

---

# UNIVERSAL ASSET PREFERENCES

---

**An Empirical Study on Durable Preferences for Households Throughout  
the Developing World**



## Radboud Universiteit

**Master's Thesis in Economics:** International Economics and Development (2020-2021)

**Jordi (A.A.) Gremmen:** s1005958

**18-07-2021**

## **Abstract**

---

Research indicates a universal preference for durable goods to be present within a variety of countries. Nevertheless, the universality of preferences for durable goods throughout the developing world remains a poorly studied and understood subject. We study the universality and the rationality of durable preferences for households throughout the developing world. We use logistic regression analyses to estimate ownership probabilities for a selection of four durables, which we utilize to construct patterns of durable acquisition for average households. Results indicate that household preferences for durable goods are neither universal, nor rational throughout the countries of the developing world. Yet, preferences for durable goods likely are universal within specific regions, such as Sub-Saharan Africa. Nevertheless, differences in access to electricity, the relative household position of women, urban or rural residence, complementarities and a set of country-specific factors yield varying – and irrational – patterns of durable acquisition and preferences among households throughout the developing world. Our findings indicate that when designing developmental policies for the developing world it is of importance to account for the differences in durable preferences among households. Moreover, in order to guarantee efficient patterns of development, policy makers should eradicate irrational tendencies in the acquisition of durables by households.

---

## Table of Contents

<b>1. Introduction</b> .....	1
<b>2. Theoretical Background</b> .....	3
2.1. <i>Durables and Well-Being</i> .....	3
2.2. <i>Universal Patterns of Durable Acquisition</i> .....	4
2.2.1. <i>Deviations in the Acquisitional Patterns and Preferences of Durables</i> .....	4
2.2.2. <i>The Ownership of Radios, Televisions, Motorbikes and Refrigerators</i> .....	5
2.3. <i>Subjectively Rational Patterns of Durable Acquisition</i> .....	6
2.4. <i>Hypotheses</i> .....	7
<b>3. Methodology</b> .....	8
3.1. <i>Data</i> .....	8
3.1.1. <i>Dependent and Independent Variables</i> .....	8
3.1.2. <i>Summary Statistics</i> .....	11
3.2. <i>Empirical Approach</i> .....	11
3.2.1. <i>Clustering Issues</i> .....	12
3.2.2. <i>Testing the Universality of Durable Preferences (Testing H1)</i> .....	12
3.2.3. <i>Testing the Rationality of Durable Preferences (Testing H2)</i> .....	14
3.2.4. <i>Correlation Statistics &amp; Multicollinearity</i> .....	15
<b>4. Results</b> .....	16
4.1. <i>Regression Results</i> .....	16
4.2. <i>The Patterns of Durable Acquisition</i> .....	18
4.2.1. <i>Deviations in the Patterns of Durable Acquisition</i> .....	19
4.2.2. <i>Country-Specific Effects: The Peculiar Cases of Armenia and South Africa</i> .....	20
4.3. <i>The Rationality of Durable Preferences</i> .....	22
<b>5. Conclusion and Discussion</b> .....	24
<b>References</b> .....	26
<b>Appendix to Chapter 3</b> .....	30
<b>Appendix to Chapter 4</b> .....	35



## 1. Introduction

Research has shown that preferences are universal – e.g. consistently similar – among humans in some instances (Cardoso et al., 2014 ; Rieger et al., 2021, House & Ozdenoren, 2008), but not in others (Taylor et al., 2013, Shackelford et al., 2005, Attema et al., 2018). In economics such preferential universality is often addressed by theoretical game-situations where different preferences can be explained by different payoffs and opportunity costs (Ganguli et al., 2016). In the real-world economic preferences vary by a wide variety of factors, such as demographic factors. Demographic factors – such as gender and age – cause economic preferences to vary on a spatial level. Nevertheless, economic preferences – such as time and risk preferences – are likely to some extent universal within and across countries (Falk et al., 2018). Hence, there is evidence supporting the potential presence of universal economic preferences.

Nevertheless, it remains doubtful whether similar support applies to the universality of durable preferences. Durables are characterised as consumer goods with a long lifetime, frequent usage and a relatively low repurchasing frequency. Examples are televisions, washing machines, refrigerators, furniture and vehicles (Dziechciarz & Dziechciarz-Duda, 2017). Research on the universality of durable preferences is scarce. A particular knowledge gap is that the universality of durable preferences in the developing world is poorly understood.

Research on the universality of durable preferences throughout the developing world is scarce, or the provided evidence is indirect. Indirect evidence has been uncovered by Smits & Steendijk (2015). They uncover a high correlation between regional indices of the International Wealth Index (IWI) – an index measuring well-being based on the possession of durables and assets – and the aggregated IWI-index for the developing world. In other words, across the developing world households appear to show some universality in the build-up of their possessions of durables. Such result ignites interest in whether household preferences for durables are universal throughout the developing world.

Nevertheless, such universality has not been adequately studied yet. Research on the universality of durable preferences has focused mainly on establishing universal patterns of durable acquisition for specific – mostly developed – countries such as Israel (Fishelson, 1970), the United Kingdom (Hebden & Pickering, 1974 ; Dawson, 1953), the United States (Dickson et al., 1983), Australia (Soutar & Cornish-Ward, 1997 ; Soutar et al., 1990) and China (Hu et al., 1989). Others merely studied specific societal subgroups, such as Jewish families (Paroush, 1965). The universality of durable preferences has been scarcely studied for the widespread developing world, for which research usually restricts to a small selection of specific developing countries such as Brazil (Wells, 1977) and Egypt, Turkey and Morocco (Bérenger et al., 2013).

In addition, research on durable preferences has been steered towards fulfilling purposes of informing marketeers and providing guidance to cyclical policies (Kasulis et al., 1979 ; Fishelson, 1970). Durable preferences and their resulting patterns of durable acquisition have been limitedly linked to their potentially large role in well-being and development. Such is especially important in the developing world where durables can play an important role in stimulating development. Furthermore, ambiguity roams within research on durable preferences, as a wide variety of different patterns of durable acquisition – and hence different durable preferences – has been identified to persist in different countries (Paroush, 1965 ; Hu

et al., 1989 ; Dawson, 1953). More evidence for a broader variety of countries and durables is required to potentially uncover unambiguous, universally valid patterns of durable preferences and acquisition (Clark & Soutar, 1982). Specifically, there is a need for more evidence on durable preferences throughout the developing world. Consequently, a question which remains unresolved is: “*Can a universal pattern of durable preferences be identified throughout the developing world?*”. In answering this question the current paper contributes to the existent literature by providing evidence on the universality of durable preferences among households for a large variety of developing countries. Currently such evidence is fiercely lacking.

The research question is addressed by means of logistic regression analyses. Household-level data from the Global Data Lab’s Demographic Household Surveys (Global Data Lab, 2021) is utilized. Resultingly, 137.078 households from a variety of 11 different developing countries are under study for the year 2016. The dependent variables consist of binary coded dummies on the possession of radios, motorbikes, televisions and refrigerators. The independent variables consist of factors causing deviations in patterns of durable acquisition, such as access to electricity, urban residence, complementarity and the relative position of women in the household, as measured by the age difference between husbands and wives.

The results show no universal durable preferences to persist throughout the entire developing world, as spatial country -and regional-level variation in patterns of durable acquisition is uncovered. Nevertheless, durable preferences appear to be universal within certain specific regions and across specific countries. For instance, the households of most countries in Sub-Saharan Africa exert similar durable preferences. In addition, households throughout the developing world are found to mostly exert irrational preferences for durables.

Furthermore, the research has important societal implications. It is of importance to study durable preferences for households in the developing world, as the development of such households partially depends on the order in which they acquire durables. Durables usually provide positive effects on well-being, but these effects vary in magnitude and strength (Sahn & Stifel, 2000). As of such, it may be argued that some durables should be preferred over other durables in acquisitional patterns. For instance, refrigerators may provide large positive effects on well-being, but at relatively large acquisitional and usage costs. Therefore, households should prioritize more cost-efficient durables than the refrigerator – such as the radio – in their acquisitional patterns in order to follow efficient patterns of development. Such especially applies to the developing world, where many durables have not yet been diffused across countries. For instance, the presence of refrigerators is fairly small in most developing countries. As soon as a variety of durables diffuses throughout the developing world it is of importance that households efficiently prefer the acquisition of different durables. As of such, it is crucial for the development of the developing world that we understand the patterns in which households throughout the developing world prefer and hence acquire durables.

The paper is structured as follows. Chapter 2 expands on the theoretical framework and provides our hypotheses. Chapter 3 introduces the data and our empirical approach. Chapter 4 provides the results. Chapter 5 concludes, discusses and provides recommendations for further research. The paper is concluded with a bibliography and an appendix.

## 2. Theoretical Background

In this section the widespread effects of durables on well-being are assessed (2.1). Thereafter several previously uncovered universal patterns of durable acquisition (2.2), the factors potentially influencing such patterns (2.2.1) and the factors influencing the ownership of the specific durables under study are discussed (2.2.2). Afterwards, a subjectively rational pattern of durable acquisition is constructed (2.3). Lastly, we conclude with our hypotheses (2.4).

### 2.1. *Durables and Well-Being*

Durables influence well-being on a wide variety of aspects, such as health, education, the maintaining of waged labour and connectivity. For instance, the ownership of high-quality sanitation and refrigerators are both linked with higher levels of health. High-quality sanitation highly benefits individual and communal health by preventing faecal contamination of drinking water and thereby preventing diseases to spread fast (Reddy & Snehalatha, 2011). Refrigerators allow better preservation of food, medicine and harvests, in turn avoiding health risks and costly wastage (N'Tsoukpoe et al., 2014). Additionally, refrigerators allow food and medicine to be bought in advance, which saves frequent trips to markets and stores. In similar fashion, washing machines allow washing automatically instead of by hand, thereby saving valuable time and energy (Dhanaraj et al., 2018). Hence, durables like refrigerators and washing machines may be considered as 'household burden-relieving' durables. As the burden of household work generally falls upon women, such durables empower women by allowing the saved time and energy to be used for education or waged labour, and hence personal development.

Moreover, bicycles and motorized vehicles can be crucial in enjoying education, receiving medical care or maintaining waged labour (Dawson, 1953). They allow travelling faster and further than on foot. This especially benefits those residing in remote areas, as travelling large distances on foot takes up large amounts of time and opens up potential for health issues and injuries. Bicycles lower the duration and physical burden of travelling, but still require relatively large physical action, especially in hilly areas and during long-distance travelling. Motorized vehicles minimize or even completely eliminate the physical burden of travelling, thereby allowing even further travelling at even lower physical expense (Clark, 2005).

In addition, durables influence well-being by providing utility and enjoyment, which especially applies to electronics such as televisions. The ability to watch TV yields utility by avoiding boredom, connecting humans to the world, pleasuring and the facilitation of imagination and daydreaming (Clark, 2005), while potentially boosting linguistic learning among children (Lemish & Rice, 1986). Radios serve similar connectivity purposes as televisions. In fact, radios still serve as the main source of informing and spreading knowledge in most of the distant parts of the developing world (Myers, 2008 ; Wabwire, 2013). Telephones serve similar connectivity-purposes (Freedman, 1970), but their exact role in well-being highly deviates over time. At the beginning of the 21<sup>st</sup> century phones merely functioned as connectors, today they for example serve as mini-computers, wallets and professional cameras.

Evidently, durables affect well-being in different magnitudes. Moreover, specific types of durables serve specific purposes and thereby affect specific parts of well-being. Consequently, human preferences for durables might not be similar, for which the existence of universal durable preferences might be challenged.

## 2.2. Universal Patterns of Durable Acquisition

Nevertheless, universality of preferences exists among humans in some instances (Cardoso et al., 2014 ; Rieger et al., 2021), for example as of pressures of conformity (House & Ozdenoren, 2008). Similar preferential universality is uncovered for durable preferences within specific countries. The universality of durable preferences is generally tested by establishing patterns of durable acquisition. In doing so, Paroush (1965) has identified a persistent “*gas cooker – vacuum cleaner – washing machine – refrigerator*” pattern to be universal within Israel and the United Kingdom. Kumar & Sarkar (2008) identify a “*television – refrigerator – telephone*” pattern in India. Dickson et al. (1983) identify a “*refrigerator – washing machine – television*” pattern in the United States. Wells (1977) identifies a “*radio – television – refrigerator – washing machine – vehicles*” pattern in Brazil. Bérenger et al. (2013) identify a “*television – refrigerator – washing machine – car*” pattern in Egypt, Turkey and Morocco.

Evidently, different universal patterns of durable acquisition persist in different countries. Hence, if acquisitional patterns highly deviate among countries, it becomes questionable how a ‘global’ universal pattern of acquisition could even be viably constructed. Nevertheless, one way to construct such pattern is to assume humans to be rational consumers. Rational consumers adopt an acquisitional pattern which prefers durables with the largest positive effects on well-being, given financial possibilities. Hence, preferences rely on the cost effectiveness – for instance, the utility per dollar – of respective durables (Fishelson, 1970).

Nevertheless, it is close to impossible to pinpoint exact numerical effects on well-being for respective durables. Therefore, an objectively rational universal pattern of acquisition cannot be constructed. In fact, even if such rational pattern would be constructable households are not expected to follow such pattern for several reasons. For instance, durables may affect well-being differently in different countries or regions (Sahn & Stifel, 2000). Additionally, and more importantly, humans are only boundedly rational (Lorkowski & Kreinovich, 2018). The next section dives deeper in a larger variety of factors influencing decisions of durable acquisition and thereby influencing both the rationality and universality of durable preferences.

### 2.2.1. Deviations in the Acquisitional Patterns and Preferences of Durables

As Falk et al. (2018) argue, gender and age can be decisive factors in the deviation of universal preferences. Similar applies to deviations in rational and universal durable preferences. At different ages – and hence at different stages in life – people have different wants and needs. In other words, utility functions change over time (Paroush, 1965 ; Hebden & Pickering, 1974). Hence, preferential rationality becomes a time-dependent concept, as at different ages different durables are preferable. Similar logic applies to gender, as women have different preferences in acquiring durables than men. As women are traditionally responsible for household work they prefer the acquisition of household burden-lowering durables, such as refrigerators and washing machines (Dhanaraj et al., 2018). Men likely prefer such durables less than women. Hence, differences in gender might cause differences in durable preferences.

Furthermore, ownerships of different durables are not completely independent. Some durables may be considered ‘complementary durables’, for which the ownership of a certain durable positively relates to the ownership of another durable. Washing machines and refrigerators can be identified as such complementary goods, as they are both female-preferred

durables (Hu et al., 1989). Such complementarity indicates a high probability of owning a washing machine when owning a refrigerator, and vice versa. Henceforth, complementarity might bring durables to positions in patterns of durable acquisition where they would rationally not belong, but where they are placed as of their close association and correlation – e.g., complementarity – with the ownership of other durables.

In addition, several external factors influence durable preferences, such as reputation. Reputational consumption leads to the acquisition of high-reputation durables – such as cars – despite potentially limited effects on well-being (Van Kempen, 2007 ; Clark, 2005), for instance as of pressures of conformity which tend to converge durable preferences among humans (House & Ozdenoren, 2008). More influentially, access to complementary goods affects acquisitional decisions on durables. Durables might require complementary goods – such as gas, a constant supply of electricity or piped water – in order to function properly. Exemplary, refrigerators can only function if there is constant access to electricity, while washing machines constantly need a supply of both electricity and water. This could especially lead to differences in patterns of durable acquisition between urban and rural households. Rural households often lack access to electricity, for which it is fruitless to acquire electricity-driven durables (Van Kempen, 2007 ; Dhanaraj et al., 2018 ; N'Tsoukpoe et al., 2014). Differences also persist between countries, as electrical access still largely varies among countries (The World Bank, 2021a ; The Economist, 2019 ; Ritchie & Roser, 2019). In similar fashion, rural areas usually lack functioning drainage and sewerage which are crucial complementary goods for functioning latrines (Cairncross, 2003). Complementarity is also seen in the form of 'usage-costs'. For instance, motorized vehicles not only require gasoline to function, but also require proper and timely maintenance (Fishelson, 1970). Hence, the possibility of enquiring adequate maintenance can be a decisive factor in acquisitional decisions on durables.

Furthermore, urbanization largely affects durable preferences and acquisitions. For instance, rural areas may entail larger travelling distances with rougher terrain than urban areas, which likely enhances the need for vehicles. Moreover, clear differences seem to persist in the presence of televisions and radios between urban and rural areas. In urban areas televisions are dominantly present as information-receptive durables. Radios usually serve this purpose in rural areas. Such difference may for example arise from differing quality, presence and frequency of cable networks between distant rural areas and urban areas (Myers, 2008).

### 2.2.2. *The Ownership of Radios, Televisions, Motorbikes and Refrigerators*

In this paper we specifically study the preferences for and the acquisition of radios, televisions, motorbikes and refrigerators. In the previous section many factors have been provided which influence the acquisition of durables. Here we summarize the factors influencing the ownership of the respective durables under study. Firstly, as refrigerators and televisions need constant supply of electricity, access to electricity likely positively influences the probabilities of owning these durables. Radios serve as alternatives to televisions for receiving information and gathering knowledge, as they do not require constant supply of electricity (Myers, 2008). Hence, the probability of owning a radio might be negatively affected by access to electricity.

Complementarities likely influence probabilities of ownership, as illustrated by Hu et al. (1989). As argued before, radios potentially serve as alternatives to televisions. In other words,

households are expected to acquire either a television or radio. Hence, television ownership is expected to negatively affect radio ownership and vice versa.

The relative household position of women is expected to positively affect the ownership of refrigerators and to negatively affect the ownership of televisions, as women prefer the acquisition of refrigerators. Televisions are expected to be especially prioritized by men.

Urban residence is expected to positively affect the ownership of televisions, while negatively affecting the ownership of radios and motorbikes. In urban areas televisions are generally preferred as information-receiving durables, a role which is preferably provided by radios in rural areas (Myers, 2008 ; Wabwire, 2013). In addition, in rural areas travelling distances are expected to be larger and rougher of terrain than in urban areas. Hence, the necessity for motorbikes is expected to be larger in rural areas than in urban areas.

### 2.3. Subjectively Rational Patterns of Durable Acquisition

The previous sections have indicated that the potential presence of universal durable preferences can be challenged. Universality may be assumed if humans show rational preferences for durables, but many factors appear to cause deviations from rationality. However, such variations can be accounted for. For instance, we can account for differences in access to electricity and urban residence. The remaining problem is the inexistence of an objectively rational pattern of durable acquisition. We cannot construct an objectively rational pattern which humans are expected to follow in a universal manner. Nevertheless, subjective rationality of acquisitional patterns may be argued. Such rational patterns would not assume a closed-ended truth or reality but would rather shine a light on patterns of acquisition which can be accepted as rational. For the four durables under study in this paper such pattern may likely resemble “*Radio – Motorbike – Refrigerator – Television*”.

Radios connect humans to the world and serve as important facilitators of gathering information and knowledge at low usage of electricity and low acquisitional costs. Hence, the durable is highly cost effective (Myers, 2008 ; Hussain & Tongia, 2007 ; Wabwire, 2013). As of such, rational consumers are expected to prefer and prioritize radios in their acquisitional patterns. In other words, once funds are available to a household it would be most rational to spend it first on a relatively cheap and effective radio before other durables are acquired.

Motorbikes allow large distance travelling at a low physical burden, thereby connecting people to the world and to services largely important for survival and prospering, such as healthcare, education and waged labour. They also serve as household-burden lowering durables, as they allow motorized transport to markets and stores, thereby saving time and energy. Motorbikes fulfil this purpose at lower physical burden than bicycles (Clark, 2005) and at lower costs than cars (Dawson, 1953). As of such, motorbikes are quite cost-effective durables. Nevertheless, they should not be preferred over radios, as motorbikes still have relatively large acquisitional and usage costs – for example in terms of maintenance and gasoline – compared to radios which often merely require periodical renewal of batteries.

Refrigerators serve a double purpose in enhancing well-being. They empower women by saving them valuable time in household work, but also secure food, medicine and harvest quality, thereby lowering health risks and wastage (N’Tsoukpoe et al., 2014). However, refrigerators require a large constant supply of electricity, while scarcity tends to cause the

acquisitional costs of refrigerators in the developing world to be relatively large. Hence, refrigerators are less cost-effective durables than radios and motorbikes.

Televisions serve less crucial roles in the well-being of households, as they are considered ‘convenience durables’ by serving purposes of avoiding boredom and providing pleasure (Clark, 2005 ; Dawson, 1953). Even though televisions provide educational roles towards children (Lemish & Rice, 1986) their acquisition is not considered crucial for development and well-being. Moreover, televisions have high acquisition and usage costs – such as the costs of getting cable networks – which results in a relatively low cost-effectiveness, especially compared to radios (Myers, 2008). Therefore, televisions may be considered as luxury goods. Hence, we expect that rational households use their funds to acquire efficient durables such as refrigerators, radios and motorbikes first, while postponing the acquisition of a television.

#### 2.4. Hypotheses

To reiterate briefly, research has uncovered durable preferences to be universal within certain countries by establishing patterns of durable acquisition. We expect to uncover similar evidence for the universality of durable preferences on a large scale among households of the developing world when establishing and comparing their patterns of durable acquisition. Especially when assuming humans to be rational we expect them to show similarity in their preferences for durables. Any factor causing deviations in durable preferences – and hence in patterns of durable acquisition – can be accounted for in the analysis. For instance, we can control for differences in access to electricity among various households. Hence, the following is hypothesized:

**H1:** *“Households in the developing world follow a universal pattern of durable acquisition”*

Furthermore, we expect that rationality and universality go hand in hand. If the households of the developing world are found to exert similar, universal durable preferences we assume the possibility that such universality may be the result of the underlying rationality of households. More specifically, if households throughout the developing world follow the same patterns of durable acquisition we assume that one of the factors causing such patterns to be similar may be rationality. Every rational consumer is namely expected to follow the same pattern of durable acquisition. In our particular case, a pattern of durable acquisition which is rational may be subjectively argued to be *“Radio – Motorbike – Refrigerator – Television”*. The factors which may cause irrational deviations in the patterns of acquisition are expected to be accountable for. As of such, the following is hypothesized:

**H2:** *“The uncovered pattern of durable acquisition can be subjectively considered rational”*

### 3. Methodology

#### 3.1. *Data*

The paper utilizes household data from the Demographic and Health Surveys (DHS; <https://www.dhsprogram.com/>). The data is derived from the Global Data Lab (2021). The DHS are large and representative surveys which collect household data on a vast array of topics (Alcorta et al., 2018). A sample of respondents is drawn for the year 2016. The sample is based on data availability, as we have selected households providing complete sets of data on all variables. Data is most widely available for the year 2016. In addition, 2016 is the most recent year for which data is available. Recency provides the largest chance on representative and available data, as households' acquisitional preferences usually only become visible when they actually succeed in acquiring durables (Namias, 1959). However, households can only acquire durables when these are available. Recent data yields higher chances of durable availability, as over time durables expand in presence within countries (Comer & Wikle, 2008 ; Wells, 1977). This selection leads to a sample of households from 11 different developing countries which provide complete sets of data on all variables included in the analysis. Resultingly, 137.078 households are under study for a variety of countries from Europe, Sub-Saharan Africa, South-Asia and South-East Asia & the Pacific (see appendix table 1).

##### 3.1.1. *Dependent and Independent Variables*

The dependent variables consist of binary coded dummy variables on durable possession for motorbikes, refrigerators, televisions and radios indicating possession (1) or no possession (0) of a respective durable by a respective household. The selection of durables under study is driven by data availability, definability and stability. As we aim to study a broad sample of households from multiple countries, data availability has been a decisive factor in durable selections. The four selected durables provide widely available data, while other durables such as washing machines and computers are generally suffering from missing or scarce data.

As for definability, the selected durables have clearly definable effects on well-being. Other durables such as clocks and furniture entail more difficulty to establish their respective roles in well-being. Cars could have been included, but they relate to motorbikes, as cars are expected to replace motorbikes once income is high enough (Dawson, 1953). Hence, we consider cars to be more 'high-end' durables which are limitedly possessed by households in the developing world. As for stability, the selected durables enjoy stable definitions and roles in human life over time. Other durables may experience unstable definitions and roles over time, such as phones. Phones have vastly evolved over time, leading to different roles of phones across time and space. On the contrary, the roles of the selected durables have remained essentially stable over time. Such is important, as time-differing roles of durables may result in different durable preferences over time, which makes the study of durable preferences rather difficult.

Moreover, a large variety of independent variables is included in the analyses. These are *Access to Electricity*, *Urban Residence*, *Complementarity* and *Age Difference (Husband-Wife)*. Note that some of these factors affect the ownership of specific durables; some durables are theoretically unaffected by certain factors. Nevertheless, the independent variables are included in each durable's ownership regression to avoid any potential bias. In addition, refrigerator and

motorbike ownership are not expected to display a specific complementary effect as independent variables. Nevertheless, these variables are included in each regression analysis.

*Access to Electricity* and *Urban Residence* are measured as binary coded dummies. The former indicates whether (1) or not (0) a household has access to electricity. The latter indicates whether the household resides in an urban (1) or rural (0) area. *Complementarity* entails the inclusion of the dependent variables on durable possession for the three durables not under study in the respective regression. For example, in the regression analysis of television ownership the ownership variables of the radio, motorbike and refrigerator are included as independent variables to account for any complementary effects. Note that these are measured as binary coded dummies, indicating whether (1) or not (0) a household possesses a durable.

*Age Difference (Husband-Wife)* is an interval variable ranging from -34 to 80. It is measured by subtracting the age of the wife from the age of the husband in the household. Higher scores indicate that the husband is relatively older than the wife, which indicates a lower relative bargaining power for the wife or women in the household. The age difference between husbands and wives provides us with a solid indicator of the relative position of women in the household, as large age differences between husbands and wives usually indicate low bargaining power of wives (Solanke, 2015). For instance, large age differences between husbands and wives likely indicate young age of women at the time of marriage, which is linked to a relatively low bargaining power of these women in the household (Abera et al., 2020).

An overview of the independent variables, including the way in which they are measured and the effects they are expected to display, is provided in table 2.

**Table 2: Overview of the Independent Variables' Measurements and their Expected Effects**

<b>Variable</b>	<b>Measurement</b>	<b>Values</b>	<b>Expected Effects<sup>A</sup></b>
<b><i>Access to Electricity</i></b>	Binary Coded Dummy	0 = No Access to Electricity   1 = Access to Electricity	(+) Refrigerator & Television (-) Radio
<b><i>Urban Residence</i></b>	Binary Coded Dummy	0 = Rural Residence   1 = Urban Residence	(+) Refrigerator & Television (-) Motorbike & Radio
<b><i>Age Difference (Husband-Wife)</i></b>	Interval Variable (Ranging between - 34 and 80)	The larger the value, the larger the age difference between husband and wife, the lower the relative position of women	(+) Television (-) Refrigerator
<b><u>Complementarities</u></b>			
<b><i>Ownership of Television</i></b>	Binary Coded Dummy	0 = No Ownership   1 = Ownership	(-) Radio
<b><i>Ownership of Refrigerator</i></b>	Binary Coded Dummy	0 = No Ownership   1 = Ownership	No particular effect
<b><i>Ownership of Motorbike</i></b>	Binary Coded Dummy	0 = No Ownership   1 = Ownership	No particular effect
<b><i>Ownership of Radio</i></b>	Binary Coded Dummy	0 = No Ownership   1 = Ownership	(-) Television

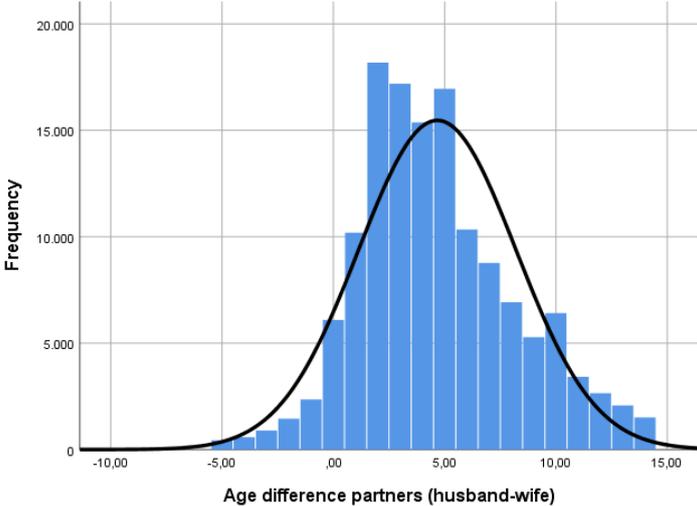
<sup>A</sup> Refer to sections 2.2.1 & 2.2.2 for the explanations on the expected effects.

The variable *Age Difference (Husband-Wife)* suffered from problematic outlying values. There appeared to be problematic outlying values for values  $\leq -6$  and  $\geq 15$  (see appendix graph 1). As of such, we decided to remove observations displaying values  $\leq -6$  and  $\geq 15$  for *Age Difference (Husband-Wife)*, which resulted in a sample containing 137.078 households. The distribution of *Age Difference (Husband-Wife)* is displayed in graph 2. Resultingly, the variable shows a relatively normal distribution of its values, which does not display any significant bias or skewedness. The distributions of our dummy variables are depicted in table 3. Neither of the variables displays a peculiar distribution of its values. It does become evident that the television is a relatively widely owned durable, while the other durables are less widely owned. Furthermore, the majority of the households has access to electricity and lives in an urban area. As of such, the distributions of *Access to Electricity* and *Urban Residence* are somewhat skewed, yet not in problematic proportions.

**Table 3: Frequency Distributions of the Dependent and Independent Dummy Variables**

	Possession	Frequency	Percentage
<i>Television</i>	Yes (1)	73.593	53,7%
	No (0)	63.485	46,3%
<i>Refrigerator</i>	Yes (1)	35.826	26,1%
	No (0)	101.252	73,9%
<i>Motorbike</i>	Yes (1)	39.499	28,8%
	No (0)	97.579	71,2%
<i>Radio</i>	Yes (1)	33.132	24,2%
	No (0)	103.946	75,8%
<i>Access to Electricity</i>	Yes (1)	96.693	70,5%
	No (0)	40.358	29,5%
<i>Urban Residence</i>	Yes (1)	43.472	31,7%
	No (0)	93.606	68,3%

**Graph 2: Frequency Distribution of Independent Variable ‘Age Difference (Husband-Wife)’**



### 3.1.2. *Summary Statistics*

Table 4 displays the summary statistics of our variables. The summary statistics provide information on the number of observations (N), the minimum value (Min), the maximum value (Max), the mean value (Mean) and the standard deviation (Std. Deviation). Neither of the variables show peculiarities. Interestingly, the mean values indicate that the majority of the households in our sample have access to electricity and the majority of the households lives in a rural area. In addition, husbands are on average almost 5 years older than their wives, which likely indicates relatively low bargaining power by women in the households of our sample.

**Table 4: The Summary Statistics for the Dependent and Independent Variables**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Radio</i>	137.078	,00	1,00	,2400	,42800
<i>Motorbike</i>	137.078	,00	1,00	,2900	,45300
<i>Refrigerator</i>	137.078	,00	1,00	,2614	,43937
<i>Television</i>	137.078	,00	1,00	,5369	,49864
<i>Access to Electricity</i>	137.078	,00	1,00	,7054	,45587
<i>Urban Residence</i>	137.078	,00	1,00	,3171	,46536
<i>Age Difference (Husband-Wife)</i>	137.078	-5,00	14,00	4,6681	3,53518

### 3.2. *Empirical Approach*

In a nutshell, this paper employs logistic regression analyses to estimate probabilities of durable ownership for households in order to test both hypotheses, which is somewhat similar to the approach of Hu et al. (1989). Such analyses estimate the probability of household ‘*i*’ owning durable ‘*y*’ given the vector of independent and controlling variables ‘*x*’. As our dependent variable can only take on two values – zero and one – we utilize Logit-regressions. Despite receiving critique (Fine & Simister, 1995), logistic regression analyses are superior in testing our hypotheses. For instance, it outperforms ordinary least squares (OLS) analyses as our dummy variables cannot take on any value in between zero and one, which is usually a requirement for conducting proper OLS-analyses (Verbeek, 2017 ; Adkins & Hill, 2011).

In addition, logistic regression analyses better suit our study than the large variety of methods suggested by past research. The best available method to study acquisitional patterns is time-series analysis, but large consumption intervals usually eliminate the possibility to use such analysis (Soutar et al., 1990). Hence, conditional probability approaches (Fishelson, 1970), Borda-ruling (Fine & Simister, 1995), Pyatt-approaches (Hebden & Pickering, 1974), cross-correlations (Paroush, 1965), Guttman-scaling (Kasulis et al., 1979 ; McFall, 1969) and Rasch-analyses (Soutar & Cornish-Ward, 1997) have been proposed as alternative methods. However, these methods are flawed. For instance, Guttman-scaling provides highly fluctuating and inconsistent results (Soutar et al., 1990), while Pyatt-probability estimations may yield distortive negative probabilities (Fine & Simister, 1995). More problematically, neither of these analyses allow the adequate controlling for any of the aforementioned factors influencing acquisitional patterns, which logistic regression analyses do. A more detailed discussion of our empirical approach follows below.

### 3.2.1. Clustering Issues

Our data may be suffering from clustering issues, as households might correlate strongly with each other. Households are likely bound by their country of residence, which may cause their ownership probabilities to correlate strongly. Resultingly, households from the same country may show similar patterns of durable acquisition as they are bound by the same fixed characteristics of their country of residence. Such characteristics could entail culture, climate and development which can highly influence durable preferences (Dickson et al., 1983). In order to test whether our data suffers from clustering issues we conduct a mixed model analysis. Such analysis assesses the degree of intercept variation among the different countries for the ownership probabilities of the durables under study. Large degrees of clustering would be indicated by large significant variance estimates of approximately over 0.5. The results of the analysis are depicted in table 5. Based on the threshold value of 0.5 we conclude that our data largely suffers from clustering issues. As of such, country fixed dummies are added to our model in order to control for the clustering of values within countries. Hence, we add a dummy variable for each country depicting whether a household resides in that country (1) or not (0).

**Table 5: Cluster Analysis Using Generalized Linear Mixed Models**

	N	Variance Estimate	Std. Error	Significance
<b>Radio</b>	137.078	1,351**	,606	,026
<b>Motorbike</b>	137.078	3,540**	1,599	,027
<b>Refrigerator</b>	137.078	3,744**	1,678	,026
<b>Television</b>	137.078	4,401**	1,999	,028

*Note: \* = significant at 90% level, \*\* = significant at 95% level, \*\*\* = significant at 99% level.*

### 3.2.2. Testing the Universality of Durable Preferences (Testing H1)

In order to test the first hypothesis we conduct a five-stage approach. In a nutshell, we estimate ownership probabilities for the four durables under study for the average household of each separate country. Afterwards, we construct a ranked pattern using the durable ownership probabilities per average household, and hence per country. For instance, if the probability that the average Angolan household owns a television is larger than its probability of owning a radio we place the television above the radio in the Angolan pattern of durable acquisition. Moreover, in such case we assume that in Angola the preference for a television is larger than the preference for a radio. Once a ranked pattern of durable acquisition has been constructed for each separate country we compare the patterns to see whether they show similarity, and hence whether there is universality of durable preferences. Therefore, the essence of our empirical approach is to estimate probabilities of durable ownership and to create a ranked pattern of such probabilities. Such probability estimation is captured in equation (1.1), where  $F$  is defined as logistic distribution function (1.2).

$$(1.1) \quad P\{Y_{ij} = 1 \mid X\} = F(X_n\beta)$$

$$(1.2) \quad F(z) = \ln(w) = \frac{e^w}{1+e^w}$$

Combining and rearranging equations (1.1) and (1.2) results in the construction of the model used by Hu et al. (1989), which is denoted in equation (1.3). Note that ‘ $x$ ’ captures the vector of independent and control variables, while probability ‘ $P$ ’ can take on any value in between zero and one. In other words, the probability that household ‘ $i$ ’ owns durable ‘ $Y$ ’ is a logistic function of the independent variables’ values – e.g., vector ‘ $x$ ’ – and the independent variables’ effects – e.g., vector ‘ $\beta$ ’.

$$(1.3) \quad P\{Y_i = 1\} = \frac{1}{1 + e^{-\beta x}}$$

Now that we have constructed our basic model we can elaborate in more detail on the separate stages of our approach. In the first stage we estimate equation (1.3) by means of logistic regression analyses. However, in order to better understand the model which we estimate in this approach we dissect equation (1.3) into equation (1.4). Equation (1.4) estimates the log odds of owning a respective durable. Note that *Complementarity* captures the separate dummies for the other durables’ ownership. Furthermore, *Country* captures the variety of country dummies which are included in the analysis in order to control for clustering effects. The estimation of equation (1.4) yields coefficients, which we further utilize in the second stage.

$$(1.4) \quad \ln\left(\frac{P\{Y_i=1 | X\}}{P\{Y_i=0 | X\}}\right) = a_i + \beta_1 \text{AccessToElectricity}_i + \beta_2 \text{UrbanResidence}_i + \beta_3 \text{AgeDifference}_i + \beta_4 \text{Complementarity}_i + \beta_5 \text{Country}_i + e_i$$

In the second stage we calculate the log odds of owning respective durables for the average households of each country. Therefore, we fill in the estimated equation (1.4) with the characteristics of the average household of each country. The characteristics of the average households are derived by assessing the summary statistics of each individual country (appendix tables 6-16). Note that each variable – except for *Age Difference (Husband-Wife)* – can only take on values of 0 and 1. Hence, the mean values of these variables are rounded to the nearest whole. For instance, the average household of a country which shows a mean value of 0.600 for *Access to Electricity* is expected to have access to electricity (*Access to Electricity* = 1). Thereafter these characteristics are placed in the estimated equation (1.4), which yields the log odds of owning the respective durables for each average household of each specific country under study.

In the third stage we transform the log odds derived in the second stage into probabilities. In order to derive probabilities we first calculate the odds of owning a durable by using the previously derived log odds and deriving its antilog. In equation (1.5) this step is denoted. Afterwards we derive the probabilities of owning a respective durable by dividing the odds by itself plus one. In equation (1.6) this step is denoted. The derivation of the probabilities of owning durables for each average household finalises the third stage.

$$(1.5) \quad \text{Odds} \{Y_i = 1 | X\} = \frac{P\{Y_i=1 | X\}}{P\{Y_i=0 | X\}} = e^{\ln\left(\frac{P\{Y_i=1 | X\}}{P\{Y_i=0 | X\}}\right)}$$

$$(1.6) \quad P\{Y_i = 1 | X\} = \frac{\text{Odds}\{Y_i=1 | X\}}{\text{Odds}\{Y_i=1 | X\} + 1}$$

In the fourth stage we rank the derived ownership probabilities for the average households. If  $P_x > P_y$ , then we expect that in general durable ‘x’ is acquired and preferred before durable ‘y’. For example, if the average Angolan household shows a pattern of  $P_{radio} > P_{motorbike} > P_{refrigerator} > P_{television}$  we expect that the universal pattern of durable acquisition in Angola consists of “Radio – Motorbike – Refrigerator – Television”. Such pattern is constructed for each country based on the ranking of the ownership probabilities of their average household. The fourth stage is finalised when the average pattern of durable acquisition is established for each of the countries under study.

In the fifth and final stage we test the first hypothesis. Note that the null hypothesis indicates that there is no universality of durable preferences persistent among the countries under study. The alternative hypothesis indicates that there is universality. In order to test the first hypothesis we compare the derived patterns of durable acquisition for all countries based on their degree of similarity. If the patterns are uniformly similar across the countries we may conclude that there is strong evidence for the presence of universal durable preferences. In other words, if the average households of all countries under study would follow the same pattern of durable acquisition we conclude that the households of the countries under study display universal preferences for durable goods.

### 3.2.3. Testing the Rationality of Durable Preferences (Testing H2)

The second hypothesis is tested by assessing the globally uncovered pattern of acquisition on its rationality. Hence, whether we are able to test the second hypothesis depends to some extent on whether we have been able to extract a universal pattern of durable acquisition in testing the first hypothesis. Such may lead to two scenarios, as we either find a universal pattern of durable acquisition (1) or we do not find such pattern (2).

In the first case the uncovered universal pattern of acquisition is simply compared with the previously constructed subjectively rational pattern of acquisition. Recall such pattern to resemble “Radio – Motorbike – Refrigerator – Television”. If the uncovered universal pattern is similar to such pattern the second hypothesis is accepted, for which we can deem households of the developing world as being rational in their durable preferences.

In the second case there is still a possibility to test the second hypothesis, as in this case the second hypothesis can be tested for each specific country. Hence, we can test whether the uncovered patterns of acquisition for each specific country display similarity to the subjectively rational pattern of acquisition. Hence, we conclude that durable preferences within a country are rational if the uncovered pattern of durable acquisition of the average household of that country exactly matches the subjectively rational pattern of durable acquisition.

In a nutshell, in order to test the second hypothesis the uncovered patterns of durable acquisition from testing the first hypothesis are assessed on their degree of similarity with the subjectively rational pattern of acquisition “Radio – Motorbike – Refrigerator – Television”. Any pattern that is exactly similar to such pattern may be considered as rational, for which durable preferences may be considered as being rational.

### 3.2.4. *Correlation Statistics & Multicollinearity*

Table 17 shows the pairwise correlation statistics for our independent variables. Note the exclusion of the country dummies. The country dummies do not show large correlations with either each other or with the independent variables. Hence, for convenience only the independent variables' correlations are included in table 17. The correlation statistics indicate a large correlation between the ownership of televisions and refrigerators. Such correlation might be explained by the fact that both durables are electricity-driven. If a household possesses an electricity-driven durable we assume such household to have access to electricity, which likely enhances the probability of owning more electricity-driven durables. Furthermore, television ownership and *Access to Electricity* show large pairwise correlation. This is not unexpected, as a television is an electricity-driven durable which is expected to be owned when there is access to electricity.

Such large correlations might be problematic when variables enter regressions as independent variables simultaneously. Nevertheless, no distortive effects are expected to exist for two reasons. Firstly, relatively low VIF-scores – far below the critical value of 5 – indicate no distortive level of multicollinearity to persist between any of the independent variables (see appendix table 18). Note that the variable *Indonesia* is excluded from the VIF-tests, as it is the reference category of the country dummies. Secondly, the correlations between the coefficients of television ownership and *Access to Electricity*, and television ownership and refrigerator ownership in the results are relatively low, for which we assume no distortive levels of multicollinearity to persist.

Additionally, we would expect a large, significantly negative correlation to persist between *Age Difference (Husband-Wife)* and refrigerator ownership. In other words, we would expect that the older the wife is relative to the husband, the larger the household's probability of owning a refrigerator. Nevertheless, neither the correlations nor the VIF-scores indicate such preliminary correlative relationship to exist.

**Table 17: Pearson's Pair-Wise Correlation Statistics for the Independent Variables**

	<i>Television</i>	<i>Refrigerator</i>	<i>Motorbike</i>	<i>Radio</i>	<i>Access to Electricity</i>	<i>Urban Residence</i>	<i>Age Difference (Husband-Wife)</i>
<i>Television</i>	1						
<i>Refrigerator</i>	,505**	1					
<i>Motorbike</i>	,375**	,333**	1				
<i>Radio</i>	-,017**	,015**	-,041**	1			
<i>Access to Electricity</i>	,605**	,368**	,272**	-,121**	1		
<i>Urban Residence</i>	,347**	,349**	,132**	,063**	,285**	1	
<i>Age Difference (Husband-Wife)</i>	-,005**	-,005	-,042**	,020**	-,036**	,011**	1

\*\*Correlation is significant at the 0.01 level (2-tailed).

## 4. Results

### 4.1. *Regression Results*

Table 19 shows the results of the logistic regression analyses. The results indicate that several of our proposed theories hold. As expected, *Access to Electricity* strongly and positively affects the ownership of televisions and refrigerators. Peculiar are the significantly positive effects of *Access to Electricity* on motorbike and radio ownership. The former effect cannot be explained since motorbikes are unrelated to electricity. The latter is an effect which is contrary to our expectations. We expected radio ownership to be negatively affected by electrical access, as radios are expected to operate on batteries for which a constant access to electricity is not a necessity. Therefore, in the absence of a constant electrical access radios may still function perfectly (Myers, 2008). Perhaps the contrary effect holds as radios throughout the developing world differ, where some radios may need constant electrical supply while others do not.

Moreover, *Urban Residence* positively affects the ownership of televisions and negatively affects the ownership of radios. Hence, the theory of Myers (2008) and Wabwire (2013) on rural-urban differences in preferences for information-receptive durables likely holds. In rural areas the radio is relatively more preferred than the television, while the opposite holds in urban areas. Such may be explained by rural-urban differences in television network qualities or the receptive range of radio frequencies. Contrary to our expectations *Urban Residence* positively affects motorbike ownership, which might disprove the perceived large travelling distances and rough terrains in rural areas. In fact, the opposite appears to hold as the probability of owning a motorbike is larger in urban areas than in rural areas. Such may be explained by factors such as traffic jams, which may be more likely in urban areas. As of such, motorbikes are the preferred means of transportation by urban households as they can provide transportation more quickly through the congested urban areas than for instance a car could provide.

Furthermore, the results provide evidence on our theory on the role of female bargaining power in durable preferences. As expected, *Age Difference (Husband-Wife)* shows a significant positive effect on television ownership, while its effect on refrigerator ownership is negative. In other words, the older wives are relative to their husbands, the larger the relative female bargaining power in the household, the more likely the household is to acquire a refrigerator and the less likely it is to acquire a television.

Peculiar are the significant, negative effects of *Age Difference (Husband-Wife)* on radio and motorbike ownership. Apparently women prefer radios and motorbikes relatively more than men do. As of such, refrigerators, motorbikes and radios may be considered as ‘female-preferred durables’, while the television is a ‘male-preferred durable’. The female preference for refrigerators and motorbikes probably arises from the household burden-lowering roles of such durables. Refrigerators and motorbikes lower the burden of household chores that traditionally falls on women, for which women prefer their acquisition more than men do. The relatively low preference for radios by men compared to women may be explained by the male preference for televisions. Once the household owns the male-preferred television the role of the radio may become obsolete. Hence, men rather acquire a television than a radio.

In addition, the results indicate strong levels of complementarity to persist among the possession of different durables. Especially large complementarity persists between televisions and refrigerators. Such may be explained by the electrical necessity of both durables.

**Table 19: Logistic Regression Results for Estimating Equation (1.4)**

<b>Variable</b>	<b>Y=Television</b>	<b>Y=Refrigerator</b>	<b>Y=Motorbike</b>	<b>Y=Radio</b>
<i>Access to Electricity</i>	2,835*** (,028)	2,394*** (,058)	,092*** (,026)	,562*** (,025)
<i>Urban Residence</i>	1,075*** (,019)	1,089*** (,017)	,029* (,017)	-,033* (,018)
<i>Age Difference (Husband -Wife)</i>	,025*** (,002)	-,007*** (,002)	-,011*** (,002)	-,004** (,002)
<i>Ownership of Television</i>	-	2,217*** (,031)	1,252*** (,020)	,637*** (,022)
<i>Ownership of refrigerator</i>	2,211*** (,031)	-	1,330*** (,017)	,320*** (,021)
<i>Ownership of Motorbike</i>	1,258*** (,020)	1,364*** (,017)	-	,138*** (,019)
<i>Ownership of radio</i>	,657*** (,022)	,378*** (,022)	,159*** (,020)	-
<i>Angola (AGO)</i>	,718*** (,093)	-1,876*** (,084)	3,368*** (,126)	,146** (,056)
<i>Armenia (ARM)</i>	3,876*** (,343)	1,802*** (,128)	-2,519*** (,338)	-3,886*** (,092)
<i>Ethiopia (ETH)</i>	-,728*** (,086)	-3,018*** (,081)	,670*** (,157)	-,400*** (,051)
<i>Indonesia (IND)</i>	,255*** (,077)	-2,851*** (,067)	4,147*** (,119)	-2,617*** (,046)
<i>Myanmar (MMR)</i>	,749*** (,085)	-4,057*** (,079)	5,460*** (,122)	-,961*** (,054)
<i>Malawi (MWI)</i>	-,385*** (,084)	-2,418*** (,079)	1,951*** (,128)	,473*** (,049)
<i>Nepal (NPL)</i>	-,618*** (,080)	-3,973*** (,075)	3,259*** (,123)	-1,086*** (,051)
<i>Senegal (SEN)</i>	,027 (,121)	-3,289*** (,126)	2,855*** (,157)	,880*** (,083)
<i>Timor-Leste (TLS)</i>	-,676*** (,083)	-3,342*** (,076)	4,596*** (,122)	-1,084*** (,053)
<i>Uganda (UGA)</i>	-1,250*** (,085)	-3,744*** (,086)	3,589*** (,123)	,849*** (,051)
<b>Intercept</b>	-3,294*** (,081)	-3,121*** (,084)	-6,013*** (,121)	-,707*** (,048)
<b>Prob &gt; F</b>	,000	,000	,000	,000
<b>Cox &amp; Snell's R<sup>2</sup></b>	,476	,382	,276	,190

**Note:** \* = significant at 90% level, \*\* = significant at 95% level, \*\*\* = significant at 99% level.

The variable 'South Africa' is excluded as of being the reference category for the country dummies.

The ownership of an electricity-driven durable likely indicates that there is access to electricity, which may enhance the probability of acquiring more electricity-driven durables. Moreover, the significantly positive complementary effects of all durables may be explained by the factor of wealth. Any prior possession of durables might indicate relatively large wealth, which may enhance the probability of acquiring more durables. Nevertheless, radio ownership appears to be limitedly affected by the prior possession of any of the other durables.

#### 4.2. *The Patterns of Durable Acquisition*

The results in table 19 are utilized to construct a pattern of durable acquisition for the average household of each country. In order to construct such patterns we conduct the five-stage approach as explained in the methodological section. Note that the characteristics of the average households can be found in tables 6-16 in the appendix. An example of the construction of the acquisitional pattern for the average Angolan household is provided in appendix figure 1.

Table 20 displays the derived patterns of acquisition. The table shows the respective probabilities of owning the durables under study for the average household of each country, as well as the pattern of acquisition that follows from these probabilities. Based on the results we conclude that there is evidence that the first hypothesis “*Households in the developing world follow a universal pattern of durable acquisition*” does not hold to be true. A simple glance at the uncovered patterns unveils a wide variety of different patterns of durable acquisition to be persistent within different countries. For instance, the preferences for televisions and radios widely differ among the different countries. As of such, there is limited to no evidence for a universal preference for durable goods throughout the developing world.

Nevertheless, durable preferences appear to be universal within specific regions and within specific combinations of countries. We observe three main clusters consisting of identical patterns of durable acquisition and hence similar durable preferences. The first cluster consists of most African countries, which are Malawi, Angola, Ethiopia and Senegal. The second cluster consists of Armenia and South Africa. The third cluster consists of Nepal and Timor-Leste. Hence, durable preferences are likely not universal throughout the entire developing world, but they are universal within certain regions of the developing world, such as Sub-Saharan Africa.

**Table 20: The Patterns of Durable Acquisition for the Average Households Under Study**

Country	Probability of Ownership				Pattern of Durable Acquisition
	Television (T)	Refrigerator (R)	Motorbike (M)	Radio (RA)	
<i>Angola</i>	,329	,201	,220	,505	<i>RA – T – M – R</i>
<i>Armenia</i>	,999	,987	,003	,042	<i>T – R – RA – M</i>
<i>Ethiopia</i>	,020	,002	,004	,244	<i>RA – T – M – R</i>
<i>Indonesia</i>	,478	,199	,361	,105	<i>T – M – R – RA</i>
<i>Myanmar</i>	,835	,227	,681	,415	<i>T – M – RA – R</i>
<i>Malawi</i>	,028	,004	,016	,437	<i>RA – T – M – R</i>
<i>Nepal</i>	,524	,193	,194	,342	<i>T – RA – M – R</i>
<i>Senegal</i>	,082	,002	,044	,535	<i>RA – T – M – R</i>
<i>Timor-Leste</i>	,285	,016	,196	,202	<i>T – RA – M – R</i>
<i>Uganda</i>	,023	,001	,089	,530	<i>RA – M – T – R</i>
<i>South Africa</i>	,973	,949	,039	,682	<i>T – R – RA – M</i>

#### 4.2.1. Deviations in the Patterns of Durable Acquisition

In order to assess the factors causing deviating durable preferences we compare the uncovered patterns of acquisition of the three clusters, as well as those of the singular cases of Indonesia, Myanmar and Uganda. The main difference between the three clusters and the individual cases concerns the relative positions of and preferences for radios and televisions. In the African cluster and in Uganda we observe a priority preference for the radio. In the other two clusters and in Indonesia we observe a priority preference for the television. Such difference likely arises from differences in *Access to Electricity*. The average African household usually lacks access to electricity, for which we expect and observe a relative preference for radios. The average Asian, Armenian and South African households usually have access to electricity, for which we expect and observe a relative preference for televisions.

In addition, the different preferences for televisions and radios may be explained by differences in *Age Difference (Husband-Wife)*, *Urban Residence* and *Complementarities*. The relative position of women in most African households is lower than in Asian, Armenian and South African households. Hence, we would expect relatively large preferences for radios in Asia, Armenia and South Africa and relatively large preferences for televisions in African countries. Nevertheless, the opposite holds true. Moreover, differences in *Urban Residence* may explain differences in radio and television preferences. However, there is no structural difference in the urban residency of the average households of the various clusters. In fact, in most countries the majority of the households resides in rural areas. As of such, the large differences in radio and television preferences among the clusters and singular cases is likely not or merely limitedly explained by differences in *Age Difference (Husband-Wife)* and *Urban Residence*. Yet differences in durable preferences can vary between specific countries based on differences in *Urban Residence*. For instance, Nepal has higher levels of urbanization than Ethiopia, which may explain the higher preference for televisions in Nepal than in Ethiopia.

There is a more important role for complementary effects in explaining different radio and television preferences. We observe that complementary effects are larger for television ownership than for radio ownership. In other words, the prior possession of durables enhances the probability of owning a television more than that of a radio. Such can explain the relatively large preference for the television in Asian countries, Armenia and South Africa as their average households usually priorly possess one or more durables. Hence, the prior possession of a refrigerator, motorbike or radio can strongly boost the probability of owning a television. On the other hand, African households usually lack priorly possessed durables or they merely possess a radio, for which the stimulating effect on television ownership is absent or weak.

The position of the motorbike is roughly similar throughout the patterns of acquisition. In our African cluster and in Nepal and Timor-Leste the motorbike is positioned third in the patterns. In South Africa and Armenia it is placed last. In Indonesia, Myanmar and Uganda it is placed second. Such raises the question why the motorbike is so differently preferred. Firstly, there are no clear differences in *Age Difference (Husband-Wife)* between the various countries, for which the different preferences for motorbikes cannot be adequately explained by differences in the relative position of women. The same applies to differences in complementarities. For instance, the average South African and Armenian households have large prior durable possessions. As of such, we would expect such households to prioritize a

motorbike over for example a radio, but such is not the case. In addition, the effect of *Access to Electricity* on motorbike ownership is too small to cause large variations in motorbike preferences among different countries and clusters.

The refrigerator is almost consistently placed last in the acquisitional patterns. Only in Armenia, Indonesia and South Africa the refrigerator is not the least preferred durable. The average Indonesian, Armenian and South African households have access to electricity, which may explain their relatively large preference for the refrigerator. Nevertheless, the average households in Myanmar and Nepal have access to electricity as well. Yet, the refrigerator is positioned last in Myanmar's and Nepal's patterns of acquisition. Moreover, there is not a clear difference on *Age Difference (Husband-Wife)* between Indonesia, Armenia and South Africa, and the other countries. Hence, the different preferences for the refrigerator cannot be adequately explained by differences in household bargaining power of women. Yet, the overall low preference for the refrigerator in most countries could be the result of a relatively weak position of women in every average household within our sample. In addition, differences in *Urban Residence* may yield differences in refrigerator ownership, as *Urban Residence* exerts a strong, significant and positive effect on refrigerator ownership. Hence, the refrigerator may be more preferred by the average Armenian household than by the average Senegalese household, as the average Armenian household lives in an urban area, while the average Senegalese household lives in a rural area. However, the average Nepalese household lives in an urban area, but such household exerts the lowest preference for the refrigerator.

Concludingly, differences in *Access to Electricity* likely yield different preferences for televisions and radios among the countries in the African cluster and countries in the Asian cluster, South Africa and Armenia. Nevertheless, differences in refrigerator and motorbike ownership cannot be sufficiently explained by differences in *Access to Electricity*, *Age Difference (Husband-Wife)*, *Urban Residence* and *Complementarities*. Such differences may be explained by country-specific effects. In the next section we dig deeper into such country-specific effects, especially by dissecting the peculiar cluster of Armenia and South Africa.

#### 4.2.2. Country-Specific Effects: The Peculiar Cases of Armenia and South Africa

The cases of Armenia and South Africa show the importance of country-specific effects – captured in the country dummies – in explaining differences in durable preferences. Such mainly applies to refrigerator and motorbike preferences. The large preference for a television and refrigerator, and the low preference for a radio in both countries may be the result of the average Armenian and South African household having access to electricity, living in an urban area and having multiple durables which are priorly possessed. Nevertheless, the low preference for a motorbike in both countries is more difficult to explain based on such factors. Therefore, we assess the effects of two country-specific factors, which are culture and development.

Cultural differences may result in different durable preferences. For instance, some cultures may place a higher preference on televisions as information-receptive durables than other cultures. Hence, African cultures might place a higher preference on radios than televisions, while the opposite may hold for Asian cultures and the cultures of Armenia and South Africa. Moreover, some cultures may place a higher preference on motorbikes to facilitate their transportation than other cultures, which may culturally prefer bicycles or cars.

In addition, developmental or wealth differences may yield different durable preferences. We assume that the more developed a country is, the more widely durables are available in the country. Such may especially apply to refrigerators, which are expensive and scarcely available durables in the developing world. In relatively more developed developing countries we then expect refrigerators to be cheaper and more widely available. In our sample Armenia and South Africa are relatively more developed than the other countries. South Africa is often considered to be the most developed country on the African continent (Arora & Vamvakidis, 2010). Armenia is the only country in our sample located in the developed continent of Europe. In addition, Armenian and South African households have higher average incomes than households in the other countries under study (The World Bank, 2021b). Such may result in high preferences for refrigerators in two ways. Firstly, more refrigerators are expected to be available, for which they are expected to become cheaper. Secondly, wealthier households are expected to be better able to acquire the relatively expensive refrigerators. In addition, wealth can be an explaining factor in the low preference for motorbikes in Armenia and South Africa, as wealthier households are expected to prefer relatively more expensive cars over motorbikes. Cars are more expensive than motorbikes, but the large wealth of such households allows them to ‘leapfrog the motorbike-phase’ (Dawson, 1953).

The importance of country-specific factors in durable preferences becomes even more visible when establishing patterns of acquisition for average households when assuming these households to be similar. We have priorly constructed patterns of acquisition for average households which exerted vastly different values for our independent variables. For instance, the average Indonesian household had access to electricity, while the average Senegalese household did not. Resultingly, a large variety of different acquisitional patterns has been uncovered. However, now we question whether the patterns of acquisition for the average households of the different countries become similar when the only differing factor is the country of residence and hence the set of country-specific factors. Let us assume a situation where the average household of each country has access to electricity, lives in a rural area, has no prior durable possessions and experiences an age gap between husband and wife of 5 years. The derived patterns of acquisition under such circumstances are provided in table 21.

The results indicate that the role of country-specific factors is of such importance that even under similar circumstances households throughout the developing world show vastly different patterns of durable acquisition. Interestingly, our previously uncovered clusters of countries displaying similar patterns of acquisition – and hence similar durable preferences – have been altered. The patterns of acquisition for Armenia, Nepal, Senegal and Timor-Leste have remained the same. In Angola, Myanmar and Uganda the average households now have access to electricity – which they previously lacked – which causes the television to move up in their patterns of acquisition. In Ethiopia and Malawi the gathered access to electricity has increased the position of the refrigerator, which is no longer positioned last. Such changes usually come at the expense of the motorbike, which falls several places in most patterns of acquisition.

Changes are peculiar for Indonesia and South Africa. For instance, the radio overtakes the refrigerator in Indonesia, even though there is still access to electricity. Nevertheless, such can be explained by the now lacking prior possession of a television by Indonesian households, which largely decreases the ownership probability for a refrigerator. In South Africa, the radio even overtakes two other durables, namely the television and refrigerator. Such is peculiar, as

the average South African household still has access to electricity. Nevertheless, the changes can be explained by the fact that in the new situation the average South African household no longer lives in an urban area, while it also does not priorly possess any durables.

Resultingly, when households only differ on their country of residence we observe new clusters of universal durable preferences to unfold. The first cluster consists of Angola, Nepal and Timor-Leste. The second cluster consists of Ethiopia, Malawi and South Africa. The third cluster consists of Indonesia and Myanmar. The fourth cluster consists of Senegal and Uganda. Hence, in conclusion we observe that under both differing and similar circumstances households throughout the developing world differ on their preferences for durable goods. Such mostly arises from differences in *Access to Electricity* and the country of residence. Nevertheless, durable preferences are universal among specific clusters of countries, which is likely the result of similarities in country-specific factors such as culture and development.

**Table 21: Patterns of Acquisition for the Average Households Under Similar Circumstances – e.g. Similar Values for the Independent Variables**

Country	Probability of Ownership				Pattern of Durable Acquisition
	Television (T)	Refrigerator (R)	Motorbike (M)	Radio (RA)	
<i>Angola</i>	,595	,067	,069	,495	<i>T – RA – M – R</i>
<i>Armenia</i>	,972	,739	,000	,017	<i>T – R – RA – M</i>
<i>Ethiopia</i>	,257	,022	,005	,362	<i>RA – T – R – M</i>
<i>Indonesia</i>	,480	,026	,138	,058	<i>T – M – RA – R</i>
<i>Myanmar</i>	,602	,008	,374	,245	<i>T – M – RA – R</i>
<i>Malawi</i>	,328	,040	,018	,576	<i>RA – T – R – M</i>
<i>Nepal</i>	,278	,009	,062	,223	<i>T – RA – M – R</i>
<i>Senegal</i>	,424	,017	,042	,693	<i>RA – T – M – R</i>
<i>Timor-Leste</i>	,267	,016	,201	,222	<i>T – RA – M – R</i>
<i>Uganda</i>	,170	,011	,084	,665	<i>RA – T – M – R</i>
<i>South Africa</i>	,417	,318	,003	,459	<i>RA – T – R – M</i>

#### 4.3. The Rationality of Durable Preferences

Now that we have derived the patterns of durable acquisition we can test the second hypothesis “*The uncovered pattern of durable acquisition can be subjectively considered rational*”. Note that no universal pattern of durable acquisition has been uncovered in the previous sections. Hence, we assess the rationality of each country’s specific pattern of acquisition. Recall that our subjectively rational pattern of acquisition resembles “*Radio – Motorbike – Refrigerator – Television*”. Based on the results in tables 20 and 21 we reject the second hypothesis. In other words, durable preferences appear to be highly irrational throughout the developing world.

Irrational durable preferences are especially found among Asian, Armenian and South African households, as such households usually prefer a television. African households show signs of irrationality as well, even though they rationally prefer a radio. Ugandan households display a quite rational pattern of acquisition, as the radio is positioned first, followed by the motorbike in second place. Nevertheless, the average Ugandan household irrationally prefers the television over the refrigerator. Such irrationality of durable preferences may originate from a large variety of factors.

For instance, having access to electricity largely increases the probability of owning a television and refrigerator. Hence, it relatively increases the probabilities of owning a refrigerator and television a vis the probabilities of owning a radio and motorbike. Such may be considered irrational, as the radio and motorbike should be priority durables. Nevertheless, the results in table 21 indicate that even if every household would have access to electricity the radio remains a priority durable in most African countries. Moreover, in such instance the refrigerator remains the least preferred durable in most countries. Hence, deviations from rational durable preferences cannot be solely explained by *Access to Electricity*.

Moreover, deviations in rational durable preferences may be explained by differences in *Urban Residence*, *Age Difference (Husband-Wife)* and *Complementarities*. Rural households may be considered more rational than urban households, as rural households tend to rationally prefer the radio over the television. The opposite holds for urban households. In addition, urban households tend to highly prefer refrigerators, which is somewhat irrational. Nevertheless, table 21 displays that even if every household is assumed to live in a rural area there are large differences in especially television and radio preferences. Hence, *Urban Residence* may not fully explain deviations in rational durable preferences.

Additionally, rationality may be gender-based. Women may be considered as more rational than men, as women rationally seem to prefer radios, refrigerators and motorbikes over the television. Men irrationally seem to prefer the acquisition of a television. As of such, we may argue that households with lower values of *Age Difference (Husband-Wife)* – and hence with larger relative bargaining power of women – display more rational durable preferences than household with high values of *Age Difference (Husband-Wife)*. In addition, complementary effects may cause deviations in the rationality of durable preferences. The cases of South Africa and Armenia show that high levels of prior durable possession highly enhance the probability of irrationally preferring a television and refrigerator. For instance, the results in table 21 display that when South African households go from priorly possessing multiple durables to priorly possessing no durables they display a rational increase in radio preference. Hence, large prior possessions of durables likely enhance the irrationality of durable preferences.

Nevertheless, the most influential factors in causing irrational deviations in durable preferences are found in the country-specific factors. There may be a cultural preference for any durable which is irrational. In addition, the cases of South Africa and Armenia show that large development and wealth generate higher irrational preferences for televisions and refrigerators. Moreover, the motorbike is scarcely preferred in Armenia and South Africa, which is irrational. Likely such arises from the ability of Armenian and South African households to acquire expensive cars to make the role of motorbikes obsolete.

In conclusion, durable preferences appear to be irrational throughout the developing world. Such especially arises from a consistent low preference for refrigerators by the households of most developing countries. Additionally, Asian, Armenian and South African households irrationally prefer the television over the radio. In Africa, households usually rationally prefer the radio over the television, but they irrationally tend to prefer the television over the motorbike and refrigerator. The irrationality of durable preferences may be country-specific, as it may be for instance culturally determined. Moreover, factors such as *Access to Electricity*, *Age Difference (Husband-Wife)*, *Complementarities* and *Urban Residence* may exert an important role in causing and establishing irrational durable preferences.

## 5. Conclusion and Discussion

This paper researches the universality and rationality of household's durable preferences throughout the developing world. In order to do so patterns of durable acquisition are constructed for the average households of eleven developing countries. Thereafter the patterns of durable acquisition are compared. The presence of similar patterns of durable acquisition would indicate the presence of universal durable preferences. However, the results indicate that there is no universal preference for durables present among the households of the developing world, as the uncovered patterns of durable acquisition vary widely among different countries.

Nevertheless, the results indicate the presence of regional universality of durable preferences as similar patterns of durable acquisition are found to persist in specific combinations or clusters of countries. For instance, most of the countries in Sub-Saharan Africa display similar patterns of durable acquisition by their average households. The same applies to most Asian countries. However, there is no evidence indicating the presence of uniformly universal durable preferences throughout the entire developing world. In addition, the results indicate that the durable preferences of households throughout the developing world are irrational. Such results hold when assuming households across the developing world to be different as well as similar on the independent variables under study.

Differences in durable preferences across countries and the presence of irrationality in durable preferences especially arise from the largely different preferences for radios and televisions among countries. For instance, African households prefer the acquisition of a radio, while most Asian households prefer the acquisition of a television. As of such, African households show larger degrees of rationality than Asian households. Moreover, the refrigerator appears to be the least preferred durable in almost every country except Armenia and South Africa, which is irrational. In addition, the preference for motorbikes seems to differ vastly among countries. For instance, most Asian households show somewhat large preferentiality for motorbikes, while motorbikes are the least preferred durable in Armenia and South Africa.

The large deviations in durable preferences throughout the developing world find their fundament in a large variety of factors. For instance, *Access to Electricity* largely affects the relative preferences for televisions and radios. Households with access to electricity irrationally tend to prefer the television. Households without access to electricity tend to rationally prefer the radio. In addition, factors such as the relative position of women, complementary effects of durables and urban residency cause varying and irrational durable preferences. Moreover, country-specific effects such as the degree of development, wealth and culture strongly affect the universality and rationality of durable preferences.

Nevertheless, our analysis is limited by a variety of factors. For instance, the dataset contains data on 137.078 households from eleven different developing countries. Some countries, such as Armenia, provide a limited number of respondents. Hence, our dataset is based on a limited selection of households from the developing world. Therefore, our conclusions may not be applicable to the households of every country in the developing world. Moreover, the results may be slightly biased, as our dataset contains a small number of households from several countries. For instance, there are just over 1.000 households from Senegal, while there are over 50.000 Indonesian households present in the dataset.

In addition, data availability has limited the amount of independent and controlling variables used in the study. Resultingly, several potentially important factors have not been included in the analysis. For instance, we have not been able to control motorbike ownership for relative gasoline prices, costs of maintenance or relative prices of alternative vehicles. In fact, we have not been able to control for the relative prices of durables at all.

In addition, our analysis is limited by the potential inequality between durable preferences and decisions of durable acquisition. In other words, we study durable preferences by assessing the order in which durables are acquired, but acquisitions do not always have to resemble preferences (Namias, 1959). Nevertheless, given the possibilities of our study the assessment of acquisitional patterns of durables comes as close to studying actual durable preferences as possible. Further research could aim to gather more direct evidence on durable preferences, for example by means of questionnaires. For instance, further research could hold questionnaires among households in the developing world directly asking them on their durable preferences. Given the time and resources available for this study we have not been able to gather such data.

Moreover, the limitations of our research can be used by further research to expand into interesting directions. For instance, once more data on durable possession becomes available for a larger variety of developing countries our hypotheses can be tested on a larger scale. Further research may then also include a larger variety of durables under study. Additionally, we encourage further research to expand the base of independent and controlling variables. For instance, we encourage further research to include factors such as relative prices of durables, maintenance costs, gasoline costs and educational levels to create more accurate patterns of durable acquisition. Moreover, further research is encouraged to delve further into the country-specific factors of culture and development which appear to strongly affect durable preferences. For example, further research could distinguish different cultures to assess the different preferences for durables in different countries. Additionally, the assessment of country-specific factors may yield some insight in the underlying fundamentals of the uncovered country clusters. For instance, further research may be able to explain more profoundly and in more detail why households throughout Sub-Saharan Africa display similar durable preferences.

Finally, the results have social implications. The results indicate that households throughout the developing world mostly follow different patterns of durable acquisition, as their preferences for durables differ. More problematically, such households follow patterns of acquisition which are irrational. Households throughout the developing world especially appear to put a high preference on televisions, while their patterns of development would be more efficient if the television would be acquired later on. Such irrationality mainly arises from the effect of *Access of Electricity*, as households which have access to electricity tend to place a higher, irrational preference on televisions. Hence, there is a task for policy makers and governments to guide households in their durable acquisitions. For instance, as Mohn (2013) already argued, policy makers and governments should guide households in the developing world through the tremendous increase in possibilities once they attain access to electricity. Exemplary would be the stimulation of refrigerator acquisition, while stimulating the postponement of television acquisition when there is access to electricity. In doing so, policy makers can use durable preferences and patterns of durable acquisition to make the patterns of development for households in the developing world more efficient.

## References

- Abera, M., Nega, A., Tefera., Y. & Gelagay, A. A. (2020). Early marriage and women's empowerment: the case of child-brides in Amhara national regional state, Ethiopia. *BMC International Health and Human Rights*, 20(1), 1-16.
- Adkins, L. C. & Hill, R. C. (2011). *Using Stata for Principles of Econometrics* (4<sup>th</sup> ed.). Hoboken, NJ: Wiley Custom.
- Alcorta, L., Smits, J., & Swedlund, H. J. (2018). Inequality and ethnic conflict in Sub-Saharan Africa. *Social Forces*, 97(2), 769–792.
- Arora, V., & Vamvakidis, A. (2010). South Africa in the African economy. *Global Journal of Emerging Market Economies*, 2(2), 153–171.
- Attema, A. E., Bleichrodt, H., & L'Haridon, O. (2018). Ambiguity preferences for health. *Health Economics*, 27(11), 1699–1716.
- Bérenger, V., Deutsch, J., & Silber, J. (2013). Durable goods, access to services and the derivation of an asset index: comparing two methodologies and three countries. *Economic Modelling*, 35, 881–891.
- Cairncross, S. (2003). Sanitation in the developing world: current status and future solutions. *International Journal of Environmental Health Research*, 13, 123–31.
- Cardoso, G. C., Leitão A. V, Funghi, C., Batalha, H. R., Lopes, R. J., & Mota, P. G. (2014). Similar preferences for ornamentation in opposite- and same-sex choice experiments. *Journal of Evolutionary Biology*, 27(12), 2798–2806.
- Clark, D. A. (2005). Sen's capability approach and the many spaces of human well-being. *The Journal of Development Studies*, 41(8), 1339-1368.
- Clarke, Y., & Soutar, G. N. (1982). Consumer acquisition patterns for durable goods: Australian evidence. *Journal of Consumer Research*, 8(4), 456–460.
- Comer, J., & Wikle, T. (2008). Worldwide diffusion of the cellular telephone, 1995-2005. *The Professional Geographer*, 60(2), 252–269.
- Dawson, R. F. F. (1953). Ownership of cars and certain durable household goods. *Bulletin of the Oxford University Institute of Economics & Statistics*, 15(5), 177–191.
- Dhanaraj, S., Mahambare, V., & Munjal, P. (2018). From income to household welfare: lessons from refrigerator ownership in India. *Journal of Quantitative Economics*, 16(2), 573–588.
- Dickson, P. R., Lusch, R. F., & Wilkie, W. L. (1983). Consumer acquisition priorities for home appliances: a replication and re-evaluation. *Journal of Consumer Research*, 9(4), 432–435.

- Dziechciarz, J. & Dziechciarz-Duda, M. (2017). Non-metric data in household durable goods analysis. selected aspects. *Acta Universitatis Lodziensis. Folia Oeconomica*, 4.
- Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D., & Sunde, U. (2018). Global evidence on economic preferences. *Quarterly Journal of Economics*, 133(4), 1645–1692.
- Fine, B., & Simister, J. (1995). Consumption durables: exploring the order of acquisition. *Applied Economics*, 27(11), 1049–1057.
- Fishelson, G. (1970). Durable ownership-the order of acquisition. *Applied Economics*, 2(4), 277–287.
- Freedman, D. S. (1970). The role of the consumption of modern durables in economic development. *Economic Development and Cultural Change*, 19(1), 25–48.
- Ganguli, J., Heifetz, A., & Lee, B. S. (2016). Universal interactive preferences. *Journal of Economic Theory*, 162, 237–260.
- Global Data Lab (2021). “Database Developing World”. Available at <https://globaldatalab.org/>.
- Hebden, J. J., & Pickering, J. F. (1974). Patterns of acquisition of consumer durables. *Oxford Bulletin of Economics and Statistics*, 36(2), 67–94.
- House, C. L., & Ozdenoren, E. (2008). Durable goods and conformity. *Rand Journal of Economics*, 39(2), 452–468.
- Hu, T., Li, M., & Wei, S. (1989). Household durable goods ownership in Tianjin, China. *The China Quarterly*, 120(120), 787–799.
- Hussain, F., & Tongia, R. (2007). Community radio for development in South Asia: A sustainability study. *International Conference on Information and Communication Technologies and Development*, 1-13.
- Kasulis, J. J., Lusch, R. F., & Stafford, E. F. (1979). Consumer acquisition patterns for durable goods. *Journal of Consumer Research*, 6(1), 47–57.
- Kumar, R. V., & Sarkar, A. (2008). Psychographic segmentation of Indian urban consumers. *Journal of the Asia Pacific Economy*, 13(2), 204–226.
- Lemish, D., & Rice, M. L. (1986). Television as a talking picture book: a prop for language acquisition. *Journal of Child Language*, 13(2), 251–74.
- Lorkowski, J. A., & Kreinovich, V. (2018). *Bounded rationality in decision making under uncertainty : towards optimal granularity* (Ser. Studies in systems, decision and control, volume 99). Springer.
- McFall, J. (1969). Priority patterns and consumer behaviour. *Journal of Marketing*, 33(4), 50-55.

Mohn, T. (2013). It takes a village: rural electrification in East Africa. *Ieee Power and Energy Magazine*, 11(4).

Mujahid-mukhtar, E., & Mukhtar, H. (1991). Female participation in household decision-making: an analysis of consumer durables' acquisition in Pakistan. *Pakistan Development Review*, 30(4), 953–62.

Myers, M. (2008). Radio and development in Africa. *A Concept Paper Prepared for the International Development Research Centre (IDRC) of Canada*.

Namias, J. (1959). Intentions to purchase compared with actual purchases of household durables. *Journal of Marketing*, 24(1), 26–30.

N'Tsoukpoe, K. E., Yamegueu, D., & Bassole, J. (2014). Solar sorption refrigeration in Africa. *Renewable and Sustainable Energy Reviews*, 35, 318–335.

Paroush, J. (1965). The order of acquisition of consumer durables. *Econometrica*, 33(1), 225–235.

Reddy, B., & Snehalatha, M. (2011). Sanitation and personal hygiene. *Indian Journal of Gender Studies*, 18(3), 381–404.

Rieger, M. O., Wang, M., & Hens, T. (2021). Universal time preference. *Plos One*, 16(2), 0245692.

Ritchie, H. & Roser, M. (2019). "Access to Energy". *Our World in Data*. Available at <https://ourworldindata.org/energy-access>, accessed on 28-05-2021.

Sahn, D. E., & Stifel, D. C. (2000). Poverty comparisons over time and across countries in Africa. *World Development*, 28(12), 2123–2155.

Shackelford, T. K., Schmitt, D. P., & Buss, D. M. (2005). Universal dimensions of human mate preferences. *Personality and Individual Differences*, 39(2), 447–458.

Smits, J., & Steendijk, R. (2015). The international wealth index (iwi). *Social Indicators Research : An International and Interdisciplinary Journal for Quality-Of-Life Measurement*, 122(1), 65–85.

Solanke, B. L. (2015). Marriage age, fertility behavior, and women's empowerment in Nigeria. *Sage Open*, 5(4).

Soutar, G. N., Bell, R. C., & Wallis, Y. M. (1990). Consumer acquisition patterns for durable goods: a Rasch analysis. *European Journal of Marketing*, 24(8), 31–39.

Soutar, G. N., & Cornish-Ward, S. P. (1997). Ownership patterns for durable goods and financial assets: a Rasch analysis. *Applied Economics*, 29(7), 903–911.

Taylor, C., Clifford, A., & Franklin, A. (2013). Color preferences are not universal. *Journal of Experimental Psychology. General*, 142(4), 1015–27.

The Economist (2019, 13 November). “More than half of sub-Saharan Africans lack access to electricity”. *The Economist*. Available at <https://www.economist.com/graphic-detail/2019/11/13/more-than-half-of-sub-saharan-africans-lack-access-to-electricity>, accessed on 07-04-2021.

The World Bank (2021a). “Access to Electricity (% of Population)”. Retrieved from <https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS>, accessed on 07-04-2021.

The World Bank (2021b). “Adjusted net national income per capita (current US\$)”. Retrieved from <https://data.worldbank.org/indicator/NY.ADJ.NNTY.PC.CD?end=2016&start=2016>, accessed on 07-06-2021.

Van Kempen, L. (2007). Status consumption and ethnicity in Bolivia: evidence from durables ownership. *International Journal of Consumer Studies*, 31(1), 76–89.

Verbeek, M. (2017). *A guide to modern econometrics* (5<sup>th</sup> ed.). Hoboken, NJ: Wiley Custom.

Wabwire, J. (2013). The role of community radio in development of the rural poor. *New Media and Mass Communication*, 10, 40-47.

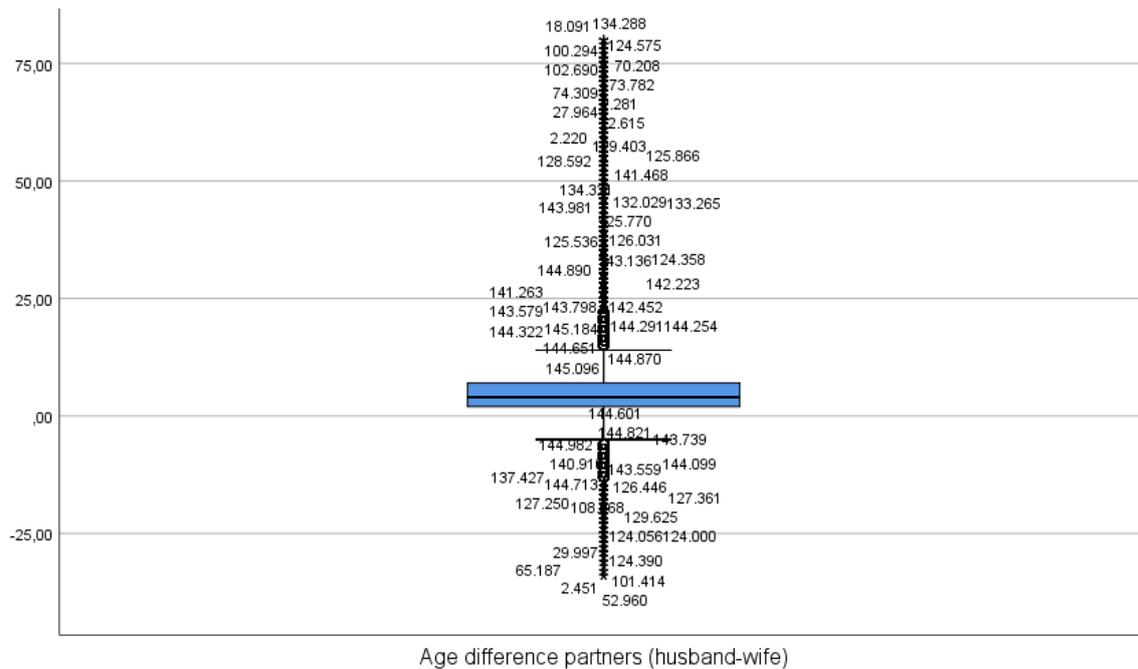
Wells, J. (1977). The diffusion of durables in Brazil and its implications for recent controversies concerning Brazilian development. *Cambridge Journal of Economics*, 1(3), 259–279.

## Appendix to Chapter 3

**Table 1: Frequency Distributions of Households Among the Countries Under Study**

	Frequency	Percent	Cumulative Percent
<i>Angola</i> (AGO) – Sub-Saharan Africa	3.712	2,7	2,7
<i>Armenia</i> (ARM) – Europe	3.665	2,7	5,4
<i>Ethiopia</i> (ETH) – Sub-Saharan Africa	7.837	5,7	11,1
<i>Indonesia</i> (IND) – South-Asia	73.861	53,9	65,0
<i>Myanmar</i> (MMR) – South-East Asia and the Pacific	6.368	4,6	69,6
<i>Malawi</i> (MWI) – Sub-Saharan Africa	13.929	10,2	79,8
<i>Nepal</i> (NPL) – South-Asia	7.824	5,7	85,5
<i>Senegal</i> (SEN) – Sub-Saharan Africa	1.011	0,7	86,2
<i>Timor-Leste</i> (TLS) – South-East Asia and the Pacific	6.394	4,7	90,9
<i>Uganda</i> (UGA) – Sub-Saharan Africa	9.911	7,2	98,1
<i>South Africa</i> (ZAF) – Sub-Saharan Africa	2.566	1,9	100,0
<b>Total</b>	137.078	100,0	

**Graph 1: Plot Indicating the Range of Outlying Values for the Independent Variable ‘Age Difference (Husband-Wife)’**



*Note: The marked values indicate the observations which are considered as problematic outliers.*

**Table 6: Summary Statistics for the Angolan Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	3.712	,00	1,00	,5348	,49886
<i>Refrigerator</i>	3.712	,00	1,00	,3335	,47153
<i>Motorbike</i>	3.712	,00	1,00	,2500	,43300
<i>Radio</i>	3.712	,00	1,00	,5200	,50000
<i>Access to Electricity</i>	3.712	,00	1,00	,3998	,48992
<i>Urban Residence</i>	3.712	,00	1,00	,5946	,49104
<i>Age Difference (Husband-Wife)</i>	3.712	-5,00	14,00	5,2562	3,80526

**Table 7: Summary Statistics for the Armenian Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	3.665	,00	1,00	,9975	,04950
<i>Refrigerator</i>	3.665	,00	1,00	,9765	,15140
<i>Motorbike</i>	3.665	,00	1,00	,0000	,05200
<i>Radio</i>	3.665	,00	1,00	,0400	,20100
<i>Access to Electricity</i>	3.665	,00	1,00	,9992	,02860
<i>Urban Residence</i>	3.665	,00	1,00	,5662	,49567
<i>Age Difference (Husband-Wife)</i>	3.665	-5,00	14,00	4,5563	3,37974

**Table 8: Summary Statistics for the Ethiopian Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	7.837	,00	1,00	,2178	,41279
<i>Refrigerator</i>	7.837	,00	1,00	,0960	,29455
<i>Motorbike</i>	7.837	,00	1,00	,0100	,11100
<i>Radio</i>	7.837	,00	1,00	,3200	,46700
<i>Access to Electricity</i>	7.837	,00	1,00	,3180	,46572
<i>Urban Residence</i>	7.837	,00	1,00	,2609	,43918
<i>Age Difference (Husband-Wife)</i>	7.837	-5,00	14,00	6,0909	3,66424

**Table 9: Summary Statistics for the Indonesian Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	73.861	,00	1,00	,6663	,47154
<i>Refrigerator</i>	73.861	,00	1,00	,3124	,46346
<i>Motorbike</i>	73.861	,00	1,00	,3900	,48800
<i>Radio</i>	73.861	,00	1,00	,1000	,30300
<i>Access to Electricity</i>	73.861	,00	1,00	,8935	,30844
<i>Urban Residence</i>	73.861	,00	1,00	,2961	,45653
<i>Age Difference (Husband-Wife)</i>	73.861	-5,00	14,00	4,6114	3,24724

**Table 10: Summary Statistics for Myanmar's Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	6.368	,00	1,00	,5828	,49314
<i>Refrigerator</i>	6.368	,00	1,00	,1457	,35268
<i>Motorbike</i>	6.368	,00	1,00	,5900	,49200
<i>Radio</i>	6.368	,00	1,00	,3100	,46300
<i>Access to Electricity</i>	6.368	,00	1,00	,5895	,49196
<i>Urban Residence</i>	6.368	,00	1,00	,2550	,43591
<i>Age Difference (Husband-Wife)</i>	6.368	-5,00	14,00	2,8428	3,94890

**Table 11: Summary Statistics for the Malawian Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	13.929	,00	1,00	,1521	,35916
<i>Refrigerator</i>	13.929	,00	1,00	,0742	,26204
<i>Motorbike</i>	13.929	,00	1,00	,0400	,18400
<i>Radio</i>	13.929	,00	1,00	,4800	,50000
<i>Access to Electricity</i>	13.929	,00	1,00	,1385	,34542
<i>Urban Residence</i>	13.929	,00	1,00	,1947	,39599
<i>Age Difference (Husband-Wife)</i>	13.929	-5,00	14,00	4,9538	3,48217

**Table 12: Summary Statistics for the Nepalese Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	7.824	,00	1,00	,5194	,49965
<i>Refrigerator</i>	7.824	,00	1,00	,1456	,35270
<i>Motorbike</i>	7.824	,00	1,00	,1800	,38100
<i>Radio</i>	7.824	,00	1,00	,2900	,45500
<i>Access to Electricity</i>	7.824	,00	1,00	,8944	,30731
<i>Urban Residence</i>	7.824	,00	1,00	,6364	,48107
<i>Age Difference (Husband-Wife)</i>	7.824	-5,00	14,00	3,9047	3,47090

**Table 13: Summary Statistics for the Senegalese Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	1.011	,00	1,00	,4243	,49449
<i>Refrigerator</i>	1.011	,00	1,00	,1464	,35367
<i>Motorbike</i>	1.011	,00	1,00	,1200	,32700
<i>Radio</i>	1.011	,00	1,00	,6600	,47400
<i>Access to Electricity</i>	1.011	,00	1,00	,4738	,49956
<i>Urban Residence</i>	1.011	,00	1,00	,3551	,47878
<i>Age Difference (Husband-Wife)</i>	1.011	-5,00	14,00	7,9822	3,77953

**Table 14: Summary Statistics for Timor-Leste's Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	6.394	,00	1,00	,4823	,49973
<i>Refrigerator</i>	6.394	,00	1,00	,2236	,41672
<i>Motorbike</i>	6.394	,00	1,00	,4100	,49100
<i>Radio</i>	6.394	,00	1,00	,2900	,45500
<i>Access to Electricity</i>	6.394	,00	1,00	,7795	,41463
<i>Urban Residence</i>	6.394	,00	1,00	,3081	,46174
<i>Age Difference (Husband-Wife)</i>	6.394	-5,00	14,00	4,3059	4,13214

**Table 15: Summary Statistics for the Ugandan Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	9.911	,00	1,00	,1531	,36007
<i>Refrigerator</i>	9.911	,00	1,00	,0481	,21405
<i>Motorbike</i>	9.911	,00	1,00	,1300	,33500
<i>Radio</i>	9.911	,00	1,00	,5900	,49200
<i>Access to Electricity</i>	9.911	,00	1,00	,2657	,44171
<i>Urban Residence</i>	9.911	,00	1,00	,2035	,40263
<i>Age Difference (Husband-Wife)</i>	9.911	-5,00	14,00	5,1031	3,83034

**Table 16: Summary Statistics for the South African Households**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<i>Television</i>	2.566	,00	1,00	,8211	,38332
<i>Refrigerator</i>	2.566	,00	1,00	,7915	,40631
<i>Motorbike</i>	2.566	,00	1,00	,0300	,16800
<i>Radio</i>	2.566	,00	1,00	,6300	,48400
<i>Access to Electricity</i>	2.566	,00	1,00	,8889	,31428
<i>Urban Residence</i>	2.566	,00	1,00	,6294	,48306
<i>Age Difference (Husband-Wife)</i>	2.566	-5,00	14,00	4,4879	4,13501

**Table 18: VIF-Scores for the Independent Variables**

<b>Variable</b>	<b>VIF</b>	<b>Variable</b>	<b>VIF</b>
<i>Television</i>	1,902	<i>Ethiopia (ETH)</i>	1,268
<i>Refrigerator</i>	1,566	<i>Indonesia (IND)</i>	<i>Reference</i>
<i>Motorbike</i>	1,344	<i>Myanmar (MMR)</i>	1,126
<i>Radio</i>	1,258	<i>Malawi (MWI)</i>	1,689
<i>Age Difference (Husband-Wife)</i>	1,036	<i>Nepal (NPL)</i>	1,128
<i>Urban Residence</i>	1,268	<i>Senegal (SEN)</i>	1,047
<i>Access to Electricity</i>	1,938	<i>Timor-Leste (TLS)</i>	1,058
<i>Angola (AGO)</i>	1,153	<i>Uganda (UGA)</i>	1,446
<i>Armenia (ARM)</i>	1,165	<i>South Africa (ZAF)</i>	1,114

## Appendix to Chapter 4

*Figure 1: Example Calculations of Ownership Probabilities for the Average Angolan Household*

**Recall from summary statistics that our average Angolan household:**

Does not own a refrigerator (**Refrigerator = 0**) ; Owns a television (**Television = 1**)

Owns a radio (**Radio = 1**) ; Does not own a motorbike (**Motorbike = 0**)

Has no access to electricity (**Access to Electricity = 0**) ; Does live in an urban area (**Urban Residence = 1**)

Has an age difference of 5,2562 (**Age Difference (Husband-Wife) = 5,2562**)

### Television:

$$\ln\left(\frac{P(Y = 1 | X)}{P(Y = 0 | X)}\right) = -3.294 + 0.718 * 1 + 0.657 * 1 + 1.075 * 1 + 0.025 * 5.2562 = -0.712595$$

$$\frac{P(Y = 1 | X)}{P(Y = 0 | X)} = e^{-0.712595} = 0.490370034$$

$$P(Y = 1 | X) = \frac{0.490370034}{0.490370034 + 1} \approx \mathbf{32.9\%}$$

### Refrigerator:

$$\ln\left(\frac{P(Y = 1 | X)}{P(Y = 0 | X)}\right) = -3.121 - 1.876 * 1 + 2.217 * 1 + 0.378 * 1 + 1.089 * 1 - 0.007 * 5.2562 = -1.3497934$$

$$\frac{P(Y = 1 | X)}{P(Y = 0 | X)} = e^{-1.3497934} = 0.259293825$$

$$P(Y = 1 | X) = \frac{0.259293825}{0.259293825 + 1} \approx \mathbf{20.1\%}$$

### Motorbike:

$$\ln\left(\frac{P(Y = 1 | X)}{P(Y = 0 | X)}\right) = -6.013 + 3.368 * 1 + 1.252 * 1 + 0.159 * 1 + 0.029 * 1 - 0.011 * 5.2562 = -1.2628182$$

$$\frac{P(Y = 1 | X)}{P(Y = 0 | X)} = e^{-1.2628182} = 0.282855758$$

$$P(Y = 1 | X) = \frac{0.282855758}{0.282855758 + 1} \approx \mathbf{22.0\%}$$

### Radio:

$$\ln\left(\frac{P(Y = 1 | X)}{P(Y = 0 | X)}\right) = -0.707 + 0.146 * 1 + 0.637 * 1 - 0.033 * 1 - 0.004 * 5.2562 = 0.0219752$$

$$\frac{P(Y = 1 | X)}{P(Y = 0 | X)} = e^{0.0219752} = 1.022218433$$

$$P(Y = 1 | X) = \frac{1.022218433}{1.022218433 + 1} \approx \mathbf{50.5\%}$$

*Note:* Only the values of the variables scoring different from zero are included in the equations. Out of convenience-induced reasons the components matching up to zero are excluded, such as the country dummy for Ethiopia where the average household scores zero.