NERA
ECONOMIC CONSULTING

Review of Schiff Consulting Analysis of MNO Customer Billing Data

Spark New Zealand

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Project Team

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1.   Introduction

The New Zealand Commerce Commission (NZCC) commissioned Schiff Consulting (SC) to examine billing data from mobile network operators (MNOs) over the period from 1 September, 2018 to 31 August, 2019. The NZCC provided a letter to the MNOs on 17 September 2020[1] summarizing the findings of the SC report and making recommendations in light of the SC report's findings.

We have been engaged by Spark to review SC analysis, with a focus on:

▪   The robustness of the SC analysis; and

▪   Whether the analysis in the SC report supports the conclusions reached by SC and the NZCC in its letter.

The NZCC describes the SC analysis as finding the following:[2]

▪   64% of consumers who bought base plans did not switch during the 12-month period;

▪   just over 25% of post-paid consumers could save an estimated average of $11.58 a month by moving to a cheaper base plan that would still cover their usage (a saving of 23% of the average post-paid monthly spend); and

▪   around 7% of residential consumers spend a relatively high amount on mobile services, given their usage. These consumers could potentially save an average of $48.65 per month.

Based on this, the NZCC's letter recommends the following interventions:

▪   **increasing the usage information made available to consumers** – to address transparency issues and empower customers to make meaningful choices;

▪   **implementing measures to help ensure customers are on plans that best reflect their actual requirements** – to address inertia issues and protect customers from overspending; and

▪   **initiating work on a "consumer data right" for the industry** – to enable consumers to share their usage and product information with competitors and comparison services if they choose to do so.

In the remainder of this report we:

▪   Describe the SC analysis of savings at a very high level (section 2);

▪   Set out our views on the robustness of the SC analysis and the conclusions that can be drawn from it (Section 3);

▪   Review the SC benchmarking analysis (Appendix A); and

▪   Review the SC right planning analysis (Appendix B).

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[1] NZCC, *Addressing transparency and inertia issues in the mobile market*, 17 September 2020. (the "**NZCC letter**")

[2] NZCC letter, para. 13.

2. High level overview of SC savings analysis

We have been provided with the full SC dataset and code.

- The data has observations for 79,944 unique customer IDs.[3]

- The code has 1,672 lines for data cleaning and 4,996 lines for the analyses carried out in the report, for a total of 6,668 lines.

The SC analysis calculates customer savings in two broad ways:

- **Econometric benchmarking:** this involves calibrating an econometric model to predict a customer's bill if the sole determinant of expenditure is the data, voice minutes and number of SMS messages consumed. Actual expenditure is then compared to this fitted value and the entire difference is treated as savings. If consumers actual expenditure is less than the fitted value (i.e. they "underspend"), this is ignored.

- **"Right-planning":** For customers that are either consistently over or under their quota, match their usage to a different plan that would cover their data, voice minutes and SMS consumption. The difference between actual expenditure and expenditure on the new plan is savings.

The $11.58 the NZCC references relates to the "right planning" analysis while the $48.65 relates to the benchmarking analysis. Note that while the $11.58 assumes that post-paid customers would switch to another post-paid plan, the $48.65 is calculated assuming that customers would switch between pre-paid and post-paid. The SC report provides results from the benchmarking analysis when switching between billing types is allowed and when it is not. The number for the latter is $31.65.[4] The SC report does not appear to prefer one figure over the other.

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[3] Based on count of distinct customer ids from the clean data object called "dat_customers".

[4] SC, p.38.

3. Review of SC analysis

Given the time available for this analysis and sheer volume of code, our review of the SC analysis has necessarily been high level. In this section we provide:

▪ General observations on the SC analysis (section 3.1);

▪ Separate analysis of the specific details of both the benchmarking (section 3.2) and the right-planning (section 3.3) analyses ; and

3.1. General observations

Our general observations on the SC analysis are as follows:

▪ Both the benchmarking analysis and "right planning" analysis estimate savings for customers who switched plans during the period, and therefore are likely to have "right planned" themselves during the period. Given the NZCC is concerned about inertia, including customers who actually switched during the period will overstate the extent of any inertia problem.

▪ Neither the benchmarking analysis nor the right planning analysis account for value-add services (VAS), which can be very material in the case of handset subsidies. For example, the NZCC's monitoring data suggests that at least 26% of post-paid customers are on an interest free plan.[5] Therefore, it is difficult to be confident that the identified savings are actually savings. That is to say, neither analysis is capable of accounting for the fact that a customer SC thinks could save money by switching would be giving up VAS, which could make them net worse off from the switch. In particular, the overstatement of savings may be a particular problem for the figures which allow switching from post-paid to prepay, given this is the situation where customers would most likely be giving up VAS. The SC report explicitly acknowledges that valued added services may influence consumer purchasing behaviour:[6]

> *It should also be noted that the analysis in this section focuses only on usage of the three core mobile services (mobile data, NZ voice, and NZ SMS) and there may be other reasons why people exhibit the purchasing behaviour that they chose. For example, they may want to be on a base plan that provides a subsidised or interest-free handset or that bundles value-added media services such as Spotify, or that offers better value for other services such as international calls or roaming.*

▪ Neither analysis identifies a widespread problem. Rather, as SC describes it, there are "pockets" of consumers who could save money. The point about VAS suggests this conclusion should be modified to state consumers *might* be able to save money, as the savings SC finds might actually be offset by lost/reduced VAS when a customer switches.

3.2. Specific comments on the benchmarking analysis

A more detailed review of the benchmarking analysis is contained in Appendix A. A summary of our views on the specifics of the benchmarking analysis is as follows:

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[5] NZCC, *Annual New Zealand Telecommunications Industry Questionnaire – Aggregate Results 2019,* 12 March 2020. From: https://comcom.govt.nz/__data/assets/excel_doc/0022/212764/2019-Telecommunications-industry-questionnaire-results-12-March-2020.xlsx.
Note that the 26% is calculated using the number of scribers with a payment plan as a proportion of total on-account subscribers. To the extent that payment plans are skewed towards residential, this n number will understate the proportion of residential post-paid customers with and IFP.

[6] SC, p.36

- The benchmarking analysis should be interpreted with caution. SC interprets differences between the predicted value and a customer's actual expenditure as savings. In econometrics, the difference between the "fitted" or predicted value and the actual value is a measure of variation the model cannot explain. SC attributes the entirety of this amount to savings for customers it categorises as having high expenditure, despite the fact that SC own analysis demonstrates that the benchmarking models are very poor predictors of spending.[7] Because the SC benchmarking analysis cannot control for things like whether a customer receives a handset subsidy, interest free phone purchase or other value-added services, the variation SC attributes to being "overspending" may actually be explained by VAS that customers receive.

- The assumed "prediction interval" directly determines the proportion of customers that SC categorises as having high expenditure. SC gives no justification for using and 80% prediction interval. 95% statistical significance is a common threshold used in statistical analysis. Had SC used a 95% prediction interval the proportion of customers identified as being high expenditure would more than halve, from 6.94% of the total sample to 3.35%.

- Our alternative formulation of the benchmarking analysis (removing customers who are on shared plans, treating Spotify as a discount, and correcting for high-expense users who have indeed switched) reduces the proportion of the sample that could save from 6.94% to 3.96%, and the residual in the SC benchmarking analysis from:

  – $48.65 to $36.91, allowing for bill type switching; and

  – $31.65 to $27.49 when not allowing bill type switching.

- The benchmarking analysis as originally presented suggests that over spenders represent only 6.94% of the sample of customers for which savings are estimated. Under our alternative formulation this proportion doesn't substantially change. However, if we also do not count customers who switched during the period, only 3.96% of customers would be categorized by SC as "over spenders".

3.3.   Specific comments on the right planning analysis

A more detailed review of the benchmarking analysis is contained in Appendix B. A summary of our views on the specifics of the **"right planning"** analysis is as follows:

- There is a simple but fundamental mistake which results in the SC analysis vastly overstating the number of customers who are consistently under their quota but could save money. SC calculates the price of plans which customers can switch to by calculating the average that appears on customer bills. Because customer bills contain partial charges and reversals, this average is in some cases materially below the retail price a customer would pay if they switched plans. This results in the perverse result where a customer can "switch" to the plan they are already on and save money. That is to say, the SC analysis finds savings for customers that do not actually exist.

- The below table contains an example using a Spark's 59.99 post-paid plan, which has a data allowance of 4GB. SC calculate a "price" for this plan of $55.04. Consider a customer on this plan that receives no discounts and uses 3.9GB per month. The example below shows that the SC analysis would find savings of $4.95 for this customer from switching to the $59.99 plan.

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[7] SC notes that "On average the models explain between 15% and 60% of the variation in monthly average expenditure across customers in each subset used to estimate the models". To put this another way, this means that on average 85% to 40% of the variations in expenditure is explained by something *outside* of the SC benchmarking models.

Table 3.1: Example of the right planning analysis finding savings where none exist using Spark's $59.99 post-paid plan

Customer spend and characteristics	
Customer's current monthly average expenditure	$59.99
Customer's monthly average usage	3.9GB
"Alternative" plan characteristics	
SC assumed plan cost for 59.99 plan	$55.04
Data allowance for 59.99 plan	4GB
Actual plan cost for 59.99 plan	$59.99
Savings calculation	
SC analysis calculation of savings from "switching" to 59.99 plan	**$4.95**
Actual cost-savings available to customer	**$0**

▪ We have also removed plans that have been grandfathered and therefore not available for purchase during the period. Correcting for these points reduces the proportion of post-paid customers that are consistently under their quota and could save from 25% of post-paid customers to 7% of post-paid customers.

▪ This proportion reduces further if the analysis excludes customers who switched plans during the period (i.e. we do not calculate savings for customers who likely right planned themselves during the analysis). Correcting the pricing and availability of plans resulted in only 7% of post-paid customers being able to save. Then, if customers who switched are removed from this revised count, we find that only 2.5% of post-paid customers did not switch and would be able to save by buying a cheaper plan.

▪ While SC also analyses customers who consistently go over their quota, the NZCC does not reference these findings in its letter, nor does it comment on the market wide move towards "endless data" plans for post-paid which makes this less of a concern.

4. Conclusions

Taking into account our discussion of the SC analysis in section 3, our conclusions regarding the analysis and the conclusions that can be drawn from it are as follows:

▪ **Materiality**: even before our adjustments, the SC findings suggest that the market is working for the vast majority of customers, with the benchmarking analysis the NZCC relies on showing that 7% of all customers could save money and the right planning analysis showing that 25% of post-paid customers could save money. That 7% would fall to 3.35% if a 95% prediction interval had been used instead of an 80% interval. Our alternative formulation of the benchmarking analysis does not change the 7% substantially, but the correction of the right-planning analysis to not allow customers to save money by "switching" to the plan they are already on reduces the 25% to 7%. If customers who switched during the period are removed, the benchmarking analysis number falls to 3.96% of all customers and the right planning analysis figure falls to 2.5% of post-paid customers. Therefore, while we agree with the SC conclusion that there are "pockets" of customers who could save money, our analysis suggests these pockets are substantially smaller than originally calculated.

▪ **Interpretation of savings given value added services are excluded from the analysis**: Given the prevalence of VAS services, which has only increased in recent times,[8] the NZCC should be cautious interpreting the entirety of the calculated savings as "savings". Interest free periods and handset subsidies for post-paid customers in particular can provide material value for consumers that is not accounted for in the analysis.

▪ **Evidence concerning inertia:** The evidence of customer inertia is not as strong as the NZCC suggests - customers that SC categorises as over-spenders actually switch more than the market as whole.

▪ **Policy measures to provide more information and improve transparency:** There appears to be little downside to providing more information to consumers about their usage, and potentially even providing prompts that users are persistently and materially below their quota. Going the next step and requiring MNOs to tell consumers which plan they should be on could have unintended consequences given the evidence suggests that the market is working for the majority of customers, the savings are smaller than NZCC/SC reported and the measure of savings is incomplete and ignores VAS.

The NZCC makes reference to consumer switching sites in electricity,[9] but electricity does not involve the multi-dimensional bundle that mobile services involves – you just need to know when and how much electricity you use. In addition, the telco bundle is dynamic – the VAS services that exist today already differ from those available during the period of the SC analysis.[10] The comparison service (or MNOs if done internally) would also need to know how individual consumers value different VAS, in order to point each customer to a "better" package. These factors make implementing a comparison service more difficult than it is for electricity. If the information provided does not allow a like-for-like comparison due to the dynamic and multidimensional nature of the bundle, or comparison services ignore or relegate certain VAS in their comparisons, this type of measure could disincentivize MNOs from competing by offering VAS, making consumers worse off.

Similarly, the NZCC discusses implementing a consumer data right (CDR). In a sense, a CDR would be an extension of the NZCC's first and second suggestions. That second suggestion is aimed at facilitating consumer movement between plans of the consumer's existing MNO. A CDR would be aimed at facilitating consumer movement between MNOs. Because the concepts are similar, the comments we make about the second suggestion also apply to the suggestion to develop a CDR. That is say, the existence of VAS could make the design of a CDR more complicated than it is for electricity.

In summary, our conclusions are essentially the same as that reached by the SC report, which we reproduce below:

Overall, this analysis provides evidence that there are 'pockets' of residential mobile customers who could save money by changing their purchasing behaviour. Thus, while the majority of customers appear to be getting good value for money, it is likely that actions to encourage and/or enable mobile customers to shop around could be beneficial for consumers. This could include, for example, providing information to consumers about their usage and expenditure trends, and proactively alerting customers who are consistently using less or more than their quotas that they may be able to save money by changing plans. **However, this analysis was limited to usage and expenditure on core mobile services, and there could be other reasons beyond use of these services that explain why**

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[8] For example, video streaming services and WiFi are now part of the bundles that MNOs offer, and some plans include tethering/hot spotting while others don't.

[9] NZCC letter, para. 18.

[10] For example, Spark now offers free Netflix

*consumers choose the mobile services that they buy. **This means that some possible interventions to improve consumer outcomes could benefit from additional analysis and evidence, to mitigate the risk of unintentionally making consumers worse off.** [emphasis added]*

The emphasized text is the key point a reader should take from our report. The evidence in the SC report supports the information measures suggested by the NZCC. However, the SC report suggests that more analysis and evidence would be required before implementing measures such as the second and third interventions proposed by the NZCC (MNOs implementing measures to "right plan" their customers and implementing a CDR). The additional analysis in this report strengthens the conclusion that more work would be required before implementing stronger measures.

In fact, given the multidimensional and dynamic nature of telco bundles, we might even say that the findings of the SC report (particularly as amended by us) suggest that consumers on the whole are doing a very good job of achieving value for money.

Appendix A. Benchmarking analysis

A.1. Caution is warranted interpreting the difference between fitted and actual values (the "residual") as savings

### A.1.1. Explanation of the SC benchmarking analysis

To determine which customers overspend, SC estimates an 80% "prediction interval" around the fitted values from his regressions of usage (data, voice minutes and SMS) against expenditure, and treats any observations that fall outside the 80% prediction interval as being over spenders. SC describes prediction intervals as follows:[11]

> *For an individual customer, a prediction interval gives the range within which their expenditure is expected to fall with a given degree of certainty (80% in this case).*

That is to say, if a customer spends more than the range which their expenditure is expected to fall (with 80% certainty), then they are categorized as high expenditure customers. The difference between their actual expenditure and the fitted value (i.e. the regression line) is treated as "savings".

The SC approach is depicted graphically in Figure A.1 using a randomly generated dataset of two correlated random variables. In this figure the green area is the prediction interval. Therefore, observations which fall outside the prediction interval are those which SC categorise as high spenders and estimate the potential savings for. Savings is depicted by the red line, which is the difference between the actual value and the fitted value (i.e. the regression line).

Figure A.1: Graphical illustration of the benchmarking approach using randomly generated data
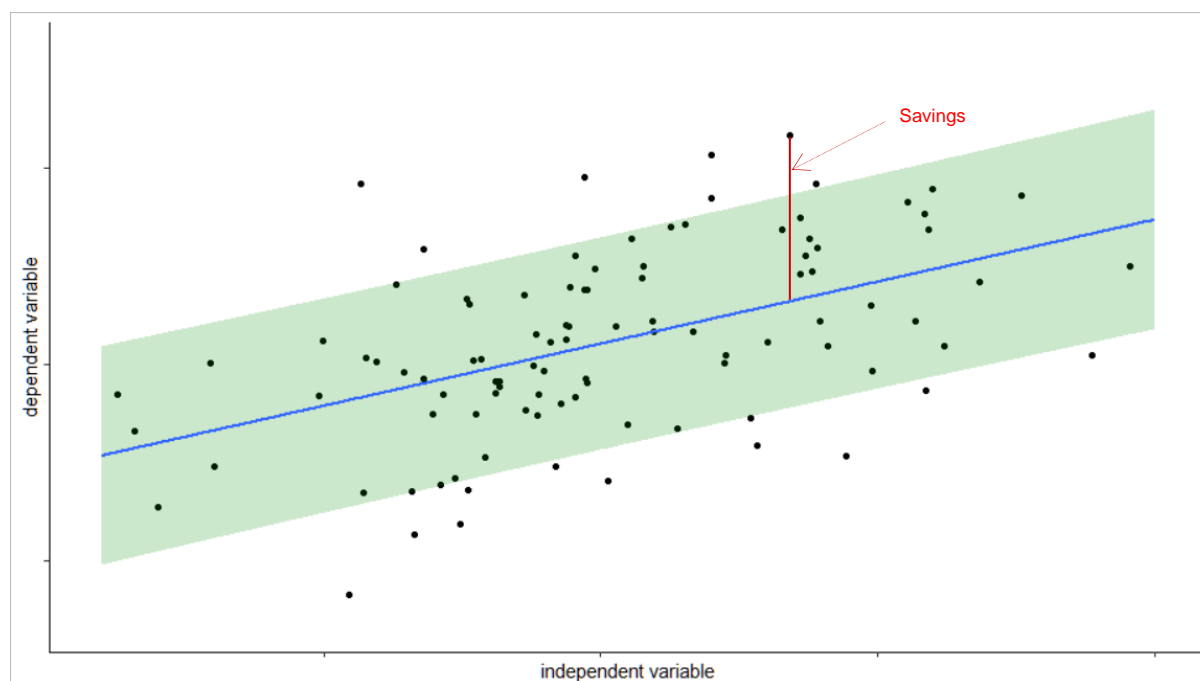
Note: green area represents an 80% prediction interval.

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[11] SC, p.37.

A.1.2.   The benchmarking models have poor predictive power, and therefore "savings" may actually just be poor model fit

In the benchmarking analysis, SC interprets differences between the predicted or "fitted" value and a customer's actual expenditure as savings. In econometrics, the difference between the "fitted" or predicted value and the "actual" value is known as the residual and is a measure of both:

▪   variation the model cannot explain; and

▪   statistical noise when estimating the fitted value (what is known as "sample error").

SC attributes the entirety of this amount to savings for customers SC categorises as having high expenditure, despite the fact that SC's analysis demonstrates that the models are relatively poor predictors of expenditure, particularly in the case of post-paid. Figure A.2 below reproduces Figure 27 from the SC report, but shows the "adjusted R-Squared" instead of the R-Squared.[12]

Figure A.2: Adjusted R-Squared for benchmarking models
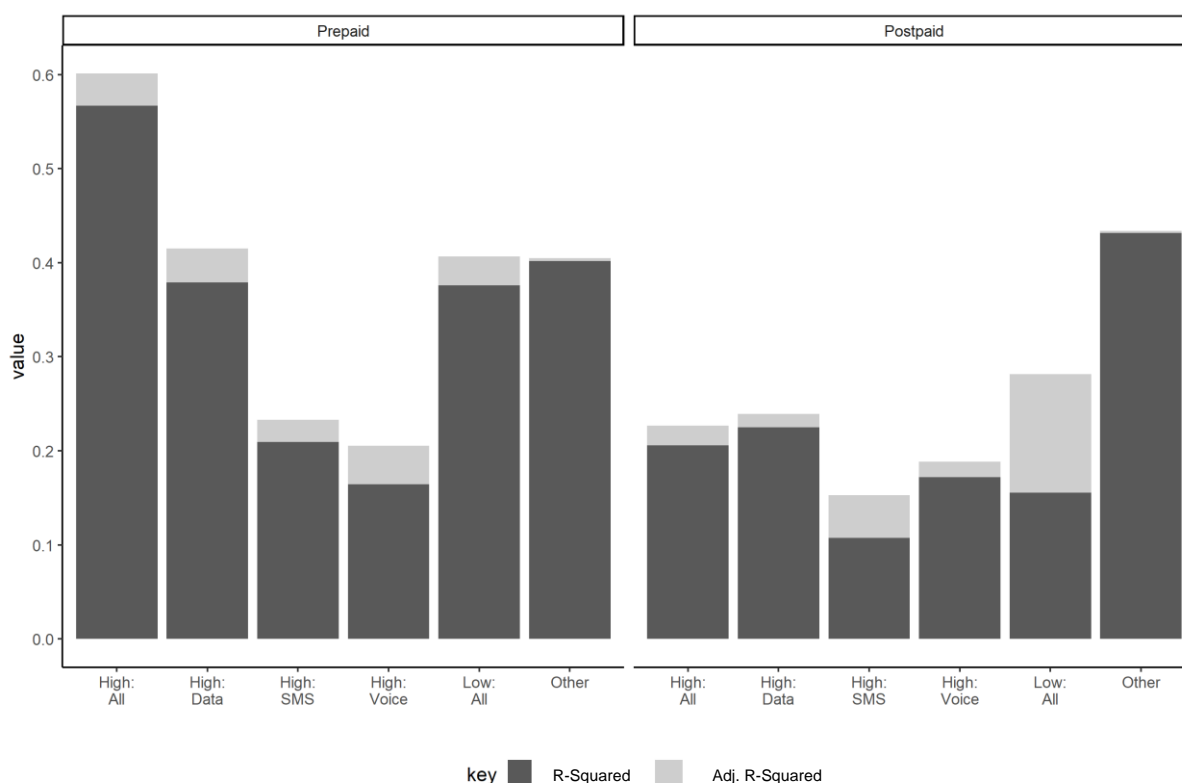
The range of the adjusted R-Squared is 11% to 57%. This means that across the models, on average, 89% to 43% of variations in expenditure are explained by something outside of the model. Implicit in SC and the NZCC's interpretation of these numbers is that the entirety of this unexplained variation, (for consumers categorized as "high expenditure") is that the customer is on the "wrong plan" due to a lack of transparency and inertia.

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[12] The regular R-squared can never decrease when a new independent variable is added to the model. The main benefit of adjusted R-squared is that it imposes a penalty for adding additional variables to the model, and only increases if the terms added to the model improve its explanative power more than would be expected by chance.

A.1.3. Not controlling for value added services will contribute to the poor model fit

In the absence of other value-added services (VAS), treating the residual as savings might be a reasonable assumption. However, consumers are purchasing more than just minutes, data and SMS messages when they select and plan. They also might be receiving a handset subsidy, interest free phone purchase or other VAS such as Spotify or international calling. The SC benchmarking analysis does not control for this, a point which is acknowledged in the SC report:[13]

> *It should also be noted that the analysis in this section focuses only on usage of the three core mobile services (mobile data, NZ voice, and NZ SMS) and there may be other reasons why people exhibit the purchasing behaviour that they chose. For example, they may want to be on a base plan that provides a subsidised or interest-free handset or that bundles value-added media services such as Spotify, or that offers better value for other services such as international calls or roaming.*

The fact that the SC analysis does not control for VAS may go a long way to explaining the poor predictive power of the models. For example, the NZCC's monitoring data suggests that at least 26% of post-paid customers are on an interest free plan.[14] This is also consistent with the apparent worse performance of the post-paid models, given VAS will be more material for post-paid. We therefore consider interpreting the residual as "savings" to be problematic, as large residuals could simply be the result of poor fitting model, rather than savings.

Note that in theory one could build benchmarking models that attempt to control for VAS. SC did not do this, and we have not attempted to do this given the short amount of time we have had to review the SC analysis and the lack of consistent or complete data on VAS across all providers.

A.1.4. Using an 80% prediction interval instead of 95% increases the number of customers SC categorise as being high expenditure

To determine which customers overspend, SC estimates an 80% "prediction interval" around the fitted values, and treats any observations that fall outside the 80% prediction interval as being over spenders. SC describes prediction intervals as follows:[15]

> *For an individual customer, a prediction interval gives the range within which their expenditure is expected to fall with a given degree of certainty (80% in this case).*

Figure A.1 illustrates that the width of the prediction interval directly determines how many customers are categorised as high expenditure. The width of this areas is determined by two factors:

- How good a fit the model is; and

- The assumed statistical confidence for the prediction interval.

Regarding the first factor, we already described that model is a poor fit. This means the model will have relatively wide prediction intervals, which, as SC notes,[16] makes the model less likely to find

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[13] SC, p.36.

[14] NZCC, *Annual New Zealand Telecommunications Industry Questionnaire – Aggregate Results 2019,* 12 March 2020. From: https://comcom.govt.nz/__data/assets/excel_doc/0022/212764/2019-Telecommunications-industry-questionnaire-results-12-March-2020.xlsx. Note that the 26% is calculated using the number of scribers with a payment plan as a proportion of total on-account subscribers. To the extent that payment plans are skewed towards residential, this n number will understate the proportion of residential post-paid customers with and IFP.

[15] SC, p.37.

[16] SC, p.55.

high expenditure customers. It does however, mean that those customers that are high expenditure are likely to have quite high savings.

Regarding the second factor, SC gives no justification for using the 80% interval, despite the fact that this assumption directly determines the proportion of the sample SC categorises as being high expenditure. It is common to use a 95% confidence interval in statistics, so this is also a plausible assumption that SC could have used. The difference between using an 80% PI and a 95% PI is shown in Figure A.3, using the same stylized example as Figure A.1.

Figure A.3: Stylised example of 95% vs 80% prediction interval
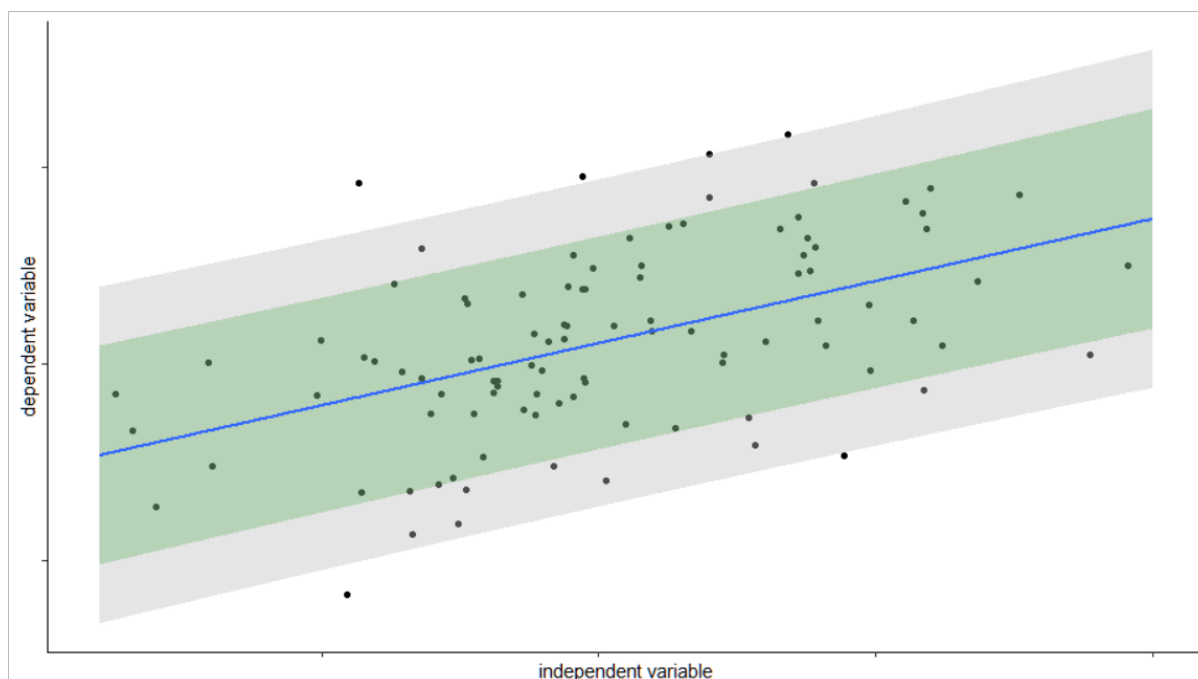
Note: green area represents an 80% prediction interval while the grey areas represents the additional area covered by a 95% prediction interval.

Had SC made this assumption, instead of finding that 6.94% of customers could save, the number would instead have been 3.35%, while the savings per customer would, by definition, be much higher at $61.66 vs the reported $48.65.

A.2. Deficiencies in the analysis suggest that the "savings" are lower and fewer customers are affected

We have identified a number of deficiencies in the benchmarking analysis which, once corrected for, reduce (but do not eliminate) the estimated savings and also decrease the number of affected customers:

▪ **Sharing plans**: We understand from the MNOs that plans which allow sharing of data are included the data set, but that the various customers that are sharing data cannot be linked in a consistent way across MNOs. Therefore, there are instances in the data where a customer will be on an expensive "leader" plan, but based on their individual usage this plan looks expensive. This could bias the savings found by the benchmarking analysis upwards.

- **Free Spotify Premium**: this is a value-added service that is straightforward to account for as it is an externally service with a known retail price, and therefore there is market benchmark for its value (at the time, $14.98 per month).

- **High expenditure customers who switched during the period**: the benchmarking analysis is framed as calculating the savings a customer would get if they switched, but the group of customers categorized as high expenditure includes customers who switched during the period. If the concern is inertia, it is not clear why these customers are included in the group of problematic customers.

We discuss each briefly in turn in isolation before setting out the cumulative effect of making all of the changes.

A.2.1. Sharing plans

Based on discussions with the MNOs and analysis of the data, we have removed customers with any plans that allow the sharing of data or are companion plans that can use a sharing allowance[17] and re-run the analysis. This is on the basis that these plans are not properly linked in the data and therefore the "leader", who is on a relatively expensive plan, may appear to be spending more than they should.

This results in the total sample reducing from 78,325 customers to 73,553 customers. The estimated savings are shown in Figure A.4 below.

Figure A.4: Savings excluding sharing plans

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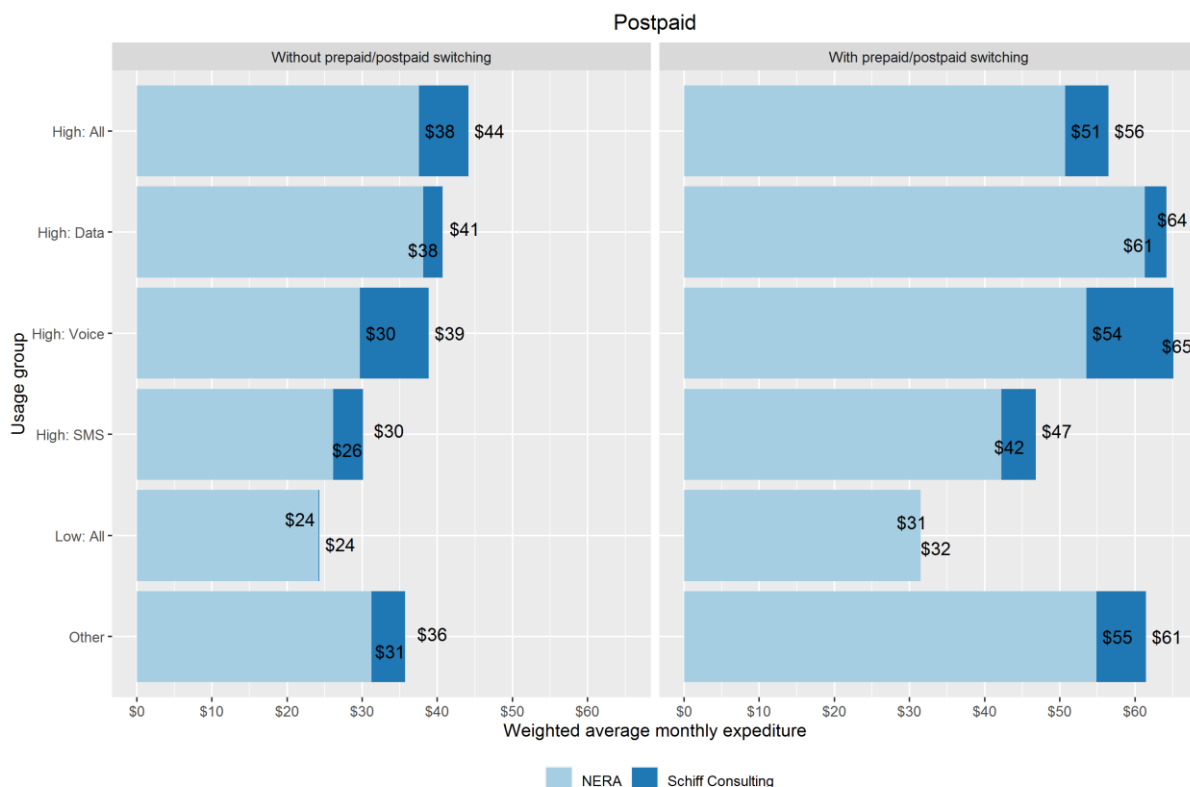
[17] This list of plans can be provided confidentially to the NZCC if required.
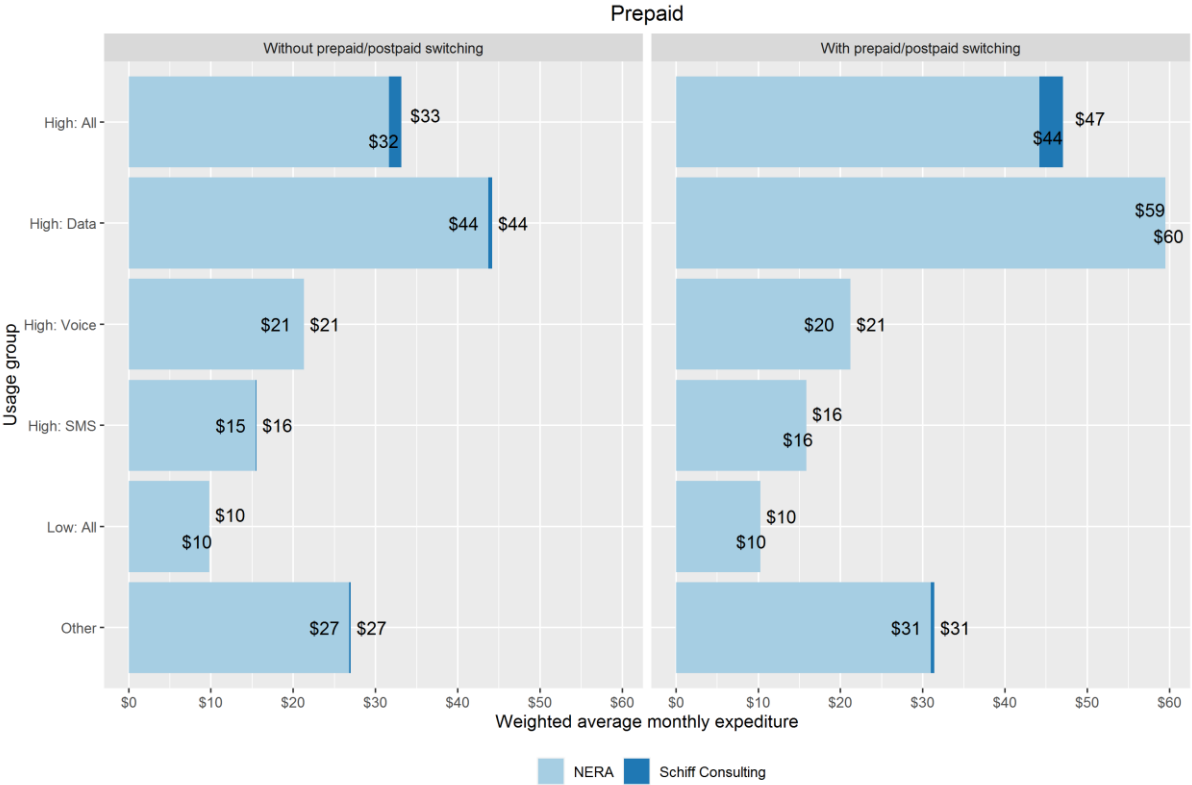
Overall, removing shared plans has the effect of changing the overall estimated savings from $48.65 to $43.62 if switching billing types is possible, and from $31.65 to $28.43 if we assume no switching between billing types. The proportion of the sample that are classified as having high expenditure reduces from 6.94% to 6.80%.

A.2.2.   Spotify premium

We have modified the analysis to treat free Spotify premium as an effective discount of $14.98, for those post-paid customers that have take-up the promotion offered by the service providers. Figure A.5 below shows the impact on the estimated savings by user group compare to the original SC numbers.

**Figure A.5: Savings treating Spotify as discount**
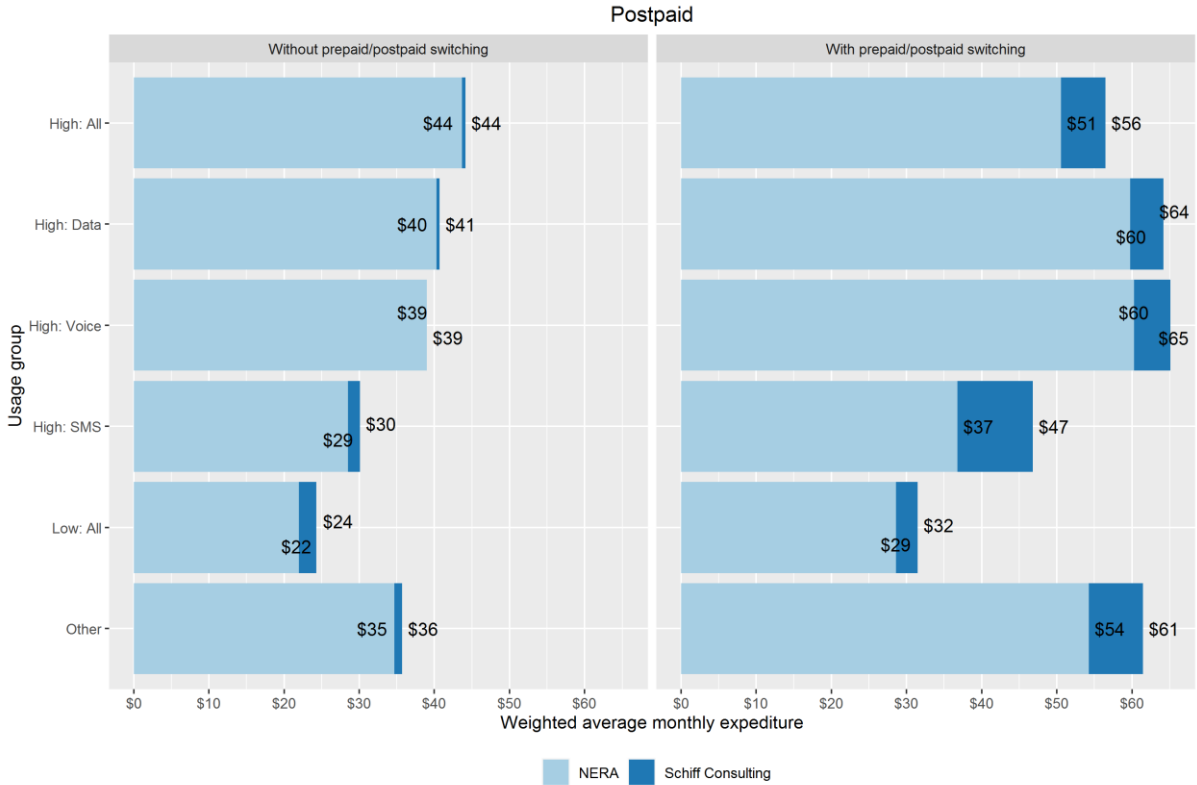
As this graph demonstrates, a material amount of savings for post-paid customers who can switch to pre-paid disappears. This makes sense intuitively as pre-paid plans are often "cheaper" because they do not have any VAS. Therefore, an analysis of savings might erroneously find savings from moving from post-paid to pre-paid if it ignores VAS.

Overall, treating Spotify as a discount has the effect of changing the overall estimated savings from $48.65 to $44.46 and reduces the proportion of the sample that are classified as having high expenditure from 6.94% to 6.93%.

A.2.3.   High expenditure customers who switched during the period

As discussed above, if a customer switched during the period, they are unlikely to be a concern from the perspective of inertia. We tested the impact of limiting the group of customers of concern to those that did not switch. Of the 6.94% customers that SC categorized as being high expenditure, 55.88% did not switch. If we do not count customers who switched and calculate the potential savings, we get the results in Figure A.6.

Figure A.6: Savings available to high spending customers that did not switch
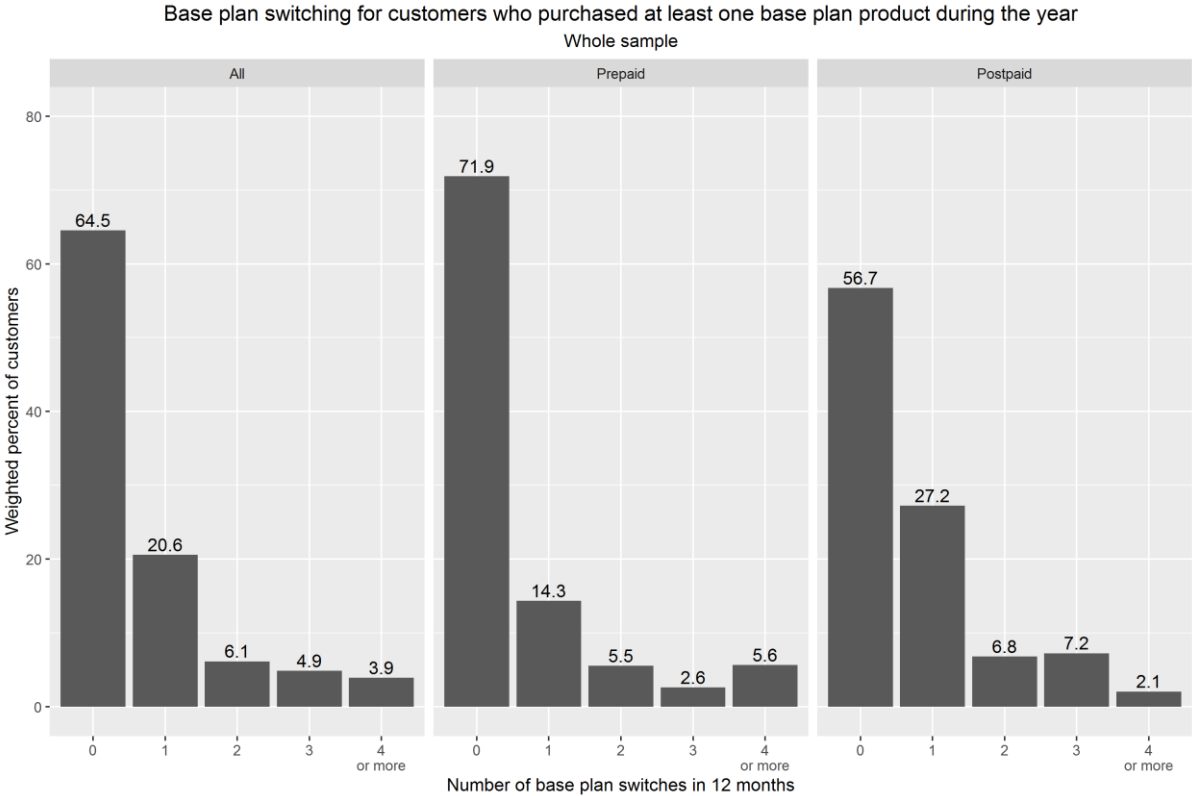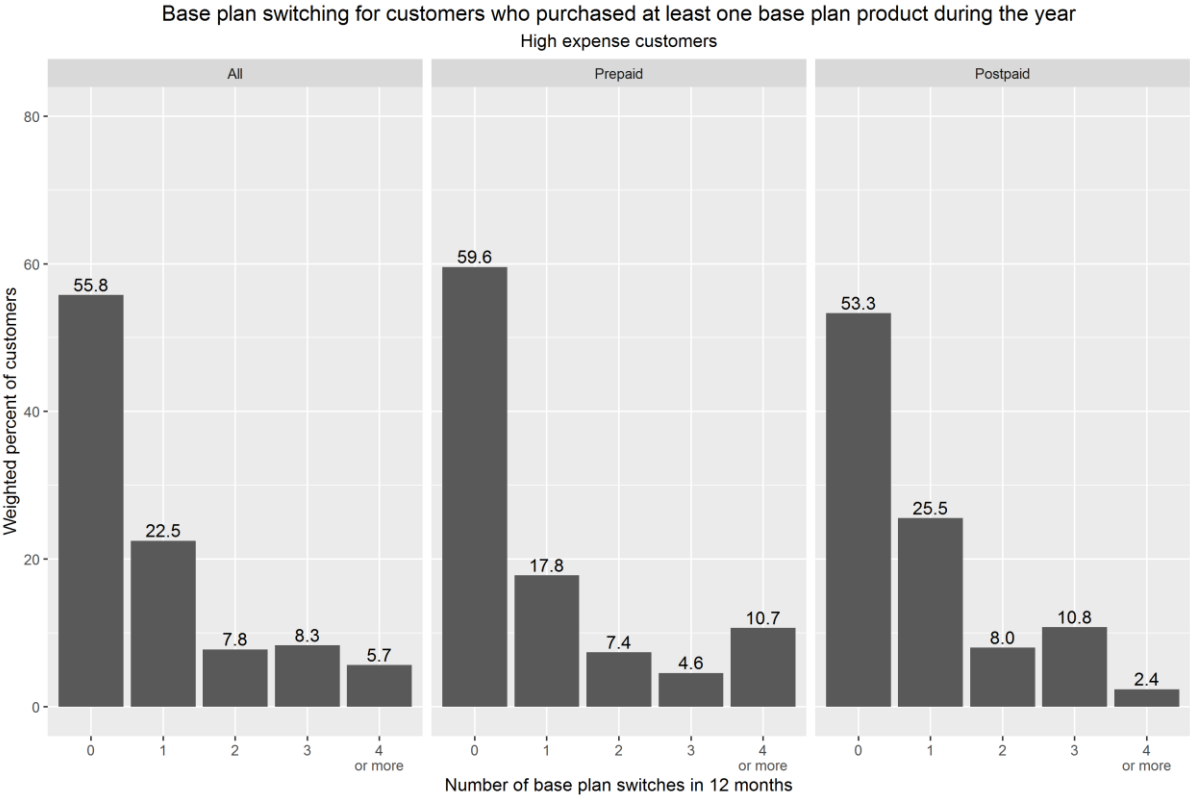
Postpaid

Prepaid
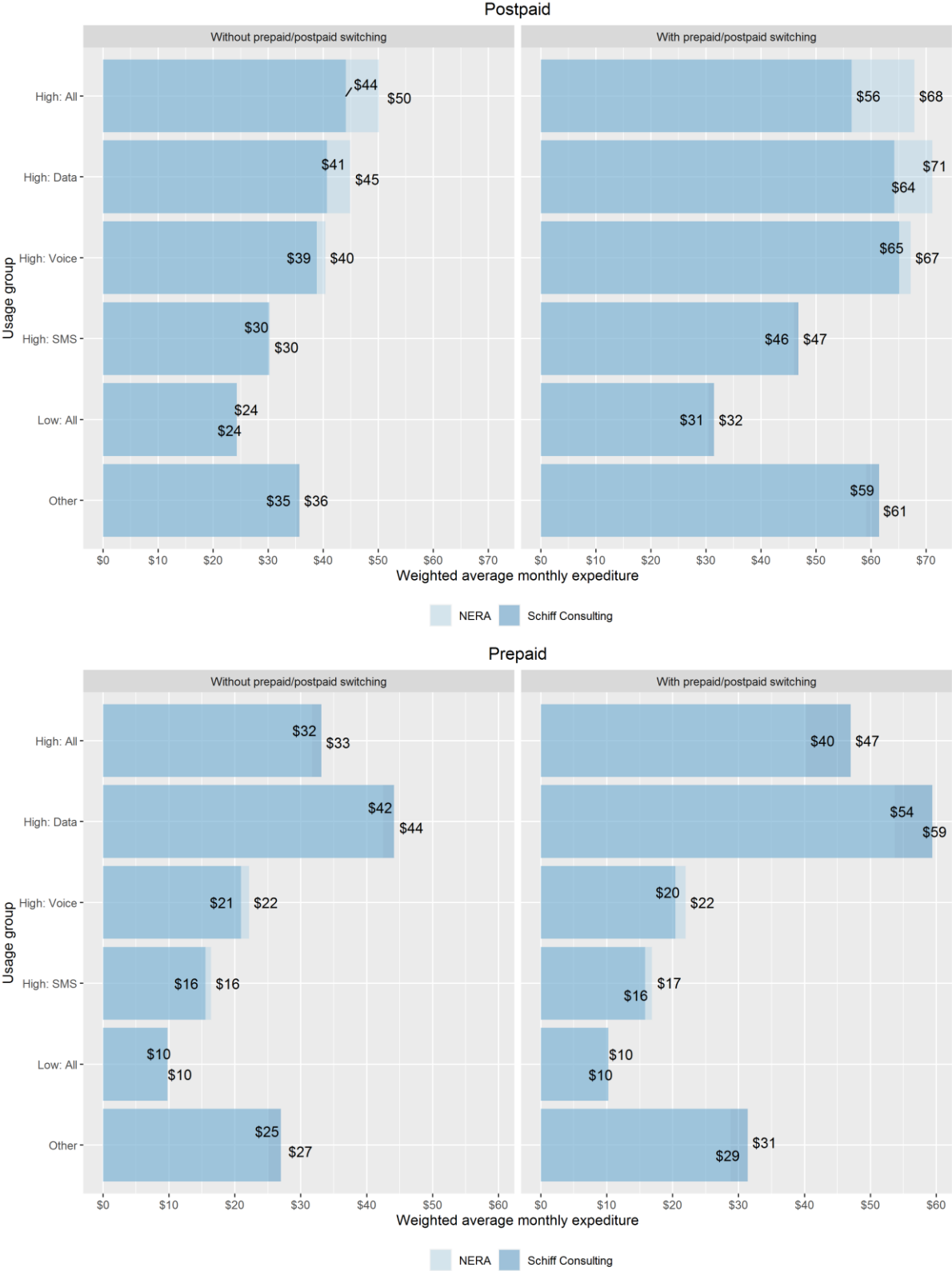
Overall, removing switching customers and focusing on high expenditure customers that did not switch has the effect of changing the overall estimated savings from $48.65 to $45.11 if bill payment

switching type is allowed, and from $31.65 to $30.14 if it is not. The proportion of the total sample that are classified as having high expenditure that did not switch is 3.88%, compared to the 6.94% SC obtains when customers that switched are included in the count. This is an interesting result, as it implies that the high expenditure customers who switched are actually those with the most savings, which seems inconsistent with a concern about inertia.

We also find that high expenditure customers appear to have switched more than the total sample. Figure A.7 below recreates Figure 16 from the SC report which shows the distribution of switch counts for the total sample as well as the same plot for the customers SC categorises as high expenditure. This shows that while 65% of the total sample did not switch, for the high expenditure customers this 56% of customers did not switch during the period. This is consistent with high expenditure customers are right planning themselves.

Figure A.7: Distribution of switch counts for total sample vs customers categorised by SC as high expenditure

Base plan switching for customers who purchased at least one base plan product during the year
Whole sample

Base plan switching for customers who purchased at least one base plan product during the year
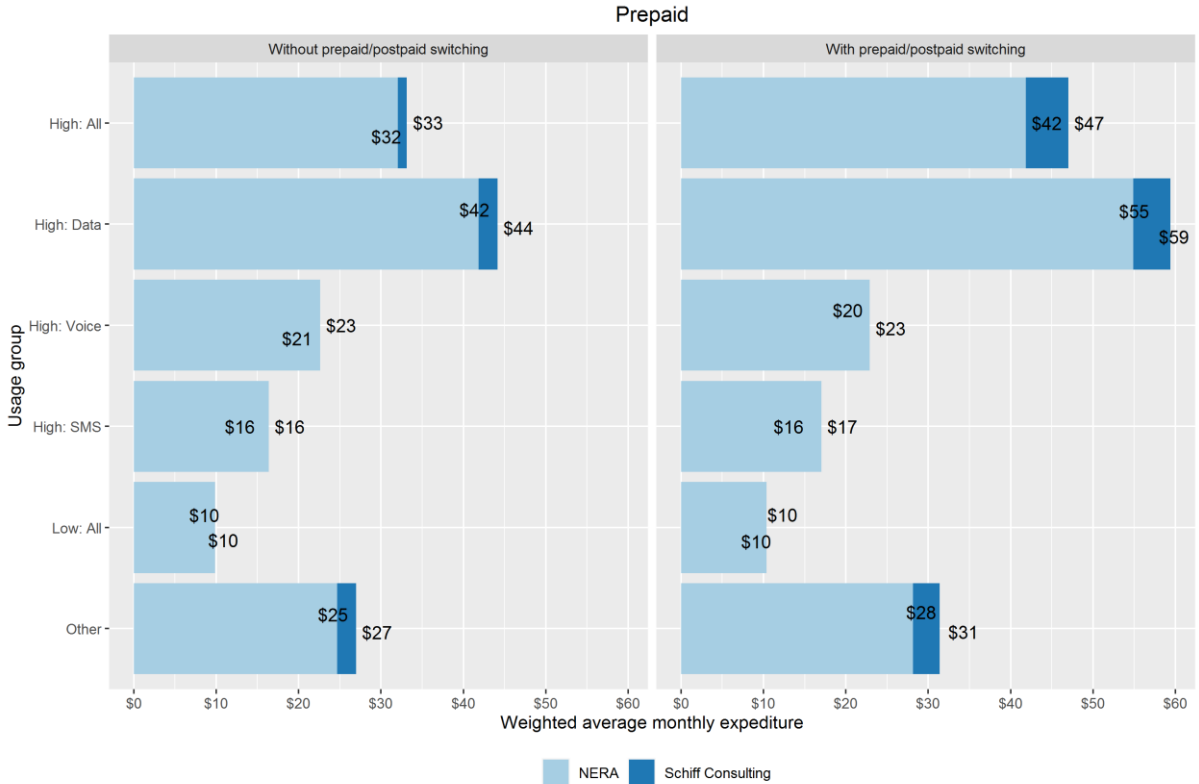High expense customers

A.2.4.   Cumulative impact of changes

In this section we present results for the cumulative impact of all the changes we have discussed (removal of sharing plans, treating of Spotify as a discount, and not counting high expenditure customers who have switched). The proportion of the total sample[18] that are classified as having high expenditure that did not switch is 3.96%, compared to the SC figure that 6.94% of customers are categorized having high expenditure.

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[18] Note that our sample excludes customers with sharing plans before doing any analysis, so our sample is 73,060 customers compared to the total SC sample of 78,325 customers.

Figure A.8: Savings of all NERA amendments (remove shared plans, treat Spotify as a discount, do not count customers who switched)
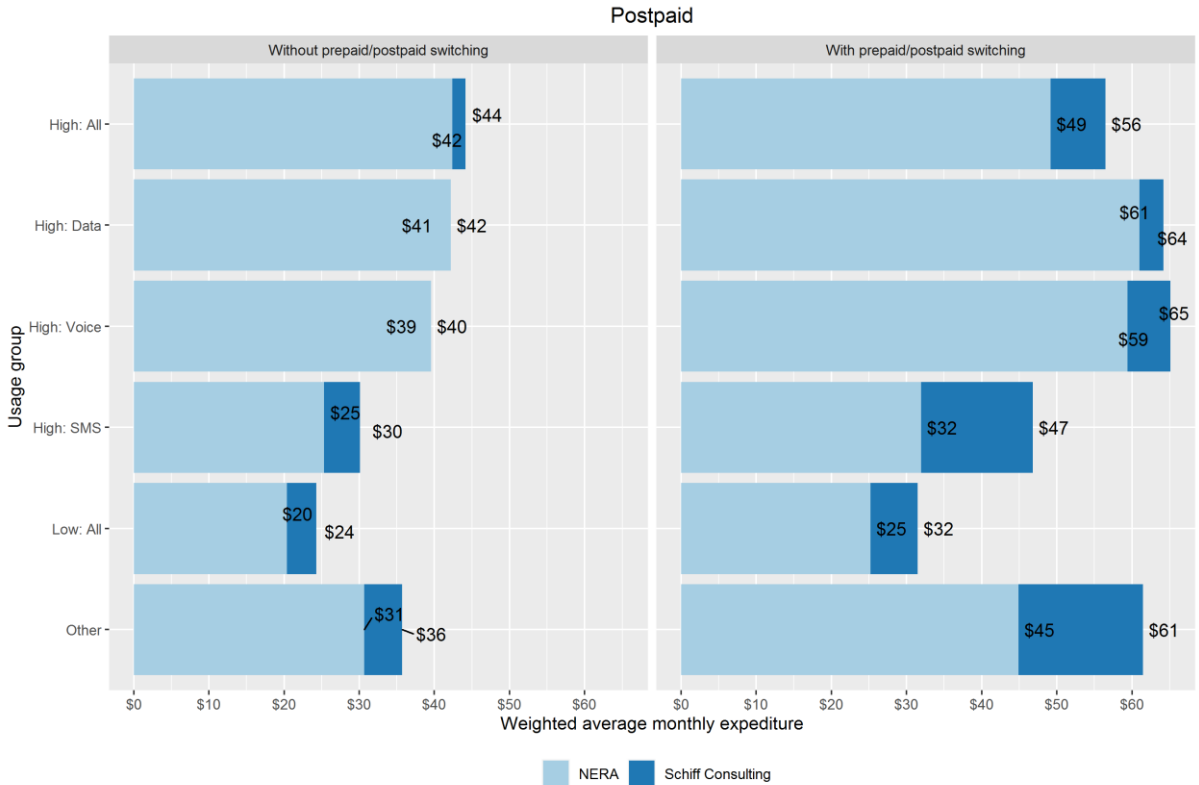
The aggregate average dollar savings for customers categorized as having high expenditure is shown in Table A.1 below.

Table A.1: $ savings for high expenditure customers, NERA vs SC results

	Without bill type switching	
	NERA (exclude sharing plans and treat Spotify as discount)	Schiff Consulting
Switchers included		
$ Savings (average)	$27.95	$31.65
% of sample affected	6.89%	6.94%
Switchers excluded		
$ Savings (average)	$27.49	30.14
% of sample affected	3.96%	3.88%

	With bill type switching	
	NERA (exclude sharing plans and treat Spotify as discount)	Schiff Consulting
Switchers included		
$ Savings (average)	$39.45	$48.65
% of sample affected	6.89%	6.94%
Switchers excluded		
$ Savings (average)	36.91	45.10
% of sample affected	3.96%	3.88%

In conclusion, our adjustments have reduced average savings across the whole market by between $2.65 and $9.20 depending on the measure chosen and the impacted segment of the market drops to ~3.9% if customers who switched are excluded.

Appendix B. Right planning analysis

This analysis involves "right planning" customers by directly comparing actual expenditure on an alternative plan. This suffers from the same issues we have already discussed concerning VAS. That is to say, when SC match a plan to a customer's current usage, they are only matching data, voice minutes and SMS messages but do not account for whether the plan being switched too is, e.g., eligible for a handset subsidy. It is however a more direct method of calculating savings.

Our review of this analysis was higher level than the benchmarking analysis, given relatively more emphasis is placed on the benchmarking analysis by SC (at least in terms in raw page count).

Our review revealed four issues:

▪ The same issue with sharing plans as for the benchmarking analysis;

▪ The SC analysis inadvertently understates the price of plans that consumers can switch to, resulting in the perverse outcome that most customers can save money simply by "switching" to the plan they are already on;

▪ The set of plans SC assumes customers can switch to includes grandfathered plans; and

▪ The analysis includes customers who switched during the period of the analysis. These customers have therefore likely "right planned" themselves, or at the very least are not inert

B.1. Drop sharing plans

As with the benchmarking analysis, the inclusion of customers on plans which allow sharing may distort the analysis – customers may purchase a plan that appears more expensive for the leader, but the average per customer cost spread across the group on the plan will be lower. Therefore, these customers will show as being able to save money under the SC analysis.

The impact of dropping the sharing customers is shown in Table B.1.

Table B.1: Savings for customers consistently under quota after removing customers on shared plans

	Post paid		Pre-paid	
	NERA	**SC**	**NERA**	**SC**
Savings ($)	$9.46	$11.58	$4.36	$4.36
Proportion of customers consistently under quota who can save (%)	78%	78%	71%	71%

Source: NERA analysis, SC analysis. Note: proportions have been rounded.

This shows that dropping sharing plans principally effects post-paid savings and reduces the estimated savings by $2.12. Removing sharing plans also results in the proportion of post-paid customers who are consistently under quota from 35.8% to 34.6%.

B.2. Customers can save money by "switching" to their existing plan and by switching to grandfathered plans

For the analysis in sections 7.2.1 and 7.2.2, SC need a list of plans that can be switched to. SC derive the list of plans that can be switched to by finding products that accounted for more than 1% of

purchases for each MNO during the period. To determine the price for these plans SC derives a "price" for each plan by taking the *average* of the amount that appears for that product in the billing data.

The problem with this approach is that customer bills include reversals (negative charges) and partial charges. This can occur, for example, when a customer changes plans. This has the effect of materially dragging the average down such that, for example, a $60 plan has an average amount charged of $55. The SC analysis in this case assumes the price for the $60 plan is $55, even though customers on this plan are actually charged $60. The SC analysis therefore assumes that a customer on the $60 plan can save $5 a month by "switching" to the plan they are already on, but this saving is a fiction. A simple method to find the actual retail price in the data is to calculate the *maximum* value charged for that product instead of the average.

In addition, the SC list of plans customers can switch to includes plans which had been grandfathered and were not actually available to purchase. We have confirmed with each MNO which plans were available in market during the period and removed them from the list of plans and come up with the following list of plans that can be switched to and their retail prices.

Making these corrections to the analysis results in the following changes to the 7.2.1 analysis, which the NZCC cites.

Table B.2: Savings for customers consistently under quota after removing customers on shared plans and correcting list of plans that can be switched to

	Post paid		Pre-paid	
	NERA	**SC**	**NERA**	**SC**
Savings ($)	$18.15	$11.58	$3.20	$4.36
Proportion of customers consistently under quota who can save (%)	20%	78%	58%	71%

Source: NERA analysis, SC analysis. Note: proportions have been rounded.

We find a dramatic reduction in the proportion of customers who are consistently under their quota who can save, with the proportion of these customers decreasing by 58 percentage points for post-paid and 13 percentage points for pre-paid. This is not surprising given the SC analysis incorrectly assumes customers can save money by "switching" to their existing plan.

When the NZCC states that just over 25% of post-paid customers could save money by purchasing a cheaper plan that still covers their usage, this 25% is derived by multiplying the 78% above by the 34.6% of customers that are consistently under their quota. If we instead multiple the 34.6% by the 20% above, we find that approximately 7% of post-paid customers could save money in this manner. I.e. the NZCC's statement should be that approximately 7% of post-paid customers could save $18.15 by switching to a cheaper plan that still covers their usage. Therefore, while the savings are larger, the affected group is less than half the size found in the original analysis.

B.3. Only considering customers who didn't switch during the period further reduces the number of customers who could save

As a further change, if we focus only on those customers who did not switch during the period, to remove customers who "right planned" themselves during the period and narrow in on "inert" customers, the proportion of customers who could save reduces further.

Of the customers who could save by purchasing a cheaper plan, the proportion that did not switch (i.e. the relevant part of the sample when considering inert customers) is set out below.

Table B.3: Proportion of customers consistently under data quota that did not switch during the period

Billing type	Proportion that didn't switch
Post-paid	55%
Prepay	85%

Source: NERA analysis

Table B.1: Savings for customers that did not switch, are consistently under quota, after removing customers on shared plans and correcting list of plans that can be switched to

	Post paid		Pre-paid	
	NERA	**SC**	**NERA**	**SC**
Savings ($)	$23.56	$11.58	$3.02	$4.36
Proportion of customers that are consistently under quota	34.6%	35.8%	6.7%	6.7%
Proportion of customers consistently under quota, that did not switch	55%	N/A	85%	N/A
Proportion of customers consistently under quota that did not switch, who can save (%)	13%	78%	59%	71%
Proportion of customers that are consistently under quota, could save by switching and did not switch	2.5%	25%	3.4%	4.8%

Source: NERA analysis, SC analysis. Note: proportions have been rounded.

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