Standard of Living of Households
The Influence of Second-Hand Markets

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ABSTRACT

This paper investigates the influences of second-hand markets on the standard of living of households in different countries. Using data from Living Standard Measurement Surveys, second-hand prices of refrigerators and television are calculated for seven countries with different levels of development. The indicator for level of development used in the multi-level regressions is the percentage of households possessing a refrigerator or a television. The analysis shows that second-hand prices of televisions and refrigerators differ for different levels of development. In less developed countries, these prices decrease at a slower rate than in more developed countries. This means that second-hand prices are higher in less developed countries. Therefore, households in poor countries have less possibility to satisfy their basic material needs, and thus have a disadvantage compared to equally poor households in wealthy countries.

Keywords: Second-hand markets, durable goods, television, refrigerator, poor households, multi-level regression analysis

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Chapter 1. Introduction

Material well-being is an important indicator for the standard of living of households all across the globe. The possession of certain assets, and particularly durable assets, ranging from refrigerators to cars, is considered necessary to live a comfortable life (Smits & Steendijk, 2015). Durable assets are goods that yield utility over time, instead of being completely consumed in one use. They are valued for their useful services, and decrease in value with the passing of time (Scitovsky, 1994).

Households' possession of (durable) assets differs largely between countries. Table 1 shows that in Malawi, an extremely poor country, only 3.7% of households own a refrigerator and only 10.8% own a television (TV). In contrast, table 1 shows that in the developed country of Japan, almost all households own a refrigerator and a TV.

Table 1. Differences in the possession of durables and development between countries

	Refrigerator	TV	GDPpc
Malawi	3.7%	10.8%	$372
Nigeria	18.4%	47.8%	$2640.3
El Salvador	74%	93%	$4219.4
Turkey	97.7%	96%	$9125.7
Japan	99%	97.3%	$34523.7

1 Data on % of households who own a refrigerator and TV for Malawi (2010), Nigeria (2013), El Salvador (2012) and Turkey (2008) from Global Data Lab Area Database

2 Data on % households who own a refrigerator and TV for Japan (2004) from Statistics Bureau, Ministry of Internal Affairs and Communication

3 Data on GDP per capita (current US$) 2015 from World Bank

These differences can in part be explained by income, since with a lower income, fewer assets can be bought. Table 1 shows that lower income per capita is associated with a lower percentage of households owning a refrigerator or a TV. However, income is not the only factor that determines whether households are able to buy durable goods. This possibility is also influenced by the prices of those durable goods at the local market. These prices can vary because of the potential presence of a second-hand market. In second-hand markets, the price of a durable good decreases relatively faster than its lifetime, which makes it efficient to spend one's income there (Thomas, 2003). Thus, second-hand markets create the possibility for households to buy durable goods for a relatively low price.

Since in developing countries relatively few households possess (durable) assets, one could assume that the second-hand markets are not well developed there. If so, households in

poor countries that would have the money to buy a second-hand good in a wealthy country may not be able to buy that good at their local market. Therefore, these households would have a disadvantage compared to equally poor households in wealthy countries, since they would have less possibilities to satisfy their basic material needs (Smits, 2017).

The role of second-hand markets is largely underrepresented in the current literature, and especially little has been written about the role of second-hand markets for the poorer segments of society and the world. More research is needed to gain a better understanding of this topic. In this vein, the aim of this study is to answer the following question:

"*To what extent can differences in the standard of living of poor households between countries be explained by second-hand markets?*"

To support the process of the research, some sub-issues are also addressed. Hence, this paper investigates *whether*

- *scarcity of durable goods is associated with levels of development,* and
- *lower levels of development are associated with higher second-hand prices for durable goods.*

The first sub-investigation contains an overview of the possession of durable assets in relation to levels of development. Possession of durable assets could potentially indicate the level of development of second-hand markets. Then, using a multi-level regression, the second sub-investigation examines the relationship between second-hand prices and levels of development.

This paper proceeds as follows. First, it presents the theoretical framework and formulates the hypotheses. Second, it explains the methodology used for the two steps in detail. Subsequently, the paper discusses the results of the analyses, and finally, it makes some concluding remarks.

Chapter 2. Theoretical background

2.1 Standard of living

National income is often used as an instrument to measure economic status. However, for low- and middle-income countries, this instrument comes with some problems and is therefore considered weak for those countries (Howe et al., 2009; Devarajan, 2013). Harttgen et al. (2013) note that "basic underlying data to construct national accounts are often missing or estimated, weights are outdated, and price information is missing or subject to poor quality" (p.38). Therefore, the reliability of national income as an indicator for economic status is questionable.

As a result, economists have tried to circumvent those problems by using various proxies for economic performance. Henderson et al. (2009, 2011), for example, took a highly unusual approach: they found that satellite maps are a good proxy for economic activity for areas where income data is of poor quality or completely missing. Another, more straightforward measure for economic status is wealth indices. Since the 1990s, these indices have been widely used to measure economic status for households all across the globe. Wealth indices are particularly useful in low- and middle-income countries because of the flaws in national income for those countries. Numerous studies (Filmer & Pritchett, 1999, 2001; Sahn & Stifel, 2000, 2003; Howe et al., 2009; Young, 2012) have used data from the Demographic Health Surveys (DHS) to construct an asset-based index for measuring economic status. Possession of assets is considered necessary for living a comfortable life, and material well-being is thus an important indicator for the living standard of households (Sahn & Stifel, 2003; Smits & Steendijk, 2015). Most studies have found that asset-based indices are a useful proxy for consumption at a point in time. However, Harttgen et al. (2013) argue that measuring consumption across heterogeneous settings can lead to biased results, especially when consumption over time is measured. These authors (2013, p.41) list four biases:

1) preferences for specific assets could change with time;
2) changes of relative prices could change the demand for assets;
3) it is problematic to proxy consumption with asset ownership; and
4) government policies are, especially in poor countries, influential for the provision of certain assets.

Furthermore, McKenzie (2005) and Gwatkin et al. (2007) argue that wealth indices are not comparable among countries and at different time points. This comparability problem exists because the surveys are usually not identical, and therefore a separate wealth index is often

constructed for each survey (Smits & Steendijk, 2015).

A fairly new wealth measure that overcomes the comparability problem is the International Wealth Index (IWI). The IWI is a general index that uses the same criteria for rating households independent of country and year (Smits & Steendijk, 2015). Thus, the IWI is the first comparable asset-based index for material well-being that can be used for all low- and middle-income countries. The index consists of 12 assets divided into 3 categories: 7 consumer durables, 3 housing characteristics, and 2 public utilities. Every asset has a specific formula weight by which the IWI score can be calculated.

A highly influential category for constructing the value of the IWI is the category of durable goods. Therefore, these goods can be considered as an important indicator for the standard of living of households. The IWI includes the following durable goods: TVs, refrigerators, phones, cars, bicycles, cheap utensils, and expensive utensils (Smits & Steendijk, 2015).

As shown above, durable assets are a crucial indicator to determine the standard of living of households. Durable assets are goods that, instead of being completely consumed in one use, yield utility over time. These goods are valued for the time of their service, and decrease in value with time (Fox, 1957; Scitovsky, 1994). Adam Smith (1776), already stated that durable goods purchased by the rich were taken over by the poor, and that this could contribute to the wealth of nation. However, since then, the role of second-hand markets has largely been ignored in the literature (Smits, 2017).

2.2 Second-hand markets

Economists have neglected second-hand markets for a long time. According to Scitovksy (1994), classical economists realized that second-hand markets distracted demand from first-hand markets. However, they treated this as a transfer from the buyers' income to the seller, leaving the total sum of spending unchanged. Classical economist also realized that the prices in both markets of similar products were dependent on each other. Trades in second-hand markets do have an indirect effect on the prices in the first-hand market and vice versa. However, classical economists neglected this too, probably because they believed the indirect effects to be subordinate to the direct effects (Scitovsky, 1994).

These economists' arguments seem plausible when second-hand markets are very small. However, when they are large, their effects could become significant and should not be neglected.

The best current example of a large second-hand market is that for used cars. In

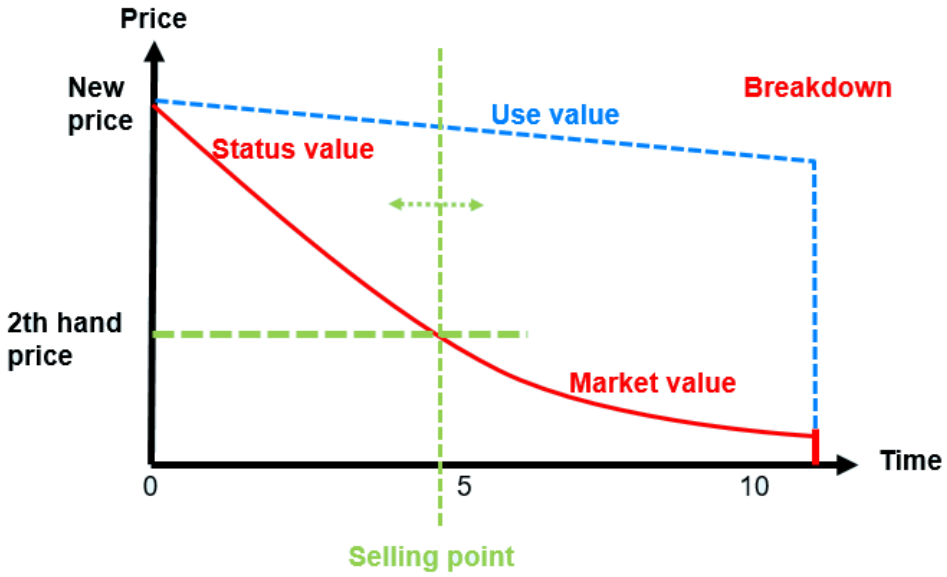
developed countries, for example the United States, the market for used cars is three times as large as the one for new cars (Gaveza, Lizzeri & Roketskiy, 2014).

Large second-hand markets have various effects on the economy: they may stimulate it, but may also harm it. Scitovksy (1994, p.37) notes that the "second-hand markets for consumer durables perform a socially valuable service of mitigating the inequalities of income distribution," and that the second-hand markets also stimulate the economy. They do this in two ways: first, they enable the rich to replace their durables with new ones, which creates more demand for new goods; and second, they create employment and income for the ones who run the second-hand market (Scitovsky, 1994).

On the other hand, second-hand market transactions also lead to problems. The most striking problem acknowledged by many economists is that of quality uncertainty, which is presented in the famous paper by Akerlof (1970). Whereas sellers of second-hand cars are informed about the quality of those cars, buyers are not. Therefore, Akerlof (1970) argues that due to information asymmetry, mostly "bad cars" are sold, resulting in a reduction in the second-hand market. However, this is not the case in the current second-hand car market.

Smits (2017) notes that "the essence of a second-hand market is that the price of a durable good goes down rather fast while its use value remains high over a long period". This is illustrated in figure 1. The investment in a certain good can be too expensive for the poor, but on a second-hand market they have the opportunity to buy this good at a relatively cheap price. The wealthier households, who are the suppliers of the second-hand markets, care about status and are therefore willing to buy new durables even though their current durables are still useable. The poorer households can then buy those goods for a relatively inexpensive price, thereby satisfying the material needs of both household types.

Figure 1. Price and value of durables



Source: Smits (2017)

However, for the households to be able to satisfy those needs, there must be a second-hand market. According to Smits (2017), the second-hand markets in poor countries are less developed or even almost completely lacking. This is because there are fewer wealthy households in poor countries, resulting in hardly any supply for second-hand markets.

Table 2. Differences in possession of durables and level of development between countries

Country	IWI	GDPpc	%TV	%Refrigerator
Algeria	85.7	5564.8	96.6	94.8
Malawi	21.5	374.5	11.1	4.48
Niger	19.9	391.5	11.5	3.28
Nigeria	41.3	2755.3	46.1	17.9
Zambia	32.3	1734.9	33.4	17.9
Albania	85.0	4247.6	98.9	94.8

1 Data on % of households who own a refrigerator and TV and 2012 IWI from Global Data Lab Area Database
2 Data on GDP per capita (current US$) 2012 from World Bank

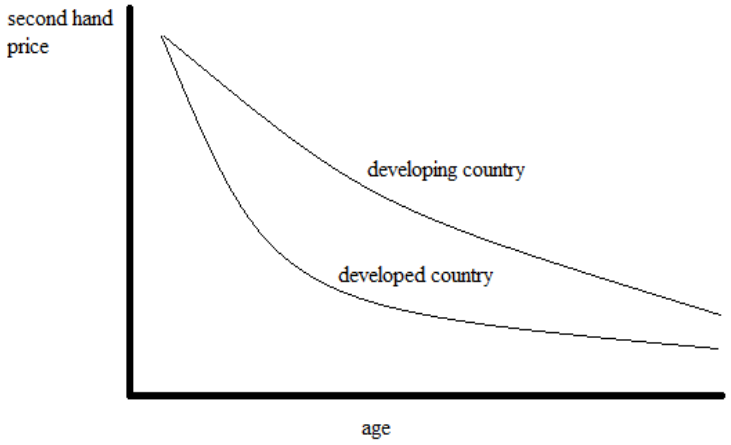
As table 2 shows, there are large differences in possession of assets, and they seem to be correlated with the level of development. Higher levels of GDP per capita and higher levels of IWI seem to be correlated with higher percentages of possession of TVs and refrigerators. Therefore, the following hypothesis is constructed:

H_1 = In less developed countries, fewer households possess durable goods.

In poor countries, for example Malawi and Niger, only few households own such durables, and it is therefore highly difficult to find them on a second-hand market. Moreover, if they are found, their price is expected to be high. This high price can be explained from a standard economic supply and demand point of view, where less supply in a market leads to higher prices (Arrow, 1959).

In more developed countries such as Albania and Algeria, almost all households possess a TV and refrigerator. The potential presence of a well-developed second-hand market is therefore more likely, and the price for durables on this market is expected to be lower. Figure 2 roughly illustrates the different expectations for second-hand price between developed and developing countries.

Figure 2. Different expectations for second-hand price between developed and developing countries



These expectations for second-hand price development result in the following hypothesis:

H_2 = Higher levels of development are associated with lower second-hand prices for durable goods.

The next chapter presents the methodology used in this study. It starts by explaining the method used to analyze the association between scarcity of durables and levels of development. Thereafter, it discusses how the relationship between second-hand prices of durables and levels of development is investigated.

Chapter 3. Methods

This chapter explores the empirical framework of this thesis. To test the two hypotheses, two different methods are developed; therefore, the hypotheses are discussed separately. First, the chapter discusses the method to investigate the association between scarcity of durables and levels of development; and second, it presents the method to examine whether lower levels of development are associated with higher second-hand prices for durables.

3.1 Durable goods and levels of development

3.1.1 Data

To investigate whether scarcity of durables is associated with levels of development, this study uses data on the level of development and household possession of durables. The sample consists of 112 developing and semi-developed countries, a detailed list of which can be found in Appendix A. For every country, the latest available data on durable assets is used. The year for each country can also be found in Appendix A. The data on the level of development corresponds to the same year in which the data for each asset is available. GDP per capita is available for every country, but for some countries data on durable goods is not. Appendix B provides a list of the missing data. The data on the level of development, GDP(pc), is downloaded from the World Bank (data.worldbank.org) and the data on the percentage of households possessing a durable good is downloaded from the area database of the Global Data Lab (www.globaldatalab.org/areadata).

3.1.2 Measurements and model

The indicator for level of development is GDP per capita, and the indicator for possession of durables is the percentage of households in a country possessing certain durables. The analysis uses durable goods that are broadly considered to be necessary to live a comfortable life: TVs, fridges, cars, cellphones, phones, and computers (Smits & Steendijk, 2015).

First, this thesis presents correlations between GDP per capita and the durables to illustrate their association. Second, the thesis provides a graphic overview of the percentage of households who possess the durable goods in relation to GDP per capita. For GDP per capita, the log value is used to ensure a more detailed view on the relationship.

3.2 Second-hand prices and levels of development

3.2.1 Data

To investigate whether lower levels of development are associated with higher prices for durables, a regression analysis is conducted. The regression requires data on second-hand prices by age, and data on the possession of durables by households. Data on second-hand prices are

not directly available; therefore, the present author calculates them using data gathered from questions in Living Standard Measurement Surveys (www.microdata.worldbank.org/index.php/catalog/lsms), which are surveys on living conditions, and mainly to assess poverty. The surveys from the following countries are used: Albania (2012), Bulgaria (2007), Malawi (2010-2011), Niger (2011), Nigeria (2010-2011), Serbia (2007), and Tajikistan (2009). The answers from which the second-hand prices are derived are in local currencies. Two methods are used to convert them to comparable dollars: the exchange rate method and the purchasing parity power (PPP) method. However, for Serbia no PPP conversion factor is available, and therefore second-hand prices in this country are only calculated through the official exchange rate method. For all countries but Bulgaria, the data on the percentage of households possessing a durable good are downloaded from the area database of the Global Data Lab (www.globaldatalab.org/areadata). For Bulgaria, data on refrigerators are derived from Euromonitor (https://www.ers.usda.gov/media/9393/householdamenities.xls), while data on TVs are retrieved from Trading Economics (https://tradingeconomics.com/bulgaria/households-with-television-percent-wb-data.html), which collects data from the World Bank development indicators (https://data.worldbank.org/data-catalog/world-development-indicators). The complete, constructed dataset used in the regressions can be found in Appendix C.

3.2.2 Measurements and model

The dataset consists of seven countries, for each of which the second-hand prices are calculated for 12 years. To account for the clustered structure at country level, multi-level regressions are conducted (Afshartous & de Leeuw, 2005).

The dependent variable in the regressions is the second-hand price of the durable good. These prices are derived from Living Standard Measurement Surveys, most of which contain a module on household durables. However, not every survey contains the full information necessary to derive the second-hand prices for the durables. In this paper, seven national surveys can be used to derive second-hand prices for two durables. The following questions are used to derive the prices:

1) *Does your household own an [ITEM]?*
2) *How many [ITEM]s do you own?*
3) *What is the age of this [ITEM]?*
4) *If you wanted to sell this [ITEM] today, how much would you receive?*

Second-hand prices by age are derived for TVs and refrigerators, while the lack of respondents for most durables makes it impossible to derive reliable prices for other durables that are generally considered necessary for a comfortable life. Even for TVs and refrigerators, a similar problem appears for some years. Furthermore, differences in rates of respondents per age sometimes lead to unrealistic outcomes. If, for example, only 25 people indicated that they had a three-year-old refrigerator, and a few of those 25 people would ask a very high price for their refrigerator, then the price derived for a three-year-old refrigerator in this survey (country) would be extremely high. Therefore, the Moving Average Method is used to calculate stable values for the second-hand prices. This method calculates averages several times for several subsets of data (James, 1968). In this study's dataset, the three-year average prices are calculated for every age of the durable. This means that for a refrigerator of three years of age, the sum of the prices for a refrigerator of two, three, and four years is divided by 3 to determine the second-hand price. The only exception in the dataset is the new prices for the durables: the number of respondents for an item with age 0 is high enough to determine a reliable price. The number of respondents for old items is, however, very low. Therefore, the data on those cases is less reliable.

The second-hand prices for refrigerators and TVs are calculated for the first 12 years (0 to 11) of the item. The last year (11^{th}) is calculated by taking the average of all the remaining years reported in the surveys. As a robustness check, the analysis is also conducted without this 11^{th} year. Furthermore, as another robustness check, the analysis is also conducted with the exclusion of the last three years, since most respondents possessed an item between the ages of zero and eight years.

The Bulgarian survey includes questions about two types of TVs: color TVs and black and white TVs. The second-hand prices for both types are calculated as described above and then weighted averages, taking into account the number of respondents for both types of TVs, are used to determine the final second-hand prices for Bulgarian TVs. In Albania, a large number of respondents were willing to give away (selling price is zero) their refrigerators. This results in unrealistic second-hand prices, as the price increases as the age of the refrigerators does. Therefore, those respondents are removed before calculating the final second-hand prices for refrigerators in Albania. As a robustness check, Albania is also excluded from the analysis, as the method of deriving its prices deviates from that used for the other countries.

The second-hand prices for the durables obtained from the surveys are in local currencies. To make the prices comparable, two methods are employed. The first is to use the official exchange rate (LCU per US$, period average) and the second is to use the PPP

conversion factor, private consumption (LCU, per international $ of 2011), both obtained from the World Bank (https://data.worldbank.org/). Both these methods are used to determine relative values of different currencies in the international market. However, there are differences between the two. In the official exchange rate method, the volume of goods and services that a dollar could buy in the US may not correspond to what that dollar could buy in another country when converted into the currency of that other country, especially when non-tradable goods and services account for a large share of the country's output (Van Vuuren & Alfsen, 2006). In contrast, the PPP method reflects differences in price levels for tradable and non-tradable goods and services. Appendix D provides a detailed list of the conversion factors used. The conversion factors used for each country correspond to the year in which the survey took place. For Malawi and Nigeria, this was in both 2010 and 2011, and the 2010 conversion factors are used. For Tajikistan, the PPP 2011 conversion factor is used because it is the closest one available. In the survey conducted in Serbia, answers had to be written down in euros. Therefore, the conversion factor for the euro area is used. However, the conversion factor to PPP is not available for the euro area, and therefore Serbia is excluded in the two regressions that use the PPP method to calculate second-hand prices.

Because two different techniques are used to convert the second-hand prices to comparable dollars for two durables, separate multi-level regressions are conducted for each technique and durable: two regressions using the PPP method to determine the second-hand prices for TVs and refrigerators, and two regressions using the official exchange rate method. Thus, a total of four multi-level regressions are performed.

Each multi-level regression contains two independent variables. The first independent variable is the percentage of households possessing the durable in a country. Logically, the regressions on prices of TVs use the percentages of households possessing a TV, while the regressions on refrigerators use the percentages of households possessing a refrigerator. The percentage of possession of TVs and refrigerators is fixed for every country since the value corresponding to the survey year is taken. The second independent variable is the age of the durable, since age is expected to be the most important factor influencing the second-hand price. Because the relationship between age and second-hand price is expected to be nonlinear, the squared term of age is also added to the regression. The second-hand price is expected to decrease more slowly with the passing of time.

To test the hypotheses, the following equations are estimated:

(1) $SHP\ Fridge\ (MER) = \beta_0 + \beta_1 \%hhwithFridge + \beta_2 Age + \beta_3 Age2 + e$

(2) $SHP\ TV\ (MER) = \beta_0 + \beta_1 \%hhwithTV + \beta_2 Age + \beta_3 Age2 + e$

(3) $SHP\ Fridge\ (PPP) = \beta_0 + \beta_1 \%hhwithFridge + \beta_2 Age + \beta_3 Age2 + e$

(4) $SHP\ TV\ (PPP) = \beta_0 + \beta_1 \%hhwithTV + \beta_2 Age + \beta_3 Age2 + e$

To determine whether second-hand prices differ between levels of development, the study also tests interactions between age[(2)] and the percentage of households possessing the durable. The latter is used as an indicator for level of development, since possession of durables is positively associated with this level. To capture the main effects of the coefficients, the interaction variables are centered in every regression.

Chapter 4. Results

4.1 Scarcity of durables and levels of development

Table 3 provides the descriptive statistics for the variables used to investigate the association between durable goods and development. The variable (log)GDPpc represents the logarithmic term of GDP per capita for the countries used in the analysis. The variables %hh with [durable good] are the percentages of households possessing the durable good in a country. For some countries, information on some durables is missing; those durables can be found in Appendix B. The possession of a certain asset ranges from countries where almost no households possess it to a situation where (almost) every household does (for most assets).

Table 3. Descriptive statistics of data used to analyze the relationship between levels of development and possession of durables

Variable	Observations	Mean	Std. Dev.	Min	Max
%hh with TV	112	62.90687	32.10593	3.67	99.75
%hh with Fridge	107	47.25355	35.60003	1.07	99.38
%hh with Car	115	18.6247	16.82834	0.76	75.29
%hh with Cellphone	95	73.52947	22.63106	11.4	98.6
%hh with Phone	112	76.57455	22.86634	0.77	99.41
%hh with Computer	90	21.94789	17.83575	0.64	78.25
(log)GDPpc	112	3.34625	0.4658444	2.28	4.23

1 Data on % of households who own a TV, fridge, car, cellphone, phone, and computer from the Global Data Lab Area Database

2 Data on GDP per capita from World Bank

Table 4 shows the Pearson's correlations between the durables and (log)GDP per capita. The values for all durables are above 0.5, suggesting a strong positive association between GDP per capita and the percentage of households possessing the durables.

Table 4. Pearson's correlations between (log)GDP per capita and several durable goods

	TV	Fridge	Car	Cellphone	Phone	Computer
(log)GDPpc	0.7676	0.8235	0.6969	0.589	0.6735	0.7891

Figure 3 shows the relationship between TVs and (log)GDP per capita. At the lower levels of development, only a small percentage of households possess a TV. Then, as income increases, more households start possessing one, and at a certain point of income most own one. Figure 4 shows a similar pattern for refrigerators. However, the threshold of income at which almost all households own a refrigerator seems to be slightly higher.

Figure 3. Relationship between percentage of households owning a TV in a country and (log)GDP per capita

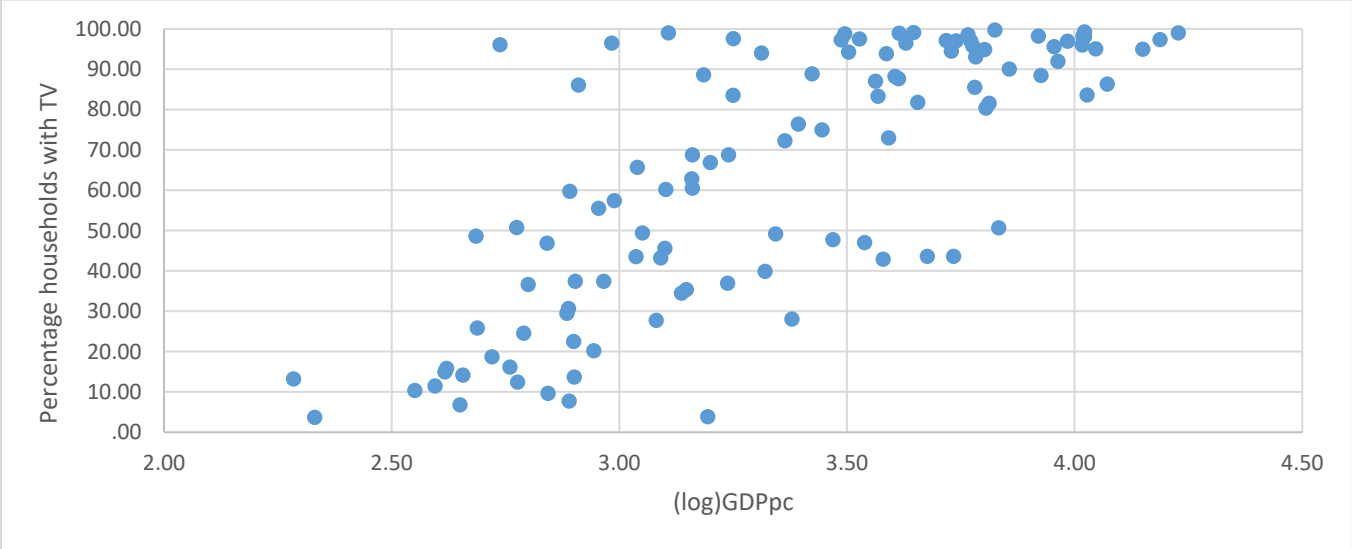
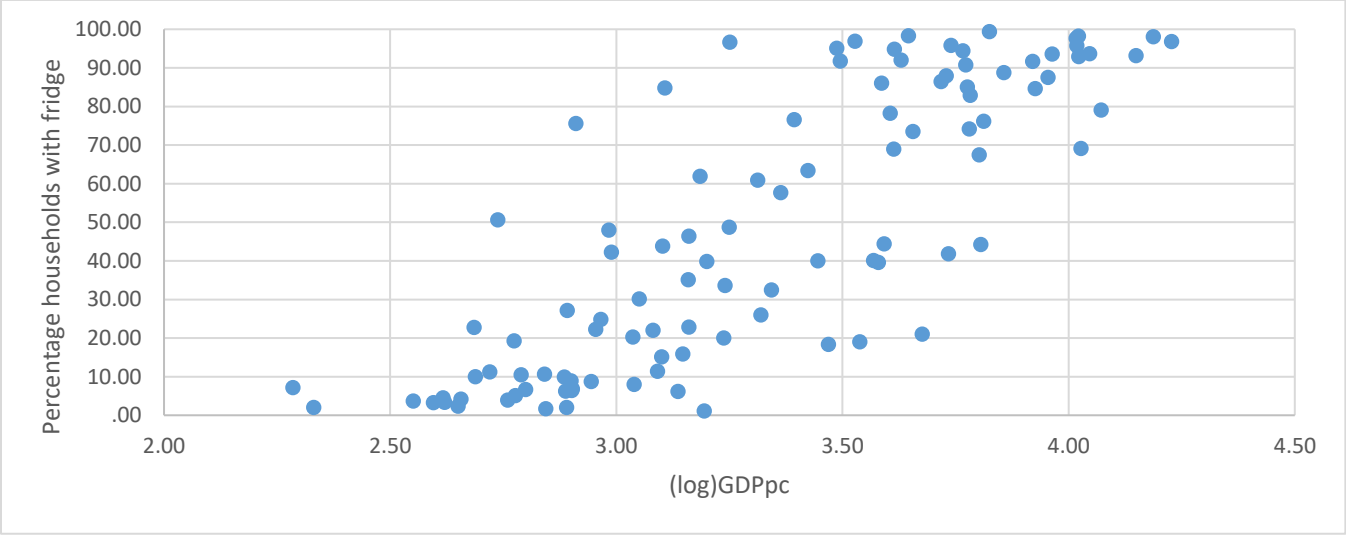


Figure 4. Relationship between percentage of households owning a refrigerator in a country and (log)GDP per capita



For the possession of cellphones and phones (figures 5 and 6) the pattern is different in comparison to TVs and refrigerators. The level of income at which most households own a

(cell)phone is lower than for TVs or refrigerators: at the lower levels of development, a large number of households are already in possession of a (cell)phone.

Figure 5. Relationship between percentage of households owning a cellphone in a country and (log)GDP per capita

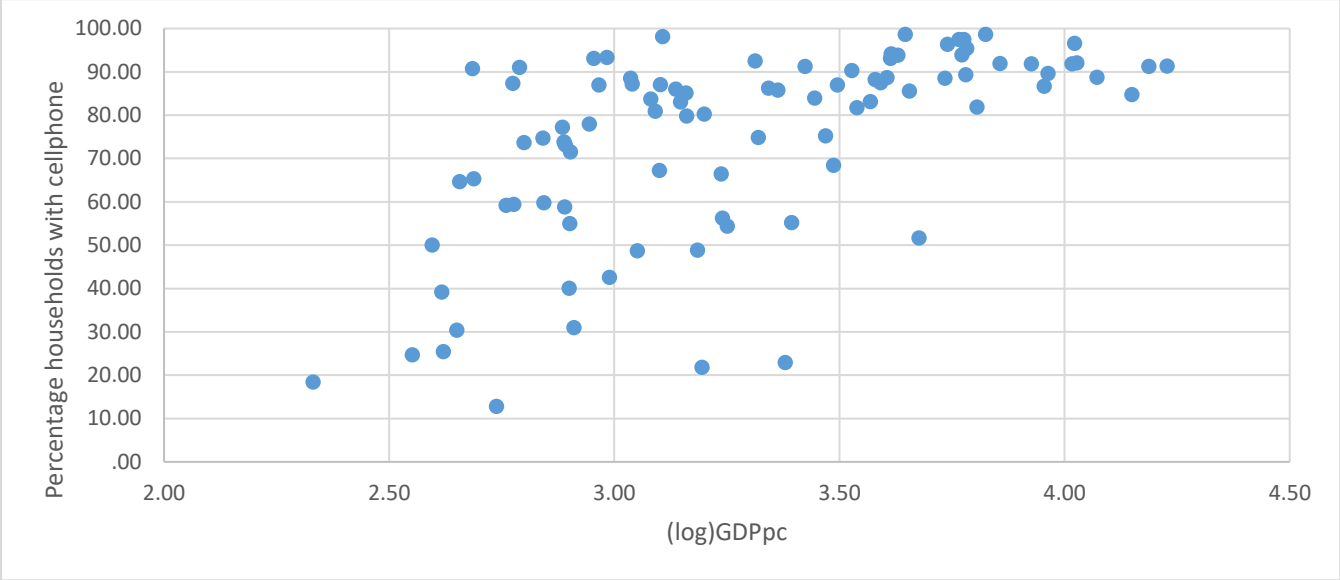
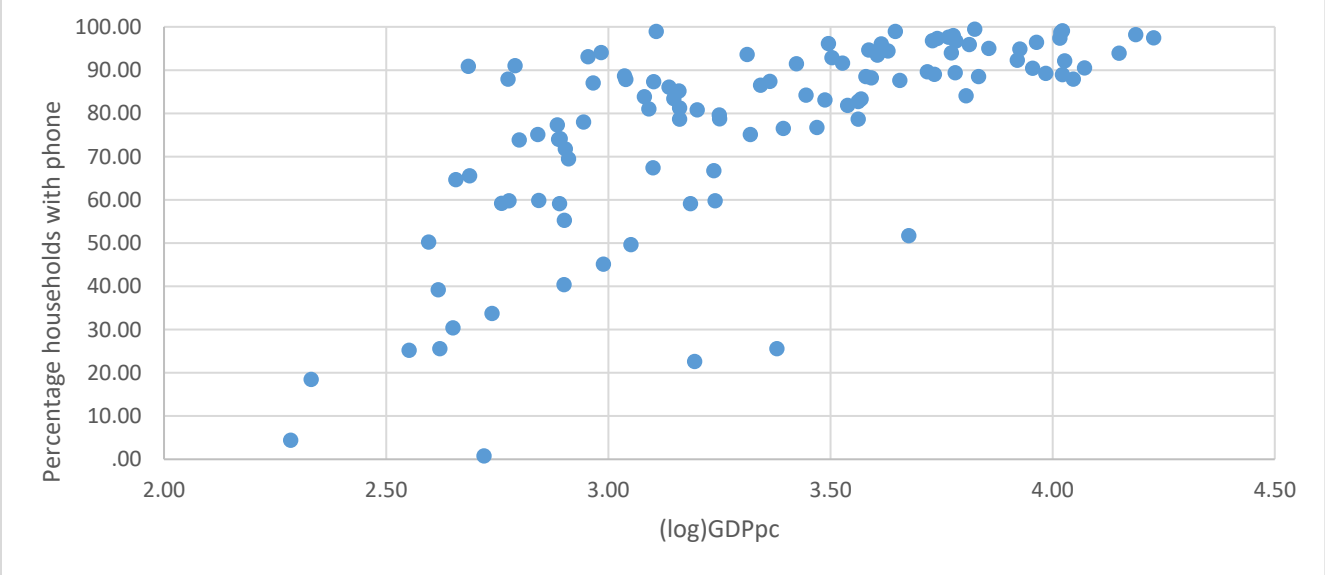


Figure 6. Relationship between percentage of households owning a phone in a country and (log)GDP per capita



More expensive assets such as computers and cars show another pattern. Figures 7 and 8 demonstrate the relationship between GDP per capita and possession of these goods: at the

lower levels of income, almost no households own these assets, and only at a higher level of development do they start obtaining them.

Figure 7. Relationship between percentage of households owning a computer in a country and (log)GDP per capita

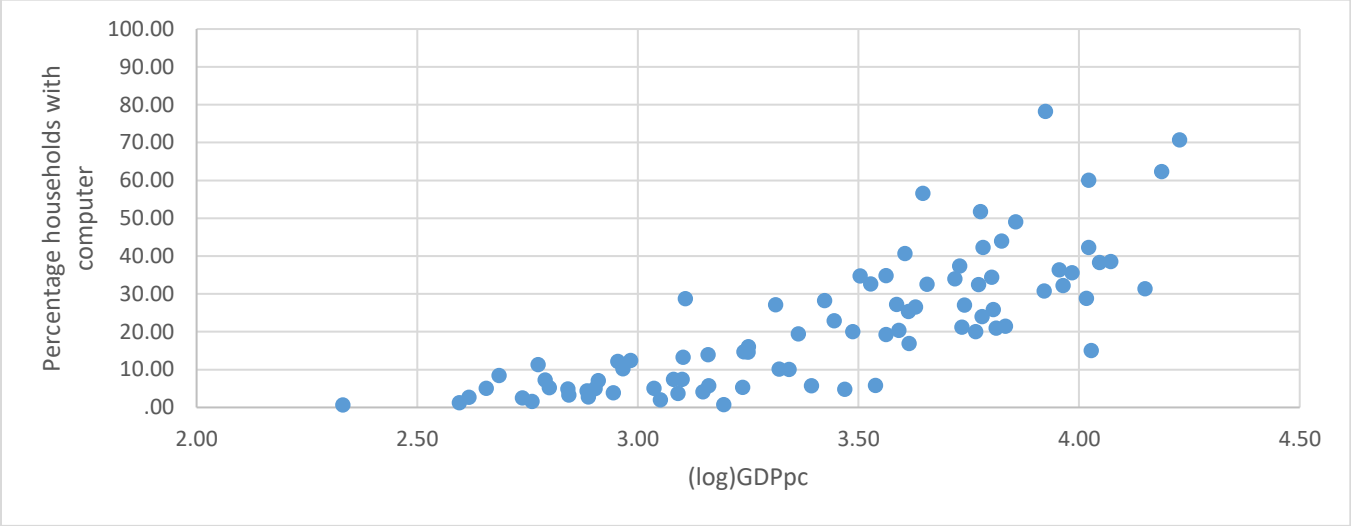
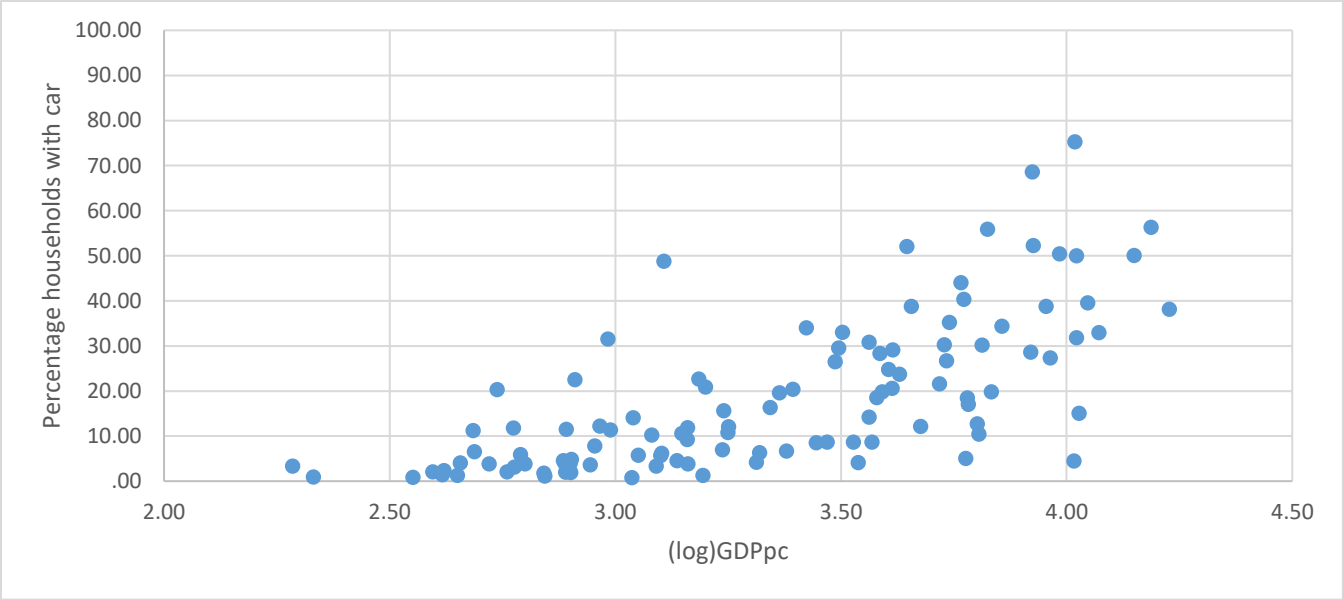


Figure 8. Relationship between percentage of households owning a car in a country and (log)GDP per capita



The relationship between durable assets and levels of development differs between assets. In general, households obtain more assets as income increases. However, for more expensive assets the point at which households possess those assets is at a higher level of income.

This evidence indicates that at the lower levels of development, households possess few

durables, and that as income increases, the possession of durables by households increases. Therefore, the following hypothesis cannot be rejected:

H_1 = In less developed countries, fewer households possess durable goods.

4.2 Second-hand prices and possession of durables

With only few households owning durables at the lower levels of development, the presence of a second-hand market is unlikely. Moreover, even if such a market is present, second-hand prices are expected to be very high. To test whether lower levels of development are indeed associated with higher second-hand prices of TV and refrigerators, several multi-level regressions are conducted.

Table 5 provides the descriptive statistics for the variables used to investigate whether higher levels of development are associated with lower second-hand prices for durables. The dependent variables for the four multi-level regressions are Fridge (MER), Fridge (PPP), TV (MER), and TV (PPP). Fridge (MER) and TV (MER) represent the second-hand prices for refrigerators and TVs, respectively, calculated using the official exchange rate method, while Fridge (PPP) and TV (PPP) represent their second-hand prices using the PPP conversion method. The variable %hh with Fridge captures the percentage of households possessing a refrigerator, and the variable %hh with TV the percentage those owning a TV. Recall that %hh with Fridge and %hh with TV are fixed numbers for every country, since they represent the value for the year in which the Living Standard Measurement Survey took place. The variable age ranges from 0 to 11 years and age^2 is the quadratic function of age.

Table 5. Descriptive statistics of data used for the multi-level regressions

Variable	Observations	Mean	Std. Dev.	Min	Max
Fridge (MER)	84	199.9076	117.1355	30.15316	712.0115
Fridge (PPP)	72	419.4055	229.7983	98.56143	1287.334
%hh with Fridge	84	49.4	40.34753	3.2	97.5
TV (MER)	84	102.7755	43.65514	26.52669	251.6629
TV (PPP)	72	200.2264	79.41079	50.00135	417.1674
%hh with TV	84	64.57143	38.96633	10.6	98.8
Age	84	5.5	3.472786	0	11
Age^2	84	42.16667	39.64658	0	121

1 Data on % of households who own a TV and a fridge from the Global Data Lab Area Database
2 Data on second-hand prices (by age) calculated by the present author from a question in the Living Standard Measurement Surveys

Table 6. Multi-level regression with Second-Hand Price Fridge as the dependent variable, calculated using the official exchange rate method

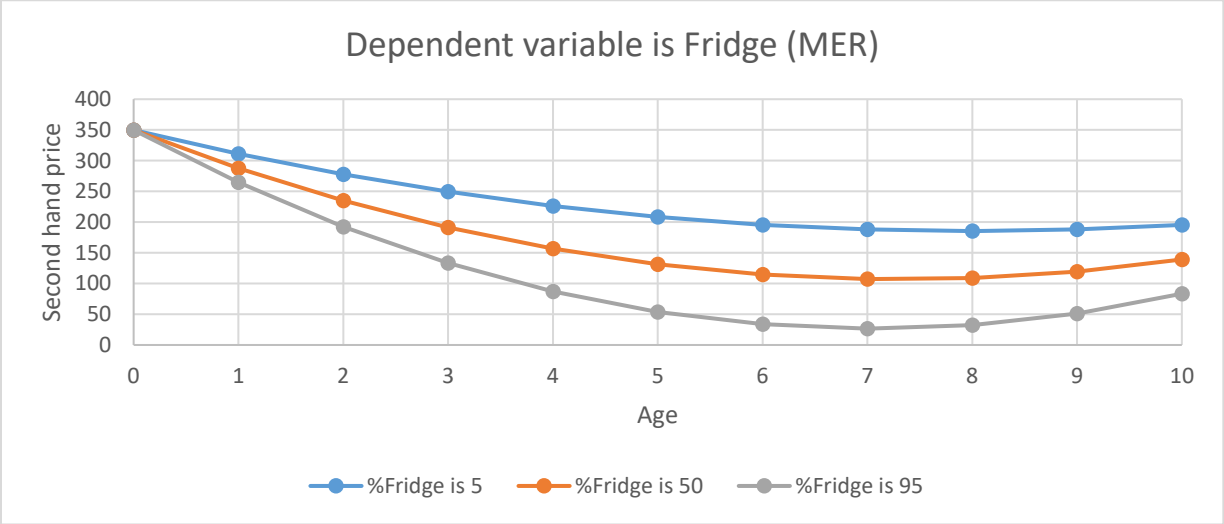
Dependent variable	(1) Fridge (MER)	(2) Fridge (MER)	(3) Fridge (MER)	(4) Fridge (MER)	(5) Fridge (MER)
%hh with Fridge	-0.776	-0.776	-0.776	-0.776	-0.776
	(0.735)	(0.735)	(0.735)	(0.735)	(0.735)
Age	-12.43***	-38.29***	-38.29***	-38.29***	-38.29***
	(2.255)	(7.850)	(7.727)	(7.817)	(7.383)
Age^2		2.351***	2.351***	2.351***	2.351***
		(0.688)	(0.677)	(0.685)	(0.647)
Interaction %hh with Fridge and Age			-0.0811		-0.562***
			(0.0516)		(0.184)
Interaction %hh with Fridge and Age^2				-0.00371	0.0437***
				(0.00457)	(0.0161)
Constant	306.6***	349.7***	349.7***	349.7***	349.7***
	(48.39)	(49.80)	(49.71)	(49.78)	(49.46)
Observations	84	84	84	84	84
Number of countries	7	7	7	7	7

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 presents the multi-level regressions on the second-hand prices of refrigerators calculated using the official exchange rate conversion method. The first regression (1) captures the effects of the percentage of households with a refrigerator and age; only age is significant. The negative sign of the coefficient implies that with an increase in age, the second-hand price for a refrigerator decreases. This is in line with expectations: as a durable good ages, its price is expected to decrease. In the second regression, the quadratic term of age is added. Both age and the quadratic term of age are highly significant, implying that the relationship between age and second-hand price is nonlinear. However, in this study the particular interest is in whether the decrease in price differs between levels of development. Therefore, interactions are added in regressions 3, 4, and 5. In regression 3, the interaction between %hh with Fridge and Age is added, while in regression 4 the interaction between %hh with Fridge and Age^2 is included. In both regressions, the interaction effect remains insignificant, implying that there is no interaction between the variables. However, when both interaction effects are added to regression 5, both interaction effects are found to be significant. The interpretation of the

regression now becomes difficult, and the regression lines are therefore plotted. Figure 9 shows three regression lines with different values for percentage of households possessing a refrigerator: the blue line represents the regression line for which this is 5%; the orange line represents a value of 50%; and the grey line represents the regression slope for a value of 95%. The results show that when only a small percentage of households in a country own a refrigerator, the second-hand price decreases at a much slower rate than in a country where many people own a refrigerator. However, from age 7 the second-hand price starts to increase slightly. As discussed before, this is probably due to the small amount of cases for determining the second-hand prices of old items.

Figure 9. Visualization of regression slopes for different values of %Fridge



Equation: 349.7 + (Age*-38.29+Age*%hhwithFridge*-0.562) + (Age^2*2.351+Age^2*%hhwithFridge*0.0437).

Table 7. Multi-level regression with Second-hand Price TV as the dependent variable, calculated using the official exchange rate method

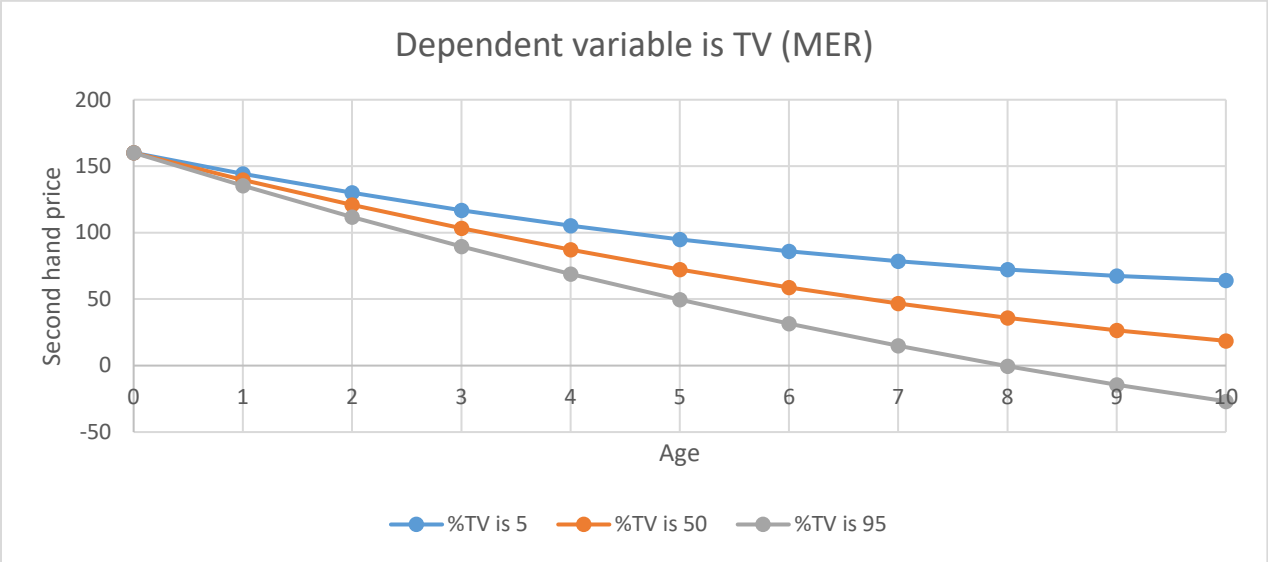
Dependent variable	(1) TV (MER)	(2) TV (MER)	(3) TV (MER)	(4) TV (MER)	(5) TV (MER)
%hh with TV	0.0238	0.0238	0.0238	0.0238	0.0238
	(0.238)	(0.238)	(0.238)	(0.238)	(0.238)
Age	-8.425***	-15.94***	-15.94***	-15.94***	-15.94***
	(0.694)	(2.437)	(1.773)	(1.870)	(1.764)
Age^2		0.684***	0.684***	0.684***	0.684***
		(0.213)	(0.155)	(0.164)	(0.155)
Interaction %hh with TV and Age			-0.101***		-0.141***
			(0.0123)		(0.0455)
Interaction %hh with TV and Age^2				-0.00829***	0.00358
				(0.00113)	(0.00399)
Constant	147.6***	160.1***	160.1***	160.1***	160.1***
	(18.32)	(18.68)	(18.32)	(18.37)	(18.32)
Observations	84	84	84	84	84
Number of countries	7	7	7	7	7

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7 presents the multi-level regressions on the second-hand prices of TVs calculated with the official exchange rate conversion method. The results are similar to those of the regression on the second-hand price of refrigerators. In every regression, the variable age is highly significant and the coefficients are again negative, as expected. Again, the positive, significant coefficient of Age^2 shows that the relationship is nonlinear. However, the interaction effects are different than for the second-hand price of refrigerators. Whereas for the latter, the interaction terms are only significant when added simultaneously to the regression, the interaction terms for %hh with TV and Age, and %hh with TV and Age^2 are significant when they are put in the regression separately. In contrast, when both interaction terms are added into the regression, only the one between %hh with TV and Age is significant. Therefore, the interaction term between %hh with TV and Age^2 can be excluded. To visualize the interpretation of the regression, several regression lines are plotted again for different values of %hh with TV (figure 10).

The blue line represents the regression line when 5% of households own a TV; the orange line represents a value of 50%; and the grey line a value of 95%. A similar pattern is found as in the previous regression. When fewer households in a country own a TV, the second-hand price decreases at a slower rate.

Figure 10. Visualization of regression slopes for different values of %TV



Equation: 160.1 + (Age*-15.94+Age*%hhwithTV*-0.101) + (Age^2*0.684)

Table 8. Multi-level regression with Second-hand Price Fridge as the dependent variable, calculated using the PPP method

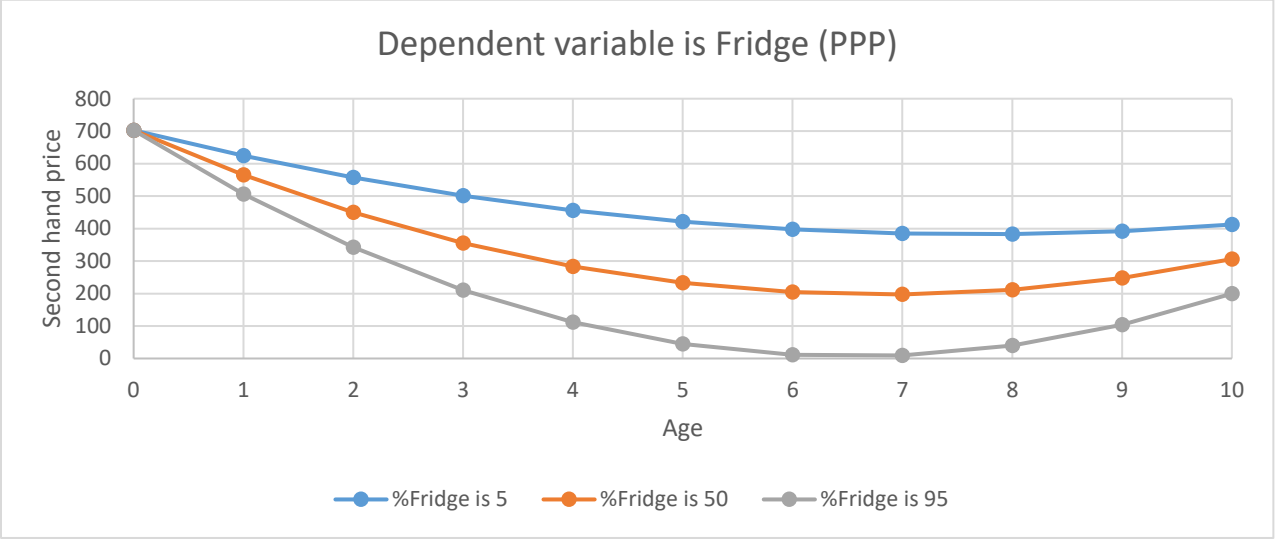
Dependent variable	(1) Fridge (PPP)	(2) Fridge (PPP)	(3) Fridge (PPP)	(4) Fridge (PPP)	(5) Fridge (PPP)
%hh with Fridge	-1.637	-1.637	-1.637	-1.637	-1.637
	(1.667)	(1.667)	(1.667)	(1.667)	(1.667)
Age	-23.02***	-76.39***	-76.39***	-76.39***	-76.39***
	(4.802)	(16.60)	(16.49)	(16.60)	(15.20)
Age^2		4.852***	4.852***	4.852***	4.852***
		(1.454)	(1.444)	(1.454)	(1.331)
Interaction %hh with Fridge and Age			-0.111		-1.436***
			(0.117)		(0.402)
Interaction %hh with Fridge and Age^2				-0.000763	0.120***
				(0.0103)	(0.0352)
Constant	613.8***	702.7***	702.7***	702.7***	702.7***
	(97.08)	(100.2)	(100.1)	(100.2)	(99.11)
Observations	72	72	72	72	72
Number of countries	6	6	6	6	6

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8 presents the multi-level regressions on the second-hand prices of refrigerators calculated using the PPP conversion method. Similar results are found as in table 6, with the main difference being that the coefficients are larger in the present table as a result of the different method used to calculate the prices. The variable age is again significant and its coefficient is negative. The significant positive coefficient of the quadratic term of age shows that the relationship between age and second-hand price is again nonlinear. Furthermore, both interaction effects are again significant in regression 5.

Figure 11 visualizes the regression slopes for different levels of development. The blue line represents a case where 5% of households own a fridge, the orange line 50%, and the grey line 95%. The regression slopes are highly similar to those in figure 9, indicating again that prices decrease at a slower rate in countries where fewer households possess refrigerators and that after age 7 the second-hand price starts to increase slightly.

Figure 11. Visualization of regression slopes for different values of %Fridge



Equation: 702.7 + (Age*-76.39+Age*%hhwithFridge*-1.436) + (Age^2*4.852+Age^2*%hhwithFridge*0.12).

Table 9. Multi-level regression with Second-hand Price TV as the dependent variable, calculated using the PPP method

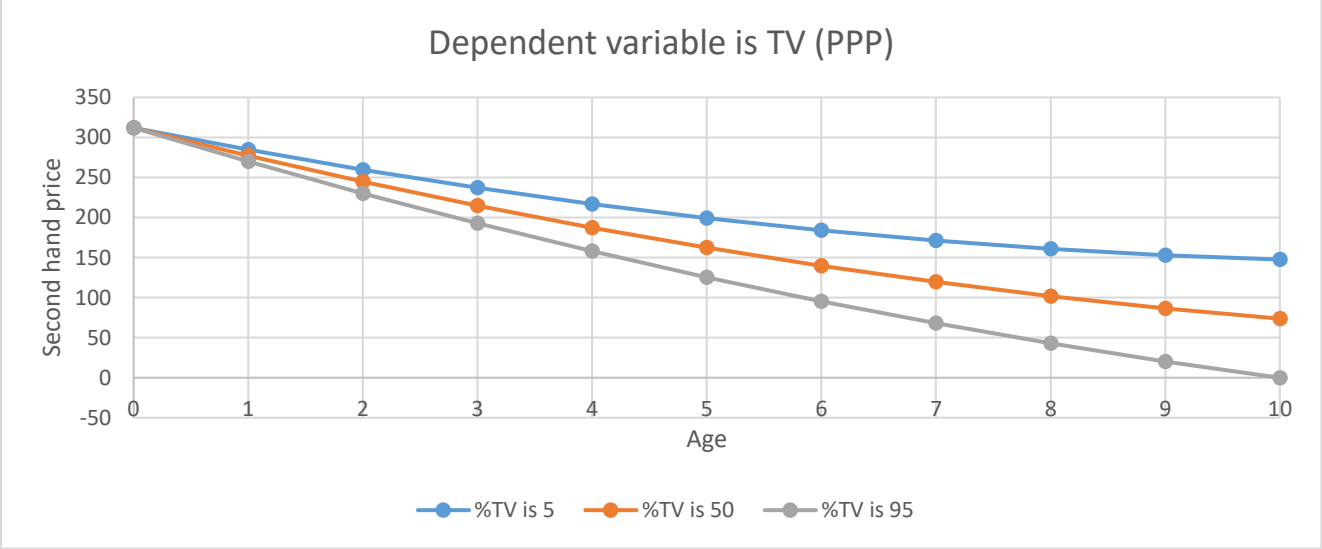
Dependent variable	(1) TV (PPP)	(2) TV (PPP)	(3) TV (PPP)	(4) TV (PPP)	(5) TV (PPP)
%hh with TV	-0.173 (0.510)	-0.173 (0.510)	-0.173 (0.510)	-0.173 (0.510)	-0.173 (0.510)
Age	-14.41*** (1.290)	-27.82*** (4.507)	-27.82*** (3.408)	-27.82*** (3.541)	-27.82*** (3.403)
Age^2		1.219*** (0.395)	1.219*** (0.299)	1.219*** (0.310)	1.219*** (0.298)
Interaction %hh with TV and Age			-0.164*** (0.0233)		-0.203** (0.0869)
Interaction %hh with TV and Age^2				-0.0136*** (0.00212)	0.00358 (0.00761)
Constant	289.7*** (36.78)	312.0*** (37.40)	312.0*** (36.85)	312.0*** (36.90)	312.0*** (36.84)
Observations	72	72	72	72	72
Number of countries	6	6	6	6	6

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9 presents the multi-level regressions on the second-hand prices of TVs calculated using the PPP conversion method. Again, the results are similar to those of the previous regression on the second-hand price of TVs. Coefficients are larger due to the different method used to calculate the second-hand prices. Adding the interaction effect between %hh with TV and age, and %hh with TV and age^2 separately shows significant coefficients in the regressions. However, adding both interactions in the regression results in only one significant interaction: the one between the percentage of households possessing a TV and age. Therefore, the interaction term with age^2 can be excluded again.

Figure 12 shows the regression lines for three different levels of development again: 5% (blue line), 50% (orange line), and 95% (grey) of households owning a TV in a country. The results are once more similar to those of the previous regressions: second-hand prices decrease at a slower rate when fewer households own a TV.

Figure 12. Visualization of regression slopes for different values of %TV



Equation: 312 + (Age*-27.82+Age*%hhwithTV*-0.164) + (Age^2*1.219)

The results of all four multi-level regressions are roughly the same. In countries where only a few households possess a refrigerator or a TV, the second-hand price of the durable decreases more slowly than in countries where more households own such a durable. Hence, in developing countries the prices on the second-hand market are higher than in more developed countries. Therefore, the second hypothesis cannot be rejected:

H_2 = Lower levels of development are associated with higher second-hand prices for durable goods.

Households in poor countries that would have the money to buy a TV or a refrigerator in a wealthy country may not be able to buy the good at their local market because of the higher prices there. Therefore, households in poor countries have a disadvantage compared to equally poor households in wealthy countries, because they have fewer possibilities to satisfy their basic material needs.

4.3 Robustness checks

To investigate the robustness of the results, three sub-samples are analyzed. The first sub-sample excludes Albania because the calculation of second-hand prices for this country deviates slightly from that for the other countries. The second sub-sample excludes the last year for which the second-hand price is calculated, because this represents the average price of all the remaining years reported on in the Living Standard Measurement Surveys. Finally, the last sub-sample excludes the last three years, since most respondents owned a refrigerator or TV from zero to eight years old. Since the interpretation of the regression is difficult due to the interaction effects, a detailed list of graphs with regression lines can be found in Appendix E.

Table 10. Multi-level regression with the exclusion of Albania

Dependent variable	(1) Fridge (MER)	(2) TV (MER)	(3) Fridge (PPP)	(4) TV (PPP)
%hh with Fridge/TV	-0.616	-0.0734	-0.949	-0.561
	(0.888)	(0.253)	(2.330)	(0.497)
Age	-40.50***	-14.76***	-81.61***	-24.12***
	(8.236)	(1.987)	(15.76)	(3.459)
Age^2	2.554***	0.661***	5.367***	1.133***
	(0.721)	(0.174)	(1.380)	(0.303)
Interaction %hh with Fridge/TV and Age	-0.802***	-0.0920***	-2.772***	-0.116***
	(0.215)	(0.0136)	(0.496)	(0.0242)
Interaction %hh with Fridge/TV and Age^2	0.0635***		0.237***	
	(0.0189)		(0.0434)	
Constant	351.0***	156.6***	699.4***	303.3***
	(53.39)	(18.36)	(108.3)	(32.56)
Observations	72	72	60	60
Number of countries	6	6	5	6

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10 presents the multi-level regressions when Albania is excluded from the dataset. This exclusion does not change the main findings from the previous regressions. The signs of the coefficients remain the same in every regression, as does the significance of the interaction effects. Plotting the regression lines (Appendix E) shows that when only a small percentage of households own a refrigerator or a TV, the second-hand prices decrease at a slower rate compared to in countries where more households own such a good.

Table 11. Multi-level regression with exclusion of age 11 years

Dependent variable	(1) Fridge (MER)	(2) TV (MER)	(3) Fridge (PPP)	(4) TV (PPP)
%hh with Fridge/TV	-0.774	0.0795	-1.681	-0.0816
	(0.737)	(0.239)	(1.674)	(0.503)
Age	-50.56***	-18.68***	-101.8***	-32.34***
	(8.103)	(1.894)	(16.36)	(3.754)
Age^2	3.848***	1.017***	7.950***	1.771***
	(0.780)	(0.182)	(1.576)	(0.362)
Interaction %hh with Fridge/TV and Age	-0.655***	-0.0983***	-1.712***	-0.158***
	(0.202)	(0.0132)	(0.433)	(0.0258)
Interaction %hh with Fridge/TV and Age^2	0.0551***		0.154***	
	(0.0195)		(0.0417)	
Constant	363.1***	159.5***	732.4***	311.6***
	(49.54)	(18.41)	(99.21)	(36.40)
Observations	77	77	66	66
Number of countries	7	7	6	6

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11 presents the multi-level regressions without the last year for which second-hand prices are calculated for refrigerators and TVs. Once again, the results are highly similar to those of the previous regressions. The signs of coefficients are the same, are is the significance of the interaction effects. Plotting the regression lines confirms the main findings in the previous regressions. Less possession of durables is again associated with higher second-hand prices.

Table 12. Multi-level regression with exclusion of the last three years

Dependent variable	(1) Fridge (MER)	(2) TV (MER)	(3) Fridge (PPP)	(4) TV (PPP)
%hh with Fridge/TV	-0.803	0.170	-1.872	0.0680
	(0.676)	(0.252)	(1.554)	(0.519)
Age	-55.66***	-20.26***	-113.6***	-33.57***
	(9.574)	(2.419)	(19.73)	(5.005)
Age^2	4.617***	1.246***	9.715***	1.949***
	(1.151)	(0.291)	(2.373)	(0.602)
Interaction %hh with Fridge/TV and Age	-0.228***	-0.229***	-0.506***	-0.164***
	(0.0650)	(0.0625)	(0.142)	(0.0348)
Interaction %hh with Fridge/TV and Age^2		0.0156**		
		(0.00751)		
Constant	368.8***	155.1***	750.5***	303.9***
	(45.53)	(19.37)	(92.40)	(37.59)
Observations	63	63	54	54
Number of countries	7	7	6	6

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12 presents the multi-level regression with exclusion of the last three years for which second-hand prices are calculated. The number of observations in the analysis is therefore heavily reduced. However, the results are similar to those of the previous regressions. The signs for the coefficients remain the same, but the significance of the interaction terms is slightly different. In all the previous regressions, the second interaction term, between %hh with [durable] and Age^2, is significant. However, when excluding the last three years, this interaction term becomes insignificant for refrigerators. Nevertheless, this does not change the main findings of the previous regressions. Plotting the regression lines still shows that when fewer households in a country possess a refrigerator, the second-hand price decreases at a much slower rate in comparison to in countries where more households own a refrigerator. Furthermore, the regression for TV calculated with the official exchange rate method now shows a significant second interaction term, but this does not change the main findings.

All three robustness checks enhance the previously found results. Excluding Albania,

the last year, or the last three years does not change the main findings of this paper. Instead, doing so reinforces the findings and makes them more robust.

Chapter 5. Conclusion and discussion

Material well-being is an important indicator for the standard of living of households all across the globe. Smits and Steendijk (2015) state that the possession of certain assets, such as refrigerators, TVs, (cell)phones, and computers, is considered necessary for living a comfortable life. Besides ones income, the prices on the local market also influence the possibility for one to buy durable goods. These prices can vary because of the potential presence of a second-hand market. The essence of such a market is that the price of a durable good decreases relatively fast while the value of its use remains high for a long period of time (Smits, 2017).

This paper investigated whether second-hand markets can explain the differences in the standard of living of poor households between countries. Since in developing countries only few households possess durable assets, one could assume that the second-hand markets are not well developed there or are completely non-existent. Moreover, it could also be assumed that the prices on these markets would be high because of the lack of supply.

This study tested the influence of second-hand markets on the standard of living of households using multi-level regressions. This showed that the possession of durables is positively associated with level of development. Therefore, the study used the percentage of households owning a TV or refrigerator as an indicator of development. Living Standard Measurement Surveys were used to calculate second-hand prices by age for seven countries with different levels of development.

The results showed that, for TV and refrigerators, second-hand price development differs between levels of development. Every regression analysis significantly showed that the lower the level of development is, the more slowly the second-hand prices decrease. This means that the prices of second-hand TVs and refrigerators are higher in less developed countries. Households in poor countries that would have the money to buy a TV or refrigerator in a wealthy country may not be able to buy those goods at their local markets because of the higher prices there. Therefore, households in poor countries have fewer possibilities to satisfy their basic material needs, and thus have a disadvantage compared to equally poor households in wealthy countries.

The analysis was repeated with three different sub-samples of the data: one excluding Albania, one excluding the last year for which the second-hand prices were calculated, and one in excluding the last three years. The results of those analyses enhanced the previously obtained findings. Every robustness check showed that when only a small percentage of households own a TV or refrigerator in a country, the second-hand price of the durable decreases at a slower

rate than in countries where more households own that good. Thus, the analyses showed that second-hand prices are higher in less developed countries.

However, some critical points should be taken into consideration regarding the findings. Seven limitations are discussed here. The first limitation of this study is that the author calculated the second-hand prices, since data were not available in this regard. Especially for developing countries, where second-hand markets barely exist, it is challenging to find second-hand prices. However, the Living Standard Measurement Surveys provided a good basis to estimate reliable second-hand prices of TVs and refrigerators for both developing and developed countries, and the questions used to calculate the prices were almost identical in most surveys. A second limitation of the research is the difference in response rate to the questions in the Living Standard Measurement Surveys. The possession of durables is generally higher in more developed countries, meaning that more data was usually available for those countries to calculate second-hand prices. However, for TVs and refrigerators, the response rate seemed high enough to determine realistic prices for all countries used in the analysis. A third limitation is that most surveys did not distinguish between different qualities of a durable good. For instance, the Bulgaria and Tajikistan surveys differentiated between color TVs and black and white TVs, but that was the most comprehensive quality distinction made. For Tajikistan, the black and white TV was not used in calculating the prices because of the very low number of respondents in this regard. A fourth limitation is that only seven countries were used in the analysis. Including more countries would enhance the robustness of the results, but this was not possible because the questions in different surveys on household durables were not comparable, or even existent. A fifth limitation is that the calculation of second-hand prices of refrigerators for Albania was different than for the other countries. In the Albania survey, many respondents answered that they would give their durable away for free, especially for relatively new durables. This resulted in unrealistic second-hand prices. Excluding these respondents resulted in more realistic second-hand prices. The Albanian questionnaire did not provide an explanation as to why this was the case. A sixth limitation is that for refrigerators the second-hand price starts to increase slightly after age 7. However, this is probably due to the small amount of cases. Finally, the last limitation has some overlap with some of the previous limitations: it is the limited data used in the regression analysis. Using more countries or more years of a durable's age could enhance the research. However, this was not possible because of the limited availability of the data.

Despite the limitations, this study provides a good basis for future research. The role of second-hand markets is largely underrepresented in the current literature, and especially little

has been written about the role of second-hand markets for the poorer segments of society and the world. More research is needed to obtain a better understanding of this topic.

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Appendices

Appendix A

Country	Year
Afghanistan	2015,00
Angola	2011,00
Albania	2009,00
Armenia	2010,00
Azerbaijan	2006,00
Burundi	2010,00
Benin	2011,00
Burkina Faso	2010,00
Bangladesh	2014,00
Belize	2011,00
Bolivia	2008,00
Brazil	2010,00
Barbados	2012,00
Buthan	2010,00
Botswana	2013,00
Central African Republic	2010,00
Chili	2007,00
China	2012,00
Cote d'Ivoire	2011,00
Cameroon	2011,00
Congo Democratic Republic	2013,00
Congo Brazzaville	2011,00
Colombia	2015,00
Comoros	2012,00
Cape Verde	2013,00
Costa Rica	2011,00
Cuba	2011,00
Djibouti	2006,00
Dominican Republic	2013,00
Algeria	2013,00
Ecuador	2011,00
Egypt	2014,00
Eritrea	2002,00
Ethiopia	2011,00
Gabon	2012,00
Georgia	2005,00
Ghana	2014,00
Guinea	2012,00
Gambia	2013,00
Guinea Bissau	2014,00
Equatorial Guinea	2000,00
Guatemala	2015,00
Guyana	2014,00
Honduras	2011,00
Haiti	2012,00

Indonesia	2012,00
India	2012,00
Iran	2006,00
Iraq	2011,00
Jamaica	2012,00
Jordan	2012,00
Kazakhstan	2015,00
Kenya	2014,00
Kyrgyzstan	2014,00
Cambodia	2014,00
Lao	2012,00
Lebanon	2013,00
Liberia	2013,00
Saint Lucia	2012,00
Lesotho	2014,00
Morocco	2014,00
Moldova	2005,00
Madagascar	2009,00
Maldives	2009,00
Mexico	2015,00
Mali	2013,00
Mongolia	2010,00
Mozambique	2011,00
Mauritania	2011,00
Mauritius	2013,00
Malaysia	2011,00
Namibia	2013,00
Niger	2012,00
Nigeria	2013,00
Nicaragua	2012,00
Nepal	2011,00
Pakistan	2012,00
Panama	2013,00
Peru	2012,00
Philippines	2013,00
Paraguay	2012,00
Rwanda	2015,00
Sudan	2014,00
Senegal	2015,00
Sierra Leone	2013,00
El Salvador	2014,00
South Sudan	2010,00
Sao Tome & Principe	2009,00
Suriname	2010,00
Swaziland	2010,00
Syria	2006,00
Chad	2015,00
Togo	2014,00
Thailand	2012,00
Tajikistan	2012,00
Turkmenistan	2015,00

Timor Leste	2009,00
Trinidad & Tobago	2006,00
Tunisia	2011,00
Turkey	2008,00
Tanzania	2015,00
Uganda	2011,00
Ukraine	2007,00
Uruguay	2013,00
Uzbekistan	2005,00
Venezuela	2007,00
Vietnam	2014,00
Vanuatu	2007,00
Yemen	2013,00
South Africa	2014,00
Zambia	2014,00
Zimbabwe	2015,00

Appendix B

Missing's TV:

Cuba, Equatorial Guinea, Iran, and Lebanon.

Missing's refrigerator:

Botswana, Cape Verde, Cuba, Equatorial Guinea, Iran, Lebanon, Morocco, Mauritius and Vanuatu.

Missing's car:

Cuba and Equatorial Guinea.

Missing's cellphone:

Brazil, Botswana, Chili, China, Cape Verde, Cuba, Ecuador, Eritrea, Equatorial Guinea, India, Iran, Jamaica, Lebanon, Morocco, Mozambique, Mauritius, Malaysia, Nicaragua, Paraguay, Venezuela and South Africa.

Missing's phone:

China, Cuba, Equatorial Guinea and Lebanon.

Missing's computer:

Angola, Armenia, Central African Republic, Comoros, Cuba, Djibouti, Eritrea, Ethiopia, Georgia, Guinea, Equatorial Guinea, Indonesia, Kenya, Cambodia, Lao, Madagascar, Mozambique, Malaysia, Sierra Leone, Suriname, Swaziland, Chad, Timor Leste, Uganda, Vanuatu and Yemen.

Appendix C

Country	Fridge (MER)	Fridge (PPP)	TV (MER)	TV (PPP)	%hh with Fridge	%hh with TV	Age	Age^2
Niger	366.422	755.846	154.669	319.047	3.2	10.6	0	0
Niger	324.57	669.514	137.111	282.83	3.2	10.6	1	1
Niger	281.265	580.186	119.324	246.139	3.2	10.6	2	4
Niger	267.84	552.494	103.33	213.147	3.2	10.6	3	9
Niger	247.527	510.593	889.023	183.385	3.2	10.6	4	16
Niger	247.103	509.719	811.797	167.455	3.2	10.6	5	25
Niger	208.328	429.734	810.527	167.193	3.2	10.6	6	36
Niger	222.135	458.215	739.278	152.496	3.2	10.6	7	49
Niger	232.025	478.616	722.019	148.936	3.2	10.6	8	64
Niger	256.557	529.219	685.675	141.439	3.2	10.6	9	81
Niger	233.117	480.868	863.456	178.111	3.2	10.6	10	100
Niger	194.853	401.937	728.099	150.19	3.2	10.6	11	121
Malawi	391.417	787.688	131.449	264.527	3.7	10.8	0	0
Malawi	361.658	727.801	134.081	269.825	3.7	10.8	1	1
Malawi	345.668	695.624	137.449	276.604	3.7	10.8	2	4
Malawi	325.348	654.731	138.997	279.719	3.7	10.8	3	9
Malawi	316.868	637.665	140.635	283.015	3.7	10.8	4	16
Malawi	314.931	633.769	140.923	283.595	3.7	10.8	5	25
Malawi	352.106	708.579	131.136	263.899	3.7	10.8	6	36
Malawi	406.777	818.6	130.817	263.257	3.7	10.8	7	49
Malawi	405.964	816.963	127.853	257.291	3.7	10.8	8	64
Malawi	370.154	744.899	137.129	275.959	3.7	10.8	9	81
Malawi	295.027	593.714	135.267	272.211	3.7	10.8	10	100
Malawi	243.676	490.375	134.748	271.167	3.7	10.8	11	121
Bulgaria	712.011	1287.33	189.048	341.803	87.8	98	0	0
Bulgaria	393.676	711.776	147.515	266.711	87.8	98	1	1
Bulgaria	200.016	361.634	119.495	216.049	87.8	98	2	4
Bulgaria	167.242	302.378	105.381	190.532	87.8	98	3	9
Bulgaria	195.531	353.526	984.137	177.934	87.8	98	4	16
Bulgaria	197.149	356.451	925.927	167.41	87.8	98	5	25
Bulgaria	166.551	301.129	831.546	150.346	87.8	98	6	36
Bulgaria	154.473	279.29	772.917	139.745	87.8	98	7	49
Bulgaria	147.664	266.98	698.893	126.362	87.8	98	8	64
Bulgaria	204.87	370.41	640.947	115.885	87.8	98	9	81
Bulgaria	546.05	987.273	583.421	105.484	87.8	98	10	100
Bulgaria	225.949	408.521	276.552	500.013	87.8	98	11	121
Nigeria	175.366	356.091	102.532	208.197	16.9	42.7	0	0
Nigeria	166.652	338.396	881.247	178.942	16.9	42.7	1	1
Nigeria	144.597	293.612	772.238	156.808	16.9	42.7	2	4
Nigeria	125.154	254.133	684.636	139.02	16.9	42.7	3	9

Nigeria	110.149	223.664	630.142	127.954	16.9	42.7	4	16
Nigeria	110.505	224.388	564.323	114.589	16.9	42.7	5	25
Nigeria	104.06	211.3	531.333	107.89	16.9	42.7	6	36
Nigeria	106.436	216.126	531.922	108.01	16.9	42.7	7	49
Nigeria	102.243	207.61	511.037	103.769	16.9	42.7	8	64
Nigeria	975.737	198.129	517.493	105.08	16.9	42.7	9	81
Nigeria	958.496	194.628	484.901	98.462	16.9	42.7	10	100
Nigeria	625.326	126.976	265.267	53.864	16.9	42.7	11	121
Albania	255.38	512.939	207.698	417.167	95.5	98.8	0	0
Albania	189.585	380.787	197.694	397.075	95.5	98.8	1	1
Albania	155.5	312.328	187.163	375.922	95.5	98.8	2	4
Albania	160.503	322.375	163.629	328.654	95.5	98.8	3	9
Albania	146.333	293.915	138.938	279.061	95.5	98.8	4	16
Albania	137.663	276.5	116.438	233.869	95.5	98.8	5	25
Albania	123.546	248.145	105.493	211.886	95.5	98.8	6	36
Albania	113.118	227.201	939.688	188.739	95.5	98.8	7	49
Albania	102.207	205.285	819.283	164.556	95.5	98.8	8	64
Albania	978.256	196.486	773.932	155.447	95.5	98.8	9	81
Albania	100.53	201.918	770.229	154.703	95.5	98.8	10	100
Albania	749.075	150.454	623.552	125.242	95.5	98.8	11	121
Tajikistan	260.182	572.515	141.219	310.744	41.2	93.2	0	0
Tajikistan	190.129	418.368	112.642	247.862	41.2	93.2	1	1
Tajikistan	191.472	421.322	980.951	215.853	41.2	93.2	2	4
Tajikistan	173.936	382.735	876.359	192.838	41.2	93.2	3	9
Tajikistan	155.452	342.062	807.492	177.684	41.2	93.2	4	16
Tajikistan	955.937	210.349	746.805	164.33	41.2	93.2	5	25
Tajikistan	900.137	198.07	761.048	167.464	41.2	93.2	6	36
Tajikistan	915.597	201.472	793.477	174.6	41.2	93.2	7	49
Tajikistan	920.249	202.496	758.221	166.842	41.2	93.2	8	64
Tajikistan	745.801	164.109	725.466	159.635	41.2	93.2	9	81
Tajikistan	71.665	157.695	652.187	143.51	41.2	93.2	10	100
Tajikistan	447.916	985.614	45.597	100.334	41.2	93.2	11	121
Serbia	265.49		251.663		97.5	97.9	0	0
Serbia	238.058		200.598		97.5	97.9	1	1
Serbia	206.703		163.012		97.5	97.9	2	4
Serbia	172.915		143.372		97.5	97.9	3	9
Serbia	149.886		125.516		97.5	97.9	4	16
Serbia	129.139		112.582		97.5	97.9	5	25
Serbia	118.006		106.348		97.5	97.9	6	36
Serbia	105.925		100.827		97.5	97.9	7	49
Serbia	978.164		911.773		97.5	97.9	8	64
Serbia	841.541		793.975		97.5	97.9	9	81
Serbia	818.588		704.744		97.5	97.9	10	100
Serbia	301.532		360.349		97.5	97.9	11	121

Appendix D

Official exchange rate (LCU per US$, period average)

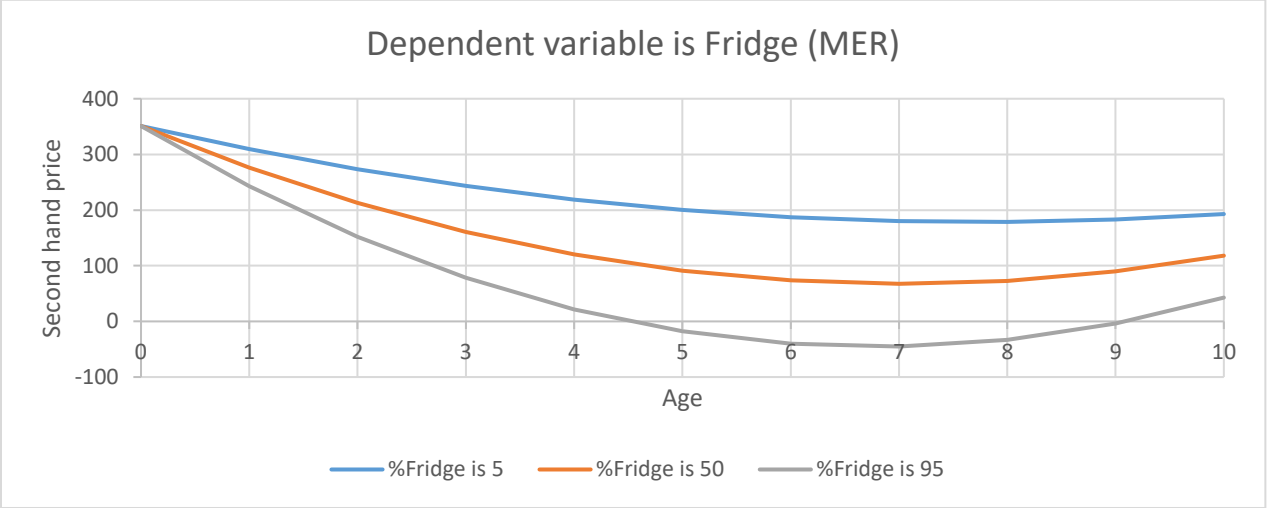
Official exchange rate	2007	2009	2010	2011	2012
Bulgaria	1,42905				
Euro Area	0,730638				
Tajikistan		4,142708			
Malawi			150,4867		
Nigeria			150,298		
Niger				471,8661	
Albania					108,184644599242

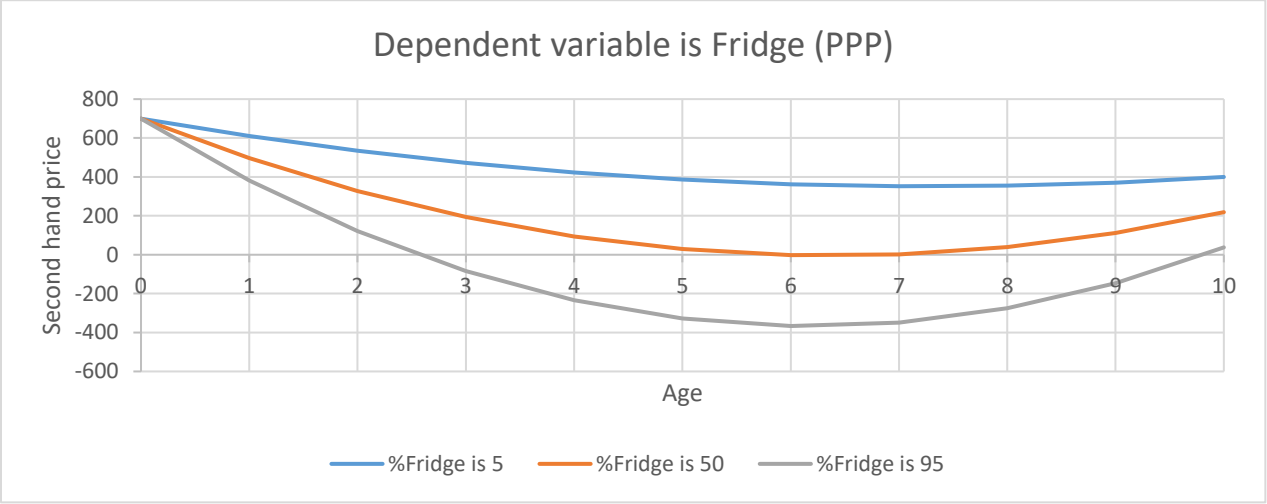
PPP conversion factor, private consumption (LCU per international $, 2011)

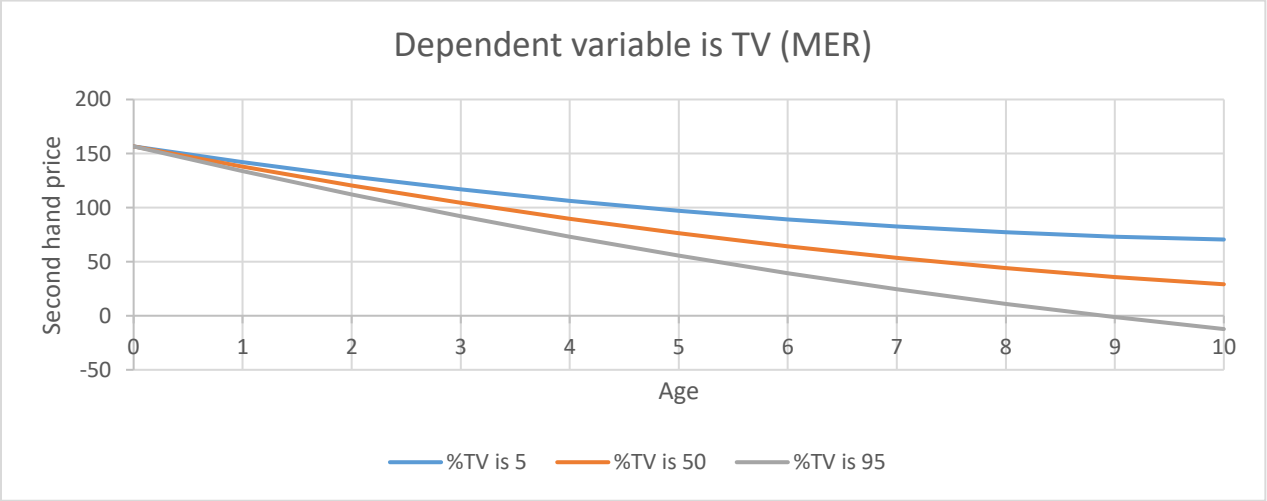
PPP conversion factor	2007	2009	2010	2011	2012
Bulgaria	0,790393				
Tajikistan				1,88267	
Malawi			74,77957		
Nigeria			74,01802		
Niger				228,7532	
Albania					53,8625483638271

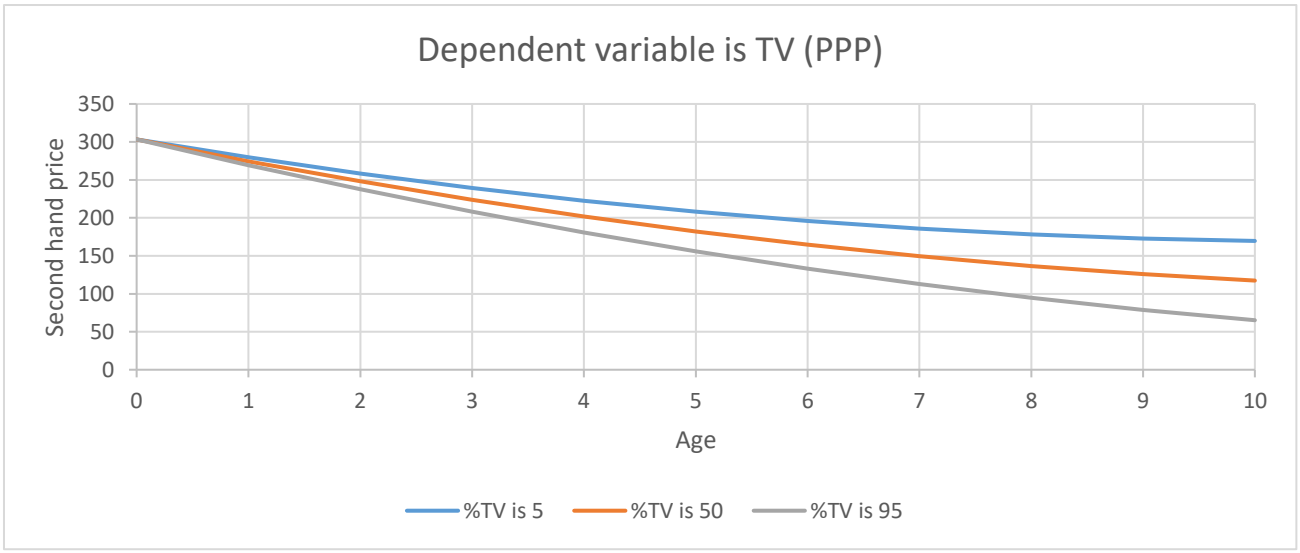
Appendix E

1. Visualization of the regression slopes excluding Albania

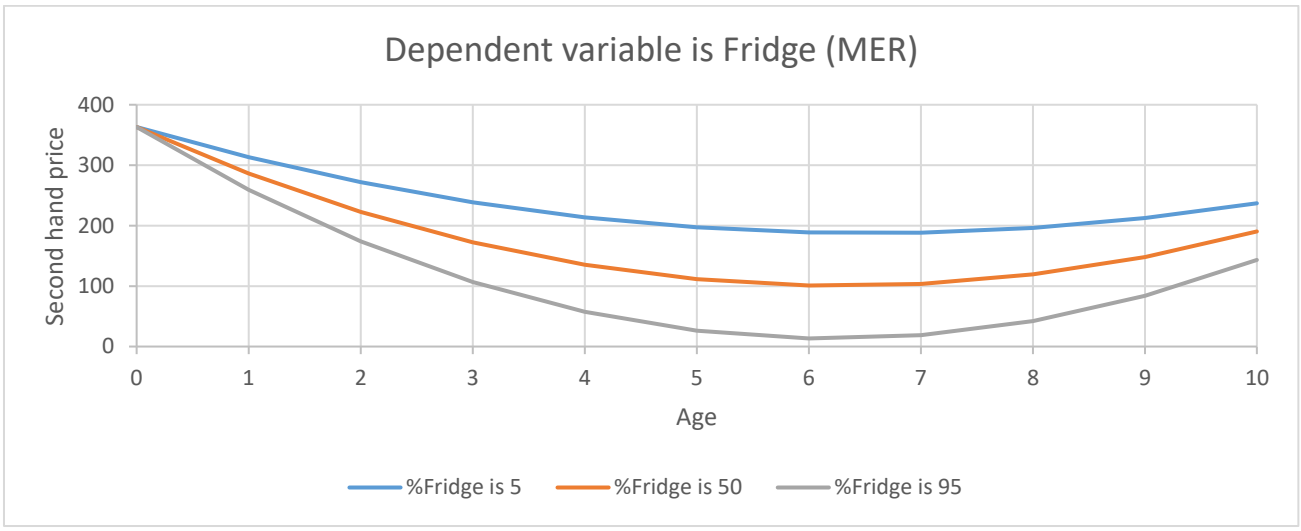


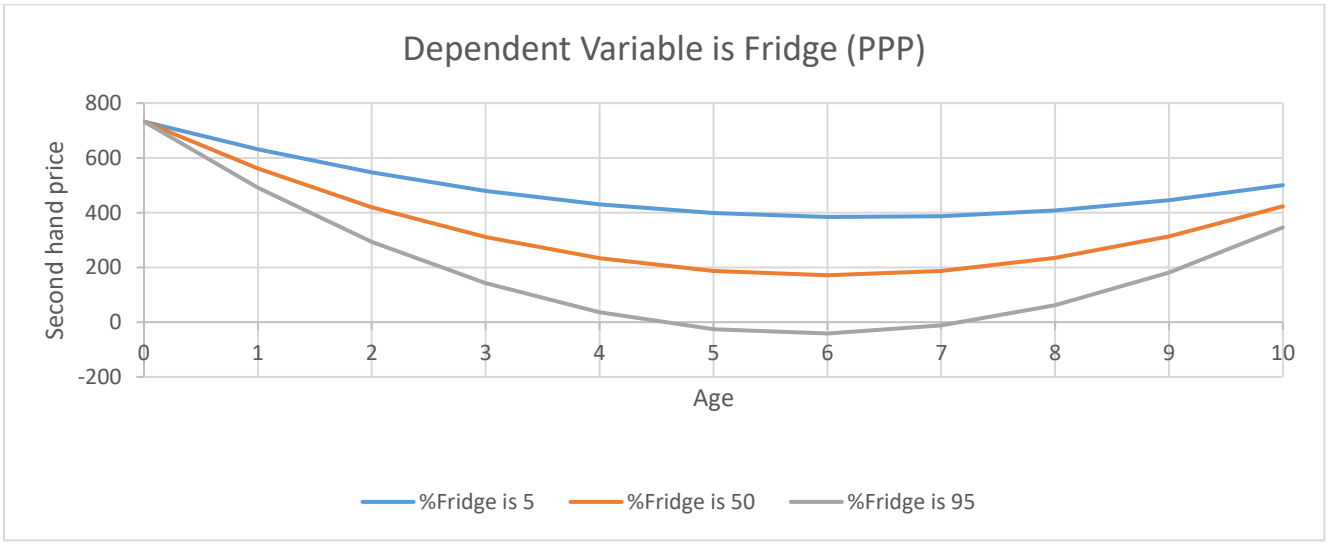


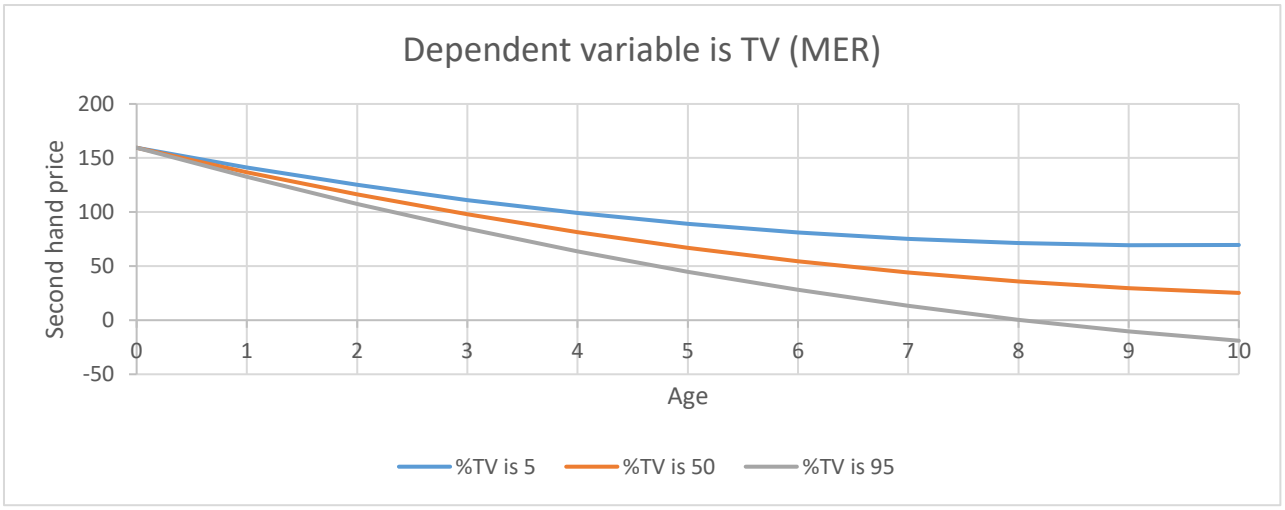


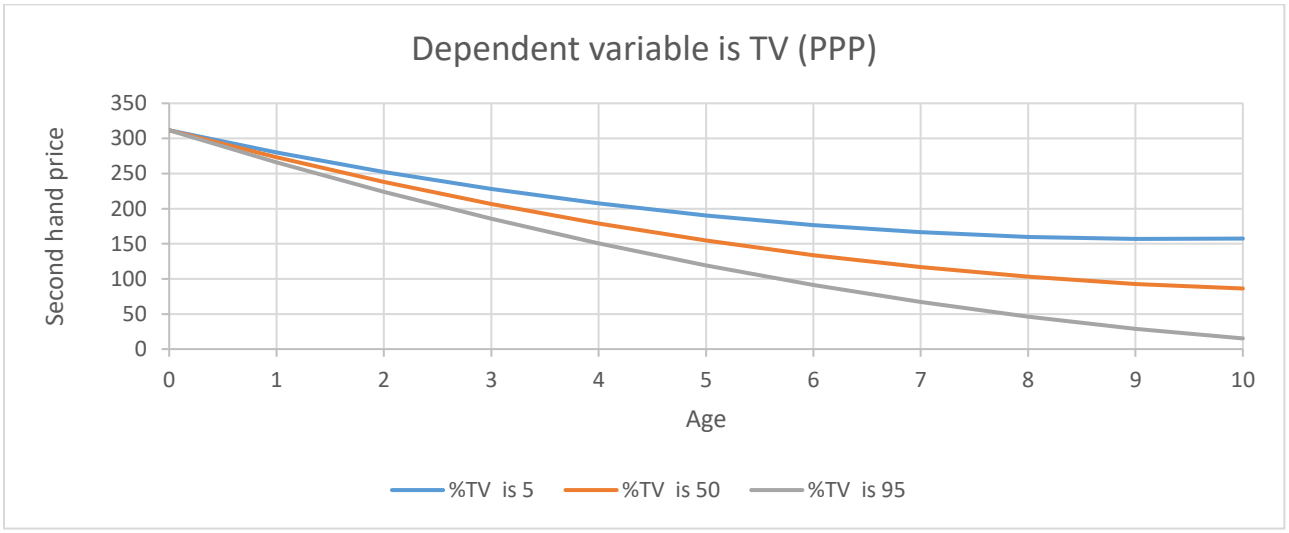


2. Visualization of the regression slopes excluding the last year

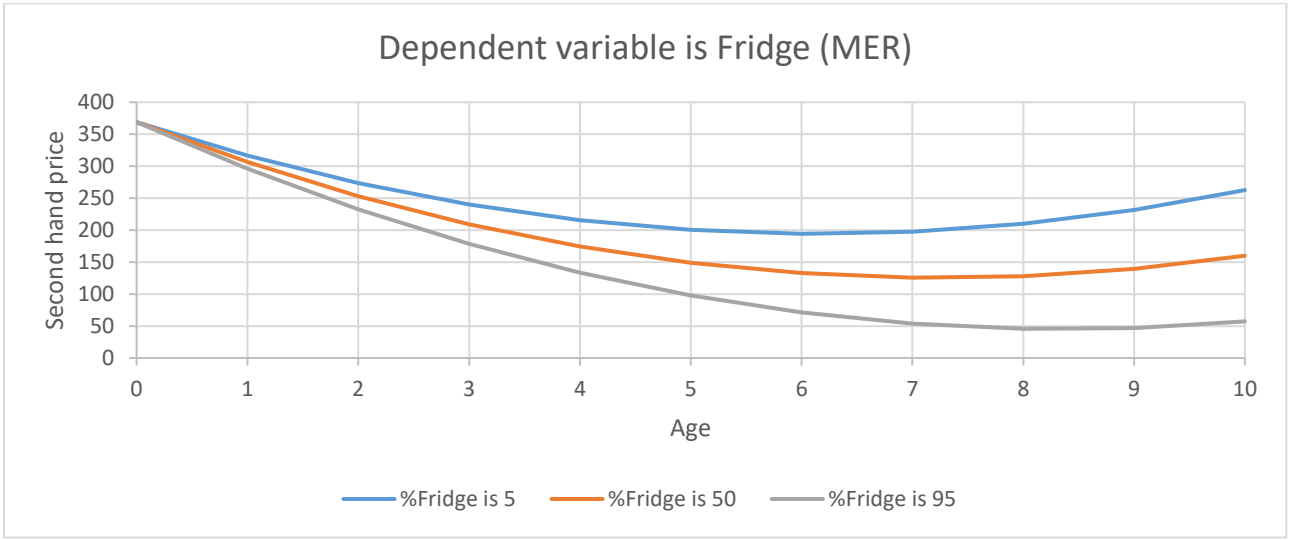


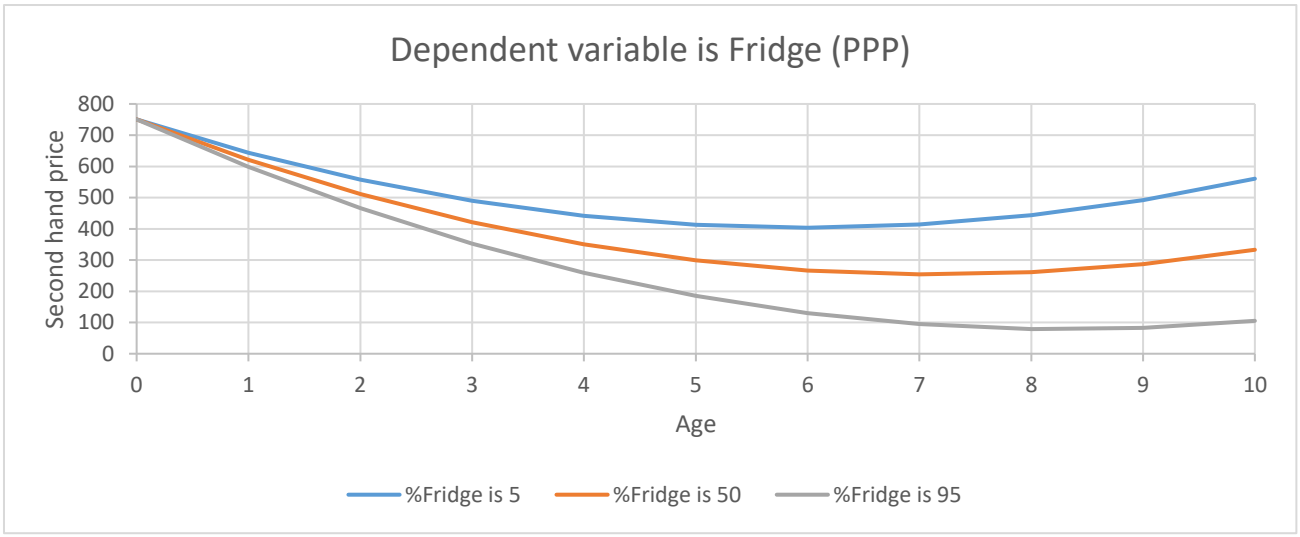


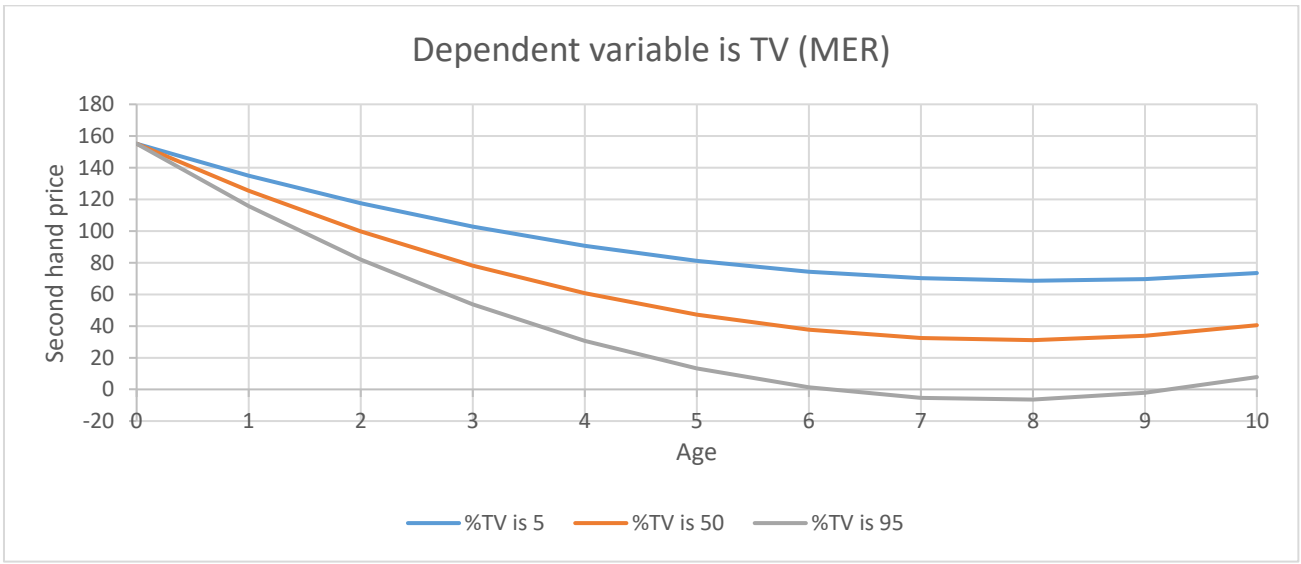


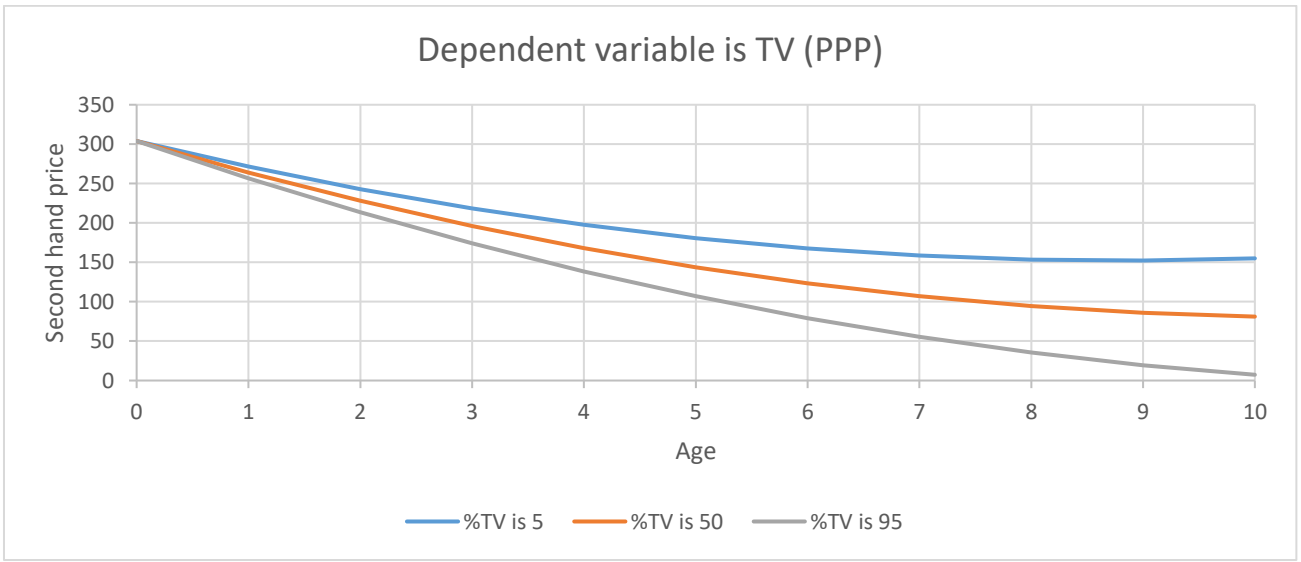


3. Visualization of the regression slopes excluding the last three years




Dependent variable is Fridge (PPP)
Second hand price
800
700
600
500
400
300
200
100
0
0 1 2 3 4 5 6 7 8 9 10
Age
%Fridge is 5
%Fridge is 50
%Fridge is 95


Dependent variable is TV (MER)
Second hand price
180
160
140
120
100
80
60
40
20
0
-20
0 1 2 3 4 5 6 7 8 9 10
Age
%TV is 5
%TV is 50
%TV is 95


Dependent variable is TV (PPP)
Second hand price
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10
Age
%TV is 5
%TV is 50
%TV is 95