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# Review of report and model by Frontier Economics

Report to the ACCC

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## 1 Executive summary

- 1 RBB Economics has been retained by the Australian Competition and Consumer Commission (the **ACCC**) to review the confidential version of a report by Frontier Economics entitled “The Consumer Impact from Domestic Roaming” (the **Frontier Report**) and the economic model developed by Frontier Economics to quantify those consumer benefits.<sup>1</sup> The economic model developed by Frontier is a differentiated Bertrand model and we refer to the model as the Frontier differentiated Bertrand model (the **FDBM**).<sup>2</sup> Frontier also provided written responses to a set of questions asked by RBB and discussed as part of a conference call involving Frontier, RBB, the ACCC, Vodafone Hutchison Australia (**VHA**) and Norton Rose Fulbright (the **Frontier Responses**).<sup>3</sup>
- 2 The ACCC asked RBB to provide its views on the following.
  - i. Is the Frontier Model suitable for analysing the competitive interactions between the mobile network operators (**MNOs**) and, the likely market outcomes if a domestic mobile roaming service was to be declared in Australia?
  - ii. Are the assumptions and inputs used in the Frontier Model appropriate? If not, how would changes to the assumptions and inputs used in the Frontier Model impact on its results?
- 3 We have reviewed the Frontier Report and the FDBM and conclude that the FDBM is unlikely to produce reliable results of the impact of domestic roaming. We have formed this view for the following three reasons.
  - i. The results of the FDBM rest on a number of assumptions relating to the extent to which geographic coverage affects consumer demand.
  - ii. Frontier assumes that Telstra has market power and the reduction of this market power is the main driver of its modelling results.<sup>4</sup>
  - iii. Although Frontier claims that it has used market data to inform the model, we do not believe that the way in which Frontier has used these data captures how competition actually operates in the market for mobile services in Australia.
- 4 We summarise each of these reasons below. We also examine how changes to the assumptions and inputs used by Frontier impact on its results in Annex A of this report.

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<sup>1</sup> Frontier, ‘The consumer impact from domestic roaming’, 15 June 2017, provided by Norton Rose Fulbright as Attachment E, dated 16 June 2017, ‘Re: Vodafone Hutchison Australia Pty Ltd submission to the Australian Competition and Consumer Commission’.

<sup>2</sup> The spreadsheet model is entitled ‘VHA - confidential - Frontier roaming model for ACCC’.

<sup>3</sup> Frontier, ‘Modelling the consumer impact from domestic roaming: response to RBB’s clarification questions’, 31 August 2017.

<sup>4</sup> Frontier Responses, p. 9.

## The importance of geographic coverage

- 5 The key assumptions of the FDBM are a split between “urban” and “national” segments (through the application of an “uplift” to diversion ratios based on the market share of each operator) and that some of Telstra’s demand will be transferred to Optus and VHA respectively following the declaration of wholesale domestic roaming. The FDBM does not predict what would happen following the introduction of domestic roaming but, rather, the results are driven by the simplifying assumptions that Frontier makes regarding the transfer of market shares that will occur following the introduction of domestic roaming and the relative closeness of competition between different “urban” and “national” products respectively.
- 6 In particular, Frontier assumes that domestic roaming will lead to a transfer of market share between the MNOs in Australia, namely from Telstra, on the one hand, to Optus and VHA, on the other, such that the existing urban versus national market share differential between Telstra, on the one hand, and Optus and VHA respectively, on the other hand, closes by an assumed (and exogenous) 60 per cent.<sup>5</sup> This assumption largely drives the results from the FDBM that domestic roaming will lead to price reductions and consumer benefits.
- 7 Frontier also assumes in the FDBM that products with “national” coverage compete more closely than products with “urban” coverage than suggested by historic market shares. This assumption drives the results of even larger price reductions and consumer benefits as a result of introducing domestic roaming in the FDBM.

## Frontier assumes that Telstra has market power

- 8 Frontier’s model assumes that there is considerable scope for the significant falls in prices shown in their model because Telstra has market power.
- 9 Frontier states in its Responses that “*the main driver of our modelling results is the reduction in Telstra’s market power following the introduction of domestic roaming*”.<sup>6</sup> Frontier also defines the competitive price level as “*the level of prices that would be observed if all MNOs had similar levels of coverage*”.<sup>7</sup>
- 10 Two of the reasons Frontier provides to support its finding that Telstra has market power are Telstra’s higher ARPU compared to Optus and VHA and also the increase in Telstra’s share price following the release of the ACCC’s draft decision not to authorise domestic roaming.
- 11 We have not undertaken an assessment of whether Telstra has market power or not as part of our assessment. But we do note that the ACCC has found that the national uniform prices

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<sup>5</sup> See Frontier Report, page 39. As discussed later in this report, we do not consider that the market share gap is closed by 60 per cent in the FDBM. Frontier estimates the market share gap excluding MVNOs, but then implements 60 per cent of this gap in a section of its model in which market shares are calculated including MVNOs. This leads to a greater reduction in Telstra’s market share and a greater increase in Optus and VHA’s market shares such that the market share gap is closed by approximately 67 per cent. See footnote 45.

<sup>6</sup> Frontier Responses, p. 9.

<sup>7</sup> Frontier Report, p. 16.

offered by Telstra mean that consumers who may have limited choice of mobile provider in many regional and remote areas still benefit from competition in other areas.<sup>8</sup>

- 12 We also do not accept Frontier's view that the competitive price level is the price that would be observed if all MNOs had a similar level of coverage. It is possible for MNOs to offer different levels of coverage (and to offer different levels of services in general). These differences do not necessarily suggest that consumers would be unlikely to consider the mobile services offered by those MNOs as effective demand-side substitutes. What matters is how many consumers would switch to MNOs offering less coverage in response to a small but significant and non-transitory increase in the price offered by the MNO with wider coverage. This is, ultimately, an empirical question but if enough consumers would switch to the services offered by the MNO offering less coverage, then the two MNOs would be considered to be in the same market.
- 13 The fact that MNOs that offer wide coverage could be in the same market as MNOs that offer narrower coverage means that an MNO offering narrow coverage will still constrain the MNO offering wider coverage and, consequently, that competition in that market could still be effective.

### **The use of market data to justify Frontier's model**

- 14 Frontier claims that it has based its model on "*real-world data and captures how different operators respond to price changes by other operators and how market outcomes might be expected to change as a result*".<sup>9, 10</sup>
- 15 We agree that models of this kind should be based on real world data and, to the extent possible, tested against observed market outcomes. We have identified the following three categories where the model is either inconsistent with real world data or where further evidence is required in order to support key assumptions. These are:
- i. **Lack of evidence on the extent to which geographic coverage matters.** The choice of geographic coverage rather than customer segmentation as a way to determine the extent of substitutability between operators may be appropriate. However, we do not consider that Frontier has presented strong evidence on the extent to which geographic coverage matters and has instead relied on market share differences between operators (which will be affected by a wide range of factors), survey results and on marketing claims made by operators regarding their coverage.<sup>11</sup>
  - ii. **Inconsistency in the use of "real-world" data or inconsistency of the data used with observed market evidence.**

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<sup>8</sup> ACCC, 'Domestic mobile roaming declaration inquiry: Draft Decision', May 2017, p. 3.

<sup>9</sup> Frontier Responses, p. 1.

<sup>10</sup> See, for example page 7 of the Frontier Report, which states that Frontier adapted the model to "*reflect the specific circumstances of the Australian market*", page 19, which states that information on prices, incremental costs and diversion ratios "*allows the model to reflect the current situation in the Australian mobile market*". Similarly, page 1 of the Frontier Responses states that Frontier's approach allows it to base its model on "*real-world data*" and page 3 states that its approach is based on "*actual data*".

<sup>11</sup> Frontier Report, pp. 5-6 and 11-15.

- a. Frontier claims that the economic model it has used captures the key features of competition between mobile operators and has already been used by the European Commission and others to assess and quantify the impact of changes in policy/market structure on retail mobile prices.<sup>12</sup> The adaptations made by Frontier to a standard differentiated Bertrand model are significant. The economic models used by the European Commission and others for assessing mergers in the telecoms sector have assumed that substitutability is affected more by the segments into which subscribers belong rather than the extent to which an operator provides geographic coverage (which, as stated above, has not been substantiated by Frontier). For example, the European Commission’s modelling methodology assumes that subscribers are more likely to substitute from a post-paid plan offered by one operator to a post-paid plan offered by another operator, rather than to switch from a post-paid plan offered by one operator to a pre-paid plan offered by another operator. Although, in principle, the cases on which the European Commission has used demand estimation could have captured closer substitution within these segments due to geographic coverage differences or other differentiating factors.
- b. The diversion ratios used in the model – which are a critical input to the model – are based on historic market shares and “uplifted” using a single estimate from VHA’s porting data of switching from Telstra to VHA. In general, historic market shares are unlikely to accurately reflect how competition operates for differentiated products. This is because they may not reflect the current state of competition and because switching between products in a differentiated market may be greater or less than what is suggested by market shares alone. More importantly, to the extent that those market shares are the product of competition that takes place across a number of different parameters, it is inappropriate to use them as the basis for estimating diversion ratios between and within the new, assumed “national” and “urban-only” product constructs which assume coverage is a key driver of competition. Frontier then applies this uplift, which is likely to be inappropriate, not only between Telstra and VHA but assumes that it applies across all the urban and national products in its model.<sup>13</sup> Finally, as far as we are aware, the diversion ratios based on historic market shares have also been derived without any reference to how consumers will respond to a price change. The response of these marginal customers is key to understanding how the MNOs may choose new prices following the introduction of Optus and VHA national products in the counterfactual modelled by Frontier.
- c. It is also unclear how the assumed demand curves for products 5 and 6 in both the “factual” and the “counterfactual” scenarios are consistent with observed market evidence. The customers in products 5 and 6 – who are Telstra customers – are

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<sup>12</sup> Frontier Report, p. 7, and Frontier Responses, p. 1.

<sup>13</sup> The way in which Frontier has used porting data can be contrasted to how it is used by the European Commission to simulate the effects of mergers in the telecom sector. When assessing mergers, porting data can be used to reflect the relative closeness of competitors, which might not be revealed by market shares. However, Frontier takes porting data, which may reveal something about the relativeness closeness of firms, and assumes instead that it reveals the relative closeness of “urban” and “national” products. This is a critical assumption and is not based on market data regarding the importance of geographic coverage in driving consumer demand (given that Telstra and VHA differ on more dimensions than just geographic coverage).

assumed to be “latent” Optus and VHA customers and Frontier estimates a demand curve for those customers which differs from the demand curves used for other Telstra, Optus or VHA customers. Although the estimates used to compile the demand curves for the latent customers of these artificial products are sourced from “real-world” data it is impossible to test the reasonableness or accuracy of the estimates given the hypothetical nature of the underlying model.

iii. **The model assumes a fixed and static view of competition.**

- a. The use of a differentiated Bertrand model, which is a static model, to explain competition in a dynamic industry, such as telecoms, raises problems. The dynamic aspect of competition in telecoms implies that differentiation between the products supplied by rival firms is not constant (as firms may reposition their products over time, such as by investing in the speed of their network or coverage).
- b. Given that Telstra has the largest market share, it is unlikely to have a strong incentive to engage in price reductions that will dilute its earnings from the majority of the customers. And given that Telstra currently offers a uniform price for its products and faces competition from “urban-only” operators in urban areas, it is unclear how declaration could lead to additional benefits to consumers above those that are currently being delivered.
- c. We also understand that Optus and TPG plan on making further investments in the mobile market in Australia. As a result, the estimate of benefits in the model, which relies on a static assessment of a continuation of a status quo (other than the transfer of ownership of two Telstra “national” products to Optus and VHA respectively), will overstate the benefits of extending regional coverage to operators other than Telstra relative to what is likely to occur anyway without domestic roaming. Further, and as Frontier acknowledges, the FDBM does not assess any potential harm to dynamic competition and investment incentives that may result from domestic roaming.<sup>14</sup>

16 The remainder of this review is structured as follows.

- i. Section 2 discusses the assumptions made in the FDBM regarding the importance of geographic coverage and the creation of the two “products” that capture Frontier’s view of how competition actually works in the mobile market in Australia.
- ii. Section 3 then comments on Frontier’s view of the extent to which the mobile market in Australia is subject to effective competition and the role of uniform pricing.
- iii. Section 4 makes a number of observations on other elements of the FDBM, including the model’s reliance on historic market shares and the way in which it estimates diversion ratios.
- iv. Annex A presents the results of the sensitivity analysis that we have undertaken on the FDBM.

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<sup>14</sup> Frontier Report, p. 9.

## 2 The importance of geographic coverage in Frontier’s model

- 17 Differentiated Bertrand models make important assumptions about the structure of consumer demand and the nature of competition. A critical assumption underlying Frontier’s diversion ratio adjustments within its differentiated Bertrand model is that there is limited substitution between products with “urban” coverage and products with “national” coverage, and that Telstra is the only operator that supplies products with “national” coverage in the factual scenario (i.e. without wholesale domestic roaming). Given that this is a key factor in determining the large estimated benefits from wholesale domestic roaming, it needs to be justified by other evidence.
- 18 In the factual scenario in its model, Frontier assumes that Telstra only supplies “national products” whereas Optus and VHA supply “urban products”.<sup>15</sup> Frontier assumes that Telstra provides the only “national products” as no other operator has “national” coverage.<sup>16</sup> Telstra’s “national products” are assumed to cover 11.4 million subscribers whereas the “urban products” are assumed to cover 11.9 million subscribers.<sup>17</sup>
- 19 Frontier’s choice to structure the product segments based on geographic coverage is critical. By allocating operators to each of the product categories, Frontier dictates the extent to which prices will fall. For example, by assuming that, first, customers for two “national” products will transfer from Telstra to Optus and VHA respectively following declaration of domestic roaming, and, second, that these products compete closely with Telstra’s national product (and more closely with Telstra’s product than with Optus’ and VHA’s existing “urban-only” products), then their introduction will lead to lower prices for these “national” products, and will lead to even lower prices than if they were assumed to be less close substitutes.<sup>18</sup>
- 20 These two simplifying assumptions are critical to driving the results in the FDBM and, in this sense, the FDBM does not provide any separate predictive power regarding what would happen following the introduction of domestic roaming but reflects the likely price and consumer benefit effects of the simplifying assumptions.
- 21 In our view, Frontier has not presented strong evidence to justify their choice of geographic coverage as a key factor determining how competition takes place in the mobile services market in Australia. Frontier relies on market share data, results of surveys (that, as far as we are aware, do not ask how customers would respond to a price change) and marketing

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<sup>15</sup> “National products” are those that offer “national” geographic coverage. See Frontier Report, page 12.

<sup>16</sup> Frontier Report, p. 20.

<sup>17</sup> This is based on the 45 per cent national product market share, and 47 per cent urban product market share of a total market of 25.3m subscribers assumed in Frontier’s model. Frontier’s model excludes 8 per cent of the market share attributed to non-Telstra MVNOs. It also excludes Boost. See Frontier model for ACCC “Model 6 products – de-averaged”.

<sup>18</sup> The approach taken by Frontier can be contrasted with a merger simulation, for which the European Commission has used differentiated Bertrand models in the telecoms sector. In a merger, the size of the respective products and the change of ownership is known, and then the effect of that change of ownership can be simulated. In the FDBM, Frontier does not know what the size of the products will be that will transfer ownership from Telstra to Optus and VHA respectively, or even whether there will be any transfer of ownership from Telstra to Optus and VHA respectively. Instead, these changes in ownership are assumed and based on the assumption that Optus and VHA will close more than half the market share gap between themselves and Telstra based on the difference between their current respective urban and national shares.

claims, but none of these appear to address the key question of how customers would respond to a price change in the relevant market and, critically, how they would respond to the introduction of new Optus and VHA products that provided “national” coverage. A survey that asks consumers for their subjective views of the value they place on coverage is no substitute for a well-designed consumer survey aimed at answering the critical question of what products consumers would switch to in the event of a small but significant, non-transitory increase in price. Moreover, such a survey would need to ask how consumers would switch in response to a small price rise for the artificial “urban-only” and “national-only” products used in the FDBM.

- 22 Frontier’s reliance on market share data and segments based on geographic coverage has the following effects.
- i. The choice to place all of Telstra’s customers (except the 500,000 Telstra MVNO) subscribers in a “national” product means that Telstra faces weaker competition for its 11.4 million customers from Optus and VHA than indicated by market shares.<sup>19</sup>
  - ii. Within the FDBM, there are substantial differences in “urban” diversion ratios based on historic market shares between Telstra MVNOs, Optus and VHA, which suggests that they differ on competitive parameters other than geographic coverage and potentially cater to different types of consumer. However, Frontier assumes that the same diversion ratio uplift applies to all of them meaning that the extent of geographic coverage is important in driving consumer demand for all these products, and that switching based on historic market shares would understate actual switching for all these products by the same amount (due to the assumed importance of geographic coverage).
- 23 The only way in which the Frontier model accounts for differences on dimensions other than geographic coverage (such as retail network size and marketing spend)<sup>20</sup> is to maintain a market share gap, albeit a smaller one, between Telstra, on the one hand, and Optus and VHA, on the other. Maintaining a gap between the market shares is a blunt way of capturing all the dimensions of competition that are not included in the model.

### 3 Is competition effective?

- 24 Frontier makes a number of claims about the effectiveness of the market for mobile services in Australia.
- 25 First, Frontier, defines the competitive price level as “*the level of prices that would be observed if all MNOs had similar levels of coverage*”.<sup>21</sup> This definition of the competitive price level is incorrect and unjustified.<sup>22</sup>

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<sup>19</sup> See footnote 17.

<sup>20</sup> With regards to Telstra’s wider retail network in regional areas, Frontier claims at page 15 of its report that “*it is not clear that this is the cause rather than the result of its wider geographic coverage and hence higher regional market share.*”

<sup>21</sup> Frontier Report, p. 16.

<sup>22</sup> Geographic coverage is distinct from population coverage. Telstra’s population coverage for its 3G network is 99.3 per cent, compared to 98.5 per cent for Optus and around 97 per cent for VHA (under its agreement with Optus). See ACCC, ‘Domestic mobile roaming declaration inquiry’, draft decision, May 2017, p. 7. Telstra’s population coverage for



- 26 Second, Frontier claims in their Responses to RBB's questions that "*the main driver of our modelling results is the reduction in Telstra's market power following the introduction of domestic roaming*".<sup>23</sup>
- 27 Third, the evidence that Frontier presents to support their claim that Telstra has market power is their ARPU advantage over Optus and VHA and also the increase in Telstra's share price following the release of the ACCC's draft decision not to authorise domestic roaming.
- 28 Fourth, it argues that "*as long as Telstra is not facing effective competition in regional areas (and for a significant share of subscribers that value wide geographic coverage), the nationally uniform tariff will still be higher than the (relevant) competitive benchmark*".<sup>24</sup>
- 29 In our view, Frontier has not demonstrated that Telstra has market power, which means that it cannot justify what it describes as a key driver of their model, and its view of when competition is "effective" is flawed and cannot be relied upon to provide the scope for the price reductions assumed in their model.
- 30 Frontier assumes that Telstra has a higher margin than Optus or VHA. Frontier relies on margins used by the European Commission, which it states were confirmed by VHA as reasonable assumptions, and does not use actual Telstra, Optus and VHA margins.<sup>25</sup> Frontier should have provided a more objective justification for applying European margins to the Australian mobile roaming market.
- 31 We have not undertaken an assessment of whether Telstra has market power or not as part of our assessment. But we do note that the ACCC has found that the national uniform prices offered by Telstra mean that consumers who may have limited choice of mobile provider in many regional and remote areas still benefit from competition in other areas.<sup>26</sup>
- 32 If Telstra is constrained to set prices at competitive levels in urban areas, then its nationally uniform prices would be at competitive levels and it is unclear whether there will be, in practice, scope for declaration to lead to the price differences predicted by the Frontier model. In the de-averaged pricing scenario, for example, Frontier predicts that declaring domestic roaming would lead to a significant reduction in the price of national products (-8.4 per cent) and a smaller reduction in prices for urban-only products (-3.0 per cent).<sup>27</sup>
- 33 We also do not accept the view that for prices to be competitive, all MNOs must have a similar level of coverage. It is possible for MNOs to offer different levels of coverage (and to offer different levels of services in general), and this is a key assumption that leads firms to set different prices in the differentiated Bertrand model on which Frontier relies. Despite these differences, consumers may still consider the mobile services offered by those MNOs as effective demand-side substitutes. What matters is how many consumers would switch to MNOs offering less coverage in response to a small but significant and non-transitory

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its 4G network is 98 per cent, compared to 94 per cent for Optus and 94 per cent for VHA. See ACCC, 'Domestic mobile roaming declaration inquiry', draft decision, May 2017, p. 28.

<sup>23</sup> Frontier Responses, p. 9.

<sup>24</sup> See Frontier Report, page 6. See also Frontier Report, page 16.

<sup>25</sup> Frontier Report, p. 23.

<sup>26</sup> ACCC, 'Domestic mobile roaming declaration inquiry: Draft Decision', May 2017, p. 3.

<sup>27</sup> Frontier Report, p. 27.

increase in the price offered by the MNO with wider coverage. If enough consumers would switch to the services offered by the MNO offering less coverage, then the two MNOs would be considered to be in the same market.

- 34 The fact that different MNOs could be in the same market means that an MNO with limited coverage could act as a constraint on the pricing of a firm with wider coverage and that MNOs do not need to provide the same level of coverage in order to constrain the prices charged by one another.
- 35 The point about Telstra earning an ARPU premium and this demonstrating that prices are not set at the competitive level is also unproven. MNOs compete across a number of dimensions (across segments, i.e. post-pay and pre-pay, across quality and across inclusions).<sup>28</sup> This may enable one firm to charge prices that are higher than competitors who do not supply products with the same characteristics or which are perceived as being of higher quality. However, such an outcome can be the result of competition, and the fact that different MNOs charge different prices does not show that some prices are above the competitive level.<sup>29</sup>
- 36 The ARPU earned by operators is also affected by the mix of services (including voice calls, SMS and data) as well as the mix of plans (such as, post-pay versus pre-pay, and business versus consumer), and also the take-up of plans by the subscribers for each operator. ARPU is a blended measure of all of these and a higher (or lower) ARPU could simply reflect differences in the mix of services. It is incorrect to claim that an ARPU premium is actually a measure of the market power of a particular operator.
- 37 Finally, Frontier claims that the Telstra share price increase observed on the day on which the ACCC stated that it was unlikely to declare domestic roaming provides evidence that its wider geographic coverage to Optus and VHA allows it to charge a price premium.<sup>30</sup> This analysis is not reliable. It relies on a single data point, and, even that one data point, involves a smaller or comparable share price change when compared to the share price movements for other days in the chart presented by Frontier.<sup>31</sup>
- 38 The lack of any evidence on whether Telstra has market power is important. It suggests that the price reductions “predicted” by the model may be illusory if the mobile market is already effectively competitive (for example, because the national uniform prices offered by Telstra mean that consumers who may have a limited choice of mobile provider in many regional and remote areas still benefit from effective competition in non-regional areas) and if the relevant competitive benchmark is properly defined.

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<sup>28</sup> ACCC, ‘Domestic mobile roaming declaration inquiry’, draft decision, May 2017, p. 3.

<sup>29</sup> As noted at page 60 of S. Bishop and M. Walker, ‘The Economics of EC Competition Law Concepts, Application and Measurement’, Sweet & Maxwell (2010), “*identifying the competitive price level is almost always impossible*”.

<sup>30</sup> Frontier Report, pp. 6, 17 and 36-37; and Frontier Responses, p. 2.

<sup>31</sup> Frontier Report, p. 37, Figure 4.

## 4 Frontier’s use of “real world” data

- 39 Frontier claims that it has based its model on *“real-world data and captures how different operators respond to price changes by other operators and how market outcomes might be expected to change as a result”*.<sup>32</sup>
- 40 We agree that models of this kind should be based on real world data and, to the extent possible, tested against observed market outcomes. However, we have identified the following issues with the way that Frontier has either estimated or applied the “real world” data used in its modelling.
- 41 First, as discussed in section 2 above, insufficient evidence has been provided to support Frontier’s claim on the importance of coverage. The choice of geographic coverage rather than customer segmentation as a way to determine the extent of substitutability between operators may be appropriate. However, Frontier has only relied on market share differences between operators (which will be affected by a wide range of factors), survey results and on marketing claims made by operators regarding their coverage.<sup>33</sup>
- 42 Second, although the diversion ratios are an important way to estimate own and cross price elasticities and consequently in estimating the demand curves for each of the six products in the FDBM, it does not appear to us that any of the data actually used to estimate the diversion ratios actually consider how consumers respond to price changes. And, critically, none of the data used relates to how consumer demand is affected by geographic coverage and what consumer demand would be for two new “national” products supplied by Optus and VHA respectively as a result of market share being transferred from Telstra.
- 43 Historic market shares, which form the basis of the diversion ratios, contain information about the share of sales accounted for by each firm in the relevant market. Historic market share data, however, provide no insight into how current customers respond and react to changes in price and does not indicate which firms they are more (or less) likely to switch to if faced with a small, but significant and non-transitory increase in prices. This issue is exacerbated by the fact that some subscribers will be on contracts, and not all demand is likely to be contestable at any one time.
- 44 Given that porting data contains information regarding more recent movements between firms, porting data is potentially a more useful way to estimate diversion ratios. However, the porting data that have been used by Frontier are subject to the following limitations.
- i. Frontier has only relied on one data point from the porting data, namely customers porting from Telstra to VHA. And Frontier has applied the “uplift” derived from that one data point to all of the historic market shares used in the model.
  - ii. The porting data may not capture all of the movements of customers across networks, and will not capture switching between products supplied by the same company.

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<sup>32</sup> Frontier Responses, p. 1.

<sup>33</sup> Frontier Report, pp. 5-6 and 11-15.

- iii. The porting data do not indicate why people have moved from one operator to another. If the reasons for the move were unrelated to price, then the porting data will not be capturing information that is relevant to demand estimation.
  - iv. The porting data captures switching from Telstra to VHA, but this switching could be for reasons unrelated to geographic coverage as Telstra and VHA differ on more dimensions than just geographic coverage.
- 45 The demand curves for each product are critical in terms of understanding how consumers respond to price changes. If the diversion ratios have been estimated in a way that does not actually capture the way consumers respond to prices then it is not possible to have confidence in the reliability of estimates that are derived from such estimates.
- 46 The diversion ratios relating to two products, namely the “national” products that are supplied by Telstra in the factual and by Optus and VHA in the counterfactual (products 5 and 6) are artificial products that do not currently exist. Instead, Frontier assumes that Telstra’s current demand is split across three “national” products, and then assumes that two of these products will be transferred to Optus and VHA respectively following the introduction of domestic roaming.
- 47 Even if the diversion ratios were derived from data sources that showed how consumers responded to price changes, those responses would be the result of the nature of competition in the market and may not reflect consumer preferences relating to geographic coverage. It may be, for example, that they reflect changes that consumers made in response to a change in pre-pay pricing or in the amount of inclusions in a bundle, or in response to a change in the quality of the network.
- 48 It would be incorrect to take the diversion ratios that are the result of the way competition actually works in the market and to apply it to a model that assumes that competition works in a very different way, namely that geographic coverage is a key driver of competition.
- 49 Frontier’s choice of geographic coverage as a key competitive parameter does not follow the choice made in these types of models when used in the European Commission. Those models were designed to reflect greater substitution between firms competing in similar *segments*. These segments were defined around the types of plans offered by operators and included post-pay, pre-pay and business. Although, in principle, the cases on which the European Commission has used demand estimation could have captured closer substitution within these segments due to geographic coverage differences or other differentiating factors.
- 50 We have not examined the extent to which competition is more likely to take place around segments than around geographic coverage. We do note that the ARPUs used by Frontier in their model suggest a significant difference between post-pay and pre-pay ARPU. For example, Telstra’s post-pay ARPU is \$59.83 per month and pre-pay ARPU is \$20.40 per

month.<sup>34</sup> Optus' post-pay ARPU is \$47 per month and pre-pay ARPU is \$21 per month.<sup>35</sup> Frontier also notes that Telstra had 3.9 million pre-pay subscribers and Optus has 3.74 million pre-pay subscribers.<sup>36</sup> The ARPU estimates appear to suggest that substitution between Telstra's 3.9 million pre-pay customers with an ARPU of \$20.40 and Optus' 3.74 million pre-pay customers with an ARPU of \$21 could be strong, but the strength of substitution is ultimately an empirical question.

- 51 Frontier only includes an urban-only MVNO in its model, accounting for 2 per cent market share. Excluding non-Telstra MVNOs with 8 per cent market share, as well as Boost, which provides national coverage, is likely to exclude an important competitive constraint in the market. As acknowledged by Frontier, this would require estimating the demand curve for each MVNO separately.<sup>37</sup> While Frontier claims that including MVNOs could lead to greater price reductions and larger consumer benefits,<sup>38</sup> this has not been tested.
- 52 Demand estimation using econometric analysis of price and sales data would be likely to be a more reliable method of obtaining the own and cross-price elasticities, than relying on historic market share and porting data.<sup>39</sup> However, there would still be the issue that substitution between "national" products in the FDBM would not be observable because Optus and VHA are assumed to not currently provide "national" products. This makes any attempt at modelling what the likely substitution will be between the new "national" products in the FDBM an inherently speculative exercise.
- 53 Third, the model assumes a fixed and static view of how competition takes place and does not reflect how competition works in the "real world".
- 54 The use of a differentiated Bertrand model, which is a static model, to explain competition in a dynamic industry, such as telecoms, in itself raises problems. The dynamic aspect of competition in telecoms implies that differentiation between the products supplied by rival firms is not constant (as firms may reposition their products over time, such as by investing in the speed of their network or coverage). This is in contrast to some other industries for which differentiated Bertrand models are used, such as fast-moving consumer goods ("FMCG") for which differentiation may be more constant.
- 55 The FDBM contains an assumed view of how competition will take place in the relevant market. Following declaration, prices are assumed to fall as Optus and VHA gain market share. This follows directly from the use of a differentiated Bertrand model and the assumption that geographic coverage is a key driver of competition. It is, however, unclear

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<sup>34</sup> The post-pay ARPU is calculated as post-paid handheld revenue of \$5,385m divided by the post-paid subscribers of 7.5m and divided by 12 (to obtain a monthly figure). The pre-paid ARPU is provided in the 2016 Telstra annual report cited by Frontier at page 42 of its report. See Frontier Report, page 42 and <https://www.telstra.com.au/content/dam/tcom/about-us/investors/pdf-e/FY16-Annual-Report-single-pages.pdf>.

<sup>35</sup> The estimated ARPUs are calculated as average monthly revenue per user for pre-pay and post-pay respectively. See Frontier Report, p.42.

<sup>36</sup> Frontier Report, p. 42.

<sup>37</sup> Frontier Responses, 9.

<sup>38</sup> Frontier Responses, 9.

<sup>39</sup> Econometric estimation of consumer demand can help identify demand characteristics by analysing patterns in "real world" transactional data. Although econometric demand estimation is computationally intensive and requires detailed transaction data, it allows for fewer assumptions to be imposed on the demand structure. Simpler models which impose assumed demand characteristics reveal more about the model's own properties than about the world. See Peter Davis and Eliana Garcés, 'Quantitative techniques for competition and antitrust analysis', Princeton University Press (2010), pages 491 to 492.

whether competition will actually work in this way in the event that domestic roaming was to be declared. Given that Telstra has the largest market share, it is unlikely to have a strong incentive to engage in price reductions that will dilute its earnings from the majority of the customers. And given that Telstra currently offers a uniform price for its products and faces competition from “urban-only” operators in urban areas, it is unclear how declaration could lead to additional benefits to consumers above those that are currently being delivered.

- 56 We also understand that Optus and TPG plan on making further investments in the mobile market in Australia. We have not examined the extent or effect of those investments but expect that these investments will provide consumer benefits to some or all subscribers. These benefits have not been reflected in the model. As a result, the estimate of benefits in the model, which relies on a static assessment of a continuation of a status quo (other than the transfer of ownership of two Telstra “national” products to Optus and VHA respectively), will overstate the benefits of extending regional coverage to operators other than Telstra relative to what is likely to occur anyway without domestic roaming.<sup>40</sup> Further, and as Frontier acknowledges, the FDBM does not assess any potential harm to dynamic competition and investment incentives that may result from domestic roaming.<sup>41</sup>

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<sup>40</sup> Frontier suggests that assuming only part of the market share gap will be closed could be a way to account for Optus and TPG increasing their regional networks in the factual. See Frontier Responses, footnote 5. However, it is unclear that this is an appropriate way to account for the factual being incorrectly specified, and it is also unclear what impact this has on Frontier’s view that assuming 60 per cent of the market share gap will be closed is “conservative”.

<sup>41</sup> Frontier Report, p. 9.

# A Sensitivity testing

## A.1 Introduction

- 1 The most important feature of Frontier's model is an assumed split into "urban" and "national" product segments. Telstra is assumed to be the only provider that supplies a "national" product whereas without domestic roaming (i.e. in the "factual") Optus and VHA are assumed to supply "urban" products. The diversion ratios used for products within and between each of these segments are based on national historic market shares with an "uplift" for switching between products in the same segment (and a compensating reduction in diversion ratios for switching between products in different segments, to ensure that the diversion ratios from one product to all other products sum to 100 per cent).
- 2 The assumptions that can be readily sensitivity-tested, such as the extent to which the market share gap is closed, margins, the extent of the uplift between "urban" and "national" products, wholesale cost of domestic roaming and switching to the outside good, obviously lead to changes in the estimated benefits of declaring wholesale domestic roaming. However, we consider that the range of values produced by these sensitivity tests are still unreliable, as they rely on the assumption that the market can be segmented between "urban" and "national" (for which we do not consider that Frontier has provided strong evidence). We nevertheless present the results of these sensitivity tests below. They show that to the extent that some of the assumptions may be overestimated (such as the importance of coverage in determining the shares for products 5 and 6 and the market share uplift to estimate diversion ratios based on historic market shares), then the estimated benefits will be substantially reduced.
- 3 Differentiated Bertrand models that are used to assess mergers predict price increases absent marginal cost efficiency reductions, and this feature cannot be assumed to be true if the model does not provide a good description of the industry (which for the FDBM is unlikely to be true given that Frontier does not provide strong evidence on the extent of the importance of geographic coverage, and the model takes a static view of a dynamic industry).<sup>42</sup> The converse of this is that using a differentiated Bertrand model to predict the impact of a demerger will lead to price reductions absent marginal cost inefficiencies.<sup>43</sup> We note that while most of the sensitivity tests below still lead to estimated price reductions and consumer benefits (albeit smaller than those predicted by Frontier), assuming a higher domestic roaming charge can lead to estimated price increases and consumer harm (section A.5 below). This is because a higher domestic roaming charge is treated in the model as

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<sup>42</sup> See Daniel Gore, Stephen Lewis, Frances Dethmers, 'The Economic Assessment of Mergers Under European Competition Law', Cambridge University Press (2013), page 218. This states: *"For all their sophistication in measuring the historical relationship between competing brands, the theoretical foundations of most merger simulation models are... extremely simple Bertrand models that incorporate a built-in bias towards predicting that any horizontal merger will raise prices. Questions as to whether such models provide a valid representation of real world oligopoly interaction have led a number of critics to caution against reliance on these techniques."*

<sup>43</sup> The FDBM models a transfer of ownership of two products (products 5 and 6) from a firm with larger market share, Telstra, to firms with smaller market shares, Optus and VHA respectively.



leading to a higher marginal cost, which effectively operates like a merger inefficiency in the FDBM.<sup>44</sup>

## A.2 Market share gap

- 4 Frontier assumes that 60 per cent of the gap between urban historic market shares and national historic market shares for, Telstra, on the one hand, and Optus and VHA, on the other, will be closed in the counterfactual.<sup>45</sup> We consider the estimated benefits under the assumption that half of the market share gap between the national market shares and urban market shares excluding MVNOs are closed in the counterfactual. We then estimate benefits when 60 per cent of the market share gap excluding the 200,000 subscribers in Telstra-only areas is closed.<sup>46</sup>

### A.2.1 50 per cent of market share gap closed

- 5 Table 1 below provides the estimate of the market share gap scaled by 50 per cent based on Frontier's estimate of the difference between weighted average historic market shares across capital cities and existing national historic market shares.<sup>47</sup>

**Table 1: Market share gap estimates**

	Telstra	Optus	VHA
Weighted average across capital cities	[c-i-c]	[c-i-c]	[c-i-c]
Existing market shares (excluding MVNOs)	[c-i-c]	[c-i-c]	[c-i-c]
Difference in market shares	[c-i-c]	[c-i-c]	[c-i-c]
Difference in market shares multiplied by 50%	[c-i-c]	[c-i-c]	[c-i-c]

Source: Frontier roaming model for the ACCC, RBB analysis.

- 6 Table 2 below displays the average price changes of urban-only products (products 1, 2 and 3), national products (products 4, 5 and 6) and overall for every product. The average

<sup>44</sup> This is contrary to the claim at footnote 2 of the Frontier Responses: [c-i-c]

<sup>45</sup> Frontier assumes that products 5 and 6 have market shares equal to 60 per cent of the gap between urban market shares (calculated as the weighted average market share across capital cities) and national market shares for Optus and VHA respectively. These market shares exclude MVNOs. The share for Telstra's product 4 is calculated as Telstra's national market share (including MVNOs) minus the shares for products 5 and 6 (which exclude MVNOs). However as market shares including MVNOs are lower than if MVNOs are excluded, this leads to greater market share being allocated to products 5 and 6 in the model and, consequently, a lower market share being allocated to Telstra's product 4. The market share gap that is closed in Frontier's model is effectively 67 per cent of the gap between the urban and national market shares. Adjusting the shares of products 5 and 6 for the presence of MVNOs leads to shares of [c-i-c] per cent for product 5 (as compared to [c-i-c] per cent used by Frontier) and [c-i-c] per cent for product 6 (as compared to [c-i-c] per cent used by Frontier). The estimated discounted net benefit over 10 years is \$3,611m rather than \$3,894m estimated by Frontier.

<sup>46</sup> Frontier Report, p. 13.

<sup>47</sup> To maintain consistency with Frontier's methodology of applying market share gaps to the model, we likewise calculate the share of Telstra's product 4 as Telstra's national market share (including MVNOs) minus the shares of products 5 and 6 (which exclude MVNOs). As this leads to higher market shares being allocated to products 5 and 6, and lower market shares to product 4, then adjusting for the presence of MVNOs leads to shares of [c-i-c] per cent for product 5 (as opposed to [c-i-c] per cent without accounting for MVNOs) and [c-i-c] per cent for product 6 (as opposed to [c-i-c] per cent without accounting for MVNOs). The estimated discounted net benefit over 10 years would then be \$3,147m rather than \$3,411 when estimating without accounting for MVNOs.



counterfactual prices are calculated using factual subscriber volumes, such that prices are weighted in the same manner as the average factual prices.

**Table 2: Changes to average prices based on 50 per cent of market share gap closure**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$36.36	\$46.30	\$46.30	\$41.22	\$41.22
Counterfactual	\$35.27	\$35.39	\$42.43	\$42.93	\$38.77	\$39.07
Percent change	-3.0%	-2.7%	-8.4%	-7.3%	-5.6%	-5.0%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 7 As shown in Table 2, average prices decrease in the counterfactual across all products, however to a lesser extent than the price change in Frontier’s original model.
- 8 Table 3 below shows the average effect on consumer welfare overall through changes to consumer expenditure. We display the annual difference in expenditures after counterfactual prices are fully realised in the market, the NPV of changes to consumer expenditure over a period of 10 years with a social discount rate of 7 per cent and a four year glide path such that prices reach counterfactual levels linearly over four years, and the average NPV of consumer expenditure changes per subscriber, using the original Frontier assumptions and the revised market share assumptions.

**Table 3: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	\$600m
NPV 10 years	\$3,894m	\$3,411m
NPV per subscriber	\$167	\$146

Source: Frontier roaming model for the ACCC, RBB analysis.

- 9 As shown in Table 3, the 10 year NPV of changes to consumer expenditures decreases by \$3.4 billion in the counterfactual with the revised market share assumptions, which is about \$0.5 billion less than the decrease under Frontier’s original model estimate.

## A.2.2 30 per cent of market share gap closed

- 10 Table 4 below provides the estimate of the market share gap scaled by 30 per cent based on Frontier’s estimate of the difference between weighted average historic market shares across capital cities and existing national historic market shares.

**Table 4: Market share gap estimates**

	Telstra	Optus	VHA
Weighted average across capital cities	[c-i-c]	[c-i-c]	[c-i-c]
Existing market shares (excluding MVNOs)	[c-i-c]	[c-i-c]	[c-i-c]
Difference in market shares	[c-i-c]	[c-i-c]	[c-i-c]
Difference in market shares multiplied by 30%	[c-i-c]	[c-i-c]	[c-i-c]

Source: Frontier roaming model for the ACCC, RBB analysis.

- 11 Table 5 below displays the average price changes of urban-only products (products 1, 2 and 3), national products (products 4, 5 and 6) and overall for every product. The average counterfactual prices are calculated using factual subscriber volumes, such that prices are weighted in the same manner as the average factual prices.

**Table 5: Changes to average prices based on 30 per cent of market share gap closure**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$36.36	\$46.30	\$46.30	\$41.22	\$41.22
Counterfactual	\$35.27	\$35.70	\$42.43	\$44.09	\$38.77	\$39.80
Percent change	-3.0%	-1.8%	-8.4%	-4.8%	-5.6%	-3.3%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 12 As shown in Table 5 average prices decrease in the counterfactual across all products, however to a lesser extent than the price change in Frontier's original model.
- 13 Table 6 below shows the average effect on consumer welfare overall through changes to consumer expenditure. We display the annual difference in expenditures after counterfactual prices are fully realised in the market, the NPV of changes to consumer expenditure over a period of 10 years with a social discount rate of 7 per cent and a four year glide path such that prices reach counterfactual levels linearly over four years, and the average NPV of consumer expenditure changes per subscriber, using the original Frontier assumptions and the revised market share assumptions.

**Table 6: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	\$397m
NPV 10 years	\$3,894m	\$2,258m
NPV per subscriber	\$167	\$97

Source: Frontier roaming model for the ACCC, RBB analysis.

- 14 As shown in Table 6, the 10 year NPV of changes to consumer expenditures decreases by \$2.6 billion in the counterfactual with the revised market share assumptions, which is about \$1.6 billion less than the decrease under Frontier’s original model estimate.

### A.2.3 Market share gap excluding 200,000 subscribers in Telstra-only areas closed

- 15 This sensitivity test assumes that market shares converge from national historic market shares to national historic market shares excluding the 200,000 consumers living in Telstra only areas. We retain the assumption that the market share gap closes by 60%. To calculate the overall market shares excluding 200,000 consumers living in the Telstra only coverage areas, we use the subscriber volumes of Optus, VHA and Telstra that were calculated from their respective market shares excluding MVNOs. The market shares are then recalculated after removing 200,000 subscribers from Telstra. The differences (i.e. “gaps”) are calculated and scaled down to 60 per cent.<sup>48</sup> This is shown in Table 7 below.

**Table 7: Market share gap recalculation**

	Telstra	Optus	VHA
Existing market shares (excluding MVNOs)	50%	30%	20%
Existing subscriber numbers	11,385,000	6,831,000	4,554,000
Subscriber numbers less 200,000 Telstra only consumers	11,185,000	6,831,000	4,554,000
New market shares	49.6%	30.3%	20.2%
Market share gap	-0.44%	0.27%	0.18%
Market share gap multiplied by 60%	-0.27%	0.16%	0.11%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 16 Table 8 below displays results of the average price effects on urban-only products, national products, and overall. The original Frontier estimates are shown first and then the results of the sensitivity test are shown for each product category and overall.

<sup>48</sup> In the interest of consistency, we calculate the share of Telstra’s product 4 as Telstra’s national market share (including MVNOs) minus the shares of products 5 and 6 (which exclude MVNOs). Adjusting for the presence of MVNOs leads to shares of [c-i-c] per cent for product 5 (as opposed to [c-i-c] per cent without accounting for MVNOs) and [c-i-c] per cent for product 6 (as opposed to [c-i-c] per cent without accounting for MVNOs). The estimated discounted net benefit over 10 years would then be \$174 as opposed to \$193 when estimating without accounting for MVNOs.

**Table 8: Changes to average prices based on market share gap excluding 200,000 Telstra subscribers**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$36.36	\$46.30	\$46.30	\$41.22	\$41.22
Counterfactual	\$35.27	\$36.31	\$42.43	\$46.12	\$38.77	\$41.10
Percent change	-3.0%	-0.2%	-8.4%	-0.4%	-5.6%	0.3%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 17 Table 9 below displays the estimated consumer benefits. We provide the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber, using Frontier's original assumptions and the revised market share assumptions.

**Table 9: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	\$34m
NPV 10 years	\$3,894m	\$193m
NPV per subscriber	\$167	\$8

Source: Frontier roaming model for the ACCC, RBB analysis.

- 18 As Table 9 above shows, the smaller market share gap has a very substantial impact on the 10 year NPV of the difference in subscriber expenditure overall, reducing it to only \$193m (as compared to \$3,894m estimated by Frontier). As such, the welfare benefit to consumers under the counterfactual is also very substantially reduced compared to that obtained using Frontier's model assumptions.

### A.3 Margins

- 19 Based on information provided by the ACCC, the margins earned from mobiles for Telstra, Optus and VHA may be lower than the margins assumed by Frontier which relied on gross margins for mobile operators used by the European commission and confirmed by VHA as reasonable assumptions.<sup>49</sup> We assume that Telstra's mobile margins are **[c-i-c]** per cent, Optus margins are **[c-i-c]** per cent, and VHA margins are **[c-i-c]** per cent.<sup>50</sup> In addition, we retain the assumption that Telstra MVNOs earn a 20 per cent margin. It is, nevertheless, unclear whether the margins provided by the ACCC capture the incremental margin of providing mobile phone services for the products considered by Frontier and so whether they are an appropriate input to the FDBM.

<sup>49</sup> Frontier Report, p.23.

<sup>50</sup> Based on ACCC data on estimated EBITDA margins for 2016. Telstra's estimated EBITDA margin was **[c-i-c]** per cent, Optus' estimated EBITDA margin was **[c-i-c]** per cent, and VHA's estimated EBITDA margin was **[c-i-c]** per cent.

- 20 Table 10 below provides results of the average price effects on urban-only products, national products, and overall. The original Frontier estimates are shown first and then the results of the sensitivity test are shown for each product category and overall.

**Table 10: Changes to average prices based on revised margins**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$36.36	\$46.30	\$46.30	\$41.22	\$41.22
Counterfactual	\$35.27	\$35.90	\$42.43	\$44.48	\$38.77	\$40.09
Percent change	-3.0%	-1.3%	-8.4%	-4.0%	-5.6%	-2.6%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 21 Table 11 below displays the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber using Frontier's original assumptions and the revised assumptions.

**Table 11: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	\$315m
NPV 10 years	\$3,894m	\$1,791m
NPV per subscriber	\$167	\$77

Source: Frontier roaming model for the ACCC, RBB analysis.

- 22 As shown in Table 11, the estimated total benefits to consumers over 10 years are only \$1,791m under the revised margins as opposed to \$3,894m estimated by Frontier.

## A.4 ARPUs

### A.4.1 ARPU assumptions based on ACCC estimates

- 23 Based on information provided by the ACCC, the ARPUs of Telstra, Optus and VHA differ to the estimated ARPUs used by Frontier. We test the model using the ACCC data, and assume that Telstra's ARPU is \$45.6, Optus' ARPU is \$39.4, and VHA's ARPU is \$41.9. In addition, we use the same assumption as Frontier for Telstra MVNO's ARPU which is \$30. The ARPUs for products 5 and 6, however, are adjusted to uniformly equal Telstra's ARPU of \$45.6.<sup>51</sup>
- 24 A result of using alternative ARPU assumptions and not changing marginal costs (that is, maintaining the same marginal costs as used by Frontier) is that the assumed margins earned by Telstra, Optus and VHA also change. Using the revised ARPUs, and maintaining the same marginal costs as used by Frontier, results in us assuming that Telstra's mobile

<sup>51</sup> Based on ACCC data on ARPUs for the 2015-16 financial year.

margins are 69 per cent, Optus' mobile margins are 64 per cent, and VHA's margins are 64 per cent.<sup>52</sup>

- 25 Table 12 below provides results of the average price effects on urban-only products, national products, and overall. The original Frontier estimates are shown first and then the results of the sensitivity test are shown for each product category and overall.

**Table 12: Changes to average prices based on revised ARPUs**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$39.95	\$46.30	\$45.63	\$41.22	\$42.72
Counterfactual	\$35.27	\$38.77	\$42.43	\$41.94	\$38.77	\$40.32
Percent change	-3.0%	-3.0%	-8.4%	-8.1%	-5.6%	-5.5%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 26 Table 13 below displays the impact to consumer welfare on the basis of changes to consumer expenditure assuming ARPUs based on data from the ACCC. We provide the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber, using the original Frontier assumptions and the revised ARPU assumptions.

**Table 13: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	\$674m
NPV 10 years	\$3,894m	\$3,828m
NPV per subscriber	\$167	\$164

Source: Frontier roaming model for the ACCC, RBB analysis.

- 27 As shown in Table 13, the revised ARPU assumptions lead to a consumer benefit over 10 years of \$3,828m as compared to \$3,894m in Frontier's model.

#### A.4.2 ARPU assumptions based on Analysys Mason estimates

- 28 Based on the Analysys Mason calculations of the blended ARPU over time using annual report information, the estimated ARPUs of Telstra, Optus and VHA also differ to the estimated ARPUs used by Frontier. We test the model using the Analysys mason data, and assume that Telstra's ARPU is \$41.75, Optus' ARPU is 34.58, and VHA's ARPU is 37.97. We continue to hold the same assumption as Frontier for Telstra MVNO's ARPU which is

<sup>52</sup> The marginal costs are fixed to the marginal cost values as seen in the FDBM. The factual margins are calculated as  $Margin = 1 - \frac{Marginal\ cost}{Price}$ . Therefore, Telstra's margin (i.e., product 4's margin in the FDBM) is calculated as  $1 - \frac{14.0}{45.6} = 0.69$ , Optus' margin is calculated as  $1 - \frac{14.3}{39.4} = 0.64$ , and VHA's margin is calculated as  $1 - \frac{15.2}{41.9} = 0.64$ .

\$30. In addition, products 5 and 6 ARPUs are adjusted to uniformly equal Telstra’s revised ARPU of \$41.75.

- 29 A result of using alternative ARPU assumptions and not changing marginal costs (that is, maintaining the same marginal costs as used by Frontier) is that the assumed margins earned by Telstra, Optus and VHA also change. Using the revised ARPUs, and maintaining the same marginal costs as used by Frontier, results in us assuming that Telstra’s mobile margins are 66 per cent, Optus’ mobile margins are 59 per cent, and VHA’s margins are 60 per cent.<sup>53</sup>
- 30 Table 14 below provides results of the average price effects on urban-only products, national products, and overall. The original Frontier estimates are shown first and then the results of the sensitivity test are shown for each product category and overall.

**Table 14: Changes to average prices based on revised ARPUs**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$35.67	\$46.30	\$41.75	\$41.22	\$38.64
Counterfactual	\$35.27	\$34.76	\$42.43	\$38.62	\$38.77	\$36.65
Percent change	-3.0%	-2.5%	-8.4%	-7.5%	-5.6%	-5.0%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 31 Table 15 below displays the impact to consumer welfare on the basis of changes to consumer expenditure assuming ARPUs based on Analysis Mason estimates. We provide the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber, using the original Frontier assumptions and the revised ARPU assumptions.

**Table 15: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	\$557m
NPV 10 years	\$3,894m	\$3,165m
NPV per subscriber	\$167	\$136

Source: Frontier roaming model for the ACCC, RBB analysis.

- 32 As shown in Table 15, the revised ARPU assumptions lead to a consumer benefit over 10 years of \$3,165m as compared to \$3,894m in Frontier’s model.

<sup>53</sup> The factual margins are calculated as  $Margin = 1 - \frac{Marginal\ cost}{Price}$ . Therefore, Telstra’s margin (i.e., product 4’s margin in the FDBM) is calculated as  $1 - \frac{14.0}{41.75} = 0.66$ , Optus’ margin is calculated as  $1 - \frac{14.3}{34.58} = 0.59$ , and VHA’s margin is calculated as  $1 - \frac{15.2}{37.97} = 0.60$ .

## A.5 Roaming charges

- 33 Frontier assumes that the domestic roaming access charge would be \$5 per subscriber, we examine the sensitivity of estimated outputs to potentially higher domestic roaming charges and consider the welfare impact of counterfactual estimates with a \$10, and \$20 per domestic roaming charge per subscriber.
- 34 Table 16 below provides results of the average price effects on urban-only products, national products, and overall. The original Frontier estimates are shown first and then the results of the sensitivity test are shown for each product category and overall.

**Table 16: Changes to average prices based on \$10 and \$20 roaming charge**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$36.36	\$46.30	\$46.30	\$41.22	\$41.22
Counterfactual - \$10	\$35.27	\$35.76	\$42.43	\$43.71	\$38.77	\$39.65
Percent change	-3.0%	-1.7%	-8.4%	-5.6%	-5.6%	-3.6%
Counterfactual - \$20	\$35.27	\$36.75	\$42.43	\$46.27	\$38.77	\$41.40
Percent change	-3.0%	1.1%	-8.4%	0.0%	-5.6%	0.5%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 35 Table 17 below displays the impact to consumer welfare on the basis of changes to consumer expenditure assuming the higher domestic roaming charge of \$10 and \$20 per subscriber. We provide the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber, using Frontier's original assumptions and revised roaming charge assumptions.

**Table 17: Estimated consumer benefits based on \$10 and \$20 roaming charge**

	Original	Revised
Per annum difference - \$10	\$685m	\$440m
NPV 10 years	\$3,894m	\$2,498m
NPV per subscriber	\$167	\$107
Per annum difference - \$20	\$685m	-\$52m
NPV 10 years	\$3,894m	-\$293m
NPV per subscriber	\$167	-\$13

Source: Frontier roaming model for the ACCC, RBB analysis.



36 As shown in Table 17, using a \$10 wholesale domestic roaming charge leads to an estimated 10 year NPV benefit to customers of \$2,498m as compared to \$3,894m estimated by Frontier. Using a \$20 wholesale domestic roaming charge, however, leads to an estimated 10 year NPV loss of \$293m compared to a \$3,894m gain estimated by Frontier.

## A.6 Diversion to the outside good

37 Frontier’s model assumes a [c-i-c] per cent diversion ratio to outside goods. We change this assumption and consider the effect of [c-i-c] diversion ratios to outside products of 1, 5 and 10 percent. The European Commission has modelled similar sensitivities to reflect that while it is unlikely that consumers would stop buying mobile phone services in response to a price increase, they might change their mobile phone usage, and assuming a higher diversion ratio to the outside good could be one way to capture this.

38 Table 18 below provides results of the average price effects on urban-only products, national products, and overall. The original Frontier estimates are shown first and then the results of the sensitivity test are shown for each product category and overall.

**Table 18: Changes to average prices based on 1%, 5% and 10% outside diversion ratios**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$36.36	\$46.30	\$46.30	\$41.22	\$41.22
Counterfactual – 1%	\$35.27	\$35.33	\$42.43	\$42.51	\$38.77	\$38.84
Percent change	-3.0%	-2.8%	-8.4%	-8.3%	-5.6%	-5.5%
Counterfactual – 5%	\$35.27	\$35.56	\$42.43	\$42.84	\$38.77	\$39.11
Percent change	-3.0%	-2.2%	-8.4%	-7.5%	-5.6%	-4.8%
Counterfactual– 10%	\$35.27	\$35.78	\$42.43	\$43.20	\$38.77	\$39.40
Percent change	-3.0%	-1.6%	-8.4%	-6.8%	-5.6%	-4.1%

Source: Frontier roaming model for the ACCC, RBB analysis.

39 Table 19 below displays the impact to consumer welfare on the basis of changes to consumer expenditure assuming diversion rates to outside goods of 1, 5 and 10 per cent. We provide the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber, using the original Frontier assumptions and the revised diversion to the outside good assumptions.

**Table 19: Estimated consumer benefits**

	Original	Revised
Per annum difference – 1%	\$685m	\$666m

	Original	Revised
NPV 10 years	\$3,894m	\$3,785m
NPV per subscriber	\$167	\$162
Per annum difference – 5%	\$685m	\$589m
NPV 10 years	\$3,894m	\$3,348m
NPV per subscriber	\$167	\$144
Per annum difference – 10%	\$685m	\$508m
NPV 10 years	\$3,894m	\$2,885m
NPV per subscriber	\$167	\$124

Source: Frontier roaming model for the ACCC, RBB analysis.

- 40 As shown in Table 19, increased diversion to the outside good leads to lower predicted price effects. For the factual volumes and the lower predicted price effects, this leads to lower estimated consumer benefits. For 1 per cent diversion to the outside good, the 10 year estimated NPV benefits are \$3,785m, for 5 per cent diversion to the outside good they are \$3,348m and for 10 per cent diversion to the outside good they are \$2,885m. This compares to Frontier’s estimated benefits of \$3,894m.

## A.7 Urban uplifts

### A.7.1 No urban uplift

- 41 Frontier assumes a **[c-i-c]** per cent uplift to diversion ratios within the same product group, and a proportionate decrease to diversion ratios across product groups. We consider the model’s sensitivity to changes in the urban uplift value, estimating the effect of having no urban uplift. Note that the effect of this assumption is to completely eliminate the assumed differentiation across the “urban” and “national” product groups.
- 42 Table 20 below provides results of the average price effects on urban-only products, national products, and overall. The original Frontier estimates are shown first and then the results of the sensitivity test are shown for each product category and overall.

**Table 20: Changes to average prices without urban uplifts**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$36.36	\$46.30	\$46.30	\$41.22	\$41.22
Counterfactual	\$35.27	\$36.29	\$42.43	\$44.27	\$38.77	\$40.18
Percent change	-3.0%	-0.2%	-8.4%	-4.4%	-5.6%	-2.3%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 43 Table 21 below displays the impact to consumer welfare on the basis of changes to consumer expenditure assuming no uplift. We provide the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber, using the original Frontier assumptions and the revised uplift assumptions.

**Table 21: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	\$289m
NPV 10 years	\$3,894m	\$1,642m
NPV per subscriber	\$167	\$70

Source: Frontier roaming model for the ACCC, RBB analysis.

- 44 As shown in Table 21, the estimated 10 year NPV benefits using no uplift are \$1,642m as compared to \$3,894m estimated by Frontier.

## A.7.2 15 per cent urban uplift

- 45 We consider the impact on the model's output assuming a 15 per cent urban uplift value, implying a [c-i-c] degree of differentiation across the "urban" and "national" product groups. Table 22 below provides results of the average price effects on urban-only products, national products, and overall. The original Frontier estimates are shown first and then the results of the sensitivity test are shown for each product category and overall.

**Table 22: Changes to average prices with 15 per cent urban uplifts**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$36.36	\$46.30	\$46.30	\$41.22	\$41.22
Counterfactual	\$35.27	\$35.82	\$42.43	\$43.40	\$38.77	\$39.52
Percent change	-3.0%	-1.5%	-8.4%	-6.3%	-5.6%	-3.9%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 46 Table 23 below displays the impact to consumer welfare on the basis of changes to consumer expenditure assuming a 15 per cent uplift. We provide the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber, using the original Frontier assumptions and the revised uplift assumptions.

**Table 23: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	\$475m
NPV 10 years	\$3,894m	\$2,701m

	Original	Revised
NPV per subscriber	\$167	\$116

Source: Frontier roaming model for the ACCC, RBB analysis.

- 47 As shown in Table 23, the 10 year NPV benefits using a 15 per cent uplift are \$2,701m as compared to \$3,894m estimated by Frontier.

## A.8 Changing multiple assumptions simultaneously

- 48 We consider the impact on the model's output assuming a collective sensitivity test on multiple input variables on the model shown previously. We collectively estimate the effect of a 30 per cent market gap closure, using the estimated margins and ARPU values based on ACCC data, a \$10 per subscriber roaming charge, 10 per cent outside product diversion ratio, and a 15 per cent urban uplift on diversion ratios within a product group. We note that the combined effect of collective sensitivity testing of ARPU values and margins also implies a different marginal cost to Frontier's original estimate due to the dependence of marginal costs on the assumed margins and ARPUs.

**Table 24: Changes to average prices when changing multiple assumptions simultaneously**

	Urban (original)	Urban (revised)	National (original)	National (revised)	Total (original)	Total (revised)
Factual	\$36.36	\$39.95	\$46.30	\$45.63	\$41.22	\$42.72
Counterfactual	\$35.27	\$40.05	\$42.43	\$45.55	\$38.77	\$42.74
Percent change	-3.0%	0.3%	-8.4%	-0.2%	-5.6%	0.0%

Source: Frontier roaming model for the ACCC, RBB analysis.

- 49 Table 25 below displays the impact to consumer welfare on the basis of changes to consumer expenditure when changing multiple assumptions simultaneously. We provide the expenditure difference per annum after the 4 year glide path, the aggregate NPV of expenditure differences over a period of 10 years, and the NPV of expenditure differences per subscriber, using the original Frontier assumptions and the revised uplift assumptions.

**Table 25: Estimated consumer benefits**

	Original	Revised
Per annum difference	\$685m	-\$4m
NPV 10 years	\$3,894m	-\$20m
NPV per subscriber	\$167	-\$1

Source: Frontier roaming model for the ACCC, RBB analysis

- 50 As shown in Table 25, the 10 year NPV benefits are -\$20m as compared to \$3,894m estimated by Frontier. This implies a negative impact on consumer welfare based on changing multiple assumptions simultaneously.