characteristics that differ from other services and if so how?
- should different cost of capital rates be calculated for different operators?

139. We consider each question in turn below.

2.14.1. The nature of the MTAS

140. The need to distinguish the average risk and required rates of return for a company as a whole from the risk of and required rate for a specific project, business line or service is well recognised in corporate finance texts and courses. For example: [22]

> *"The cost of capital is the rate of return that the firm must expect to earn on its average-risk investments in order to provide a fair expected return to all its security holders.*
>
> *We use it to value new assets that have the same risk as the old ones and that support the same rate of debt.*
>
> *…the weighted average cost of capital [for the firm as a whole] is an appropriate discount rate only for a project that is a carbon copy of the firm's existing business."*

141. Brealey et al. (2001) also cite the example of Siemens which, in recognition of the fact that required returns should depend on the riskiness of each line of business, distinguishes 16 different discount rates based on the volatility of shares of rival companies in each relevant industry.[23]

142. Where the risk to the business line differs substantially from that of the average of the company's total portfolio of activities, all risk dependent

[22] Brealey, R, Myers, S and Marcus (2001), *Principles of Corporate Finance,* p.333

[23] *The Economist, How High a Hurdle?*, 8 May, 1999, p. 82 quoted in Brealey, R, Myers S and Marcus, A *ibid*, p. 306.

parameters will be affected. These include the gearing ratio, the debt margin and the betas.

143. Because there are potentially different levels of risk in MTAS services than in other parts of an operator's business activities, it is convenient to form a summary opinion on comparative levels of risk before the individual parameters are reviewed. In order to do so, we consider the nature and characteristics of the investment in different parts of the telecommunications business, in particular we consider (and compare) the fixed network market, the mobile market and that of the MTAS on a number of fundamental features.

144. We note that the category, MTAS, per definition is a subset of the category mobile business.

TABLE 1: COMPARISON OF FIXED AND MOBILE BUSINESSES AND THE MTAS

Category	*Fixed Business*	*Mobile Business*	*MTAS*
Technology	Stable predictable technology.	Different technology platforms that are constantly evolving. Operators use different technologies.	As for mobile business.
Demand characteristics	Established usage patterns, low income elasticity.	Fairly volatile demand patterns, significant growth in subscriber numbers and usage in recent years	As for mobile business.
Pricing	Pricing structure largely based on fixed fees from subscription charges.	A diversity of fixed and variable revenue with a large degree of variable elements, through pre-pay arrangements	Revenue depends on the fixed to mobile and mobile to mobile calling pattern.
Regulation	Significant.	Currently limited.	As for mobile business.
Competition prospects	Service competition (reselling). Limited prospect of infrastructure competition. Duplication of the local loop is not economical.	Infrastructure competition in retail segment. Lack of competition for wholesale termination services.	Doubtful prospect of competition for termination services, limited or no countervailing power.
Nature of customer	Traditional mix of residential and business customers. Interconnection agreements with other operators.	Retail revenue contains a relatively larger share from young people compared with that of the fixed network. Interconnection agreements with other operators.	Only wholesale revenue, with contracts between operators. Reduced credit risk.
Nature of services	Many mature services. Increased focus on broadband	A large range of different services Increasing number of data services.	Degree of variability is likely to be less than other mobile services (on average). More mature than other mobile services.

145. The comparison shows that the fundamental nature of the mobile business differs considerably from that of the fixed line business.

146. Regarding *technology*, the fixed line business is mature; it uses stable and fairly predictable technology. This contrasts mobile operators that may operate on different technology platforms (i.e. CDMA and GSM) that are constantly evolving. Accordingly the technology risk is greater for mobile businesses than their fixed line counterparts.

147. In terms of *demand,* the fixed line business has established usage patterns and a low income elasticity (it is a basic commodity). In contrast to this, mobile services are arguably more income elastic than fixed line services and follow a more volatile demand pattern. The question is whether the MTAS in itself is very income elastic.

148. Evidence suggests that the MTAS service is relatively price inelastic.[24] Unfortunately, the two elasticity concepts are not directly comparable. Further, it is conceptually difficult to separate out the income elasticity of the basic mobile service from that of termination. However, we would expect mobile income elasticities to be higher than their fixed network counterparts.[25] Accordingly, this points to a higher beta value for mobile operators than that of the fixed line operator.

149. The *pricing* structure deployed by mobile operators typically encompasses a higher degree of variable revenue than that of the fixed network operator. In particular, a large share of revenue generated by mobile operators is through pre-pay arrangements. It is likely that the revenues from these customers would be more sensitive to the business cycle than contract or post-paid customers. For example pre-pay customers have a greater ability to vary their expenditure on a month-by-month basis. This variability in revenue increases sensitivity to real GDP shocks relative the fixed line business where revenue to a much larger degree is fixed and thus contains a cushion against downturns in the economy.

---

24 See for example evidence provided in Competition Commission (2003), Chapter 8, pp 206 – 218. Chapter 8 is available at:
http://www.competition-commission.org.uk/rep_pub/reports/2003/fulltext/475c8.pdf

25 In this respect we note a comment provided by COG (a group of fixed network operators) to the Competition Commission (2003), ibid, p 192, footnote 1 on the evolution of the income elasticity of mobile services: "*…during the high growth phase … mobile phones adopted the characteristics of a 'superior good' where customers viewed the product as a non-essential luxury that they could do without if they needed to cut their spending. As the market approached saturation, the product takes on the form of a 'normal' or even 'inferior' good with much lower income elasticity.*" Chapter 7 is available at:
http://www.competition-commission.org.uk/rep_pub/reports/2003/fulltext/475c7.pdf

150. An issue related to pricing is the duration of contracts with customers. If contract prices are set for relatively long periods this will reduce the ability to react to changes in the economy. Likewise shorter periods will improve reaction speed. In our view, neither retail or wholesale contracts in fixed network businesses or mobile businesses are likely to be of a length that will have substantial influence on risk or beta.

151. With regard to *regulation* the fixed line business has historically been subject to tight regulation. Compared to the fixed line business we would therefore expect the mobile business with little or no regulation to have higher asset beta. However, the exact effects of regulation will depend on its type and nature. Further, firms that do not face explicit regulatory controls may nevertheless operate in the knowledge that regulation may be introduced.

152. Together, this group of four factors: evolving technology, relatively high income elasticity, variability of revenue and lack of regulation, imply an *a priori* expectation that the level of risk is higher for mobile operators than that of fixed network operations.

153. The last three points in the table above comprise competition prospects and nature of customer and service.

154. With regard to the prospects of *competition*, there are clearly limited prospects of real infrastructure competition in the fixed line market - it would not be economical to duplicate the CAN. In contrast we can already observe infrastructure competition in the mobile market. This apparent difference in market dynamics therefore suggests the same conclusion as above – a higher risk for mobile operations.

155. However, a special issue arises in the case of the MTAS. Here the following may be observed:

- the separate market for the MTAS is a monopoly, no one else can provide the caller with the same service; and
- the price impact for the calling party A is separate from any decision from the call receiver (party B) on the choice of providing mobile services.

156. As stated above evidence suggests that the price elasticity of mobile termination is relatively small and as such has influence on the possible degree of monopoly power. As call termination is initiated, and paid for, by

the person calling the mobile phone, there is little competitive incentive for mobile operators to reduce termination charges for calls to their networks. The caller cannot choose another operator to terminate the call if the caller finds the cost is too high. The caller is forced to terminate on the network in question to reach the particular mobile customer.

157. Given the lack of competitive pressures and absence of countervailing power, each mobile operator may therefore be characterised as having market power in the supply of the MTAS to its own network.[26] Not surprisingly this the same conclusion reached by the Commission in its Mobile Services Review. Given these characteristics it may therefore be argued the MTAS, exhibits a lower level of risk. Accepting this argument therefore implies a lower beta value for mobile termination than other services provided by the mobile operator.

158. There is however, one issue that deserves additional comment. The economics of two-sided markets has recently been used to characterise the nature of the telecommunications business which face a two-sided demand (i.e. calls to and from mobile telephones are two-sided in nature since networks can be seen as platforms that bring two groups of agents together where there are externalities).[27] This characterisation of the market as also been used to cast doubt over the appropriateness of the regulation of mobile termination and the existence of market power.

159. While this literature sheds new light on the workings and economics of markets (with potential policy challenges), it is our view that it does not give us reason to revise the picture we have painted of the MTAS so far, i.e. it has monopoly characteristics. An important example that sheds light on this conclusion is Wright (2002). In his paper, Julian Wright shows that mobile operators typically have the freedom to set termination rates at a monopoly level even within a two-sided framework where they are competing intensively. Hence in a two-sided logic an operator's ability to monopolise the MTAS market is preserved. A key insight from Wright (2002) is that, at the margin, lower access price does not affect the mobile operator's profits but it does lead to higher welfare because FTM prices are reduced.

---

[26] We note the existence of countervailing buying power clearly is absent in the context of residential customers. In terms of business customers, however, some countervailing buying power should be expected.

[27] The fact that each side of the market is affected by what the other side of the market does is important, since otherwise nearly every market could fall within a two-sided framework.

160. In terms of *customer* there is also a clear difference between those buying retail services (residential and business customers) and those buying wholesale services (operators). The MTAS is a wholesale product. Revenue from the MTAS is generated from other operators (or through internal transfer). There is no retail revenue. Accordingly, this reduces the credit risk for the MTAS market compared with the mobile market as whole and that of fixed line services.

161. Finally, the *nature of the MTAS* may differ from that of other mobile services. Compared to more advanced mobile data services the MTAS is a relatively mature service. In addition, although the range and type of mobile products may change over time with new tariff packages and new technologies the service of providing the MTAS is likely to remain as it is an essential feature of communication between networks.

162. In summary, mobile and fixed telephony businesses clearly have fundamentally different characteristics. Importantly, the levels of risk are lower for fixed telephony compared to mobile telephony. When we consider the MTAS evidence suggests that the risks are lower than for mobile services generally.

2.14.2. Different cost of capital rates

163. In reality, each mobile operator will differ in terms of size, subscriber numbers, economies of scale, technology deployed, capital structure, financing arrangements etc. Each mobile operator is therefore also likely to have different cost of capital rates. However, as discussed above (see section 2.4) we regard an appropriate costing benchmark to be that of an industry average measured by a hypothetical new entrant to the market. In this case differences due to for example capital and ownership structure are irrelevant. Further, to the extent that the benchmark is taken to be an industry average it makes little sense to calculate different cost of capital rates.

164. Within an efficient operator framework we would therefore only calculate one cost of capital rate. The determination of this cost of capital should not differ materially from other determinations of the cost of capital employed by the Commission.

165. Decisions on individual parameters should not be constrained by evidence of historical practices by incumbents, but should be forward-looking. For example, capital costs should reflect the cost of an optimal capital structure

because the forward-looking cost measure is concerned with the cost of an efficient operator.

2.15. WACC - parameters

The Commission also seeks interested parties' views on the appropriate parameter values (for parameters that are typically included in a WACC calculation) that should be used when attempting to estimate the forward-looking efficient economic cost of supplying the MTAS.

166. Vodafone's approach to calculating the MTAS WACC involves applying the post tax nominal WACC formula developed by RR Officer. The formula for the Officer model is:

$$\frac{1-t_e}{1-t_e(1-\gamma)} \cdot r_E \cdot \frac{E}{D+E} + (1-t_c) \cdot r_D \cdot \frac{D}{D+E}$$

where:

t_e = *the effective tax rate*

t_c = *the marginal corporate (or statutory) tax rate*

γ = *the dividend imputation factor (the ability of investors to use imputation credits)*

r_E = *the return on equity*

r_D = *the return on debt*

E = *equity funding*

D = *debt funding*

167. In order to calculate the cost of equity, Vodafone uses the Capital Asset Pricing Model (**CAPM**). The CAPM needs estimates of the risk free rate, market risk premium and beta (systematic risk).

168. To estimate the Officer WACC and compare our results with those of Vodafone we estimate the following parameters:

- the risk-free rate;
- gearing;
- debt margin, including debt raising costs;
- market risk premium;
- effective and corporate tax rate;

- gamma; and
- beta.

169. We discuss each in turn below.

2.15.1. The risk-free rate

170. In order to calculate an appropriate risk-free rate for a mobile operator, we must consider the following factors[28]:

- maturity period for government bonds; and
- historical vs. current yields as estimates of the prospective risk-free rate.

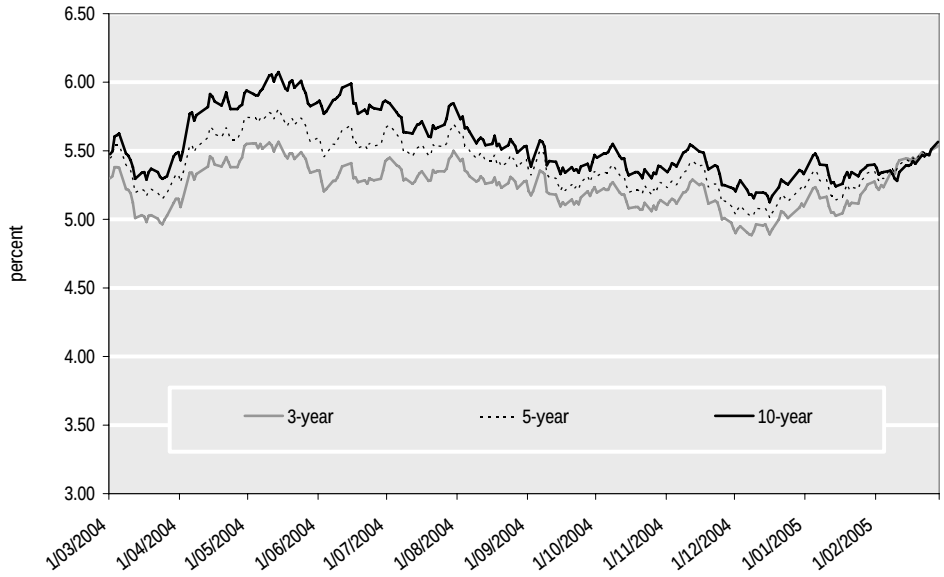
171. The issue of maturity period has previously been discussed at length by the Commission. We believe there are arguments in favour of using a maturity period equal to the length of the regulatory period. However, the length of the potential regulatory pricing period is currently unknown. Nevertheless, given that the prices are to be set and adjusted over a 1-3 year period we suggest a short regulatory period of 3 years.

172. With regard to yields, theory predicts that current yields will reflect (all) expectations of future earnings (if capital markets are efficient). Despite this, it is also important to recognise that current yields can be significantly affected by general market influences in the short term (e.g. thin trading) and be prone to significant cyclical variations. It is therefore worthwhile to review the historical yields as these may be better indicators of future yields than current yields.

173. During the past 2 years, the 10, 5 and 3 year government bond has followed a pattern as illustrated in the figure below:

[28] In addition there is a choice of a real or nominal government bond. Since we a calculating a nominal WACC, a nominal government bond is used.

FIGURE 3: DEVELOPMENT IN THE 3, 5 AND 10 YEAR GOVERNMENT BOND



Source: MJA analysis of data from Reserve Bank of Australia[29]

174. The relative rise in shorter yields, particularly of 3 year bonds, reflects a general flattening of the yield curve associated with concerns about possible future cash rate rises.

175. The figure shows that yields have fluctuated between 5 and 6% during the past year and currently lie around 5.5%. We have investigated whether there are any abnormalities in the daily yields for the most recent period leading to atypical results. We conclude that 5.5% is a reasonable estimate of the risk-free rate for an estimate of the WACC today based on a 20-day averaging approach used by the Commission.[30]

2.15.2. Gearing

176. The gearing ratio refers to the level of debt as a proportion of the market value of the company or project. In our view, the target gearing ratio adopted should relate to an efficiently financed entity and should be established from first principles.

---

29 Spreadsheet available at [viewed 18 May]: http://www.rba.gov.au/Statistics/Bulletin/F02Dhist.xls

30 That said, we find the 20-day averaging period used by the majority of Australian regulators to be problematic. For example, the 20-day moving average has over short periods of several months fluctuated by 30 or more basis points. This volatility has a significant effect on the estimated cost of debt that is unrelated to financing costs for regulated utilities. It is notable that UK regulators minimise this effect by taking a less 'scientific' approach and not 'calculating' a specific value for the risk free rate. Instead, UK regulators place greater reliance on information and advice sourced from financial market practitioners.

177. A key consideration is that the level of debt should be set to maximise the value of the business. As a first approximation, the optimal level of debt will also tend to minimise the WACC for the relevant investment. Since the cost of debt is less than the cost of equity (as debt has a prior claim), increasing gearing at first can reduce the total cost of capital. However, dependent on the risk and volatility of the business beyond a certain level, the variance/elasticity of the income to shareholders begins to increase rapidly with attendant risk of failure and higher required equity earnings. Beyond a certain level, increased gearing can therefore cause the WACC to rise again.[31]

178. Thus, in determining the optimal capital structure there is a trade-off between the benefits of substituting lower cost capital (i.e., debt) for higher cost capital (i.e., equity), and the costs of possible financial distress. Because the latter especially depends upon the assessment of risk, this trade-off is a matter for informed but ultimately subjective judgement.[32]

179. Under a classical tax system, such as in the US, where there is no system of tax imputation, the use of debt also provides a significant tax shield. With imputation, this advantage is potentially lost with the result that optimal levels of gearing in Australia should, *ceteris paribus,* be lower than in the US.

180. An additional complicating factor is that the optimal capital structure should be determined for MTAS since the relevant risks are those of the MTAS business only. They do not extend, for example, to the risks relating to other mobile services or indeed fixed line services of integrated operators.

181. The Commission has used a gearing ratio of 40% for Telstra's PSTN business. We consider that the gearing ratio (consistent with an efficient financing structure and which maximises the value of the business and minimises the WACC) would be lower than 40% for mobile services (or the MTAS) because of different risk characteristics.

182. We make the following observations in relation to overseas evidence:

- in the UK mobile termination context, all the involved parties estimated gearing ratios for mobile operators at between 10 and 30%;

31 Brealey, R, Myers, S and Marcus, A (2001), pp. 438-447

32 We note in practice any change in the gearing ratio leading to a change in the calculation of the equity return will roughly cancel each other out such that the overall cost of capital changes by only a small amount in response to a change in the gearing ratio. Therefore the gearing assumption is usually not considered to be a critical one in a WACC calculation.

- in the Swedish process a gearing ratio between 10 and 20% was used; and
- the Commerce Commission in New Zealand estimated a gearing ratio of 30% for Telecom Mobile.[33]

183. Based on this evidence we conclude that an optimal leverage level of 20 to 30% is a reasonable estimate for a hypothetical efficient forward-looking Australian mobile operator.

2.15.3. Debt costs

Debt margin

184. The debt margin refers to the interest premium demanded by lenders and bond markets for debt issued by a company compared with the rate for risk free debt (i.e. the risk-free rate). As an empirically calculated estimate, the debt margin requires no theory such as CAPM from which to derive an estimate. The debt margin is therefore inserted into the WACC formula directly.

185. The debt margin can be estimated by observing published credit ratings, which in turn are based on financial fundamentals such as market capitalisation, earnings volatility and business risks specific to the company and/or the sector. Credit rating agencies consider a wide range of financial indicators that inform on different but related aspects of a business' debt service capacity. For example, a company with low interest coverage[34] is less likely to maintain a premium credit rating since the probability of default on its interest payments will be relatively high. Likewise, a company with a high gearing is also less likely to maintain a high credit rating, as the probability of default on interest payments will be higher. Credit ratings are therefore closely related to the capital structure and should be determined with consistent reference to the gearing level.

186. For the purpose of the WACC calculation, we suggest that a rating of A be taken.

187. In our view, most weight should be put on observations of debt premium that are consistent with the maturity period of the risk-free rate and that best reflect a credit rating consistent with an optimal gearing level for a mobile

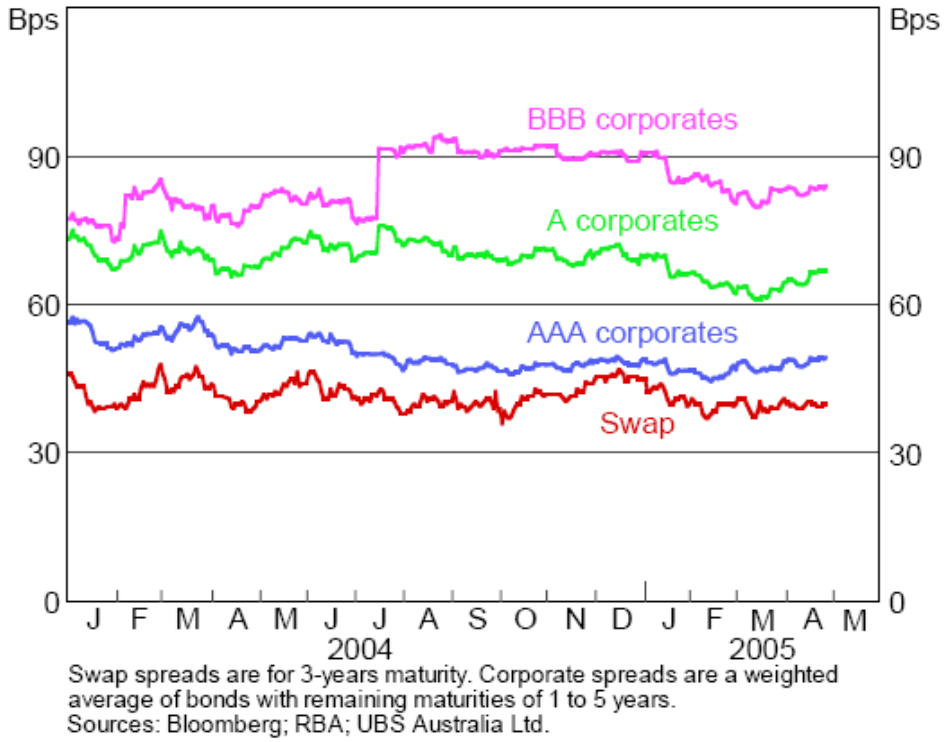
[33] Commerce Commission (2004), p. 2

[34] The number of times a company can meet its interest payments out of its earnings.

operator. The Commission assessed that the applicable debt margin for Telstra in 2000 was 0.80%[35] (using a 40% gearing); a value that since has been retained in other determinations.

188. To ensure consistency with the calculation of the MRP and cost of equity, a three-year maturity should be used. Below we have sourced corporate bond spreads for different credit ratings from the Reserve Bank of Australia.

FIGURE 4: AUSTRALIAN CORPORATE BOND SPREADS[36]



Swap spreads are for 3-years maturity. Corporate spreads are a weighted average of bonds with remaining maturities of 1 to 5 years.
Sources: Bloomberg; RBA; UBS Australia Ltd.

189. For an AAA rating the figure indicates 45-55 basis points (bps) margin above Commonwealth bonds, for A there is a 65-75 bps margin, BBB a 75–90 bps and for swaps a margin of 35-45 bps.

190. In terms of international experience in this area we note that:

- Ofcom estimated a debt margin for BT in relation to private partial circuit charge control of 1% for a gearing of 30 to 12%. For mobile termination, Ofcom used a debt margin between 1 to 3.5% (see appendix B).[37]

35 ACCC (2001), p. 93.

36 See http://www.rba.gov.au/ChartPack/interest_rates_australia.pdf

37 Ofcom (2004b), n 111

- The Swedish regulator Post och Telesytrelsen (**PTS**) set a debt margin of 1 to 1.4% in 2004 for fixed network services[38] and 2.5 to 2.9% for mobile termination (see appendix B).
- The Danish regulator IT og Telestyrelsen (**ITST**) estimated the debt premium to lie between 1 to 2% with a gearing between 30 to 45%,[39] in their LRIC model of co-location, interconnection and raw copper services.
- In France, l'Autorité de régulation des télécommunications (**ART**) determined that a 1.5% debt premium was appropriate for France Telecom.[40]
- The Commerce Commission in New Zealand used a debt margin of 1% for mobile services.[41]

191. Based on this evidence (where the most weight is placed on Australian evidence) we conclude that a debt margin of 0.8 to 1.0% would be appropriate.

Debt raising costs

192. The Commission's previous estimates of debt-raising costs were based on information provided by a number of commercial banks, indicating that debt raised on capital markets was likely to incur fees in the range of 8 to 12.5 basis points per year. In its recent 2005 decision for TransGrid,[42] the Commission considered that 8 basis points should be allowed for debt raising. For Energy Australia, the Commission included an allowance of 9 basis points.[43]

193. We note the decision of the Australian Competition Tribunal to allow 25 basis points for debt raising.[44]. However, no detailed empirical work has been published to support this figure. We therefore do not support this

38 PTS (2004c), p.16

39 IT- og Telestyrelsen (2002), p. 30

40 ART, *Décision n°03-1084 de l'Autorité de régulation des télécommunications en date du 7 octobre 2003 fixant le taux de rémuneration du capital employé pour évaluer les tarifs d'interconnexion et les tarifs du dégroupage de la boucle locale de France Télécom pour l'année 2004*, 07 October 2003

41 Commerce Commission (2004), p. 2

42 ACCC (2005a), p. 145

43 ACCC (2005b), p. 82

44 See http://www.austlii.edu.au/au/cases/cth/ACompT/2003/6.rtf

figure and suggest an upper estimate of 10 basis points, which is in line with previous Commission decisions.

194. We note that that the cost of debt issuance could be removed from the WACC and placed in allowable operating expenditure. In the current case, we suggest an allowance through the WACC to be a more tractable approach.

2.15.4. Market risk premium

195. The Market Risk Premium (**MRP**) is the additional return required by investors for accepting the systemic risk associated with investing in the market portfolio instead of a risk-free asset.

196. Of all the components of the WACC, the magnitude of the market risk premium attracts the most disagreement among practitioners and academics alike. In particular, we note that the size of this premium has been highly disputed in the previous regulatory processes undertaken by the Commission. This is to be expected and much academic argument has been presented about the merits of alternative methods for deriving a value for such a premium. Different methods produce very different values. The MRP can be calculated on an arithmetic or geometric basis. In addition, the MRP is very sensitive to the time period over which it is calculated. However, we are concerned that the Commission's favoured value of 0.06 remains higher than need be.

197. Our primary concern is the reliance on historical approaches to calculating the MRP that are likely to provide estimates that are too high. Investors care about expected returns, not historical returns. The MRP therefore should be estimated on a forward-looking basis. Evidence from forward-looking studies almost universally shows that these estimates, on average, are lower that determined by arithmetic and statistical analysis of historical data.

198. In addition, historical estimates differ considerably depending on the averaging technique and time period used. The arithmetic mean is typically around 2 percentage points higher than the geometric mean, depending on volatility and time period.[45] The statistical nature of the problem is such

[45] See e.g. Wright, Mason and Miles (2003). This report was commissioned by the UK economic regulators and the Office of Fair Trading in order to gain an independent view on emerging and new issues in the estimation of the cost of capital, the scope for greater consistency between regulators and to understand why there may be differences in approach.

that an arithmetic average is likely to overestimate the MRP. While it is beyond the scope of this paper to address this issue, we urge the Commission to examine it more closely.

199. Historical returns are often used as a proxy for the expected forward-looking returns, which is what CAPM is supposed to estimate. The main problem with this is that historical data cannot measure the expectations of investors so the use of historical data is therefore inconsistent with the theoretical underpinnings of the CAPM. In particular, we note Wright, Mason and Miles (2003):[46]

> *"It is evident that even over quite long periods, realised returns need not provide any relation to the expected premium. If they did, the experience of the bull market of the 1990s would have implied a risk premium of equities over cash of around 15%, switching to a large negative risk premium in the subsequent bear market of the early years of the new millennium. This would be manifestly absurd. There is no evidence that rational investors were expecting to receive such returns in advance."*

200. Further, there is support for the view that the historical approach overestimates the return required by investors:[47]

- *ex-post* historical studies may be based on long time periods, but capital markets have changed substantially since 1900 and 1930, particularly in the past two decades. Financial markets have been liberalised, the Australian dollar floated, capital markets around the world have become less segmented and more integrated with world markets and the scope to diversify has increased substantially[48];
- over the past century the market has outperformed the expectations of investors, i.e. investors could not reasonably have expected to experience such prolonged periods of growth and economic stability.[49]
- a downward shift in the MRP may be caused by improved regulatory and legal infrastructures to protect investors, lower trading costs and improved market liquidity.[50] For example, historical trading costs

46 Wright, Mason and Miles (2003), p 22

47 For an overview see Allen Consulting Group (2004)

48 See e.g. Ragunathan, V. (1999)

49 Dimson, Marsh and Staunton (2002), p. 189. The authors conjecture that the historical MRP is likely to over-estimate the forward-looking MRP and make two adjustments: *i*) the impact of unanticipated cash flows and *ii*) the impact of the fall in the required risk premium. The authors' adjustment to the historical world MRP (based on the arithmetic mean) is 2.2 percentage points (a reduction from 6.2% to 4.0%).

50 AMP Henderson (2003), p. 3

will have been incorporated into shareholders' required gross return historically.

201. The Commission should therefore exercise care when using historical estimates as representative of the current or recent situation, as they are likely to overestimate the MRP.[51]

202. Due to the perceived difficulties associated with collecting reliable prospective estimates of the market risk premium, regulators have typically based their assessment on analysis of historical data. However, the prospective approach is supported by several economic experts, for example Siegel (1992), Jenkinson (1993) and Blanchard (1993). Further, as a result of the concerns about the validity of ex-post realised returns as an indicator of future expectations, there has also been a general trend amongst UK regulators in recent years to adopt more forward-looking approaches to estimating the MRP. In particular, we note that Oftel considers both historical and prospective evidence:[52]

> *"In deciding the appropriate value for the equity premium, Oftel has taken account a range of evidence, both historical and forward-looking. Oftel's judgement reflects its recognition of the need to balance both short and long run interests of consumers."*

203. The choices available are thus:

- to use a "firmly estimated" but inappropriate historical measure;
- to use the "less firm" measure, but appropriate forward-looking concept; or
- to interpret the range of estimates based on the inappropriate measure in the light of the insights from the forward-looking results.

204. While we would favour a truly prospective and forward-looking approach, the second best solution, which is adopted by UK regulators, is to place explicitly greater weight on the available forward-looking estimates when deciding upon a range of values for the MRP.

205. In a recent report to the Queensland Competition Authority, Professor Martin Lally summarised his views on the MRP as follows:

---

[51] Further, the prospective method requires an assessment of expectation of the future equity market return and is calculated by subtracting the risk-free rate from the expected future market return. As such it can overcome the problem of consistency between the risk-free rate and MRP.

[52] Oftel (2001), Annex E, paragraph E.13

> *"To summarise this evidence on the market risk premium in the Officer CAPM, the estimates are .075 from historical averaging of the Ibbotson type, .054 from historical averaging of the Siegel type, .07 from the Merton methodology, and an upper bound of .040-.057 from the Cornell forward-looking approach. If a point estimate for the last approach is the mid-point of .048, then the median across these four approaches is .062. However the figure of .048 is biased up in view of the fact that the Cornell approach generates an upper bound. Furthermore, plausible arguments suggest that the Ibbotson-type estimate is too high. Finally, various other methodologies have been alluded to, for which Australian results are not available but which have generated low values in the markets to which they have been employed. On the other hand, all of these reported results reflect the use of a ten-year risk free rate; the appropriate rate may be shorter, and therefore the market risk premium is likely to be larger. This is mixed evidence, but it suggests that the Authority's currently employed estimate of .06 is reasonable."*

206. Lally concluded that an estimate of 0.06 is reasonable. However, his reasoning is not based on any theoretical selection mechanism, but on a simple average of the reviewed methodologies. In addition to the evidence cited by Lally we note that a survey conducted by Goldman Sachs in 2002 for over 100 of its international clients globally, revealed an average MRP of 0.039[53] (with most responses clustered in the 0.035 – 0.045 range).

207. As stated above, we believe considerably more weight should be placed on forward-looking estimates, i.e. the Cornell estimate and survey evidence. We are of the opinion that an appropriate estimate of the MRP lies within the range of 0.04 to 0.06 with a mid-point estimate of 0.05.

2.15.5. Tax rate

208. As is recognised by the Commission, the appropriate tax rate to use is the effective tax rate. However, it is difficult to estimate accurately a single effective tax rate that will reflect a company's taxation liabilities, as the taxation liabilities will inevitably vary from year to year. Further, forward-looking costs do not depend on the tax rate for previous years, but on the tax rate that can be expected in a forward-looking perspective.

[53] O'Neill, Wilson and Masih (2002)

209. In formal terms, the effective tax rate measures how closely the definition of income for tax purposes conforms with the benchmark provided by comprehensive, real (i.e. inflation-adjusted) income.[54]

210. Factors causing the effective tax rate to diverge from the statutory tax rate include:

- inflation which, *ceteris paribus*, understates the cost of depreciation and overstates the real revenue growth;
- tax concessions such as accelerated depreciation or the use of tax depreciation based on nominal asset lives different from economic lives;
- incomplete or over-extended definitions of income; and
- the deferral and delay of tax payments due to administrative or other reasons.

211. In principle, the effective tax rate can exceed or fall below the statutory tax rate. However, with low inflation the effective rate is more likely to fall below the statutory rate.

212. In our view, the effective tax rate is likely to be below the statutory rate. However, it is beyond the scope of this answer to attempt to estimate the effective tax rate. As an interim measure we therefore suggest an effective tax rate of 20% (which the Commission has relied on in several previous determinations) to be an appropriate estimate looking forward.

2.15.6. Gamma

213. The Australian system of imputation allows Australian taxpayers to credit tax payments franked on dividends towards their own tax liability. This credit is not available to foreign taxpayers who are shareholders in a company paying Australian income tax. The dividend imputation rate, γ, is defined as the product of α, the ratio of credits attached to company tax paid, and θ, the rate of utilisation of those credits. The lower the rate of imputation, the higher the pre-tax revenue required to give the same post-tax return to equity.

214. The value for γ can range anywhere between zero and one, where a value of zero implies no credits are used and a value of one means that imputation credits are fully utilised. The imputation rate may be derived from market

[54] Commonwealth of Australia (1998), p. 142

estimates. However, as with effective tax rate, forward-looking costs do not depend on past decisions, but should be evaluated in a forward-looking perspective. In the context of gamma, given the difficulty in estimating such a value looking forward, we suggest the Commission's preferred mid-point estimate is appropriate.

2.15.7. Beta

215. The term 'beta' refers to the relative risk of a return-producing asset, such as a ratio of the covariance of income from the particular asset and a well-diversified portfolio and the variance of the income from the diversified portfolio.[55] We distinguish between three betas: equity, debt and asset beta.

216. The *equity* beta measures the relative risk to shareholders in the particular company or project and this reflects both the underlying risk of the project and the risk to shareholders as a result of the higher claims of debt holders resulting from having leveraged the balance sheet.[56]

217. The *debt* beta is similarly a measure of the systematic, i.e., non-diversifiable, risks facing debt holders.

218. *Asset* betas can never be directly estimated. Therefore, it follows that any estimate of an asset beta must have behind it a directly estimated equity beta. De-gearing the equity beta to derive an unlevered (i.e., asset) beta removes one source of non-comparability. However, the de-gearing also requires an estimate on the debt beta.

219. Estimates of asset (unlevered) betas should indicate the level of the debt beta on which they are derived. One such method is to derive the equity beta from a proxy (i.e., inferred) asset beta and an assumed debt beta for the project/company using a transformation formula. One such formula is the Monkhouse formula.[57]

---

55 In formal statistical terms, beta is defined as the covariance of returns to the particular asset and returns to the market portfolio divided by the variance of returns to the market portfolio.

56 An equity beta of 1.5 means that the share moves 1.5% for every 1.0% move in the market index, outperforming the index in a bull market and underperforming in a bear market. Conversely, a beta of 0.5 means that the share's return is more stable than the market as a whole. The higher the beta, the riskier the share and the higher the return required to compensate for this higher risk.

57 For an examination of alternative formulae, see Macquarie Risk Advisory Services (1998). The Monkhouse transformation can be written as:

$$\beta_e = \beta_a + (\beta_a - \beta_d)\{1 - [r_d/(1+r_d)][(1-\gamma)T_e\}\cdot D/E$$

Methodology for Estimating Beta

220. Beta values are not available for the MTAS. Beta estimates may only be made for the companies as a whole.

221. Optus became a 100 per cent owned subsidiary of SingTel on 30 August 2001 and listed on the Australian Stock Exchange (ASX) on 10 September 2001. With regards to Telstra, those shares that are not held by the Commonwealth[58] are quoted on the ASX. Vodafone is not listed in Australia. Hutchison Telecommunications Australia (**HTA**) has been listed on the ASX since August 1999. Beta estimates are therefore only available for Optus, Telstra and Hutchison.

222. There is however, a complicating factor in that neither Optus' nor Testra's mobile companies are listed separately. It is therefore not possible to measure a beta value for their mobile activities.

223. In order to determine an appropriate asset beta for a mobile operator in Australia, we therefore have the following two basic approaches:

- review of domestic evidence from Telstra, Optus and HTA on their actual beta values, noting that the values of Telstra and Optus would need to be adjusted as they reflect those of an integrated operator; and
- review of international surveys, in particular, information considered by the UK and Sweden in their determination of cost estimates for mobile termination.

224. In order to use the former approach it is necessary decompose the asset beta into different service components. A telecommunications company can be thought of as a portfolio of assets, with each part carrying a different degree of risk. This could be differing risk for regulated and non-regulated activities or differing demand structures. For example, demand for mobile services is likely to fluctuate more with changes in economic conditions than demand for basic telephony services. As such, we would expect

---

where: β_e is the equity beta;
β_a is the asset beta;
β_d is the debt beta;
γ is the imputation factor;
T_e is the effective tax rate;
r_d is the return on debt; and
D/E is the debt to equity ratio.

[58] As at 30 June 2004, the Commonwealth owned approximately 51% of Telstra issued shares (it is required by legislation to own at least 50.1%).

mobile activities in general to exhibit a higher non-diversifiable risk than that of fixed line PSTN. However, the special characteristics of the MTAS would tend to reduce the beta value even further compared with other mobile services.

225. To decompose beta values with confidence would require detailed information from each operator. Without this information, we do not explore this option further.

226. According to Bloomberg, the equity beta for HTA is 0.607.[59] However, over two-thirds of HTA shares appear to be not traded[60] and issues related to the financing structure of HTA raises some concern over the use of the HTA beta in the current analysis. We have therefore chosen not to attribute this estimate any weight.

International Evidence

227. In the appendix to this report we have compiled international experience from the UK and Sweden. We find this evidence of particular relevance, since in both cases it is related to the issue of determining the cost of mobile termination.[61]

228. In terms of asset beta, the UK exhibits very broad intervals from 0.93 to 1.54. In contrast, the Swedish regulator only uses one estimate of the asset beta, namely 1.1.

229. In the UK a wide of range of methods were used to estimate a range for beta and numerous submissions were made on the subject. Based on an assessment of the evidence, the Competition Commission concluded[62]:

> *"We believe a range of 1 to 1.6* [for equity beta] *takes into account all of the uncertainties brought about by taking daily as opposed to monthly returns, choosing the appropriate time period, any differences between UK and overseas activities and any differences between the regulated and non-regulated operations of the MNOs [Mobile Network Operator]. The lower end of this range takes account of monthly data and that which could apply to a regulated*

59 http://www.bloomberg.com/apps/quote?ticker=hta:AU (viewed 20 May).

60 The current shareholdings are: Hutchison Whampoa Limited (57.82%), Leanrose (12.52%) and public shareholding (29.66%).

61 Note that we have explicitly attempted to correct for differences in market leverage, but acknowledge the difference.

62 Competition Commission (2003), p. 195

> *operator. The upper end takes account of daily data and that which could apply to overall activities of the MNOs. In order to avoid the difficulties caused by overseas ownership, our upper estimate of beta is based on mmO_2 and not Vodafone."*

230. In Sweden both estimates of the operators' actual beta values and international survey data were used to determine the appropriate value. The asset beta values explicitly calculated for Tele2 and Vodafone[63] were 0.850 and 0.936, respectively. However, based on an international survey it was concluded that these values might be too low and hence a value of 1.1 was chosen.

231. In New Zealand, the Commerce Commission uses an asset beta estimate of 0.77 for Telecom Mobile.[64]

232. In addition, we have surveyed evidence provided by Damodaran[65] on the beta values for US cellular companies. This analysis indicates a range of asset beta values from 0.6 – 1.2 although there are outliers at both ends of the range.

233. Based on this surveyed information, we believe an asset beta range of 0.7 to 1.1 is reasonable for mobile services in aggregate, noting that an asset beta for mobile termination will lie at the lower end.

Conclusion

234. Based on the available evidence we estimate that a reasonable range for the asset beta for a mobile operator in Australia is 0.7 – 1.1. We note that the asset beta for the MTAS will be lower than the mobile business as a whole. In the absence of sufficient data to make an explicit adjustment to the asset beta, we propose to use a beta value for the MTAS of 0.7 (i.e. the minimum)[66].

2.15.8. Summary of values and calculation

235. Below we have summarised the parameters and calculation of the WACC for the MTAS.

---

63 Vodafone in Sweden solely provides mobile services, while Tele2 in addition to mobile telephony also provides fixed line services through reselling and wholesale arrangements with TeliaSonera.

64 Commerce Commission (2004), p.2.

65 Available at (viewed 10 May): http://pages.stern.nyu.edu/~adamodar/

66 We note that our choice of the lower range estimate solely reflects a pragmatic solution to a potentially complex adjustment for which we currently do not have sufficient data.

TABLE 2: CALCULATION OF THE WACC FOR THE MTAS

	Low	High	Selected
Input Values			
Risk-free rate	5.5%	5.5%	5.5%
MRP	4.0%	6.0%	5.0%
Asset beta	0.7	1.0	0.7
Gearing ratio	20%	30%	25%
Debt margin	0.8%	1.0%	0.90%
Debt raising costs	0.10%	0.10%	0.10%
Effective tax rate	20%	20%	20%
Statutory tax rate	30%	30%	30%
Imputation gamma	0.5	0.5	0.5
Debt beta	0.00	0.00	0.00
Calculated values			
Equity beta (after Monkhouse)	0.87	1.42	0.93
Post-tax return on equity	8.99%	14.04%	10.15%
Pre-tax cost of debt	6.40%	6.60%	6.50%
Vanilla WACC	8.47%	11.81%	9.24%
Post tax Nominal WACC	7.29%	10.12%	7.91%

236. Based on the parameters discussed above, our calculation yields a vanilla WACC of 9.24% and a post-tax nominal WACC of 7.91%. This compares to a post-tax nominal WACC of [c-i-c]% estimated by Vodafone.

237. Sensitivity analysis conducted on the selected WACC parameter estimates indicate that:

- using a MRP of 6% will increase the vanilla WACC to 9.9% and post-tax WACC to 8.5%;
- using an asset beta of 0.85 (i.e. the mid-point in our range) will increase the vanilla WACC to 10.0% and post-tax WACC to 8.6%;
- the combined affect of these changes are a vanilla WACC of 10.8% and a post-tax WACC of 9.3%; and
- changing the imputation factor to either 1 or 0 has a significant effect on the post-tax nominal WACC. With gamma equal to 1, the post-tax nominal WACC decreases by 0.7 percentage points. Setting gamma equal to 0 increases the post-tax nominal WACC by 0.8 percentage points.

2.16. Calculation of FCCs

The Commission seeks views of the interested parties as to whether the methodology used in the PwC model to calculate FCC's is appropriate?

238. As noted above, we regard TSLRIC as the appropriate method for calculating the forward-looking economic costs of the MTAS. As such, the estimation of fixed common costs (**FCC**s)[67] is closely linked to the interpretation of TSLRIC. Further, the FAC approach provides only limited information on the extent of common costs.

239. TSLRIC is basically LRIC[68] where it is made clear that the relevant increment in the service under consideration is the total output of that service. TSLRIC includes the incremental costs of dedicated facilities and operations that are used by only the service in question. TSLRIC also includes the incremental costs of shared facilities and operations that are used by that service as well as other services.

240. The application of LRIC principles is widely recognised. Today most regulators and experts generally agree that forward-looking LRIC is the ideal approach for calculating the level of interconnection charges.[69] Specifically, the rapid implementation of LRIC principles for mobile termination in an increasing number of countries reflects the increasing acceptability and applicability of the approach.

241. Because TSLRIC only considers service-specific costs, it makes no allowance for common costs associated with multiple products. A firm that only receives revenue equal to TSLRIC on all its services would make a loss. For this reason, it is normal to allocate some of the common costs associated with a regulated service to the revenue that can be earned from that service. Mark-ups are therefore required to recoup a portion of common (and joint) costs, which are not included in TSLRIC.

242. This is clearly recognised in the Commission's access pricing guidelines and in the Mobile Service Review. However, we note that the report describes these costs as 'organisational costs'. While it is true that

---

67 In the following we do not make the distinction between costs that are fixed common or simply common. unless referring to commentary by Vodafone or its consultants.

68 LRIC is most frequently used as a generic term for a pricing standard that accords the basic principles of incremental costing. As such TELRIC, LRAIC or TSLRIC are all special cases of LRIC.

69 See for example Intven, H. (ed) (2000), *Telecommunications Regulation Handbook*, November, World Bank, Washington, for an overview, available at: http://www.infodev.org/projects/314regulationhandbook/

organisational costs (also called overhead costs) are 'true' common costs, it not clear that these will be the only common costs within the TSLRIC framework.

243. In order to more fully understand the extent of common costs it is necessary to analyse more closely the size (or definition) of the increment in the context of TSLRIC.

244. To assist our discussion and avoid misunderstandings we briefly categorise different cost concepts below:

- *Direct costs* are those costs that can be directly and unambiguously related to a service or network element (and which are recorded against the relevant service or network element in the operator's accounting system). An example could be costs of equipment specific to the service or directly related costs such as installation.
- *Joint costs* are typically defined as costs that are shared between a family of services or network element[70]. An example could be the cost of a mobile switching centre switch when services are defined at a disaggregated level (i.e. mobile originating access, mobile terminating access etc.).
- *Common costs* may be defined as costs that are shared across all services of the company such as e.g. corporate overheads.

245. In terms of top-down modelling it is also common to distinguish between directly or indirectly attributable costs as many joint and common costs can be attributed on a cost-causative basis:

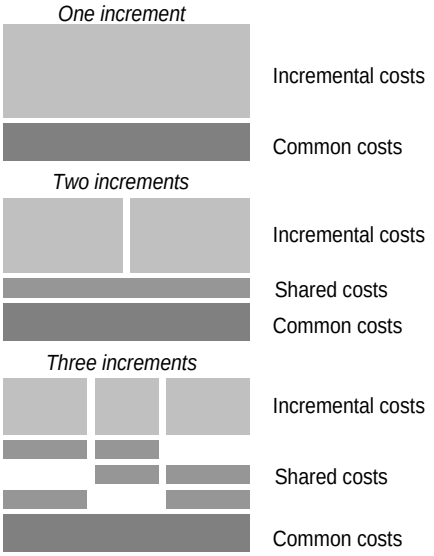
- *directly attributable costs* are directly and unambiguously related to a service or network element, but they are not recorded in the operator's accounts against the service or network element to which they relate. An example is the salaries of maintenance staff that can be allocated directly to switches; and
- *indirectly attributable costs* are costs that can be related to a service or network element on a non-arbitrary basis, based on the relationship with direct costs and directly attributable costs. Such costs should be allocated using an appropriate cost driver.

[70] The definition of a joint cost in telecommunications is more liberal than the strict economic theoretical definition. In economic theory, a joint cost is one where the cost of a productive input by necessity produces more than one good in fixed proportions (e.g. wool and mutton).

246. Once all direct and indirect attributions have been made, the remaining costs are residual joint and residual common costs. These residual costs are by definition unattributable, i.e. costs for which no direct or indirect method of allocation can be identified. It is therefore only possible to allocate these costs to services or network elements on a largely arbitrary basis. Hence common costs may be defined as the costs that are left over from total costs after the incremental costs have been subtracted. Residual common costs are sometimes referred to as 'true' common costs. In the following, we will occasionally make the explicit distinction between residual and non-residual common costs.

247. In a TSLRIC context, the size and number of increments will significantly affect the amount of common costs. This is illustrated in Figure 5.

FIGURE 5: DEFINITION OF INCREMENTAL, COMMON AND SHARED COSTS

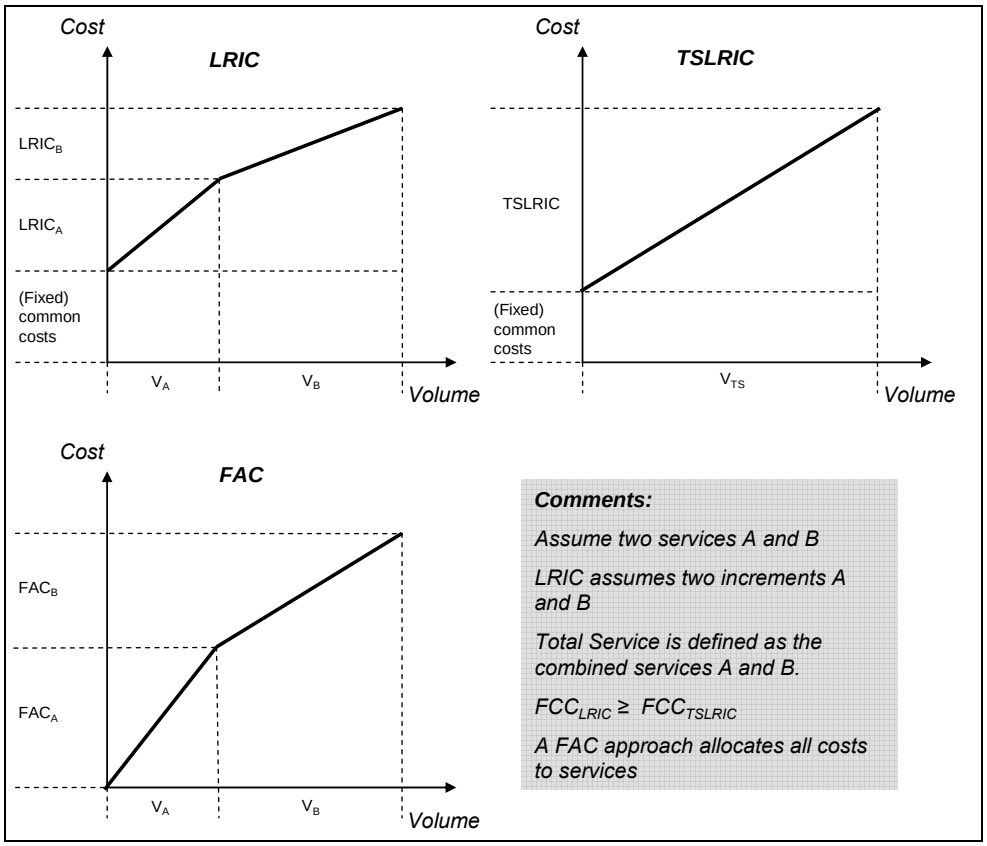


248. With one increment there are still costs that are not incremental but common. In the particular case with one increment common costs will only consist of those we termed 'true' in the discussion above. With two increments, the amount of 'true' common cost is unchanged, there are however costs that may be termed as shared between the increments. With three increments the shared cost combinations increases to four. With four increments shared cost combinations would increase to twelve. The larger the number of increments, the larger the potential number of combinations of shared costs there are between increments and the larger the total amount of shared and common costs.[71]

249. This principle is illustrated in another way below with reference to different cost concepts. In the figure below, we assume that there are two services - A and B. TSLRIC includes both, while LRIC consists of two increments - A and B. For illustrative purposes we include the FAC approach.

[71] The more increments and common costs will also increase the complexity in allocating these costs. It is also for this reason that larger increments are often preferred in a regulatory setting as this increases transparency and minimises complexity.

FIGURE 6: SIMPLIFIED ILLUSTRATION OF LRIC, TSLRIC AND FAC



250. The figure illustrates that a FAC approach allocates all costs to services while the (TS)LRIC approach will identify the extent of common costs. Given that common costs are allocated using an equi-proportionate mark-up,[72] the FAC and (TS)LRIC may yield similar results assuming that the cost pools are similar. However, based on our discussion in previous sections, it should be clear that this is only likely to be the case in exceptional circumstances.

251. In the fixed network TSLRIC model used by the Commission, the increment is defined as being the whole of Telstra's inland PSTN and ISDN service together with its leased line (or 'private circuit') service. This suggests that the Commission should adopt an increment definition that includes a group of services. Alternatively, it suggests that TSLRIC considers the costs that are caused by the provision of a defined increment of output related to the "total service", where total service includes all services that use the same assets as mobile termination, and hence a group of services.

[72] Proportionate to the incremental cost incurred.

252. In the fixed network this translates into two predominant increments: the core network increment where the main cost driver is the traffic, and the access network increment where the main cost driver is the number of subscribers. While assets are still shared[73] between increments under this definition, it effectively eliminates a large proportion of common costs that would have otherwise arisen if a more narrow definition of increment were adopted.[74]

253. The question is how this increment definition based on key cost drivers would operate in a mobile TSLRIC framework. The key factors driving the cost of mobile networks include:[75]

- *Number of subscribers* - this affects the size of certain of the network elements such as the HLR, the billing system and the number of SIM cards that need to be purchased;
- *Call traffic volume in the busy hour* - this is the key variable in determining the capacity that the network must support. The number of lines and the number of radio channels, as well as most of the other supporting network infrastructure, will be designed to support this level of traffic. Decisions on how much capacity is provided also determine some aspects of the quality of service that the network provides;
- *Number of incoming and outgoing call attempts* - the MSC within the mobile network must be able to cope with call attempts including those for unsuccessful incoming calls; hence the amount of processing capacity in the MSC is driven by the total number of call attempts as well as the total traffic in the busy hour;
- *Traffic on the transit layer in the busy hour* - the cost of the transit layer, which includes the transit switching centres and all the associated lines, is driven by the traffic it must carry; and
- *Coverage provided* - the area covered and the depth of coverage (in particular, the quality of in-building coverage) are the principal drivers determining the number of cell sites that the network uses (the other being the call traffic in the busy hour as cells can also be added for

[73] For example the line card is often allocated to the access increment. However, the line card is situated and takes up space in the exchange building where equipment costs are predominately related to the core increment. Building costs (asset) are therefore shared between the two increments.

[74] For example a small change in the volume of a service or the addition of a particular service.

[75] The definition of cost drivers are based on the Competition Commission (1999), *Cellnet and Vodafone: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Cellnet and Vodafone for terminating calls from fixed-line networks*, para 5.30, p 203. The report is available at: http://www.competition-commission.org.uk/rep_pub/reports/1999/421cellnet.htm#full

capacity reasons). To provide equivalent coverage for an 1800 MHz network requires more cell sites than a 900 MHz network.

254. While an increment definition based on cost drivers may appear problematic, the majority of network equipment in a mobile network is deployed in response to traffic demands and only a small amount is deployed in response to subscriber numbers. Therefore, one option would be to group increments as follows (as Oftel has done in the UK):

- *subscriber increment* - the network's capacity to handle users of the network;
- *traffic increment* - the network's capacity to handle traffic (including voice minutes and data services); and
- *coverage increment* - the geographical extent of the network.

255. The subscriber increment would include those network-related costs that are driven by the number of subscribers on the network, assuming a constant output of the various traffic-related services produced by the network. On this basis, the increment of subscribers includes the cost of handsets and SIM cards. Hence these costs should not be allocated to the MTAS.

256. The traffic increment may be defined as the increment of traffic from all services using the network, voice services only or, even more narrowly, as the increment of voice termination.

257. When the increment is defined as that related to voice calls, the incremental costs would be the difference between the costs of providing a network that did not carry voice calls versus a network that does carry voice calls. When the increment includes all traffic, the incremental cost would be the difference between the costs that does not carry any traffic and a network that did carry traffic.

258. In this case it could be argued that the traffic increment would actually be the entire network. All services provided are related to conveying voice and data across the network; costs that are neither incremental to services nor shared between them are not network costs.

259. An alternative is to define the incremental costs of traffic, as the costs of the extra network elements and capacity required in order to provide the final services, additional to those required to provide coverage or part of the subscribers' increment as discussed above. The main advantage of this

approach is that shared costs will be transparent and mainly related to the costs of providing coverage.

260. Coverage is an important cost driver but is not readily attributable to either subscribers or traffic. A mobile network is initially deployed in the form of a large coverage network. However, this initial network already contains a considerable amount of capacity. Additional capacity is required to support traffic levels over and above that already deployed, and additional subscriber numbers in excess of the initial capacity.

261. The analysis of coverage is central to the difference between fixed and mobile networks. However coverage is defined, the element of shared costs to the other increments will be a relatively large proportion of total costs – much larger than for a fixed network.

262. The treatment of coverage will have significant influence on the categorisation of fixed and common costs. This is clearly demonstrated by an analysis of the approach to account for coverage costs by the Oftel mobile LRIC model. Before considering the PwC's approach it is worthwhile to briefly review the UK approach.

263. Oftel classifies coverage costs into two categories: those arising from the so-called minimum coverage presence (MCP) and those arising from coverage capacity. MCP costs are defined as the costs of a network management system and of acquiring, preparing and leasing the number of sites needed to meet the coverage requirements. The costs related to coverage capacity are defined as those which relate to the provision of traffic-handling capacity in the coverage sites.

264. The MCP costs are treated as common costs to be recovered through mark-ups on the services increments, whereas the costs related to coverage capacity are considered part of the LRIC traffic. According to Oftel, the magnitude of network common costs is therefore small (3-5%)[76].

265. However, it could be argued that some of the costs related to coverage capacity identified by Oftel are in reality either fixed costs (the costs of the antennas, for example, do not depend on the amount of traffic carried) or subject to a relevant degree of scalability. In this case the whole of coverage costs can be treated as common costs. Moreover, these costs being fixed costs rather than driven by capacity, the cost causation principle

[76] Oftel (2002), p 4

is of no use when allocating them to the service increments. So, even accepting the point of view that part of coverage costs should be attributed to the traffic increment, any allocation of these costs to terminating (or originating) traffic would not follow the cost causation principle.

266. An alternative is to define the coverage increment as the cost required to build a network that provides full geographic coverage and is capable of carrying traffic, but is only dimensioned to carry the minimum amount of traffic. This was the original approach adopted by Oftel. However, as noted above, Oftel concluded that a better reflection of cost causation would be provided by regarding those coverage costs that relate to traffic-handling capacity as being part of the incremental cost of traffic.

267. In practical terms a coverage increment defined according to these principles could be estimated by assuming that coverage network costs are those that remain as traffic in the network approaches zero (or what the network design converges to as traffic approaches zero).[77]

268. In Sweden, Post och Telestyrelsen opted for a two increment approach: traffic and subscribers. Coverage was not explicitly treated as an increment, but as a network common cost to the traffic and subscriber increments. The reasoning behind the identification of common network costs was:[78]

> *"In a particular area (e.g. urban) where the initial coverage sites, sector or TRXs have become traffic driven (in the long run) then the corresponding variable costs of sites, sectors or TRXs would be present in the long run marginal cost of traffic, and hence would be treated as network common costs.*
>
> *Correspondingly, the costs of coverage sites, sectors or TRXs which are not traffic-driven (in the long run) would be considered as long-run fixed cost, and hence network common costs."*

269. Coverage costs are an intrinsic characteristic of mobile networks. In the fixed network, the costs arising from providing an access increment are driven by the number of subscribers. Each subscriber will need to be provided with its own connection with the core network, most probably through the means of physical line. An additional subscriber would cause additional access costs, whereas an increase in traffic, for a given number of subscribers, would cause no additional costs to arise. In the mobile

---

77 Note that traffic should not be zero as this would correspond to no network.

78 Conceptual issue: *What size of increment*, Update for Industry, 17 March 2004, Analysys for PTS, p 3, may be downloaded as part of the model documentation for the Swedish bottom-up model: http://www.pts.se/Archive/Documents/SE/Modelldokumentation_generisk_modell_10_maj2004.zip

network, the same clear cut separation between coverage and other increments does exist. Indeed, as we have argued above, coverage is not clearly driven by either traffic nor number of subscribers.

270. The PwC approach, where a number of coverage related cells are defined as common, is not without merit. However, without more detailed analysis and reasoning behind the choice of cells it is difficult to comment in detail on the approach. However, we would not expect urban or suburban cells/sites to be defined as coverage related. A reasonable proportion of rural cells/sites, on the other hand, are likely to have MCP characteristics. Further, it is necessary to consider costs at a fairly detailed level due to varying cost drivers. It would, for example, be appropriate to differentiate between different components of base stations, including transceivers, sector-specific equipment and site-specific equipment and infrastructure in order to transparently indicate how coverage is treated.

271. In addition, it is important that the extent of these costs is consistently considered within a TSLRIC framework.[79] Indeed, the extent of common costs cannot reasonably be asserted without reference to a particular costing principle. Our discussion of increment definition above clearly illustrates this point.

272. Given that international experience in the application of the TSLRIC principle shows that the extent of common costs is relatively limited, we suggest that the extent of network common costs be set at 5% of total annual MTAS service costs. This figure is in line with the proportion of common costs in the Swedish bottom-up model[80] and that suggested by Ofcom (see above). In addition to network common costs are non-network common costs. Based on our examination of the updated UK LRIC model and the Swedish model we estimate that these may be between 0 - 10% of total annual costs. Hence we suggest that (fixed) common costs represent between 5% and 15% (or 10% on average) of the total network and non-network costs within an efficient forward-looking economic cost concept (such as TSLRIC) for a mobile operator. This is [c-i-c] of total network costs as suggested by Vodafone.

---

79 We note that extent of fixed common costs also may be estimated using econometric approaches or by using engineering input and analysis. We do not regard any references to these approaches as satisfactory in the context of TSLRIC. Indeed such analyses are likely to yield widely differing results depending on how the problem is specified.

80 For more information on the approach to common costs in the Swedish bottom-up model, please refer to http://www.pts.se/Archive/Documents/SE/Final%20position%20on%20common%20costs_130204.pdf

2.17. Inclusion of non-network FCCs

The Commission seeks the views of interested parties as to whether the inclusion of non-network FCCs, as specified in the PwC Report, is appropriate for estimating the forward-looking efficient economic costs of providing the MTAS?

273. Very limited information on the non-network FCCs is contained in the PwC report. However, it is noted that these costs are related to overhead functions such as finance and human resources departments.

274. As a matter of principle, we regard a forward-looking efficient economic costs estimate of providing the MTAS should include these costs. However, care must be taken to specify these costs correctly.

275. To the extent that any of these costs can be separated out as either retail or wholesale, they should be. Only costs related to wholesale should be included in the estimate of the MTAS.

276. To the extent that they are 'true' common costs and cannot be separated, care should also be taken to "spread" them amongst services provided by Vodafone.

2.18. Working capital – efficient costs

The Commission seeks the views of interested parties as to whether an adjustment/mark-up to account for working capital is appropriate when seeking to model the efficient costs of providing MTAS?

277. It is the nature of the telecommunications business that there is a delay between paying out cash for inputs and receiving cash for outputs. For that reason, a stock of cash (working capital) is required at the beginning of trading to be able to cope with the delay that arises from the normal activities. Working capital may also include stock of network spare parts, capital work in construction, i.e. assets not yet being activated, and other current assets and liabilities.

278. Once the investment is made, this cash is tied up in the running of the business until trading ceases. The business incurs an opportunity cost as this working capital (cash) could be invested elsewhere.

279. In our view, the cost of working capital is a legitimate cost item and should be included in the estimate of efficient forward-looking costs. However, it

is it is essential that working capital costs are calculated based on efficient operator assumptions (i.e. efficient debtor days, creditor days, cash-management, assets in course of construction, and engineering stores levels).

280. Further, we would expect that the total working capital items of the various network elements and network services to be minimal, and not a significant element of the total asset base. Indeed, LRIC approaches within telecommunications often assume that the cost of working capital is negligible or even zero.

281. With regard to allocation, we note that appropriate cost drivers must be defined and used as discussed in the answer to the following question. However, given that we would expect the level of working capital to be very small, we do not have a strong preference for any one method.

2.19. Working capital – PwC methodology

The Commission seeks the views of interested parties as to whether the methodology used in the PwC model to estimate and allocate working capital is appropriate.

282. PwC mark-up all asset values to account for working capital costs. They state that this "*allows the capital charge, calculated as the mean capital employed multiplied by the cost of capital, to be applied to all assets present in the business, rather than just the fixed assets*."[81]

283. We have a number concerns with this approach.

284. Firstly, the analysis presented is extremely high level and no attempt seems to have been made to analyse in detail the cost categories associated with working capital (although we note that data was only available on an aggregate basis). These cost categories are likely to include:

- stocks, e.g. spare parts;
- capital work in progress, e.g. under construction;
- cash;
- debtors;
- creditors; and

[81] PricewaterhouseCoopers (2004), op. cit., p.12

- provisions.

285. When estimating the total amount of working capital in each cost category, (as noted in the answer to the previous question) the total should not exceed the amount that would be required by an efficient mobile operator. Accounting data may not necessarily reflect the working capital of an efficient operator. Adjustment of operational costs may influence the level of working capital as will more efficient management of debtors, creditors, and current assets.

286. Secondly, only working capital which is related to the Vodafone's network (wholesale) may be included. Working capital related to retail debtors and creditors should not be included.

287. Thirdly, working capital costs should be apportioned according to an appropriate cost driver for each cost category. The cost driver may be different for each cost category. For example, for debtors, the appropriate cost driver may be the proportion of termination or interconnection charges incurred, and for creditors, the appropriate cost driver may be particular network elements (or activities).

288. Fourthly, working capital, which is calculated on the basis of accounting data at a certain point in time, may not be representative. This problem may partly be solved by calculating the working capital at different points in time and then taking an average. We recommend that PwC use multiple sets of accounts in their estimates. The amount of cash is likely to be of particular importance. Average daily cash balances over the year should be taken, rather than the mean of the start and end points, since the latter could be subject to atypical distortions.

2.20. Reasonableness of charges

The Commission seeks the views of interested parties as to the reasonableness of Frontier's estimated range of the welfare-maximising level of MTAS charges for Vodafone.

289. Individual elements of the Frontier approach are discussed in following sections. However, we note that the estimate range suggested by the Frontier model is above the current weighted average MTAS charge of 22.5 cents[82], while the mark-ups on incremental cost range from 86% to 214%.

[82] ACCC (2004), Table 9.2, p. 220.

These observations alone raise serious concerns over the reasonableness of the Frontier approach. In essence, to follow the Frontier approach would result in significant increases in the MTAS which would be contrary to all international precedents in this area.

2.21. Methodology for inputs

The Commission seeks views of interested parties on whether the methodology used to calculate the various cost, price and demand inputs is appropriate.

290. In terms of cost inputs we note that these are based on Vodafone's Global Price Book. Without a more detailed understanding of this cost source it is difficult to comment on the methodology used to derive costs.

291. However, we note that any cost estimates ideally should reflect the cost achievable by an operator operating on the Australian market and should be based on several sources to increase the robustness of the cost estimate.[83]

2.22. Calculated inputs

The Commission seeks view of interested parties on whether the calculated input values for cost, price and demand are appropriate.

292. In terms of the input values for cost (network assets), we have compared the values used by PwC with other publicly available cost models. The inputs generally seem higher than those used in other countries. In terms of the estimated (fixed and) common costs it is our view that these are excessive (see section 2.16) compared to international best practice.

[83] In a TSLRIC context there is also the issue of build-out vs. discounts. If the network is assumed to be built over a year (or even over night), it could be argued that very large discounts could be achieved by buying all the equipment up front (assuming the supplier had no capacity constraints). On the other hand, trench sharing, co-digging etc. would approach zero the quicker the assumed build out. Therefore, judgment must be exercised in this area. For example, a reasonable assumption could be that that the network from a technical perspective is over a year, but all input parameters (trench sharing, equipment prices, etc.) should be verifiable and reflect the costs of an actual network built over time. Effectively this implies that equipment prices follow from normal purchases and sharing reflects normal planning and construction activity where co-ordination of trench sharing and co-diggings may be planned some years ahead.

2.23. Cost categories and Ramsey mark-ups

The Commission seeks the views of interested parties on, specifically, which categories of costs should be covered by Ramsey mark-ups when applying a TSLRIC+ model to access pricing.

293. In theory, Ramsey mark-ups for a multi-product firm should only be applied to those costs are that are defined as being (fixed and) common, i.e. network common costs and non-network common costs or overheads.

294. As we have discussed in section 2.16, we regard both to be a relatively limited amount of total annualised costs provided that an appropriate definition of the increment is used within a TSLRIC framework.

2.24. Ramsey and international experience

The Commission seeks information on where regulators in other jurisdictions have applied Ramsey principles in access pricing.

295. To our knowledge no regulators have to date applied Ramsey principles in access pricing.

296. The main reasons cited by regulators for this preference based on our survey and experience with regulatory determinations in other jurisdictions include but are not limited to:

- the calculations of Ramsey prices involves a significant amount of data, most of which is highly uncertain;
- the calculation of Ramsey prices is difficult and costly;
- the results will only be as reliable as the data upon which they are based (data is likely to be unreliable as key information including demand elasticities and cross-elasticities are uncertain);
- applications of Ramsey pricing will lead to regulatory gaming as there is a great deal of scope for various interested parties to argue about whatever elasticities are used (also increasing the regulatory burdens and the cost of regulation);
- large mark-ups based on Ramsey prices would put excessive weight upon evidence that is not robust; and
- Ramsey pricing will not replicate the sort of outcome that would prevail in a competitive market, hence it is not an appropriate form of regulation.

297. Regardless of whether one agrees with the reasons noted above, it is clear that international regulators do not favour the implementation of Ramsey principles.

2.25. Elasticities in the Frontier model

The Commission seeks the views of interested parties as to the appropriateness of the elasticities used in the Frontier model.

298. Price elasticities are complicated and time consuming to estimate in practice and require access to large data sets comprising time series of prices and demand (and ideally access to other information such as changes in the number of competitors, introduction of new services, major advertising campaigns etc).

299. The examination of Ramsey allocations of common costs by the Competition Commission and by Oftel in the UK provided a forum for examination of the elasticity estimates. These estimates were derived in the context of for mobile access and mobile originating calls. The study by DotEcon for BT is a good example of the formal analysis of price elasticities that was presented. The analysis was conducted using different econometric models and based on monthly data from January 1997 – February 2001.[84]

300. In its evaluation, Oftel concluded that it:[85]

> *"...saw no compelling reason to believe that the own-price elasticities of mobile-originated calls, fixed-to-mobile calls and mobile subscriptions were significantly different from one another. ... Oftel assumed that all three own-price elasticities were equal to –0.3 ... In that work it assumed that all cross-price elasticities, with the exception of the cross-price elasticity of the number of subscribers with respect to the mobile-originated call price, were equal to zero. It is said that the welfare implications of such cross-price elasticities were captured through the application of the R-G* [Rolhfs-Griffen] *factor and so to include values for cross-price elasticities would involve double counting.*

[84] We note that Oftel commissioned a review by Dr John Hunter and Professor Christos Ioannadis in 2001. Their review raised concerns about the validity of the model used by DotEcon. They suggested that it was not clear that the estimates obtained from the defined models were in fact estimates of the own-price elasticity.

[85] ibid, para 8.53, pp. 216-217.

301. The UK Competition Commission was wary of using the elasticity estimates: [86]

> *"First, we were not satisfied that there was any way of establishing reliable estimates of elasticities of demand in the mobiles sector with enough precision to inform pricing decisions. Hence, we believe that there are problems in calculating reliable Ramsey prices."*

302. The UK Competition Commission also noted that the elasticity estimates were not stable over time.[87] The stability of the estimates is of particular concern where prices change by significant amounts. In these cases, there may be different elasticity estimates unless a constant elasticity is assumed across the entire demand curve.

303. In our view, elasticity estimates for welfare analysis are notoriously difficult to calculate. It is therefore our opinion that reliance on any point estimate is placing too great a burden on that estimate. For this reason, it is important to consider a range of estimates and to conduct sensitivity analysis to inform final judgement. In this respect, we acknowledge that Frontier Economics run several scenarios of their welfare model with different elasticity estimates.

304. In order to evaluate the appropriateness of the elasticities used in the Frontier model, we review and summarise publicly available information on elasticities within each category.

2.25.1. Mobil subscription own price elasticity

305. In its submission on Optus MTAS undertaking, CRA provides a comprehensive list of estimates covering Calling Party Pays (**CPP**) regimes in developed countries.

[86] Competition Commission (2003) para 2.431, p. 99.

[87] Competition Commission (2003), para 8.24, p. 210.

TABLE 3: SUBSCRIPTION OWN-PRICE ELASTICITY

Study	Elasticity
Ahn and Lee, 1999	–0.36
Dotecon, 2002	–0.37
Frontier Economics, 2002	–0.54
Grzybowski, 2004	–0.3
Hausmann, 1999	–0.51
Madden, Coble-Neal and Dalzell, 2004	–0.53
Rodini, Ward and Woroch, 2003	–0.43
Tishler, Venture and Watters, 2001	–0.42
Simple average	–0.43

Source: CRA (2004) pp. 35-36

306. In addition, we note a survey of rural residents in Australia that estimated a mobile own price elasticity of -0.0255.[88] This suggests that for the relatively small number of people in isolated or small communities, that the nation-wide subscription own-price elasticity estimates will be overstated.

307. Based on the estimates provided, we regard a reasonable range estimate for mobile subscription to be -0.3 to -0.55 with a mid-point of -0.43.

2.25.2. Mobile outbound own price elasticity

308. There is a significant difference in consumer responses to whether charges are based on CPP or Receiving Party Pays (**RPP**). As a result, we have focussed on insights from non-US studies into own-price elasticity (but have listed a number of US estimates). Outside of developed countries, the own-price elasticity is likely to be significantly higher. For example, Telang (2004) examined mobile own price elasticity across different pricing plans in Thailand. The estimates of elasticity ranged from –1.12 for the 95% of subscribers on the lowest value plan to –0.15 on the highest.

309. In addition, Holden and Pearmain (2001) provided an estimate of own-price elasticity of –0.48 for all mobile calls based on a consumer intentions survey. These estimates, however, are likely to overstate actual responses by consumers and have not been included.

310. In the UK, DotEcon (2002) has estimated an own-price elasticity of -0.62. As well as DotEcon's estimate for the review by Oftel/Ofcom, Frontier Economics (2002) examined own-price elasticity estimates. However, its

[88] Crase, Patullock and Lamb (2000)

estimation did not generate significant figures for mobile own price elasticity. Nonetheless the point estimate was –0.53.

311. Dineen (2000) estimated a price elasticity of –0.49 and –0.52 (including lagged FTM minutes) under two models in the UK for the period of the first quarter 1996 to the third quarter of 1999.

312. In addition, Dewenter and Haucap (2004) have estimated demand elasticities for Austria over the period 1998-2002[89] including using firm-specific tariff information. Using their preferred model, they found estimates of the long-run own-price elasticity to be in the range –0.61 to –1.05 which they noted were at the upper end of existing estimates.

313. For the US, Rodini, Ward and Woroch (2002) found that their estimate of mobile own price elasticity was not reliable. For 2000, the estimate was -0.17 and significant but +0.04 in 2001 and not significant. A later analysis of the same data by Ward and Woroch (2004, p. 12) suggests that estimates of own price elasticity range from –0.3 to –0.7.[90]

314. Finally, Hausman (2003) has estimated an own-price elasticity of -0.55.

315. Based on the estimates provided, we suggest a reasonable elasticity estimate for mobile outbound calls to be -0.3 to -0.7 with a mid-point of -0.5.

2.25.3. Fixed-to-mobile own price elasticity

316. The fixed-to-mobile elasticity was discussed by the Commission in its Mobile Service Review.[91]

317. Below we have summarised the estimates considered by Commission (in the Mobile Service Review fn 409) and used by CRA in support of the Optus MTAS undertaking. In addition, we have added estimates quoted from Aldebert (1999)[92] and Francis (2000)[93].

---

89 The Austrian mobile market being opened to competition in 1996.

90 Separate figures were estimated for IntraLATA, InterLATA intrastate and interstate with equal changes in fixed and mobile prices. With only mobile prices rising, the elasticity estimates are higher.

91 ACCC (2004), p. 154 fn 409.

92 Aldebert (1999) estimated an own-price elasticity for residential consumers.

93 The analysis by Francis (2000) relates to Optus customers. As such, it is unlikely to be an appropriate estimate of the market's own-price elasticity (see also section 2.7). The Francis estimate also appears to relate to a short time period.

TABLE 4: FIXED-TO-MOBILE OWN PRICE ELASTICITIES

Source	Range	Point estimate
Access Economics (Aust), 1998	–0.08	–0.08
Aldebert (France), 1999	–0.491	–0.491
Francis (Aust), 2000	–0.3 - –0.5	–0.40
DotEcon (UK), 2001	–0.33 - –0.76	–0.43
Frontier Economics (UK), 2001	–0.18	–0.18
Holden Pearmain (UK), 2001	–0.11	–0.11
Macquarie (Aust), 2003	–0.75	–0.75
CommSec (Aust), 2003	–0.50	–0.50

Source: ACCC (2004), CRA (2004), Aldebert (1999) and Francis (2000)

318. Based on this information we consider a reasonable elasticity interval for FTM calls to be -0.2 to -0.8 with a mid-point of -0.5. This interval represents the entire range of estimates excluding the Access Economics estimate and an adjustment to the Holden Pearmain estimate.

319. The Access Economics figure is based on data from two studies from 1980 and 1988 which where not even their own estimates. This coupled with the apparent age of the estimate and the fact that it is a clear outlier in the data set means we have little or no confidence in the estimate. Further, our review of the comments provided to the Competition Commission on the Holden Pearmain study suggests that the estimate is too low. As such we have set the lower point estimate at -0.2. With regard to the upper limit in our interval, we are guided by the DotEcon and Macquarie estimates.

320. In the case of the DotEcon estimates, we note that the weighted average figure of –0.43 represents the average of, effectively, DotEcon's lowest (in an absolute sense) long-run price elasticity estimate for each of the three time periods calculated: Daytime, Evening and Weekend. In terms of examining different types of consumers, it is likely that business users are relatively more important in Day estimates (–0.375) than for Evening (-0.860) or Weekend (–0.485).

321. DotEcon examined three different model configurations: *i*) a simple static model; *ii*) a static model with lagged dependent variable; and *iii*) an error-correcting model. DotEcon (2001, p. 5) states:

> *Models (a) and (b) ... are open to potential criticism in this case because they may simply measure correlations between trended variables. In particular, FTM minutes and mobile subscribers are upward mobile, while tariffs are downward trended. There is a danger that any estimates of relationships between these variables*

> *may be driven by correlations caused by the variables' overall trends and may fail to capture short-run relationship properly.*
>
> *Aware of this potential criticism, we have also estimated model (c), which addresses this problem. Although more complex, it produces estimates that are robust to trends in the dependent and explanatory variables. In practice, the estimates produced by all three models appear broadly consistent.*

322. The UK Competition Commission raised a series of concerns regarding the econometric analyses used by DotEcon and Frontier. In particular, Oftel had commissioned a review by Dr John Hunter and Professor Christos Ioannadis in 2001. The review raised concerns about the validity of the model used by DotEcon. They suggested that it was not clear that the estimates obtained from the defined models were in fact estimates of the own-price elasticity.

323. In reviewing the Frontier Economics analysis, the UK Competition Commission noted that the estimates for fixed-to-mobile were not stable over time.[94] The stability of the estimates is particularly of concern where prices change by significant amounts. In these cases, there may be different elasticity estimates unless a constant elasticity is assumed across the entire demand curve.

324. We note that the Commission's selected elasticity of –0.6 in the Mobile Services Review is within the interval of -0.2 to -0.8 that we consider appropriate.

2.25.4. Volume elasticities

325. The Frontier model requires estimates of:

- the change in the volume of fixed-to-mobile calls from a change in the number of subscribers;
- the change in the volume of fixed-to-mobile calls from a change in the number of subscribers; and
- the change in the volume of subscriptions from a change in the number of subscribers.

[94] Competition Commission (2003), para 8.24, p. 210.

326. As noted by Frontier, the size of these elasticity estimates will depend on the position taken on externalities. We therefore refer to later commentary on this issue.

2.25.5. Summary of price elasticity estimates

327. The table below summarises our preferred elasticity estimates and compares them to those suggested by Frontier Economics.

TABLE 5: FRONTIER AND MJA ELASTICITY ESTIMATES

Relationship	Vodafone Elasticity – interval	Vodafone Elasticity – mid point	MJA Elasticity - interval	MJA Elasticity –mid point
Subscription own-price	[-0.6:-0.3]	–0.45	[-0.55:-0.3]	–0.43
Mobile outgoing own-price	[-0.6:-0.3]	–0.45	[-0.7:-0.3]	–0.50
Fixed-to-mobile own-price	[-0.6:-0.3]	–0.45	[-0.8:-0.2]	–0.40

Source: Vodafone (2004) and MJA analysis

328. Frontier seem to have applied a fairly pragmatic approach to their estimate of elasticities, hence their mid-point estimates are the same. Compared to the MJA estimates the Frontier estimates are similar.

2.26. Ramsey mark-ups proposed by the Frontier model

The Commission also seeks the views of interested parties as to whether the Ramsey mark-ups proposed by the Frontier model are reasonable.

329. The Ramsey mark-ups proposed by the Frontier model are the result of the combined inputs on elasticties and the amount of common costs and demand equations in their model. Of particular importance is the magnitude of (fixed) common costs. Given that we believe that these are excessive (see section 2.16), the estimates provided will, per definition, exceed what we regard as reasonable.

330. We do not necessarily reject the elasticity estimates used by Frontier (see section 2.25). Their assumption of the ratio of private to public benefits (the RG factor) of 1.5 is reasonable (see section 2.30). However, we note that the Ramsey mark-ups vary from 6.37 – 14.58 cpm, which corresponds to 27% - 43% of total costs respectively. That costs may vary so considerably raises serious concerns about the appropriateness of the approach.

331. Although the model has been subject to scrutiny during the UK LRIC process we note that no evidence has been provided to support two of its key assumptions: the zero-profit constraint and a full waterbed effect.

332. As we discuss in section 2.29, if an externality surcharge is to be added we believe that such adjustments cannot rely on one model alone, but must consistently consider a range of methodologies, models and sensitivity estimates. The same argument should apply to any estimate of Ramsey mark-ups.

2.27. Alternative elasticity estimates

The Commission seeks information on whether interested parties are aware of alternative estimates of own-price elasticities of demand and cross-elasticities of demand for key services in a Ramsey model.

333. Please refer to section 2.25.

334. We note that CRA in its report for Optus provides estimates of the fixed-to-mobile cross price elasticity.

TABLE 6: SUBSCRIPTION FIXED-TO-MOBILE CROSS-PRICE ELASTICITY

Study	Elasticity
Dotecon, 2001b	–0.12
Hausmann, 2003	–0.24

Source: CRA (2004), p. 37

335. In our view, the estimates provided suggest an elasticity estimate for mobile outgoing calls to be -0.1 to -0.3 with a mid-point of -0.2.

2.28. Appropriateness of surcharge for network externalities

The Commission seeks comments from interested parties on the appropriateness of the efficient cost of providing the MTAS being supplemented with a surcharge to reflect the existence of network externalities.

336. The purpose of incorporating a network externality surcharge on the MTAS is to provide incentives for new customers to join a mobile network that, from society's perspective, may be under-utilised due to the existence of the externality.

337. We have a number of concerns with such an approach, including:

- for there to be any benefit in allowing a higher MTAS charge due to network externalities, it is necessary that there be a significant waterbed effect. Without a waterbed effect, higher MTAS charges will only result in greater profits for mobile network operators and will not result in lower handset/mobile access charges. A surcharge on the MTAS is a form of indirect subsidy – it is not a direct subsidy on the set of prices that individuals take into account when deciding whether or not to subscribe. Therefore, some assessment must be made of the likelihood that allowing for an increase in the MTAS is matched by a reduction in the price of subscription services. In this respect, we note that the Commission, in the Mobile Services Review, is clearly concerned that competition in the retail sector is not effective at this time and that this is not likely to change in the near future.[95] Given that this is the case, it cannot simply be assumed that adding a surcharge to the MTAS will lead to subscription costs being lower than they would be otherwise.
- no allowance is currently made for network externalities in the Commission's TSLRIC modelling of the fixed network business although any externality argument should apply in both directions. A consumer choosing between a fixed line or a mobile phone will, *ceteris paribus*, choose to subscribe to the mobile network if he/she receives a subsidy financed by other mobile subscribers (including fixed network subscribers)[96];
- when penetration increases, the number of potential new subscribers is increasingly limited, eroding the benefit of including a surcharge over time;
- some subscribers are likely to join the network without an additional subsidy or at purely cost-based rates (the infra-marginal subscriber). For these customers, no additional benefits will accrue to society. The surcharge will only act as a demand distorting mechanism;
- there may be offsetting externalities. The *call* externality is one such externality; and

95 ACCC (2004), p. 148

96 Of course, such an effect would be reduced if mobile subscription prices fell correspondingly. But even then, mobile phone users are "subsidised" by the fixed line users – the decrease in mobile subscription charges is financed by an increase in fixed to mobile termination charges. This may not be fair in distributional terms, and is incomplete because externalities are also likely to exist in the fixed line network being cross-subsidised by mobile to fixed termination charges.

- if the cost of MTAS is above incremental costs (or on an above cost glide path) there is no argument for taking account of network externalities. We are not convinced that the current cost estimates made by any of the parties (Vodafone and Optus) reflect the forward-looking efficient economic cost of the MTAS. Given that they are above this benchmark, it would clearly be inappropriate to include a surcharge for a network externality.

338. On the other hand, we acknowledge that a surcharge above the efficient forward-looking cost of the MTAS may have positive welfare effects. To the extent that a price below cost (i.e. subsidised) is necessary to entice or encourage consumers to become mobile subscribers (the marginal subscribers) an externality surcharge may be justified. Where the surcharge leads to a reduction in mobile subscription fees and/or prices for handsets, this contributes to the expansion of the mobile market – an expansion that also will benefit fixed line users. From a welfare perspective it may therefore be desirable to let fixed network users indirectly subsidise mobile network expansion. However, as noted above and discussed in more detail below, this argument becomes less convincing as the mobile market matures and reaches saturation.

339. If a subsidy to marginal subscribers is required from a welfare perspective then it would seem that mobile operators should have a legitimate opportunity to recover such costs. However, evidence regarding the appropriateness of a surcharge would need to be demonstrated before it was factored into a regulated MTAS charge. For example, an important precondition for including a surcharge is the existence of a waterbed effect, i.e. the assumption that an increase in mobile retail prices will be caused by a reduction in the MTAS charge.

340. To the extent that higher mobile termination charges induce mobile operators to reduce subscription fees and thereby attract more mobile subscribers it could be argued that any reduction in mobile termination fees would result in an increase in subscription fees. On the other hand, if mobile operators kept termination profits for themselves, there would be no impact on mobile retail rates. Hence there is a correlation between the extent to which the waterbed effect operates and the intensity of competition between mobile operators.

341. In paper a recent paper submitted to the Commission[97], Frontier Economics review the workings of the waterbed effect. In this report, Frontier critique the Commission's discussion and interpretation of the waterbed effect. In particular, Frontier criticise the argument that the waterbed effect depends on the existence of a zero-profit constraint. Frontier make the point that the waterbed effect may operate in large array of competitive or non-competitive scenarios and that the lack of effective competition is not enough to conclude the waterbed effect does not exist.

342. Frontier make reference to Professor Hausman who has argued that a waterbed effect will operate as long as firms are assumed to be profit maximisers. Professor Hausman notes that the size of the waterbed will be positively related to intensity of competition in the retail market and be present even though competition is weak or even absent.

343. In principle, we do not disagree that the waterbed effect may operate under a wide range of different competitive and non-competitive scenarios for the retail market. However, it is unclear how and to what extent the effect will operate in practice. In this respect it is useful to consider the two extremes:

- A monopoly on retail (and wholesale) mobile services: In a monopolised market with no constraints on the monopoly provider, any mandated decrease in mobile termination may be off-set by an increase in retail service costs. Hence re-balancing occurs because the monopoly provider exploits his/her monopoly power.
- Full competition for retail mobile services: With full competition in the retail market, operators may be assumed to be operating under a zero economic profit constraint. Any reduction in the mobile termination rate would therefore imply that mobile operators would not recover their costs (or the rate of return would fall below that of the cost of capital). Hence operators would seek other means to bring themselves into balance by increasing revenues from other sources, for example, mobile subscription fees.

344. The dynamics of re-balancing are substantially different in the two extreme cases. In the case of a monopoly, the operator will re-balance because it is able to, hence ensuring its excessive profits are maintained, while in the case of a full competition scenario re-balancing occurs out of necessity to ensure cost recovery. Between these two extremes we find the workings of the Australian market.

[97] Frontier Economics (2005), *The Waterbed effect*, A report prepared for Vodafone, July

345. Frontier make no attempt to consider the workings of the Australian market, but simply refer to theoretical propositions. In our view, failure to consider the strategic interactions between the players on the market is vital to understanding the extent of the waterbed effect in any market. In particular, Frontier fails to consider the strategic incentives and commercial impacts on the different operators. For example, any reduction in the MTAS charge will have far from the same commercial effect on Telstra and Vodafone. While the commercial impact of a reduction in the MTAS for Vodafone is (ceteris paribus) negative, the net effect for an integrated business such as Telstra is less clear and hence will influence the strategic interactions in the market.

346. Without further analysis it is difficult to estimate the exact extent of the waterbed effect for the Australian market, however, it our contention that it is not full and only likely to be partial. Indeed, we are not convinced that a waterbed effect would even be material. .

2.29. Magnitude of mark-up for network externalities

The Commission seeks comments from interested parties on the appropriateness of the magnitude of the mark-ups on cost, suggested by the Frontier model, to reflect network externalities.

347. The case for including a network externality has been widely debated by operators and regulators alike in every consultation on the regulation of mobile termination that we are aware of. In terms of international experience in this area, we note that only two countries we are aware of have taken account of network externalities. These are the UK and Israel.

348. Although there seems to be general agreement that a network externality exists, there is considerable dispute as to its size and if it should be included or not. For example the Swedish regulator, PTS has argued that the network externality is negligible and can be ignored in the case of Sweden. PTS' main argument is that Sweden has a penetration of 90% making it unlikely that it is welfare maximising to add a surcharge to encourage additional subscribers to join the network and that adding an additional margin on top of costs is more likely to lead to excessive profits than to encourage new users.[98] On the other hand, Ofcom adds a network externality surcharge of 0.5 ppm to their LRIC estimate.

[98] See PTS (2004a)

349. The UK case, in particular, illustrates that enormous effort is required to derive even an approximate estimate of the network externality and that estimates will vary widely depending on the particular methodology and assumptions used.

350. As Frontier Economics note:[99]

> *"Models were prepared for the regulator Oftel (by Dr Rohlfs) and by those providing mobile terminations services. Models included those developed by Frontier Economics UK (for Vodafone UK), DotEcon and Lexecon.*
>
> *There was a long process of vigorous discussion as to the appropriateness of the assumptions used in each of the models and on the differing model outputs."*

351. Ofcom ultimately relied on the work of Professor Rohlfs to calculate the externality surcharge.[100] Oftel noted that:[101]

> *"The Director did not consider that any of these models* [DotEcon on behalf of O2, Frontier Economics on behalf of Vodafone and CRA on behalf of T-Mobile] *provided useful results that should be taken into account in this market review. This is because such models were subject to methodological flaws and/or implausible elasticity estimates. As discussed above, it is reasonable to believe that the R-G factor lies between 1.3 and 1.7 and certainly between 1 and 2. The elasticity assumptions used in these models, including the cross-price elasticities, imply significantly larger values for the R-G factor. Therefore, the Director considers that the elasticity assumptions used in these models are implausible and cannot be relied upon, because they are inconsistent with credible underlying economic relationships."*

352. We note that in our opinion the Frontier Economics model provided in the current case uses more reasonable assumptions than were used in the UK.

353. The Rohlfs model(s) provide an estimate of the optimal mark-up to recover common costs as well as an adjustment for externalities. Given that Ofcom preferred to use the EPMU approach for the recovery of common costs,

---

99 Frontier Economics (2004b), p. 8

100 A table summarising the mark-up results (for both common costs and the externality surcharge) of the different models are shown in Competition Commission (2003), Table 9.1. It is interesting to note the very clear discrepancy between the models delivered. This discrepancy is analysed in detail in the chapter 9 of the Competition Commission document, where the models are attempted reconciled.

101 Oftel (2003), Annex G, p. 272

adjustments are needed to the Rohlfs estimates to isolate the effect of externalities on the optimal set of prices that are an output from the model.

354. In the UK, Ofcom used an EPMU approach to common costs. Hence Ofcom only uses the Rohlfs models to inform a reasonable figure for the externality surcharge, not the common cost mark-up.

355. Ofcom uses four different versions of the Rohlfs model to inform the likely size of the network externality. They are:

- *The Rohlfs Targeting Model* - incorporates the ability of mobile operators to distinguish marginal and infra-marginal subscribers through price discrimination;
- *The Rohlfs Principal-Agent Model* - incorporates mobile operators sub-optimal use of higher mark-ups on termination;
- *The Rohlfs No Targeting Model* - a linear pricing model (no price discrimination - all subscribers are offered the same subscription price) with some internalisation of externalities by mobile operators assumed; and
- *The Rohlfs Reduced Internalisation Model* - reduces assumptions about amount of externality internalised by mobile operators.[102]

356. Apart from magnitude of the RG factor,[103] Ofcom focussed heavily on targeting when establishing the optimal surcharge. Ofcom considered two main issues:

- *the ability to target a subsidy*. On the one extreme, no targeting is possible, i.e. a mobile operator charges the same price to all subscribers, both marginal and infra-marginal. In this case, the subsidy would be at a maximum. At the other extreme is perfect targeting, i.e. a mobile operator can charge a bespoke price to all marginal subscribers and provide no subsidy to infra-marginal subscribers. This results in the lowest required subsidy. Of course, there are number of targeting scenarios between these two extremes; and
- *the incentive to target different customers*. The incentive to target is a function of its profitability, for example, infra-marginal subscribers

[102] Increasing the usage cross-elasticities, j2 = 0.5, j4 = 0.5, n = 0.25.

[103] The Rohlfs-Griffin (RG) factor (or gross externality factor) is the ratio of social benefit to private benefit. In this context, it provides a measure of the externalities associated with the addition of subscribers to a network. Ofcom (2003) Annex D.

are likely to be more profitable (and high value) customers than marginal customers providing mobile operators with more direct incentive to target these customers.

357. In terms of the ability to target, Ofcom believes the extent of price discrimination in retail tariffs (the range of different usage and subscription/handset prices) provides evidence of this ability. As noted above, the ability to target suggests that the overall subsidy required will be lower since subsidies can be targeted more towards those who need them. However, Ofcom also believes that price discrimination facilitates internalisation of the total externality by mobile operators. This is explained by Oftel as follows:[104]

> *"*[Mobile operators] *are likely to be able to internalise a substantial proportion of the total externality, and in particular the positive benefit which accrues to existing mobile customers. They can internalise this benefit by capturing the additional benefit that accrues to existing mobile subscribers through price discrimination. This may have a further effect in reducing the size of the subsidy to be recovered from a surcharge on mobile termination."*

358. In terms of the ability to target, we have no reason to believe that this ability is different in Australia compared with the UK. In particular, we note that Optus has invested heavily in a customer value system which facilitates the identification of different customer types, making retention strategies more effective.[105] Further, recent growth by Telstra has been attributed to a detailed segmentation of their customer base in order to identify areas of opportunity and weakness.[106]

359. However, to the extent targeting is more difficult (or there is limited incentive to target) such that subsidies are inefficient (for example, funding of upgrades to handsets for infra-marginal subscribers or encouraging inefficient switching of existing subscribers), any surcharge should be reduced.

360. In estimating the surcharge, it is also interesting to note that Ofcom has expressed extreme caution due to the conceptual and practical difficulties in making judgements in this area. For this reason, Ofcom's judgement is

---

104 Oftel's Response to the Competition Commission's Letter on Externalities of 28 March, sourced from Ofcom (2004), Annex G, p. 263

105 Citigroup (2004), p. 61

106 Citigroup (2004), p. 58

made on the basis of a range of estimates produced by different models of behaviour in wholesale and retail mobile markets.[107]

361. Given the uncertainty and difficulty in making such an estimate, any estimate cannot rely on one method or model, but should consistently analyse different models and options in order to gain sufficient knowledge and insight on the magnitude of an efficient surcharge for network externalities.

362. We therefore agree with the position taken by Oftel when they stated that:[108]

> *"…in developing the appropriate surcharge the Director has considered a number of estimates that he believes are relevant. As before, he does not consider that any estimate is, on its own, sufficiently accurate due to the omission or simplification of relevant considerations, the reliance on uncertain parameter values and complex interactions between the factors relevant to the determination of the optimal surcharge, such as the existing internalisation of externalities or the form of retail competition. However, each of the estimates considered places different weight on these factors, and thus logically informs his decision"*

363. In this respect, we believe it is important to inform the debate on the externality surcharge with additional estimates and methodologies. One methodology not considered by either Vodafone or Optus in their undertaking submissions is the approach adopted the UK Competition Commission (**UKCC**). Their approach involves capping the surcharge at a level that corresponds to the amount of subsidy which targeted marginal customers for whom the subsidy would mean the difference between joining and not joining a mobile network, bringing about at least as much external benefit as the amount of the subsidy.

364. Another approach that could inform a view on the likely magnitude of the externality is data on the amount of subsidy that mobile operators currently offer to attract new subscribers and maintain loyalty among their existing customer base.[109] While the latter approach requires detailed data from the mobile operators, the former UKCC approach is relatively simple and transparent and may be replicated for Australia.

365. The UKCC approach relies on the following inputs and assumptions:

---

107 Ofcom (2004), p. 63

108 Oftel (2003), Annex G, p 274

109 See for example, the UK Competition Commission (2003), appendix 8.4.

- *Existing population 12 years and over*. Based on data from ABS population statistics we estimate that there are 16.9 million Australians who are 12 years and over.
- *Current number of people aged 12 years and over who have a mobile phone*. By applying a conservative penetration rate of 75%[110] to the population who are 12 years and over, we yield and estimate of approx. 12.2 million people.
- *Proportion of those people currently without a mobile phone that would consider getting one*. Without available data for Australia, we use the UKCC survey figure of 26%.
- *Annual increase in number of mobile subscribers that would be required to reach saturation by 2008*. Based on the calculated number of people aged 12 years and over currently without a mobile phone, and the proportion of those people currently without a mobile phone that would consider getting one, we can estimate the total number of people aged 12 and above that would consider getting a mobile phone. We assume this figure, spread over the four years, as representative of the annual increase necessary to reach saturation by 2008.
- *Proportion of marginal non-subscribers that will pay their own joining fees*. Without available data for Australia, we use the UKCC survey figure of 12%.
- *The Rohlfs-Griffin factor*. We assume a value of 1.5.
- *Minimum subscription fee (Marginal Social Benefit)*. As a proxy for the minimum subscription fee we use (as did the UKCC) an estimate of the minimum price of a prepay handset. We estimate conservatively that such a handset would cost $100. We note that handsets are available below this price.
- *Total number of 2G and 3G minutes (bn) terminated in 2008*. We estimate this traffic amounts to 10 bn minutes. This figure may be refined by requesting actual figures from each operator.
- *Proportion of subscribers that would not replace a lost handset*. Without available data for Australia, we use the UKCC survey figure of 34%.

[110] It is generally agreed that penetration in Australia currently exceeds 80%, however, due to the inherent difficulty in measuring penetration and a tendency to overstate this figure we have used the conservative figure 75% as a basis in our estimation.

- *Handset life of marginal existing customers*. The UKCC adopted an estimate of 4 years. We use the same figure.

366. Using the assumptions and inputs above, we calculate the level of subsidy required to induce a marginal subscriber to join the network as the ratio of the minimum subscription fee (marginal social benefit) to the RG factor. This calculation yields a subsidy of $66.67.

367. The externality surcharge is then calculated as the surcharge required to provide the level of subsidy sufficient to induce on to the mobile network those marginal existing and non-subscribers for whom the external benefits that would thereby be generated exceed this subsidy.

368. The calculations are summarised in the table below.[111]

[111] The UKCC's calculation is replicated in Annex A.

TABLE 7: THE UKCC'S EXTERNALITY SURCHARGE CALCULATION FOR AUSTRALIA #1

Item	Ref.	Value	Derivation / Source
Marginal non-subscribers			
Existing population 12 years and over	A	16,900,000	MJA estimate based on ABS population stats.
Current number of people aged 12 years and over who have a mobile phone	B	12,168,000	MJA calculation based on penetration estimate and ABS population stats.
Number of people aged 12 years and over currently without a mobile phone	C	4,732,000	A-B
Proportion of those people currently without a mobile phone that would consider getting one	D	26.00%	UKCC Survey
Annual increase in number of mobile subscribers that would be required to reach saturation by 2006	E	307,580	(C*D)/4
Proportion of (C) that will pay their own joining fees	F	12.00%	UKCC Survey
Assumed value of Rohlfs-Griffin factor	G	1.5	UKCC Assumption
Minimum subscription fee (Marginal Social Benefit)	H	$100.00	MJA estimate of min. price of a prepay handset
Marginal Private Benefit	I	$66.67	H/G
Subsidy required to induce a marginal subscriber to join the network	J	$33.33	H-I
The proportion of marginal subscribers for whom this amount of subsidy would make the difference between joining and not joining	K	33.33%	J/H (assuming marginal subscribers' valuations of joining are evenly distributed from $0 to $100)
Total value of externality surcharge justified	L	$4,237,769	E*J*(F+K*(1-F))
Total number of 2G and 3G minutes (bn) terminated in 2005/06	M	10	MJA estimate based on Citigroup (2004) and ACCC (2004b)
Externality surcharge justified for marginal non-subscribers	N	*0.04 cpm*	(L/M)*100
Marginal existing subscribers			
Proportion of subscribers that would replace a lost handset but who are not prepared to pay enough to do so (i.e. would need subsidy)	O	34%	UKCC Survey
Number of marginal existing customers	P	4,137,120	O*B
Handset life of marginal existing customers	Q	4 years	UKCC Assumption
Number of existing subscribers who become marginal every year	R	1,034,280	P/Q
The proportion of (P) who would pay for their own handset	S	0%	UKCC Assumption
Total value of externality surcharge justified	T	$11,492,000	R*J*(S+K*(1-S))
Externality surcharge justified for marginal (non-)subscribers	U	*0.11 cpm*	(U/M)*100
Total Externality Surcharge	V	*0.16 cpm*	N+U

369. Using this methodology, the total externality surcharge is 0.16cpm. Note that if mobile operators were able to engage in 'perfect' targeting of the subsidy, only half of the 0.16cpm surcharge would be required.

370. Based on a number of criticisms of the above methodology, the UKCC revised their approach. In particular, it considered how a subsidy scheme might work in practice, i.e. the amount of targeting of subsidy that is actually possible. It considered that mobile operators in the case of current subscribers know their level of spending and hence have an indication of their private valuation of a mobile subscription which would enable individual targeting. In other words, a customer whose handset was lost, stolen or broken might require a discount of almost the full price of a handset if his or her spending was very low, while customers with very high spending might require little or no subsidy.

371. The UKCC assumed that marginal customers were distributed equally between these two extremes and therefore that the average discount that a mobile operator would need to offer was half of the minimum subscription fee. This translates into an offer of $50.

372. The revised calculations are shown in Table 8 below.[112]

373. The result is a total externality surcharge of 0.62cpm. We note that Oftel rejected the revised calculation because it involves directing a subsidy at marginal subscribers for whom the Marginal External Benefit (**MEB**) is less than the marginal resource cost (i.e. the subsidy). The UKCC nevertheless concluded that their final estimate should be based on the revised approach.

374. In terms of the sensitivity of the approach to different assumptions, we calculate a total externality surcharge of 1.02cpm using the following conservative assumptions:

- an increase in subscription fees by $10 to $110;
- a decrease in the average handset life from 4 to 3.5 years;
- that the proportion of those people currently without a mobile phone who would consider getting one is increased from 26% to 35%; and
- the proportion of subscribers (requiring a subsidy) to replace a lost handset is increased from 34% to 45%.

[112] The UKCC's calculation is replicated in Annex A.

TABLE 8: THE UKCC'S EXTERNALITY SURCHARGE CALCULATION FOR AUSTRALIA #2

Item	Ref.	Value	Derivation / Source
Marginal non-subscribers			
Existing population 12 years and over	A	16,900,000	MJA estimate based on ABS population stats.
Current number of people aged 12 years and over who have a mobile phone	B	12,168,000	MJA calculation based on penetration estimate and ABS population stats.
Number of people aged 12 years and over currently without a mobile phone	C	4,732,000	A-B
Proportion of those people currently without a mobile phone that would consider getting one	D	26.00%	UKCC Survey
Annual increase in number of mobile subscribers that would be required to reach saturation by 2008	E	307,580	(C*D)/4
Proportion of (C) that will pay their own joining fees	F	12.00%	UKCC Survey
Assumed value of Rohlfs-Griffin factor	G	1.5	UKCC Assumption
Minimum subscription fee (Marginal Social Benefit)	H	$100.00	MJA estimate of min. price of a prepay handset
Marginal Private Benefit	I	$66.67	H/G
Subsidy required to induce a marginal subscriber to join the network	J	$33.33	H-I
The proportion of marginal subscribers for whom this amount of subsidy would make the difference between joining and not joining	K	33.33%	J/H (assuming marginal subscribers' valuations of joining are evenly distributed from $0 to $100)
Total value of externality surcharge justified	L	$4,237,769	E*J*(F+K*(1-F))
Total number of 2G and 3G minutes (bn) terminated in 2005/06	M	10	MJA estimate based on Citigroup (2004) and ACCC (2004b)
Externality surcharge justified for marginal non-subscribers	N	*0.04 cpm*	(L/M)*100
Marginal existing subscribers			
Proportion of subscribers that would replace a lost handset but how are not prepared to pay enough to do so (i.e. would need subsidy)	O	34%	UKCC Survey
Number of marginal existing customers	P	4,137,120	O*B
Handset life of marginal existing customers	Q	4 years	UKCC Assumption
Number of existing subscribers who become marginal every year	R	1,034,280	P/Q
Average subsidy required per marginal subscriber	S	50.00	H/2 (assuming an even distribution from $0 to $100)
Total value of externality surcharge justified	T	$51,714,000	R*S
Externality surcharge justified for marginal (non-) subscribers	U	*0.52 cpm*	(U/M)*100
Marginal existing subscribers for whom subsidy to non-subscribers is more attractive			
Proportion of subscribers offered less than non-subscriber subsidy	V	33%	J/H
Average increase in subsidy to these subscribers	W	16.67	J/2
Total value of externality surcharge justified	X	$5,746,000	R*S
Externality surcharge justified for these subscribers	Y	*0.06 cpm*	(X/M)*100
Total Externality Surcharge		*0.62 cpm*	N+U+Y

375. A major problem with applying the UKCC approach is that no survey data is available for the Australian market. Ideally, surveys should be conducted to more firmly assess the externality surcharge using this method. Further, the approach does not consider demand responsiveness and cannot consider the welfare effects of adding a surcharge to termination or derive the optimum subsidy (we consider this in more detail below). Also of significance is that the UKCC's methodology makes no attempt to quantify issues relating to competition in the retail market (or the waterbed effect) and therefore the extent to which a surcharge is passed through to retail prices. Such considerations are particularly relevant when considering the net benefits from adding a surcharge to the efficient cost of the MTAS. Adding a surcharge to the MTAS without it being passed through to lower subscription prices for marginal subscribers would clearly be inappropriate.

376. Nevertheless, the UKCC approach is simple and highly transparent and provides a valuable cross-check of the more advanced calculations using a system of demand equations. To the extent that evidence suggests that a surcharge is appropriate and justifiable, we suggest the UKCC approach provides a conservative estimate of the externality surcharge. In particular, we note that recovery of a subsidy from termination alone is likely to be inefficient and that the UKCC revised methodology errs on the side of being conservative in its definition of marginal subscribers.

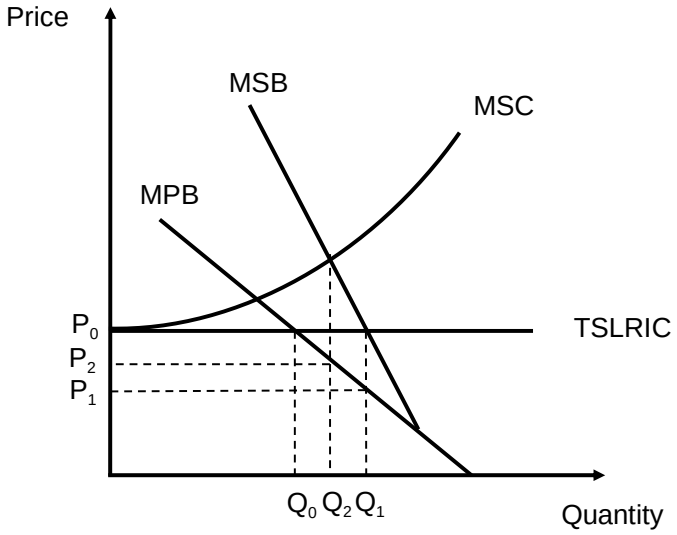
377. Erring on the side of conservatism is also warranted when considering in more detail the workings of an optimal surcharge.

378. Any mark-up above the forward-looking economic cost of the MTAS will create a deadweight loss. For example, assume that a mobile operator raises the cost of the MTAS to cover the cost of subsidising subscription. Further, assume that this increase in the MTAS is passed-through by the fixed-line operator purchasing the MTAS. This results in a price of FTM calls that is increased above efficient (TSLRIC) levels – an above cost price that that also reduces the demand for FTM calls and creates a deadweight loss. This deadweight loss will be increasing at an increasing rate relative to an increase in the FTM price. The Marginal Deadweight Loss (**MDL**) created by the subsidy is reflected in the Marginal Social Cost (**MSC**) of providing the subsidy.

379. The optimal subsidy is found at the point where the Marginal Social Benefit (**MSB**) equals the MSC, i.e. the socially optimum number of subscribers to the mobile network is reached where the MSB equals the MSC. If MSB is larger than MSC, the market is under-provided, if MSB is smaller than

MSC the market is over-provided. We illustrate this in the figure below, where the efficient forward-looking economic cost of the MTAS (for simplicity) is illustrated by a constant linear TSLRIC.

FIGURE 7: THE OPTIMAL SUBSCRIPTION SUBSIDY



380. Note that MSB converges to Marginal Private Benefit (**MPB**). Hence, the figure illustrates a situation with falling MEB.

381. The optimal price for mobile subscription is set at P_2. Note that this is lower than the pure TSLRIC price of P_0, but higher than the P_1 which is the price needed to bring the MSB in line with the TSLRIC.

382. While the figure above provides a stylised example of how an optimal subsidy should be set, it also clearly highlights the fact that any optimal subsidy must take account of the deadweight loss created by a surcharge on the MTAS – and that depending on the size of the deadweight loss there may be cases where a subsidy is not necessary at all, or indeed is not welfare enhancing.[113] The latter may be the case where the MEB of an additional subscriber is very low or zero. This may be the case where mobile penetration reaches saturation.[114]

[113] Note also that a MDL that is increasing at an increasing rate also implies that a more broad funding of the subsidy would be welfare enhancing. This is discussed in more detail in Albon and York (2004).

[114] We note that the availability and dispersion of second-hand handsets increases as penetration increases. The use of cheaper, second-hand handsets would in principle contribute to a lower price for subscription without a need for a subsidy with most significant effects if second-hand handsets were used by the marginal subscribers. However, we have seen no evidence to suggest that this occurs.

383. For example, when saturation is reached and the ownership of mobile handsets is regarded as essential by most current users, the responsiveness of subscription choices to relatively small changes in subscription prices might be expected to diminish. This observation also seems to be confirmed by industry comment. Chief Marketing Officer of Vodafone, Mr Scherger, commented in relation to a question of whether subsidies are required to stimulate growth that:[115]

> *"…subsides were required to stimulate adoption, but with penetration now exceeding 80% awareness is high as is the customers' familiarity with the service".*

2.30. The Rohlfs-Griffen factor

The Commission seeks the views of interested parties on the RG factor of 1.5 used in the Frontier model.

384. The Rohlfs-Griffin (**RG**) factor (sometimes referred to as the 'gross externality factor')[116] is a way of describing the amount of indirect benefit that is generated by additional subscribers. It is equal to the ratio of marginal social benefits to the private benefit created by the customer's decision to join a network. The marginal social benefit is defined as the sum of the marginal *private* benefits obtained by an additional subscriber and the *external* benefits which existing fixed and mobile subscribers obtain from the addition of that subscriber. If private benefit is 4 and external benefit 3 the RG factor is ([4+3]/4) 1.75, i.e. the external benefits to existing subscribers are 75% of the private benefits to the additional mobile subscriber.

385. A low value of the RG factor implies fewer external benefits from additional subscribers and a less justification for a higher subsidy to mobile subscribers and hence surcharge on the efficient forward-looking economic cost of MTAS.

386. Dr Rohlfs has suggested[117] that the ratio of marginal social benefit to marginal private benefit has a lower limit of 1, i.e. the external benefits from joining the network are zero (and not negative) or that they are entirely internalised. Hence the RG factor would not be much above 1 for a person who values making calls but whom existing subscribers do not value having

115 Citigroup (2004), p. 59

116 See Rohlfs (1979) and/or Griffin (1982)

117 Competition Commission (2003), p. 229

contact with.[118] An upper limit of 2 for the RG factor implies that the external benefit to existing subscribers is as large as the private benefit obtained by the marginal subscriber. In other words, it is deemed unlikely that existing members of the network in aggregate benefit by a greater amount than the potential new subscribers themselves.

387. We concur that the RG factor is unlikely to exceed 2 in practice. Given that a RG factor of 2 would not allow for any internalisation of the externality and the value of 1 would not allow for any external benefit, i.e. no externality at all, it therefore seems reasonable to expect that the RG factor lies between these two extremes. This was the conclusion reached by Ofcom and the UK Competition Commission, both of which recommend a RG factor of 1.5.[119]

2.31. Other externalities

The Commission seeks the views of interested parties on whether there are other kinds of externalities (relating to fixed-line, mobile and other networks and calls) that may be relevant to the decision about the imposition of a network externality surcharge.

388. In addition to the (fixed-line and mobile) network externality, the externality most often referred to is the call externality.

389. This externality arises from the fact that both the caller and the called party derive utility from communicating with each other. If a caller chose not to make a call, because his or her benefit was less than the price paid, even though the combined benefit of the caller and call recipient exceeded the price, we would have a sub-optimal outcome. In other words, the act of calling therefore generates its own value beyond that reflected by the usage charge paid by the caller.

390. If mobile subscribers receive utility from receiving calls, Armstrong (2002) demonstrates that this lowers the socially optimal termination rate. A call externality, therefore works in the opposite direction of a network

[118] Note that there is a possibility that the RG factor is below 1 for say a nuisance caller.

[119] The RG factor is assumed to take a value between 1.3 and 1.7. This is also consistent with the estimates used by the UK Competition Commission in 1998 (see p. 370 of the report on Termination Price Caps). However, the apparent consistency does raise some concerns in that mobile subscriber numbers have changed dramatically from 1998 to 2004 and demand functions could be quite different. Without more detailed information of the actual methodologies used to derive the range estimate we are not able to investigate this issue further.

externality, i.e. welfare is improved by lowering termination charges. A similar argument is made in the Mobile Services Review.

391. We observe that CRA's *a priori* reasoning suggests:[120]

> *"…it is likely that on average both parties to a call receive the same benefit from the call so that the total social benefit generated by a call is twice that of the private benefit."*

392. If the benefit to both caller and receiver were the same, then each call would be undervalued by the calling party by a half, leading to a very large under-consumption of calls.

393. Ofcom believe that call externalities are roughly internalised:[121]

> *"Call externalities – while they almost certainly do exist … are likely to be internalised by callers, as a high percentage of calls are from known parties and there are likely to be implicit or explicit agreements to split the origination of calls."*

394. While we concur that there is likely to be some internalisation of call externalities, full internalisation of all calls is unlikely. For example, outside repeat call relationships, callers would not expect to receive return calls and so might not be prepared to make calls if their private benefit was less than the price.

395. Unfortunately, taking account of call externalities is difficult without a more detailed research of their relevance for the Australian market. However, the fact remains: allowance for call externalities will, *ceteris paribus*, reduce the size of the network externality surcharge.

396. Regarding other externalities, we note those considered only briefly during by the UK Competition Commission (UKCC). In particular the UKCC identified a number of 'other' externalities, all of which they failed to quantify:[122]

> *"Types of negative externality in mobile telephony could be said to include:*
>
> - *possible health effects of exposure to radio frequency fields from mobile phones or their base stations;*

[120] CRA p. 39

[121] Ofcom (2004), Annex D The network externality surcharge

[122] Competition Commission (2003), chapter 8, p 256

- *other possible environmental effects of masts including unsightliness;*
- *the dangerous effects of mobile phone use while driving;*
- *nuisance caused by mobile phone ring tones and conversations in public places; and*
- *Congestion — the quality and reliability of service to existing customers would decline if subscribers used the network more intensely than expected and it became congested…*

Positive externalities (other than the network and option externalities) may include:

- *quicker reporting of crime and accidents;*
- *stimulus to economic growth resulting from more efficient use of time;*
- *benefits in terms of personal safety, with resulting benefits to the families of users;*
- *possible increased public participation in elections and debates through the use of mobile phones; and*
- *a scale externality. New subscribers would increase subscriber and call volumes and so lower unit costs, were there to be unexploited economies of scale. These lower unit costs would (in a competitive setting) benefit all mobile subscribers…."*

397. Even if this 'externality list' is incomplete it suggests that there are a number of externalities in addition to those most frequently quoted: namely the network and call externality. While both the former are intrinsic to the current investigation, those in the quote above are of a more general nature and are difficult quantify. In particular, it is difficult to quantify with any precision their net affect in a welfare analysis. We would therefore not recommend that any of these 'additional' externalities be taken account by the Commission.

2.32. External value of new subscribers and penetration

The Commission is interested in receiving views and evidence on the relationship between external value placed on new subscribers and the level of population penetration of mobile telecommunications. Can the Rohlfs-Griffin factor be regarded as a constant?

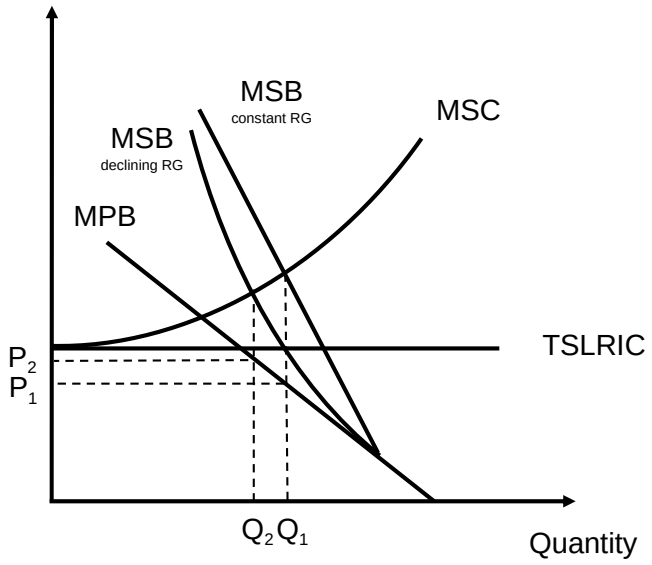
398. As the number of mobile subscribers approaches saturation, we would expect that the benefit obtained by new mobile subscriber (i.e. the marginal private benefit) to be smaller than the benefit obtained by existing

subscribers (i.e. the average benefit). This is because additional subscribers are likely to make and receive fewer calls than existing subscribers.

399. Similarly, as the set of remaining non-users becomes increasingly those who do not value the ability to make and receive calls whilst away from the fixed network, these people may be the potential customers whose joining the network is least likely to confer benefits on others. Hence the absolute size of the external benefit (at the margin) to the existing fixed and mobile subscribers from an additional mobile subscriber would fall.

400. In this respect it is probably not unreasonable to assume the RG factor is declining. This is illustrated below.

FIGURE 8: THE RG FACTOR UNDER DIFFERENT ASSUMPTIONS



401. With a declining RG factor, the optimal number of subscribers would fall from Q_1 to Q_2. Likewise, the subsidy would also fall.

402. In our view, a RG factor that increases with penetration (at least at the levels currently experienced in Australia) is unlikely. We suggest it either be constant or declining. However, provided that no detailed evidence is available of the likely size nor the change in the RG factor over time for Australia, we consider that a constant RG factor of 1.5 based on analysis from the UK is a reasonable estimate at this point in time.

2.33. Trade-off in efficiency

The Commission seeks views on the trade-off between possible efficiency costs from a surcharge on mobile termination and the possible efficiency gains from subsidising mobile subscription.

403. A surcharge on mobile termination can be regarded as a tax on that service. A tax has the effect of distorting relative prices and effecting consumption decisions. For end-users, an increase in price away from costs (for a normal good) will result in consumption of that good that is less than optimal. Similarly, the effect of increasing the cost of mobile termination will raise the cost input of operators buying that service, effecting downstream markets and pricing of services.

404. The extent of distortion or efficiency costs associated with a surcharge on mobile termination will depend on the elasticity of supply and demand of that service. The more inelastic the service, the less the change in the behaviour that will be induced by a given change in price. Since the price elasticity for fixed-to-mobile calls is relatively inelastic, the distortion created by a surcharge will therefore be less compared to the situation where demand was relatively elastic. This argument is equivalent to that underlying Ramsey pricing, i.e. mark-ups should be inversely related to the price elasticity of demand.

405. To the extent that mobile termination is relatively inelastic, the efficiency costs of adding a surcharge on mobile termination are therefore reduced compared to situation where the service as elastic.

406. As discussed in section 2.29 the efficiency costs of applying a surcharge on mobile termination is captured through the marginal deadweight loss. For certain states of the market it may be the case that costs associated with the surcharge will result in net welfare loss for the market. Further, depending on the precise shape and size of the deadweight loss, it may be welfare enhancing to spread the surcharge across a number of services (not only the termination charge) in order to minimise costs.

407. This observation is equivalent to the general principle that taxes should be raised from as broad a base as possible because they are distortionary. The more narrowly based the taxation (and therefore the higher the effective tax rate) the more distortionary it becomes.[123] For this reason it may be argued

[123] An optimal tax policy is one that is designed to minimise the deadweight loss to society. The size of the deadweight loss of a tax depends on a range of factors including the elasticity of demand and supply and

that mobile subscriptions should be funded through general government taxation as this would achieve the broadest tax base possible.

408. The efficiency gains from subsiding mobile subscription relate to the additional uptake of mobile subscribers and hence penetration to the benefit of existing mobile users but also fixed line users. As discussed in section 2.29, where the Marginal External Benefit (MEB) of additional subscribers is low, there may be no efficiency gain from subsidising mobile subscription. This may be the case where mobile penetration reaches saturation.

409. To summarise, there are certain states of the market where the welfare gain from adding a surcharge to mobile termination is likely to be minimal or even negative. This is the case where penetration has reached saturation. Here, there is likely to be little or no efficiency gain of subsiding mobile subscription - this is true of a direct subsidy through a broad tax base or an indirect narrow subsidy from a surcharge on mobile termination. Clearly, in such a situation it would inappropriate to have a subsidy. Further, the distortions or efficiency costs of adding a surcharge on mobile termination are greater than if the burden were spread across a wide range of services. This is implies that greater care must be taken to support any surcharge on mobile termination.

2.34. Welfare flowing to fixed users

The Commission seeks views on ways of analysing the increase in welfare that may flow to fixed-line callers as a result of additional subscription to a mobile network.

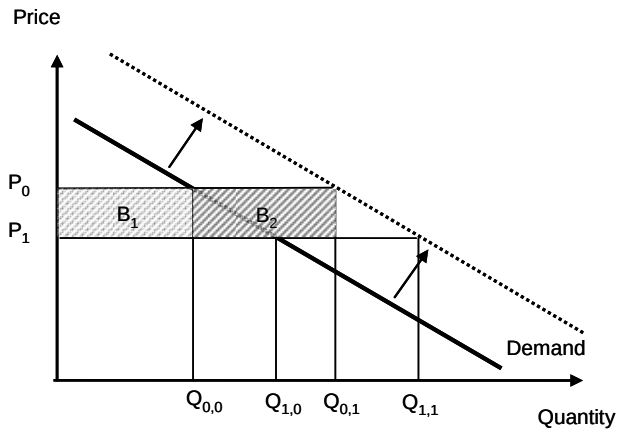
410. Changes in welfare to fixed line users from changes in the MTAS charge can in the simplest set-up be analysed by considering changes to the FTM prices by changing the MTAS charge. This entails making a number of assumptions, including the degree to which changes to the MTAS cost are passed-through to FTM tariffs, the shape of the demand curve and price elasticities of demand for FTM calls.

411. Within such a framework the welfare effect of additional subscribers (or increased penetration) may be analysed through an outward shift in the demand curve. This is illustrated below.

---

also the size of the tax. For a given tax rate, the deadweight loss of a tax is minimised by using Ramsey principles.

FIGURE 9: DEMAND CURVE SHIFT OUTWARDS



412. FTM Prices are decreased from P_0 to P_1 resulting in an increase in demand from $Q_{0,0}$ to $Q_{1,0}$. The increase in consumer surplus is equal to the reduction in price (P_0-P_1), multiplied by existing demand $Q_{0,1}$. With a lower FTM price, additional demand of $Q_{1,0}$ - $Q_{0,0}$ is stimulated. This generates an additional consumer surplus equal to the deadweight triangle. The latter is a 'pure' efficiency gain. With an increase in demand due to an increase in mobile subscribers, the demand curve shifts outwards. This results in an increase in transfers from mobile networks to fixed to mobile consumers, which is illustrated in the figure by an increase in the shaded area from B_1 to B_1+ B_2. When there is no change to the slope of the demand curve the pure efficiency gain (size of triangle) is unchanged.

413. In practice, this shift in the demand curve could be achieved by re-calibrating changes in demand taking into account additional FTM minutes. Alternatively, an economic model of the FTM market could be created, i.e. modelling both the price and quantity of FTM calls simultaneously in a system that takes into account the influence of mobile penetration and changes to the cost the MTAS.

Bibliography

ACCC (2000), *A report on the assessment of Telstra's undertaking for the Domestic PSTN Originating and Terminating Access Services*, July

Available at (viewed 12 May):

http://www.accc.gov.au/content/item.phtml?itemId=356283&nodeId=file3fa1a1d38871a&fn=Final%20Report%20-%20PSTN%20undertaking%20-%20July%202000.zip

ACCC (2004), *Mobile Services Review – Mobile Terminating Access Service: Final Decision on whether or not the Commission should extend, vary or revoke its existing declaration of the mobile terminating access service*, June

Available at (viewed 1 May 2005):

http://www.accc.gov.au/content/item.phtml?itemId=520596&nodeId=file40e2657cac70b&fn=Final%20report%20-%20mobile%20terminating%20access%20service%20(June%202004).pdf

ACCC (2005a), *NSW and ACT Transmission Network Revenue Cap TransGrid 2004/5 to 2008/9: Decision*, 27 April

Available at (viewed 19 May):

http://www.accc.gov.au/content/item.phtml?itemId=605996&nodeId=file4271978d7ddee&fn=Decision%20-%20EnergyAustralia%20(27%20April%202005)%20.pdf

ACCC (2005b), *NSW and ACT transmission network revenue cap EnergyAustralia 2004–05 to 2008–09: Decision*, 27 April

Available at (viewed 19 May):

http://www.accc.gov.au/content/item.phtml?itemId=605996&nodeId=file4271978d7ddee&fn=Decision%20-%20EnergyAustralia%20(27%20April%202005)%20.pdf

Ahn, Hyungtaik and Lee, Myeong-Ho (1999) "An econometric analysis of the demand for access to mobile telephone networks", *Information Economics and Policy*, Vol. 11 No. 3, pp. 297-305

Albon, Robert and York, Richard (2004), Market Power and its Policy Implications for Mobile Termination, ITS conference paper

Available at (viewed 12 May):

http://userpage.fu-berlin.de/~jmueller/its/conf/berlin04/Papers/albon_york_paper.pdf

Aldebert, Marc; Ivaldi, Marc and Chantal Roucolle (1999) *Telecommunications demand and pricing structure: An econometric analysis*, Mimeo

Available at (viewed 20 May):

http://idei.fr/doc/by/ivaldi/telecommunications.pdf

Aldebert, Marc; Ivaldi, Marc and Chantal Roucolle (2004), *Telecommunications demand and pricing structure: An econometric analysis*, Telecommunications Systems, vol 25 No 1-2, January pp. 89-115

Allen Consulting Group (2004), *Review of Studies Comparing International Regulatory Determinations*, Report for the ACCC, March

Available at (viewed 12 May):

http://www.allenconsult.com.au/resources/ACCC_Int_Reg.pdf

Allen Consulting Group (2005) *Electricity Networks Access Code 2004: Advance Determination of a WACC Methodology*, report to the Economic Regulation Authority WA, January

Available at (viewed 12 May):

http://www.era.wa.gov.au/electricity/library/ERA_Electricity_WACC_Consultation_Paper_13Jan05_FINAL.pdf

AMP Henderson (2003), *The equity risk premium – what is it and is it enough*?

Available at (viewed 8 May):

http://www.ampcapital.co.nz/MarketViews/Economic/EquityRisk.pdf

Analysis (2004b), Report for the Israel Ministry of Communications, Response to issues raised concerning the Analysys cost model, 15 December.

Available at (viewed 12 May):

http://www.moc.gov.il/new/documents/about/analisis_m.pdf

Analysys (2004a), Report for the Israel Ministry of Communications and Ministry of Finance, A study of mobile termination charges, 22 July.

Available at (viewed 12 May):

http://www.moc.gov.il/new/documents/about/analisis_10.2.05.pdf

Armstrong, M (2002), *The theory of access pricing and interconnection*, in: M. Cave, S. Majumdarand I. Vogelsang (eds.), Handbook of Telecommunications Economics, Volume 1. Amsterdam, Elsevier Science, 295-384

Armstrong, M and Vickers, J (2001), *Competitive Price Discrimination*, RAND Journal of Economics, Vol 32 No 3 Winter.

Blanchard, O.J., (1993), *Movements in the Equity Risk Premium*, Brookings Papers on economic Activity, Vol. 2.

Brealey and Myers (2000), *Principles of Corporate Finance*, M^{c}Graw Hill

Citigroup (2004), Smith Barney, Equity Research, Telecommunications Services, *Aust/NZ Mobile Study*, 22 November

Available at (viewed 10 May):

http://www.comcom.govt.nz//IndustryRegulation/Telecommunications/Investigations/MobileTerminationRates/ContentFiles/Documents/citigroup.pdf

Commerce Commission (2004), *Letter to TelstraClear on WACC for Telecom mobile and Xtra*, 19 July

Available at (viewed 1 May 2005):

http://www.comcom.govt.nz//IndustryRegulation/Telecommunications/TelecommunicationsServiceObligations/ContentFiles/Documents/Letter%20to%20TelstraClear%20on%20WACC%20for%20Telecom%20%20Mobile%20and%20Xtra.pdf

Commonwealth of Australia (1998), *An International Perspective: Discussion paper Examining How Other Countries Approach Business Taxation,* Review of Business Taxation. An information paper commissioned from Arthur Andersen, AGPS, December

Competition Commission (2003) *Vodafone, O2, Orange and T-Mobile: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Vodafone, O2, Orange and T-Mobile for terminating calls from fixed and mobile networks,* December

Available for download of separate sections at (viewed 6 May 2005):

http://www.competition-commission.org.uk/rep_pub/reports/2003/475mobilephones.htm#full

CRA (2004), *Pricing Mobile Termination in Australia*, Submitted to Singtel Optus Pty Ltd, 20 December

Available at (viewed 10 May):

http://www.accc.gov.au/content/item.phtml?itemId=573237&nodeId=file425216ae7cd1d&fn=Appendix%20II%20to%20Optus%20MTAS%20undertaking%20submission.pdf

Crase, L., Patullock, E., Lamb, P. & Dollery, B. (2000) *Measuring the Demand for Mobile Telephony in Rural Australia: Is Mobile Telephony for Remote Australian Communities a Natural Monopoly?*, Proceedings of the Communications Research Forum 2000, Canberra, October

Available at: (viewed 12 May)

http://www.crf.dcita.gov.au/papers2000/crase.pdf

Dimson, Elroy; Marsch, Paul and Stauton, Mike (2002), *Triumph of the Optimists: 101 Years of Global Investment Returns*, Princeton University Press, Princeton, New Jersey and Oxford

DotEcon (2001), *Estimation of Fixed to Mobile Price Elasticities*, prepared for BT, 8 May

Available at (viewed 12 May):

http://www.dotecon.com/images/reports/elastftm.pdf

DotEcon (2001b), *Optimal Fixed-to-Mobile Interconnection Charges*, paper by Koboldt, Christian and Maldoom, Dan and presented at the 12th European Regional ITS Conference Dublin, 2-3 September

Available at (viewed 12 May):

http://www.dotecon.com/images/reports/rmsyitsp.pdf

DotEcon (2001b), *Ramsey Prices for Mobile Services*, unsighted paper quoted by Oftel and reviewed by Hunter and Ioanaddis, 15 June

Available at (viewed 12 May):

http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/hunt0901.htm
http://www.dotecon.com/images/reports/rmsyits.pd

Francis, Derek (2000), *An Economic Analysis of the Welfare Effects of Price Regulating Mobile Services*, Cable & Wireless Optus, paper to the 2000 Communication Research Forum, 4 October

Available at (viewed 12 May):

http://www.crf.dcita.gov.au/papers2000/francis.pdf

Frontier Economics (2004a), *The importance of price elasticities in the regulation of mobile call termination*, paper by Dan Elliott, September

Available at (viewed 12 May):

http://www.frontier-economics.com/publication.php?id=84&PHPSESSID=67982a261e87b15e46e1b1c27356f2a4

Frontier Economics (2004b), *Modelling welfare maximising mobile termination rates*, A report prepared for Vodafone, November.

Available at (viewed 10 May):

http://www.accc.gov.au/content/item.phtml?itemId=551928&nodeId=file42521824e99d8&fn=Appendix%203%20to%20Vodafone%20MTAS%20undertaking%20submission%20(amended%20version).pdf

Gans and King (2003), *Price Regulation of Mobile Termination: Promoting Competition and Investment in Telecommunications*, A Report on Behalf of Hutchison Telecommunications, CoRE Research, Melbourne, 26 June

Available at (viewed 6 May):

http://www.core-research.com.au/Papers/Mobile%20Termination2003.pdf

Gough, N and C Grezo (2005), *Africa: The Impact of Mobile Phones*, Moving the Debate Forward: The Vodafone Policy Paper Series, Number 2, March.

Available at (viewed 6 May):

http://www.vodafone.com/assets/files/en/AIMP_17032005.pdf

Grajek, M (2003), *Estimating Network Effects and Compatibility in Mobile Telecommunications*, Wissenschaftszentrum Berlin für Sozialforschung, SP II 2003 – 26, December

Available at (viewed 10 May):

http://skylla.wz-berlin.de/pdf/2003/ii03-26.pdf&e=10313

Griffin, J M (1982), *The Welfare Implications of Externalities and Price Elasticities for Telecommunications Pricing*, Review of Economics and Statistics, 64: 59-66

Hotelling, H. (1925), A general mathematical theory of depreciation, Journal of the American Statistical Association, 20, pp. 340-53.

Hunter, Dr John and Ioannadis, Professor Christos (2001) *Calls to mobiles: Assessment of Demand Elasticity Estimates of .econ*, report to Oftel

IT- og Telestyrelsen (2002), *Rapport om hybridmodellen*, December, p. 29.

Available at (viewed 10 May):

http://www.itst.dk/wimpdoc.asp?page=tema&objno=112315125.

Click on: 'Se rapporten om modellen her' to download the report (in Danish)

Jenkinson, T. (1993), *The Cost of Equity Finance: Conventional Wisdom Reconsidered*, Stock Exchange Quarterly, Autumn.

Jorion, P. and E. Schwartz, (1986) *Integration vs. Segmentation in the Canadian Stock Market*, Journal of Finance, 41, pp. 603-616.

Kahn, A. E. and Shew, W. B. (1987), *Current Issues in Telecommunications Regulation: Pricing*, Yale Journal on Regulation, 4(2):191-256

Lally, Martin (2004), *The Cost of Capital for Regulated Entities*, Report prepared for the Queensland Competition Authority, October 14

Available at (viewed 12 May):

http://www.qca.org.au/www/getfile.cfm?fid=777&lib=0&catlist=&pageID=6&searchtype=1&wordsearch=martin&sortBy=0

Macquarie Risk Advisory Services (1998) *Weighted Average Cost of Capital – Further Issues*, paper prepared for Office of Regulator General (Vic)

Available at (viewed 16 May)

http://archive.esc.vic.gov.au/1998/gas_public_register_mriskadv.pdf

Malaysian Communications and Multimedia Commission (2003), *Commission Determination on the mandatory standard on access pricing*, 28 June.

Available at (viewed 10 May):

http://www.cmc.gov.my/mcmc/registers/cma/comdeter/pdf/Register%20-%20AcessPricing.pdf

NERA (1999), Estimating the Long Run Incremental Cost of PSTN Access: Final Report for ACCC, January

Available at (viewed 10 May):

http://www.accc.gov.au/content/item.phtml?itemId=520531&nodeId=file40e4f42a5bdfa&fn=NERA%20report%20-%20long%20run%20incremental%20cost.pdf

Ofcom (2004a) *Wholesale Mobile Voice Call Termination*, Statement, 1 June

Available at (viewed 2 May):

http://www.ofcom.org.uk/consult/condocs/mobile_call_termination/wmvct/wmvct.pdf

Ofcom (2004b), *Partial Private Circuits Charge Control – Final Statement*, 30 September

Available at (viewed 12 May):

http://www.ofcom.org.uk/consult/condocs/ppc_charge_control/statement/?a=87101

Oftel (2001), Proposals for network charge and retail price controls, February

Available at (viewed 2 May):

http://www.ofcom.org.uk/static/archive/oftel/publications/pricing/pcr0101.htm

Oftel (2002), Common Network Costs

Available at (viewed 2 May):

http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/ctm_2002/network_costs.pdf

Oftel (2003), *Wholesale Mobile Voice Call Termination, Proposals for the identification and analysis of markets, determination of market power and setting of SMP conditions*, Explanatory Statement and Notification, December.

Available at (viewed 12 May):

http://www.ofcom.org.uk/consult/condocs/mobile_call_termination/mct_consultation/

O'Neill, Wilson and Masih (2002), *The equity risk premium from an economics perspective*, Goldman Sachs, Global Economics Paper No. 84, 25 October

PTS (2003), *Konsultationssvar på Model Specification för kalkylarbete i mobilnät*, 11 June.

Available at (viewed 6 May):

http://www.pts.se/Archive/Documents/SE/PTS%20konsultationssvar%20pa%20Model%20Specification.pdf

PTS (2004a), *LRIC prismetod för terminering av röstsamtal i mobilnät*, 5 July

Available at [in Swedish] (viewed 6 May):

http://www.pts.se/Archive/Documents/SE/Prismetod_MLRIC.pdf

PTS (2004a), *LRIC prismetod för terminering av röstsamtal i mobilnät PTS – UTKAST*, 10 Maj.

Available at (in Swedish) (viewed 6 May):

http://www.pts.se/Archive/Documents/SE/Prismetod_mobil_%20LRIC_EXTERN_4maj2004.pdf

PTS (2004c), *Hybrid Model Documentation*, (PTS Hybrid model v 2.1), December, p.16.

Available at (viewed 6 May)::

http://www.pts.se/Archive/Documents/SE/Hybrid_model_documentation_v2_1_10dec04.pdf

Ragunathan, V. (1999), *The effect of financial deregulation on Integration: An Australian Perspective*, Journal of Economics and Business, 51, pp. 505-674

Ragunathan, V., Faff, R. W., and Brooks, R.D., (2000), *Australian industry beta risk, the choice of market index and business cycles*, Applied Financial Economics, 10

Rodini, M Ward, M and G Woroch (2002) *Going Mobile: Substitutability between Fixed and Mobile Access*, Conference on "Competition in Wireless: Spectrum, Service and Technology Wars", PURC February

Rohlfs, J (1979), *Economically efficient Bell-system pricing*, Bell Laboratory Discussion Paper No 138, January

Securities and Exchange Commission (2004), Form 6-K, *Report of Foreign Private Usuer Pursuant to Rule 13a-16 or 15d-16 of the Securities Exchange Act of 1934*, July

Available at (viewed 10 May):

http://www.sec.gov/Archives/edgar/data/1015650/000114554904000922/u99147e6vk.txt

Siegel, J.J., (1992), *The Equity Premium: Stock and Bond returns since 1802*, Financial Analysts Journal, Jan/Feb.

SK Telecom (2004), *Investor Relations News Letter Interconnection rate for 2004-2005*, 9 July

Available at (viewed 10 May):

http://www.sktelecom.com/english/ir/ir_activities/ir_news/1194588_3092.html

Telang R (2004) *An Empirical Analysis of Cellular Voice and Data Services*, NET Institute Working Paper #4-10, October

Available at (viewed 10 May):

http://www.netinst.org/Telang.pdf

Valletti, T. (2003), *Obligations that can be imposed on operators with significant market power under the new regulatory framework for electronic communications: Access services to public mobile networks*, Imperial College London.

Available at (viewed 10 May):

http://europa.eu.int/information_society/topics/ecomm/doc/useful_information/library/studies_ext_consult/economic_expert_group/mobile%20_valletti_final.pdf

Vodafone (2003), *Review of price elasticities of demand of fixed line and mobile telecommunications services*, submitted to New Zealand Commerce Commission, August

Available at (viewed 10 May):

http://www.comcom.govt.nz/IndustryRegulation/Telecommunications/TelecommunicationsServiceObligations/ContentFiles/Documents/Voadafone%20paper%20on%20price%20elasticities%20for%20weighted%20revenues%20approach1.PDF

Ward, M and G Woroch (2004) *Usage Substitution between Fixed and Mobile Telephony in the US*, May

WorldCom (2002), *Comments on Report Prepared for PTS by Andersen Management International A/S. Cost Oriented Access and Interconnection in Sweden*, 14 January

Available at (viewed 4 May):

http://www.pts.se/Archive/Documents/SE/Worldcom.pdf

Wright, J. (2002), *Access pricing under competition: An application to cellular networks*, Journal of Industrial Economics