

Rationality vs Reality

Challenging the standard rational choice theory

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1 Introduction

2 Literature review

2.1 “The challenge of our time”

In the last decades, the increase in income inequality has generated growing concern. In 2013 it was defined “the challenge of our time” by President Obama and one year later Pope Francis condemned the global “economy of exclusion”. In fact, inequality and economic growth can be regarded as two sides of the same coin and the rise of the former associates both developed economies, where the gap between rich and poor is now at highest levels in decades, and emerging economies, experiencing more mixed trends (Dabla-Norris et al. 2015).

The relation between economic development and inequality is bilateral. On the one hand, a rise in income inequality reduces economic growth at least in three ways. First, it triggers political instability, which in turn tends to reduce investment and - consequently - economic growth. Moreover, disparities in income distribution encourage poor people to undertake rent-seeking or illegal activities threatening property rights, and that drives down investment (Alesina and Perotti 1996). In addition, inequality reduces the capacity of poorer members of the society to invest in education thus hampering social mobility and skill development (Cingano 2014). Furthermore, it reduces social consensus required to adjust shocks and sustain growth. Nevertheless, all those effects may be non linear: increases in inequality from low levels provides growth enhancing incentives, while increases part some point encourage rent-seeking and lower growth (Ostry, Berg, and Tsangarides 2014). Finally, in highly unequal contexts the majority of the voters - who are usually poor - ask for redistributive policies, which decrease the after-tax marginal product of capital, hence lowering the rate of accumulation and driving down growth (Alesina and Perotti 1996). Nevertheless, redistribution policies may also affect growth positively, by reducing tensions and incentivizing productive activities and capital accumulation. Yet, the net effect of redistributive policies on growth has to weigh the costs of distortionary taxation against the benefits of reduced social tensions. More broadly, taxation may not be inherently detrimental to growth, as long as it reduces tax expenditure or loopholes that benefit the rich, increases public investment through progressive taxation or social insurance spending on welfare favouring poor people (Ostry, Berg, and Tsangarides 2014).

On the other hand, economic growth may produce a rise in income inequality, leading to social tensions and political discontent that jeopardize the wellbeing of society (Gallo 2002). According to the inverted U hypothesis (Kuznets 1955), income inequality widens in the early phases of economic growth; then it stabilizes for a while; and finally it narrows in the later phases. There are two factors explaining the rise in income inequality. First, the concentration of savings in the hands of the upper social classes leads to higher amount of income for them and their descendants. Second, the rise in the urban share of the population resulting from economic growth, that is assumed to be more unequal than rural population, whose income is lower than the urban one: hence, this gap in relative mean incomes tends to widen as a result of a more rapid growth of the per capita productivity in economic urban activities than in agriculture. However, such negative effects of economic growth only hold in the short run, since in the long run this trend tends to reverse due to government redistribution policies and other exogenous factors (the decrease in the proportion of rich families and immigration entering at the lower income levels). Moreover, this tendency towards increasing inequality is reversed when all the surplus labour is absorbed into modern sector employment, becoming a scarce factor of production. Therefore, further growth, implying an increase in labour demand, will push the wages up, thus levelling inequality. Nevertheless, no definite causal relation has been found that allows generalizing the ways in which economic growth affects income inequality. Instead, empirical evidence shows that the impact of economic growth on income distribution depends more on the way in which growth is pursued than on the level of per capita income or the rate of growth (Gallo 2002).

2.2 Inequality and consumption behavior

According to rational choice theory, individuals have rational preferences and use the full and relevant information at their disposal to determine which options are available, rank them and choose the most preferred one in order to maximise their utility (optimization-based approach) (Levin and Milgrom 2004). It is further assumed that individuals rationally pursue their self-interest taking into account all economics constraints (such as time, prices, income and capital). Particularly, in maximising utility consumers are constrained by the total amount of wealth they draw upon to purchase goods/services, save money or invest. Hence, utility maximisation is a matter of arranging spending permitted by the budget constraint to achieve the highest total utility possible. Ultimately, it is by weighing up the marginal benefit (the increased benefit obtained by consuming an additional unit of a product) and marginal cost of making a given purchase, that consumers make the final consumption decision: only if the marginal benefit of purchasing one item exceed its marginal cost the consumer will make the purchase (Green 2002).

Despite optimization-based approach has been witnessing a remarkable intellectual convergence since 19th century (Levin and Milgrom 2004), in recent years it has been challenged and/or complemented by findings in the behavioral economics turf. Differently from the standard theory, behavioural economics draws on psychology and the behavioural sciences in assessing consumer behaviour, maintaining that there is a wide variety of cognitive, social and emotional variables that can influence consumers' choice. The behavioural factors which affect consumers' choice can be categorised as follows: - Adversion to loss.

- Evaluation of choices relatively to some reference point rather than objectively.
- Changing opinions over time.
- Influence of social factors (social norms, ego, channels through which they receive information, etc.)
- Additional factors such as incapacity to value money (due to attached values, for instance), mental short-cuts when taking decisions, and emotions (Green 2002).

Among the above-mentioned variables that may encourage luxury consumption, reference points and attached values are particularly relevant. Reference points are mental thresholds that individual set in order to compare themselves with others. It is often assumed that the relevant reference point for evaluating gains and losses is the current status of wealth and welfare, exhibited, for instance, by purchasing and expensive good (Wilkinson and Klaes 2012): in fact, especially when information is incomplete, people may use conspicuous consumption as a signal of their wealth to acquire acknowledgement of the social status (Jin, Li, and Wu 2010). However, the reference point may also be the expected status, rather than the current one. Moreover, rational choice may be distorted when the value of a good is not give exclusively by its measurable value but by subjective attached values. For example, the car used by a Rock Star can reach higher prices on an auction that the very the same model, because its additional embedded attributes: fame, status, etc (Wilkinson and Klaes 2012).

Following this approach, consumption decisions can therefore be explained not only by comparing costs and benefits related to them, but consumers can also act "irrationally" and get fully emotional basing their decisions on the feelings like pleasure, happiness and gratification, that they get through the buying behavior. For instance, people might purchase a luxury good such as a car to acquire some hedonic values (Bilge 2015), rather than because it emerges as the best mode of transportation after rationally weighing travel time, travel cost, value of journey, and quality of transport (Department for Transport 2011).

In general, individuals care about social status, and their behavior are often motivated by the desire to improve their ranks in the hierarchy, not less than by pecuniary rewards such as consumption. Nevertheless, income inequality can produce different consumption behaviours in the the people, depending on the social strata of which they are part. In the case of lower classes, inequality may strengthen the incentive to reduce consumption and accumulate wealth so to improve social status more than rich families: in fact, the diminishing marginal utility of status means that the poor get more pleasure from a marginal increase in their relative wealth than the rich (Jin, Li, and Wu 2010).

3 General overview of the project

3.1 Research question, justification and hypotheses

The aim of our work is to investigate **how the rise in inequality, economic growth and usage of public transportation influences the purchase of cars (as an example of luxury good) in Singapore, from 1995 to 2014.**

Singapore claims to be a successful country, which implies increasing competition, economic development, as well as inequality in comparison with other countries that lack Singapore's success standards. The government of Singapore constantly displays how well ranked the country is, in order to promote the '*success*' paradigm. Kishore Mahbudani, Dean of Lee Kuan Yew School of Public Policy, recently stated that the island went from having a 500 dollars GDP per capita in 1965 to 76.237 dollars in 2015, almost doubling U.K., its former colonizer. Likewise, he added that '*more than one out of six households have \$1 million in cash savings*' (Mahbudani 2015a). International competitiveness of Singapore is out of doubt. However, how competitive Singaporeans are between each other, how unequal the society is and what is triggered by this traits, are considerations worth analyzing.

According to a recent survey (Mahbudani 2015b), 9 out 15 Singaporeans agreed that its society is based on competitiveness, materialism, self-centredness, '*kiasi-ism*' (fear of dying) and blame-shifting. Additionally, the same rate of Singaporean youngsters are worried that extreme competition would get them out of not affording what they called "basic goods", namely flats and a cars (Rachel and Maryam 2014).

The consideration a cars as a basic need in a country that has relentlessly tried to have world class transportation systems indicates that there are hidden reasons for owning cars. In fact, the country displays a variety of alternative public means of transportation covering almost all the island, a factor that should limit the scope of owing a car. In fact, a part from buses and taxis (that are public in Singapore), the country also has two extensive rail lines, the MRT (Mass Rapid transit) and the LRT (Light Rail Transit, complementing the MRT).



In addition, Singapore has tried to deter the purchase of cars by subjecting the purchase of cars to high taxation: in fact car owners need to own a certificate of car entitlement that can cost even more than 70,000 dollars. Therefore ‘Singapore has made the car one of the most important status symbols in Singapore. This explains the attraction of European car brands in Singapore’ (Mahbudani 2014).

When in the so-called developing world - to which Singapore belongs - the number of private cars grows despite the attempt of the state to reduce their usage (The Economist 2012) through extensive provision of public transports and high taxation on car purchasing, such overpopulation of cars might be understood under the lenses of high inequality, fierce competition and the need of displaying status symbols.

Under these considerations, by collecting and analysing data on economic growth, inequality, and usage of public transportation, the hypotheses to be tested are the following:

- *H1*: The higher the economic growth, the higher the purchase of luxury cars
- *H2*: The higher the inequality, the higher the purchase of luxury cars
- *H3*: The less usage of public transport, the higher the purchase of luxury cars

3.2 Description of variables

As suggested by the research question and the hypotheses, the dependent variable is the number of private cars in Singapore between 1995 and 2014 (in thousands).

On the other hand, the explanatory variables are economic growth, inequality and usage of public transports. Economic growth is measured by Singapore’s GDP per capita in Singaporean dollars (in thousands) at current prices, derived by dividing current price GDP by total population. Inequality is measured by the number of

times by which in number of times by which the top 10% earners are richer than those earning the bottom 90% average income. Both top 10% and bottom 90% average income are measured in real singaporean dollars (in thousands). Finally, the usage of public transports can be divided into three parts:

- usage of buses;
- usage of MRT;
- usage of LRT.

In all of the cases data is expressed by the daily average of commuters (in thousands) using public transport yearly.

The following table summarizes the variables taken into consideration for the analysis.¹

Table 1: Summary of variables

Variable	Description	Time.frame
GDP per capita	Current price GDP divided by the population, in singaporean dollars (thousands)	1980-2021
Top 10% average income	Average income earned by the richest 10% of the poluation in real singaporean dollars (in thousands)	1947-2009
Bottom 90% average income	Average income earned by the poorest 90% of the poluation in real singaporean dollars (in thousands)	1947-2009
Inequality	Difference beteen top 10% and bottom 90% average income (number of times)	1947-2009
Annual motor vehicles	Number of cars, rental cars, buses, taxis, buses, motorbikes (in thousands)	1960-2015
Public transport utilization	Average daily commuters using MRT, LRT, buses, taxis	1995-2014

3.3 Methodology

3.4 Data sources and gathering

The data for our empirical analysis were retrieved from the following sources:

- IMF Cross Country Macroeconomic Statistics open data available on Quandl. From this source we downloaded data showing the trend in Singapore's GDP per capita measured in singaporean dollars from 1981 to 2021 (forecasted from 2015 onwards). The data was provided in csv format and imported on R using the URL of the website.
- World Top Incomes Database available on Knoema, provides access to data on the distribution of top incomes in more than twenty five countries across the globe. From this source we downloaded data on the top 10% average income and bottom 90% average income in Singapore from 1947 until 2009,

¹Time frame refers to the time span available in the sources from which gathered the data. Instead, as specified by the research question, our analysis only takes into account the years from 1995 to 2014

measured in singaporean dollars. Since it was not possible to directly import the database to R, we requested and received the data via e-mail in csv format. This data set is available in the repository.²

- Singapore’s open data portal offered two data bases:
 - The Annual Motor Vehicle Population, provides the number of public and private vehicles from 1960 to 2015, including: mortorbikes, rental cars, buses, taxis and other type of vehicles. While mortorbikes, rental cars and cars are private means of transportation, buses and taxis are to be considered public since in Singapore even the taxis are provided by the state.
 - Public transport utilization. This data is expressed as the daily average of thousand commuters using public trasport by year. It covers the span from 1995 to 2014 and includes the following modes of transportation: MRT (underground), LRT (a localised rail systems acting as feeder services to the Mass Rapid Transit network), taxis (publicly run) and buses.

3.5 Cleaning, processing and merging data sets

After importing data we used the “date” variable (year) as a unique identifier for all four datasets, in order to merge them afterwards. The following operations were needed before proceeding to the merge.

Since time frames of the data were different, we selected a common span of time: 1995-2014. In the case of bottom 90% and top 10% average income, we had to make a linear regression to forecast missing values (from 2009 until 2014). The results, available in a new dataframe, were later on bounded with the orginal one, in order to have the entire time series. As for LRT, values from 1995 until 1998 were missing since the service started to be provided from 1999 (Infopedia 2005); therefore, we completed the dataframe giving the value “0” for the first 4 years of the time span taken into consideration.

Cleaning the data was limited to changing column names, eliminating the unnecessary ones and organizing the various data frames so to merge them more easily afterwards, using the year as common denominator. Only in the case of the dataframe containing the number of private cars in Singapore from 1995 until 2014 `~[car.pop.1]` we had to change the format of the data from characters to integers, due to an incorrect import.

In order to have an indicator showing the trend in inequality in Singapore between 1995 and 2014, we created a new variable - named “inequality” - by divididing the top 10% avereage income by the bottom 90% average income for each year: the coefficient of the division shows how many times Singaporeans earning the top 10% average income are reacher than the bottom 90% earners of the population.

As for the number of cars, we simply divided them into the categories provided in the data original set: cars, buses, etc. Originally, they were in one column so we separate them in several ones to have the year as a unique identifier.

Finally, we merged all the single dataframes into the new one, containing all the variables that we used to perform descriptive and inferential statistical analyses.

3.6 Packages used

This document and particularly data processing was made using: R (2016), Quandl (2015), Corrplot (2013), Ggplot(2016), Pander (2015), Repmis (2016), Stargazer (2015), Knitr [R-knitr].

4 Statistical analysis

4.1 Descriptive statistics and central tendency

The table below shows the basic decriptive statistics for our variables.

²We did not gather data from the database Clio Infra as initially stated in our ResearchProposal, since it did not provide sufficient data for the time span we are considering.

Throughout the period the average GDP per capita is 50.277 singaporean dollars, but it varied a lot, ranging from a minimum of 35.345,5 to 70.966,9 singaporean dollars per person. An even grater variation can be observed in the top 10% average income, whose value has been increasing reaching the peak of 325,450 singaporean dollars. Compared to the top 10%, the bottom 90% average income witnessed a more reduced change and its average of 29.022 singaporean dollars shows a great distance from the top 10% earners. In fact, if we look at inequality we see that on average top 10% average income is 6 times greater than the bottom 90% average income. Moreover, the difference between the richest and the poorest has been high for the entire period, with the top 10% earners gaining from 4 to 8 times more than the bottom 90% earners.

As for the number of vehicles, troughout the period there were, on average, 466.148 cars in Singapore, and their number varied consistently, with a minimum of 342.245 (in 1995) and a maximum of 607.292 (in 2013). Instead, the variation in the number of rental cars, taxis, buses and motorbikes was more restrained, as shown by the standard deviation.

Finally, if we look at the usage of public transports, we see that the highest variation in the number of passengers was witnessed by the MRT, with a number of daily commuters ranging from 740 to 2762 thousands. However, buses show the highest number of average daily passengers, whose amount was more stable than MRT passengers in the time-span considered. Finally, the LRT displays the lowest amount of daily passengers and a relatively low variation, probably due to the fact that the service was only provided from 1999 onwards (Infopedia 2005).

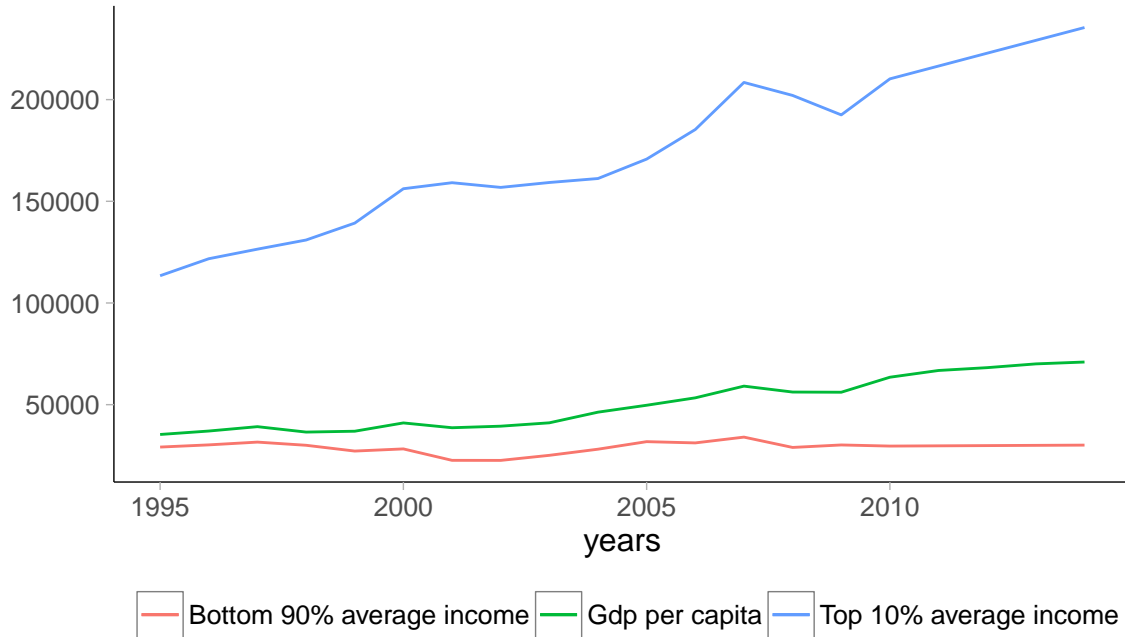
Table 2: General data summary

Statistic	N	Mean	St. Dev.	Min	Max
gdp.per.capita	20	50,277.2	12,717.7	35,345.5	70,966.9
inequality	20	6.1	1.3	3.9	7.8
top	20	174,881.0	38,176.0	113,402.5	235,450.0
bottom	20	29,022.2	2,851.4	22,602.4	34,043.3
cars	20	466,148.3	97,290.5	342,245	607,292
rentalcars	20	10,097.0	3,881.3	5,144	18,847
taxis	20	21,958.7	4,201.0	16,517	28,736
buses	20	13,993.9	2,302.3	10,723	17,554
motorbikes	20	138,985.9	6,435.2	129,587	148,160
other	20	146,548.7	10,180.8	134,756	161,698
bus.u	20	3,159.9	254.5	2,779	3,751
mrt.u	20	1,504.2	635.1	740	2,762
lrt.u	20	62.8	45.0	0	137

4.1.1 Trends in gdp per capita and inequality

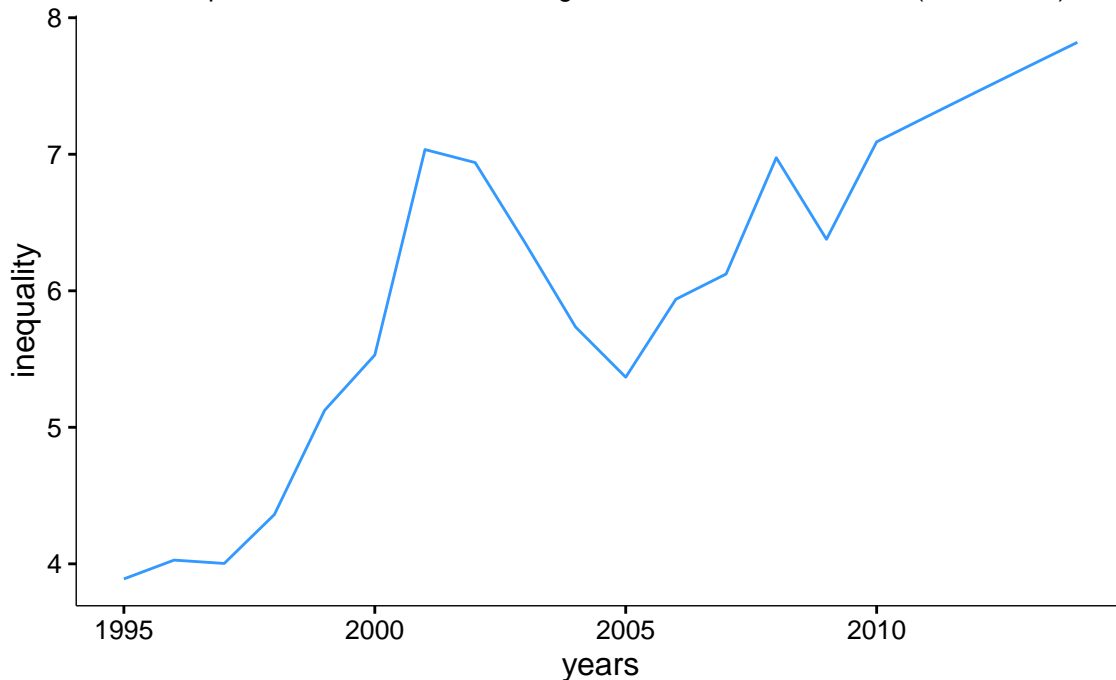
The following graph shows the trend of the explanatory variables in Singapore between 1995 and 2014. As we can see, although slowly, the gdp per capita has risen thourghout the whole period, despite a slight decline between 2002 and 2005 and a more serious reduction in the years of the financial crisis, between 2008 and 2010. The top 10% average income shows the same trend: a steady increase throughout the whole period (in 2014 its value was more than 100% higher than the initial one), with a slight decline between 2002 and 2005, and a more serious reduction in the years of the financial crisis. However, the value of the bottom 90% average income has barely changed, enlarging the difference between the top and bottom populations.

Figure 1 – Gdp per capita, top 10% and bottom 90% average income in Singapore measured in national currency at current prices (1995–2014)



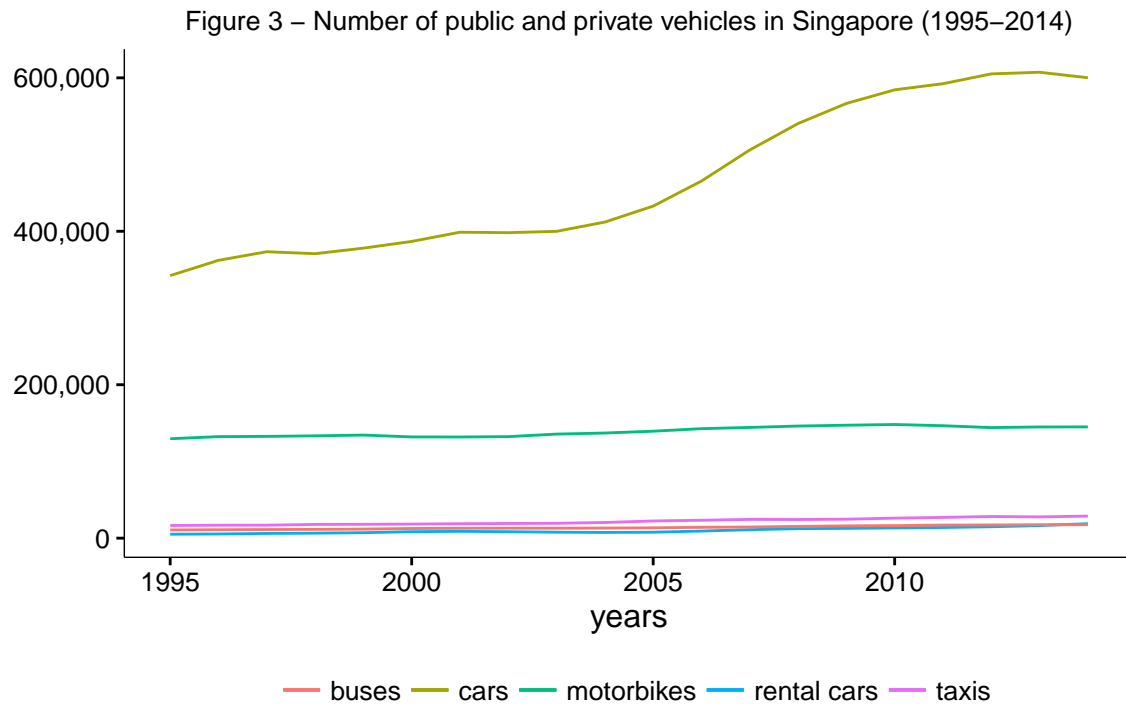
The growing difference between the top and bottom earners is clarified by the following graph, showing trend in inequality in Singapore, measured in number of times by which the top 10% earners are richer than those earning the bottom 90% average income. The graph confirms what already highlighted above: the difference between the rich and the poor has been increasing all the time, and the trend only reversed between 2002 and 2005 and between 2008 and 2010. The average ratio between both groups is 6.1 and has reached a maximum value of 7.8.

Figure 2 – Inequality in Singapore measured by the distance between the top 10% and bottom 90% average income in number of times (1995–2014)



4.1.2 Trends in ownership and usage of vehicles

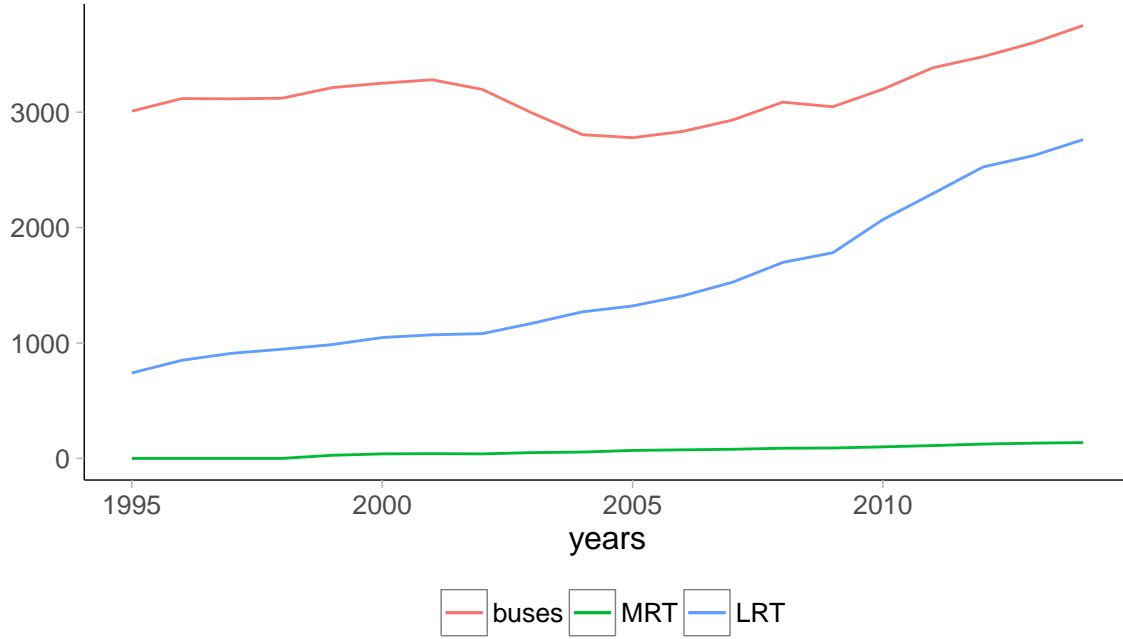
The following graph shows the number of public and private vehicles present in Singapore between 1995 and 2015. What is striking, is the continuous and rapid increase in the number of privately owned cars (especially since 2006). This trend supports the hypothesis which links high the economic growth, high the inequality and increase of cars' purchase.³ A further assumption to be investigated is that such increase might be linked to the likewise rise in the top 10% average income: as the rich become richer, the purchase of luxury goods, such as cars, increases as well.



At the same time, the number of passengers in the main public transportation (MRT and buses) has increased consistently over time. Despite that, the publicly owned buses have not significantly changed in number. Consequently, this also supports the hypothesis that the usage of public transport is not entirely linked with the purchase of cars: in fact, usage of public transport has either increased (in the case of MRT and buses) or stayed the same (in the case of LRT), while the number of private cars has grown consistently. Even in this case a further assumption to be investigated is that those using public transports are lower earners.

³For more details about the hypotheses see <https://github.com/EmiliaSicari/ResearchProposal>

Figure 4 – Average daily passengers using public transport in Singapore in thousands (1995–2014)



4.2 Correlation analysis

The graph below⁴ shows the correlation among the variables considered in our analysis: the darker the colour, the stronger the correlation. Likewise, the size of the circles shows the magnitude of the correlation. While blue indicates negative correlation, red is associated with positive correlation.

What clearly emerges from the plot, is that the variables are in almost all of the cases highly and positively correlated to each other. Bottom 90% average income and buse utilization are less correlated to the other variables, and bottom 90% average income is also negatively correlated with both inequality and buses utilization (which weakens the assumption that the poorest are those who use more public transportations). However, high correlation among explanatory variables might create problems due to multicollinearity and may show a biased in the variables in general , which will be assessed in the next stage of the research.

⁴bus.u, lrt.u and mrt.u stand for the utilization of these modes of transportation. We also eliminated the “other” variable since it not included in the anlysis

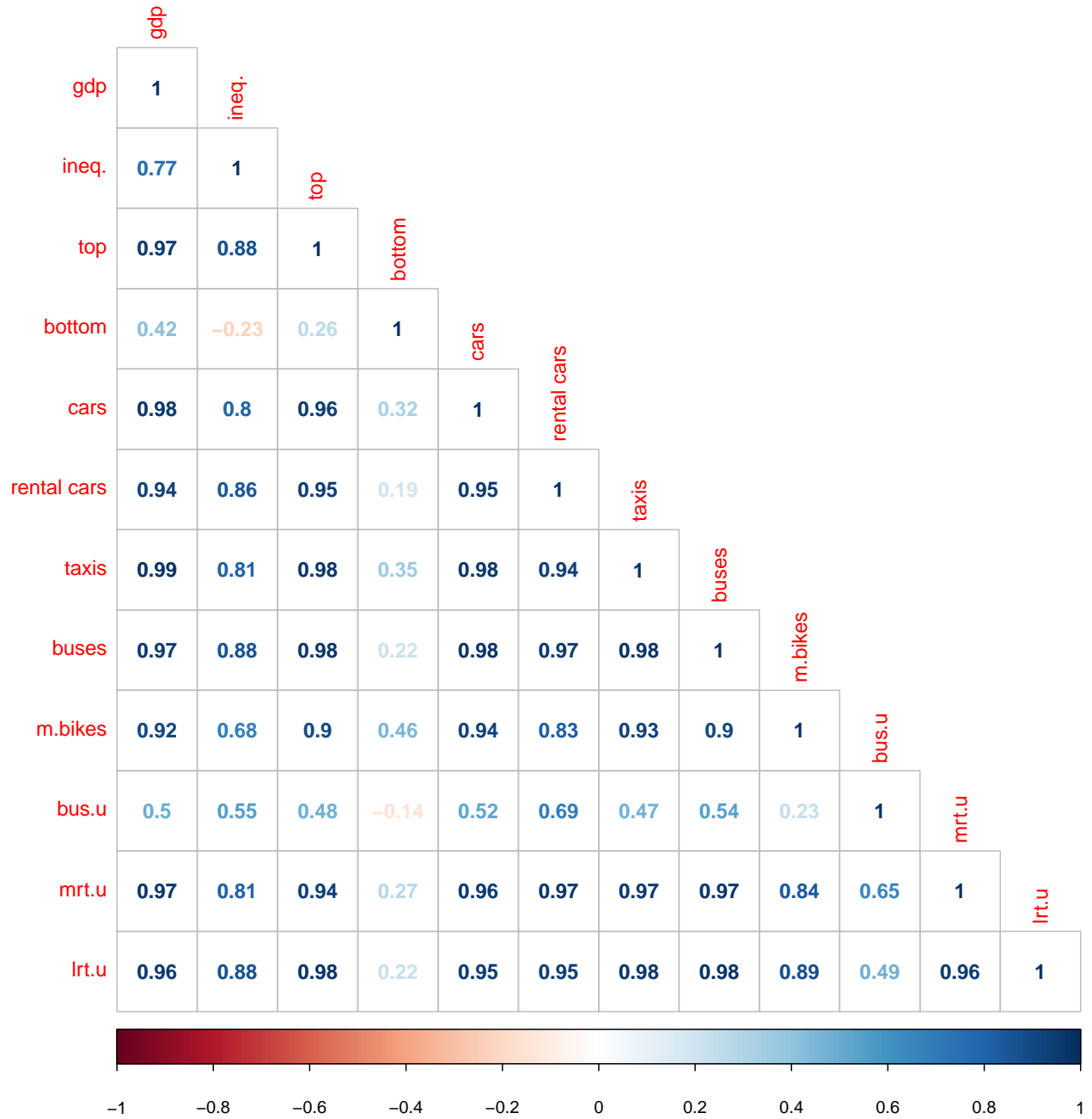


Figure 1: Correlation Matrix

4.3 Inferential Statistics

5 Conclusions

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