



Mobile Data in Handcuffs:

How Limited Mobile Data Affect People's Behavior on Mobile Data Usage and Megabyte Allocation in Different Locations.

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Abstract

In the era of mobile data, there have been many changes regarding human behavior on data consumption. Having abundant or “unlimited” data is becoming more and more common. However, what would happen to the behaviors of people if they were under extreme conditions of data limitations. This study shows the behavioral outcome of the participants of this survey when exposed to limitations regarding data consumption. Some of the most chosen applications in terms of importance when travelling abroad and when staying home were mobility applications, communication, social media, and restaurant search downloads. There exist many different types of research on mobile data but very few highlight the importance of behavioral change and data prioritization. Under the umbrella of mobile data, many different businesses are being disrupted due to the mass interconnectivity of people and differentiated networks. Using real-life data, this study shows us that people do prioritize their applications when exposed to certain data limitations in different scenarios. The outcomes of the survey show us businesses could be affected by mobile data and the pulling of information that participants have. The exposure to limited data further increased this disruption as people only require applications that were necessary and most of these were related to some specific industries such as tourism and gastronomy. This study shows us that people in general, prefer to download information with an average mean of 70.2 megabytes rather than upload information with an average mean of 29.8 with a certain pattern in application prioritization.

Keywords: Mobile data, data, megabytes, pulling information, download, pushing information, upload, behavioral outcomes, application prioritization, industries threatened

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Resumo

Em tempos modernos com o crescimento da importância do mundo digital, tem havido muitas mudanças no comportamento dos utilizadores de dados móveis. Cada vez mais, os consumidores têm acesso a tarifários de dados móveis ilimitados. Porém, o que aconteceria se o uso de dados viesse a ser limitado? Este estudo analisa as mudanças nos comportamentos dos participantes quando confrontados com limitações no tarifário. Parte das aplicações mais importantes para o consumidor são aplicações dos setores da mobilidade, comunicação, redes sociais e pesquisas de restaurantes. Existem diferentes investigações na área dos dados móveis, mas poucas das mesmas realçam a importância das mudanças no comportamento e na priorização dos dados. Com o crescimento dos dados móveis, múltiplos negócios têm sido perturbados pela interconectividade dos consumidores e pela diferenciação das redes. Através de dados reais, este estudo mostra como as pessoas priorizam as suas aplicações quando expostas a limitações nos dados móveis. Os resultados da nossa pesquisa mostram-nos que, de facto, certos negócios podem ser afetados pelos dados móveis e pela sondagem de informação sujeita aos mesmos. A exposição à limitação de dados continuou a aumentar esta distorção, visto que os consumidores só usaram as aplicações que consideram mais importantes, a maioria dos quais relacionados com indústrias específicas como o turismo e a gastronomia. O estudo concluí que os consumidores no geral preferem ter velocidades de download de 70.2 megabytes por segundo do que velocidades de upload de 29.8 megabytes.

Palavras chave: dados móveis, megabytes, sondagem de informação, download, upload, mudanças comportamentais, priorização de aplicações, indústrias ameaçadas

Título: Dados Móveis Algemados: O Efeito da Limitação dos Dados Moveis no uso de Dados Móveis e na Distribuição de Dados Móveis em Diferentes Áreas

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List of Abbreviations

SM	Social Media
Q	Question in Survey
Uit	Idiosyncratic Error
Ai	Individual Fixed Effects Term
WTP	Willingness to Pay
Accom	Accommodation
ID	Unique Participant Identification
Comm	Communication
Rest	Restaurant
EU	European Union
MB	Megabyte
GB	Gigabyte
P	P-value

1. Introduction

1.1 Topic and Relevance

Mobile smartphones and mobile data are one of the few technologies people have been tied to for the past years. With the rise of mobile smartphones and an increasing amount of data, social platforms have been increasing. 2.26 billion people are using Facebook, 1.9 billion people are using YouTube and around 1 billion are using Instagram (Ortiz-Ospina, Ritchie, Roser 2018). The boom of technology enabled companies to mass produce these handheld devices that give users more freedom in connectivity, communication, travelling, and a thriving network of pushing and pulling information. Mobile data has been increasing to the point where there will be 231 million 5G connections in 2025 (GSMA,2019). By the end of 2025, there will be 481 million unique mobile subscribers in Europe alone (GSMA, 2019). In North America, mobile users are approximately 400 million users (O’dea, 2020). By 2024 the average data usage per person will have increased from 10 gigabytes per month to 56 gigabytes per month in North America followed by a 5.8 gigabyte to a 32 gigabyte per month for Europe (Statista, 2018). This study will investigate the behavioral changes of people using mobile applications and the effect of limitations of mobile data consumption.

In 1992, the first text message was sent. In 1993, the telephone company Nokia decided to implement this new and disruptive technology within their phones so people could communicate with ease. In 2002, more than 250 billion SMS messages are sent worldwide (Gayomali, 2012). The change in technology allowed for new platforms to rise such as iOS and Android with more sophisticated softwares that allows new applications to be used (Dolgaya, Phongtraychack, 2017). In 2001, EDGE (Enhanced Data Rate for GSM Evolution) was launched with a download speed of 10kb/s which was a bigger breakthrough than the dial-up internet connection. In 2005, a revolution of mobile technology was created with 3G giving users approximately 7.4 MB/s of mobile download speed. Currently, companies are using 4G technology which enables users to download information at a speed of 100 MB/s. (Balasanova, 2015). In Great Britain alone in 2010 only 43% of people aged between 16-24 had access to mobile data. In 2015, this number has more than doubled reaching 100% of people aged between 16-24 with access to mobile data. With the advancement in mobile technologies and smartphones, cheaper data plans, more and more advanced mobile applications and higher income, the willingness to pay of consumers as well as

travelling have increased. Mobile data has reached globally 4 billion people and is becoming more and more widespread than ever (Clement,2019).

One of the major factors is that mobile data has become less expensive and affordable. Prices of mobile data have decreased drastically where in some countries such as India, the price for 1 GB of mobile data is as low as approximately 0.26\$. France has an average price per GB of 2.99\$ while the UK is a bit more expensive with 6.66\$ per GB (Cable, 2019). In 2007, the cost of roaming per 1 GB of internet was 6.00 Euros while in 2015 the price significantly dropped to 0.2 euros (Europa,2018). Therefore, people can afford more data and allow them to consume more and more information. The implementation of Roaming Like at Home (RLAH), introduced on the 15th of June 2017, enables people in the EU that travel to other countries that are part of the EU to pay the same fees as their domestic prices without extra charges. (Europa, 2020). This incentivizes people to use more mobile data travelling abroad. When more people travel and have more access to mobile data, the online space is going to grow, and more information will be uploaded/downloaded on numerous platforms. This could also change people's perspectives and how frequently they will use certain applications when they are abroad. Recently, global travel has accounted for 1.4 billion travelers which was a rise of 6% from 2017 (World Tourism Organization, 2017). The usage of internet has increased drastically from 2017 where users consumed 11.5 exabytes of mobile data (11.5×10^9 GBs) to an expected leap of 78 exabytes of global consumption in 2022 (Clement, Statista, 2019). This shows that with a decreasing price threshold for mobile data and an increase in global usage, people will consume more data. When both mobile data and information about the tourism sector in terms of travelling increase, it creates a fusion of information where the consumer now has access to abundant and high-quality information abroad. New software advancements on both mobile and tourism platforms increases the ease of information "pushing" and "pulling" and are allowing consumers to use this information wherever they want. This is changing the fundamentals of communication from a "push" based system to a "pull" based system (Coussement and Teague, 2013). Prior to the technological boom in mobile data, management in firms believed that they should only push information as much as they can towards consumers in order for them to reach their target segment known as pushing information (Coussement and Teague, 2013). Pulling information is the concept where consumers engage and receive information from different marketing campaigns and different promotional tools such as websites, search engines and maps (Yoo, Lin, Beldona, 2012). Location Based Services (LBSs) involve

using a consumer's location to further communicate with the consumer. This allows for a more extensive information pull and enhances the user experience (Yoo, Lin, Beldona, 2012). In 2017, 52% of smartphone users accumulated used mobile data on online videos/entertainment, 54% used their smartphones for social media applications and 42% on online shopping (Statista, 2017).

1.2 Aim of Research

This research paper aims to study how people's behaviors regarding based on data limitations. The different behaviors regarding applications that people see important while travelling based on certain data limitations will be observed. This will show the behavioral changes of travelers with limitational constraints on the amount of mobile data each participant attains to show whether people are more prone to push or pull information depending on different travel situations. The methodology used in this research paper is based on a meticulous survey with different mobile applications sent randomly amongst different participants that quantifies the usage of mobile data abroad or at home with varied mobile data constraints. This survey is conducted to understand the behavioral differences that people display when they are exposed to different amounts of megabytes. The main issue is to see the tradeoff between the applications based on certain categories such as social media and mobility the participants use and the limitations of mobile data. The applications will then be correlated to different industries, mainly, the tourism industry as most of these applications are used by travelers.

The thesis shows us **6** important results:

1) No matter what amount of data the participants were offered (200 and 50 megabytes) or different demographics the participants fall in, all of them would prefer to download information than to upload their experiences and information abroad and at home.

2) The participants prefer to upload at home much more than while travelling. Megabytes used to upload are significantly higher at home than abroad.

3) Travelers who are provided with a lower megabyte package allocate their megabytes in a non-linear form. They do not develop a stable way to allocate their data and the allocation is abrupt in their changes in terms of relative importance. There was no specific way the participants allocated their megabyte data consumption.

4) Travelers with higher and lower megabyte constraints chose the same applications abroad for their travels as priorities. The applications were based on the categories of communication, mobility and restaurant pulling of information.

5) Some industries could be disrupted because of the increase in mobile data and information push and pull. This is because the dynamic of traditional methods is being overruled by the mass mobile data market.

6) Participants have a pattern with the way they allocated their megabytes based on certain travel applications.

2. Literature Review

The following review provides an establishment of mobile technology and mobile data and how it might affect some industries. The literature review highlights that people use mobile data increasingly and currently have more freedom to upload and download information with ease.

Table 1

Overview of existing studies of mobile data and the behavioral and industrial effect on consumption

Authors	Year	Effect on Mobile Data	Database	Methodology	Findings
Mo Kwon, J., Bae, J. (Stephanie), & Blum, S. C.	1976	This research paper shows us that peoples' behaviors changes towards applications in the tourism industry	University Students	Using technology acceptance model in order to see the potential of adoption with mobile data and change	More than half of the respondents mentioned that they never used applications from big hospitality firms
Martha Anne Coussement and Thomas J. Teague	2013	This research paper shows us that people are nowadays always connected which supports the dynamic between hospitality industries and the guest	Customers with access to mobile data	Conceptualizing framework from the beginning of internet which then migrated to the use of mobile data	This research paper states that consumers now have more freedom to push and pull information which effects their behavior with mobile data
Garry Wei-Han Tan and Voon Hsien Lee, Binshan Lin, Keng-Boon Ooi	2017	This research paper shows us the behavior of purchasing of mobile applications related to the tourism industry	474 participants	Partial Least squares was used in order to conceptualize the framework	Mobile phones nowadays are becoming the preferred medium for consumers
Leung, Wang, He	2017	This research paper shows us the behavior of people in the mobility industry and how different mobile phone data has a great potential to further exploit behavioral patters	N/A <i>Theoretical Study</i>	Research with different articles based on mobility and mobile data	Mobile phone data can be used to trace back people's behaviors in the mobility industry

2.1 Mobile phones and business

The mobile sector has increased drastically from prior years when physical stores dominated, and mobile commerce was just a myth. Desktop personal computers are withering away, and mobile phones are being used more. It is important to mention that applications increase 69% year-over-year in terms of average usage, however messaging and social media applications dominate with a 394% increase year-over-year (Flurry Analytics, 2017). In 2008, the average hour spent on a desktop was 2.2 hours while the mobile phone was 0.3 hours. In 2016, the average hour spent on a personal computer was still 2.2 hours (rising only to a maximum of 2.6 hours in 2011) while the average hour spent on mobiles was 3.1 hours (Molla, 2017). 51% of people stated that they checked their phones around 10 times a day and 25% of people mentioned they check their phones around 20 times a day (Panko, 2018). Using mobile smartphones, people have access to an abundant number of applications and features. 49% of people use social media applications and communication applications, 10% use gaming applications, and 7% use retail applications (Panko,2018). Tying this back to the research, mobile data and mobile technology are increasing at a great speed and users now have more freedom than ever to choose what to do with this data. Electronic businesses once dominated the marketplace; however, mobile businesses are taking big steps into that market. With the connectivity and wireless network, people can access their phone for endless possibilities of different business factors. This is the new era of electronic commerce which allows the users to access internet without requiring any sort of plugin or hinderance (Alvi, Laila, Khan, Husseiny, 2016). These hinderances could be thought of as mobile desktops and wired internet connection where the consumer must be in very close proximity in order to use these devices and surf the web. The traditional brick and mortar stores are ultimately becoming less and less important to the consumer as technology and mobile data increases with mobiles being the preferred medium for consumers (Tan, Lee, Ooi, 2017). This contributes to this paper by showing that there are some methods of business that are being dominated by mobile data and mobile technology.

2.2 Mobile data and travelling

Many people have been using mobile data for the ease of travelling in terms of reservations, flight tickets, hotel rentals, car rentals, tour guides and more (Wang, Wang 2010). Agencies once dominated the travel industry but now there is a massive switch with online reviews. This is because people have more access to mobile data and with many platforms available online, people are switching from these agencies to relying on reviews (TripBarometer, 2013). Travelers are increasingly connected 24/7 with all the networks around them via different social platforms. 42% of all bookings globally have been completed through mobile devices and due to the increase in data, these numbers will surely increase (Berelowitz, 2018). 70% of last-minute bookings are completed with mobile phones (Intelity.2018). With this advancement of mobile data and technology implemented in mobile phones, many different hospitality companies devised their own mobile applications to meet the demands of the travelling consumers (Kwon, Bae, Blum, 2012). This network of connectivity is due to the increase of mobile data that consumers are using nowadays. The development in third generation and fourth generation (3G, 4G) allows for the creation of social content on many different websites and platforms so that individuals now can easily download and upload new information (Ghose, Han, 2011). Travelling consumers now have the option to pull and push information with more freedom due to the increase of mobile data and the roaming laws which enable people to use mobile data in different countries when they travel (Coussement, Teague, 2013). People nowadays tend to use their mobile phones for a more “trusted” experience much more than the traditional “word-of-mouth” or any other personal method of finding alternatives to hospitality services. With a click of a button, and with the help of increased mobile technology and more data, people have access to high quality information such as reviews, downloads, maps and more. This is causing a shift from traditional hospitality services to cheaper substitutes. Hotels are switching to Airbnb’s and hostels, tourist trap restaurants are being noticed and avoided due to reviews and the dynamic of the tourism sector is changing. Mobile phones have great potential to dig deeper into the behaviors of people in the mobility industry (Wang, He, Leung, 2017). There are many different types of technology that are being used to collect behavioral outcomes such as mobile phone data points (Dulay, Choujaa, 2010).

Due to this shift and gap in the tourism industry, a factor considered in this study is to research if there will be some possible industries that could be affected because of the increase by mobile data.

3. Methodology

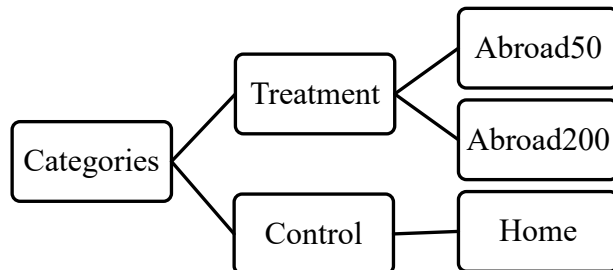
The data in this research paper is derived from 3 main sources. First, Amazon Mechanical Turk was used to enroll 200 participants randomly to eliminate any bias of not being randomly selected. Using this platform most of the participants, 97% were from the United States. This might create a bias since the behavior of US citizens might differ from people from Europe. The survey was sent to 120 colleagues in Europe to eliminate excess bias. Hence, most of the participants who participated in this survey were from Europe and the United States of America. Almost 8 out of 10 people use their mobile phones and mobile data in Europe (Eurostat, 2016). In the United States, 96% of people own a smartphone with access to mobile data (Pewresearch, 2019). This survey was developed to quantify the usage of megabytes on different applications of people travelling abroad or staying at home (*see appendix 12*). To keep the participants interested in the survey, a simulation was set to receive more accurate responses. The simulation was based on a participant “winning” a lottery for 50 and 200 megabyte coupons when travelling abroad.

Megabyte spending in terms of upload and download was tested on smartphones to observe how much megabytes each application spent. Some application megabyte usage was researched online and smartphones were used to confirm the results. The participants had to input their usage of this megabyte coupon into different applications (variables). This survey was conducted with 3 categories of participants. Those who were travelling with a 50-megabyte package to use, those who were travelling with a 200-megabyte package to use and those who stayed at home with a 200-megabyte package to use. The control group were the participants who stayed at home and the treatment groups were the participants abroad.

For the purpose of this thesis, in the survey, the variables “WTP” and “Privacy” were not used. These variables do not address the hypotheses that will be tested.

Figure 1

The following figure illustrates the 3 main categories of this thesis



3.2 Dataset

Empirical Context

Within the mobile data context, participants were allowed to choose any of the applications they deem important when at home or abroad. There was no constraint on how they could place their allocated data. The dataset applications range from social media to mobility. The simulations were conducted as an interesting way to keep the participant engaged throughout the survey.

Dummy variables were used in the categories to control time trends in the regressions. If a participant was at *home* in the simulation the dummy variable was 1. If the participant was abroad in the simulation the dummy variable was 0.

4. Hypothesis Testing

There are 3 main hypothesis that are tested in this study. All pertain to mobile data and the effect of the limiting participant's megabyte consumption.

H1: *Participants prioritize travel-specific applications more than entertainment applications when they are abroad*

This tests what people allocate their megabyte usage to. Each participant will have a limited number of megabytes they can use and with this limitation, it can be observed what they prioritize in terms of megabyte usage linked with application importance.

There have been different strenuous methods to quantify human behavior based on travels which include maps, travel patterns, shopping patterns, and reservations (Wang, He, Leung, 2017). Given the fact that most people are connected to their smartphones (GSMA, 2018) tracking behavior now is easier than it was before. This research will be able to trace some behavioral effects of the participants. Mobile data has been increasing more over the years (Cisco, 2020). Travelling has increased over the years to a point where travelling makes over 2% of the world's GDP (Blackall, 2019). With the increase of new laws such as RLAH (Roam Like At Home) which allows people in the EU to have access to mobile data without having to purchase a new subscription (Europa, 2020) and decrease in megabytes in the mobile data industry (JeanJean, 2015). People are more likely to have access to reviews, travel blogs and much more. Every month, approximately 563 million people access review sites before making their trip (Tripadvisor, 2018). This access to new information could push people to venture into different areas and help them with new trips. However, these behaviors could change when a person is exposed to certain data limitations and this hypothesis will test to see if there are any observations based on data limitations.

H2: Tourism and Mobility industries are threatened due to data connectivity and mobile data

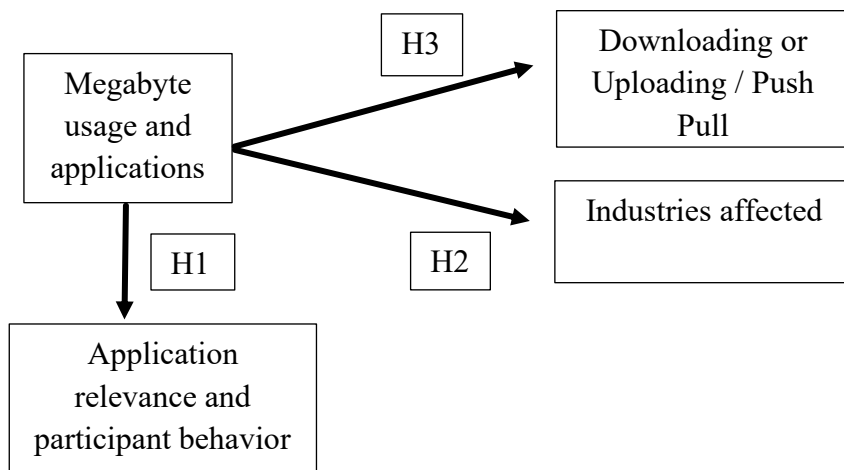
There are some businesses and industries that are threatened because of mobile data and the disruption of mobile technology. Travel websites have been replacing agents that usually book for their clients. Language translation and paper dictionaries have been replaced with massive online dictionaries that can be accessed with a push of a button (Hayes,2019). Since this thesis is related to behavioral outcomes, a tie between behavioral outcomes and industry stability would be one hypothesis to test. Due to different application usage, some people might shift from traditional methods in the industry such as booking from a travel agent to simply using their mobile data to book. Hospitality industries are going to suffer if they do not keep up with this technology. Some hotels are starting to implement 3D tours of their rooms because of the increase in mobile data and technology (Lerner,2019). This disruption of mobile data could show us that people are using their mobile phones more for different business-related issues. This could change the dynamic of the once known in-store business models.

H3: People upload their experiences more when they travel abroad

This will be tested to see if people share their experiences online during their travels or if they wait to connect to a more stable connection. 97% of people travelling abroad will share their travel experiences with others (Condor Ferries, 2019). This way the usage of pushing and pulling information could be quantified and how the participants allocate importance. This could refer to social hiatus whether people’s showing off their travel is more important than the travel itself. According to the “Social Influence Theory” sharing one’s travel experiences are one of the most important factors of travelling abroad (Scheutt, Kang, 2013). Certain data limitations could alter the effect of uploads and this hypothesis will test this.

Figure 2

The following figure illustrates the hypothesis testing that will occur in the thesis



5. Descriptive Analysis of Variables and Megabyte Consumption

The explanation of the different variables used in this survey will be explained in *Appendix 1*.

The variables in *Appendix 1* will be used as a part of a differentiated analysis that will contribute to some of the findings in this thesis.

The main equation that will be used in the thesis is:

$$\begin{aligned} & \log(\text{amountofMBspent}) \\ &= \sum(SM_{Pull} + SM_{Push} + Comm_{Pull} + Comm_{Push} + VideoCall + Video_{Pull} \\ &+ Music_{Pull} + Game + GPS + Web + AccomReserv + LangaguagePackage \\ &+ Rest_{Pull} + Rest_{Push} + Weather) \\ &+ \sum(SM_{Pull} + SM_{Push} + Comm_{Pull} + Comm_{Push} + VideoCall + Video_{Pull} \\ &+ Music_{Pull} + Game + GPS + Web + AccomReserv + LangaguagePackage \\ &+ Rest_{Pull} + Rest_{Push} + Weather) * \text{Different Categories} \end{aligned}$$

The interaction variables and terms were included in the regression models below.

5.1 Empirical Strategy

Since the targeted sample of people do not represent the whole population of people who use mobile data there could be selection bias. If the population targeted was based more on differentiated and more geographically dispersed areas the selection bias could have decreased.

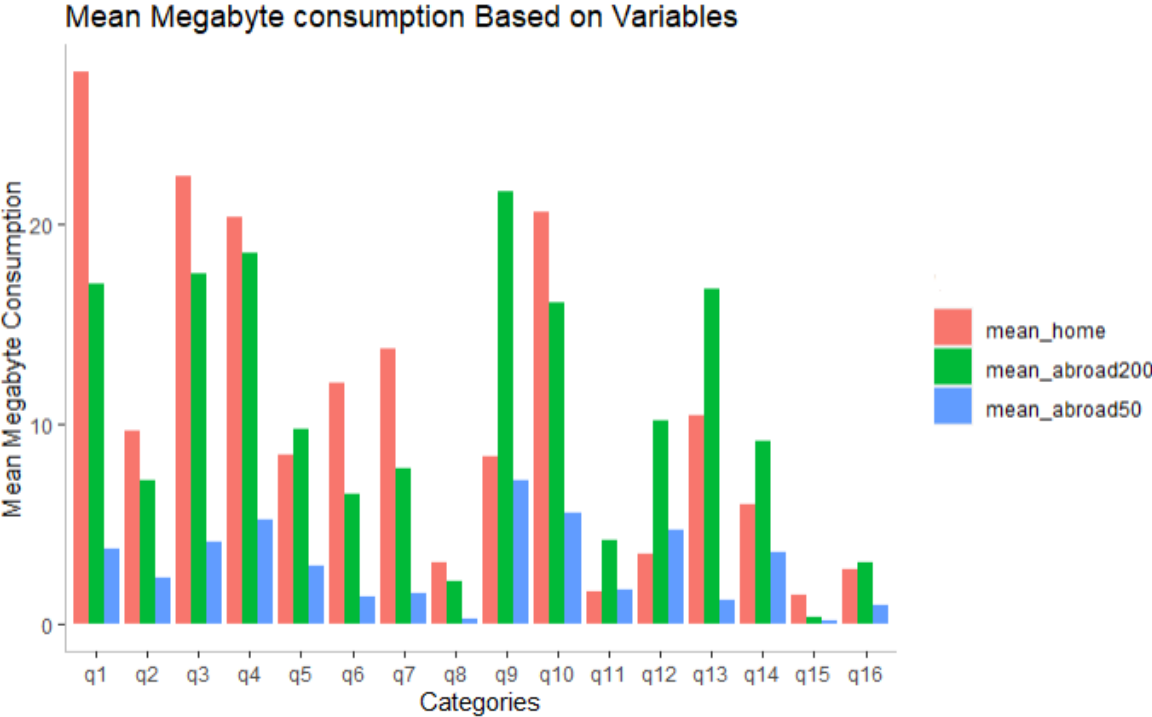
When panel data sets differ systematically from each other and have unobservable ways that affect the desired outcome fixed effect is often used to eliminate the variation between the different sets (Woolridge, 2010). The fixed effects model was used in the regression between the two categories *abroad200* and *home*. This will show us the effect these variables have by stating the interaction between the different variables of the two sets. Regarding the least squares, fixed effects is a better estimator for controlling time constant variables and this way improves casual interference for the panel data sets (Brüderl & Ludwig, 2015). To do so, in this paper the fixed effect are user fixed effects which are captured by the variable *ResponseId*.

The means of different variables pertaining to download, and upload were taken in terms of means to quantify the actual megabyte consumption of people when they choose to download or upload content abroad or in their home areas. The means were suitable for this category as they were observed in a measurement of megabyte consumption.

A regression was composed to observe the differences in megabyte allocation in percentage between the 3 categories to quantify any significant change. Only the significant results were analyzed.

Graph 1

The following table shows the mean megabyte consumption of all the variables based on the 3 different categories



Looking at the previous table, the mean average usage of megabytes of the 3 categories is less than the total amount given (50 megabytes and 200 megabytes) and this shows that some participants chose not to use all their megabytes. This can be a reason for application unimportance. Instead of reallocating their megabytes to different applications to use up all their megabytes, some were not

interested in doing so and chose not to use all of it. All users in this survey who participated were not disregarded since eliminating some participants to lead to a bias since we do not know the real reason as to why these people did not spend all their megabytes. There was not a linear method where the participants placed their megabyte usage. There was no specific method where the participants in the survey allocated their megabytes and this is non-linear.

5.2 Analysis of Megabyte Consumption in the *home* Category

Low Choice Applications

Regarding megabyte consumption in the *home* category (see appendix 2), the least chosen variable was accommodation which had a megabyte consumption mean of 1.647. People in their home countries chose accommodation applications the least which shows that people do not need to look for accommodation in their home as they already have places to settle and live. This is different from the abroad scenarios where the choice of reserving accommodations is higher.

Another low choice is the weather application with a megabyte consumption mean of 2.752 as people seem to choose this less because of different outlets such as news reports that forecast the weather for the entire week and do not need to use their mobile data on applications that are already mentioned in other places. Another reason could be the lack of travelling, if someone is in their home country, they probably do not need to know the weather as urgently as someone who is travelling.

High Choice Applications

Some of the most used applications in the *home* category are Social Media Pull, Communication Pull, and Web with a megabyte consumption mean of 27.5, 22.4, and 20.3 respectively. *Web does not have a push and pull since it was considered “web” a mix of both pulling and pushing evenly.* Social media and connectivity are extremely important to people in their home countries and despite being close to one another, connectivity is still a factor of importance. This might be because telephones nowadays in homes are being slowly obsolete and mobile data is taking over to always stay connected and updated with what friends or colleagues are doing. Landlines have decreased to less than 40% in households and mobile phones have been increasing overtaking landlines by more than 10% (Richter, 2017).

5.3 Analysis of Megabyte Consumption in the *abroad50* Category

Low Choice Applications

In the category *abroad50* (see appendix 3) with a constraint of 50-megabyte consumption per participant, the least chosen application was restaurant pushing information with a megabyte consumption mean of 0.195. This is probably because people abroad with a low constraint on megabytes would use this to read reviews about restaurants and search for different options in the area. This is because the mean for restaurant pulling information is 2.031 which is a significant increase from a megabyte mean of 0.2 when using 50 megabytes in total. The participants would rather search for restaurants and different options in their chosen destination than giving information about a restaurant. Another low application chosen would be an online gaming application with a megabyte mean of 0.283. With a low megabyte consumption constraint, online gaming is probably unimportant to travelers with such a small limitation on what they could use their mobile data for. Most of mobile online games run about 50 megabytes per hour (Choros,2019) and people abroad would not spend all their megabytes on online gaming in one hour.

High Choice Applications

The most application chosen was coordination services such as GPS with a megabyte mean of 7.150. This is a very significant choice as this value is almost 14% of the total 50 megabytes used for consumption. Travelers abroad tend to use these services more to get from one place to another. Another application high in choice was surfing the web with a mean megabyte of 5.2. This is probably because people travelling to new destinations need to check things online such as general information about the country, they are going to stay in. Another factor is that people might still want to check important factors such as news outlets or any other source pertaining to relevant importance of information and therefore surfing the web is chosen highly amongst the participants.

5.4 Analysis of Megabyte Consumption in the *abroad200* Category

Lower Choice Applications

Regarding the *abroad200* (see appendix 4) category the lowest chosen variable with a megabyte mean variable of 2.095 was also gaming. This portrays people who are travelling with more megabytes (200) also consider gaming a non-important application. In both cases, with or without more megabytes gaming was of unimportance and the participants would rather use their mobile data on something they consider more important. When the participants were exposed to data limitations a sense of “need” more than “want” occurred and that is why some applications were regarded as very low. Another application that was low on choice was also the restaurant pushing of information which had a megabyte mean of 1.498. People travelling are more likely to use their data to search for restaurants within the limitations instead of giving reviews about them.

Higher Choice Application

The most chosen application in terms of megabyte mean consumption of 21.648 was coordination services such as GPS. Again, even with more mobile data given the participants chose GPS services as their top priority since they need to travel and move around without getting lost. Social media pull was the second highest choice with a megabyte mean of 16.97. 52% of Facebook users stated that the photos posted by their friends and close contacts were the reason they traveled to a specific location (Four Pillars, 2018). This portrays that people staying in their home areas and abroad in their travel destinations regardless of limitations in megabytes and data usage will choose to pull information rather than share their experiences. This could relate back towards the ideology that people want to see what their friends and other closely related people are doing during their time of travel as well. Communication push and pull was also high with a megabyte mean of 17.5 and 18.5 respectively. The pulling of communication relates back to people wanting to search for new things in the new destination they are in. The small change could be a psychological aspect in nature where people want to be talked to or others that do not enjoy talking with others as much. In the time people travel (whether for business or tourism) downloading information and searching for good restaurants, touristic areas and using applications for wandering the city streets come as

a priority. As of 2011, interest has grown in travel technology such as information search applications (42%) and social networking (52%) (Dickinson, Ghali, 2014).

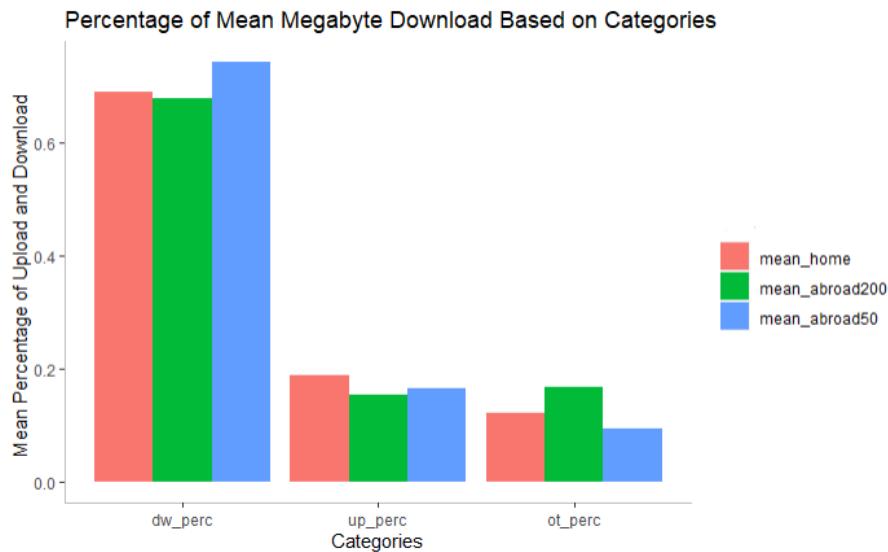
6. Upload versus Download

Graph 2

The following graph represents the percentage value of total megabytes offered to participants in all 3 categories

Explanation of variables:

- dw_perc = Download Percentage
- up_perc = Upload Percentage



In terms of purely downloading content and uploading content abroad and at home (*see appendix 5*) some variables were considered as “other”. This is primarily because people in these categories (gaming and surfing the web) are always exchanging information and could not decide for sure, whether they were purely download or upload. Looking at the variable “download”, it has dominated the download variable. The value of download was 69.3% for people staying at home, 67.6% for people travelling with a constraint of 200 megabytes and 73.7% of people travelling with a constraint of 50 megabytes.

In terms of uploading content despite having such a low megabyte constraint while travelling abroad (50 mb) the total was 16% of the 50 megabytes which is approximately 8 megabytes. Something interesting in this survey is when the total number of megabytes increased from 50 to 200, the upload percentage decreased instead of increasing from 16% to 15%. Usually, when mobile data constraints and limitations decrease, but would expect some increase in the amount of data uploaded, however, in this survey the participants chose the upload option less. The amount of megabyte data uploaded when a participant was at home was 18.6 which was the highest amongst the 3 categories. This is most likely because the participants would be connected to Wi-Fi and have a higher megabyte consumption data which allows them to upload more.

This analysis indeed represents that people tend to pull and search for information rather than upload content to different platforms. In regard with the hypothesis H3, the test is to observe if people are going to upload their experiences more despite having a limitation in data. This proves the hypothesis incorrect and people tend to download more when being abroad and focus on certain applications. The main reason for this was the data limitations. If the participants had more data to consume, perhaps, uploading content to various platforms would have increased. Travelers would rather use their data on searching for new information than uploading their own experiences but might wait till they are back home and upload their entire travel experiences.

7. Industry Disruption

Variables identified pertaining to Industry Analysis

The variables “Rest push / Rest pull”, “GPS”, “Social Media” and “Communication” will pertain to the tourism industries. The following explanation will state why these variables were chosen;

88.2% of people travelling chose food as one of the top reasons why they chose a specific destination and 11.8% mentioned that gastronomy was only a minor role in their decision to be abroad in another area. The growing food and restaurant sectors are one of the fastest growing in terms of tourism. (UNWTO, 2018).

Communication happens between people that travel to certain places and thus the new people travelling can communicate on different applications to get overviews of different touristic areas

and where to stay. This changes the dynamic of the tourism industry as people are more towards the notion of choosing new destinations based on people they trust.

The variable “Uber” and “GPS” will pertain to mobility (taxi’s, busses, etc...). Uber is one of the world’s largest growing applications in terms of mobility and is available in more than 65 countries. There are 14 million uber trips completed every day. In New York, Taxi rides have dropped from 500,000 in 2015 to 270,000 in 2019. Uber has increased from 100,000 in 2014 to 510,000 in 2019 (Iqbal, 2019). This obviously is a large change in the dynamic of mobility and with different methods of travelling the mobility sector within the tourism industry might also be disrupted.

Table 2

The following analysis pertains to mobile data and applications that could possibly disrupt the aforementioned industries

The following table was compared to the people travelling with 200 megabytes as they have more data to download/upload applications and other factors:

- Low: pertains to megabyte mean of 0-4.9
- Medium: pertains to megabyte mean of 5-9.9
- High: pertains to megabyte mean of 10-20
-

Application	Usage	Industry Disrupted
Social Media	High	Tourism People look at other’s posts and areas they go to and become influenced by these decisions
Restaurant Pull	Medium	Tourism and Gastronomy Pulling reviews about different places will allow tourists to check out new options and disrupt hotels and diners.
Restaurant Push	Low	This research paper shows the behavior of purchasing of mobile applications related to the tourism industry

Communication	High	Tourism People can now send information about new and cheaper places that they recommend, and hotels will be disrupted.
Uber	High	Mobility People now can use their mobile data to order an Uber instead of taking the traditional taxi's and pay more.
GPS	High	Mobility People can now use more affordable ways of travel instead of the traditional taxis to move around

The ranges high, low, and medium were based on a percentage of total megabyte given and the chosen megabyte allocated for each variable

Regarding the conducted analysis, the participants chose to download information more than upload. Downloading information could be extremely useful to people travelling in terms of looking for different places, restaurants etc... Looking at the analysis, there could be a possibility where the tourism and mobility industries could be disrupted. Based on the research analyzed so far, the tourism industry could be in danger since the participants spent most of their data on surfing the web. The participants could easily find substitutes that will enable them to pay less than the regular hotel stays and other touristic accommodations. According to this research, when people surf the web they are mostly downloading and not uploading information which means that they are looking at new factors that were uploaded by travelers before them which gives more insights on where to go, where to stay and much more that could enhance their travel. 24% of data consumers in the UK share their experiences while they are on their holiday or vacation while 49% wait to get back home and share this experience (BDRC Continental, 2013). Another interesting factor is that 69% of people travelling abroad is based on reviews and recommendations of different travel destinations they want to travel to (TripBarometer, 2013). Agents and travel sponsors can now be replaced by mere reviews on highly “accredited” websites. More than 25 % of people globally book travels mostly by mobile phones and the brick and mortar agency stores are slowly suffocating (Meola, 2016). Restaurants and pricey “tourist traps” could now be avoided when people look for reviews online and social media allows for the push and spread of these types of information. People can communicate with one another freely and give recommendations of

different gastronomical areas they have already been to. There are thousands of blogs dedicated to travelling and the perfect places to enjoy meals and especially, where not to go. This includes a vast majority of “tourist trap” areas that enable the traveler to be more aware of these scenarios. This supports the claim as to why surfing the web and social media were some of the highest chosen amongst the participants.

This intertwines with the research as more participants chose social media when at home, and due to limitations on data usage they would want to connect to a stable Wi-Fi and use their mobile data for other reasons. They can check all this before they travel online without the presence of any personnel.

The taxi industry could also be destructed as participants use applications such as Google Maps and Uber for travelling and wandering around. With the growing technology of Uber and the increase and freedom in mobile data, the taxi industry is threatened (Krueger, Cramer, 2016). The typical “wait and pay as you go” for taxis are being replaced by a prepaid fee that is usually cheaper and even with constraints on mobile data people still choose these navigation applications as a priority. The participants showed that the diversion from methodical ways of conducting business is inevitable and the entire dynamic of business models will eventually shift.

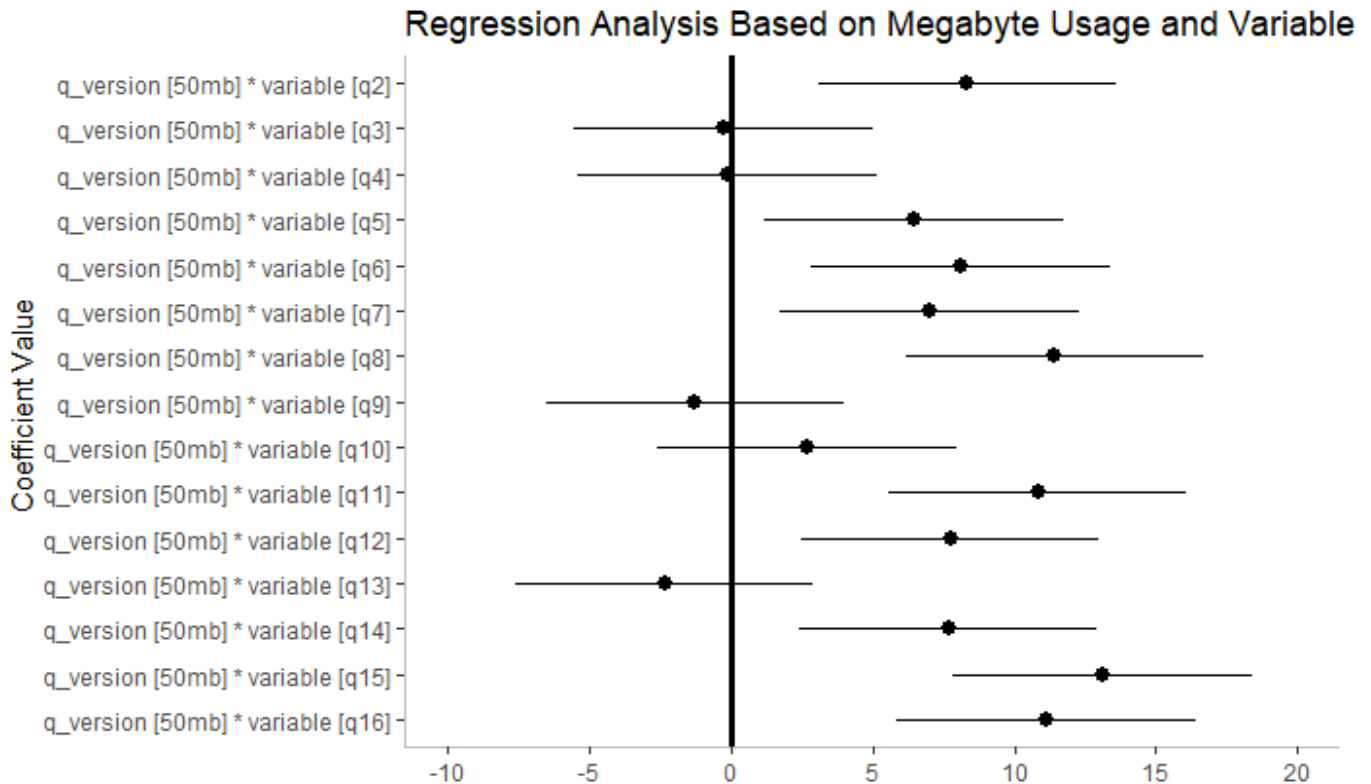
One of the hypotheses tested H2 was to observe if any industry would be affected by mobile data. Analyzing the participant’s responses two industries appeared that could have been affected the most. There is, however, not enough data regarding this hypothesis in terms of industry choices. The survey was not based on industries but applications and in turn, these applications with the effect of mobile data could disrupt some of the industries mentioned. H2 was tested, and partially proved.

8. Regression Analysis

8.1 Regression Analysis Based on Megabyte Usage and Variable

Figure 3

Regression Analysis of the different variables to see the relationship between the categories



*q_version[50mb] * variable[q2] pertains to the relationship between the abroad 50 and abroad 200 category*

Abroad 200 Category

Regarding the regression, there are some interesting results. First, the variable Q8 (gaming) is one the lowest in the regression with a value of -14.8. This variable is significant at a $P < 0.001$. People abroad with 200 megabytes of data to consume spend approximately 15 megabytes less than on Q1 (SM Pull). The participants did not choose gaming as a variable to allocate their megabyte

consumption. This is plausible as when travelling abroad with data limitations, gaming applications are unimportant as there are much more important applications that the participants would rather use. The mean megabyte consumption of Q8 is very low with a mean of 2.095. This backs up the regression analysis with the notion that people abroad will rather spend their megabyte allocation on applications that are in regard with their travels.

Another variable that is low was Q15 (Rest Push). The value for this variable is -16.638. This variable is significant at a $P < 0.001$. People who are travelling with 200 megabytes to consume spend 16.638 megabytes less than Q1. Restaurant pushing is extremely low even in the means of the megabyte consumption. This further strengthens the argument that people would rather spend their megabytes of consumption elsewhere than using their limited data to upload content and reviews for restaurants. People would rather search for restaurants and reviews rather than upload information about them during their travels. The value for variable Q14 which has a significance of $P < 0.001$ (restaurant pull) is much higher than Q15. In the variables for megabyte mean of consumption, the mean of Q14 is also higher than Q15. This implies that people would rather spend their megabyte consumption on searching for restaurants.

An interesting observation is that usually the data spent on video entertainment and downloading movies is high. YouTube has 250 million hours viewed in 2019 alone (Spangler, 2019). However, in this regression the value for Q6 (Video Pull) was -10.4. This variable is significant at a $P < 0.001$. People who are abroad and have 200 megabytes to consume will spend -10.4 megabytes less on video entertainment than on Q1. People are not willing to watch videos abroad when they have limitations on their data and would rather allocate the megabytes in a different area.

Variable Q9 (GPS) was one of the highest on the regression and the value is 4.676. This variable is significant at the $P < 0.05$ which is much more significant than the other variables mentioned before. Participants allocate, on average, 4.676 megabytes more on GPS services than on Q1. People tend to use GPS services for mobility and moving around. People who are travelling require applications that take them from one place to another and being in an area for the first time, or an unfamiliar area, these applications will come in better use than others. Backing this up, the mean for Q9 is higher than that of Q1 when being abroad and having 200 megabytes to consume.

Variable Q4 is also high on the regression of *abroad200*. This value displayed that on average, participants would spend 1.571 megabytes more on Q4 than on Q1. The participants would rather push communication than pull communication as the mean graph and regression shows.

Interaction between Abroad 50 Category and Abroad 200

Regarding the interaction between the two categories *abroad50* and *abroad200*, one interesting observation that can be noticed is that Q15 (Rest Push) is 13.107. This variable has a $P < 0.001$. People who are abroad and have 50 megabytes would, on average, spend 13 more megabytes on Q15 than being abroad with 200 megabytes to consume. This could be the outcome of the difference of data limitations. Participants in the 50-megabyte category had low megabyte data consumption and perhaps, if they had more megabytes, they would allocate their megabytes differently not placing the consumption on Q15. Another high valued variable is Q16 (weather). This variable is significant at $P < 0.001$. This shows that on average people who have 50 megabytes to consume will spend approximately 11 more megabytes on weather applications. Weather is one of the lowest applications chosen by the participants, however, due to lack of megabyte data the allocations must have been placed differently.

Variable Q11 (accommodation reservation) is a high value which depicts that on average, the participants who had 50 megabytes to consume abroad would spend 10.829 megabytes more on accommodation services than being abroad with 200 megabytes to consume. This is primarily since people need places to stay when abroad and therefore Q11 is a high value. Another reason is that it could be crucial to the participants who had 50 megabytes as this is considered high prioritization since they will not travel if they do not have a place to stay. If the participants had more megabytes to allocate, they would choose to allocate their consumption in a different way and variable Q11 might change.

Variables Q3 and Q9 are the only negative values in the regression for the *abroad50*. In variable Q3 (communication pull), participants on average would spend 0.245 megabytes less if they had 50 megabytes abroad to consume rather than 200 megabytes abroad to consume. This is represented by the low data limitation so the participants could not have spent that much

megabytes. This is an interesting observation because Q3 was one of the high values in terms of megabyte mean consumption in the *abroad50* category.

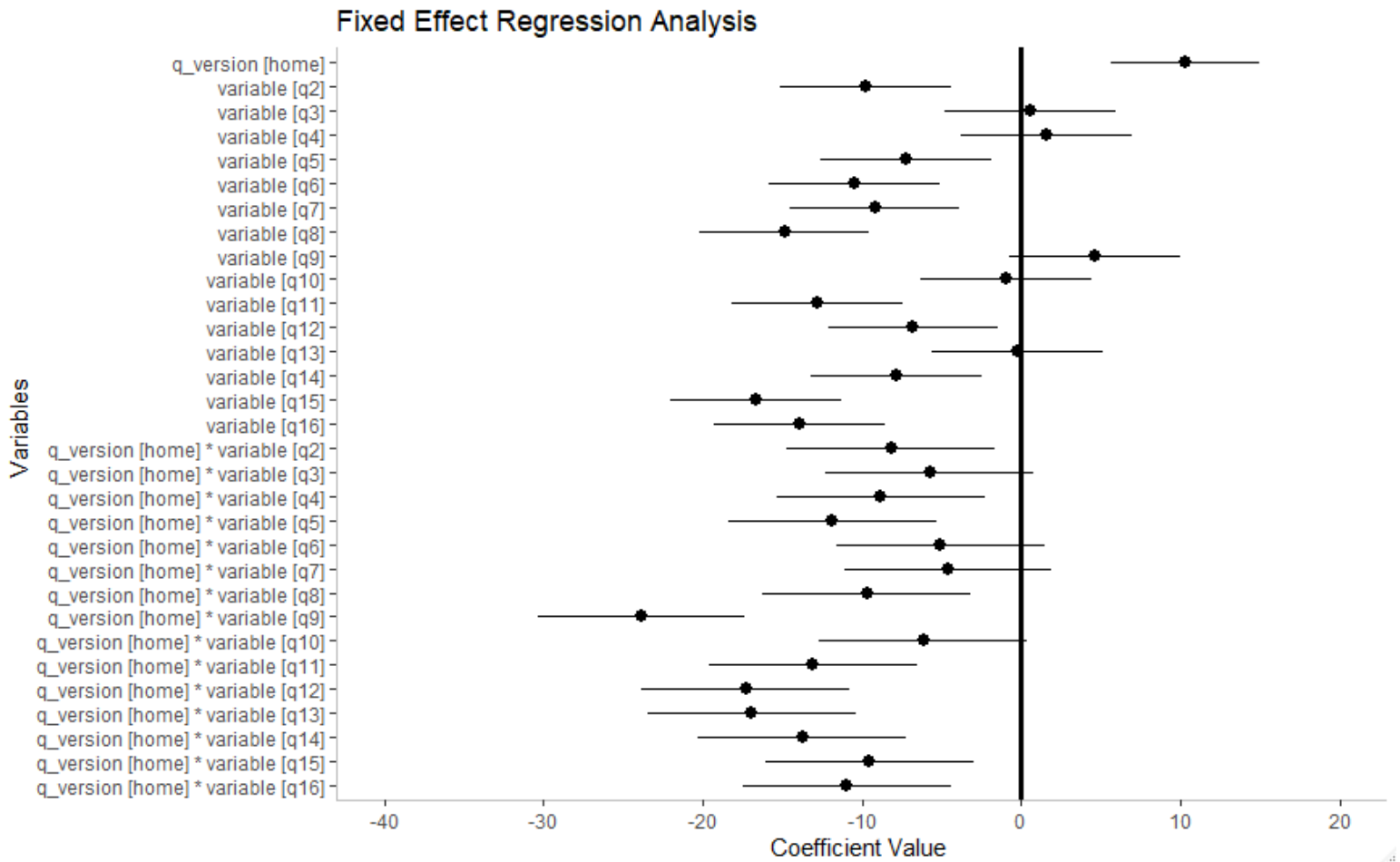
The value of variable Q9 shows that participants on average would spend 1.251 megabytes less on GPS services. They did not have enough megabytes to allocate to this specific variable. Another reason is that in *abroad200* GPS services is one of the highest in the regressions and mean values so if these participants had more data, they would probably reallocate their megabytes consumption with higher GPS usage. Variable Q5 (video calling) has a value of 6.47 which shows that people who have 50 megabytes to consume abroad will spend 6.47 megabytes more on average than people with 200 megabytes has a high significance of $P < 0.05$ and this displays that the interaction between this variable when people are abroad and have 50 megabytes to consume and abroad with 200 megabytes to consume is high.

One of the hypothesis (H1) is to test the behavioral outcome based on application prioritization when abroad with different data constraints. This regression explains that there is a differentiated behavioral outcome when the participants consumed limited data. The participants chose only the necessary applications such as booking an accommodation. It also showed that these applications have high importance and will triumph over any other type of “entertainment” application. Certain prioritization where the participants preferred to allocate their megabyte consumption to certain applications when other applications such as gaming are very low in all categories can be observed. Approximately 16% of this regression is explained by the variables having an impact on megabyte usage consumption. R2 is low is because there might be different unexplanatory variables that are not mentioned in the error term.

8.2 Regression Analysis based on Fixed Effect between *home* and *abroad200*

Figure 4

The following table shows the regression Analysis of the different variables to see the relationship between the categories *abroad200* and *home*



Regarding the analysis of the previous table, the different categories *home* and *abroad200* were taken into consideration since they both pertain to the same megabyte usage (see appendix 9). Fixed effects model is used when there is strict exogeneity in a linear model. (Zhang, Wei, Su, 2016). When strict exogeneity is available, the error u_{it} should not be correlated with the explanatory variables (Wooldridge, 2013). Based on using fixed effects, the expectation of the error will be 0 and if this is violated fixed effects should be used. (Hayashi, 2000). This analysis is to observe if there are any behavioral differences amongst megabyte consumption abroad or at home. The fixed effects model was used to control for any observable or unobservable predictors as these

are different groups. The fixed effect was captured by the participants ID. The relationships of the variables are all shown in the coefficients of the variables above.

The variable Q8 is negative here which implies that people who are travelling with a data consumption of 200 megabytes will spend 14.876 megabytes less on gaming services as this value is negative. This is also portrayed in the mean megabyte consumption for *abroad200*, this variable is also low which relates back to the fact that people want to spend their megabytes on something rather than gaming as this is of unimportance to them when they travel.

Variable Q15 (rest. push) is negative and shows that if people are abroad and have 200 megabytes to consume, they will spend 16.638 less. This relates back the value of Q8 in the *abroad50* category where the value is also low. People would rather spend their megabytes somewhere else than uploading information about restaurants and using their limited data on something that will not benefit their travels. Q14 (rest. pull) is higher than Q15 which shows that people would rather search for restaurants as well. The mean megabyte consumption of the value Q14 is higher than Q15. Variable Q11 (accommodation) is a low valued variable. This is interesting since in the category *abroad50* there was a high relationship between megabyte usage and accommodation. In this case, the value is lower, and this is due to having more megabytes. In the *abroad50* category, the participants had to choose what they basically considered necessary for them, in this case, the freedom is pushed higher with 150 more megabytes to consume and this is the reason why this value is lower.

The variable Q9 is high and if the participant was abroad and had 200 megabytes to consume, on average, they would use 4.6 more megabytes on navigation applications. Q9 is also considered something people need when they travel and the reason why this is a strong argument is because the mean of Q9 in both *abroad200* and *abroad50* categories is high and the relationship in both cases in the regression with the amount of megabytes spent is positive. The variables Q3 and Q4 are also positive. People who are abroad with 200 megabytes to consume consider communication applications important to their travel. An interesting observation is that when they are travelling with 50 megabytes to use this variable is lower. This would be considered that for people with lower constraints communication is probably not as necessary as finding a place to stay for the duration of the travel.

Regarding the *home* category, all the variables are negative. This could be due to the constraint in data megabyte consumption and that people would choose different applications when they travel. In that sense, the variables are negative. The value for Q12 is low in the home regression table. This variable pertains to language packages and since people are in their home country, there is probably no need for these packages as the people who live there speak the native language or have an understanding of the language spoken. As soon as people travel to new places, this will increase as seen in the categories *abroad50* and *abroad200*.

Another observation found is that people who live in their home countries who have 200 megabytes to consume, on average, spend around 23 megabytes less on GPS services. This is interesting because in the other two categories the GPS is high, and it shows that this is what people need when they travel. In their hometown, this is low because people know the roads of their hometowns and do not need to depend on GPS services getting from one place to another.

When people are in their home countries and have 200 megabytes to spend the megabyte amount to consume on average will decrease by approximately 17 megabytes. The reason behind this could be that people in their home countries have their own cars to drive around and this do not require transportation methods such as Uber.

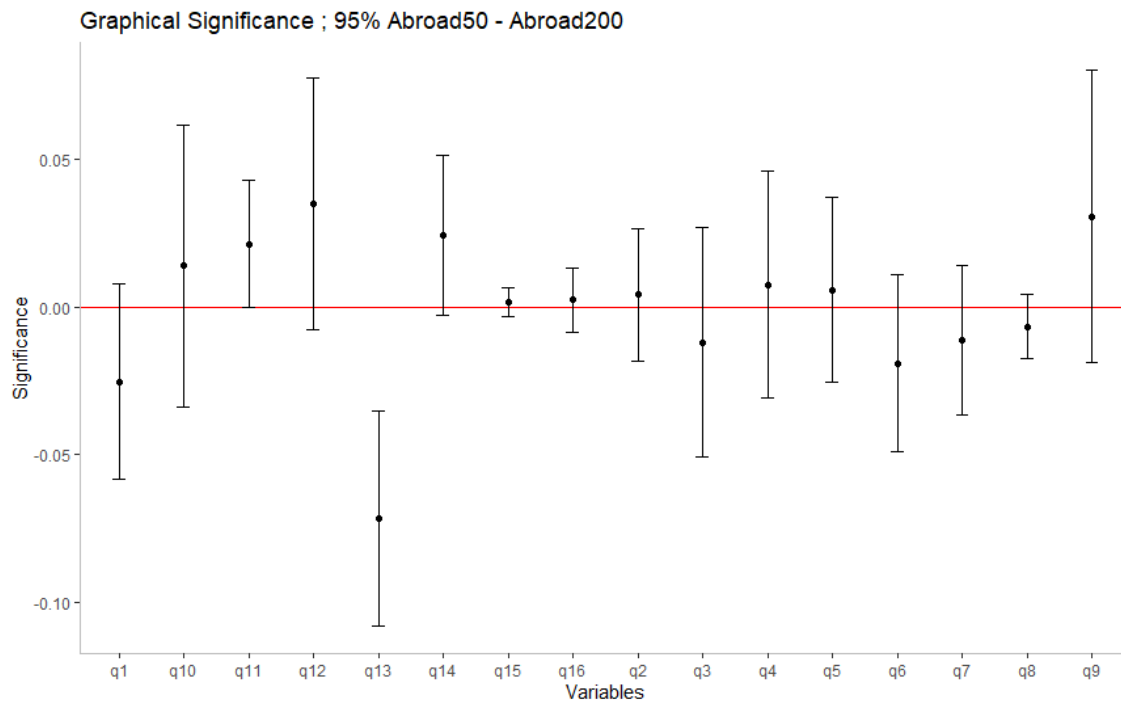
Regarding the previous regression, the R2 is 0.32 which shows that 32% of the variables defined in this regression explain the dependent variable which is the megabyte usage.

9. Significance and Comparison of Categories

9.1 Significance and Comparison between *abroad50* and *abroad200*

Figure 5

The following figure represents the comparison of coefficients of the variables between the categories *abroad200* and *abroad50*



Comparing the coefficients in the two categories there is one observable significance that take place. At a 95% confidence level, the variable Q13 is significant.

The participant abroad with 50 megabytes to consume uses on average 2.496% of total megabytes while the participant abroad with 200 megabytes to consume uses on average 9.6% of total megabytes on Q13. (see appendix 10.1)

Q11 ($P < 0.1\%$) and Q14 ($P < 0.001\%$) were also significant but not at the 95% confidence level.

The participant with 50 megabytes to consume uses on average 7.5% of total megabytes while the participant with 200 megabytes to consume uses on average 5.14% of total megabytes on Q14(see

appendix 10.3). This portrays that participants consider searching for restaurants a very important factor when facing extreme data limitations.

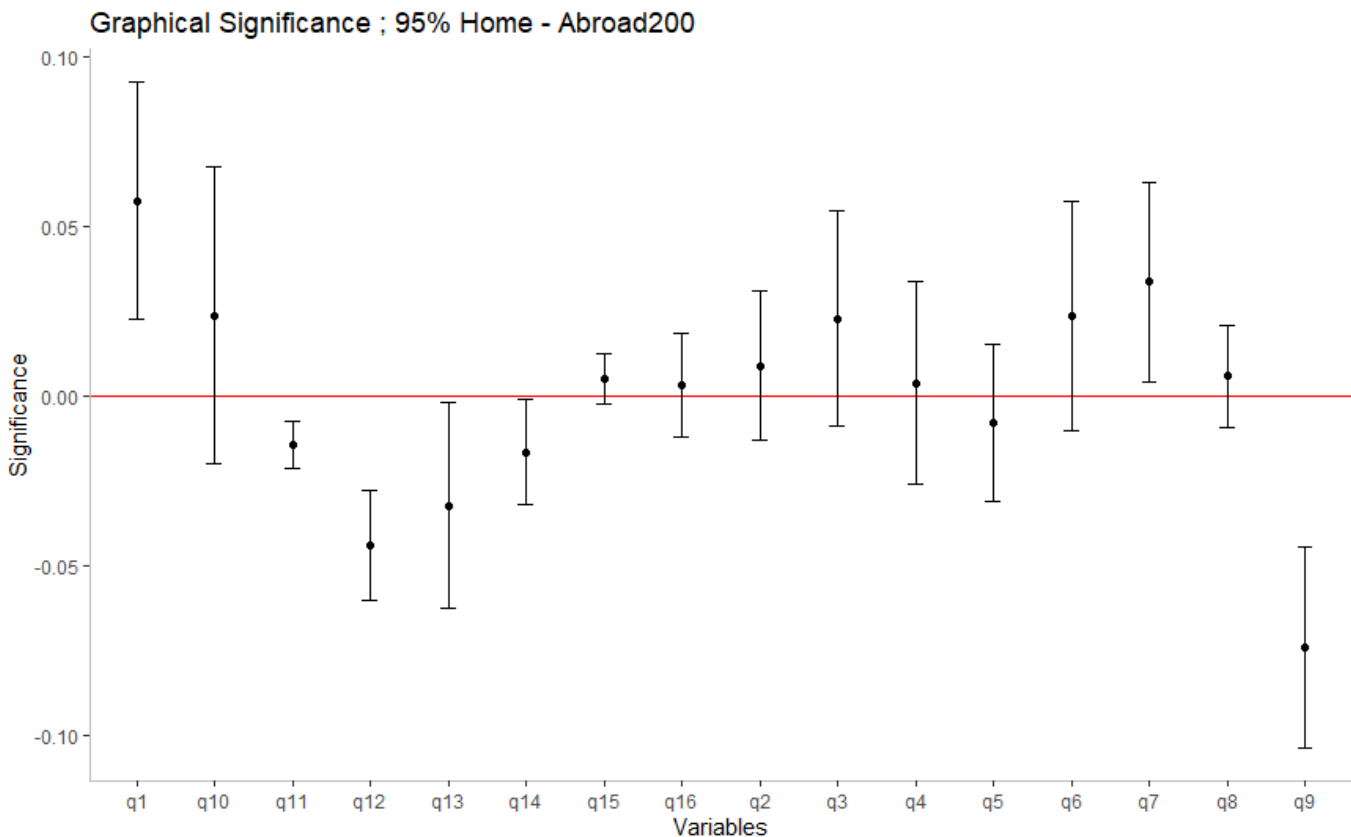
The participant with 50 megabytes to consume uses on average 4.523% of total megabytes while the participant with 200 megabytes to consume uses on average 2.4% of total megabytes on Q11(see appendix 10.2).

The other variables are not significant between the two categories.

9.2 Significance and Comparison between *home* and *abroad200*

Figure 6

The following figure represents the comparison of coefficients of the variables between the categories *abroad200* and *home*



Comparing the coefficients in the two categories there are 7 observable significances that take place which are Q1, Q7, Q9 Q11, Q12, Q13, Q14.

Participants who are home spend on average 15.9% of their total megabytes on while people who are abroad with 200 megabytes to consume spend on average 10.2% of their total megabytes on Q1. Participants who are home have less worries about using other applications since they do not require such applications such as GPS, and thus Q1 increase at home (*see appendix 11.1*).

Participants who are home spend on average 7.7% of their total megabytes while people who are abroad with 200 megabytes to consume spend on average 4.37% of their total megabytes on Q7. Participants who are abroad with limited do not consider music to be something urgent to their travels (*see appendix 11.2*).

Participants who are home spend on average 4.7% of their total megabytes while people who are abroad with 200 megabytes to consume spend on average 12.169% of their total megabytes Q9. GPS services have been proved to be very important to participants throughout this research (*see appendix 11.3*).

Participants who are at home spend on average 1% of their total megabytes while people who are abroad with 200 megabytes spend on average 2.4% of their total megabytes on Q11. This proves that people abroad consider accommodation services more important than people who are home (*see appendix 11.4*).

Participants who are at home spend on average 2.1% of their total megabytes while people who are abroad with 200 megabytes spend on average 6.4% of their total megabytes on Q12. Again, this portrays that people abroad require language packages more than people who are at home (*see appendix 11.5*).

Participants who are at home spend on average 6.4% of their total megabytes while people are abroad with 200 megabytes spend on average 9.6% of their total megabytes on Q13. People who are abroad, need to move around a mobility is a top priority this is why Uber has a higher percentage than people at home (*see appendix 11.6*).

Participants who are at home spend on average 3.5% of their total megabytes while people who are abroad spend on average 5.1% of their total megabytes on Q14. Locals in the area do not necessarily need to search for restaurants in the area and therefore searching for restaurants has a higher percentage abroad than at home (*see appendix 11.7*).

The previous regressions explain that people have a pattern to choose specific applications when traveling and decrease the consumption of these applications when they are at home. The pattern can be based on what the participants prioritize when they travel abroad.

10. Scientific Implications

This study adds the field of science in a data driven method by further understanding the behavior of people when they are exposed to limited data. This is one of the first research that has highlighted the behavioral outcomes of participants. Research papers about data and tourism do exist, however, to the best of this author's knowledge this was amongst the first to provide such information. This real-life scenario based on a simulation will further help researchers understand how data limitations cause people to behave differently.

11. Managerial Implications

This thesis gives businesses and managers the perception of what people need the most when traveling. This entire research highlighted the importance of travel-based applications and how people allocated their megabytes. This allocation can show managers what to focus on when consumers decide to travel. Managers can also start creating offline based applications that relate to the consumers' wants and needs. Tourism industries can focus on producing applications that are tied with different GPS systems to attract more tourists. Restaurants can partner up with mobility applications such as Uber to give consumers a more satisfying experience and to find their restaurants. Cities can use this information to provide a more sustainable connection on what consumers really need when they travel abroad. Businesses can diagnose the patterns of behavior of these consumers when the travel and narrow their scope linking it to the applications that will

provide the most profit. The participants chose to download information so companies can use this to boost their ads and target more consumers.

12. General Comments

As mentioned before there exists research about how people use their mobile data and what applications are being used the most. The research gap that is filled here is what people do when they are exposed to certain data constraints. This is important to mobile data providers and different companies that rely on applications. This research can show how and what people prioritize when they are travelling abroad or at home when exposed to limits on megabyte consumption.

This study finds that people prioritize necessary applications such as navigation services, applications that search for restaurants and surfing the web. It also shows that applications that provide entertainment such as Netflix (video download) are unimportant to participants when travelling abroad.

This study also shows that people abroad tend to download much more than upload when travelling when they have limits on their data capacity.

The study shows that there are two possible industries that could be disrupted due to mobile data: the tourism/hospitality industries and the mobility industries.

13. Hypothesis Overview

Table 3

Overview of hypothesis tested in this thesis

Hypothesis	Verified	Partially Verified	Not Verified
H1	x		
H2		x	
H3	x		

The hypotheses mentioned before were all tested using statistical measures such as means, and regressions, and fixed effects.

As previously stated in the hypothesis there were 3 main hypotheses to test. There was a research gap in how the behavior of people change with certain mobile data limitations in different contexts (abroad or at home). This research provides the answer of megabyte consumption regarding the application priorities. This can be proven by looking at the means and the regression analysis of the different variables where they show a difference in prioritization. There was a positive relationship between megabytes and behavioral outcomes. This was shown in the way that participants chose only the applications they deem necessary and had a higher mean and correlation with the megabyte consumption.

The participants also all wanted to download data when abroad which proved hypothesis H2 wrong. When travelling, research showed that people want to upload their experiences as a sort of “social status”, however this study showed that with data limitations people will choose to download information.

14. Limitations to the thesis

Limitations to the research are factors that are out of our hand and factors can't be controlled (St. Cloud University, 2018). In this thesis, only participants who are located in the USA and in Europe were taken into consideration. This could bias the information as there is not enough quantitative information about the usage of applications and mobile behaviors of countries located elsewhere (for example, Canada and Asia). This could have changed the behavior of the way participants choose their megabytes and what applications will they allocate these megabytes to. The adoption of mobile phones and mobile applications could differ from culture to culture (Kotzé. Biljon, 2008). Another issue is that perhaps, giving the participants more data would allow them to allocate their megabytes differently and show a true “render” of what they would choose with their current/more data plan. The issue of “time spent abroad” could be another limitation as people could perceive their time travelling abroad for a week or a year in this survey since the time abroad was not actually stated in this survey. If the participants had a certain time frame perhaps the results would have changed and became much more different. Another limitation could be the fact that

not all participants used their entire allotted megabytes. The reason for this could be unimportance of the different applications. In this study the participants who did not fill out their entire megabyte consumption limit were still included since removing them might cause different biases in this thesis. The participants were studied in terms of a group basis and the individual reasons as to why they chose these applications and allocated the megabytes were not studied.

Bibliography

- Alvi, S., Laila, U., Khan, K., & Hussainy, K. (2016). Intention to Adopt M-Commerce over E-Commerce. *9*(1), 154-175.
- Anne Coussement, M., & J. Teague, T. (2013). The new customer-facing technology: mobile and the constantly-connected consumer. *Journal of Hospitality and Tourism Technology*, *4*(2), 177–187. doi:10.1108/jhtt-12-2011-0035
- Balasanova, A. (n.d.). The Evolution of Mobile Data. Retrieved June 13, 2020, from <https://www.keepgo.com/blogs/articles/74570819-the-evolution-of-mobile-data>
- BDCR. (n.d.). Mobile Information Technologies for Tourism Domain ... Retrieved from <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-dd6321fe-202b-4b0e-a452-595f58e8787c>
- Beldona, S., Lin, K., & Yoo, J. (2012). The roles of personal innovativeness and push vs pull delivery methods in travel-oriented location-based marketing services. *Journal of Hospitality and Tourism Technology*, *3*(2), 86–95.
- Berelowitz, S. (2018, December 12). Important mobile booking stats for hotels in 2018. Retrieved from <https://www.pegs.com/blog/important-mobile-booking-stats-for-hotels-in-2018/>
- Biljon, Judy & Kotzé, Paula. (2008). Cultural Factors in a Mobile Phone Adoption and Usage Model. *Journal of Universal Computer Science*. 14.
- Blackall, M. (2019, July 01). Global tourism hits record highs - but who goes where on holiday? Retrieved from <https://www.theguardian.com/news/2019/jul/01/global-tourism-hits-record-highs-but-who-goes-where-on-holiday>
- Brüderl, J., & Ludwig, V. (2015). Fixed-effects panel regression. *The Sage handbook of regression analysis and causal inference*, 327-357
- Choros, A. (2020). How much data do you need for gaming? Retrieved from [whistleout.com/How much data do you need for gaming?](http://whistleout.com/How-much-data-do-you-need-for-gaming?)

- Choujaa, Driss & Dulay, Naranker. (2010). Predicting human behaviour from selected mobile phone data points. UbiComp'10 - Proceedings of the 2010 ACM Conference on Ubiquitous Computing. 105-108. 10.1145/1864349.1864368.
- Cisco Annual Internet Report - Cisco Annual Internet Report (2018–2023) White Paper. (2020, March 10). Retrieved from <https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.html>
- Clement, J. (2019, June 20). Leading mobile internet activities by device 2017. Retrieved from <https://www.statista.com/statistics/249761/most-popular-activities-carried-out-on-mobile-internet-devices/>
- Clement, J. (2020, February 28). Global mobile data traffic 2022. Retrieved from <https://www.statista.com/statistics/271405/global-mobile-data-traffic-forecast/>
- Cramer, Judd & Krueger, Alan. (2016). Disruptive Change in the Taxi Business: The Case of Uber . American Economic Review. 106. 177-182. 10.1257/aer.p20161002.
- Demographics of Mobile Device Ownership and Adoption in the United States. (n.d.). Retrieved June 13, 2020, Retrieved from <https://www.pewresearch.org/internet/fact-sheet/mobile/>
- EuroStat Newsrelease, 260/2016, Internet use by individuals Almost 8 out of 10 internet users in the EU surfed via a mobile or smart phone in 2016... Different patterns across Member States in managing personal information
- Flurry Analytics, 2017
- Garwal, Arun. (2019). Evolution of Mobile Communication Technology towards 5G Networks and Challenges.. 10.12691/ajeee-7-2-2.
- Gayomali, C. (2012, December 03). The text message turns 20: A brief history of SMS. Retrieved June 13, 2020, Retrieved from <https://theweek.com/articles/469869/text-message-turns-20-brief-history-sms>
- Ghose, A., & Han, S. P. (2011). A dynamic structural model of user learning on the mobile Internet. Available at SSRN 1485049.
- Ghose, A., & Han, S. P. (2011). User Content Generation and Usage Behavior on the Mobile Internet: An Empirical Analysis. SSRN Electronic Journal. doi:10.2139/ssrn.1669678
- GSMA, (2019, October 18). 2018 State of the Industry Report on Mobile Money. Retrieved June, from <https://www.gsma.com/mobilefordevelopment/resources/2018-state-of-the-industry-report-on-mobile-money/>

- Hayashi, F. (2000). *Econometrics*. Princeton: Princeton University Press.
- Hayes, A. (2020, January 29). App-pocalypse! 20 Industries Disrupted By New Tech. Retrieved from <https://www.investopedia.com/articles/investing/020615/20-industries-threatened-tech-disruption.asp>
- Iqbal, M. (2020, April 24). Uber Revenue and Usage Statistics (2020). Retrieved from <https://www.businessofapps.com/data/uber-statistics/>
- Janet E. Dickinson, Karen Ghali, Thomas Cherrett, Chris Speed, Nigel Davies & Sarah Norgate (2014) Tourism and the smartphone app: capabilities, emerging practice and scope in the travel domain, *Current Issues in Tourism*, 17:1, 84-101, DOI: 10.1080/13683500.2012.718323
- Jeanjean, F. (2015). What causes the megabyte price drop in the mobile industry? *Economia E Politica Industriale*, 42(3), 277-296. doi:10.1007/s40812-015-0013-6
- Kang, Myunghwa & Schuett, Michael. (2013). Determinants of Sharing Travel Experiences in Social Media. *Journal of Travel & Tourism Marketing*. 30. 93-107. 10.1080/10548408.2013.751237
- Kwon, Jun & Bae, Jung-In & Blum, Shane. (2013). Mobile Applications in the Hospitality Industry. *Journal of Hospitality and Tourism Technology*. 4. 81-92. 10.1108/17579881311302365.
- Lerner, S. (2019, March 25). 5G: 7 Industries That Will Be Affected The Most. Retrieved from <https://www.enterprisemobilityexchange.com/eme-big-data-analytics/articles/5g-industries-impact>
- Limitations and delimitations in research. (2017, March 28). Retrieved June 13, 2020, Retrieved from <https://blog.stcloudstate.edu/ims/2017/03/28/limitations-and-delimitations-in-research/>
- Luckerson, V. (2016, January 19). How Much Netflix People Watch Per Day. Retrieved from <https://time.com/4186137/netflix-hours-per-day/>
- Meola, A. (2016, May 19). More than 25% of all people book travel through mobile devices. Retrieved from <https://www.businessinsider.com/more-than-25-of-all-people-book-travel-through-mobile-devices-2016-5>

- Molla, R. (n.d.). Mary Meeker's 2017 internet trends report: All the slides, Retrieved from <https://www.vox.com/2017/5/31/15693686/mary-meeker-kleiner-perkins-kpcb-slides-internet-trends-code-2017>
- O'Dea, S. (2020, February 28). Smartphone users worldwide 2020, Retrieved from <https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/>
- Panko, R. (n.d.). Riley Panko. Retrieved June 13, 2020, Retrieved from <https://themanifest.com/mobile-apps/mobile-app-usage-statistics-2018>
- Phongtraychack, Anachack & Dolgaya, Darya. (2018). Evolution of Mobile Applications. MATEC Web of Conferences. 155. 01027. 10.1051/mateconf/201815501027.
- Richter, F. (2019, May 17). Infographic: Landline Phones Are a Dying Breed
- Roaming: Using a mobile phone in the EU. (n.d.). Retrieved from https://europa.eu/youreurope/citizens/consumers/internet-telecoms/mobile-roaming-costs/index_en.htm
- Roaming: Using a mobile phone in the EU. (n.d.). Retrieved from https://europa.eu/youreurope/citizens/consumers/internet-telecoms/mobile-roaming-costs/index_en.htm
- Roser, M. (2017, April 24). Tourism, OurWorldInData.org. Retrieved from <https://ourworldindata.org/tourism>
- Roser, M., Ritchie, H., & Ortiz-Ospina, E. (2015, July 14). Internet. Retrieved from <https://ourworldindata.org/internet>
- Spangler, T. (n.d.). YouTube crosses 2 billion viewers a month - CNET. Retrieved from <https://www.cnet.com/news/youtube-crosses-2-billion-viewers-a-month/>
- Statista Research Department. (2016, November 23). Number of mobile phone users worldwide 2015-2020. Retrieved from <https://www.statista.com/statistics/274774/forecast-of-mobile-phone-usersworldwide/>
- Su, L., Zhang, Y., & Wei, J. (2016). A practical test for strict exogeneity in linear panel data models with fixed effects. *Economics Letters*, 147, 27-31. doi:10.1016/j.econlet.2016.08.012
- Tan, G.W.-H., Lee, V.H., Lin, B. and Ooi, K.-B. (2017), "Mobile applications in tourism: the future of the tourism industry?", *Industrial Management & Data Systems*, Vol. 117 No. 3, pp. 560-581. <https://doi.org/10.1108/IMDS-12-2015-0490>

Trends Report: Experiences, Tours & Activities. (2018, February 14). Retrieved from <https://www.tripadvisor.com/blog/travel-industry-tourism-trends-attractions-activities-experiences-2018/>

Wang, H.Y. and Wang, S.H. (2010), "Predicting mobile hotel reservation adoption: insight from a perceived value standpoint", *International Journal of Hospitality Management*, Vol. 29 No. 4, pp. 598-608.

Wang, Zhenzhen & He, Sylvia & Leung, Yee. (2017). Applying mobile phone data to travel behaviour research: A literature review. *Travel Behaviour and Society*. 10.1016/j.tbs.2017.02.005.

Wooldridge, J. M. (2013). *Introductory econometrics: a modern approach* 5th edition. Mason, OH: South-Western.

World Tourism Organization (2018), *UNWTO Annual Report 2017*, UNWTO, Madrid, DOI: <https://doi.org/10.18111/9789284419807>

Worldwide Mobile Data Pricing League: Cost of 1GB in 230 countries. (n.d.). Retrieved June 13, 2020, from <https://www.cable.co.uk/mobiles/worldwide-data-pricing>

60+ Millennial Travel Statistics & Trends (2020). (n.d.). Retrieved from <https://www.condorferries.co.uk/millennials-travel-statistics-trends>

Appendix

Appendix 1

The following table will be an explanation of each of the variables give to the participants to allocate their megabyte usage in the survey

Name	Construct	Question
Abroad 200	Which pertains to people who are abroad and have a constraint of 200 megabytes for downloading/uploading	N/A
Abroad 50	Which pertains to people who are abroad and have a constraint of 50 megabytes for downloading/uploading	N/A
Home	Which pertains to people who are abroad and have a constraint of 200 megabytes	N/A
Push	The act of uploading information	N/A
Pull	The act of downloading information	N/A
SM_Pull (Social Media Pull)	The download of information pertaining to social media platforms such as Instagram, Facebook and Twitter	Q1
SM_Push (Social Media Push)	The upload of of information pertaining to social media	Q2

Name	Construct	Question
Comm_Pull (Communication Pull) :	The download of information pertaining to communication applications such as WhatsApp and Facebook Messenger	Q3
Comm_Push (Communication Push)	The upload of information pertaining to communication applications such as WhatsApp and Facebook Messenger	Q4
Videocall _ (Push and Pull)	The upload/download of information pertaining to applications such as Skype and WhatsApp Video	Q5
Video_Pull (Video Entertainment Pull)	The download of videos for entertainment purposes such using applications such as Netflix and YouTube	Q6
Music_Pull	The download of music using applications such as Spotify	Q7
Game	The download or upload of online gaming on mobile phones	Q8
GPS (Navigation Pull)	The download of navigation content used with applications such as Google Maps and Waze	Q9
Web (web push/pull)	The download or upload of content on the web	Q10
Accom_Reservation (Accommodation Reservation Pull)	The download of content when reserving for an accommodation using applications such as Airbnb	Q11
Langage_Package (Language Package Pull)	The download of a new language package (dictionary) using applications such as Google Translate	Q12

Name	Construct	Question
Uber (Push and Pull)	The download/upload of mobility using applications such as Bolt and Uber.	Q13
Rest_Pull (Restaurant Pull)	The download of searching and reserving restaurant using applications such as Zomato and TheFork	Q14
Rest_Push (Restaurant Push)	The upload of content regarding restaurants such as comments and reviews using applications such as Zomato and TheFork.	Q15
Weather (Weather Pull)	The upload/download of information pertaining to applications such as Skype and WhatsApp Video	Q16

Appendix 2

The following table shows the descriptive summary statistic values of variables for the category of participants at home

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
q1	218	27.578	28.679	0	5	50	150
q2	218	9.628	19.780	0	0	10	200
q3	218	22.422	26.170	0	0	40	120
q4	218	20.317	25.113	0	0	30	150
q5	218	8.468	17.092	0	0	10	100
q6	218	12.055	25.719	0	0	10	200
q7	218	13.784	25.327	0	0	20	150
q8	218	3.037	12.872	0	0	0	117
q9	218	8.404	18.626	0	0	10	150
q10	218	20.546	32.317	0	0	30	200
q11	218	1.647	3.556	0	0	2	20
q12	218	3.500	8.742	0	0	0	50
q13	218	10.404	19.264	0	0	10	50
q14	218	5.972	10.051	0	0	10	50
q15	218	1.431	7.639	0	0	0	100
q16	218	2.752	5.934	0	0	5	50

Appendix 3

The following table represents the descriptive summary statistic of the values for the variables of the category abroad50

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
q1	113	3.726	5.549	0	0	5	25
q2	113	2.292	4.479	0	0	5	20
q3	113	4.062	7.279	0	0	10	40
q4	113	5.195	7.229	0	0	10	30
q5	113	2.929	5.849	0	0	1	30
q6	113	1.381	4.021	0	0	0	25
q7	113	1.531	3.498	0	0	0	20
q8	113	0.283	1.479	0	0	0	10
q9	113	7.150	9.509	0	0	10	40
q10	113	5.522	8.688	0	0	10	50
q11	113	1.717	2.534	0	0	2	10
q12	113	4.690	9.612	0	0	0	25
q13	113	1.142	6.736	0	0	0	50
q14	113	3.540	5.352	0	0	5	30
q15	113	0.195	1.156	0	0	0	10
q16	113	0.965	2.031	0	0	1	10

Appendix 4

The following table represents the descriptive summary statistic for values of the variables for the category abroad200

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
q1	105	16.971	22.968	0	0	25	100
q2	105	7.190	12.287	0	0	10	60
q3	105	17.552	23.483	0	0	30	100
q4	105	18.543	22.692	0	0	30	80
q5	105	9.705	20.786	0	0	10	100
q6	105	6.505	19.190	0	0	0	100
q7	105	7.771	21.680	0	0	5	150
q8	105	2.095	8.285	0	0	0	70
q9	105	21.648	32.942	0	1	29	150
q10	105	16.057	26.675	0	0	25	180
q11	105	4.133	7.954	0	0	4	50
q12	105	10.200	12.433	0	0	25	50
q13	105	16.724	22.502	0	0	50	50
q14	105	9.114	15.683	0	0	10	100
q15	105	0.333	1.498	0	0	0	10
q16	105	3.086	7.39	0	0	5	70

Appendix 5

The following table represents the means of download and upload based on the different categories

Var1	Var2	Value
mean_home	dw_perc	0.69095980
mean_abroad200	dw_perc	0.67859031
mean_abroad50	dw_perc	0.74254094
mean_home	up_perc	0.18761067
mean_abroad200	up_perc	0.15395005
mean_abroad50	up_perc	0.16423473
mean_home	ot_perc	0.12142953
mean_abroad200	ot_perc	0.16745964
mean_abroad50	ot_perc	0.09322434

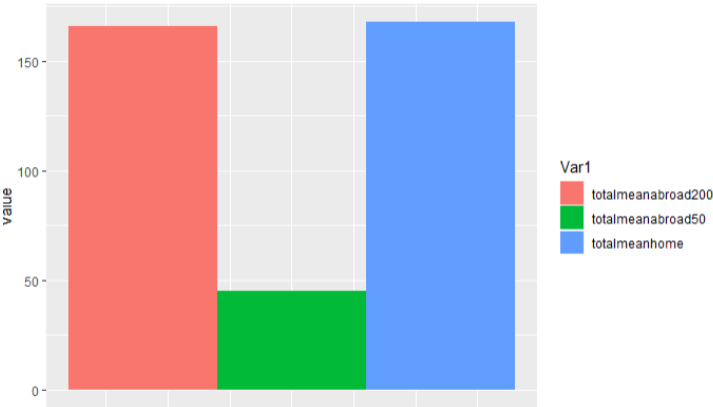
Appendix 6

Mean per question based on the 3 categories

	q1	q2	q3	q4	q5	q6	q7	q8	q9	q10	q11	q12	q13	q14	q15	q16
mean_home	27.578	9.628	22.422	20.317	8.468	12.055	13.784	3.037	8.404	20.546	1.647	3.500	10.404	5.972	1.431	2.752
mean_abroad200	16.971	7.190	17.552	18.543	9.705	6.505	7.771	2.095	21.648	16.057	4.133	10.200	16.724	9.114	0.333	3.086
mean_abroad50	3.726	2.292	4.062	5.195	2.929	1.381	1.531	0.283	7.150	5.522	1.717	4.690	1.142	3.540	0.195	0.965

Appendix 7

The following table shows the mean of upload and download based on category



Appendix 8

Regression Analysis

Dependent variable:

	lm2
q_version200mb	18.988*** (3.991)
q_versionhome	29.338*** (3.756)
variableq2	-9.781*** (2.738)
variableq3	0.581 (2.738)
variableq4	1.571 (2.738)
variableq5	-7.267*** (2.738)
variableq6	-10.467*** (2.738)
variableq7	-9.200*** (2.738)
variableq8	-14.876*** (2.738)
variableq9	4.676* (2.738)

variableq10	-0.914
	(2.738)
variableq11	-12.838***
	(2.738)
variableq12	-6.771**
	(2.738)
variableq13	-0.248
	(2.738)
variableq14	-7.857***
	(2.738)
variableq15	-16.638***
	(2.738)
variableq16	-13.886***
	(2.738)
q_versionhome:variableq2	-8.169**
	(3.333)
q_versionhome:variableq3	-5.737*
	(3.333)
q_versionhome:variableq4	-8.833***
	(3.333)
q_versionhome:variableq5	-11.843***
	(3.333)
q_versionhome:variableq6	-5.056

	(3.333)
q_versionhome:variableq7	-4.594
	(3.333)
q_versionhome:variableq8	-9.665***
	(3.333)
q_versionhome:variableq9	-23.851***
	(3.333)
q_versionhome:variableq10	-6.118*
	(3.333)
q_versionhome:variableq11	-13.093***
	(3.333)
q_versionhome:variableq12	-17.307***
	(3.333)
q_versionhome:variableq13	-16.927***
	(3.333)
q_versionhome:variableq14	-13.748***
	(3.333)
q_versionhome:variableq15	-9.509***
	(3.333)
q_versionhome:variableq16	-10.940***
	(3.333)

Observations	5,168
R ²	0.324

Adjusted R ²	0.290
Residual Std. Error	19.838 (df = 4919)
F Statistic	9.464*** (df = 249; 4919)

Note: * p < 0.05 ** p < 0.01 *** p < 0.001

Appendix 9: Regression

	<i>Dependent variable:</i>
	(value + 1)
q_version50mb	-13.088*** (1.915)
variableq2	-9.781*** (1.938)
variableq3	0.581 (1.938)
variableq4	1.571 (1.938)
variableq5	-7.267*** (1.938)
variableq6	-10.467*** (1.938)
variableq7	-9.200*** (1.938)
variableq8	-14.876***

	(1.938)
variableq9	4.676**
	(1.938)
variableq10	-0.914
	(1.938)
variableq11	-12.838***
	(1.938)
variableq12	-6.771***
	(1.938)
variableq13	-0.248
	(1.938)
variableq14	-7.857***
	(1.938)
variableq15	-16.638***
	(1.938)
variableq16	-13.886***
	(1.938)
q_version50mb:variableq2	8.347***
	(2.692)
q_version50mb:variableq3	-0.245
	(2.692)
q_version50mb:variableq4	-0.102
	(2.692)

q_version50mb:variableq5	6.470** (2.692)
q_version50mb:variableq6	8.122*** (2.692)
q_version50mb:variableq7	7.005*** (2.692)
q_version50mb:variableq8	11.434*** (2.692)
q_version50mb:variableq9	-1.251 (2.692)
q_version50mb:variableq10	2.711 (2.692)
q_version50mb:variableq11	10.829*** (2.692)
q_version50mb:variableq12	7.736*** (2.692)
q_version50mb:variableq13	-2.336 (2.692)
q_version50mb:variableq14	7.671*** (2.692)
q_version50mb:variableq15	13.107*** (2.692)

q_version50mb:variableq16	11.125*** (2.692)
Constant	15.969*** (3.821)

Observations	3,488
R ²	0.159
Adjusted R ²	0.145
Residual Std. Error	14.041 (df = 3428)
F Statistic	11.000*** (df = 59; 3428)

Note: * ** *** p < 0.01

Appendix 10

The following are the significant coefficients for the abroad50 and abroad200 categories

10.1

Q13

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.09635	0.01327	7.263	6.77e-12	***
q_version50mb	-0.07139	0.01842	-3.875	0.000142	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

10.2

Q11

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.024094	0.007858	3.066	0.00245	**
q_version50mb	0.021139	0.010915	1.937	0.05408	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

10.3

Q14

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.051499	0.009839	5.234	3.92e-07	***
q_version50mb	0.024122	0.013666	1.765	0.079	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Appendix 11

The following are the significant coefficients for the home and abroad200 categories

11.1

Q1

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.10226	0.01460	7.005	1.46e-11	***
q_versionhome	0.05747	0.01777	3.234	0.00135	**

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

11.2

Q7

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.04376	0.01228	3.563	0.000422	***
q_versionhome	0.03361	0.01495	2.249	0.025206	*

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

11.3

Q9

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.12169	0.01237	9.835	< 2e-16	***
q_versionhome	-0.07385	0.01506	-4.904	1.5e-06	***

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

11.4

Q11

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.024094	0.002844	8.473	8.79e-16	***
q_versionhome	-0.014275	0.003461	-4.124	4.75e-05	***

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

11.5

Q12

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.064593	0.006766	9.546	< 2e-16	***
q_versionhome	-0.043769	0.008236	-5.314	2.01e-07	***

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

11.6

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.09635	0.01259	7.655	2.29e-13	***
q_versionhome	-0.03212	0.01532	-2.097	0.0368	*

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

11.7

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.051499	0.006498	7.926	3.77e-14	***
q_versionhome	-0.016479	0.007909	-2.084	0.038	*

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Appendix 12: Survey Conducted for this thesis

The following are the coupons that the participants “won” during their travel abroad;



Home Information

You are in your home city.

You have your smartphone, but no other electronic devices, and you have no mobile data plan on your phone.

While going to your favorite place, you find the following mobile data coupon on the advertising shelf of a large local mobile phone carrier.

The card has the following message: Redeem and get 200 megabytes of mobile data valid for 30 days to use in any mobile device.

Abroad Information

50MB:

You are arriving in a foreign city.

It is the first time you are in this city, and you have no local friends or acquaintances.

You have your smartphone, but no other electronic devices, and you have no mobile data plan on your phone.

When you arrive at the airport, you find the following mobile data coupon on the advertising shelf of a large local mobile phone carrier.

The card has the following message: Redeem and get 50 megabytes of mobile data valid for 30 days to use in any mobile device.

200MB:

You are arriving in a foreign city.

It is the first time you are in this city, and you have no local friends or acquaintances.

You have your smartphone, but no other electronic devices, and you have no mobile data plan on your phone.

When you arrive at the airport, you find the following mobile data coupon on the advertising shelf of a large local mobile phone carrier.

The card has the following message: Redeem and get 200 megabytes of mobile data valid for 30 days to use in any mobile device.

MB Allocation

Read/watch contents for 1 minute on social media (Facebook, Instagram, Twitter): 5MB	<input type="text" value="0"/>
Post 1 content on social media (Facebook, Instagram, Twitter): 5MB	<input type="text" value="0"/>
Read/watch contents for 1 minute from a messaging app (WhatsApp, Snapchat, Messenger): 10MB	<input type="text" value="0"/>
Send 1 content with a messaging app (WhatsApp, Snapchat, Messenger): 10MB	<input type="text" value="0"/>
Video-call for 1 minute (using Facetime, WhatsApp, Skype): 10MB	<input type="text" value="0"/>
Watch video entertainment for 1 minute (YouTube, Netflix): 10MB	<input type="text" value="0"/>
Listen to a song on a streaming platform (Spotify, Apple Music): 5MB	<input type="text" value="0"/>
Play an online multiplayer game for 1 minute: 20MB	<input type="text" value="0"/>
Use a navigation app for 10 minutes (Google Maps, Apple Maps, Waze): 1MB	<input type="text" value="0"/>
Surf the web for 1 minutes (Safari, Chrome): 1MB	<input type="text" value="0"/>
Check your accommodation reservation (Booking, AirBnb): 2MB	<input type="text" value="0"/>
Download a language translation package (Google Translator): 25MB	<input type="text" value="0"/>
Download a local transportation application (Uber, Kapten, Lyft) : 50MB	<input type="text" value="0"/>
Search 1 time for restaurants/bars (TripAdvisor, Zomato, Google maps): 5MB	<input type="text" value="0"/>
Write 1 review about a restaurant/bar (TripAdvisor, Zomato, Google maps): 2MB	<input type="text" value="0"/>
Check the weather: 1MB	<input type="text" value="0"/>
Total	<input type="text" value="0"/>

Real Package

Thank you for your collaboration in the 2 scenarios presented above. It's time to get back to a real scenario.

Do you currently have a subscription with mobile data included?

- Yes
 No

How many megabytes per month are included in your mobile telecommunications package? (1 gigabyte = 1000 megabyte)

How much does your mobile telecommunications package cost per month? (including mobile data, text messages and in plan call minutes) Please, express the amount in dollars, without inserting the \$ symbol

Demographics

Please indicate your gender.

- Male
 - Female
 - Other
-

Please indicate your age.

- Under 18
- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 - 74
- 75 - 84
- 85 or older

Please indicate your nationality.

Please indicate your employment status.

- Employed full time
 - Employed part time
 - Freelance
 - Unemployed
 - Retired
 - Student
 - Other
-