Analysis of
Climate Change Survey Data

A Memorandum Report

By : Tithra Chap

Dear Daisy,

I am writing this report in response to your questions regarding the climate change survey. After analyzing the data thoroughly, I found the answers related to your six questions. To make my answers more concrete and acceptable, I have added up detail explanations regarding the analyzing processes to some of the difficult answers and how I come up to final decisions. I also know that you have less idea about the statistical calculation techniques, so I have made my explanations simple to ensure you will not miss any point.

Firstly, I would like to present the overall summary of the monthly payment as to respond to your first question. The total amount of monthly payments from all respondents who are willing to pay is $92682.00. In addition, I also found that up to 52% of respondents are willing to pay less than $130. Although the maximum payable amount is up to $1349, extremely few Australians (about 1%) are willing to pay more than $1040. The rest of the people (about 47%) rest on a wide range of affordability from $130 to $1039.

To give a comprehensive answer to your second question, I have setup contingency tables in order to locate any relationship between the amount of monthly payments against the level of people's concerns. These contingency tables contain crossing points of information (with real numbers as well as percentages) between all levels of concern and a range of monthly payment amounts that I have categorized into 5 groups (from $0-$299, $300-$599, $600-$899, $900-$1199 and 1200-1500). For the ease of explanation, I assign the level from 1 to 5 for people's concerns where 1 represents the lowest (not concerned) and 5 represents the highest (extremely concerned). Similarly, for monthly payment, level 1 is for the lowest ($0-$299) and level 5 is for the highest ($1200-$1500).

Based on these tables, I found that people who are willing to afford paying at level 1 are up to 70% of all Australians. Among these people, about 45% and 35% are having their concerns at level 3 and 4 respectively about the climate change. In addition, for those who are having their concerns at level 3, only about 21% of them are willing to pay higher than level 1. Similarly, only about 27% of people whose concerns are at level 4 can afford to pay higher than level 1. It can be inferred that their levels of concern and their willingness to pay are unlikely to be related because their concerned levels are at level 3 and 4 but their willing to pay are mainly at level 1. I also notice that among the extremely concerned Australians (level 5), about 31% of them are willing to pay at a lower rate than level 3 of monthly payment, while only 46% could pay higher than level 3. This additional information shows more uncertainty of relationship between level of concern and level of affordability.

However, the tables also reveal that up to 81% and 69% of the people whose concern levels are at level 1 and 2 respectively are only willing to pay at level 1. Furthermore, their willingness to pay higher reaches a maximum of level 2 of monthly payment (for level-1 concerned people) and level 3 of monthly payment (for level-2 concerned people). This explains a noticeable relationship of concern level and affordability since their concern levels are low and so do their willing to pay.

Based on the above evidences, I am confident that there is a weak positive relationship between Monthly Payment and Concerned which means the amount that people are willing to pay does not increase in accordance with their level of concerns, even though it happens sometimes.

Regarding your question 3(a) which inquires to learn about the average of monthly payment of people who are willing to pay for renewable energy in Australia, I can simply say it is $231.70 based on the survey data. However, this average number is based on a statistical number taken from 400 respondents. I am afraid that in real population of all Australians, this number might not be the same. Therefore, I have conducted an analysis which is able to predict this average number in a range of possibilities. The result reveals the possible range of plus/minus $26.19 from the central point I have mentioned earlier ($231.70). To say in a simple way, the average of monthly payment

which people are willing to pay is between $205.32 to $257.89. Within this range, I am 95% sure that my prediction is correct. Since it is prediction from a test and I cannot say it is 100% correct.

Similarly, to your question 3(b) which ask for the proportion of all Australians who believe that Australia should financially support developing countries in their efforts to address Climate Change. I have conducted the analysis of the data you have given. The analysis reveals the central value of the proportion to be 421 which is 60.25% of all respondents. As I have mentioned in the previous answer (3a), this is just a statistic number which is based on 400-sample of real population. So, I have done further analyzing test to find out the range of possible proportions that can a better reliability. As the result, the range comes out with a plus/minus 4.8%. Therefore, it can be interpreted that the proport of all Australians who think that developing countries should be financially supported by Australia is between 55.45% to 65.05%. For this test result, I am 95% optimistic that it is correct.

Now let's discuss about your question 4(a) regarding the different viewpoints between a national daily newspaper and the industry energy groups over the proportion of Australians who have "already installed" or "plan to install" the solar panels. According to survey data, I can immediately locate the proportion of all Australians who have already installed or plan to install the solar panels which lies at 44.22%. This figure gives an idea that parallels with the claim of industry energy group who said the proportion is higher than 25% and, in opposite, rejects the statement of the national daily newspaper. Since that data holds only 400-population sample, this cannot be the final result yet. Therefore, I have run a further test (hypothesis test which tells whether the claim by the national daily newspaper is acceptable using the survey data) to confirm the answer. The result of test does repeat my claim above that the proportion of Australians who have already installed or plan to the install the solar panels is higher than 25%. Since the test is just a prediction, it still has 5% chance of being wrong about the claim. This 5% chance is part of the test parameters which is required by hypothesis test.

In your next question 4(b) also discusses about the controversial statement between these two industry parties which I can answer using similar statistical technique. In relation to average amount of the up-front payment which all Australian are willing to pay, I found it to be approximately $20388 under with my quick calculation from the given survey data. This number seems to support the report statement of the national daily newspaper and disagree the claim of industry energy groups who said to be at least $21500. Again, I cannot prove it without a hypothesis test since the data is only from 400 respondents. The hypothesis test result indicates that there is no enough evidence to reject the report statement from national daily newspaper that the average amount of money of all Australians who are willing to pay up-front is less than $21500. Similarly, this test has been conducted with the setting of 5% chance of wrong prediction.

In order to learn whether the Income can provide any explanation to the amount of Monthly Payment, in your question 5(a), we need to find the level of linear relationship between them based on their numerical values. This linear relationship can project whether or not the monthly payment depends on the income. There are a few ways that I can investigate this linear relationship. Firstly, I have plotted a scatter chart which is one kind of graphical presentation, telling whether the increment of income value will accompany the increment of monthly payment. Secondly, I have also tested the covariance as well as coefficient of correlation which are the statistical techniques to uncover the strength and types of linear relationship between the income level and the amount of monthly payment. As the result, those tests above yield a strong positive linear relationship between income and monthly payment. It means if an Australian has high income, it would very likely that the person is willing to pay more amount of monthly payment.

For a feedback to your question 5(b) regarding similar problem of whether Age may have any relationship to the amount of monthly payment, I have employed same statistical techniques by using scatter chart, covariance and coefficient of correlation. The results from those tests have

confirmed that there is barely any evidence links to the existence of linear relationship between Age and Monthly Payment. In other word, the increment of the amount of monthly payment does not depend on whether a person is younger or older.

Based on the discovery above, I am certain that the Income is the most influent factor which drives people's willingness to pay more on the monthly payment or the other way round.

Your concern in question 6(a) is correct. Sample of 400 Australians might not be able to accurately predict those Australians who are Aware and Very Aware about the climate change. As requested in the question, I have done analytical tests to find out what should be the appropriate sample size for next-year survey based on the range of plus/minus 3% of the current proportion of all Australians who are Aware and Very Aware about the climate change. The tests have been conducted with three different confidence levels: 90%, 95% and 99% by using the survey data. This confidence level is part of the test requirements which determines how much accuracy we want from the test result. The outcomes of the tests suggest the sample size to be 603, 856 and 1479 for confidence level 90%, 95% and 99% respectively. In case you are doubtful or hesitate about the accuracy level which caused by insufficient sample size, you can always choose the test result that is projected by the highest confidence level i.e. 99%. However, if you have budget constraint or limitation, I suggest the lowest confidence level which requires the least number of sample size. You would also want pick 95% of confidence level for a good balance of accuracy of the study and the budget.

I notice the similarity of the issue you have mentioned in question 6(b). But this time you would like to know the appropriate sample size for an accurate prediction of the average of Monthly Payment within a range of plus/minus $20. To answer this question, I have carried out another three tests with different confidence levels like I did earlier. These tests will output suggestions of sample sizes that allow you to survey the average of Monthly Payment more accurately. As the result, the tests suggest the appropriate sample sizes of 481, 682 and 1178 for the respective confidence level of 90%, 95% and 99%.

If you wish to conduct the survey for next year which can satisfy both requirements, I suggest you choose the sample size as recommended by my answer in question 6(a). My suggestion here depends on the fact that the sample size which can guarantee an accurate study of population's proportion is greater than the one which is suggested for an accurate study of population's average. For instance, if you wish to have 95% confidence level, you should pick 856 sample size instead of 682 for both studies of Australian's proportion and average of monthly payment.

Afterall, I hope my detail answers above resolve your doubts related to this climate change survey. I am pleased to assist you more for any further questions that you have in mind.

Best Regards,

Tithra Chap