Report

Benchmarking Mobile Termination Rates

Prepared for

Vodafone New Zealand

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Executive Summary

1. In conjunction with its comments on undertakings supplied by mobile operators as part of the mobile termination access services (MTAS) investigation, the Commerce Commission has provided its latest international benchmarking of mobile termination rates (MTRs). The Commission arrived at a benchmark of NZ 7 cents per minute based on benchmarking against mobile cost modelling in nine other countries. It also benchmarked SMS termination at NZ 1 cent per message.

2. Vodafone has asked us to consider issues relating to international benchmarking of MTRs, and the particular benchmarking that the Commission has undertaken. This report presents our findings, as well as the results of an independent econometric benchmarking exercise that we have carried out. In this report we concentrate on benchmarking call termination prices, however many of the same issues apply to SMS termination.

3. In general, mobile costs are affected by a large number of factors, many of which depend on local conditions. Relevant factors include population density, network scale and usage, land and labour costs, and spectrum allocations, among other things. That local factors are important can be seen in two ways in the Commission's reports. First, the benchmarks that the Commission have used span a wide range, despite the fact that all are based on similar underlying principles of cost modelling. Second, the analysis conducted by WIK-Consult for the Commission shows that countries with different characteristics such as size and population density have different mobile costs.

4. These facts have several important implications for benchmarking MTRs. First, comparability is an important issue. In contrast to other benchmarking exercises that the Commission has conducted, it has not considered the comparability with New Zealand of the countries that it has used to benchmark MTRs. As we show, most of the countries that the Commission has benchmarked against are not comparable to New Zealand in important ways such as size, population density and GDP per capita. The closest is Norway (which the Commission has benchmarked at NZ 9.54 cpm) although it likely has higher traffic levels than New Zealand given its higher GDP per capita. At New Zealand traffic levels we would expect costs higher than Norway. Similarly, the country types used by WIK in its analysis are not similar to New Zealand in terms of the same characteristics.

5. Second, the median of the Commission's benchmarking set is subject to significant uncertainty, due to the variation in MTRs across countries and the small size of the dataset. We calculate a confidence interval and show that the median MTR in the Commission's data could lie between 5.26 cpm and 11.74 cpm. Therefore, it is appropriate for the Commission to choose an estimate towards the upper end of its range, to recognise the uncertainty and corresponding asymmetric risks of setting the wrong rate. A similar approach was applied by the ACCC when it set MTRs based on benchmarking, prior to building a mobile cost model. The 75th percentile of the Commission's dataset is 10.40 cpm, with a confidence interval of 6.66 cpm to 12.90 cpm.

6. Another important feature of mobile networks is that they are subject to economies of scale. As traffic grows, the cost of coverage can be spread over more volume, reducing average costs. This is clearly shown by WIK's results, where per-minute costs reduce significantly as volumes increase. The existence of economies of scale lead the Australian Competition Tribunal to conclude that in effectively competitive mobile markets, prices will not be driven down to the costs of the most efficient operator. Similarly, benchmarking should not be conducted on that basis.

7. Finally, TSLRIC cost models impose a high standard of efficiency – one that is unlikely to be met in competitive mobile markets in the real world. In Australia for example, the ACCC recognised this fact, and treated cost model results as a lower bound estimate of the actual costs of efficient mobile operators. The ACCC and many other regulators have chosen to set regulated MTRs above the levels estimated by cost models.

8. This, plus the fact that it is likely that the initial pricing principle for mobile termination would specify benchmarking against prices, rather than costs, means that it is appropriate to benchmark against regulated MTRs in other jurisdictions instead of cost model results.

9. This type of benchmarking requires some judgement, as regulated rates in a given country may change over time or differ across operators. Nevertheless, by applying a consistent set of principles, we believe we have generated a good estimate of the MTRs that are likely to apply in other countries in May 2009 (i.e. currently) and July 2010 (i.e. the date at which regulation, if recommended, is likely to commence).

10. Table 1 shows the results of benchmarking against regulated MTRs. We have included Austria and Spain which the Commission excluded, because regulated rates are available for these countries. Section 2.3.2 gives a detailed description of how we arrived at the regulated rate for each country.

Table 1 Benchmarking against regulated MTRs.

Country	May 2009 Regulated MTR (forex)	July 2010 Regulated MTR (forex)	Currency	FX Rate (ComCom Method)	May 2009 Regulated MTR (NZD cpm)	July 2010 Regulated MTR (NZD cpm)	ComCom MTR (NZD cpm)
Australia	0.0900	0.0900	AUD	0.8883	10.13	10.13	6.53
Austria	0.0572	0.0572	EUR	0.5317	10.76	10.76	n.a.
Denmark	0.5900	0.5900	DKK	4.5984	12.83	12.83	11.74
France	0.0717	0.0333	EUR	0.5516	12.99	6.04	5.26
Israel	0.2200	0.2200	NIS	2.4190	9.09	9.09	6.66
Malaysia	0.0873	0.0873	MYR	1.6695	5.23	5.23	5.23
Netherlands	0.0970	0.0755	EUR	0.5387	18.01	14.02	10.40
Norway	0.6000	0.4500	NOK	5.0299	11.93	8.95	9.54
Spain	0.0700	0.0700	EUR	0.5059	13.84	13.84	n.a.
Sweden	0.4300	0.4300	SEK	5.2937	8.12	8.12	6.94
UK	0.0509	0.0459	GBP	0.3811	13.36	12.05	12.90
				Median	**11.93**	**10.13**	**6.94**
				75th pctile	**13.18**	**12.44**	**10.40**

11. Table 2 shows a comparison of alternative benchmarks. We argue that Israel should be excluded, on the basis that its cost modelling is out of date (the Commission excluded South Korea for the same reason). We also argue that the Commission should benchmark against the high cost estimate for Sweden. Making these two changes increases the median by approximately 2 cpm. Using regulated rates increases the median by approximately a further 1 – 3 cpm. Given the uncertainty associated with the benchmarks, in all cases we argue that the 75th percentile is a more appropriate benchmark than the median, in this case.

Table 2 Comparison of MTR benchmarks.

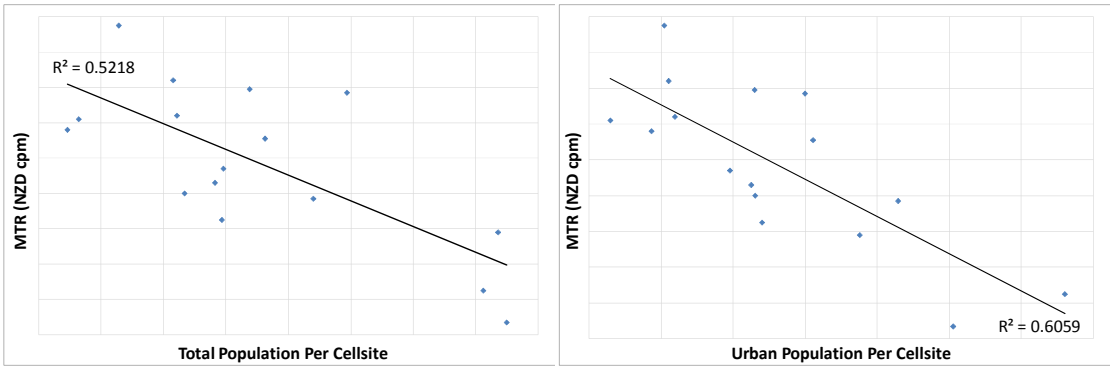
Benchmarking Set	Median	75th Percentile
Commission	6.94	10.40
Commission excl. Israel; high rate for Sweden	8.83	10.74
May 2009 Regulated rates: All countries in Table 7	11.93	13.18
May 2009 Regulated rates: Table 7 excl. Austria, Israel, Spain	12.38	13.08
July 2010 Regulated rates: All countries in Table 7	10.13	12.44
July 2010 Regulated rates: Table 7 excl. Austria, Israel, Spain	9.54	12.24

12. The final section of this report gives the results of an exercise we have undertaken in econometric benchmarking of MTRs. We obtained data on MTRs and other explanatory variables from 16 countries in which Vodafone operates worldwide. The variables

include country characteristics such as population and density, as well as the number of cellsites operated by Vodafone. This information allowed us to construct variables such as population per cellsite, which turns out to be very good at explaining the observed differences in MTRs across countries in our sample.

13. We show that variables that are independent of the MTR can explain more than 60% of the cross-country variation in MTRs. Population per cellsite or urban population per cellsite is the main explanatory factor, and is statistically significant at the 1% level. Figure 1 illustrates this by showing the simple relationship between the MTR and different measures of population per cellsite (the axis labels have been removed to protect confidential data).

Figure 1 MTR versus total population per cellsite (left) and urban population per cellsite (right) for 16 Vodafone operating countries.



14. As would be expected, there is a strong negative relationship between the MTR and population per cellsite. Higher population will generate more traffic at any given prices, and this will lead to lower average costs.

15. New Zealand has a relatively low population per cellsite compared to other countries. Our best econometric models predict an MTR for New Zealand around 18 cpm, which is greater than the current MTR of 15 cpm. In our sample, six countries have set MTRs using a forward-looking cost model, while ten have not. We show that there is no statistically significant effect of the use of a forward-looking cost model on the MTR for each country. Therefore, taking account of New Zealand's natural characteristics, there is no evidence that New Zealand's current MTR is higher than what is justified on a cost basis.

1. Introduction

16. The New Zealand Commerce Commission (the Commission) has recently commenced an investigation into mobile termination access services (MTAS) and the merits of regulating the termination rates on mobile networks (MTRs). This investigation is complicated by the existence of deeds of undertaking made by Telecom and Vodafone to the Crown, which (among other things) specify a set of declining termination rates over the next three years. These deeds, as well as the undertakings provided by mobile operators to the Commission and existing commercial offers between operators are relevant counterfactuals for the Commission's analysis.

17. The rate that would be set by regulation is a critical factor in the investigation. If the regulated rates are very different to the contracted rates, regulation will have a relatively large impact, and conversely. Large impacts alone are not sufficient to justify regulation however; the effect must also be beneficial in net terms, taking into account any flow-on impacts such as the so-called waterbed effects in the retail market similar to those that were analysed during the Commission's previous investigation of mobile termination.

18. In the Commission's comments on the draft MTAS undertakings provided by mobile operators, the Commission presented its latest attempt at benchmarking MTRs, and arrived at a rate of 7 cpm for mobile voice termination and 1 cpt for mobile sms termination.[1] In this context, Vodafone has asked us to examine issues relating to international benchmarking of mobile termination rates, and the particular benchmarking that the Commission has undertaken. We concentrate on benchmarking call termination prices, however many of the same issues apply to SMS termination.

19. The Commission's methodology consists of obtaining a sample of MTRs from countries that have regulated the MTR on the basis of a forward-looking bottom-up cost model and calculating the median MTR estimated by the various cost models for either 2008 or 2009. The criteria for inclusion in the benchmarking set appear to be:

    - Use of a forward-looking bottom-up cost model; and
    - Public information about the regulated rate available is directly from the relevant regulator.

20. The Commission's latest benchmarking excludes three countries that were included in its previous benchmarking of MTRs (in the MTAS Issues Paper): South Korea, Austria and Spain. Three new countries are included: Denmark, Netherlands and Norway. Table 3 compares the Commission's MTR benchmarking in the two cases.

[1] *Comments on undertakings received in relation to the MTAS Investigation*, Commerce Commission, 25 March 2009.

Table 3 Comparison of the Commission's MTR benchmarking in the comments on the MTAS undertakings (25 March 2009) and the MTAS Issues Paper (8 August 2008).

Country	MTAS Undertakings Comments (NZD cpm)	MTAS Issues Paper (NZD cpm)
Australia	6.53	10.47
Austria	n.a.	11.56
Denmark	11.74	n.a.
France	5.26	12.72
Israel	6.66	6.34
Malaysia	5.23	5.52
Netherlands	10.40	n.a.
Norway	9.54	n.a.
South Korea	n.a.	5.23
Spain	n.a.	11.74
Sweden	6.94	10.76
UK	12.90	11.38
Median	6.94	10.76
75th Percentile	10.40	11.56

21. Accordingly, the main objective of this report is to discuss issues relevant to international benchmarking of MTRs. We discuss the drivers of mobile costs, the importance of country-specific factors, and the implications of these facts for benchmarking. We also examine the implications of economies of scale in mobile networks, and the efficiency assumptions underlying mobile cost models. The last section of the report contains the results of an econometric benchmarking exercise, where we attempt to explain cross-country variation in MTRs as a function of country-specific variables.

2. International MTR Benchmarking

22. If termination rates were to be regulated in New Zealand, the initial pricing principle is likely to be benchmarking and the final pricing principle is likely to involve some more accurate modelling of forward looking cost. The objective of benchmarking should therefore be to predict the outcome of applying the final pricing principle (which implies that one knows what that principle is). In what follows, we consider some implications of this context.

2.1. TSLRIC Mobile Cost Modelling

23. The TSLRIC concept is reasonably well understood in telecommunications regulation. This does not mean that it is particularly objective or well-defined however. On the contrary, TSLRIC modellers have to make many judgements, including the extent to which allowances will be made for contributions to common costs.[2] Through its work on estimating the net cost of the local service telecommunications service obligation (TSO), the Commission will be familiar with fixed-line variants of these issues, particularly matters such as the extent of optimisation and the selection of discount rates.

24. Mobile cost modelling raises many new issues that are not relevant in the fixed-line context. In this section we discuss the important features of mobile cost modelling and the implications for benchmarking MTRs.

2.1.1. Drivers of Mobile Costs

25. In Australia, the ACCC has recognised nine factors that cause mobile network costs to vary:[3]

- Geographic terrain
- Population density
- Network scale and usage
- Land and labour costs in different jurisdictions
- Spectrum allocations
- The extent to which mobile operators are integrated fixed and mobile network operators
- Network purchasing power
- Cost of capital in different jurisdictions
- The mobile network technology employed in different countries (e.g. GSM versus CDMA)

26. Of these factors, coverage and usage are particularly important. Since there is no unique customer location, the geographic reach of an "efficient" network is not well-defined. Coverage can be thought of as a quality of service issue: broader coverage gives customers an option to use the service in more locations. But whereas service quality is

[2] We note that the definition of TSLRIC in Schedule 1 of the Telecommunications Act "includes a reasonable allocation of forward-looking common costs".

[3] *Mobile Services Review: Mobile Terminating Access Service*, Final Determination, ACCC June 2004, p. 214.

normally assessed using data on contention ratios and blocking probabilities (i.e. by trying to assess the probability of an attempted call succeeding), those measures presuppose a service location.

27. In reality there are many parts of New Zealand that are not served by mobile networks, and many locations where actual usage is so light that individual sites, if assessed on a stand-alone basis, are unprofitable. Just as an airline may maintain an unprofitable route for the purpose of enhancing the overall value of its network to its customers, a mobile operator may choose to cover an area that does not generate a lot of traffic, because of the option value to its subscribers of being able to make and receive calls in that area. In contrast with fixed-line networks, a large part of the consumer and economic value of mobile networks comes from mobility – the option value of being able to make and receive calls anywhere within the coverage area at any time. When dimensioning their networks, mobile operators will therefore take account of a number of factors including the expected distribution of traffic across space and time, the propensity of their subscribers to move around geographically, and the option value that subscribers place on coverage of any given area. None of these factors are relevant for fixed-line networks.

28. Most cost models that we are aware of avoid the problem of defining an efficient level of coverage by specifying the modelled coverage area equal to a representative coverage of existing operators. However this means that the estimated cost depends crucially on the coverage assumption, as well as the total volume of traffic generated by network users and the geographic and temporal distribution of this traffic within the coverage area.

29. Technology choice raises a second set of issues. Given a physical layout, what is the least cost technology? The difficulties here arise from two facts. One is the emergence of Chinese technology that appears materially cheaper than technologies that have recently been installed in existing networks, raising an asset stranding risk. The second is a degree of obscurity over the real capital price, induced by supply contracts that frequently spread cash outlays over many years and bundle maintenance services with capital outlays. It is a challenging exercise to obtain genuine "apples with apples" comparisons in this environment.

30. Usage, and its impact on unit costs, is also more problematic in mobile than fixed-line cost modelling. In a fixed-line access network, each end-user requires a single line to connect them to the network, and this line can serve the customer's needs at any point in time from a fixed location. In contrast, the users of a mobile network move around at random, and the mobile access network must be dimensioned with this in mind. Market share is also an important factor given coverage patterns and technology, since market share affects not only the total volume of traffic on the network, but the fraction that remains 'on-net', which utilises the network twice as intensively as traffic that terminates on another network.

31. All of these factors tend to point regulators towards having greater regard to embedded rather than efficient costs when modelling mobile networks.[4] This tendency has been apparent in modelling by Ofcom, for example.

2.1.2. Implications for MTR Benchmarking

32. The main implication of these facts is that when one looks around the world at regulated MTRs, those that have been assessed with reference to a forward-looking cost model will represent a combination of judgement and local facts. The same is true of jurisdictions that have not built their own cost model but instead been guided by forms of benchmarking.

33. Together with its comments on the draft MTAS undertakings, the Commission provided a report prepared for it by WIK-Consult that uses bottom-up cost models to perform various types of sensitivity analysis on the model results, to determine how the modelled cost of mobile termination varies with different drivers.[5] WIK's results are useful because they illustrate clearly how mobile costs vary with local conditions.

34. To perform the sensitivity analysis, WIK estimated costs for three different country types, described as:

> SD: A small densely populated country (not unlike Austria, Switzerland, Slovakia, etc)
>
> MD: A medium sized densely populated country (not unlike Germany, France, UK, etc)
>
> LS: A large sparsely populated country (not unlike Canada, Australia, Brazil, etc)

35. None of these types are very similar to New Zealand. Table 4 shows the population, land area, population density and real GDP per capita of the New Zealand and the above example countries. These factors will affect mobile network costs in different ways. A larger population will generate more traffic for a given coverage area, reducing per-minute costs through economies of scale. A larger land area and/or less dense population is likely to mean that a greater coverage area is required, increasing average per-minute costs. And countries in which real GDP per capita is higher are likely to have greater demand for telecommunications services at any given prices, reducing average per-minute costs.

36. New Zealand's land area is similar to the UK, but significantly smaller than the other MD countries referred to by WIK. It also has much smaller population and much lower population density than all the MD countries, and lower real GDP per capita. New Zealand's population density is closest to that of Brazil in this table, but again the land

[4] Some trade-offs of this type are inherent in TSLRIC decisions over the degree of optimisation, but the technology choice and usage issues go beyond traditional optimisation decisions.

[5] *Cost Driver Sensitivity Analyses with Mobile Cost Models*, WIK-Consult, 22 December 2008.

area, population and GDP per capita are very different. We do not think that any of the three country types that WIK have modelled are representative of New Zealand when these basic characteristics are taken into account. Indeed, WIK do not claim any of them to be similar to New Zealand. Nevertheless, WIK's results do illustrate that mobile cost estimates depend crucially on local conditions, as we discuss below.

Table 4 Statistics of the example countries in the WIK report.

Country	Population (2008, million)	Land Area (km^2)	Population Density (people/km^2)	Real GDP per Capita (2007, US$ PPP)
New Zealand	4.2	268,021	15.6	26,611
SD: Small densely populated				
Austria	8.2	82,444	99.5	38,181
Switzerland	7.6	39,769	190.6	41,265
Slovakia	5.5	48,800	111.8	20,268
MD: Medium densely populated				
Germany	82.4	349,223	235.9	34,212
France	64.1	640,053	100.1	33,509
UK	60.9	241,590	252.3	35,634
LS: Large sparsely populated				
Canada	33.2	9,093,507	3.7	38,614
Australia	21.0	7,617,931	2.8	36,226
Brazil	196.3	8,456,511	23.2	9,703

Sources: US Census Bureau International Database (http://www.census.gov/ipc/www/idb/tables.html), IMF World Economic Outlook October 2008 (http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/index.aspx)

37. WIK present base case cost model results for each of the three country types, corresponding to an operator with 35% market share and total network minutes of 4.2 billion for the SD country, 53 billion for MD and 11.5 billion for LS.[6] These correspond to costs of 3.51, 3.69 and 4.18 Euro cents per minute respectively.

38. The Commission has used an average of the 10-year average spot rate and the 2007 PPP rate to convert foreign currency MTRs to New Zealand dollars. However, the WIK results are presented in Euros for an unspecified country, thus we cannot know what the appropriate PPP rate is. Applying the Commission's exchange rate methodology to all Euro countries and averaging across them, we obtained an exchange rate of 0.5108 to the New Zealand dollar, and have used this to convert WIK's cost estimates to New Zealand dollars for comparison purposes. In their base case, this gives estimated mobile termination costs of 6.87 cpm, 7.22 cpm and 8.18 cpm for the SD, MD and LS examples

[6] 'Network minutes' count on-net minutes twice, since these calls use two base-stations. WIK also converted SMS and 2G data traffic to equivalent voice minutes.

respectively. Note that the Commission's benchmark of 7 cpm lies between the WIK results for the SD and MD cases.

39. Notwithstanding the effects of different traffic volumes, WIK's results tend to show that countries that are larger and/or less densely populated will have higher per-minute mobile costs. This has a number of consequences for benchmarking. First, selection of the jurisdictions to benchmark against in terms of comparability to New Zealand conditions is important. As mentioned in our introduction, it appears that the Commission has used very weak selection criteria that ignore comparability.

40. Mobile termination is not a designated service under the Telecommunications Act, and therefore an initial pricing principle has not been established. However, all services that have been designated and which specify benchmarking as the initial pricing principle have comparability as a criterion for benchmarking. This includes fixed-line interconnection, resale of Telecom's fixed-line services, unbundled bitstream access and backhaul, and UCLL access, co-location and backhaul. While some of these are regulated on a retail-minus basis, in all cases comparability is included in the specification of the initial pricing principle.

41. In the Commission's determination processes for UCLL and sub-loop services as well as its 2002 decision on TelstraClear's interconnection application, the Commission has been very careful to take account of comparability criteria when conducting its benchmarking. In the UCLL Standard Terms Determination, the Commission used several criteria to establish comparability – urbanisation, teledensity and population density.[7] Similar criteria were used in the 2002 TelstraClear interconnection decision.[8]

42. These criteria were developed in the context of fixed-line benchmarking, and different factors may need to be considered in the case of mobile benchmarking. Nevertheless, factors such as population size and the geographic dispersion of population are likely to affect mobile costs. In addition, demand for telecommunications services, reflected in part by real GDP, is likely to affect traffic volumes and hence average costs.

43. In contrast, the Commission has ignored comparability in its benchmarking of mobile termination, both in the current investigation and the 2005 investigation. We see no particular reason why comparability should be important for fixed-line networks but unimportant for mobile networks. Country-specific factors are likely to play an equally or more important role in determining mobile network costs as they do in determining fixed network costs.

44. Table 5 shows various characteristics of the countries that the Commission has used in its MTR benchmarking, including the three countries that were included in the MTAS

[7] *Standard Terms Determination for the designated service Telecom's unbundled copper local loop network*, Commerce Commission, 7 November 2007, paragraph 165.

[8] *Determination on the TelstraClear Application for Determination for Designated Services*, Commerce Commission, 5 November 2002.

Issues Paper benchmarking but excluded from the MTAS Undertakings Comments benchmarking.

45. In terms of population, land area and population density, Norway is most comparable to New Zealand, however its per-capita GDP is approximately twice that of New Zealand. We would therefore expect that, everything else equal, traffic volumes in Norway would be higher than those in New Zealand, and per-minute costs would be correspondingly lower in Norway. The Commission has benchmarked Norway's MTR at NZ 9.54 cpm, and given the effect of traffic volumes on economies of scale, we would expect this to be an under-estimate of the average per-minute cost for New Zealand.

Table 5 Statistics of countries used in the Commission's MTR benchmarking (MTAS Issues Paper and MTAS Undertakings Comments).

Country	Population (2008, million)	Land Area (km^2)	Population Density (people/km^2)	Real GDP per Capita (2007, US$ PPP)
New Zealand	4.2	268,021	15.6	26,611
Australia	21.0	7,617,931	2.8	36,226
Austria	8.2	82,444	99.5	38,181
Denmark	5.5	42,394	129.4	37,265
France	64.1	640,053	100.1	33,509
Israel	7.1	20,329	349.9	27,147
Malaysia	25.3	328,549	76.9	13,385
Netherlands	16.6	33,883	491.3	38,995
Norway	4.6	307,860	15.1	53,152
South Korea	48.4	98,189	492.7	24,803
Spain	40.5	499,542	81.1	30,118
Sweden	9.0	410,934	22.0	36,578
UK	60.9	241,590	252.3	35,634

Sources: US Census Bureau International Database (http://www.census.gov/ipc/www/idb/tables.html), IMF World Economic Outlook October 2008 (http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/index.aspx)

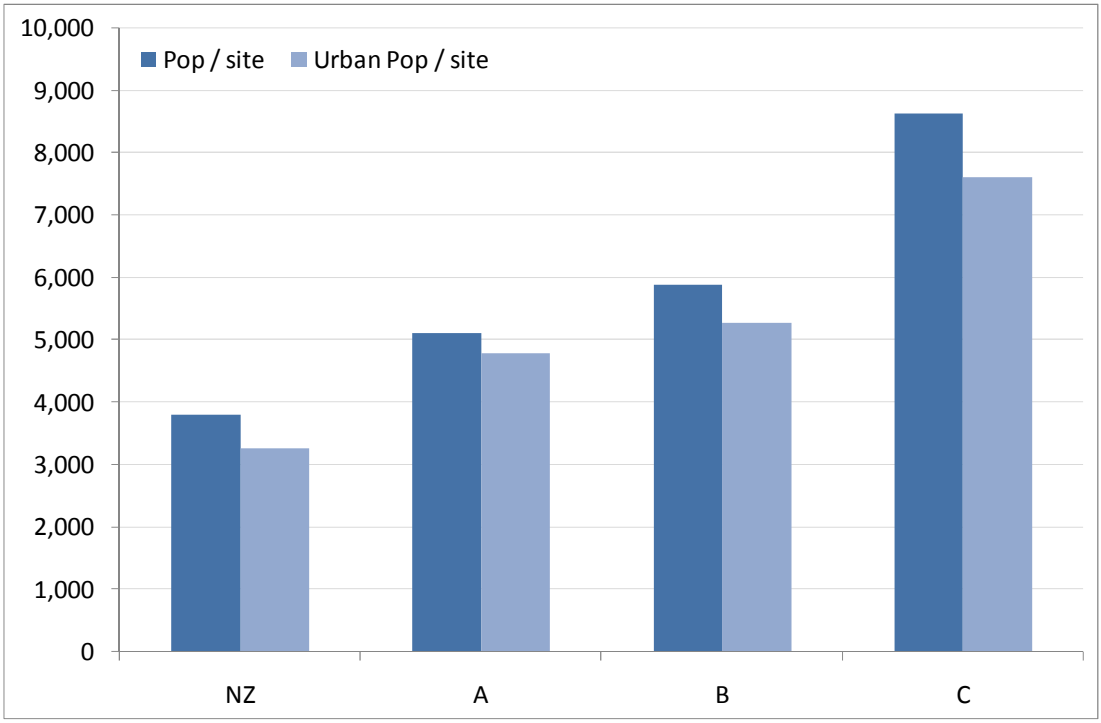
46. To further illustrate potential sources of differences in mobile network costs, we have gathered information on the number of 2G cellsites operated by Vodafone in New Zealand, Australia, the UK and the Netherlands. The latter three countries are included in the Commission's mobile termination benchmarking.

47. Figure 2 shows total population and urban population per cellsite for these four countries.[9] The average across the other three countries is approximately 6,500 people per cellsite, or 5,900 if urban population is used. By contrast, New Zealand has more than 40% fewer residents per cellsite. This means that the potential traffic that can be

[9] The numbers of cellsites in other countries are confidential, therefore the chart has been anonymised.

generated per cellsite in New Zealand is significantly less than in the other three countries. Per-minute costs in New Zealand are therefore likely to be higher.

Figure 2 Population per 2G cellsite in New Zealand, Australia, the Netherlands and the UK.

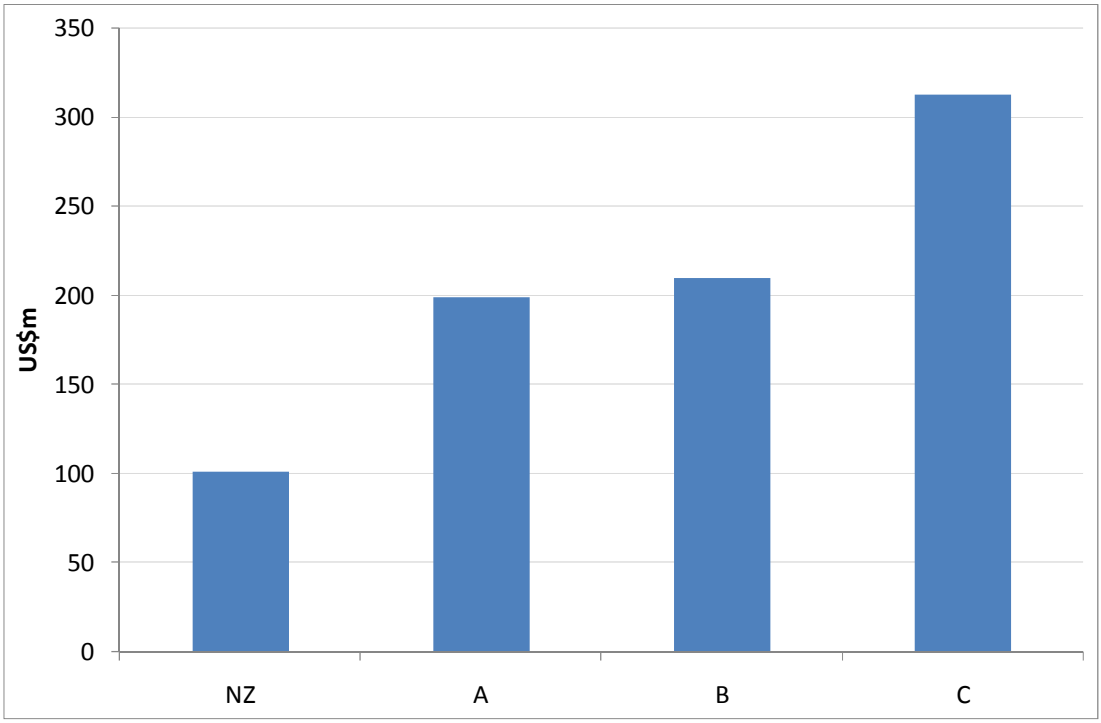


Sources: Vodafone, US Census Bureau International Database, IMF World Economic Outlook October 2008, World Bank World Development Indicators 2005.

48. Population is only one factor that determines traffic volumes. Another is people's ability to pay for mobile services. Figure 3 shows total real GDP per cellsite for the same four countries. New Zealand's at approximately US$100m per cellsite is around 50% of the next nearest country, and is approximately 60% lower than the average of the other three countries.

49. Both of these figures suggest that conditions faced by mobile operators in New Zealand are significantly different from those in other countries, including countries that the Commission has benchmarked against. Given the economies of scale that exist in mobile networks, average costs in New Zealand are very likely to be higher than those in Australia, the UK or the Netherlands. We discuss the implications of economies of scale further in section 2.2 below, and in section 3, we show how similar factors can be used to explain variation in mobile costs across countries for an expanded set of countries.

Figure 3 Total real GDP per 2G cellsite in New Zealand, Australia, the Netherlands and the UK.



Sources: Vodafone, US Census Bureau International Database, IMF World Economic Outlook October 2008.

50. We also observe that the nine MTRs included in the Commission's benchmarking set cover a wide range, from NZ 5.23 cpm for Malaysia to NZ 12.90 cpm for the UK. While all of these rates have been derived from forward-looking cost modelling following the same basic principles, the simple observation that there is a wide range of MTRs tells us that country-specific factors are important in determining the cost of mobile termination.

51. The Commission's approach is to take the median of this wide range, corresponding to the termination rate for Sweden, and assume that this is a good estimate of the cost of mobile termination in New Zealand. In reality the factors that determine mobile network costs are likely to be quite different for Sweden compared to New Zealand, which means that the median termination rate is a poor estimate of the cost of mobile termination in New Zealand.

52. As with all statistical estimates based on a sample, there is some uncertainty associated with the median value that the Commission has selected. It is possible to quantify this uncertainty by calculating a confidence interval for the median. Since the Commission's sample is small, the most appropriate way to do this is to calculate bootstrap percentile confidence intervals. This involves repeatedly resampling from the observed sample, calculating the median of each draw, and then calculating the 2.5th and 97.5th percentiles of all the medians.[10] This gives a 95% confidence interval for the median.

[10] See, for example, http://www.stat.wmich.edu/s160/book/node48.html.

53. We performed this procedure using 10,000 random draws from the Commission's benchmarking sample. The estimated 95% confidence interval is from 5.26 cpm to 11.74 cpm. If the 75th percentile (10.40 cpm) rather than the median is used as the benchmark then the confidence interval covers from 6.66 cpm to 12.90 cpm. These results show that the Commission's MTR benchmarking is subject to a significant amount of uncertainty. In statistical terms, this uncertainty is caused by the wide dispersion of MTRs in the sample, and the small sample size.

54. As the ACCC recognised in its 2004 Mobile Services Review, there are two possible responses to this problem. One is to adjust the benchmark data to incorporate information about local conditions. Done in a systematic way, such as through the use of econometric benchmarking, this will lead to a more accurate benchmark than taking a simple unadjusted average or median.

55. The alternative approach is to recognise the variation inherent in the benchmarking data, as well as that the welfare costs of setting a termination rate below cost are likely to be worse in terms of their impact on allocative and dynamic efficiency than the welfare costs of setting a termination rate above cost. The combination of wide variation in the benchmarking data and the asymmetry of risks means that it is prudent to use a benchmark towards the upper end of the benchmarking set, rather than the middle, when uncertainty associated with benchmarking is an important factor.

56. Of these two approaches, the ACCC considered both and chose the latter. When it set a price for termination based on benchmarking in 2004, it chose a termination rate that was at the upper end of its benchmarked range (emphasis added):[11]

> The Commission has not, however, modelled the TSLRIC+ of providing the MTAS in Australia. It believes such a modelling process would be time consuming and costly to implement. Rather, it has sought to estimate TSLRIC+ using reasonable cost estimates available to it. … Based on its consideration of all these sources of information, *the Commission believes the TSLRIC+ of providing the MTAS lies in the range of 5 to 12 cents per minute*.
>
> Given the Commission has not formally modelled TSLRIC+ for the MTAS, however, the Commission believes that, for the purposes of its current pricing principles, *the price of the MTAS should only trend towards the top of the range of reasonable estimates of TSLRIC+ available to it.* Hence, the Commission believes the LTIE would be promoted by the price of the MTAS trending towards 12 cents per minute.

57. In previous investigations and determinations, the Commission has not followed a consistent approach regarding the metric used for benchmarking. In the 2002

[11] *Mobile Services Review: Mobile Terminating Access Service*, Final Determination, ACCC June 2004, p. xviii.

TelstraClear interconnection decision, the Commission used the 75th percentile.[12] It also used the 75th percentile in the 2005 mobile termination investigation,[13] and in the subsequent reconsideration of its final determination used a benchmark of 15 cpm, which was in excess of the Commission's estimate of the 75th percentile at the time.[14] In the 2007 UCLL Standard Terms Determination the median was used for the local-loop price,[15] while a regression-based approach was used for backhaul.[16] In the recent sub-loop Standard Terms Determination process the Commission used the median in its draft determination,[17] but has subsequently switched to the 75th percentile for sub-loop backhaul,[18] although it has not yet issued a final determination.

58. In general we have argued that while benchmarking should be based on principles, it allows some degree of flexibility to suit the particular circumstances in which it is being applied. An important consideration is the uncertainty inherent in a particular benchmarking exercise, and as we have demonstrated the uncertainty associated with the Commission's benchmark is significant in the case of mobile termination. As the ACCC has done in Australia, an appropriate response for benchmarking mobile termination in the presence of significant identified uncertainty is to select a benchmark that is at the upper end of the benchmarking set. As shown in Table 3, the 75th percentile of the Commission's benchmarks is 10.40 cpm.

2.2. Economies of Scale in Mobile Networks

59. Economies of scale are important in mobile networks, given the fixed costs of coverage. Again this is illustrated by the results in WIK's report. Traffic volumes for New Zealand mobile networks are similar to WIK's assumptions for the SD country. However, as shown above, New Zealand has much greater land area and much lower population density than these countries. Thus the modelled average cost for New Zealand is likely to be higher than the SD country, because a similar amount of traffic will be carried by a larger coverage area, entailing greater total network costs.

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[12] *Determination on the TelstraClear Application for Determination for Designated Access Services*, Commerce Commission, 5 November 2002, paragraph 169.

[13] *Schedule 3 Investigation into Regulation of Mobile Termination, Final Report*, Commerce Commission, 9 June 2005, paragraph 510.

[14] *Schedule 3 Investigation into Regulation of Mobile Termination, Reconsideration Final Report*, Commerce Commission, 21 April 2006, paragraph 95.

[15] *Standard Terms Determination for the designated service Telecom's unbundled copper local loop network*, Commerce Commission, 7 November 2007, paragraph 66.

[16] *Standard Terms Determination for the designated service Telecom's unbundled copper local loop network backhaul (telephone exchange to interconnect point)*, Commerce Commission, 27 June 2008, paragraph 223.

[17] *Draft Standard Terms Determination for the designated services of Telecom's unbundled copper local loop network service (Sub-loop UCLL), Telecom's unbundled copper local loop network co-location service (Sub-loop co-location) and Telecom's unbundled copper local loop network backhaul service (Sub-loop backhaul)*, Commerce Commission, 5 September 2008, paragraph 127.

[18] *Sub-loop Backhaul pricing and related service description issues*, Commerce Commission, 30 January 2009, paragraph 43.

60. New Zealand's characteristics (land area and population density) lie somewhere between WIK's assumptions for the MD and LS countries, although New Zealand's real GDP per capita is significantly lower than most of the MD and LS countries shown in Table 4. As WIK point out in their report lower traffic volumes correspond to higher average costs:[19]

> Lower volumes, both when due to a lower market share or to generally lower levels of demand, have the effect of decreasing the economies of scale that may be realised. The most important example for which this is true are base stations that need to be set up in areas to be covered independently of whether the market share is high or low, and in particular even if traffic is not enough to fully utilise them. This shows in the higher cost per minute across the three country types and for each of the two scenarios.

61. We have attempted to adjust WIK's results to estimate costs under their MD and LS scenarios for traffic volumes that are more appropriate to New Zealand. In their Table 1, WIK report the results of decreasing demand by 28.5% relative to the base case, for the SD and LS scenarios. Per-minute costs increase in both cases, and WIK report an elasticity of cost with respect to volume. The elasticities are -0.37 for the SD case and -0.71 for the LS case. WIK's volume assumption in the LS case is 11.5 billion network minutes.

62. We have used the elasticity of -0.71 to estimate a cost in the LS case corresponding to a traffic volume of 4.2 billion minutes. Although a constant-elasticity assumption is a crude approximation to the sophistication of a cost model, it does embody similar characteristics to a declining average cost function due to economies of scale.

63. A volume of 4.2 billion minutes represents a reduction of 63% compared to WIK's assumption for the LS case. Using the above elasticity, this corresponds to an increase in the per-minute cost of 45%, to 11.87 cpm.

64. WIK do not perform the same sensitivity analysis for the MD case. However, in their Table 2 they compare results from the MD model for 2005 and 2007, with the main difference appearing to be an increase in volume (from 33 billion to 53 billion network minutes). Using these results, we have calculated the volume elasticity for the MD model to be -0.44, at 35% market share. With this elasticity, the effect of reducing traffic volumes to 4.2 billion network minutes in the MD case is an increase in cost to 10.15 cpm.

65. WIK also perform a similar analysis using the Analysys LRIC model for the UK (their Table 5). WIK report the elasticity of per-minute cost with respect to volume is -0.68. They report the base case cost from the UK model as 11.41 cpm (5.83 €cpm), corresponding to a volume of 33.1 billion network minutes. Adjusting to 4.2 billion network minutes using their elasticity gives a cost of 18.19 cpm.

[19] *Cost Driver Sensitivity Analyses with Mobile Cost Models*, WIK-Consult, 22 December 2008, p. 6.

66. Table 6 summarises the results of making these volume adjustments using the elasticities reported by WIK. In all cases, a reduction in traffic volumes to a level more representative of that experienced in New Zealand results in a significant increase in per-minute costs. We also note that all of these adjusted cost estimates significantly exceed the Commission's benchmark of 7 cpm.

Table 6 Estimated effects of volume adjustments to WIK's results.

Model	Base Case (NZD cpm)	At 4.2 billion network minutes (NZD cpm)	Change in per-minute cost	Cost-Volume elasticity
MD	7.22	10.15	41%	-0.44
LS	8.18	11.87	45%	-0.71
UK	11.41	18.19	59%	-0.68

67. The results presented in Table 6 show that larger and/or more sparsely populated countries tend to have higher costs of mobile termination, for a given volume of traffic. Thus the results produced by mobile cost models reflect the hypothesis that average mobile costs are affected to a large extent by the size of the coverage area and the volume of traffic generated within this area.

68. The Commission's benchmarking sets the MTR for New Zealand at between the WIK results for the SD and MD cases. Given that New Zealand is significantly less densely populated than any of the MD countries shown above, New Zealand costs are more likely to be between those estimated for the MD and LS countries. Taking into account the volume adjustment, these costs could be between 10 and 12 cpm, or up to 18 cpm if the UK cost model is used.

69. The Australian Competition Tribunal (ACT) considered the implications of these types of issues in detail in 2007.[20] Among other things, it considered what the standard of an efficient mobile operator should be in the presence of economies of scale and scope. One of the issues in that context was the assumption about the scale of the network modelled in the cost model. In its analysis of this issue, the ACT took into account the features of competition that would exist in real-world markets:

> … an efficient new entrant – even, if realistic markets are envisaged, a hypothetical one – would not itself have immediate access to the economies of scale and scope that might be achievable over time. (paragraph 72)
>
> … in seeking to emulate the outcomes realisable in a competitive market, some regard must be had to the actual process (the dynamics) by which operators compete and establish themselves in markets. It is not obvious that objectives of

[20] *Re Vodafone Network Pty Ltd & Vodafone Australia Limited [2007] ACompT 1*, Australian Competition Tribunal, 11 January 2007.

> economic efficiency lead to basing prices on the costs that an efficient new entrant could achieve after some indefinite period. (paragraph 73)
>
> As might be expected, this means that the task of deciding how to assess the efficient forward looking costs of a new entrant must involve some balancing of opposing considerations and must take account of the actual markets in which the relevant services are provided. (paragraph 74)

70. The ACT considered the implications of these observations for costing mobile termination:

> … there is sense in benchmarking against the most efficient operator on the grounds that in a competitive market no operator would be able to charge more than the most efficient operator. *However, whether this would occur in real life markets, even those considered effectively competitive but subject to normal features such as product differentiation, is another matter. The most efficient operator may well be able to price somewhat above its costs.* In the sort of highly competitive market often hypothesised it is difficult to see how any less efficient operators could survive. (paragraph 76, emphasis added)
>
> But even if the most efficient operator were chosen as the benchmark, the other difficulty remains that that operator would not be forced to base its prices on the costs of a hypothetical network optimised for all-new design and technology. *For that to happen the threat of new entry would have to be based on an ability, unrealisable in actuality under even the best of circumstances, to bring the new design and technology to bear immediately in a legacy-sized network*. (paragraph 77, emphasis added)

71. The above passages show that through careful analysis of the real-world conditions under which mobile networks compete, including the presences of economies of scale, the cost estimate produced by a hypothetical cost model is likely to be lower than the price of mobile termination achieved through workable and effective competition between mobile networks. The main implication of the ACT's conclusions for the Commission's benchmarking is that use of cost model predictions (rather than regulated MTRs) goes beyond the standard that would be achieved in competitive markets. We discuss this further below.

2.3. The Choice of Benchmarks

72. In many countries, rates that are set by regulators do not correspond to rates that were derived from cost modelling in the same country. The Commission therefore must choose whether to benchmark against modelled costs or regulated rates. In this section we discuss these two alternatives, as well as the Commission's treatment of the specific countries used in its benchmarking.

2.3.1. Benchmarking Against Cost Models

73. Cost models as they are typically implemented impose a relatively high standard of optimisation that mobile operators are unlikely to be able or forced to meet in real-

world conditions. Forward-looking bottom-up cost models estimate the cost of a hypothetically efficient operator, using lowest cost technology and a highly optimised network design. In reality, careful consideration of the competitive forces acting on actual mobile networks reveals that workable and effective competition is not likely to force prices down to the level estimated by a hypothetical cost model.

74. As discussed above, the ACT concluded that in effectively competitive mobile markets, prices would not be forced down to the cost of the most efficient operator. The results produced by cost models are therefore likely to underestimate the prices that will result from effective competition.

75. Related issues are also revealed in WIK's report. WIK models the costs of a 2G mobile network:[21]

> Being truly bottom-up, the WIK model takes a scorched-earth perspective with respect to the locations of base stations. Further, it is based on 2G technology. In many jurisdictions there is currently a transition from 2G to 3G technology. Successful 3G deployment should lead to costs per unit of service that are lower than those due to a 2G network. The WIK model is constructed on the assumption that initial higher costs of 3G technology, which would be of a transitory nature, are not to be blended into the cost of services that are modelled to be provided by an efficient 2G operator.

76. By taking this approach, the WIK model ignores the reality faced by existing mobile operators, which is that they previously invested in a 2G network and are now transitioning to a 3G network. It is unrealistic to assume that an operator only operates a 2G network, or that transition to 3G could be done instantly or without cost. This is another example of the unrealistically high standard of efficiency imposed by hypothetical cost models referred to above. The WIK model will therefore generate lower cost estimates than the actual efficient costs achievable by a real-world 2G network operator at the present point in time when transition to 3G is occurring.

77. After subsequently developing a bottom-up mobile cost model for Australia, the ACCC used the model twice to set termination rates, in 2007 and 2009. In its 2007 determination, the modelled rate was AUD 6.1 – 6.6 cpm (depending on market share), while the regulated rate set by the ACCC was AUD 9 cpm.[22] In its 2009 determination the modelled rate reduced slightly, however the ACCC maintained the regulated rate at 9 cpm.[23]

78. As with other regulators, the ACCC has thus consistently chosen to set the regulated rate higher than the termination cost estimate produced by their cost model. In its 2009 determination, the ACCC explicitly stated that it views the estimate produced by a cost

[21] Ibid, p. 3.

[22] *MTAS Pricing Principles Determination 1 July 2007 to 31 December 2008*, ACCC, November 2007.

[23] *Domestic Mobile Terminating Access Service Pricing Principles Determination and indicative prices for the period 1 January 2009 – 31 December 2011*, ACCC, March 2009.

model as a lower bound estimate of the actual cost faced by mobile operators.[24] As discussed above, this is reflected in similar views expressed by the ACT.

79. Given that such factors are taken into account by other regulators in setting MTRs, it is also appropriate for the Commission to take these factors into account in its benchmarking. By basing its benchmark on modelled cost (rather than regulated rates), the Commission is applying a standard of efficiency to New Zealand mobile operators that cannot be met in the real world, and that is not imposed by regulators in other jurisdictions.

2.3.2. Benchmarking Against Regulated Rates

80. In many countries that the Commission has benchmarked against, the MTR that is regulated does not correspond to the average termination cost estimated by the cost model for that country. However, the Commission has chosen to use the cost model rate where this differs from the regulated rate.

81. In addition to imposing an unrealistic standard of efficiency, it is not clear that such benchmarking would be appropriate if mobile termination were to become a designated service under the Telecommunications Act. We note that services already designated typically specify the initial pricing principle as benchmarking against cost-based *prices* from comparable countries.

82. The distinction between prices and costs is important when we take into account the reasons why the regulated price of mobile termination and the estimate cost of termination may differ. The initial pricing principle that has been set for other designated services appears to allow for this distinction, and we see no particular reason why mobile termination should be any different.

83. Accordingly, benchmarking against regulated MTRs is appropriate. In many countries, regulated MTRs are changing over time and may differ across operators. Such a benchmarking exercise therefore requires a set of principles to guide treatment of these cases. We attempt to benchmark both current (May 2009) and future regulated MTRs. Given that MTR regulation, if imposed in New Zealand, would probably take effect from mid-2010, we have attempted to establish, for each of the countries in the Commission's benchmarking set, the regulated MTR that will apply in July 2010. If an MTR for July 2010 has not yet been set, we use the latest published regulated rate. If different rates are set for different operators, we use an unweighted average of the rates for all operators.

84. Below we discuss our treatment of each country in comparison with the Commission's treatment.

[24] Ibid, p. 28.

Australia

85. As discussed above, the ACCC's latest cost modelling produces an estimate around AUD 0.06 per minute (depending on market share), and the ACCC regards this as a lower bound on the efficient costs of a mobile network. The Commission has benchmarked against the cost model rate, however the regulated MTR in Australia is currently AUD 0.09 per minute. The regulated MTR has been at this level since 2008 and will remain at this level until June 2011.

Austria

86. The Commission has previously included Austria in its benchmarking but has now excluded it on the basis that regulatory decisions regarding MTRs in Austria are not legally binding due to various legal issues. We do not believe the fact that determinations are not currently legally binding means that the work done in Austria to set MTRs will be any less accurate than otherwise. According to the information provided by the Commission (Table 2 of the MTAS Undertakings Comments), the current regulated MTR in Austria is €0.057 per minute; in the absence of other information we assume this will apply in July 2010.

Denmark

87. The Commission has used the Analysys LRAIC cost estimate of DKK 0.54 per minute. A rate for July 2010 has not been set, but the most recent published regulated rates are DKK 0.54 per minute for Telia Sonera, Tele2 and Telenor, and DKK 0.74 per minute for Hi3G. This gives an average of DKK 0.59 per minute.

France

88. The Commission has used the Analysys cost estimate of €0.029 per minute. Current regulated rates are €0.065 for Orange and SFR and €0.085 for Bouyges Telecom, giving an average of €0.0717 per minute. Regulated rates that apply in July 2010 are €0.03 per minute for Orange and SFR, and €0.04 for Bouyges Telecom. This gives an average of €0.033 per minute.

Israel

89. The Commission has started with the cost model rate produced by Analysys, NIS 0.159 per minute (in real 2003 NIS) and removed an externality component of NIS 0.011 per minute. There is no basis to suggest that an externality adjustment for New Zealand is not appropriate, and the Commission has not considered the reasons why this adjustment was included in Israel.

90. We note that the Israeli cost modelling was conducted in 2003 and earlier, so it is now more than five years out of date. It is likely that the estimated costs are no longer accurate, and should not be used. The Commission has excluded South Korea from the benchmarking on the basis that the information there is out of date, and we believe that Israel should be treated consistently.

91. The Israeli Ministry of Communications website also indicates that after further consultation the cost of termination was determined to be NIS 0.19 per minute (in real

2003 NIS), and the regulated rate from 2008 was set at NIS 0.22 per minute (in real 2003 NIS).[25]

92. Finally, the Commission has inflated the 2003 figures to current prices using an inflation rate of 8.2%. The average Israeli CPI for 2003 was 92.32, and at the end of February 2009 was 100.60, an increase of 8.97%.[26] Thus the cost of termination is NIS 0.207 per minute in current dollars, and the regulated rate is NIS 0.240 per minute.

Malaysia

93. The Commission has benchmarked against the cost modelled rates of MYR 0.0832 per minute for local mobile termination and MYR 0.0913 per minute for national mobile termination in 2008. In Malaysia the current regulated rates equal the cost modelled rates. We note that the modelled rates have increased approximately 3% between 2006 and 2008. However, a rate for July 2010 is not published, so in accordance with our principles above we have benchmarked against the average of the 2008 rates for local and national termination (MYR 0.0873 per minute), as the Commission has done.

The Netherlands

94. The Commission has benchmarked against the cost modelled rate of €0.056 per minute. Current regulated rates are €0.09 per minute for KPN and Vodafone, and €0.104 per minute for Orange and T-Mobile, giving an average of €0.097 per minute. The last published regulated MTRs apply from July 2009 onwards, and set rates of €0.070 per minute for KPN and Vodafone, and €0.081 per minute for Orange and T-Mobile, giving an average of €0.0755 per minute.

Norway

95. The Commission has benchmarked against the cost model rate of NOK 0.48 per minute. Current regulated rates are NOK 0.60 for NetCom and Telenor. From 1 July 2010 the regulated rate for NetCom and Telenor will be NOK 0.45 per minute.[27]

Spain

96. The Commission has excluded Spain because the cost modelled rate is confidential. However, the regulated rate is known and the most recent published rate which applies from 1 April 2009 is €0.07 per minute, as given in in Table 2 of the MTAS Undertakings Comments.

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[25] www.moc.gov.il/155-1813-en/MOC.aspx

[26] Israeli CPI data is available from www.bankisrael.gov.il/series/en/catalog/prices%20and%20inflation%20expectations/consumer%20prices/

[27] The document the Commission references in the MTAS Undertakings Comments is a supplementary decision for six smaller operators and MVNOs. The final decision for NetCom and Telenor (the main network operators) is available at www.npt.no/iKnowBase/Content/102923/Final_decision_Market_16_public.pdf.

Sweden

97. The current regulated rate is SEK 0.43 per minute, corresponding to the estimated cost of the highest cost operator. The Commission has taken the average of the cost estimates of the highest cost and lowest cost operators as the benchmark. This contrasts with the Commission's treatment of Australia and France, where it has used the highest cost estimate when there is a range. A regulated rate for July 2010 has not been set, therefore we use the current rate of SEK 0.43 per minute.

UK

98. Regulated rates for 2009/2010 are £0.044 - £0.055 per minute in 2006/07 prices. The Commission has ignored the upper end of this range because the high rate is for the 3G network H3G. It is likely that the high rate for H3G reflects a lack of realisation of economies of scale, rather than higher costs associated with 3G, since 3G networks are designed to be more efficient than 2G at high traffic volumes. It is therefore not clear that H3G's cost should be excluded from the benchmarking, especially considering that New Zealand operators do operate 3G networks currently. In addition, using the low end of the range is inconsistent with the Commission's treatment of other countries where it has used the middle or upper end of the range.

99. Current regulated rates (for 2009/10) are £0.044 for Vodafone and O2, £0.045 for T-Mobile and Orange, and £0.055 for H3G. The average, inflated at 3% per annum for three years is £0.0555 per minute.

100. Regulated rates in 2010/11 are £0.04 per minute for all operators except H3G, which has £0.044 per minute. The average, inflated at 3% per annum for four years is £0.0459.

101. Table 7 shows the results of benchmarking against regulated MTRs, as opposed to cost-modelled rates.

Table 7 Benchmarking against regulated MTRs.

Country	May 2009 Regulated MTR (forex)	July 2010 Regulated MTR (forex)	Currency	FX Rate (ComCom Method)	May 2009 Regulated MTR (NZD cpm)	July 2010 Regulated MTR (NZD cpm)	ComCom MTR (NZD cpm)
Australia	0.0900	0.0900	AUD	0.8883	10.13	10.13	6.53
Austria	0.0572	0.0572	EUR	0.5317	10.76	10.76	n.a.
Denmark	0.5900	0.5900	DKK	4.5984	12.83	12.83	11.74
France	0.0717	0.0333	EUR	0.5516	12.99	6.04	5.26
Israel	0.2200	0.2200	NIS	2.4190	9.09	9.09	6.66
Malaysia	0.0873	0.0873	MYR	1.6695	5.23	5.23	5.23
Netherlands	0.0970	0.0755	EUR	0.5387	18.01	14.02	10.40
Norway	0.6000	0.4500	NOK	5.0299	11.93	8.95	9.54
Spain	0.0700	0.0700	EUR	0.5059	13.84	13.84	n.a.
Sweden	0.4300	0.4300	SEK	5.2937	8.12	8.12	6.94
UK	0.0509	0.0459	GBP	0.3811	13.36	12.05	12.90
				Median	**11.93**	**10.13**	**6.94**
				75th pctile	**13.18**	**12.44**	**10.40**

102. Table 8 shows a comparison of different MTR benchmarks derived from this data. The Commission's decision to include Israel based on old information, and to choose an average cost estimate for Sweden results in a median benchmark approximately NZ 2 cpm lower than it otherwise would be. Using regulated rates further increases the median benchmark by about 1 – 3 cpm depending on which countries are included.

Table 8 Comparison of MTR benchmarks.

Benchmarking Set	Median	75th Percentile
Commission	6.94	10.40
Commission excl. Israel; high rate for Sweden	8.83	10.74
May 2009 Regulated rates: All countries in Table 7	11.93	13.18
May 2009 Regulated rates: Table 7 excl. Austria, Israel, Spain	12.38	13.08
July 2010 Regulated rates: All countries in Table 7	10.13	12.44
July 2010 Regulated rates: Table 7 excl. Austria, Israel, Spain	9.54	12.24

2.4. Exchange Rates

103. The Commission has used several different practices in selecting exchange rates for benchmarking analyses, particularly regarding the use of PPP rates. In the Issues Paper, PPP rates were used to convert Vodafone Group ARPUs. In earlier work it has used a

blend of 60% PPP and 40% spot exchange rates.[28] Spot rates have been averaged over periods from three years (in August 2002) to ten years (Issues Paper). In the comments on the draft MTAS undertakings, the Commission uses an unweighted average of PPP rates and ten year average spot rates.

104. Generally speaking, we support a rules-based approach to exchange rate selection. We are also comfortable with some averaging, since rates vary from day-to-day and predictability is enhanced if averaging rules smooth out some of this variation. Moreover, if the period over which any averaging is specified in a rule, it can help to deter rent-seeking through arguments in favour of particular periods being used for the average.

105. An inevitable consequence of always using any historic average is that the rate is "backward-looking", and may be quite different from either current rates, or expected future rates. In quantitative terms, such a disparity will be most serious following step changes in the value of New Zealand's currency, in response to local and/or international economic conditions.

106. There is some evidence that such a step change has recently occurred. Figure 4 shows the exchange rates used in the Commission's benchmarking over the 10-year period from January 1999, and including the latest data up to March 2009. Among the exchange rates that the Commission has used, the New Zealand dollar has depreciated significantly in recent months against the Euro, Danish kroner, Israeli shekel, Malaysian ringgit and Norwegian krone. In the context of current worldwide economic events, it appears that these exchange rate changes are likely to persist for quite some time, or represent a shift to a new equilibrium where the New Zealand dollar has a lower value than it has for the recent past. This evidence is mirrored in media comment from informed economists[29] [30], and the Prime Minister[31], suggesting that the New Zealand dollar is likely to remain weak for some time.

107. In our view, given these observations about exchange rates, there is a case for making any exchange rate "rule" flexible enough to reflect such events. That could be done by shortening the period over which rates are averaged at times when there is clear statistical evidence of a change in market valuations. We believe that the Commission has not given adequate consideration to exchange rate issues in its mobile termination benchmarking.

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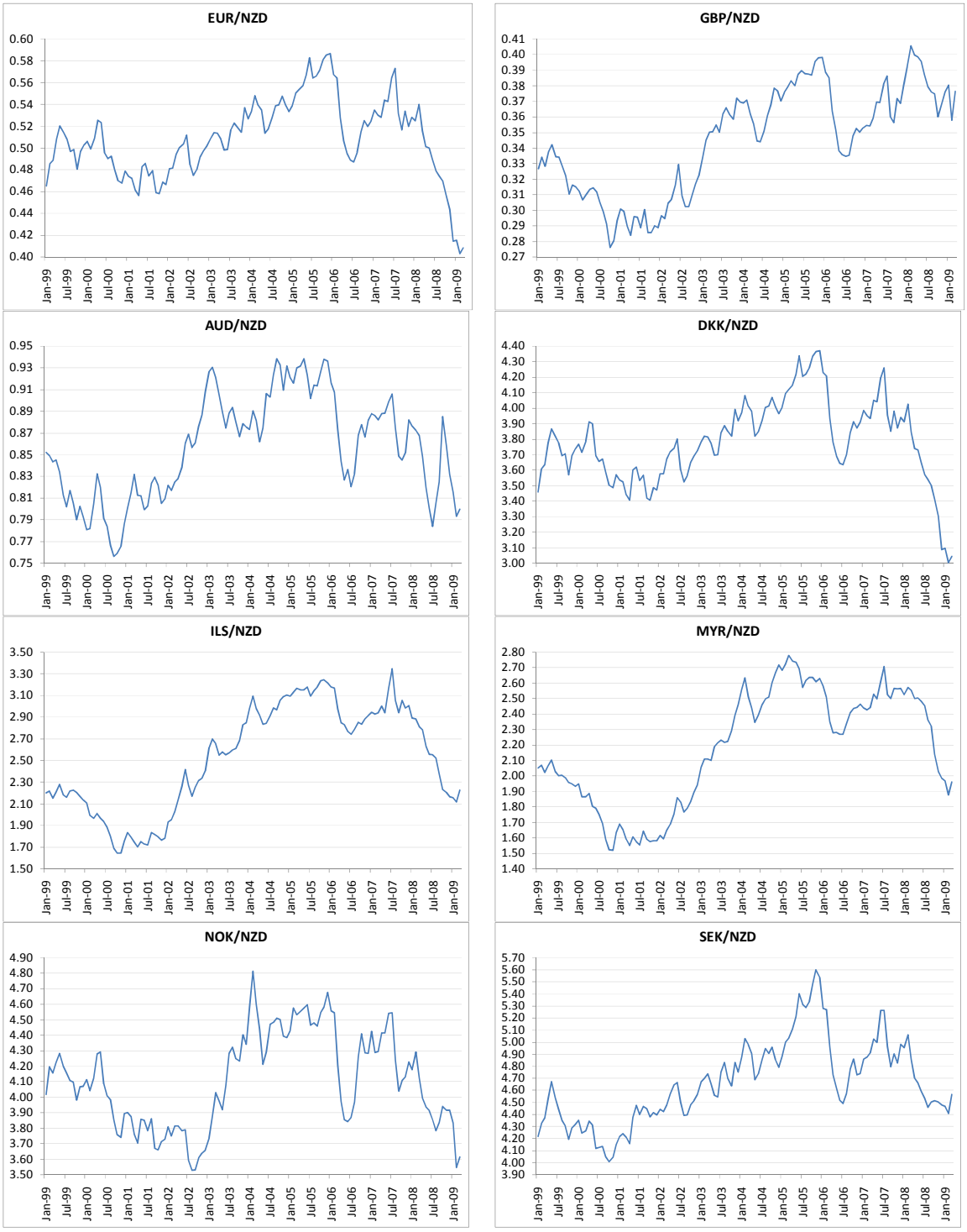
[28] *Annex to the Commerce Commission's Draft Determination on the TelstraClear Application for Determination for Designated Access Services dated 29 August 2002*.

[29] http://www.dailyfx.com/story/currency/nzd_fundamentals/New_Zealand_Dollar_Fundamentals_Foreshadow_1233978660252.html

[30] http://www.sharechat.co.nz/news/scnews/article.php/799209c1

[31] http://www.nzherald.co.nz/unemployment/news/article.cfm?c_id=353&objectid=10547004

Figure 4 Monthly average exchange rates used in the Commission's benchmarking (January 1999 - March 2009).



Source: PACIFIC Exchange Rate Service.

3. Econometric Benchmarking

108. As discussed above, the Commission's approach does not in any way take account of differences across countries that may drive differences in mobile costs. We have attempted to do this by implementing econometric benchmarking. We have gathered data on MTRs and potential drivers of mobile costs from a number of countries. Two potential drivers that we consider to be important are population per cellsite and real GDP per cellsite, as illustrated in Section 2.1.2. Accordingly, we have obtained data on the number of cellsites operated by Vodafone in 17 different countries: Albania, Australia, Czech Republic, Germany, Greece, Hungary, Ireland, Italy, Malta, The Netherlands, New Zealand, Poland, Portugal, Romania, Spain, Turkey and the UK. The data on the number of cellsites in different countries are confidential, therefore some of our results below have been anonymised.

109. This approach is consistent with the use of "comparable countries" for benchmarking. Indeed, provided care is taken with the modelling, it will generally be superior to the alternative strategy of using ad-hoc judgements when deciding whether to include or eliminate a country from the benchmarking sample. In our regression framework, the data are used to guide selection of the model, so the factors that are relevant to observed termination rates are revealed automatically as a by-product of the modelling. Moreover, analysts are able to formally test whether their own views and hypotheses about relevant factors are indeed consistent with the data.

3.1. Data

110. For consistency, we obtained termination rates as at 1 July 2008 from the European Regulators Group (ERG) for all countries covered by that group. To this we added the non-European rates for Vodafone operating companies (Australia and New Zealand).

111. Taking account of the issues with exchange rates discussed in section 2.4 above, we have used the exchange rate two standard deviations below the mean of the 10-year average of the NZD-Euro exchange rate (0.4414). To recognise that some inputs are non-traded, we averaged each of these with the most recent PPP rate from the OECD (0.5414); this is equivalent to assuming that half of the costs of a mobile network are in non-tradeables. The resulting exchange rate (0.4915) was applied to all European sourced prices. We were unable to find an MTR for Albania, reducing our sample to 16 countries.

112. Table 9 shows our sample of countries and the corresponding MTR in New Zealand dollars at the given exchange rate.

Table 9 Sample countries and MTRs at 1 July 2008 (NZD).

Country	MTR
Czech Republic	0.255
Germany	0.166
Greece	0.204
Hungary	0.174
Ireland	0.202
Italy	0.219
Malta	0.196
Netherlands	0.191
Poland	0.217
Portugal	0.224
Romania	0.138
Spain	0.145
Turkey	0.087
United Kingdom	0.157
Australia	0.105
New Zealand	0.160

113. Excluding New Zealand, the average across this sample is NZ$0.179 and the median is NZ$0.191.

114. We also gathered information on a range of other factors to use as explanatory variables. These were selected on the basis that they should be independent of the MTR. For example, the number of mobile subscribers was not included as a potential explanatory variable as it may depend on the level of the MTR through the waterbed effect. The candidate explanatory variables were:

- Whether a forward looking cost model (FLCM) was used (1) or not (0)
- Total population
- Land area in square kilometres
- Overall population density
- Total population per cellsite
- Urban area in square kilometres
- Total real GDP in US dollar terms
- Real GDP per cellsite in US dollar terms
- Proportion of population living in urban areas
- Urban land area in square kilometres
- Urban population density
- Urban population per cellsite

115. Given that we have 16 observations, it is not feasible to include all 12 of these variables in a regression model and obtain sensible results. We therefore divided the variables into two sets – those representing national level characteristics and those representing

urban area characteristics. The latter may be important for driving mobile costs as urban characteristics are important factors in determining coverage.

3.2. Results

116. Table 10 shows the results of regressing MTRs on national-level characteristics. Three models are presented. Model 1 shows the results of including all relevant variables. In this model, only population per cellsite is statistically significant. The model explains approximately 69% of the variation in MTRs across the countries in our dataset.

117. Model 2 shows the results of general-to-specific model selection starting from Model 1 and successively eliminating the variable that was least significant on the basis of a *t*-test until only statistically significant variables remained.[32] This resulted in urbanisation being included together with population per cellsite. All variables are statistically significant at the 1% level in this model and it explains approximately 63% of the variation in MTRs across countries. The two significant variables are of theoretically valid sign: higher urbanisation and/or higher population per cellsite will reduce per-minute costs due to economies of scale.

Table 10 Regression results using national-level characteristics (heteroscedasticity-robust standard errors in brackets).

Variable	Model 1	Model 2	Model 3
Population	-0.009 (0.020)		
Pop. density	-0.008 (0.021)		
Urbanisation	-0.181 (0.138)	*** -0.115 (0.038)	** -0.110 (0.040)
Pop. per cellsite	** -0.001 (0.000)	*** -0.002 (0.000)	*** -0.002 (0.000)
Urban land area (% of total)	15.779 (26.770)		
Real GDP per cellsite	0.014 (0.022)		
FLCM used	-2.126 (1.922)		-0.623 (1.427)
Constant	*** 35.948 (9.659)	*** 33.714 (3.630)	*** 33.603 (3.543)
R-squared	0.691	0.627	0.631
F-test prob.	0.000	0.002	0.006

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

[32] Due to the relatively small sample size, we permitted variables to remain if they were significant at the 10% level at least.

118. Model 3 re-introduces the forward looking cost model dummy variable into Model 2, to test the hypothesis whether countries that have set MTRs on the basis of a cost model have significantly different MTRs from countries that have not, once the other variables that have been identified as significant are accounted for. The FLCM variable is not statistically significant (*p*-value 0.67), thus there is no evidence of an effect of cost modelling on MTRs, once other factors are taken into account.

119. Table 11 shows the results of regressing MTRs on urban characteristics. Again three models are presented. In Model 1, with all variables, none of the explanatory variables are significant, although the model explains 65% of the variation in MTRs across countries. Model 2 is the result of general-to-specific model selection, where urban population per cellsite survived the model selection process and is significant at the 1% level. This single variable explains about 61% of the variations in MTRs. Model 3 reintroduces the FLCM variable and it is again not statistically significant (*p*-value 0.924).

Table 11 Regression results using urban characteristics (heteroscedasticity-robust standard errors in brackets).

Variable	Model 1	Model 2	Model 3
Urban population	-0.017 (0.345)		
Urban land area	-0.013 (0.236)		
Urban land area (% of total)	-3.665 (20.598)		
Urban pop. density	0.003 (0.020)		
Urban pop. per cellsite	-0.003 (0.002)	*** -0.002 (0.000)	*** -0.002 (0.000)
Real GDP per cellsite	0.031 (0.030)		
FLCM used	-2.894 (3.664)		0.140 (1.434)
Constant	*** 24.882 (6.582)	*** 25.219 (1.549)	25.192 (1.659)
R-squared	0.651	0.606	0.606
F-test prob.	0.013	0.000	0.001

* Significant at 10% level

** Significant at 5% level

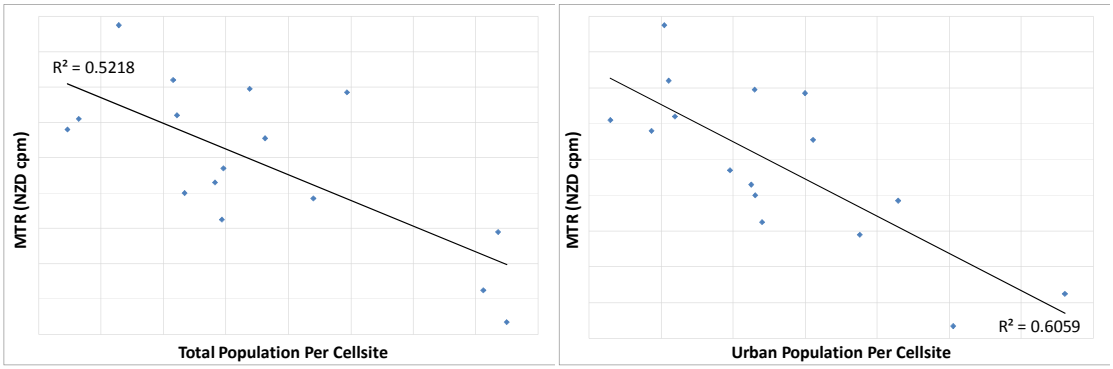
*** Significant at 1% level

120. The above results show that population per cellsite (either national population or urban population) is a very useful explanatory variable that can explain the majority of the variation in MTRs across the countries in our dataset. Population per cellsite likely captures a number of the factors that affect network design, such as population density

and geography, which affect the number of cellsites and their placement, as well as the traffic load on the network.

121. Figure 5 illustrates this by showing the relationship between MTR and total population per cellsite or urban population per cellsite for the 16 countries in our dataset.[33] When only a single variable is used, urban population per cellsite has slightly greater explanatory power than total population per cellsite. However, both explain the observed pattern in MTRs quite well.

Figure 5 MTR versus total population per cellsite (left) and urban population per cellsite (right) for 16 Vodafone operating countries.



122. The best two models above (Model 2 from each of Table 10 and Table 11) each give a predicted value of the MTR for New Zealand, given New Zealand's values of the other variables contained in the model. The predicted values are 17.96 cpm and 18.35 cpm respectively, both of which exceed the current MTR for New Zealand. Econometric benchmarking therefore suggests that there is no evidence that New Zealand's MTR is high given its domestic characteristics. As we have shown above, there is no evidence that countries that have set rates on the basis of a forward-looking cost model have lower MTRs given their other characteristics. Thus we have no reason to believe that current MTRs in New Zealand are higher than is justified on a cost basis.

[33] Axis labels have been removed to protect the confidential cellsite numbers data.