THE UNIVERSITY OF HULL

Empirical Analysis of Consumption in Mexico: Determinants, Beneficiaries and the effects of inequality.

being a Thesis submitted for the Degree of

Doctor of Philosophy

in the University of Hull

by

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July, 2020

Abstract:

Mexico has lived through several episodes of economic and social unrest during the 1970s, 1980s, and the 1990s. Since then the country has embraced a free-trade agenda and has eventually established itself as a strong manufacturing centre. GDP per capita has kept growing almost steadily, and so has the level of consumption per capita. At the same time Mexico has experienced a modest reduction in income inequality.

This piece of research was aimed at identifying the main determinants of consumption as well as to find out if the benefits of increased consumption have been distributed similarly among different groups of the Mexican society. Its main contribution is the decomposition of consumption by different cohorts of society—age cohorts, income deciles, regional trends, or consumption determinants—in order to evaluate how consumption has evolved in general and if significant sub-group differences exist.

The empirical work presents the empirical analysis of time series data on consumption and different consumption determinants. The empirical evidence confirms the long-run equilibrium relationship between consumption, income, and wealth. The results indicate how income, the wealth components and the value-added output from the manufacturing sector have had a role in steering consumption over the past 57 years.

The empirical analysis of pooled micro-level datasets found support to the consumption-puzzle postulate. Income distributional differences were found to exist in terms of the life cycle consumption profile. While the richer cohorts of the population have been able to reduce consumption before retirement age, the poorer deciles have not been able to afford to reduce consumption and increase savings until they have gone well into the later stages of the life cycle.

The analysis of the pooled microeconomic dataset has found significant distributional differences associated with over time changes in income inequality. The cohorts of the population in the middle part of the distribution do benefit by increased consumption levels when inequality reduces. Given the way inequality has reduced in Mexico—reductions in returns from financial wealth for the richer cohorts—it came as a little surprise to find that inequality reductions have not benefitted households at both ends of the income distribution: the poorer most, nor the richer ones.

Relevant for public policy is the fact that specific measures have to be put in place to help the poorer households as they reach retirement age when their consumption levels have been found to reduce drastically.

Keywords: Consumption function, consumption determinants, income distribution, income inequality.

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List of Acronyms.

ADF	Augmented Dickey-Fuller test
AIC	Akaike Information Criteria
AR	Auto-regressive
ARDL	Auto-regressive Distributed Lag
BE	The Between-Estimator model
BIC	Bayes Information Criteria
BLUE	Best Linear Unbiased Estimator
CETES	Mexico's Treasury Certificates - T-bonds (*Certificados de la Tesorería)*
CONAPO	Consejo Nacional de Población
CONEVAL	National Council for the Evaluation of Social Policy (Consejo Nacional de Evaluación de la Política Social)
CtC	Consumption Category
ECM	Error-correction Model
EG-ADF	Engle-Granger Augmented Dickey-Fuller test
ENIGH	*Encuesta Nacional de Ingreso y Gasto de los Hogares*
FDI	Foreign Direct Investment
FE	Fixed-Effects model
FW	Financial Wealth
GDP	Gross Domestic Product
GNI	Gross National Income
HW	Housing Wealth
I (0)	Stationary time-series
I (1)	Difference Stationary time-series
i.i.d.	Independently and Identically Distributed
IMF	International Monetary Fund
INEGI	Instituto Nacional de Estadística Geografía e Informática
INFONAVIT	Mexico's National Institute for House Acquisition - *Instituto de Fomento Nacional para la Vivienda de los Trabajadores*
IRF	Impulse-Response Functions
LCM	Life-Cycle Model
LR	Long-run
M2	Broad Money
MPC	Marginal Propensity to Consume
MXP	Mexican Pesos
NAFTA	North America Free-Trade Agreement
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least-squared
OPEC	Organization of the Petroleum Exporting Countries
PAYG	Pay-As-You-Go Pensions scheme
pc	Per-capita
PEMEX	*Petróleos Mexicanos*

PIH	Permanent Income Hypothesis
PP-test	Phillips-Perron test
PROGRESA	*Programa para la Educación, Salud y Alimentación*
RE	Random-Effects model
SHCP	Mexico's Financial Secretary - *Secretaria de Hacienda y Crédito Publico*
SR	Short-run
SSR	Sum of Squared Residuals
SSW	Social Security Wealth
UK	United Kingdom
USA	United States of America
USD	United States Dollars
VAT	Value-Added Tax
VECM	Vector Error Correction Model
VIF	Variance-Inflating Factors
WB	The World Bank
WDI	World Development Indicators
ZA-test	Zivot and Andrews test

1. Introduction

1.1. Research motivation.

The main motivation for this research is the changing nature of Mexico's social and economic context. Mexico is a country in the midst of a demographic transition to an ageing society, associated with decreasing fertility rates, longer life expectancies and the changing patterns of migration to the United States. As shown in figure 1.1, Mexico's birth rate passed from 47.1 children per 1000 inhabitants to 17.1 in 2018. Meanwhile, life expectancy has increased on average by almost 15 years over the 1970-2016 period of time.

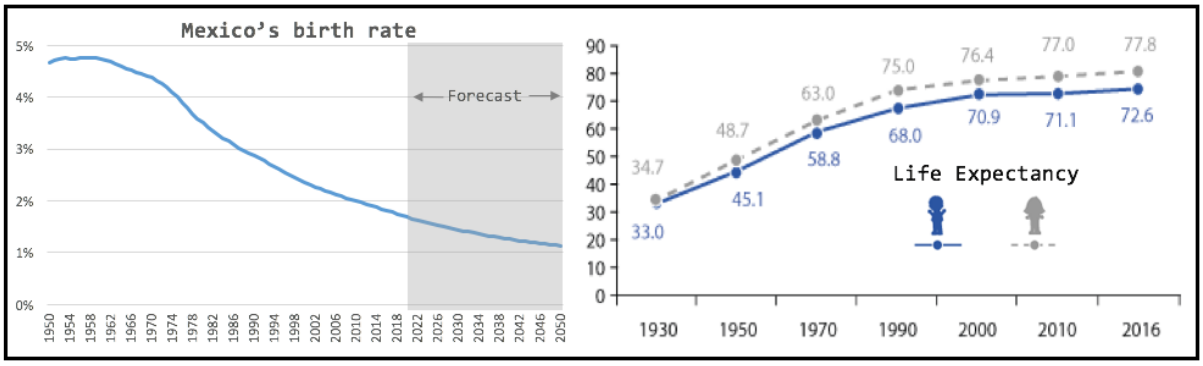

Figure 1. 1 Mexico birth rate 1950-2018 (actual data) and projections for 2019-2050 and life expectancy 1930-2016. Source: INEGI (2019); CONAPO (2019).

At the same time, Mexico's tradition of a permanent flow of migrants to the United States has seen important changes. So much that according to the Pew Research Center (Pew, 2014) the net-migration between both nations was equal to zero in 2013 as a consequence of the negative effect of the 2008-09 financial crisis on the construction sector—usually a major employer of the Mexican migrant labour force—and the increased job opportunities in Mexico. The latest available information (INEGI, 2019) shows that over twenty thousand Mexican citizens moving to the USA every year, with eighteen thousand moving south. Out of the total migrants to the USA during the 1990s about one-half of them were Mexican nationals. Meanwhile the number of people moving in the opposite direction—combining the Mexican national returning home plus the American expatriates—has been stable for many years (Deutsche Welle, 2019).

In economic terms, Mexico changed from the closed economy model - fostering a policy of import substitution during the 1970s - to a nation fully embracing the free-trade agenda, championing trade openness, foreign direct investment (FDI), and positioning itself as an important manufacturing hub (OECD, 2015a; Chiquiar and Ramos-Francia, 2009).

Mexico is a country of stark contrasts. It is home to some of the *wealthiest* people in the world; while at the same time, 9.4 million people—7.6% of the total population—live in *extreme poverty* conditions (CONEVAL, 2017). The country has the lowest levels of social mobility among OECD nations; 53% of those born into the highest income quintile will stay there throughout their life. Meanwhile, only 8% of those born in the lowest income quintile will make it to the highest income quintile throughout their lifetime (Delajara and Graña, 2017).

Mexico's case represents that of a country that has gone through recurrent economic crises during the 1970s, 1980s (the *peso crisis*) and the 1990s (the *tequila effect*). The relevant factor is that most of those economic troubles that have been associated with the poor handling of the country's economy (Schettino, 2007).

As a consequence, Mexico was one of the first nations to implement the measures of the so-called *Washington Consensus* agenda; an *economic shock therapy* meant to shift the internal economy by steering it in the direction of a more *open/market-oriented* economy (Guillen, 2012).

Taking aside the economic effects of the 2008 worldwide recession that made the economy to contract by 6% over the 2008-2009 period (Calderon-Hinojosa, 2012), Mexico has experienced more than twenty years of macroeconomic stability (Delajara and Graña, 2017). Since then, the country has experienced a permanent increase in consumption at constant prices and on a per capita basis and a reduction—albeit during the last years—of income inequality since the onset of the current century until 2008 (Lopez Calva and Lustig, 2010). Inequality, however, has increased slightly since the financial crisis in 2008, as will be shown in this thesis.

Mexico's economic transition to achieve its full potential is regarded as a work-in-progress (Bleynat et al., 2020). There is still much to be done in terms of social and economic justice in Mexico. However, given the political and economic transition Mexico has been in (Schettino, 2018b), it is relevant to evaluate if the decades of sound macroeconomic, higher consumption and inequality reductions—even if modest—have been felt similarly among different cohorts of society.

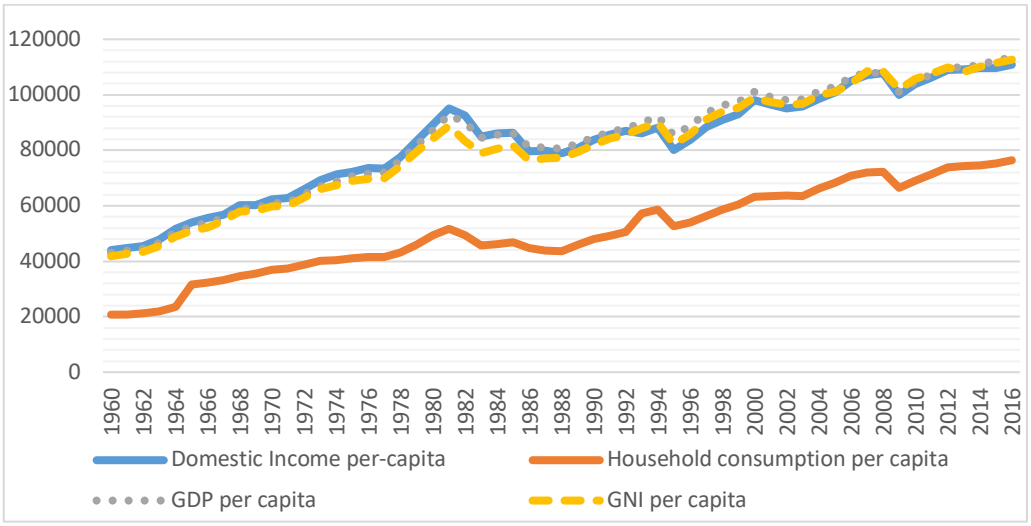

Figure 1. 1a. Mexico's GDP, GNI, domestic income[1], and household final consumption per capita 1960-2016 at constant (2008) prices in Mexican pesos. Source: WDI (2019) OECD (2019).

To illustrate the increase in consumption and reduction in income inequality, which are the bases of this thesis, figure 1.1a presents the time-series evolution of domestic income, Mexico's GDP and GNI, as well as the total consumption, all on per capita basis at constant 2008 local currency.

Although it will be discussed in detail in the second chapter of this thesis, the Mexican economy did experience periods of economic boom and bust for the best part of the 1970s and until the start of the new Millennium. As it is possible to see in that figure, the country experienced an important expansion of income and consumption after 1978, thanks to the inflow of foreign investment and foreign loans to explore and extract the newly discovered oil land fields in the Gulf of Mexico.

The increased and exuberant levels of both household consumption and government spending were brought to a halt in 1982 when the country found it was living beyond its means. A 50% devaluation of the national currency followed by the declaration of debt-

[1] Consumption expenditure is the sum of household final consumption expenditure divided by total population expressed at 2008 local currency prices. GDP at purchasers price is the sum of gross value added by all resident producers in the economy. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Income is household net adjusted disposable income determined by the amount of money that a household earns, or gains, each year after taxes and transfers. Per-capita value is obtained by dividing those values by the mean value of population. All quantities are expressed in 2008 constant Mexican *pesos*.

moratoria brought the country at the point of economic collapse. The country experienced a permanent reduction in terms of both income and consumption associated with high levels of interest rate and unemployment (Schettino, 2007).

The IMF and the World Bank had to intervene in order to get the Mexican economy again by the implementation of the *Washington Consensus.* As a requirement, the country had to change the economic model in order to embrace the Neo-liberal principles of free-trade, practically no government intervention and privatisation of public sector enterprises such as telecommunications, rail, and most manufacturing production facilities.

Eventually, Mexico joined the North-American Free Trade Agreement (NAFTA), and the level of consumption increased again. Nonetheless, the country experienced a substantial imbalance in terms of the balance of payments. The current account was recorded at minus six percentage points of the country's GDP. Such an economic problem gave way to the so-called *Tequila-effect* that made most of the Latin-American economies to tumble down. The Mexican economy experienced a reduction in output of 6.5%—measured by the GDP change—a shock therapy of contractionary policy and a drastic reduction in government spending, tax increases and austerity measures had to be implemented under the auspice of the IMF and the WB.

Overall household consumption dropped by 9%. The economic measures worked, and both consumption and income have increased since then on a permanent basis if not for two external economic shocks associated with the 9-11 attacks in the USA and the financial crisis of 2008-09 when consumption and income reduced by three and six per cent.

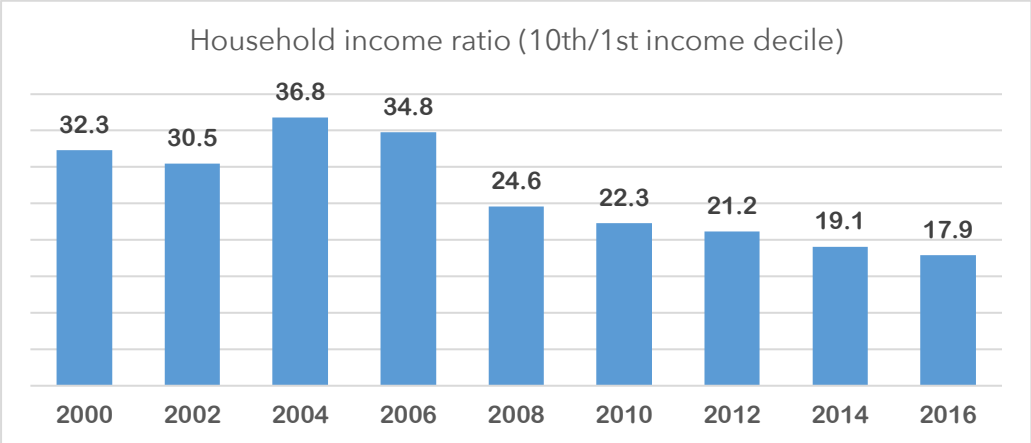

Figure 1. 2 Household mean income 10% richer decile to the 10% poorer decile Mexico 2000-2012. Source: IMF (2016); own calculations based on ENIGH 2000 to 2016 (INEGI, 2018)

Along the positive trend income and consumption have had over the period of study. Mexico has experienced small improvements in terms of income and consumption inequality. Figure 1.2 presents the ratio of the mean income of the 10% richer households to the mean income of the 10% poorer households in Mexico over the years 2000 to 2016.

The previous graph reveals a reduction in income inequality between the group of households at both ends of the income distribution. Some analysts (e.g. Lustig and Lopez-Calva, 2010) associate the reduction of income inequality to the effects of the 2008-09 financial crisis as well as to the beneficial effect of the internationally recognised direct transfer program (Progresa) which ring-fenced the income of the poorer groups of the Mexican society (Levy, 2010).

As referred to before, Mexico is undergoing an *ageing* phenomenon[2]. The most troubling element is that most of the older population have no access to pensions, fewer than 50% by 2007, according to Levy (2010). Consequently, the increasingly older population have to rely on family support, personal saving or own wealth to weather the difficulties of old age (Kim and Choi, 2011). In addition to the challenges of changing demographics and pensions reform, the Mexican population is facing the difficulties of an oversubscribed and financially broken public health service (Levy, 2010).

Acemoglu et al. (2012) contend that country-specific institutional settings play an important role in defining welfare levels. Accordingly, very open, highly productive, high-innovation nations are not necessarily the most egalitarian ones. Mexico is very much an unequal nation; innovation is not Mexico's trademark, and institutions are far from solid (Schettino, 2018a). However, the gap between the richer and the poorer has been narrowing making, Mexico's case one worthy of study.

1.2. The research objectives.

The main objective for this research is to identify the economic factors that have had an influence in determining consumption in Mexico, as well as to establish who has benefitted from such changes. Their identification has relevant policy implications. While Mexico has experienced steady improvement in living standards in terms of increased life expectancy and a more affluent society (OECD, 2018b), the country still faces important challenges

[2] According to the OECD (2018b), the share of the population aged 65 and over in Mexico was 6.7%–the lowest among OECD nations. By 2050 it is expected to be 27% of the total population.

associated extreme poverty—over nine million people living in such condition, increasing levels of corruption, and increasing personal security concerns.

If we accept the argument of consumption being the best descriptor of welfare[3] (Attanasio and Weber, 2010; Guillen-Royo, 2007) Mexico's increased levels of consumption in real terms are a testimony of better times for Mexican society over the recent decades.

Improved living standards, particularly for the poorer most, have been partly associated with the redistribution policies aimed at ameliorating the effect of abject poverty through a well-targeted cash transfer programme put in place (Attanasio et al., 2012; Villarespe and Sosa, 2012). The idea of trying to find what factors allow for well-being improvements, understood as improved living standards, is what motivates this research project.

Given the relevant contribution of consumption in most economies worldwide[4] and considering the elements of increased consumption and reduced income inequality that have taken place in Mexico, three main questions arose in terms of this research:

- What have been the main drivers of consumption over time?
- Have the changes of increased consumption benefitted all / most / some cohorts of society?
- Have the reduced levels of income inequality have resulted in better levels of consumption, and therefore well-being, for all?

Those academic concerns constituted the initial motivation to start this research. The first one is rooted at the aggregate macroeconomic level. The second and third research questions will be tackled from a microeconomic—household—level perspective.

Given the fact both macro and microeconomic information was available, the decision was made to perform a dual macro-micro econometric analysis of consumption in Mexico.

[3] Throughout this thesis welfare is understood as what Sen's (Sen, 1999, p. 70) refers to as well-being. Which according to Sen is one of the advantages (freedom being the other advantage) obtained by increased levels of income, and eventually of consumption. With well-being being a better description of what this piece of work aims to provide a better understanding of. Both terms will be used interchangeably as welfare is the terms commonly used by most authors. When the welfare state is concerned it will be stated in those terms.

[4] Consumption accounts for 50% to 70% of total expenditure in most nations (Muellbaurer and Lattimore, 1994).

1.3. Contribution of the thesis.

This thesis presents the econometric analysis of consumption in Mexico. Its main contribution is twofold: to understand the determinants of consumption over time and to evaluate how those benefits of consumption have been distributed.

The most relevant contribution from this empirical work is the decomposition or stratification[5] of consumption controlling for household composition, income, and age. It was performed in order to evaluate consumption evolution over the income distribution, and the life-cycle. According to Fortin et al. (2012), decomposition is useful for quantifying the contribution of various factors to a difference or change in outcomes.

Research around consumption in Mexico is, as the country itself, a work in progress (Bleynat et al., 2020). Nonetheless, this thesis provides an account of a very long research process full of realisations and learning points. It is the author's desire that the research outcomes offer value for the reader and that the conclusions will be relevant for decision-making and have a stimulating effect for further research in this area.

The understanding of income and consumption inequality has been identified as a key element in the pursuit of better public policy formulation (Sun and Wang, 2013). Empirical research shows that at the aggregate level, income inequality has reduced as of recent times in Mexico (Hernandez, 2012; Lopez-Calva and Lustig, 2010).

As a landmark for comparison, China's impressive economic performance has been married with increased levels of income and consumption inequality (Sun and Wang, 2013; Jin et al., 2011); a phenomenon likely to occur as economic growth takes place (Muller, 2013).

For policy-making purposes, it is relevant to ask what the determinants of consumption have been over time as well as to identify if the increases of consumption have been enjoyed similarly among different cohorts in society. Therefore, the empirical work undertaken in this piece of research aims to identify if certain macroeconomic variables other than income

[5] Deaton (2000) explain that stratification 'converts a sample from one population into a sample from many populations'. While, according to Fortin et al. (2010) 'decomposition methods are used to [disaggregate] the difference in a distributional statistic between two groups or its change over time, into various explanatory factor'. In this thesis, decomposition is used to discriminate the effect of a specific variable—consumption—among different subgroups of the population. As such stratification might better describe the procedure followed. However, the decision was made to use the term decomposition as the research's objective is what Fortin et al. (2010) describe in order to obtain specific measures for subgroups of a sample, as it is done in this thesis.

could be related to consumption changes in Mexico. This research analyses also, the empirical effects of consumption at the microeconomic—household—level. This empirical study was performed in order to understand if there have been any distributional, regional, or over the life-cycle consumption differences in Mexico.

In general terms, this piece of work has found how consumption in Mexico has followed a pattern closely related to income, manufacturing output, and financial wealth. Interestingly enough, macroeconomic stability associated with lower levels of the interest rate, reflecting the relevance of sound macroeconomic management the country has experienced over the last 30-plus years.

The decomposition analysis shows that the hump-shaped profile of consumption drops over the life-cycle, with the level of household income being a relevant predictor of when the drop in consumption is likely to occur over the life-cycle.

More importantly, this research has found that at the micro-level there have been winners and losers along the process, with the middle-aged and middle-to-high cohorts of income benefitting the most. The story is not as good for those at the end of the life cycle. The empirical evidence suggests that households at both ends of the life cycle have not been able to enjoy higher levels of consumption and, therefore, well-being.

1.4. The structure of the thesis.

The thesis starts with a chapter presenting a historical account of the socio-economic development that has taken place in Mexico. The idea is to provide an overview of the country and the evolution of its economy. The third chapter presents a review of the literature about consumption and its relationship with other economic variables.

The empirical section is composed of three different econometric procedures, each of them undertaken and presented in a *self-contained* chapter, including a review of the specific literature. The final chapter presents the conclusions and reflects on the answer to each of the research questions, implications for public policy, the identification of the research limitations, areas for further research and some final concluding remarks based on the results obtained.

2. Mexico's economic evolution.

2.1. Introduction.

Mexico as a middle-income country has been undergoing several economic and social transformations. A former crisis-prone nation during the 1970s and 1980s, it has managed lately to transit without catastrophic consequences the effects of the most recent economic crises that have had a larger impact on other developing nations (e.g. Brazil or Russia). Such transformation can be partly explained by the economic reconversion from the import-substitution policies of a close economy to that of an economy fully integrated worldwide.

2.2. Mexico: a country of contrasts.

Mexico, with a population of 120 million people and a large diaspora measured at 10 million Mexican-born individuals living in the USA. Both nations share a 2000 miles-long border with as many as 350 million crossings per year making it "the most frequently crossed international boundary of the world" (DW on-line, 2019). The *special-relationship* which is more of a dependency, as the USA is the destination of over 80% of Mexico's export (see figure 2.1), while Mexico is the second-largest USA trade partner (Secretaria de Economia, 2019).

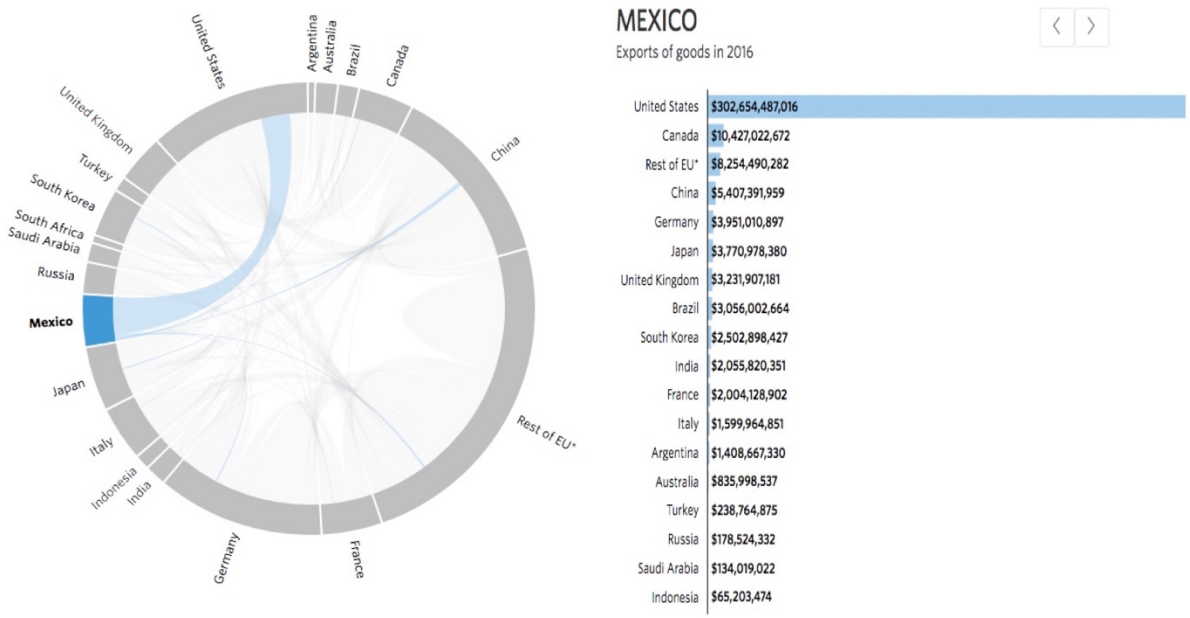

Figure 2. 1. 2016 Mexico exports by country of destination (selected countries) at current USD prices. Source: Bloomberg (2018).

Since Mexico joined the NAFTA agreement with the USA and Canada in 1994, it has become a manufacturing hub that has allowed the country to transit from a nation dependant

on exporting commodities—oil and a few agricultural products mainly—to become the fourth largest exporter of cars in the world (Workman, 2019).

However, Mexico has failed to capitalise on the full potential of an economy closely integrated with the world's largest economic market north of its border (Levy and Schady, 2013).

Mexico experienced years of erratic socioeconomic policies during most of the second half of the twentieth century. The recurrent crises during the 1980s—characterized by the insolvency, debt-repayment suspension, and high devaluation—or the *Tequila effect* crisis of the mid-1990s are a testament of the economic *misfortunes* the Mexican economy has endured. Those episodes had dire socio-economic consequences in terms of high unemployment and inflation (Schettino, 2018b; Krause, 1997).

Figure 2. 2. GDP annual growth (constant prices local currency) in Mexico 1961-2019. Source: WDI (2020)

The story of the Mexican economic fortunes—and misfortunes—is partially told in graphs 2.2 to 2.5. As it is shown in those charts, Mexico lived through drastic and recurrent economic recession episodes in 1982, 1986, 1994, and 2001, all of them associated with the internal mishandling of the Mexican economy according to different analysts (Schettino, 2007; Calderon 2012). The 2009 downturn was associated with the international financial crisis, the first crisis since 1938, whose *origins* had no roots in the country.

2.2.1. The post-war period.

Mexico experienced years of consistent economic growth over the 1940-1960 period—known as the *stabilising development* period—was in line with the world's average level of economic growth. The post-War years of fixed-exchange-rate regime and relatively closed-

economy policies brought the development of industrialization in Mexico which allowed millions of people to migrate from the rural to the urban settings (Schettino, 2007).

Mexico's industrialization agenda came at a cost in terms of foreign debt. From 1940 to 1960 external debt increased an average of 0.4% of the country's GDP yearly. However, it increased to 3.4% per year during the 1960s with the aim of financing the country's economic development. As explained by Schettino (2019) it was credit what fuelled economic growth over the 1960s and 1970s.

2.2.2. The stabilizing development era.

During the 1958-1964 period most of the international credit was used to finance different development and public infrastructure projects. Poverty levels reduced by one-half[6] but inequality increased by a factor of two (Szekely, 2005).

Figure 2.3 presents the evolution of poverty measured in terms of food-poverty[7], capabilities-related poverty[8] and equity poverty as well as the *Gini-coefficient* index value.

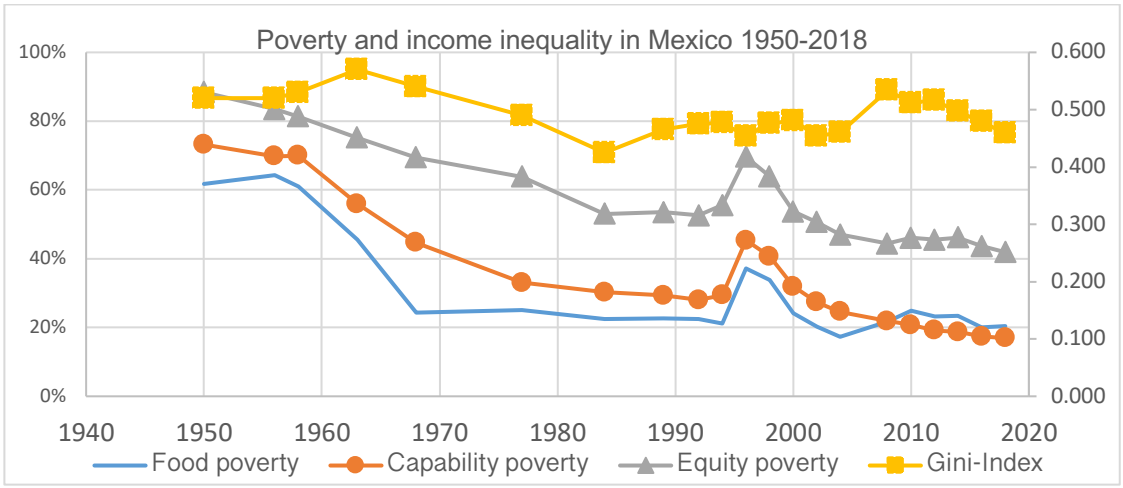

Figure 2. 3. Mexico poverty and income inequality 1950 – 2018. Source: Szekely (2005) Coneval (2020).

The reduction in poverty levels can be attributed to the impact of the social programs—mainly in terms of public health available to all formal sector employees—and the program

[6] According to Schettino (2007) in 1958 as many as 70% of the population of Mexico suffered from food-poverty.

[7] The data for this series up to 2004 is based on Szekely (2005) who defines *food-poverty* as the share of the total population whose level of income *per capita* is not enough to pay for a minimum level of food intake.

[8] Defined by Szekely (2005) as the share of total population whose level of income *per capita* allow them to pay for a minimum of food-intake, but are not able to cover the expenses related health and education for all members of a given household.

for housing acquisition partly funded by the state set in place during the second half of the 1960s.

Despite the relative success of the industrialization process of the 1960s and 1970s, the country had to deal with two important issues, the first one in terms of the public finances with a public deficit as large as 10% of the country's GDP. The second in political terms through the shift to a *nationalistic* and *populist* agenda which ruled Mexico for the following two Presidential terms from 1970 to 1982.

The government expenditure passed from 18.5% of the GDP in 1970 to over 20% just three years after. Meanwhile, the level of foreign debt went from 4 billion to 20 billion USD at the end of the Presidential term in just six years.

The country run into trouble when the decision was made to expand the influence and role of the state, and the effects of the hyperinflation period experienced in the world at the start of the 1970s associated with the oil crises. Mexico experienced a period of economic hardship once it was clear the government had been, not only overspending but using them to finance politically and ideologically related projects that never took-off or produced meagre benefits for people other than the politicians in charge of running them.

The nationalistic agenda pursued by the Federal government resulting in high levels of government spending was coupled with tax collection reductions. The consequence of all those actions resulted in a large depreciation of the local currency in 1976. In a single day, the Mexican peso (MXP) passed from 12.50 to 22.00 MXP per USD.

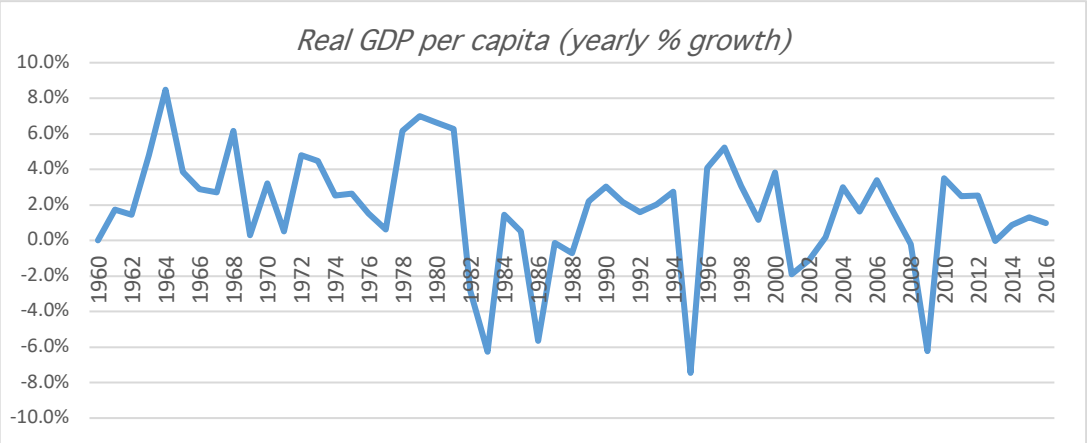

Figure 2. 3. Real GDP per capita percentage growth (yearly increase). Source: World Development Indicators (2017)

The devaluation of the Mexican currency produced a large shift in terms of the country's trade balance which is shown in the large increase in terms of economic growth as shown in figure 2.3a showing the changes in the country's GDP. Nonetheless, the negative effects for the local population in terms of unemployment, inflation, and a large cancelation of productive projects.

2.2.3. The crisis-prone era.

By the mid-1970s extensive oil fields were discovered in Mexico. The availability of easy-credit for developing countries - associated with the increase from OPEC nations who benefitted from increased oil prices – and the presence of a *populist* nationalistic government agenda of import substitution during most of the 1970s saw a large increase in public spending which brought the country to a point of yet another economic collapse in 1982 (Schettino, 2007).

Under the promise of improved infrastructure and economic progress Mexico, as many other nations in Latin-America, was caught in an upward debt-spiral, particularly once it was clear not all resources were put in productive economic projects.

After the crisis in 1976, imports to Mexico increased by a factor of 4 in only four years (1977 to 1981), the deficit in the current account registered a deficit equivalent to minus 14% of the country GDP. Even though GDP increase by a staggering 9.2% yearly, it was only the short-term effect of an expansive monetary policy fuelled by credit. Oil exports were meant to be enough to pay for the credits obtained. The reality was somehow different, given the size of the credit received and the misuse of those resources—associated with corruption and cronyism—meant that income from oil exports was only enough to pay back the interests generated by an increasing foreign debt once the price of oil went down in 1979.

The Mexican government did not reduce the exuberant spending nor control corruption. According to Saldivar et al. (2001) short-term public and private debt increased from one billion USD in 1976 to 12.6 billion in 1982 with long term debt measured at 11.7 billion the country was living beyond its means. Public debt service ratio—the debt interests paid divided by current account income—passed from 26% in 1970 to 62% in 1980.

To complicate matters further the at the President of Mexico decided to nationalize the banking sector. A decision that is still regarded as *irrational* (Urquidi, 2005, p. 310) or *personally motivated* according to some political analysts (e.g. Krauze, 2000). Mexico paid in

1984, 11.6 billion USD, just for the external debt service. The government finance all those payments with new *longer-term* debt, 68.7% of the new loans obtained in 1982 were used to pay from previously contracted debt repayments (Saldivar et al., 2001).

Amidst those decisions, the few foreign investors and most of the local business people decided to withdraw their investment in Mexico. Billions of dollars flew the country 1982 that the Mexican economy went into a deep recession as the country declared moratoria on its foreign debt payments. The crisis was associated partly, with the high levels of government spending and excess credit in the economy (Schettino, 2011). After the country's President decided the nationalization of the banking system, the whole economy went into a downward spiral of increased inflation, economic recession, and high unemployment just like the country had experienced six years before.

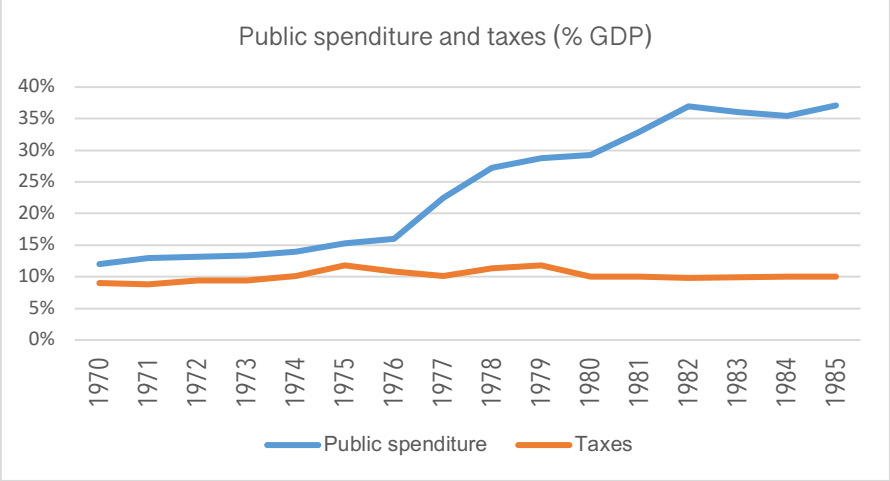

Figure 2. 4. Mexico's federal government public expenditure and tax collection as percentage of the country's GDP 1970-1985. Source: Schettino (2007)

The subsequent debt cancelation Mexico received in 1986, and the re-privatization of the banking sector allowed the free flow of capitals allow not only financial wealth to pick up in the nation (Schettino, 2011), but mainly to get the productive sector on the move again (Lopez-Calva et al., 2006).

Clearly, the GDP, which quantifies an economy's capacity to generate goods and services for its population is not a reflection of the level of welfare experienced by the population. But it is not difficult to imagine the economic hardship for the Mexican population.

After the second economic crisis in just over six years, in 1987 Mexico accepted the directives of the International Monetary Fund (IMF) adopting the *Washington Consensus* which meant reforming the country's economic model to embrace a free trade agenda.

Figure 2.5 shows the evolution of the interest rate in Mexico. It is easy to highlight the high level of interest and the associated inflation rate Mexico had during the best part of the 1980s. The inflation level Mexico had over the 1980s and 1990s—peaking at 180% in February 1988—is a sad reminder of the economic difficulties the country endured over such a turbulent period.

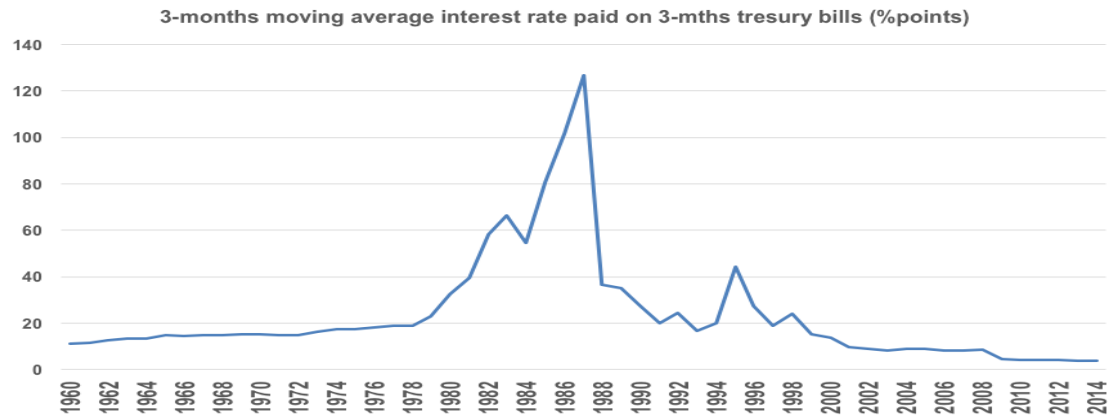

Figure 2. 5 Interest rate (3-months MA interest rate paid treasury bills). Source: Banco de Mexico (2016)

Figure 2.6 presents the country's current account balance, it indicates how the mishandling of the economy resulted in large deficits in 1982, 1986, and particularly in the first half of the 1990s as will be analysed later on. It came as little surprise the Mexican currency suffer a depreciation on an almost constant basis. The exchange rate passed from 12.50 Mexican pesos per USD in 1976 to 2500 in 1988.

The economic consequence in 1982 was the moratoria on government debt, in 1994 the adoption of a shock-therapy resulted in the adoption of the free-trade open economy agenda.

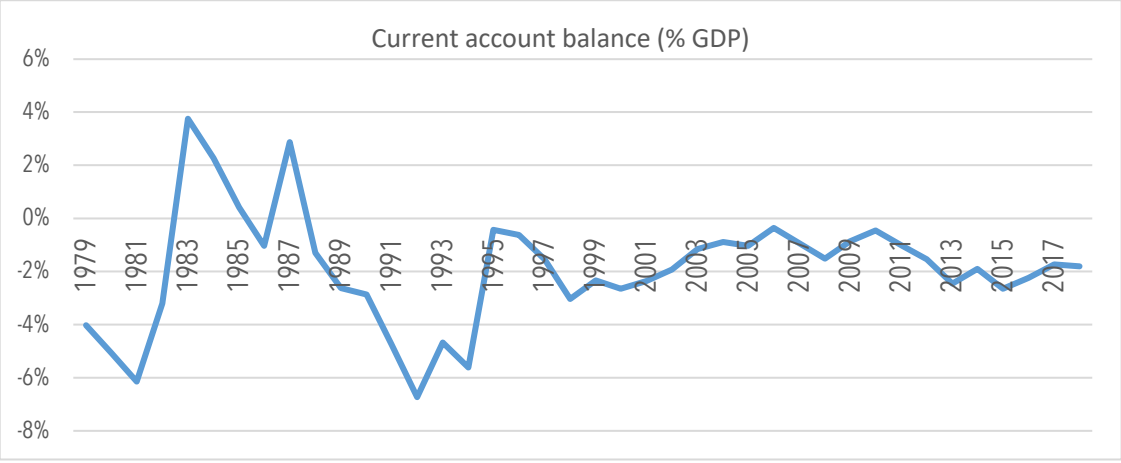

Figure 2. 6. Mexico's current account balance 1980-2018 at current USD. Source: Banco de Mexico (2019)

According to Guillen (2012) over the 1982-1988 Presidential period “minimum wages recorded a real contraction of 44%”. Showing the impact of the pre-1982 *populist* policies characterised by excessive public expenditure and the loose control over the main economic variables when the current account deficit was recorded at minus six percentage points of the country’s GDP.

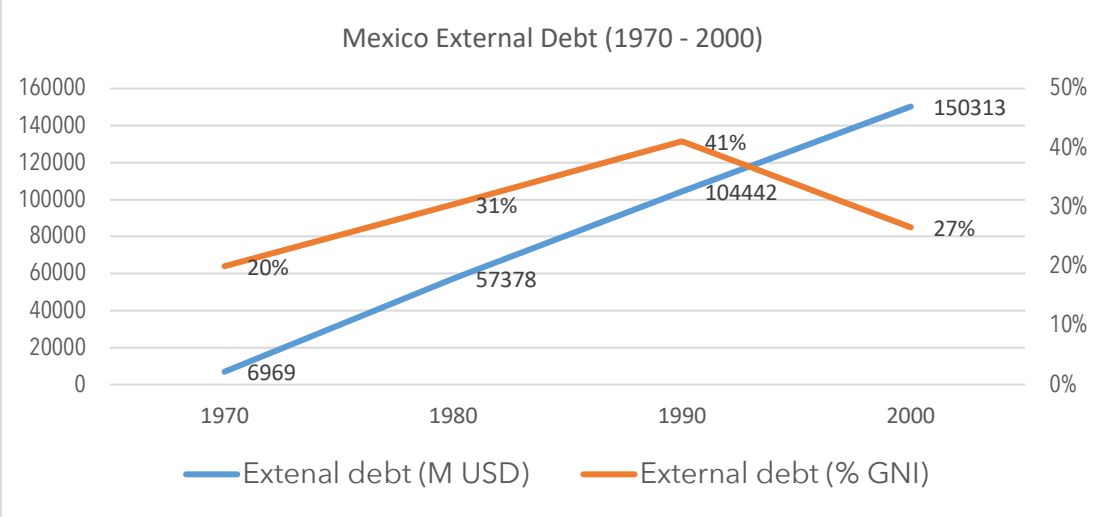

Figure 2. 7. Mexico’s external debt 1970 – 2000 in absolute terms (million USD) and as a percentage of GNI. Source: Urquidi (2005).

2.2.4. The Washington Consensus and the economic deregulation.

Figure 2.7 shows the sharp increase in external debt the country contracted over the 1970-1990 period. The excess in liquidity and credit associated by the higher oil prices allowed the developing world to access resources that were not available before.

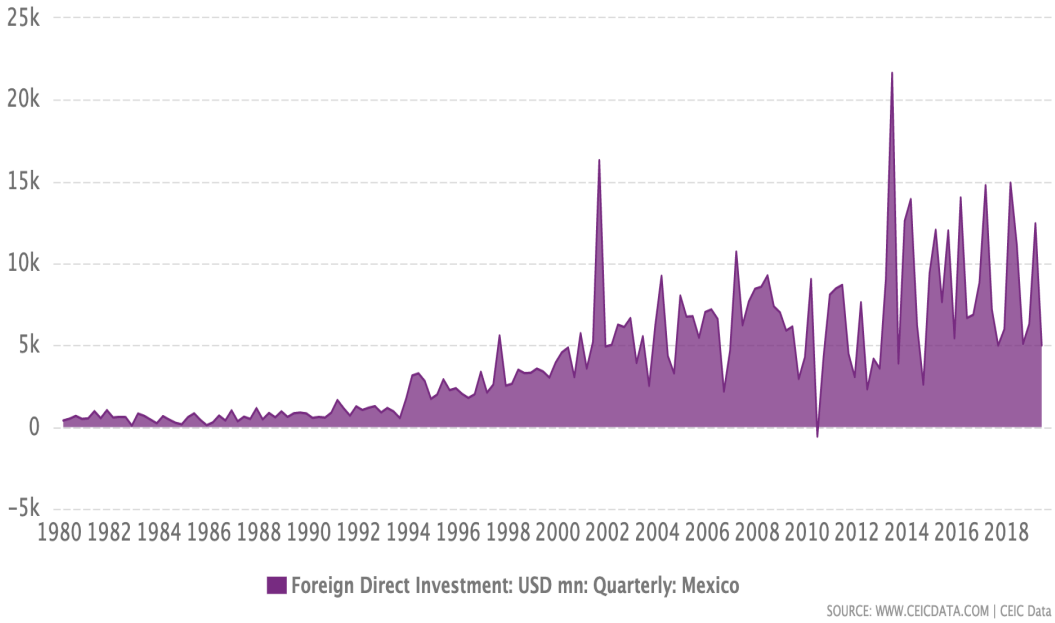

Figure 2. 8 Quarterly FDI investment in Mexico 1980 – 2019 Source: CEI (2020)

When the new government came in power in 1982 it had to act and act they did. The decision was made to change the economic agenda the country followed during the 1970s, but the solution was not as simple. Mexico City suffered a big earthquake in 1985 which hampered the fragile economy even further. The situation did not improve much for the remaining years of the decade until Mexico adopted the so-called *neoliberal* agenda and embraced free-trade under the directions of the IMF and the World Bank when the economy opened to foreign investment and international trade (see figure 2.8 and 2.9).

An open economy implied that the local industry, which enjoyed years of protectionism and import substitution, had to face foreign competition, which they were not prepared for. The Mexican consumer did enjoy the “benefits” of having access to higher quality products ranging from clothes to electronics, or from cars to fast-food. The large increase in Mexican exports was outpaced by the increase in imports (Figure 2.9).

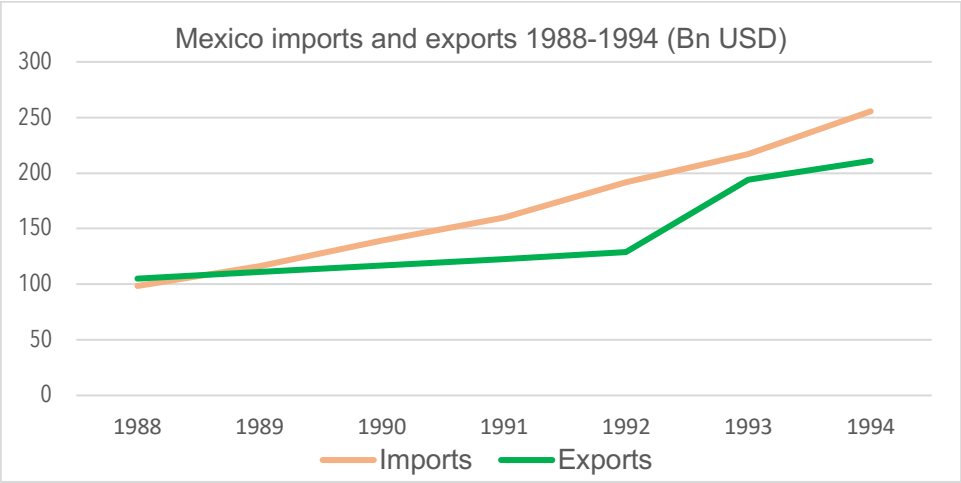

Figure 2. 9. Mexico imports and exports 1988 – 1994. Source: OECD (2020)

The large trade deficit accumulated over several years, the exuberance of credit, and the high level of government expenditure during the first half of the 1990s brought the country to the point of economic collapse (Cypher and Wise, 2012). The country underwent a series of austerity measures, the restructuring of the pension schemes, the renegotiation of its debt, and a 150% devaluation of the peso.

Figure 2.6 before gives an account of the effect all previous elements had in terms of the current account. The Mexican economy, as the then President stated, was *near the cliff*. The decision was made to allow the Mexican currency to "slide at a faster pace", the message was not well received by the international investment and suddenly Mexico found its international reserves at the point of lowest-ever. An economic crisis ensued and the country's economy contracted by as much as 7% in GDP per capita.

The decision was yet again to ask for further loans. To stick with the open-trade agenda, Mexico received a *salvage package* put forward by the Clinton administration in the USA. A shock economic therapy was implemented—reduction in government spending, increased in VAT, and petrol prices, currency devaluation—and the country managed to bounce back: GDP *per-capita* grew by as much as 4.5% in 1996 and 5.8% in 1997. Since then Mexico experienced a consistent level of economic growth—even if far from spectacular—measured at 2.2% every year on average. The economic crises in 2011 associated with the 9-11 attacks and the financial crises of 2008-09 took a toll as the Mexican economy reduced by 1.9 and 6.2% in GDP per-capita terms. Nonetheless, the economy recovered after.

The current account deficit registered after 2011 and subsequent years—as shown in figure 2.6—has been relatively stable and sound macroeconomic policies have allowed the country to curtail times of economic uncertainty. There have been, lately, effects in terms of the

current account associated with the reduction in both, the international price of oil and the drastic fall in oil production[9].

In Mexico, the level of government spending has not increased significantly over the recent past. In general, the country has been a good example of sound macroeconomic management—with general government debt at about 37% of the country's GDP and governmental deficits below 1%[10] of the country's GDP (OECD, 2013a) and slightly higher—between 2.5 and 2.9% of GDP—over the last few years (SHCP, 2018). Meanwhile, the level of household consumption has remained steady as a proportion of the country's GDP.

	Government expenditure (% GDP)	Household consumption (% GDP)
2007	10.6	67.6
2008	10.9	67.0
2009	12.0	66.6
2010	11.7	67.5
2011	11.6	67.4
2012	11.8	66.2
2013	12.2	67.0
2014	12.2	67.3
2015	12.3	67.1

Table 2. 1. Mexico's government expenditure and household consumption as a percentage of the country GDP. Source: WDI (2017)

Wage dispersion growth, coupled with the effect of the economic crisis[11] Mexico suffered during the 1980s and 1990s were partially responsible for the increase in inequality Mexico experiences during the 1990s. After Mexico joined a *free trade* agenda, inequality decreased steadily for over the 2000-2010 period (OECD, 2011). The reduction was such that in 2012 inequality was almost as high as the 1984 level, well before the recurrent *peso crises* of the 1980s and 1990s (Schettino, 2007; Camberos-Castro, 2012).

The sudden opening to trade, privatization and deregulation of the Mexican economy in the late 1980s coincided with an expansion of wages and employment that resulted in increasing differences in wage dispersion between those having the skills and those lacking them as the economy became more skill-intensive (Cragg and Epelbaum, 1996). The authors found how the highest paid workers experienced the largest wage growth. Skills

[9] According to the US Energy Information Administration in 2006 Mexico produced 3.70 million barrels per day. In 2019 oil production was recorded at 1.67 million barrels per day (Wall Street Journal, 2020).
[10] Government balances as percentage of GDP in Mexico have been 0.2% (surplus) in 2006, -0.5% in 2007; -2.4% in 2008; -0.9 in 2009; -1.4% in 2010; and -0.1 in 2011 (OECD, 2013a).
[11] Mexico's GDP contracted by 6.0% in 1995 (World Bank, 2013)

rather than industry-related effects were found to be the critical factor explaining this smaller demand for the *less skilled.*

As it will be discussed later on during the empirical chapters of this piece of research, the Mexican economy has made the transit from an oil-exporting, remittance dependant nation to one of the world's manufacturing hubs. Being located south of the world's richest and highest consuming economy has been described as a *course* and a *blessing* at the same time. Regardless, Mexico has capitalized on the opportunity to become an economy fully integrated with the American economy. So much that, as shown in figure 2.10, not only the manufacturing sector of Mexico follows closely the manufacturing output of the USA's economy, but the behaviour of the Mexican economy as a whole follows the manufacturing output fluctuations North of the border.

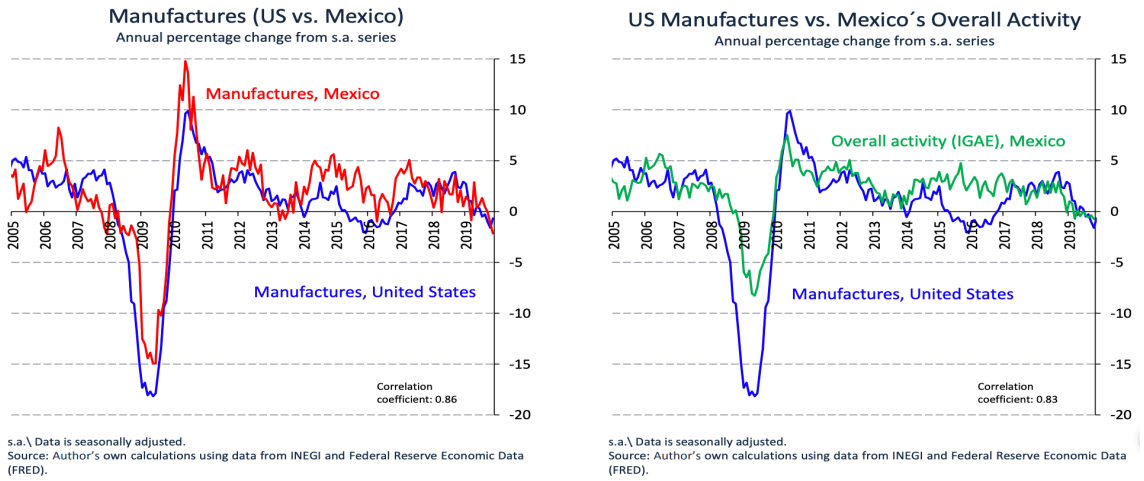

Figure 2. 10. USA and Mexico manufacturing output annual percentage change 2005-2019. Source: Banco de Mexico (2020).

The well-being impact of the economic upheavals was large in terms of shattered lives, poverty rate increases, migration, and unemployment (Cypher and Wise, 2012). Parallels can be drawn to the effects felt in nations such as Greece, Italy, or Spain after the financial crises of 2008-09.

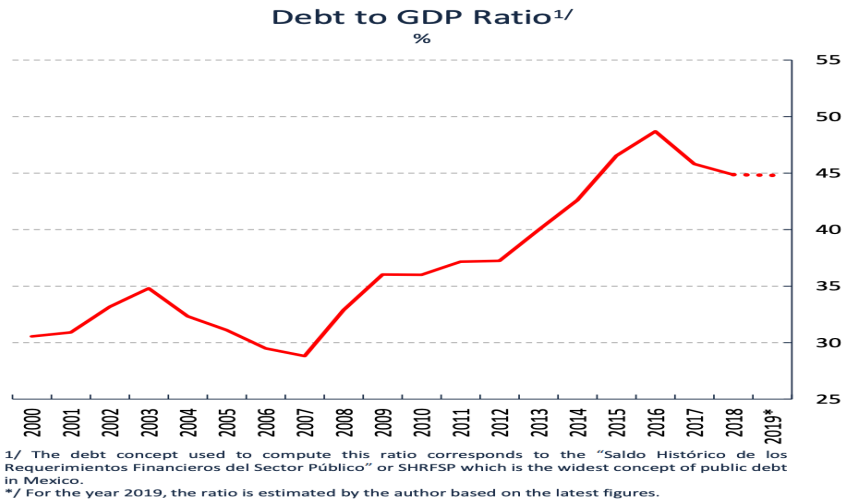

Figure 2. 11 Debt to GDP ratio 2000-2019. Source: Banco de Mexico (2020)

After some drastic economic policy changes propelled by the agenda of international organizations such as the IMF and the World Bank—the so-called *Washington Consensus*, Mexico has enjoyed the benefits of international trade (Fullerton et al., 2015). Over the last twenty-five years, the country has been undergoing a process of political and economic transformation.

Although the level of debt as a percentage of the country's GDP has not spiral out of control, it has increased over the 2013-2016 period associated with the drop oil revenue. It could be argued that the lessons obtained from past episodes have been learned and Mexico has been following sound economic policies aimed at promoting stability. Despite that fact, many questions have risen about the adequacy of the so-called Neo-liberal agenda in Mexico (e.g. Wise and Cypher, 2012). Therefore, analysing the changes in consumption, this thesis author believes will offer another element to the analysis.

2.3. Conclusions.

It has been stated that the main motivation behind this piece of research is to identify if well-being levels in Mexico have improved after almost three decades of macroeconomic stability. At the core of this piece of research is the understanding of well-being as improved living standards in the economic sense: the benefits of higher income and consumption.

Several authors have related increased levels of consumption (e.g. Brewer and O'Dea, 2012; Meyer and Sullivan, 2011) with better levels of welfare. Accepting such a premise it will be relevant to highlight the increased levels of consumption per capita and the reduction in both poverty and income inequality as shown before. Mexico has experienced as signs of

living standards improvement. Nonetheless, Mexico still faces important challenges in terms of poverty, inequality, security, and education.

This aims at adding some elements to the discussion to better inform public policy and ideally to contribute to improved levels of living standards as a consequence of better public decision making.

3. Literature Review.

3.1. Introduction.

Consumption is what an economic agent—an individual, a company, a household, or the government—spends *within a given time period* (*t*). It is also defined as "the final use of goods and services by economic agents to satisfy their needs" (Black et al., 2009). Historically consumption levels have been found to be closely related with income (Haushofer, 2014; Hall and Mishkin, 1980; Okun, 1971).

Considering economics is about improving people's living standards, and that economic standards are better reflected by consumption (Meyer and Sullivan, 2011) this chapter reviews the existing literature on consumptions, its determinants and its distribution aspects.

One source of academic controversy and research revolves around how much consumption changes along the life cycle and how much it changes with income shocks.

The importance of understanding how consumption changes has been highlighted by different researchers (e.g. Fu and Hughes, 2009; Blome et al., 2009). Understanding consumption trends relative to demographic factors and household composition makes sense to anticipate or at least have some idea of what the demographics changes might bring for the future in terms of economic growth and development.

Such an understanding is of particular relevance for the context of a country—Mexico—which, as shown in the previous chapter, has been undergoing a dual process of economic and demographic change.

3.2. The historical development of the consumption function.

Empirical models known as *'consumption functions'* are aimed at explaining the behaviour of consumption based on the patterns of consumption, income, assets and interest rates.

Around the so call consumption function two main paradigms exist: The first one is the Keynesian *fundamental psychological* view: stating that current consumption is basically determined by current income (Haushofer, 2014; Hall and Mishkin, 1980; Okun, 1971).

A seminal attempt at capturing the way consumption behaves was Keynes' *fundamental psychological view*, which states that 'when income increases consumption rises less than income, and when it decreases it falls by less', meaning that consumption is more stable than income (Skidelsky, 2010).

Past income has been highlighted as the main predicting element for current levels of consumption (Flavin, 1981).

According to Hall, consumption is a random walk process and is mainly affected by the innovation—surprise—component of consumption determinants—income and wealth innovations mainly. Meanwhile, Davidson et al. (1978) empirically demonstrated, using the error correction model on time-series data, that there was a robust short-run, dynamic relationship between income and consumption. These contrasting results provided by the research of Hall (1978) and Davidson et al. (1978) ignited the study of aggregate time-series analysis of the consumption function.

While understanding the dynamics of consumption Engle and Granger (1987) highlighted the cointegrated nature of consumption and income; as well as the relevance of the error correction model (ECM) as an ideal way to determine the long-run equilibrium relationship between different variables. The same authors regard the use of multivariate, real, per capita time-series analysis as the standard while analysing the consumption function at the aggregate macroeconomic perspective.

Important as well is the work of Molana (1991) who argues that neither Hall's nor Davidson's models were a good representation of consumption unless the variables of wealth are taken into the mix, as wealth is a better consumption descriptor than income.

Muellbauer (1994) found that the UK consumption-boom of the late 1980s-early 1990s was accompanied by a massive rise in consumer debt relative to income that produces an asset-price increase in terms of financial wealth. Meanwhile a decline in consumption occurred at a time of a slump in asset values and an increase in the cases of house repossession actions.

Recent research has highlighted the relevance of both income and wealth as the main determinants of consumption (Lettau and Ludvingson, 2005; Dreger and Reimers, 2006).

According to Jansen (2013), consumption is better expressed as a function of explanatory variables such as income, wealth and others that will capture income uncertainty and inter-temporal substitution effects.

More recently, the main source of research and academic controversy is how much consumption changes over the life-cycle, and how much it changes with income shocks.

Much of the existing analysis on consumption has been conducted at the micro-level using household datasets and reflecting households' levels of income and consumption (e.g. Brewer and O'Dea, 2012; Meyer and Sullivan, 2011; Carroll et al., 2014; Crossley et al., 2009; Attanasio and Borella, 2011; Alan and Browning, 2010).

Several other variables, in current and lagged values, have been found to be statistically significant elements associated with consumption changes. Variables of objective nature—borrowing constraints, population composition, or the interest rate—and other subjective factors, such as the bequest motives, have been found to have a role in defining changing levels of consumption (Hendry, 2013; Erlandsen and Nymoen, 2008).

At the macroeconomic level, according to Muellbauer (1994), there is a close association between consumption - and high aggregate saving rates - with population and income growth. The relevance of studying consumption at the macroeconomic data is highlighted by Fernandez-Curegedo (2004) who states that the cointegrating nature of consumption and income create the need to have different ways to understand and analyse macroeconomic data.

While analysing cross-section data about household and income in the UK, Battistin et al. (2009) concluded that the cross-sectional distribution of consumption follows a log-normal distribution[12], meaning that 'consumption is given by the past logarithmic value of consumption plus a term that reflects an innovation to permanent income'.

According to the same Battistin et al. (2009), such a need was solved through the formalisation of what became the procedures of cointegration and error correction analysis that 'allowed economists to establish a clear distinction between long-run and short-run (dynamic) statistical relationships between economic variables.

[12] 'A variable might be modelled as log-normal if it can be thought of as a multiplicative product of many independent variables' (Park and Berra, 2009). According to Clementi and Gallegati (2005) in economics, 97-99 per cent of the population has a level of income that is log-normally distributed. The median value of a log-normally distributed variable is e^{μ} and the mode is equal to $e^{\mu-\sigma 2}$.

Personal wealth, Fernandez-Curegedo (2004) contends, relative prices, or the age distribution, are the variables that allow us to describe the long-run behaviour of consumption.

According to Attanasio and Weber (2010) there are limitations to Keynes' view are due to 'theoretical and empirical limitations". Particularly as it became difficult to construct an *intertemporal optimizing behaviour* model consistent with Keynes' *psychological view*. Those inconsistencies the authors contend existed at both macro and micro level:

a. At the macro level, the marginal propensity to consumer from disposable income was found to be smaller in the short run compared to the long run.
b. At the micro level, cross section analysis revealed that groups of individuals with smaller levels of average income scored higher saving rates than groups with higher income levels.

The previously identified "contradictions" gave rise to the second paradigm championed, separately, by Milton Friedman and Franco Modigliani. It is the life-cycle model/permanent income hypothesis (LCM/PIH). Their proponents indicate that consumers form estimates of lifetime resources and then adopt plans for spreading those resources over the remaining years of their lives and so by maximise utility over a long-term horizon, which means that any movement on personal income does not necessarily will translate into higher consumption.

At the microeconomic level, the main trend during the 1960s in consumption functions was that of the optimization over the individual's life-cycle or the so-called *Life-Cycle Model* / *Permanent income hypothesis* (LCM/PIH).

> "[In PIH and LCM models] consumption was a function not of measured income, as in the Keynesian consumption function, but of the average of expected income or of the value of life-time resources… consumption smoothing and average incomes rather than transitory incomes are important". (Carlin and Soskice, 2006).

Both, the PIH and LCM models set consumption along an inter-temporal optimization path where consumption is based not on how much money is available during the present time period, but along the life-cycle and based on what is considered as "sure" inflow of money.

With income shocks treated as short run fluctuations whose impact is average out in the long run.

According to Attanasio and Weber (2010), the LCM/PIH consumer have concave utility functions and therefore prefer to smooth paths of consumption:

> "…if income is hump-shaped and declines at retirement, the consumer will save when they are young to support consumption and dis-save when they are old… The higher the rate of growth is, the larger the difference in resources between savers and dis-savers and, therefore, the higher the aggregate rate of saving" (Attanasio and Weber, 2010).

According to Lipsey and Chrystal (2007), the future/long time horizon conscious consumer is almost certain to smooth consumption and behave very much in accordance with *LCM* or with *PIH*. The less future-minded consumer will act following the *Keynesian Consumption Function.*

Some researchers however have found inconsistencies in the consumption life-cycle trajectories that have given rise to the so-called *consumption puzzle*:

> "The average propensity to consume current income seems to decrease with income when we consider micro-economic cross-section data whereas it seems to be roughly constant when we consider macroeconomic time-series data" (Sorensen and Whitta-Jacobsen, 2010).

Also, as explained by Sorensen and Whitta-Jacobsen (2010):

> *"Although microeconomic data do indicate that the richer families save more, macroeconomic time series data indicate that the ratio of aggregate consumption to aggregate income is roughly constant over time".*

At the micro-level, one economic agent might change his consumption levels due to variation on income. However, at the aggregate level—the population as a whole—consumption does not change really.

One crucial element of the LCM and PIH is that any movement on personal income does not necessarily translate into higher consumption. However, according to the empirical evidence obtained by different researchers (e.g. Sorensen and Whitta-Jacobsen, 2010) empirical evidence does not always conform with the principles of the LCM or the associated PIH, giving rise to the so-called "consumption puzzle" (Hurst, 2008) or the "excess sensitivity of consumption to income (Attanasio and Weber, 2010).

Carrol and Summers (1991) conclude that consumption and income track each other over the life-cycle contradicting the main tenants of both LCM and PIH and confirming to Keynes'.

3.2.1. The consumption function: empirical evidence.

Using empirical evidence in the USA, Hall and Mishkin (1980) concluded that consumption reacts more strongly to permanent income than to income shocks with families responding differently to different sources of income variation. They found that 80% of the sample did conform to "the pure life-cycle-income behaviour… [Whereas] about a fifth of all families set consumption to a fraction of current income instead of following the more complicated optimal rule".

According to the same authors, if a whole survey sample is considered, more often than not, statistically significant evidence rejects the life-cycle hypothesis. They also found that decomposing income helps to identify that a large share of households altered their consumption levels.

Attanasio and Weber (2010) explain how Hall (1978) through the Euler equation approach found that "consumers, at the optimum, will act to keep the marginal utility of wealth constant over time". The main practical implication from Hall's work is that "lagged values of income, or predicted changes in income, do not predict future consumption once current consumption is accounted for" (Attanasio and Weber, 2010).

Gourinchas and Parker (2002) meanwhile estimated a dynamic stochastic model of life-savings behaviour for households; they found evidence against the consumption smoothing as an accurate description of household-level behaviour. Meanwhile, Abdel-Ghany et al. (2002) have found a positive relationship between consumption and the place a household has in relation to the income ladder.

Sorensen and Whitta-Jacobsen (2010) have challenged the idea of consumption smoothing. They found that if household consumption is corrected for the 'systematic impact' of the number of children, then consumers do smooth consumption.

The drop of consumption after retirement found by different researchers (Banks et al., 1998) has been termed as the consumption puzzle[13]. Other researchers have found an *excess sensitivity of consumption to income*. Both *inconsistencies* have been suggested as evidence to reject the LCM/PIH. Different researchers (Zeldes, 1989; Campbell and Mankiw, 1991) have found evidence to reject LCM/PIH's tenant that future consumption is unaffected by predicted, current, or lag changes in income.

Different researchers (e.g. Hall and Miskhin, 1980) have found that about 20% of the households surveyed set their levels of consumption based on current levels of income and therefore not smoothing consumption tend to reject LCM/PIH's tenants. At the same time, a third group of researchers (Campbell and Deaton, 1989; Attanasio and Pavoni, 2009) have found *excess smoothness,* as consumption does not react sufficiently to permanent innovations in income.

The criticisms to LCM/PIH, according to Attanasio and Weber (2010), can be grouped into:

a. The age profile of consumption is hump-shaped, tracking the age profile of income.
b. Consumption drops at retirement, and the growth rate seem too sensitive to predictable changes in income.
c. Consumption seems to react to changes in available resources that are transitory (tax refunds).

According to Carroll and Summers (1991), the first controversy can be explained by the fact that income and consumption have a hump-shaped profile and track each other along the life-cycle. The relation is even closer if total expenditure replaces non-durable consumption (Attanasio and Weber, 2010).

Attanasio and Weber (2010) argue that if age profiles are considered, the relationship is blurred and consumption evolve over time as family composition changes. They suggest the use of consumption per-capita or consumption per-adult equivalent as a remedial measure that makes consumption profiles flatter.

[13] Refers to the drop—by as much as 14 per cent in the USA (Bernheim et al., 2001) and 35% in Italy (Battistin et al., 2009)—in consumption after retirement due to lack of enough savings.

The last criticism to LCM/PIH criticisms relates to the fact that income innovations not related to labour supply or work-related income—tax refunds as an example—do make households to increase their level of income (Stephens, 2008).

Attanasio and Weber (2010) contest the criticisms to LCM/PIH because:

a. The hump shape of consumption is due to the interplay of demographics and prudence.
b. Excess sensitivity of consumption to income is due to the dependence of the marginal utility of consumption on leisure.
c. Consumption drops after retirement due to adverse shocks inducing retirement and partly to more efficient shopping by the increase in leisure time.

The authors' conclusion, based on extensive empirical evidence they present, is that LCM/PIH does not predict that individuals smooth consumption but their marginal utility from consumption.

Based on empirical evidence for the UK, Browning and Crossley (2001) dispute that claim, as they have found not such an effect of occasional income shocks in consumption. Where the life-cycle framework is very wide and includes many possible empirical models. They state that the life-cycle framework does rule out is a rule of thumb behaviour, in which households simply spend a fix fraction of their income.

The conclusion by these authors - Browning and Crossley (2001) – is that there is much to be gained from modelling consumption jointly with other choices such as fertility and education.

According to Deaton (1996), it is not necessary to subscribe to the permanent income or life-cycle hypothesis to believe that consumption, rather than income, is the best indicator of household living standards.

While analysing consumption inequality in Canada, Croosley and Pendakur (2002) contend that consumption varies with individuals' needs, household composition, and with age cohorts.

For Aguiar and Hurst (2013), consumption exhibits two main characteristics:

a. Over the life-cycle consumption is "hump-shaped".
b. Analysis of cross-sectional data shows how consumption inequality increases as individuals age older.

Therefore, the same authors argue, it is possible to expect changes in spending within life-cycle categories for which nonmarket work time and expenditure are substitutes. However, they identified several consumption categories that continue to increase throughout the life cycle (i.e. health expenditure). In contrast others categories decline (transportation or clothing), and some stay steady (housing services).

In terms of time-series analysis of consumption, there have been several papers studying the long-run equilibrium condition of consumption, income, and wealth. There is ample empirical evidence about the long-term equilibrium relationship between income and consumption (see table 4.1 in the next chapter of this thesis). According to different researchers (e.g. Attanasio and Borella, 2006) the best way to describe both series is by past values of themselves plus an innovation term, that is, they follow a *martingale*.

Based on his extensive analysis of household consumption, Deaton (2000) argues that when the measurement of living standards is concerned, questions about total expenditure are unlikely to provoke accurate responses, and the disaggregation by consumption categories strategy is necessary in order to obtain satisfactory estimates.

In the same line the Aguiar and Hurst, (2005) argue that worker related expenditure (i.e. transport to and from work, canteen meals and business clothing) are expected to decrease after retirement as it is no longer needed. Meanwhile, Aguila et al. (2010) found that the decline in food expenditure is compensated by increases in non-food items, so that [consumption] total is roughly constant.

Chitnis and Hunt (2011) found that certain non-economic factors (i.e. socio-demographic, or geographical) do have higher explanatory power than the economic ones in terms of explaining the level of expenditure on certain consumption components such as housing, communication, health, or education.

According to Deaton and Paxson (1994) if income has a unit root then the cross-section of consumption increases over time. However, the authors continue to explain that as [income] innovations accumulate “the cross-sectional distribution of consumption fans out with age”.

Similarly, Battistin et al. (2009) analysed household income and consumption over a period of over 20 years—1980 to 2003—in the USA and the UK. They found that the cross-

sectional distribution of consumption follows a log normal distribution[14]. That means the "(log) consumption is given by past (log) consumption plus a term that reflects an innovation to permanent income". Implying that consumption should be closer to log normal than income for "demographically homogeneous groups".

Empirical evidence does not present a coherent picture of consumption patterns when households are subject to income variation due to seasonal income or discontinuous payment. Precautionary savings and liquidity constraints have been offered as an explanation for income variations (Jappelli et al., 1998). However, despite the savings motive or how constraint households are, different researchers have obtained contrasting results as is explained next.

Stephens and Unayama (2011) test the relationship between the timing of income payments and household consumption for pensioners in Japan who received their pensions paid quarterly. They found that consumption increased upon benefit receipt—by about 4 per cent—and to significantly decline until the next payment was due.

After reviewing available literature[15], Gourinchas and Parker (2002) reached a similar conclusion by observing that "at lower frequencies consumption tracks expected and unexpected income changes across groups of householders".

On the other hand, Paxson (1993) found no such consumption pattern differences for Thai households with "strikingly different seasonal income variations".

3.2.2. The consumption – wealth relationship.

Different models predict that wealth shocks affect the life-cycle pattern of household savings and consumption (e.g. Lettau and Ludvingson, 2004; Dreger and Reimers, 2006). Bostic et al. (2009) in particular found that the permanent increase in consumption in the USA can be linked to increases on either financial or housing wealth.

There is contradictory evidence about which element of wealth—financial (FW), housing (HW) or social security (SSW)—has a larger role in steering consumption. Carrol et al. (2011) have found housing wealth (HW) having a bigger effect than financial wealth (FW) in

[14] "A variable might be modelled as log-normal if it can be thought of as a multiplicative product of many independent variables" (Park and Berra, 2009). According to Clementi and Gallegati (2005) in economics 97-99% of the population has a level of income that is log-normally distributed. The median value of a log-normally distributed variable is e^{μ} and the mode is equal to $e^{\mu-\sigma^2}$.

[15] They quote the work by Lusadi (1996), Meghir and Weber (1996); and Shea (1995).

the USA. A similar conclusion was established by De Bonis and Silverstrini (2012), who analysed the effects of financial and real wealth on consumption in twelve OECD countries.

Dreger and Reimers (2009) meanwhile found similar consumption elasticity in relation to HW and FW, with FW having the edge over HW. Case et al. (2011) have found a strong effect of housing wealth upon household consumption in the USA.

Based on time-series analysis, Aydede (2008) found a close relationship was found to exist between consumption and social security wealth (SSW) associated with a generous pension system in Turkey.

Empirical research on consumption in developing nations is not as abundant according to different researchers (Aydede, 2008; Castillo and Herrera, 2005). A relevant piece of research is the work by Ghatak (1998) who analysed the aggregate consumption function for India during most of the twentieth century (1919-1986). Following an ECM, the conclusion was that 'temporary increases in income were likely to be consumed wholly', with the short-run marginal propensity to consume being larger (0.907) than in the long-run (0.827).

The work by Khan et al. (1998), Vasilev (2015), and Altunc and Aydin (2014) are good examples of research on consumption being conducted on the developing world. Altunc and Aydin (2014) used an ECM to determine the elasticity of consumption for seven Asian nations, showing that an increase of 1% in income is related with an increase of 0.624% in consumption. Meanwhile, Vasilev (2015) found that in Bulgarian households 'behave in a Keynesian way, basing their consumption decisions in current income'.

For the specific case of Mexico, most research has been conducted pooling cross-section survey-data (e.g. Binelli and Attanasio, 2010; Attanasio and Szekely, 2004).

After the analysis of the impact of wage shocks to consumption, based on ten years of pooled cross-section non-durable household consumption data, Attanasio and Szekely (2004) found that changes in wages were the main determinant of consumption changes. Meanwhile, Ramirez-Grajeda et al.'s (2013) work based on micro-data sets of household consumption found evidence of the influence of income uncertainty and demographic factors as the main consumption determinants.

However, not much else has been found about consumption analysis in Mexico. Most of the research that exists is about the influence of monetary and fiscal policies on consumption

(e.g. Noriega, 2008; Capistran and Ramos-Francia, 2007), or about the relationship between exchange rate variations and consumption differences (Hernández, 2014; Bazdrech and Werner, 2002).

Based on the relevance of consumption for any economy, and given the specific conditions of an emergent economy, the decision was made to proceed forward with the analysis of consumption changes in Mexico without any pre-conceived consumption function model.

3.3. Research on the distribution of income and consumption.

The distribution of economic resources, and the factors determining that distribution, have been at the core of economic analysis for several years according to different researchers (e.g. Salverda et al., 2009). In the aftermath of the financial crisis of 2008 one of the most pressing social and economic issues is the inequality in both develop and developing world (Asteriou et al*.,* 2014; Krugman, 2014). Increasing inequality has a major economic effect as it affects a society's ability to convert income into welfare (Herzer and Vollmer, 2012).

Extensive empirical work has been conducted on explaining the consequences, the challenges and more appropriate ways to measure inequality (Jenkins and Van Kerm, 2009). Inequality is regarded as a complex, self-reinforcing and self-sustaining phenomenon (Salverda et al*.*, 2009; Welch, 1999). Likewise, extensive research had studied the main drivers of consumption and the impact of income differences due to income inequality (e.g. De Bonis and Silverstrini, 2012; Nuñez and Tartakowsky, 2011) and economic shocks (e.g. De Nardi et al., 2011).

Deininger and Squire (1998) explain the inconsistency about the negative implications of inequality on economic growth, as inequality reduces income growth for the poor, but not for the wealthy. The level of income, wealth and consumption, as well as their respective dynamics, is of high importance to evaluate the quality of life in modern societies (Burkhauser and Couch, 2011).

Different researchers (e.g. Ferreira and Ravallion, 2009; Daudey and Garcia Peñalosa, 2007) have devoted time to understand the factors influencing the distribution of economic resources.

Some researchers have linked inequality with negative elements. Asteriou (2014) found inequality positively linked to poverty in general. Fajnzylber et al. (2002) found a positive and significant relationship between inequality with homicide and robbery with a long lagging effect[16]. Galor and Zeira (1993) found inequality to have an effect in decreasing the average level of human capital as well as having a negative effect with health, even if some contradictory evidence exists as discussed by Leigh et al. (2009).

Inequality has been linked with other economic and development of factors such as technological change, education, employment, and health[17] (Wilkinson, 1997; Stuckler et al., 2010).

Empirical evidence obtained by researchers about inequality in different countries (e.g. Jin et al., 2011; Brandolini and Smeeding, 2009) has shown how higher levels of income inequality have had negative consequences for everyone in terms of consumption, but mainly for the poorer and the old.

According to Atkinson and Bourguignon (2007) the difference in income at the individual level is a response to the differences on individual's endowed productive abilities and effort resulting on different levels of both economic productivity and contribution. The relevance of studying and analysing income is in part due to the differences in the distribution of wealth and its implications for an economy (Salverda et al., 2009).

The same Salverda et al. (2009) explain how income inequality has received more attention as emergent economies have been able to outpace the level of growth in the developed world. After World War II, the authors explain, a 'dramatic widening in the dispersion of wages' in the developed world gave rise to sustained interest and research into why this was happening.

Interest in distributional issues picked up during the 1990s when income inequality increased in most of the developed world as the returns to experience and education grew, leaving the college uneducated, and young more vulnerable (Gottschalk and Smeeding, 1997).

[16] 17 years is what Fajnzylber et al. (2002) found the lagging effect to be between inequality and violent crime.
[17] There is an increasing amount of research (Rostila et al., 2012; Aittomaki et al., 2014) showing that the relationship is due to the lower-income level of poorer households that unable to pay for medicines and treatment end up in poor health, rather than a consequence of higher inequality itself.

Changes in demand for a better trained/skilled workforce, in the bargaining power of unions, in industrial structure, increases in foreign trade, immigration, and even women entering the job force have been identified as the causes of inequality (Blau, 2016).

Most research about inequality has revolved around the relationship between inequality and growth. Some authors (e.g. Alesina and Rodrik, 1994) have found such a relationship to be a negative one. While researchers such as Galor and Moav (2004), Chambers and Krauze, (2010) or Becker (2000) have established that inequality helps promote growth at initial stages as the resources are channelled to those better equipped to produced growth, whether in the form of physical resources or human wealth.

Barro (2000) analysed economic development in a panel of countries; the author found the relationship between inequality and growth to be "little". However, a significant and negative relationship was found to exist between inequality and growth for low-income nations and a positive one for high-income countries.

Houle (2018) conducted an empirical analysis aimed at resolving the controversy on whether or not inequality hampers economic development. The conclusion was that while inequality does not affect the democratization process, it reduces the survival likelihood of democracy once established.

It is important to emphasize than inequality is not a measure of poverty, even if the two phenomena are related. There is empirical evidence of poverty affecting health (Case and Paxton, 2006). As explained by Leigh et al. (2009), we can *almost* be sure poverty and health are negatively related as the existence of a link between inequality and health is not as strong, particularly in the richer world. However, an egalitarian distribution of income will be expected to translate into better health for society as a whole, given the non-linear relationship between income and health.

Voitchovsky (2009) conducted a literature review of empirical research about the relationship between growth and inequality. The conclusion was that there is a complex and multi-dimensional effect of inequality on growth as the evidence indicates widely divergent effects of inequality on growth.

> "…most of the positive mechanisms [of growth] can be linked to inequality at the top end of the distribution, while many detrimental effects can be traced to bottom-end inequality".

Salverda et al. (2009) contend that an important failure about research on inequality is the inability to analytically link the personal and functional distribution of income. The functional distribution of income and its relation with inequality *does* matter to people, contends Glyn (2009).

After comparing the level of inequality in the high-income nations, and some of the middle-income economies, Brandolini and Smeeding (2009) concluded that changes in inequality show *rather irregular movements* as changes tend to concentrate over a shorter period—ten years—of time. They have found only one nation—France—where the Gini index of disposable income was better in 2005 compared to 1965. Nations such as the Netherlands, Canada, Sweden, West Germany and Finland show a moderate increase in inequality. Meanwhile the UK and the USA had significantly larger levels of income inequality.

Although, no consensus exists on whether inequality affects growth "positively, negatively, or at all" throughout the different stages of growth (Herzer and Vollmer, 2012; Voitchovsky, 2005). A negative link between inequality and growth has been found to exist once nations and regions achieve a certain degree of development (Persson and Tabellini, 1994). Denzinger and Squire (1998) explain this inconsistency stating that inequality reduces income growth for the poor, but not for the wealthy. In addition to the economic constraints imposed by income inequality on the worst-off, inequality has been found to be associated with social consequences such as higher levels of bankruptcy and incidence of divorce (Frank et al., 2005).

Underdeveloped countries are far more *unjust* in income terms (Campano and Salvatore, 2006). There are implications and consequences of such income inequalities as it encompasses a variety of other phenomena ranging from "health status and life expectancy, crime and community breakdown, political power, and temporal patterns of income and poverty mobility, to intergenerational immobility and the transmission of poverty from one generation to the next" (Salverda *et al*, 2009).

Out of the different emerging economies, the case of China stands out as the most impressive one. The growth levels China has achieved during the last decade, although residing over the most recent years, has been paired with relatively low consumption and high saving rate coupled with larger income inequality levels (Jin et al., 2011; Sun and Wang, 2013).

According to Xie and Zhou (2014), income inequality in China is among the highest in the world, especially in comparison to countries with comparable or higher living standards.

Jin et al. (2011) analysed the Chinese urban household survey from 1997 to 2006. They found that rapid increase in income inequality along wide variations in inequality across regions had a negative effect on consumption rate. Their main finding was that the urban Gini coefficient rose from 0.23 in 1997 to 0.29 in 2009 on average. With the average propensity to consume (APC) declining by 2.54%.

Inequality, meanwhile, has been found to be reducing in Latin-American nations[18] with an average yearly decline in inequality of 1.1 per cent (Lopez-Calva and Lustig, 2010). One of these cases is Mexico's where a decrease in "the earnings gap between skilled and low-skilled workers and an increase in government transfers to the poor" were the main factor leading to inequality reduction (Lopez-Calva and Lustig, 2010).

As it will be analysed in the third chapter of empirical work—chapter six—and already referred in the introductory chapter of this thesis. Mexico has experienced some level of improvement in terms of inequality, while consumption per capita has been increasing. These two factors gave rise to one of the questions this research aims to find an answer to.

3.3.1. Literature review on consumption inequality.

Jenkings and Van Kerm (2009) explain how, under the welfarist approach, consumption rather than income is considered a more appropriate measure for distributional analysis as consumption is what enters an individual's utility function. However, they explain, income captures best the level of inequality. A *miserly millionaire* might have low levels of consumption, but be rich regardless.

The connection between income and consumption inequality has been established by different researchers. In particular, Huggett et al. (2011) have identified that variations in income—mainly due to initial conditions in human capital rather than income shocks—do explain most of the consumption variance along the life cycle. A conclusion also found on different studies (e.g. Deaton and Paxton, 1994; Slesnik and Ulker, 2005; Aguiar and Hurst, 2008).

[18] According to Grynspan (2010) over the 2000-2006 period, twelve out of seventeen Latin-American countries have experienced inequality decline since 2000. Only Honduras, Nicaragua, Costa Rica, Uruguay and Guatemala had inequality increases.

According to Palley (2010), the overall effect of increased income inequality depends on the sizes of the absolute and relative income effects. However, as people - particularly those at the lower end of the income scale – tend to spend in order to "*keep up with the Joneses*", then it is possible than the relative income effects dominate the absolute income effect, so that widened income inequality could raise aggregate consumption.

After research done on the impact of increasing income inequality in China, Sun and Wang (2013) found that in such conditions, the younger and older households have benefitted from higher levels of consumption. Chamon and Prasad (2010) reached a similar conclusion as they found the younger and the elder were the ones with higher levels of savings and, as a consequence, having different levels of consumption.

China's impressive levels of economic growth have been accompanied by an increase in income inequality that has translated into higher consumption inequality (Jin et al., 2011; Sun and Wang, 2013). Jin et al. (2011) found that household consumption is affected by 'the relative income position within a village community'.

While analysing if the relative position of households in the income distribution could be associated with consumption expenditure in Canada, Abdel-Ghany et al. (2002) found that indeed a positive and significant relationship between relative consumption and the relative place a household has in the income ladder.

Different researchers (e.g. Gründler and Kölner, 2017; Cruces et al., 2013) have highlighted the *perception/sensorial* or even an illusory dimension of inequality that goes beyond the actual fact-faced distributional element.

According to Graham et al. (2018), the two economic *success* stories of India and China have seen reduced levels of poverty, higher real-term levels of consumption and life expectancy increases—an eight years gain in life expectancy in China in over 35 years. However, at the same time, China has experienced increasing levels of suicides—among the highest in the world—and reduction in life-satisfaction.

After conducting a literature review, Houle (2018) found three main mechanisms driving the negative relationship between long-run inequality and economic development:

1. The high levels of government spending associated with electoral promises made to gain power,
2. The social unrest, reduced level of investment and growth caused by inequality, and

3. The fact market credit imperfections preclude some individuals to invest in certain assets—human capital in particular—reinforcing the inequality cycle.

More critically, Andrews and Leigh (2009) have found evidence of a negative relationship between inequality and intergenerational social mobility. Highlighting the reinforcing element inequality has, and the perpetuation effect[19] it could have for people sitting at different stages of the income scale and for nations suffering from its effects.

As explained by Glyn (2011), employees' sense of fairness is offended when their employer's profits rise much faster than their wages'. While analysing cohort-level consumption inequality in Canada using pooled micro household survey data, Crossley and Pendakur (2002) found that increases in lifetime wealth result in a proportionate increase over the life-cycle consumption profile.

According to Nolan and Marx (2009), current income does not necessarily reflect the impact of savings, debt or previous spending. Therefore, in the way to understand inequality, the two variables most commonly studied are household income and household consumption. According to Brandolini and Smeeding (2009) "if one is interested in *deep-seated long-run inequality*, permanent income, and hence consumption is what matters".

As it will be analysed in the third chapter of empirical work—chapter six—and already referred in the introductory chapter of this thesis. Mexico has experienced some level of improvement in terms of inequality, while consumption per capita has been increasing.

3.4. Research gap.

The literature reviewed allows the identification of a few general trends. There is enough empirical evidence identifying the relationship between income and consumption. Other economic variables have also been identified as consumption determinants; wealth, probably the most relevant. However, which of the different wealth component has prominence is not necessarily clear, at least not in all cases.

It has been found how according to some researchers (e.g. Chitnis and Hunt, 2011) variables others than income—demographic and geographical variables mainly—have an

[19] Houle (2018) refers to this phenomenon as the "*Great Gatsby"* curve, where 'the lack of opportunities for social mobility leads to an inefficient allocation of resources, and reduces incentives to invest and work'.

influence in driving consumption. Such finding opens the possibility for further analysis about the determinants of consumption in the context of a country such as Mexico. Where almost constant increases in consumption have occurred over the best part of the last 60 years.

Mexico has undergone an economic transition process, moving from an import-substitution policy during the 1970s to become one of the nations with the largest number of free trade agreements. Based on the previous elements, the researcher found there was a gap in understanding what elements of public economic policy, or any other economic variables, or even demographic ones, have had a role in explaining consumption

The literature review has revealed how a stream of research on consumption has focused on two issues in particular: the distributional differences of consumption and its changes over the life-cycle. Ample empirical research exists to support the idea associated with the life-cycle model or the permanent income hypothesis, explain that economic agents spend their income considering a long-term pattern, knowing that although income does fluctuate over the life-cycle consumers act in a way that they are able to save enough resources to be spent once income reduces.

Even though the empirical research about the reduction in consumption after retirement is not as abundant; there is enough support to the so-called *consumption-puzzle* explaining how consumption does drop after retirement. Such empirical controversy allows to figure out that there is not a consistent picture of the life-cycle consumption profile.

Demographic and geographical differences have been offered as a way reconcile consumption differences. Most of the empirical evidence reviewed has been conducted in the context of developed economies and not as much about the specific context of developing economies.

Most of the research about consumption in the developing world tends to be associated with macro-economic data analysis, mainly in terms of time series analysis. The analysis of cross-sectional data analysis of consumption does exist for many developing economies. However, as it will be discussed in the fifth and sixth chapters of this thesis, most tend to centre around the evolution of consumption and changes in certain consumption categories.

However, not much empirical research was found to exist about the life-cycle and distributional differences in consumption in the developing world; and only a handful was found to be about the specific case of Mexico. This finding made the researcher wonder how the increasing levels of consumption, at the macro-economic level, have been shared at the micro-level in Mexico.

The fact that Mexico has been undergoing a dual transitional process—economic and demographic—in addition to the lack of empirical research highlighted before—the distributional differences of consumption—justifies, in the main of the researcher, the relevance of the research project described herein.

There is an agreement in the economics literature about the relevance of studying and understanding the evolution of inequality in the developing world. Particularly so as most of those nations have been experiencing higher levels of economic growth, at least in terms of GDP expansion. While conducting the literature review about empirical research on consumption in developing countries, the issue of inequality was found to be an area receiving particular attention.

The previous chapter has highlighted that Mexico, like many other Latin-American nations, has seen small improvements in terms of income inequality. Those changes are associated with the improvements in welfare and the creation of a safety-net for the poorer most (Lustig and Lopez-Calva, 2009). In some cases, inequality has reduced as a result of the losses suffered by the richer-most after the financial crisis of 2008-09 (Cortes, 2013).

The literature review revealed an array of empirical research conducted in China (e.g. Jin et al. 2011) showing how the impressive level of economic expansion has led to increasing levels of income inequality which has been married to consumption inequality. Given the fact, income inequality has experienced small reductions in Mexico. At the same time, the economy has kept expanding - even if modestly - open the opportunity to enquire what the situation is in Mexico. A gap in the literature has been found to exist related with the need to understand better the specific context of an economy which has, with some degree of success, been able to integrate to the global economy.

Those three gaps identified are defined as:

a) the identification of the determinants of consumption in Mexico, whether economic or otherwise.
b) if the benefits of macroeconomic consumption expansion have been felt similarly by different cohorts of the population.
c) if consumption inequality in Mexico has tracked the changes in income inequality.

Those three concerns constitute the centre of this research. The main purpose, beyond looking for an answer is to identify empirical support to improve public decision making.

3.5. Conclusions.

Historically consumption levels have been closely related to income. Given the widely accepted idea that both income and consumption represent an important measure of living standards, the main source of academic controversy and research has been found to revolve around how much consumption changes along the life-cycle and how much it changes with income shocks.

Existent research on consumption has been found to be dominated by two main approaches: The Life-cycle Model and its associated Permanent Income Hypothesis (LCM/PIH), and the *consumption puzzle* associated with the hump-shape profile of consumption over the life-cycle.

The basic concept around the consumption function is how close income and consumption move together. Keynes' seminal idea states that aggregate consumption is a positive but diminishing function of aggregate income.

The empirical evidence not always conform with the LCM/PIH giving rise to the so call consumption puzzle, indicating that a large drop has been found to exist once individual approach retirement age.

Other researchers have given an account of the "excess sensitivity of consumption to income while other have found that consumption and income track each other over the life-cycle contradicting the main tenants of both LCM and PIH and confirming to Keynes's.

The literature reviewed revealed different studies *explaining* why consumption smoothing is not always found in empirical studies. They range from the idea that consumers do not smooth consumption but the utility of consumption, suggesting that those who argue against consumption smoothing are looking at the wrong place.

A second explanation offered is that the drop in total non-durable consumption found after retirement disappears when leisure is considered. Once that correction is considered, then consumption behaves in agreement with the prediction of the life cycle theory.

The third stream of LCM/PIH proponents suggests that consumption drops after retirement because retirees enjoy more time to shop more efficiently and also that they no longer spend in clothing and transportation for work and so, if those elements are considered then consumption smoothing was found to exist.

The literature reviewed allow to identify that research at the macroeconomic level there is an array of research pointing in the direction of the cointegrating nature between income and consumption.

Extensive research was identified around income inequality and consumption, with the relationship between income and consumption inequality varying with individual needs, household composition, and age.

While reviewing the existing literature on the relationship between consumption and wealth, contradictory evidence was found about which element of wealth has a higher effect on driving consumption. Such inconclusive evidence regarding the relationship between wealth and consumption opens the door for further analysis which this thesis aims to understand.

A relevant finding has been the suggestion that there are factors other than the economic ones, having a higher explanatory power for explaining expenditure levels at the macroeconomic level.

The literature reviewed presents the argument that while consumption may provide a better measure of material well-being than income, and also that the relative level of income in relation to that of others—peer-inequality—has a strong implication for the consumption and savings decisions of individuals and households.

The previous findings represent the theoretical backbone of the research project undertaken herein. The literature review stage could be concluded by arguing that most of the empirical

evidence indicates the close relationship between income and consumption at the macroeconomic level, while the evidence at the micro level suggests the is an ongoing debate about the profile of consumption over the life cycle and over the income distribution with multiple factors, not only the economic ones, driving consumption.

Three specific gaps in the literature have been found to exist: which economic, or demographic variables, have had an influence in driving consumption? How have the benefits of consumption been distributed in Mexico? Is the case that the improvements in income inequality have translated in consumption inequality improvements?

Those are the questions this piece of research aims to find an answer to.

4. Macroeconomic time series analysis.

4.1. Introduction.

This chapter presents the time-series analysis of consumption in Mexico over 57 years—1960 to 2016. Different researchers (i.e. Fisher et al., 2013) contend that consumption is not *only* conditioned by income. Different researchers (e.g. Hendry, 2013) have identified variables of objective nature such as the interest rate, and others of subjective nature like the bequests motives, as having an influence on consumption.

Therefore, the main aim of this empirical analysis is to identify if there are any economic or demographic variables having explanatory power for the consumption increases Mexico has experienced over such period.

According to Blinder et al. (1985), the relationship between consumer spending and income 'is one of the oldest statistical regularities of macroeconomics'. The relevance of studying consumption is associated with the measurement difficulties and under-reporting found to exist while reporting income levels among household surveys. According to Deaton (1997), income tends to be wrongly measured for lower-income groups or under-reported by high income earning agents.

Consumption has been regarded as a better reflection of living standards than income (Brewer and O'Dea, 2012). Understanding what variables have contributed to the increases in consumption Mexico has experienced are of particular relevance.

The relevance of studying consumption at the macroeconomic data is highlighted by Fernandez-Curegedo (2004) who states that the cointegrating nature of consumption and income create the need to have different ways to understand and analyse macroeconomic data. A problem solved through the formalisation of the cointegration and error correction analysis. This latter econometric procedure allowed economists to establish a clear distinction between long-run and short-run (dynamic) statistical relationships between economic variables.

The second chapter of this thesis has illustrated how the country has experienced years of macroeconomic stability characterised by increased levels of foreign investment, low inflation and higher exports. Long gone seem the days of an inflation rate of 160% the

country had around the mid-1980s or the recurrent currency crises associated with the balance of payments deficits created by *exuberant* government spending and irresponsible monetary policies (Schettino, 2018a). Over the past fifty-plus years increases in real terms consumption levels have been coupled with improvement in terms of income and higher levels of wealth, a feature not necessarily common in today's world characterized by increasing inequality (Tcherneva, 2014; Stiglitz, 2013).

Given all these economic changes, it is valid to ask and enquire if it is possible any of these variables could be associated with consumption changes? At the same time, the country is undergoing a demographic transition—lower fertility rates, increased life expectancies, smaller households—could any of them have a relationship with consumption?

The literature review has revealed how different researchers (e.g. Chitnis and Hunt, 2011) have found a significant relationship exists between factors other than the economic ones. This piece of research aims to analyse the specific context of a developing economy where, as already stated, real-terms consumption per capita basis has been increasing on a permanent basis.

This chapter of empirical analysis aims to discover if economic variables other than income or any other non-economic variables have had any role in steering consumption in Mexico over the last half a century. The use of standard economic time-series analysis—cointegration and error correction model techniques—is at the core of this chapter.

The literature review stage of this thesis has revealed that consumption is closely related with different economic variables being income the most preeminent one, with variables such as wealth or the interest rate having some explanatory power over consumption. However, while the empirical evidence obtained by some researchers (e.g. Attanasio and Low, 2004) indicates a negative and significant relationship between consumption and real interest rate, other researchers (e.g. Campbell and Mankiw, 1989) have found no association between both variables.

In order to identify what research has been performed about consumption using time series analysis, the decision was made to include the empirical literature in this part of the thesis.

The idea was to identify a potential econometric specification form for this analysis, as well as some of the relevant variables to be included as regressors.

4.2. Literature review on consumption time-series analysis.

In order to empirically identify the consumption determinants, the first decision was to define which variables should be part of the econometric model of consumption. Table 4.1 present a review of different time-series studies of consumption.

Table 4. 1. A selection of data series analysis. Model selection, time-series period, frequency of data (y: yearly; q: quarterly), independent variables, and statistical procedure used.

Authors	Year	Dependent variable	Time period	f	Independent variables	Procedure
Khan et al.	2015	Log Ct (4)	1971-2013	y	Disposable income proxy by GDP; lags of consumption (C) and income (Y)	OLS
Vasilev	2015	Log Ct	1997-2005	q	Ln Income (GDP); Wealth; Lags (Ct, Yt)	ECM (1)
Altunc and Aydin	2014	Log Ct (4)	1980-2010	y	Ln income, Lags (Ct, Yt)	ARDL
Jansen	2013	Log Ct (5)	1971-2008	q	Income (Y), Wealth, Age composition, Real interest rate, Lags (Ct)	VAR, ECM
Lutig et al.	2013	Ct per capita	1952-2011	q	Income from labour (YL), interest rate	VAR
Fisher et al.	2012	Log Ct per capita (2)	1953-2010	q	Labour income; household net wealth	ECM
Fisher et al.	2010	Log Ct (3)	1976-2008	q	Income labour; Wealth (financial and non-financial); Wealth ratios to total wealth (Hu/W, HW/W, FW/W)	ECM
Ferreira et al.	2009	Ct per capita	1970-2003	y	Savings per capita, population growth, per-capita wealth.	OLS
Aydede	2008	Log Ct	1970-2003	y	Net disposable income; the wealth components; M2; unemployment rate; labour force participation rate; interest rate; inflation; old and young ratio.	ARDL
Brady	2008	Log Ct (6)	1959-2005	q	Log Y (real disposable income); r (T-bills 3-months moving average), credit.	2SLS
Attanasio and Borella	2006	Log Ct (2)	1974-2000	q (3)	Disposable income, interest rate (T-bills).	MA (Ct), OLS
Mantilla-Garcia et al	2006	Log Ct per capita	1948-1997	y	Log Y per capita (proxy by GNP), lags of C and Y	ARDL, ECM
Cutler	2005		1984-2002	y	Labour income; wealth (HW, FW), real interest rate.	ECM
Eitrheim et al	2002	Log Ct	1968-1985	q	Log Y, Log Wealth (FW and HW)	ECM
Ghatak	1998	Log Ct	1919-1986	y	Log Yt, dummies for structural breaks	ECM
Muellbauer and Murphy	1993	Log Ct total	1956-1988	y	Income (personal disposable); Δ income uncertainty; Unemployment; M2, Financial wealth, housing wealth	ECM
Molana	1991	Log Ct (2)	1966-1981	q	Ln income, Ln non-durable consumption, Ln wealth (HW, FW, M2) in constant prices, and interest rate	VAR, ECM

Notes: (1) ECM-2 step procedure; (2) Non-durable consumption; (3) Total consumption minus housing services; (4) Private consumption; (5) Consumption excluding health expenses; (6) Non-durables + housing services.

Table 4.1. (cont.) A selection of data series analysis. Model selection, time-series period, frequency of data (y: yearly; q: quarterly), independent variables, and statistical procedure used.

Campbell and Mankiw	1989	Log Ct per capita (2)	1953-1986	q	Δ personal disposable income per capita (GDP); Δ real stock prices; interest rate (average T-bills); lags (Ct, Yt), Ln C/Y ratio	IV
Engle and Granger	1987	Log Ct per capita	1947-1981	q	Δ Income per capita, liquid wealth, real interest rate, inflation, lags (Ct, Yt)	ECM
Blinder and Deaton	1985	Log Ct per capita	1954-1984	q	Income per capita, wealth, interest rates (T-bill rates), relative prices (in current and lag forms), inflation, housing wealth.	2SLS, VAR
Darby	1979	Ct	1929-1974	y	Permanent income (real private-sector income adjusted for the imputed yield on the stock of consumer' durable goods), Transitory income (Y - YP), M2, Stock of Consumer's durables, Price durables, Price of non-durables, Interest rate, Social security wealth.	OLS
Davidson *et al*	1978	Log Ct (2)	1958-1975	q	ΔPersonal disposable; price deflator; time-Dummies; Lags (Ct, Yt)	2SLS, ECM
Feldstein	1974	Ct per capita	1929-1971	y	Income (permanent disposable income); Wealth (excluding SSW); Unemployment; Savings rate	OLS

Notes: (1) ECM-2 step procedure; (2) Non-durable consumption; (3) Total consumption minus housing services; (4) Private consumption; (5) Consumption excluding health expenses; (6) Non-durables + housing services.

A summary of the studies surveyed is that:

- Income and consumption are cointegrated.
- Both income and consumption tend to follow a *martingale*.
- Variables such as wealth, the interest rate, and savings do play a role in explaining consumption changes.

Based on the previous elements, the literature review proceeded to review different studies where the cointegrated nature between income and consumption was undertaken. Table 4.2 presents a summary of the conclusions on them.

Among the empirical studies in consumption, as stated in the literature review sections of this thesis, a breakthrough in terms of consumption modelling was the error correction model approach of Davidson et al. (1978). The authors performed a dynamic time-series model of consumption, based on the long-run equilibrium between income and consumption, trying to understand why the use of almost similar time-series produced results that were different and not consistent.

Table 4. 2. Summary of main findings in a group of different research papers about the consumption function.

Author(s)	Findings
Fisher et al. *(*2012)	Concluded that shocks to wealth have only transitory effects for consumption.
Khan et al. (2015)	After analysing consumption in a number of developing nations in the Indian subcontinent found that in the short runs it is difficult for households to predict their permanent income. In the case of Nepal, the marginal propensities to consume were found to be higher in the short and as well long run. Consumption was found to be consistent with Keynes' absolute income hypothesis.
Jansen (2013)	Found that a consumption function including wealth effects in both, the short and long run, explain the changes in quarterly consumption over the years 2006-2008 better than Euler based equations and also better than an alternative consumption function without long-run wealth effects.
	The wealth effects were shown to be strong enough to lift the savings rate considerably and to counteract the expansive effects of a low-interest rate, which both has a positive direct effect on consumption and an indirect effect via a marked increase in real disposable income for the household sector.
Attanasio and Borella (2006)	Lag values of income and consumption and the real interest rate were found to be statistically significant.
Molana (1991)	Wealth was found to be a better descriptor of consumption than income.
Campbell and Mankiw (1989)	Found no correlation between the *ex-ante* real interest rate and expected changes in consumption.
Engle and Granger (1987); Hendry and von Ungern-Sternberg (1994)	They concluded that consumption and income are cointegrated. Wages and prices changes were not found to be able to statistically explain consumption changes. In contrast, short- and long-term interest rates were.
Altunc and Aydin (2014)	Found the elasticity of consumption to income to be 0.624%
Davidson et al. (1978)	Found evidence of interest rate influencing consumers' expenditure/savings decisions.
Vasilev (2015)	They identified how the 2008 financial crisis obliterated savings and reduced consumption.
Fisher et al. *(*2010)	Investigated the effects on non-housing consumption to permanent and transitory changes in financial and non-financial housing wealth.
	They conclude that up to 2004, transitory changes in wealth are not associated with any significant response in consumption. When post-2004 data were included in the estimation, there was evidence that household consumption responds to recent transitory rises in wealth and labour income.
Aydede (2008)	Showed how generous pension scheme in Turkey reduces savings, and have a positive effect on steering consumption. The author concludes that people who are entitled to some sort of social security payments in the future may prefer to consume more today and save less for their retirement. The main argument is that if public social security is unfunded (pay-as-you-go--PAYS), this decrease in personal savings may even reduce national savings further.

Table 4.2. (cont.) Summary of main findings in a group of different research papers about the consumption function.

Blinder and Deaton (1985)	Reject the hypothesis that only income innovations mater for consumption.
	The steady-state elasticity of consumption to income was found to be around 0.88.
	The unit-root was rejected at 10%, but not at 5% level of significance. In contrast, the time trend was found to be statistically significant.
	A 1% rise in general prices relative to the price of non-durables reduces annual consumption growth by 0.9%. A 1 percentage point rise in the interest rate will decrease consumption by 2.3%, but only in nominal terms.
Ghatak (1998)	Analysed the aggregate consumption function for India (1919-1986). Following an ECM, concluded that "temporary increases in income were likely to be consumed wholly". Identified the short-run marginal propensity to consume (MPC) to be larger, at 0.907, than the 0.827 long-run MPC.
Caroll and Summers (1991)	Found how even under uncertainty, the interest rate is a sufficient statistic to predict consumption growth.
	The results using measures of income growth over long past periods suggest a near one-to-one relationship between expected income and consumption growth. Expected future income growth is clearly correlated with past income growth (follow a *martingale).*

The authors (Davidson et al*.,* 1978) based their analysis on a consumption function as defined in (4.1):

$$\Delta \text{ Ln } C_t = \beta_0 + \beta_1 \Delta \text{ Ln } Y_t + \beta_2 \Delta \text{ Ln } Y_{t-1} + \varepsilon_t \qquad (4.1)$$

Although their main recommendation was that an overarching consumption model could not be found, they found evidence to suggest that growth in consumption was a function of present and lagged values of growth of income, inflation, savings and consumption itself.

Evaluating the merit of Davidson et al*.* contribution, Hendry (2013, pp.233) stated that:

'The widespread use of Davidson's et al*.* model… generate a greater understanding of both the terminology and the conceptual basis of many recent modelling ideas. [However] how one should or even could obtain useful empirical models is not obvious'.

Another commonly referred piece of research in time-series analysis of consumption is the work conducted by Blinder and Deaton (1985), who analysed quarterly changes in per capita consumption expenditure of nondurables (C) over the 1954 to1984 period. Using per capita income (Y), wealth, interest rates, relative prices and inflation as in (4.2):

$$\Delta C_t = \beta_0 + \beta_1 C_{t-1} + \beta_2 Y_{t-1} + \delta q_t + Z_{t-1} Y + \varepsilon_t \qquad (4.2)$$

The q variables represented 'contemporaneously dated variables like wealth, inflation, and relative prices. With the Z_{t-1} variable being the lagged values of the macroeconomic (q) variables plus a time trend.

Blinder and Deaton's main conclusion was that income innovations were found to have a statistically significant effect on consumption changes. They also found that the real interest rate was not statistically significant and, to the authors' surprise, the nominal interest rate was found to have a negative and significant effect. The rise in the price of non-durables relative to general prices had a negative and significant effect on consumption. Meanwhile, tax increases were not found to have a significant effect.

The cointegration relationship between income and consumption is among the better-documented regularities in the literature (e.g. Johansen, 2007), according to those studies when wealth is added into the mix the three variables—consumption, income and wealth—have been found to be difference stationary—or I(1)—which has allowed to conclude that there exists one equilibrium relationship between consumption, income and wealth as shown by Engle and Granger's influential work (see Engle and Granger, 1987).

There have been several papers studying the long-run equilibrium condition of consumption, income, and wealth. Different arguments having the most relevant to the context of this research are summarized in table 4.3. They offered an idea of the preferred specification that could be adopted to analyse the determinants of consumption in Mexico over time.

One highly relevant finding among those studies is the work by Fernandez-Corugedo et al. (2003). They explain that, after the seminal work by Davidson et al. (1978), the consumption function could be estimated through, either the error corrections mechanisms (ECMs) or the Euler equation. The latter being more suitable for testing theories, with the ECMs designed to answer questions 'primarily about the role of different variables in the consumption function'.

The same authors suggest that based on empirical evidence, the idea that 'consumption reacts to expect future events transforms our understanding of the wealth, income, and consumption relationship'.

Author(s)	Year	Adjusting variable	Findings	Country
Lettau and Ludvinson	2005	Wealth	Whenever consumption and wealth are in disequilibrium–deviate from each other–wealth adjust to maintain their common trend. That is, disequilibria tend to be corrected via changes in wealth, and not in consumption.	USA
Ruud and Wheland	2006	Wealth and income	If consumption is too high, either income or wealth might adjust, not just wealth as suggested by Lettau and Ludvinson (2005).	USA
Hamburg et al.	2008	Income	Income rather than wealth adjust over time to correct consumption deviation from equilibrium.	Germany
Fisher et al.	2012	Wealth and income	Found no short-run effect pre-2004, but an adjustment effect was found to exist for post-2004 data.	USA
Jansen	2013	Wealth	Wealth changes could lift the savings rate considerably and can counteract the expansive effect of a low-interest rate.	Norway
Barrel et al.	2009	Consumption	Removal of liquidity constraints reduces the response of consumption to real disposable income and boosts the wealth effect.	US, UK, GER, FRA, CAN, JAP
Fernandez-Corugedo and Muellbauer	2006	Wealth and income	Omitting the effect of credit exaggerates the effect of wealth and undermines the effect of income.	USA
Fernandez-Corugedo et al.	2003	Consumption	After constructing a model related with durable and non-durable consumption, they found one cointegration relationship where the adjustment towards the long-run common trend occurred partly via changes in wealth.	UK

Table 4. 3. Research on cointegration relationship between consumption, wealth, and income. Based on Jensen (2013)

This argument made the prospect of the ECMs an appealing option while trying to understand the impact of different socio-economic variables in driving consumption in Mexico.

As revealed during the literature review stage of this thesis, most of the research conducted on the consumption function was found to be based in the developed world. However, there is an array of research about consumption in Mexico. As explained in literature review chapter (see section 3.2.2), most research in the developing world has been conducted

using micro-level data. Usually analysing or pooling cross-section survey-data and macroeconomic data series have been used in order to evaluate the influence of monetary and fiscal policies on consumption (e.g. Noriega, 2008; Capistran and Ramos-Francia, 2007), or about the relationship between exchange rate variations and consumption differences (Hernández, 2014; Bazdrech and Werner, 2002).

4.3. Income, wealth and consumption in Mexico 1960-2016.

As it was stated in the first two chapters of this thesis that over the past three decades increased life expectancy levels and lower mortality rates are an indication of the relative levels of social progress achieved (Calderon Hinojosa, 20120. However, the country is a still a long way from eradicating poverty and reducing significantly levels of inequality conditions that act as the main determinant of violence and insecurity in the nation (Bergoglio, 2016; Binelli and Attanasio, 2010; Enamorado et al. 2014).

As shown in the introductory chapter of this thesis (see figure 1.1a), household total income per-capita and household final consumption per-capita in Mexico have increased in real terms by a factor of three over the 1960-2016 period. Such increases have occurred despite the ups-and-downs the Mexican economy has experienced.

Also, it has been shown that while in Mexico, income and consumption increases have been married with income inequality reductions over the last two decades, where the ratio of the ten to the first income decile was 32.3 in 2000, by 2016 it was recorded at 17.9.

Paradoxically, as Mexico went through serious economic hardship during the 1980s and 1990s, consumption did increase in real terms on a consistent basis for most of that period. If indeed higher consumption levels reflect higher living standards as argued by Brewer and O'Dea (2012), then it is possible to argue that there have been consistent improvements for at least parts of the Mexican population.

As referred in the previous chapter, there is a number of economic and non-economic variables with consumption explanatory power. As most of those variables were found to be available for the time period of analysis, the decision was made to analyse them visually.

Figure 4.1 shows the close relationship between the logarithmic per capita value of income and consumption. The time series does suggest the possibility of a cointegration relationship between the variables, as stated in the literature.

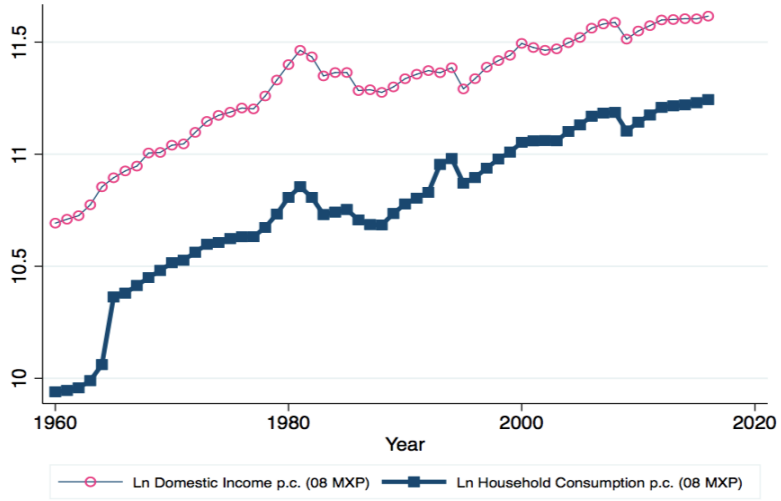

Figure 4. 1. Mexico's national expenditure per capita and income per capita 1960-2014 in 2008 pesos in natural logarithmic values. Source: Own calculations with information from WDI (2019) and INEGI (2018).

Figure 4.2 presents information on the per capita value of domestic credit to private sector, broad money, and consumption.

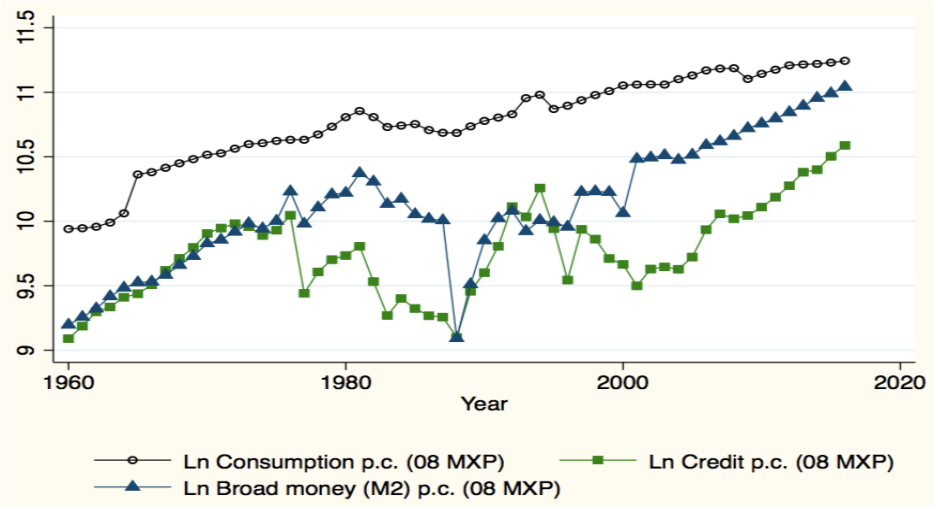

Figure 4. 2. Logarithmic value of domestic credit to the private sector, consumption expenditure and broad money on a per capita basis and in real terms 1960-2016. Source: WDI (2017)

The previous graph shows an upward trend over the period of analysis. However, during the turbulent years of the 1980s and 1990s, both credit and broad money changed in a way not resembled by the path followed by either consumption or income.

Given the fact Mexico has become a manufacturing powerhouse with increasing levels of exports (OECD, 2018a), and based on the importance remittances[20] associated with a large

[20] According to de la Fuente (2010) in 2009, 'Remittances hovered around US$21 billion'. The figures for 2018[20] saw the highest level of remittances on record after they had reduced after the financial crisis (Pew Research Center, 2019; Krogstad and Passel, 2014). However, even though Mexico is the highest remittance receiver in the Americas, they account

diaspora have for the national economy, as well as the inflow of money from oil exports (Pew, 2019; The Economist, 2012) these variables were all analysed.

The information reviewed allowed to identify that the amount of foreign direct investment (FDI)[21] for Mexico increased after the country embraced a free trade agenda which allowed the manufacturing sector—appliances, automotive, and aeronautical mainly—to blossom over the last two decades (The Economist, 2012).

Figure 4.3 presents the path followed by both of those different variables, along with the respective figures for total exports and national debt—at constant 2008 prices in national currency and on a per capita basis (pc).

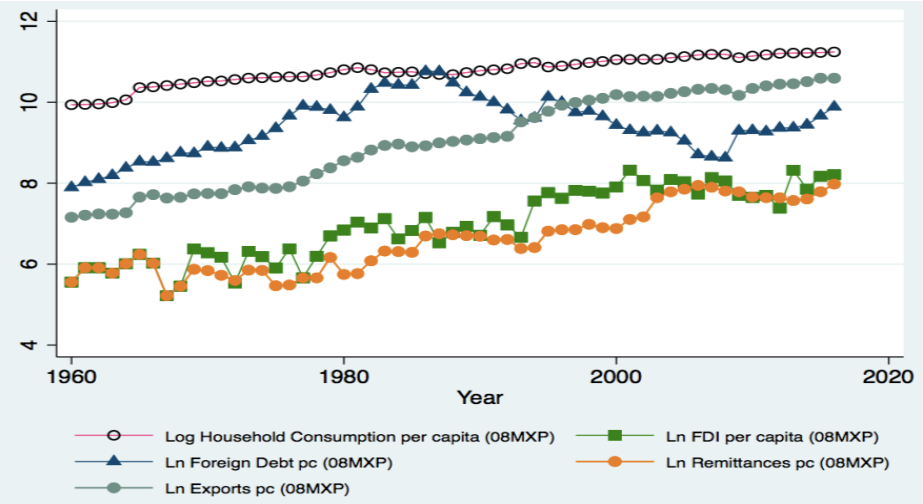

Figure 4. 3. Logarithmic value consumption expenditure, FDI, foreign debt, remittances and Mexico's exports on a per capita basis and in real terms 1960-2016. Source: WDI (2017)

The visual inspection of the data contained in figure 4.3 allows identifying how exports and remittances show a trend similar to that of consumption. FDI, despite a more erratic behaviour, have shown a positive and consistent trend over time. Meanwhile, the level of the national debt has decreased after the emergent rescue packages the country received from the World Bank and IMF in the aftermath of the *peso crisis*.

for less than 5% of Mexico's GDP (Yang, 2011). As a comparison, remittances represent as much as 20% of the Honduras' GDP. However, remittances are an important source of income for the Mexican economy and a vital source for some household in Mexico.

[21] According to Love and Lage-Hidalgo (2000) Mexico attracted throughout the 1980s about 10% of all FDI going to developing nations, and almost a quarter of all FDI going to Latin-American nations. By 2014 Mexico was the main destination for FDI in the region, 'attracting [in 2014 alone] 366 greenfield projects totalling an estimated $33bn' (Financial Times, 2015).

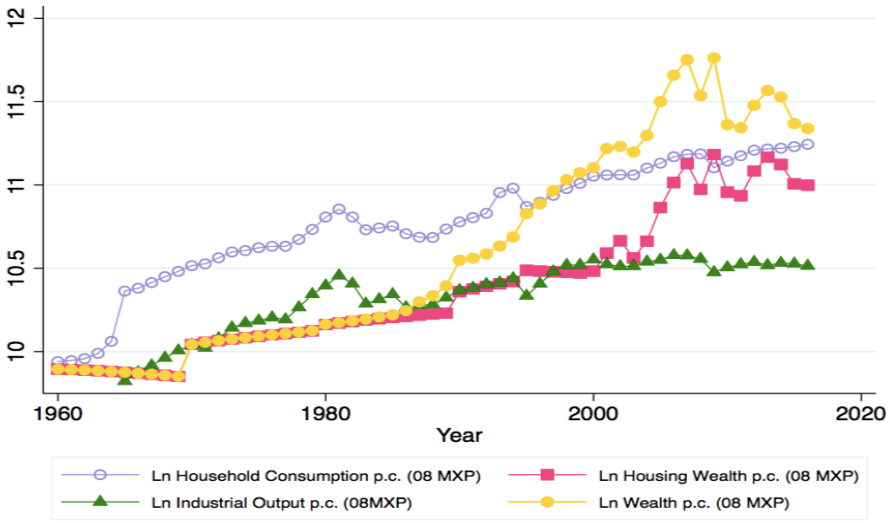

Figure 4. 4 Consumption and wealth per capita (p.c.) at constant prices in logarithmic value. Source (INEGI, 2018; INEGI, 2019; own calculations for HW-see footnote 3)

Additionally figure 4.4 presents the per capita value of industrial output, housing wealth[22] (HW) and total wealth[23] at constant prices in the logarithmic form. The visual inspection revealed that industrial output shows a trend similar to the value of consumption even though the gap between the two variables has increased over the recent years.

The value of total wealth, meanwhile, was found to have a trend similar to consumption. The relationship, however, changes once the level of financial wealth picked up. It is relevant to note that the financial markets were heavily restricted before 1982 in Mexico (Alcala et al., 2010), which is shown by the low level of financial wealth[24] before 1992.

There were others variables identified as having potential consumption explanatory power: Government spending, and the inflows of resources generated by two highly relevant industries in Mexico: tourism[25] and the national oil industry.

While the tourism industry generates over 20 billion USD per year; the national oil industry has been an important source of income for Mexico—the country is the 12th largest oil

[22] Housing wealth was determined by following Berge et al. (2007) and Cutler (2005) based on the following equation: Gross housing assets = No. of privately owned residential units × Average price per square foot × Average size of property and using data on dwellings from INEGI (2014).
[23] Total is the addition of housing wealth (HW) plus the value of financial wealth (FW).
[24] Financial wealth (FW) is given by the amount of stock and bonds value held by local residents.
[25] According to the Minister for Tourism in Mexico (Secretaría de Turismo, 2019) in 2018 tourism generated over 20 billion US dollars.

producer worldwide, with over 620 million barrels of oils per year. However, its relevance has reduced given the drop in oil prices and production[26].

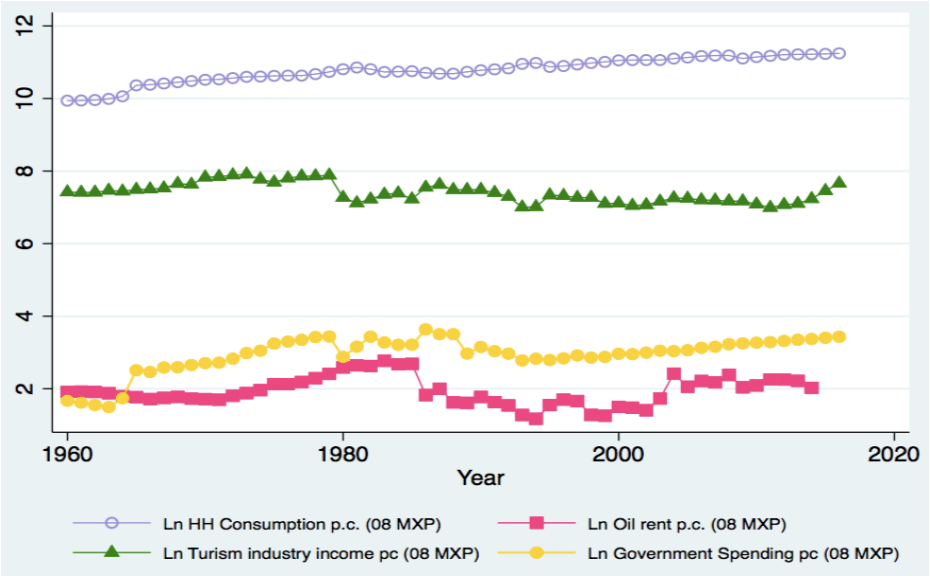

Figure 4. 5 Logarithmic value of consumption, income for the tourism and national industry and government spending per capita at constant prices. Source (WDI, 2017)

Although no variable will be discarded at this stage, none of the variables just referred—government spending and the proceeding from the oil and tourism industries—appeared not to have followed a similar trend, under visual inspection, to that of consumption (figure 4.5).

Existing literature on the consumption function has mainly analysed the regularities that exist between income, wealth and past values of consumption itself as a way to determine consumption changes. However, given the relevance of other economic variables highlighted before—remittances, FDI, income from the tourism sector, or from oil revenue, or the drastic changes in the interest rate—the decision was made to consider these different variables as all having, a potential predicting power for consumption.

The idea was to analytically inspect all the previously referred variables in order to determine the predicting power they might have for steering consumption in Mexico.

While defining the preferred specification model, the first decision to be made was the specific form—level or logarithmic—that consumption will be considered at. The canonical form of consumption defines it as a function of income and wealth. According to Attanasio

[26] During the 2003 to 2005 period, at the pick of oil prices, Mexico produced twice as much product as the country is doing today. Production was as high as 1,234 million barrels in 2004 (Pemex, 2015).

and Weber (2010), consumption can be financed through income, financial wealth or borrowing.

A positive, significant, and cointegrated relationship between both variables have been taken as given after years of empirical research using cross-section and time-series data (Battistin et al., 2009; Muellbauer, 1994; Blinder and Deaton, 1985; Hall and Mishkin, 1980; Carroll and Summers, 1991). In addition, it is commonly accepted that consumption is well defined by current and lagged levels of income, in addition to values of consumption itself. Therefore, a possible starting point could be to define consumption as an auto-regressive distributed lagged (ARDL) model.

At the microeconomic level, previous research has been conducted using households' total consumption (e.g. Carroll et al., 2014; Dynan and Cooper, 2015; Dynan, 2009). Other researchers prefer the use of per capita or per adult-equivalent levels (e.g. Aguiar and Hurst, 2013; Fisher et al., 2005). In some cases, total consumption minus some specific concepts such as education (Jin et al., 2011). Other researchers preferred the use of non-durable consumption expenditure, as it is less volatile than income (Attanasio and Weber, 2010).

At the aggregate level, the consensus is to consider consumption as the dependent variable in constant terms and on a per capita basis. Some studies have chosen to use non-durable consumption (e.g. Brady, 2008; Attanasio and Borella, 2006; Campbell and Makiw, 1989). While in other cases, total private consumption (e.g. Vasilev, 2015; Fisher et al., 2012; Cutler, 2005) was the preferred choice. In other cases, consumption has been considered at total value, but after excluding health and housing services (e.g. Jansen, 2013).

In the specific case of Jansen (2013), the health expenditure was excluded because health expenditure is exogenous as most of the health services in Norway are publicly provided. That, however, is not the case in Mexico as most people face out-of-pocket cost for medicines, even if they are entitled to public health provision.

As explained by Binelli and Attanasio (2010) after analysing consumption in Mexico, the results they obtained did not change when education and health expenditures were not considered. That is why the decision was made to use the logarithmic value of total household expenditure in constant terms. In order to understand better the explanatory potential of some of the variables just visually inspected for Mexico, the literature review stage move forward to identify often-cited research on the relationship between consumption and those variables.

- Income and consumption.

The income-consumption relationship has been subject to extensive research, as explained in the previous sections of this chapter.

However, a relevant empirical issue was the specific form income would be measured at and what variable will be an adequate measure in the definition of the consumption function at the aggregate level as the definition of disposable income can be defined in a number of ways as explained by different researchers (e.g. Aydede, 2008).

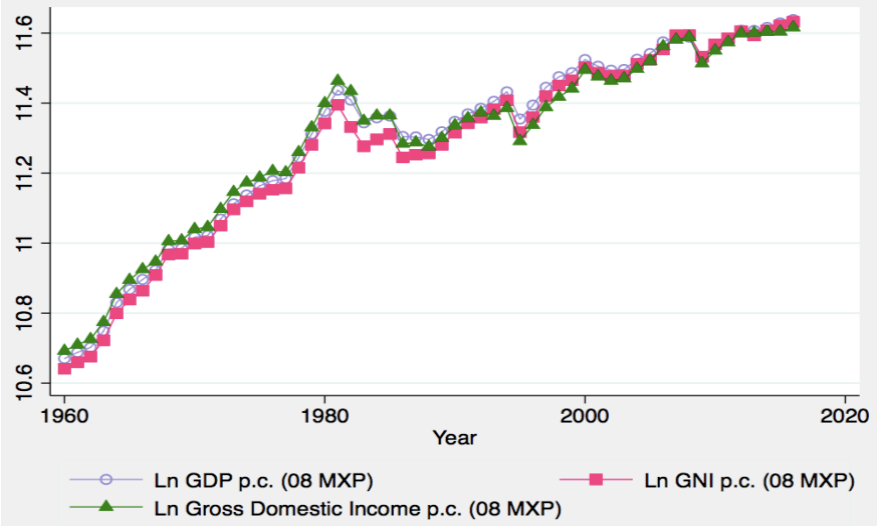

Figure 4. 6. Logarithmic value of Mexico's GDP per capita (p.c.), GNI per capita, and Gross Domestic Income at constant prices 1960-2016. Source: WDI (2015)

Some researchers (e.g. Campbell and Mankiw, 1990; Blinder and Deaton, 1985; Summers, 1982) have used GDP as a *proxy* for aggregate income, arguing that it stands adequately for permanent income. A viable alternative is the use of GNI. In Mexico's case, both GDP and GNI time-series were available for the time span of the current analysis. As an alternative, information on Gross Domestic Income[27] was also available over the period of study.

[27] GDP at purchasing price is the sum of gross value added by all resident producers in the economy. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. GNI is the sum of value added by all resident producers plus any product taxes (minus subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Income is household net adjusted disposable income determined by the amount of money that a household earns, or gains, each year after taxes and transfers. Per-capita value is obtained by dividing those values by the mean value of the country's population. All quantities are expressed in 2008 constant Mexican *pesos*.

As shown in figure 4.6, either form of output measurements has had a similar trajectory. Therefore, the decision was to use Gross Domestic Income per capita as a suitable measure of national income.

- Wealth and consumption.

According to Muellbauer (1994), assets are accumulated to provide for retirement and bequest purposes or to provide cover for a 'rainy day'. Wealth can be divided by the liquidity property of the assets, with more liquid assets—money—having a higher marginal propensity to be spent compared to illiquid ones.

In terms of the consumption function, two components of wealth have been used more regularly as consumption explanatory variables: financial wealth (money and bonds) and non-financial wealth (Fisher et al., 2012).

While empirical evidence tends to establish the positive effect of wealth on consumption (Lettau and Ludvingson, 2005; Dreger and Reimers, 2006), there is contradictory evidence about which element of wealth—financial (FW), or housing (HW)—has a higher effect on driving consumption. Carrol et al. (2011) have found HW having a bigger effect than FW in the USA. De Bonis and Silverstrini (2012) establish a similar conclusion after analysing the effects of financial and real wealth on consumption in twelve OECD countries.

On the other hand, Bassanetti and Zollino (2008) reached a different conclusion for the case of Italy, where FW was found to have a larger effect than HW. Similarly, Dreger and Reimers (2009) analysed consumption elasticity in relation to HW and FW. They concluded that consumption had higher sensitivity to FW than to HW. Case et al. (2011) found a similar effect after analysing 30 years of data for the American economy.

Lattimore (1993) found a larger marginal propensity to consume out of housing wealth over the life-cycle compared with financial wealth. Lettau and Ludvigson (2005) analysed consumption in the USA and found that much of the post-war variation in household wealth, persistent as it was, was transitory in nature eliciting little or no response in household consumption; much smaller than the estimates implied by earlier USA studies.

According to Cutler (2005), when it comes to determining the actual impact from different wealth components, there is 'a fundamental difference' between financial and housing wealth. Different researchers (e.g. Fernandez Corugedo and Muellbauer, 2006) have

recognized the effect of HW on consumption. However, the FW component is the one that has received more attention.

As an example, Hall (1978) asserted that consumption moved independently of income, but not of lagged stock prices. Brewer and O'Dea (2012) argue that only a minority of low-income receivers have positive financial assets. Meaning FW can be expected to have a different effect for certain cohorts[28] consumption level.

Lustig et al. (2013) concluded that it was the wealth effect the one explaining consumption increases during periods of abnormal wealth creation, and decreasing consumption during periods of abnormal wealth destruction. The authors found that in the USA, the average propensity to consume out of current wealth was 1.2 cents of every one dollar of wealth.

Fernandez-Corugedo and Muellbauer (2006) studied consumption and financial wealth[29] at the micro-level in Mexico using pooled cross-section data. They found the Mexican households to hold predominantly low-risk assets. They explained that the amount invested in savings accounts and government bonds increased between 1994 and 1996, but declined afterwards following a sharp increase in the interest rate on fixed investments.

Some studies (e.g. Aydede, 2008) have analysed the impact of social security wealth[30] (SSW) on consumption. Most research on the role of SSW is based on the seminal work of Feldstein (1974) who establish a positive relationship with consumption, due to the inter-generational transfer nature helping those at the end of the life-cycle.

Aydede (2010) performed a comprehensive analysis about the impact of SSW in driving consumption. While analysing the case of Turkey, the researcher found that the "generous public social security system" does translate into increases in consumption and decrease in national savings.

For the specific case of Mexico identifying and using the imputable value of SSW was not a realistic imputation for three main reasons:

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[28] According to Lustig et al. (2013) stock market wealth represents only 1% of total wealth in the US.
[29] The authors define FW as the sum of investments in fixed-rate, low-risk assets—saving accounts, government bonds—, and investments in risky assets, such as stocks and shares (Fernandez Corugedo and Muellbauer, 2006).
[30] SSW is the net present value of the future stream of money coming from a share of a representative agent's income from labour, using a number of parameters like the discount rate, the interest rate, the share of income set aside and current income.

a) Low level of penetration: In Mexico, only 20% of the population over the age of 65 receives any form of pension, with only 46% of those currently working contributing to a pension scheme (Gill et al., 2004).
b) The *unknown* future value of the DC scheme: During the 1990s Mexico reformed the pensions scheme. It changed from the *defined benefits* (DB) to a *defined contribution* (DC) scheme. With the payback stage yet to materialise, there is uncertainty about the inflows of money in an individual account system—exacerbated by the losses produced on financial investment after the financial crises. Therefore, it is highly unrealistic to think that income from pensions is an element that consumers take into account while making expenditure decisions.
c) The current pension payments. At the moment of writing this thesis, a household relying on monies coming from pensions as their only source of income will be part of the lowest income decile in the country[31]. Therefore, it will be hard to believe people in Mexico will make consumption decisions based on future *small* income streams received by current pensioners.

The previous arguments are not provided to deny any influence from SSW for consumption in Mexico. Actually, this might represent a shortcoming of the econometric analysis undertaken here. However, given the reasons referred and for the sake of simplicity, the wealth components considered in this study were HW and FW only.

- The interest rate – consumption relationship.

The negative relationship between consumption and the interest rate has been identified by different researchers (e.g. Attanasio and Low, 2004; Caroll and Summers, 1991). Hall (1978) established the marginal utility of consumption to be a function of the ratio of the interest rate to the impatient rate. With higher levels of the interest rate, influencing decisions to consume more in the future and therefore, reducing consumption today.

According to the literature reviewed, the interest rate produces a wide variation in the marginal propensity to consume (MPC). Attanasio and Low (2004) found that in the USA the MPC increased by 1.40 cents per dollar in 1981 when the real interest rate peaked in 1981 and reduced by 0.57 cents per dollar when the interest rate was as its lowest in 2010.

[31] At the moment, monthly pensions paid are just over 220 USD. Based on micro data information from the National Survey on Income and Expenditure (ENIGH) author's own calculation set the mean income of the lowest per capita income decile at 315 USD per month. Current pensions are set independently of the number of dependents the pensioner has. Confirming that those households having pensions as the only source of income are among the poorest in Mexico.

Caroll and Summers (1991) identified the real interest rate as a powerful determinant of consumption. Bilnder and Deaton (1985) found the nominal interest rate to have a significant and negative effect on consumption, while to their surprise, the real interest rate was found to be irrelevant in explaining consumption. Why nominal interest rates and not real rates were significant represents a puzzle the authors did not address. Meanwhile, after conducting a revision of the literature, Hendry (2013) found evidence for the interest rate to influence consumers' expenditure/savings decisions.

On the other hand, Muellbauer (1994) argues, in light of Hall's ideas, that the interest rate is a stochastic process, makes next period's level of consumption "almost impossible" to predict. Which means consumption is rather a martingale where current consumption equals the expectation of next period's consumption (4.3) or more generally (4.4)

$$Ln\ C_t = E\ (Ln\ C_{t+1}) \qquad (4.3)$$

$$Ln\ C_t = Ln\ C_{t-1} + \varepsilon_t \qquad (4.4)$$

Where $E\ (C_{t+1})$ is the expected value of consumption and ε_t the innovation term with a constant variance, making (4.4) consumption as a random walk.

Campbell and Mankiw (1991) argue that expected real interest rates are not associated with expected changes in consumption at the micro-level, which means that predictable movements in consumption cannot be explained as a rational response to movements in real interest rates. That is, consumers do not adjust their consumption levels in response to interest rates, making their inter-temporal elasticity of substitution in consumption close to zero.

As with other macroeconomic variables, a negative and significant effect between changes in the interest rate and consumption movements can be anticipated. However, empirical evidence does not always conform to such expectation. Which highlights the relevance of exploring the potential effect of such a variable for consumption changes in Mexico.

- Unemployment role for consumption.

Johnson (1983) found unemployment to be statistically significant relative to consumption in Australia. Muellbauer (1983) contends that unemployment is a good proxy for uncertainty about labour income, and so it should be considered as an explanatory variable in the consumption function.

While considering the unemployment rate, a relevant variable in trying to understand consumption changes in Mexico, an important warning must be placed. The official unemployment rate—at 4.35% in 2015 and 3.88 in 2016—based on international approved employment surveys determines the percentage of the working age population actively looking for a job.

Research on unemployment in Mexico has established that half of all employment exists within the *informal* or underground economic sector (Levy, 2007; Levy, 2010), which puts into question the adequacy of using the official levels of unemployment in Mexico. Nonetheless, the decision was made to consider it as a variable with potential explanatory power for consumption.

- Credit effects on consumption

Different researchers have noted the negative and statistically significant relationship between savings and consumption over the years (Muellbauer, 1994; Campbell and Schiller, 1987). Morduch (1995) explains how households can smooth consumption by borrowing and savings, depleting and accumulating nonfinancial assets, adjusting labour supply, and employing formal and informal insurance arrangements.

- Remittances, exports, tourism, oil industry proceedings.

The relevance of variables such as remittances, oil exports, manufacturing exports and even the changes in demographic variables such as longer life expectancy have been highlighted as economically relevant (see figures 2.6 to 2.9) in Mexico's case. Therefore, these variables will all be considered as potential independent variables.

4.4. The time-series analysis.

Based on the revision of the literature, and considering that most of the previously identified variables were available for Mexico, the decision made was to work in a *general-to-specific* econometric model taking into consideration the potential explanatory power of those variables.

Data on most variables were available in quarterly and monthly intervals but not for a long enough period. Therefore, the decision was to use the yearly data. Table 4.4 describes the different variables considered.

Data were obtained mainly, from the World Development Indicators (World Bank, 2017) and Mexico's National Institute for Statistics, Geography and Informatics (INEGI, 2018). A critical element that enabled the construction of the data series dating back to 1960 was the recent publication containing information on 100 years of statistics in Mexico (INEGI, 2014).

The series on housing wealth was constructed following Cutler (2005) and Berge et al. (2007). Data about the national oil industry (PEMEX) revenue was obtained from published material, mainly information in PEMEX's website, as well as information from past editions of the *Presidential Yearly Report* available from the Lower Chamber of the Legislative Power website (Cámara Diputados: http://www.diputados.gob.mx).

One of the most relevant features from the inspection of the data are the high levels of interest rate and unemployment Mexico had after the economic crises the country experience during the 1980s and 1990s. Meanwhile, the highest levels of FDI, remittances, and oil revenue occurred after the turn of the century, but have reduced since.

Time series variables	Description	Source
Consumption *per-capita*	Household final consumption expenditure is the market value of all goods and services, including durable products purchased by households at 2008 Mexican pesos on percapita terms. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, divided by mid-year population.	WDI (2017)
Gross Domestic Income *per-capita*	Gross domestic income is derived as the sum of GDP and the terms of trade adjustment at 2008 Mexican pesos on percapita terms. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources, divided by mid-year population.	WDI (2017)
Interest rate	3-month moving average of yearly interest rate paid on 3-months government bills (CETES).	WDI (2017), INEGI (2015)
Foreign direct investment (FDI) *per-capita*	Foreign direct investment per-capita at constant prices (2008 mxp): refers to direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital, divided by mid-year population.	WDI (2017), INEGI (2015), SHCP (2015)
Remittences *per-capita*	Remittances per-capita at constant prices (2008 mxp): Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households.	WDI (2017), INEGI (1990; 2001; 2015)
Financial wealth *per-capita*	Total worth of investment level in stocks and bonds in Mexico Stock Exchange per-capita, at constant 2008 prices in Mexican pesos.	WDI (2017), INEGI (2011); SHCP (2000); Bolsa Mexicana de Valores (2015)
Housing wealth *per-capita*	Housing wealth *per-capita*. Own calculation based on Bergen *et al* (2007). Total HW = number of dwellings * average price *per square meter * average household size. Values divided by mid-year population*	Bergen et al (2007); INEGI (2015); INFONAVIT (2017)
Revenue oil national industry *per-capita*	Total yearly revenue of Mexico's national oil company (PEMEX) at constant prices, expressed on a *per-capita* basis.	PEMEX (2017), WDI (2017) SHCP (2015)
Domestic credit *per-capita*	Domestic credit to private sector refers to financial resources at constant 2008 prices provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.The financial corporations include monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits).	WDI (2015)
Inflation	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.	WDI (2015), INEGI (2015)
Unemployment	Share of the labor force that is without work but available for and seeking employment.	INEGI (2015)
Broad Money (M2) per capita	Broad money is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper at constant 2008 prizes divided by mid-year population.	WDI (2017)
Exports of goods and services per capita	Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. Data are in constant local currency.	WDI (2017)

Table 4. 4. Time-series description and source of information for data construction. All monetary figures are expressed in constant 2008 Mexican *pesos*.

Government expenditure per capita	General government final consumption expenditure includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. Data are in constant 2008 local currency.	WDI (2017)
Income Tourism Industry per capita	Is the estimated amount of resources received by all tourism related enterprises. Information provided by the Federal Minister for Tourism (*Secretaría de Turismo*) based on the total number of foreign visitors and hotel room occupancy at constant 2008 Mexican pesos divided by the mid-year population.	Aguirre-Botello (2017)

Table 4.4. (cont.) Time-series description and source of information for data construction. All monetary figures are expressed in constant 2008 Mexican *pesos*.

Most of the variables have been represented in different graphs in this chapter. Table 4.5 presents the maximum, minimum, and average values of each variable over the 1960 to 2016 period.

	Minimum	year	Maximum	year	Average
Consumption per capita	$20,746	1960	$74,065	2014	$49,332
Income per capita	$43,059	1960	$109,719	2014	$81,846
Housing wealth per capita	$14,050	1969	$34,410	2014	$22,350
Financial wealth per capita	$1.23	1960	$38,490	2008	$11,121
FDI per capita	$0.04	1968	$3,114	2001	$765
Remittances per capita	$0.02	1965-68	$2,411	2006	$537
Unemployment rate	0.72%	1960	8.10%	1977	4.09%
Domestic credit per capita	$8,866	1960	$34,474	2014	$17,695
Broad money per capita	$8,872	1988	$38,744	2014	$22,912
Oil revenue per capita	$1,343	1964	$9,263,165	2004	$2,115,346
Interest rate	3.80%	2014	126.70%	1987	23.56%

Table 4. 5. Descriptive statistics for different economic variables at level value on a per capita basis. The interest rate is the year's average value of the three-month Treasury bill (CETES).

4.4.1. Stationarity test.

While conducting time-series analysis, the first assumption is that of the *stationarity* of the series (Enders, 2015). If the data series is stationary, then the relationship between two or more different variables will not be a function of time; making possible to predict or anticipate, the value of one from the other (Lambert, 2013).

It is commonly accepted that most macroeconomic variables are difference-stationary[32] or I(1) rather than trend-stationary (Enders, 2015, p. 209). In economics, most observed time-

[32] This means, it is necessary to obtain the first difference of the data ($\Delta C_t = C_t - C_{t-1}$) to obtain a stationary series.

series are generated by stochastic processes that are non-stationary. Such data is generally more difficult to model and forecast than stationary data (Ploberger and Phillips, 2003).

Chatfield (2004, pp. 24-25) states that if a given time-series is the product of an independent and identically distribution—commonly refer to as *i.i.d*—then we can expect a small correlation between consecutive observations. As a general rule, if time-series is *i.i.d.* then we can expect the sample autocorrelation coefficient (r_k) to be close to zero and follow the N(0,1/N) condition. If, on the other hand, the values of r_k do not come down to zero, it is highly likely the series contains a trend.

As in other time-series analysis on consumption, the initial decision was to investigate the order of integration and trending behaviour of all variables considered in the analysis of consumption and its determinants using the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests.

If we consider a simple auto-regressive AR(1) process of consumption as represented in (4.4), the stationarity condition requires the value of the coefficient of C_{t-1} to be smaller than the unity. However, if the series is non-stationary, it will not be possible to use the principles of the central limit theorem that lie beneath the t-test of the ordinary least square procedure (Chatfield, 2004).

Under the *unit-root analysis*—using the AR process of consumption—what applies is to deduct the lag value of the same variable from both sides of (4.3) to get (4.6):

$$C_t = \alpha + \rho\, C_{t-1} + \varepsilon_t$$

$$C_t - C_{t-1} = \alpha + \rho\, C_{t-1} - C_{t-1} + \varepsilon_t \qquad (4.6)$$

$$\Delta C_t = \alpha + (\rho - 1)\, C_{t-1} + \varepsilon_t \text{ ; if we take } \delta = (\rho - 1) \text{ then:}$$

$$\Delta C_t = \alpha + \delta\, C_{t-1} + \varepsilon_t \qquad (4.7)$$

As we want to prove $\rho<0$, if $\delta=0$ then it is possible to conclude $\rho = 1$, in which case the subsample of Ct will not be a random walk, and the series will have a *unit-root*. Under the null hypothesis $\delta=0$ (Ho: $\delta=0$). However, the test cannot be conducted using the normal critical values of the OLS procedure. Dickey and Fuller (DF) tabulated the asymptotic distribution of the least square estimates for the value of δ, against which we can compare the t-distribution values obtained. Rejecting Ho if, t-values < t-value for DF-distribution. Gujarati (2011, p. 212) explains that the DF-test can be performed in three forms:

- Random walk: $\Delta C_t = \delta\, C_{t-1} + \varepsilon_t$
- Random walk with drift: $\Delta C_t = \alpha + \delta\, C_{t-1} + \varepsilon_t$
- Random walk with drift around a deterministic trend: $\Delta C_t = \alpha + \vartheta\, tt + \delta\, C_{t-1} + \varepsilon_t$

In (2.7) where the intercept term is equal to zero ($\alpha = 0$), we have a pure random walk. The second form, with $\vartheta = 0$, represents, as long as $\delta < 0$, a random walk with a stochastic trend. In its third form, the DF-test can be performed for a series that is *trend stationary*, or stationary around a linear trend, including both a *drift* and a linear time trend. As explained by Enders (2015, p.206), the econometric procedure is the same regardless of which of the three forms of the equation is estimated. However, the critical values of the t-statistic depend on the specific form used.

Enders (2015, p. 215) explains that not all time-series can be well represented by a first-order autoregressive or AR[1] process, as implied by (4.7). Therefore, to address those cases, it is necessary to have a variation of the DF-test, known as the *Augmented Dickey-Fuller* test (ADF) which includes an autoregressive process of the same dependent variable in the test. This procedure is aimed at identifying if the series possesses a *unit-root* for higher-order processes resulting in (4.8):

$$\Delta C_t = \alpha + \delta\, C_{t-1} + \sum_{i=1}^{n} \Delta C_{t-i} + \varepsilon_t \qquad (4.8)$$

The lagged values are used in order to correct for the presence of serial correlation (Lambert, 2014). The question is how many lags of ΔCt to include. That is a critical decision in terms of the analysis as 'Too few lags mean that the regression residuals do not behave like white-noise processes… so δ and its standard error will not be well estimated. Including too many lags reduces the power of the test to reject the null of a unit root'. (Enders, 2015):

One option is to keep adding them until there is no longer a serial correlation problem. A more established decision is the use of the *Bayes Information Criteria* (BIC) or the *Akaike Information Criteria* (AIC). According to Enders (2015, p.217) '…whichever method is used, the researcher must ensure that residuals act as *white-noise* processes'.

Therefore, in addition to the information criteria, the Breusch-Godfrey test for serial autocorrelation was performed. For estimates to be *BLUE—Best Linear Unbiased Estimator-*—no serial autocorrelation should exist between error terms. That is, the error term at time *t* should not be correlated with the error term at *t-1*, which means that if errors follow an AR(1) process, then we are in the process of serial correlation. The Breusch-Godfrey test is robust

for the presence of endogenous regressors, likely to be the case in an AR(p) process, which makes the Breusch-Godfrey[33] test superior to that of the likes of the Durbin-Watson test (Lambert, 2013).

	Dickey-Fuller Augmented Test						Phillips-Perron test					
	Intercept only		Trend and intercept		No trend no intercept		Intercept only		Trend and intercept		No trend no intercept	
Ln Consumption p.c.	-2.86*	0	-2.62	0	3.36	0	-2.86*	0	-2.62	0	3.36	0
Δ Ln Consumption *p.c.*	-5.87***	0	-6.25***	0	-5.07***	0	-5.87***	0	-6.25***	0	-5.07***	0
Ln Income *p.c.*	-2.58	0	-2.09	0	3.30	0	-2.58	0	-2.22	0	3.30	0
Δ Ln Income *p.c.*	-5.97***	0	-6.25***	0	-5.21***	0	-5.97***	0	-6.25***	0	-5.21***	0
Ln Housing Wealth *p.c.*	-0.34	0	-2.80	0	1.92	0	-0.34	0	-2.80	0	1.92	0
Δ Ln Housing Wealth *p.c.*	-8.19***	0	-8.14***	0	-7.68***	0	-8.19***	0	-8.14***	0	-7.68***	0
Ln Financial wealth p.c.	-1.50	2	-0.74	2	0.04	2	-1.50	2	0.37	2	2.00	2
Δ Ln Financial wealth p.c.	-2.00	1	-2.34	1	-1.72*	1	3.83***	1	-4.23***	1	-2.85***	1
Ln FDI p.c.	-0.83	2	-2.72	2	1.48	2	-1.43	2	-4.87***	2	1.24	2
Δ Ln FDI p.c.	-8.69***	1	-8.60***	1	-8.41***	1	-10.69***	1	-10.59***	1	-10.56***	1
Ln Remittances p.c.	-0.09	2	-3.23*	1	1.76	2	0.54	2	-2.87	1	1.59	2
Δ Ln Remittances p.c.	-7.45***	1	-7.46***	1	-7.09***	1	-7.40***	1	-7.38***	1	-7.26***	1
Unemployment	-2.81*	1	-2.76	1	-0.44	0	-2.61*	1	-2.52	1	-0.44	0
Δ Unemployment	-4.97***	1	-6.19***	0	-6.20***	0	-6.16***	1	-6.19***	0	-6.20***	0
Ln Credit *p.c.*	-1.58	0	-2.09	0	1.11	0	-1.58	0	-2.09	0	1.11	0
Δ Ln Credit *p.c.*	-7.80***	0	-7.74***	0	-7.70***	0	-7.80***	0	-7.74***	0	-7.70***	0
Ln Broad Money (M2) *p.c.*	-1.41	0	-2.73	0	1.33	0	-1.41	0	-2.73	0	1.33	0
Δ Ln Broad Money (M2) *p.c.*	-8.77***	0	-8.69***	0	-8.51***	0	-8.77***	0	-8.69***	0	-8.51***	0
Ln Oil industry revenue p.c.	-2.01	0	-2.05	0	-0.33	0	-2.07	0	-2.05	0	-0.33	0
Δ Ln Oil industry revenue p.c.	-7.96***	0	-7.88***	0	-8.10***	0	-7.91***	0	-7.88***	0	-8.03***	0
Ln Tourism revenue p.c.	-1.88	0	-2.84	1	0.16	0	-1.88	0	-2.01	1	0.16	0
Δ Ln Tourism revenue p.c.	-6.08***	0	-6.06***	0	-6.13***	0	-6.08***	0	-6.04***	0	-6.13***	0
Ln Exports *p.c.*	-1.03	0	-1.31	0	4.91	0	-1.03	0	-1.31	0	4.91	0
Δ Ln Exports *p.c.*	-6.05***	0	-6.05***	0	-4.55***	0	-6.04***	0	-6.05***	0	-4.55***	0
Ln Gov. spending p.c.	-2.86*	1	-2.34	0	0.86	0	-2.53	1	-2.34	0	0.86	0
Δ Ln Gov. spending p.c.	-3.24***	4	-7.98***	0	-7.66***	0	-7.88***	4	-7.98***	0	-7.66***	0
Interest rate	-2.32	0	-2.04	0	-1.28	0	-2.32	0	-2.42	0	-1.69	0
Δ Interest rate	-3.17***	4	-3.86**	3	-4.98***	2	-8.26***	4	-8.21***	3	-8.25***	2
Inflation rate	-2.55	0	-1.78	2	-1.28	4	-2.42	0	-2.4	2	-1.83	4
Δ Inflation rate	-7.80***	1	-7.79***	1	-5.32***	2	-6.78***	1	-6.74***	1	-6.82***	2
Ln Reserves *p.c.*	-0.08	2	-2.81	3	-4.95***	0	-0.60	2	-4.89***	3	0.76	0
Δ Ln Reserves *p.c.*	-6.58***	2	-5.98***	4	-5.97***	4	-11.25***	2	-13.49***	4	-11.78***	4
Ln Wealth *p.c.*	-0.49	0	-2.05	0	2.00	0	-0.49	0	-2.05	0	2.01	0
Δ Ln Wealth *p.c.*	-8.08***	0	-8.00***	0	7.53***	0	-8.08***	0	-8.08***	0	-7.53***	0
Ln Debt *p.c.*	-2.31	1	-1.97	1	0.75	1	-2.12	1	-1.84	1	1.01	1
Δ Ln Debt *p.c.*	-5.23***	0	-5.21***	1	-5.16***	0	-5.23***	0	-5.31***	1	-5.16	0

Table 4. 6. Summary of the outcome from the Dickey-Fuller test (∂) and Phillips-Perron test for time-series variables in the logarithmic form for the preferred specification consumption function in Mexico. The Akaike Information Criteria (AIC) and the Bayes Information Criteria (BIC) in order to determine the adequacy of the number of lag values used in the model. The columns adjacent to the value of the test result is the number of lags of the variable used. (*) indicates significance at the 10% level (**) indicates significance at the 5% level (***) indicates significance at the 1% level. Values on the Phillips-Perron test are Z(t) values.

[33] For an explanation of the Breusch-Godfrey test procedure see Box 4.1 in appendix B.

Table 4.6 present summary of results from the Augmented Dickey-Fuller (ADF) test (∂) and the Phillips-Perron test for the different variables available over the whole period of analysis at the level and first difference values. Full test results are presented in Annex 2A.

The variables analysed were the ones with potential explanatory power and therefore, the ones considered to be included in the preferred specification model. For the purpose of the stationarity test, the *optimum* number of lags was determined by the smallest AIC and BIC values[34].

The result obtained from the ADF-test clearly indicates that practically all of the variables at level value were not found to be I(0) as it was not possible to reject the null hypothesis of a unit root in the series.

Once the first difference of the variables was considered it was possible to reject the null of a unit root, indicating that all series were difference stationary or I(1). The serial correlation test confirmed no further problem was found to exist for the times series analysed.

Enders (2015, p. 2008) suggests the use of the sum of the square residuals (SSR) in order to determine which of the different data generating models was the true model "responsible" for generating the data series. Data from each ADF-test were registered. However, no real differences were found to exist among the three different forms used for the stationarity test.

In order to corroborate the findings of the ADF test, the Phillips-Perron test was also performed on every time-series. The Phillips-Perron tests for all variables at level and first difference variables confirm these findings: all variables are *difference stationary* or I(1). Interestingly enough, the later test produces the same stat-values for some of the variables.

The Phillips-Perron test uses a form of the t-test in order to correct for the presence of serial correlation and heteroscedasticity in the error term with the idea that such a correction is non-parametric to the t-statistic. This makes it robust to serial correlation, and heteroskedasticity. As a consequence, no lag values of the dependent variable are required. Therefore, the Phillips-Perron test uses a simple auxiliary regression of the form (4.9):

[34] All results obtained from the stationarity test using the Augmented Dickey-Fuller test including the respective values for the Breusch-Godfrey test for serial autocorrelation using one (LM1) and two (LM2) lag values of the variable under analysis. As well as the values of the Akaike Information Criterion (AIC) and Bayes Information Criterion (BIC), used to determine the number of lag values of the variable under analysis used to run the ADF test are presented in the Annex 1.

$$X_t = \alpha + \rho X_{t-1} + \varepsilon_t \qquad (4.9)$$

Where the null hypothesis is that there is a unit-root (H_o: $\rho = 0$). It is difficult to define superiority between ADF and Phillips-Perron test (Lambert, 2014). Nonetheless, according to Lambert (2014), the ADF-test performs better in finite samples.

There were two variables (the Bank of Mexico's reserves and FDI), the Perron test found to be I(0) stationary around a time trend. However, the ADF did not provide any support to this finding.

Finally, both tests presented inconclusive evidence about the stationarity condition for the financial wealth time-series. While ADF-test suggested the series is I(2), the Phillips-Perron test categorically identifies the series as I(1). However, given the relevance of FW in steering consumption as suggested in the literature and despite some element for concern, the decision was made to take the three variables—FDI, reserves and HW—further into the analysis assuming they were indeed I(1).

Once the stationarity test was completed, the series indicated a non-stationary condition for the level variables. Given those results, the next step was to test for the presence of structural breaks in the series before the conclusion of I(1) series can be confirmed.

4.4.2. Test for structural breaks.

Enders (2015, p.227) indicates that special care is required while performing a *unit-root test*, must be taken if there is any indication that a structural break has occurred. The main concern is that if structural changes exist in the series, one could mistakenly conclude that the specific series is of an I(1) nature when in fact it is stationary unless the break—sudden jump—has been caused by different exogenous factors[35].

Mexico has undergone a series of dramatic economic episodes in the recent past. The 1982-moratoria, the peso crisis of 1986 and the financial crisis of 1994 that resulted in the so-called *Tequila effect*, did result in economic shocks that had important negative effects.

[35] Enders (2015, p. 102) exemplifies the oil crisis of the early 1970s or the financial crisis of 2008 as two likely moments an structural break could occur given the economic impact of such events.

If the change in the country's GDP can be taken as an indication of the presence of economic breaks, then the GDP time-series does present the size of the effect of such economic shocks the Mexican economy has undergone over the years.

Figure 4.7 shows the economic downturns Mexico had in 1976, marked by an 80% devaluation of the Mexican currency. Another economic crisis episode occurred in 1982 when the whole economy collapsed after years of *populism* policies that culminated with the nationalization of the banking system, and large amounts of financial resources left the country (Schettino, 2007).

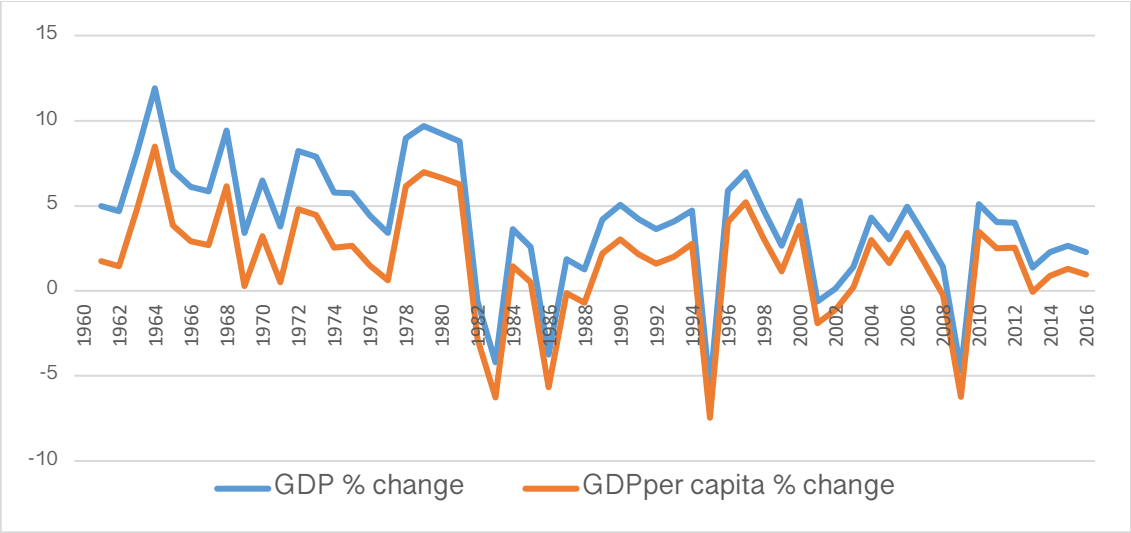


Figure 4. 7 GDP year-on-year percentage change at levels and per capita basis 1961-2016. Source: IMF (2017)

All those factors combined resulted in the insolvency of the Mexican government. Mexico declared the moratoria on its debt payments, and the economy collapsed.

According to Schettino (2007), the consequences of inadequate public policies and the mismanagement of the nation's economy kept the country drifting into deeper and deeper financial instability. A large earthquake that hit Mexico City in 1985 accentuated the economic problems. One year, latter the country was once again in a recession which required the introduction of the *shock-therapy* debt restructuring measures—reduction of government spending, privatization of the banking sector, as well as fiscal and monetary policy changes—under the supervision of the IMF and the World Bank.

Mexico embraced the *free-trade* agenda after the *peso* crisis of 1982, the country experienced a run of positive economic results. However, just after six years of the "Mexican

economic miracle" as the country had just joined NAFTA[36], the country's experience a drop of 8% of its GDP. Millions of jobs went lost, and yet another crisis ensued.

The country underwent a series of austerity measures, the restructuring of the pension schemes, the renegotiation of its debt, and a 150% devaluation of the national currency. Since then, Mexico has been an example of sound macroeconomic management—reserves were as high as 180 billion USD in 2015. Nonetheless, the USA's recession of 2001 and the world crises in 2009 took a toll on Mexico's economy.

Taking into consideration all the economic *misfortunes* just described, it is more than possible structural breaks—large changes in the structure of the series—could exist for some economic variables. Making it relevant to conduct the structural-break analysis.

One way to detect a structural break is to fit an AR(1) model and allow the intercept to change by including a *dummy variable* (D_L). If this latter variable is found to be statistically significant, then it is possible to establish there is a break at $t = L$. However, as Enders (2015) warns: '… a unit root process can also exhibit a structural break', this means care must be exercised.

An initial decision was based on the visual inspection of the time-series data. Figures 4.1 to 4.5 have already presented the time-series for most variables over the period of study: consumption, income, domestic credit, housing wealth, and broad money appear to have a similar upward time trend. FDI and remittances really pick up after the peso crises in 1994. However, there has been a reduction after the 2008-09 crisis (see figure 4.3).

The interest rate and the unemployment rate recorded large increases during the turbulent times around the mid-1980s and the second part of the 1990s. In contrast, the unemployment rate showed a more erratic behaviour than the interest rate, the former registered long runs of high unemployment after the several crises experienced in Mexico. The interest rate was as high as 150% during the aftermath of the peso crisis in the 1980s.

The wealth components also show an upward time trend similar to the one followed by consumption and income, as shown in figure 4.4.

[36] The North-American Free Trade Agreement (NAFTA) signed by Canada, Mexico, and the USA allows the free—minimum tariff and no-quota—movement of goods and services between the three nations.

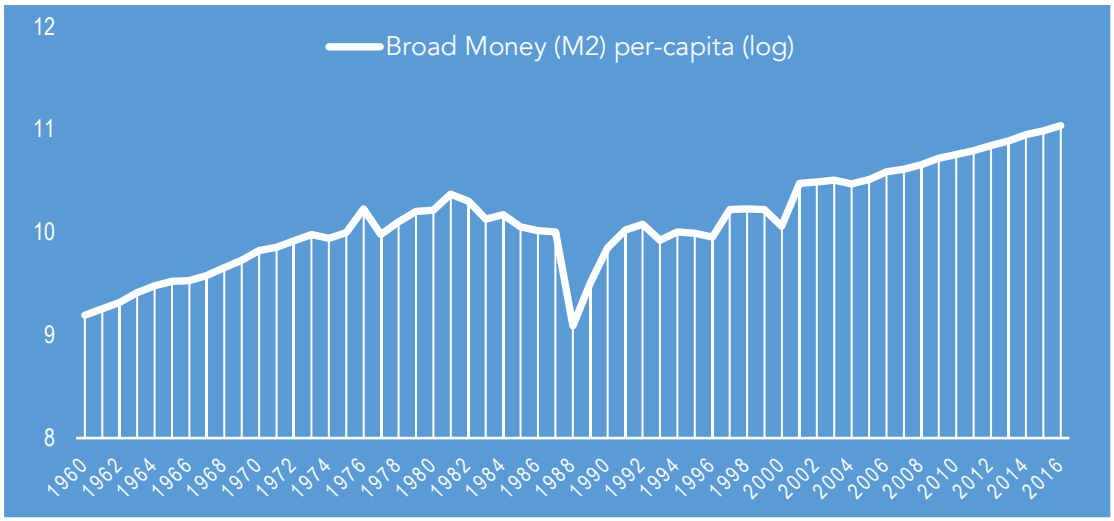


Figure 4. 8a. Broad money (M2) per capita in Mexico 1960-2014 at logarithmic value.

Two variables not to be visually inspected so far are the levels of credit and broad money. Figure 4.8a and 4.8b present the logarithmic value of both variables on a per capita basis.

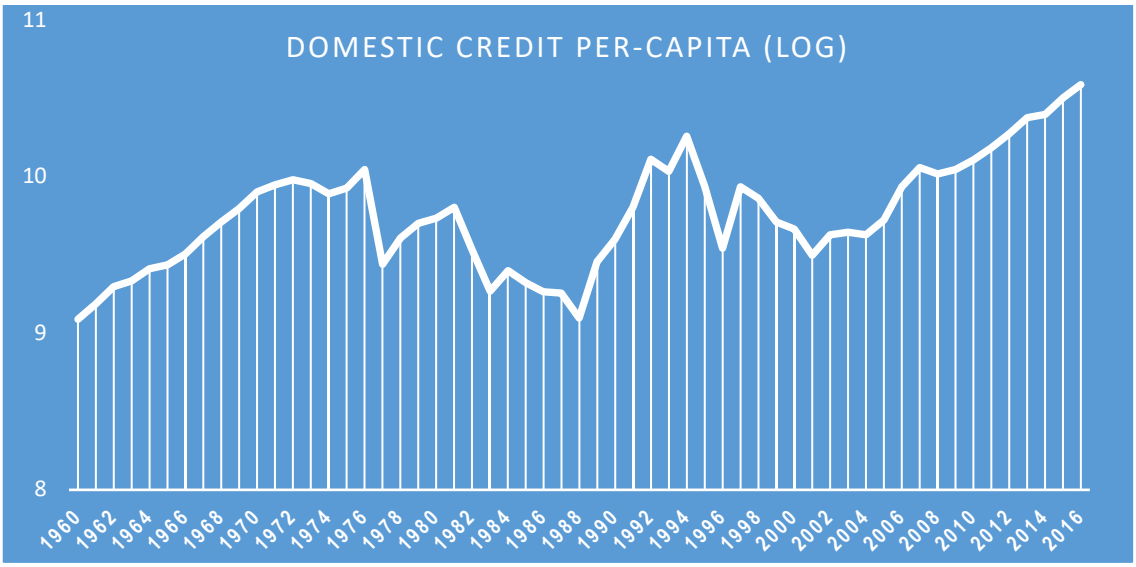


Figure 4. 8b Domestic credit per capita in Mexico 1960-2014 at logarithmic value.

In order to identify for the presence of a structural break, a proper statistical inspection was required. Enders (2015) suggests the use of the Perron-test for structural change if it is known where the structural break is located. In order to identify the structural break, an *AR(1)* equation incorporating two sets of dummy variables (4.10 and 4.11) were estimated:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \mu_1 D_L + \mu_2 [D_L * Y_{t-1}] + \varepsilon_t \qquad (4.10)$$

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \mu_2 D_P + \varepsilon_t \qquad (4.11)$$

Where D_P represents a *pulse* dummy variable such that $D_P = 1\ if\ t = \tau + 1$ and zero otherwise, the lasting change (D_L) is $D_L = 1\ if\ t > \tau$ and zero otherwise. With the *null* of no break in the series.

Table 4.7 presents the years where any of the coefficients in (4.10) were found to be significant. As can be seen, evidence of structural breaks was indicated for each one of the different variables.

Table 4. 7. Years where structural breaks found for selected variables identified through the *Perron* test. D_L denotes the lasting-dummy or the pulse-dummy (D_P) found to be statistically significant in the respective series.

Variable	DL	DP
Ln Consumption *per capita*	1963 (-)	1965 (+) 1984 (-) 1993 (+) 1995 (-) 2009 (+)
Ln Income *per capita*	1963 (-)	1983 (-) 1986 (-) 1995 (-) 2009 (+)
Ln Housing Wealth *per capita*		1970 (+) 1990 (+) 2005 (+) 2008 (-) 2009 (+)
Ln Financial Wealth *per capita*	1998 (+)	1970 (+) 2005 (+) 2008 (-) 2009 (+)
Ln FDI *per capita*	1973 (+)	1967 (-) 1972 (-) 1977 (-) 1994 (+) 2013 (+)
Ln Remittances *per capita*	1979 (+) 1994 (+)	1967 (-) 1975 (-) 1979 (+) 1980 (-) 2003 (+)
Unemployment		1972 (+) 1977 (+) 1983 (+) 1995 (+) 1998 (-)
Ln Domestic Credit *per capita*	1989 (+)	1977 (-) 1996 (-) 1997 (+)

Variable	DL	DP
Ln Government spending *per capita*	1964 (+)	1965 (+) 1980 (-) 1986 (+) 1989 (-) 2009 (+)
Inflation		1985 (+) 1986 (+) 1988 (-)
Ln Government Debt *per capita*	1987 (-)	1982 (+) 1986 (+) 1995 (+) 2006 (-) 2009 (+)
Interest rate		1983 (+) 1986 (+) 1987 (+) 1989 (-)
Ln Exports *per capita*	1976 (+)	1965 (+) 1993 (+) 2009 (-)
Ln Household Wealth *per capita*	1983 (+) 2007 (-)	2008 (-) 2010 (-)
Ln Oil Industry revenue *per capita*		1986 (-) 1998 (-) 2004 (+)
Ln Tourism Industry revenue *per capita*	1977 (-)	1980 (-) 1986 (+) 1993 (-) 1995 (+)
Ln Foreign Reserves *per capita*	1977 (+) 1982 (+)	1982 (-) 1983 (+) 1988 (-) 1994 (-) 1995 (+)
Ln Broad Money *per capita*	1989 (+)	1988 (-) 2001 (+)

The (+) or (-) sign denotes if an upward (+) or downward (-) break was found to exist in the series.

Structural breaks in the series were found to exist for practically all variables. Mainly those associated with individual's economic well-being (consumption, income, employment) and those related to the macroeconomy (inflation, government spending, reserves, or credit) in Mexico. The time series for those variables were found to have permanent-sustained changes after the turbulent times associated with the *local* financial crisis of 1976, 1982, 1986, and 1994 or with the turbulent economic context of the financial crisis in 2008-09.

As explained already, the presence of structural breaks could be taken as a sign that the series could be mistakenly assumed to be difference stationary when they are indeed stationary. In order to identify so, the *Perron*-test suggests—according to Enders (2015, pp. 230-1—to test for stationarity with one-time jump in the intercept (box 4.2 in Annex B).

Table 4.8 presents the results of the test of stationarity, assuming there is a break in the respective series of the variables analysed before. The Perron-test, as described in box 2.2, applies to the break moments where a one-time jump associated with the lasting change D_L dummy variable is found to be significant. Nonetheless, the test was performed for every possible break identified by the procedure, as indicated in equations 4.10 and 4.11.

Table 4. 8. Coefficient values for Perron-test for a one-time jump (P) or a one-time permanent change in the intercept (L) in an otherwise stationary series. Values in parenthesis are t-ratios. LM() are the p-values from the test of serial correlation. The $Y_{t-1} = 1$ column is the t-value for $\alpha_1 = 1$. The (L) sign next to the break year identifies the year where a permanent break was identified.

	Break time	λ	lags	Y t-1	Time trend	DL	DP	LM1	LM2	Y t-1 = 1	Conclusion
Consumption	1963 (L)	0.05	0	0.687 (11.13)	0.004 (3.97)	0.159 (4.02)	-0.136 (-2.77)	0.10	0.54	**-5.07**	Trend stationary with a one time permanent change in the intercept.
	1965	0.09	2	0.791 (9.48)	0.003 (2.17)	0.066 (1.48)	0.186 (3.98)	0.08	0.06	*-2.50*	Non-stationary, despite one-time structural break
	1984	0.43	0	0.854 (15.54)	0.002 (1.70)	-0.017 (-0.64)	0.009 (0.19)	0.27	0.16	*-2.66*	Non-stationary
	1993	0.59	0	0.866 (16.57)	0.001 (1.21)	0.003 (0.12)	0.109 (2.33)	0.29	0.39	*-2.53*	Non-stationary
	1995	0.63	0	0.872 (15.91)	0.001 (1.26)	-0.004 (-0.19)	-0.097 (-1.99)	0.21	0.35	*-2.34*	Non-stationary
	2009	0.88	0	0.857 (15.48)	0.002 (1.68)	-0.005 (-0.21)	-0.079 (-1.59)	0.21	0.16	*-2.58*	Non-stationary
Income	1963 (L)	0.05	0	0.836 (14.53)	0.001 (1.92)	0.056 (1.90)	-0.023 (-0.60)	0.17	0.4	**-3.85**	Stationary with a one time permanent change in the intercept.
	1983	0.41	0	0.913 (19.11)	0.001 (1.82)	-0.039 (-2.28)	-0.065 (-1.85)	0.92	0.75	*-1.82*	Non-stationary
	1986	0.46	0	0.884 (16.46)	-0.016 (1.40)	-0.020 (-1.02)	-0.076 (-2.11)	0.30	0.46	*-2.16*	Non-stationary
	1995	0.63	0	0.915 (17.26)	0.0002 (0.26)	0.016 (0.82)	-0.116 (-3.52)	0.08	0.18	*-1.60*	Non-stationary
	2009	0.88	0	0.893 (18.10)	0.001 (1.28)	0.001 (0.07)	-0.084 (-2.35)	0.11	0.28	*-2.17*	Non-stationary
Credit	1989 (L)	0.52	0	0.868 (10.53)	-0.001 (-0.62)	0.138 (1.53)	0.181 (1.01)	0.85	0.87	*-1.60*	Non-stationary
	1977	0.30	0	0.801 (9.64)	0.006 (2.18)	-0.174 (-2.08)	-0.459 (-2.81)	0.44	0.72	*-2.39*	Non-stationary
	1996	0.64	0	0.844 (10.98)	0.001 (0.59)	0.031 (0.38)	-0.433 (-2.60)	0.83	0.86	*-0.18*	Non-stationary
	1997	0.66	0	0.856 (10.79)	0.0005 (0.19)	0.054 (0.64)	0.303 (1.77)	0.29	0.27	*-1.82*	Non-stationary

Table 4.8 (cont.). Coefficient values for Perron-test for a one-time jump (P) or a one-time permanent change in the intercept (L) in an otherwise stationary series. Values in parenthesis are t-ratios. LM() are the p-values from the test of serial correlation. The $Y_{t-1} = 1$ column is the t-value for $\alpha_1 = 1$. The (L) sign next to the break year identifies the year where a permanent break was identified.

	Break time	λ	lags	Y t-1	Time trend	DL	DP	LM1	LM2	Y t-1 = 1	Conclusion
Financial wealth	1998 (L)	0.68	2	0.976 (36.52)	0.007 (1.01)	-0.191 (-1.61)	0.119 (0.57)	0.44	0.57	*-0.90*	Non-stationary
	1970	0.18	2	0.987 (37.09)	-0.002 (-0.30)	0.153 (1.44)	-0.279 (-1.37)	0.33	0.60	*-0.49*	Non-stationary
	2005	0.80	2	0.940 (29.78)	0.015 (1.74)	-0.257 (-2.08)	0.303 (1.48)	0.09	0.23	*-1.90*	Non-stationary
	2008	0.86	2	0.942 (28.58)	0.015 (1.62)	-0.244 (-1.80)	-0.257 (-1.25)	0.69	0.09	*-1.76*	Non-stationary
	2009	0.88	2	0.940 (27.83)	0.014 (1.51)	-0.246 (-1.76)	0.456 (2.17)	0.14	0.22	*-1.78*	Non-stationary
Interest rate	1983	0.41	0	0.760 (7.34)	-0.210 (-0.74)	3.948 (0.42)	14.36 (0.96)	0.89	0.85	*-2.32*	Non-stationary
	1987	0.48	0	0.674 (9.32)	0.540 (2.82)	-25.049 (-4.02)	64.305 (4.90)	0.06	0.15	**-4.51**	Stationary, with one time permanent change in the intercept
	1989	0.52	0	0.740 (8.11)	0.228 (0.90)	-12.998 (-1.48)	8.448 (0.56)	0.54	0.71	*-2.85*	Non-stationary
FDI	1973 (L)	0.23	0	0.407 (3.06)	0.027 (3.65)	0.060 (0.38)	0.319 (0.88)	0.98	0.88	**-4.46**	Trend stationary
	1967	0.13	0	0.365 (2.93)	0.030 (4.26)	-0.137 (-0.82)	-0.774 (-2.33)	0.25	0.51	**-5.10**	Trend stationary
	1972	0.21	0	0.376 (3.01)	0.028 (3.92)	0.019 (0.13)	-0.710 (-2.09)	0.78	0.92	**-5.00**	Trend stationary
	1977	0.30	0	0.347 (2.85)	0.025 (3.70)	0.229 (1.47)	-0.924 (-2.80)	0.80	0.62	**-5.36**	Trend stationary
	1994	0.61	0	0.311 (2.34)	0.022 (3.25)	0.396 (2.19)	0.295 (0.86)	0.93	0.79	**-5.18**	Trend stationary
	2013	0.95	0	0.413 (3.07)	0.028 (3.74)	-0.157 (-0.73)	0.602 (1.54)	0.67	0.83	**-4.36**	Trend stationary
Remittances	1979 (L)	0.34	4	0.710 (5.89)	0.016 (2.17)	0.003 (0.03)	0.500 (2.33)	0.72	0.88	*-2.41*	Non-stationary
	1994 (L)	0.61	0	0.700 (7.47)	0.009 (1.93)	0.190 (1.64)	-0.240 (-1.07)	0.28	0.08	*-3.20*	Non-stationary
	1967	0.13	0	0.654 (6.30)	0.018 (3.07)	-0.281 (-2.25)	-0.620 (-3.06)	0.18	0.39	*-3.33*	Non-stationary
	1975	0.27	0	0.705 (7.08)	0.015 (2.46)	-0.081 (-0.72)	-0.415 (-1.91)	0.36	0.12	*-2.96*	Non-stationary
	1980	0.36	1	0.669 (7.43)	0.015 (2.97)	0.017 (0.18)	-0.587 (-2.74)	0.51	0.06	*-3.68*	Non-stationary
	2003	0.77	2	0.713 (5.90)	0.012 (2.48)	0.099 (0.84)	0.416 (1.98)	0.99	0.77	*-2.37*	Non-stationary

	Break time	λ	lags	Y t-1	Time trend	DL	DP	LM1	LM2	Y t-1 = 1	Conclusion
Unemployment	1972	0.21	0	0.817 (10.05)	-0.006 (-0.67)	0.192 (0.40)	1.490 (1.79)	0.29	0.56	*-2.25*	Non-stationary
	1977	0.30	0	0.824 (13.22)	0.012 (1.22)	-0.750 (-2.01)	2.200 (2.73)	0.08	0.17	*-2.82*	Non-stationary
	1983	0.41	1	0.766 (12.16)	0.017 (1.47)	-0.819 (-2.05)	3.049 (4.12)	0.39	0.49	*-3.71*	Non-stationary, despite one-time structural break
	1995	0.63	1	0.812 (12.57)	0.0006 (0.05)	-0.259 (-0.63)	2.510 (3.27)	0.30	0.28	*-2.91*	Non-stationary
	1998	0.68	0	0.847 (12.03)	-0.007 (-0.61)	0.103 (0.23)	-0.622 (-0.73)	0.20	0.42	*-2.17*	Non-stationary
Govemment spending	1964 (L)	0.07	0	0.681 (9.22)	0.001 (0.66)	0.515 (3.88)	-0.252 (-1.34)	0.87	0.82	**-4.32**	Stationary with a one time permanent change in the intercept.
	1965	0.09	0	0.792 (9.71)	0.001 (0.72)	0.277 (2.04)	0.505 (2.80)	0.33	0.49	*-2.55*	Non-stationary
	1980	0.36	0	0.906 (16.02)	0.001 (0.55)	-0.063 (-0.76)	-0.524 (-3.03)	0.81	0.96	*-1.66*	Non-stationary
	1986	0.46	0	0.801 (13.88)	0.007 (2.38)	-0.211 (-2.26)	0.568 (3.31)	0.38	0.22	*-3.45*	Non-stationary, despite a permanent change in intercept
	1989	0.52	0	0.797 (10.98)	0.008 (1.96)	-0.233 (-2.01)	-0.345 (-1.88)	0.69	0.13	*-2.80*	Non-stationary
	2009	0.88	0	0.862 (14.16)	*0.0004* (0.21)	0.041 (0.46)	-0.013 (-0.07)	0.53	0.58	*-2.27*	Non-stationary
Inflation	1985	0.45	2	0.858 (8.18)	0.136 (0.41)	-9.033 (-0.81)	29.921 (1.55)	0.25	0.06	*-1.35*	Non-stationary
	1986	0.46	5	0.794 (6.11)	0.169 (0.43)	-10.736 (-0.82)	30.498 (1.47)	0.15	0.28	*-1.59*	Non-stationary
	1988	0.50	2	0.798 (9.61)	0.972 (3.67)	-40.193 (-4.63)	39.290 (2.09)	0.47	0.59	*-2.43*	Non-stationary, despite a permanent change in intercept
Govemment Debt	1987 (L)	0.48	2	0.935 (24.05)	0.008 (2.59)	-0.359 (-3.39)	0.149 (0.76)	0.37	0.53	*-1.67*	Non-stationary
	1982	0.39	0	0.944 (21.12)	0.002 (0.69)	-0.123 (-1.07)	0.501 (2.56)	0.11	0.12	*-1.25*	Non-stationary
	1986	0.46	1	0.915 (24.29)	0.005 (1.95)	-0.229 (-2.24)	0.526 (2.83)	0.63	0.13	*-2.26*	Non-stationary
	1995	0.63	1	0.754 (18.39)	0.007 (1.90)	-0.262 (-2.20)	0.624 (3.45)	0.25	0.49	**-3.84**	Non-stationary
	2006	0.82	2	0.974 (19.74)	-0.005 (-1.76)	0.221 (1.93)	-0.443 (-2.32)	0.31	0.13	*-0.53*	Non-stationary
	2009	0.88	2	0.996 (26.09)	-0.006 (-2.94)	0.262 (2.58)	0.539 (3.15)	0.06	0.07	*-0.10*	Non-stationary
Exports	1976 (L)	0.29	0	0.859 (13.25)	0.060 (1.46)	0.119 (2.85)	-0.134 (-1.47)	0.25	0.41	*-2.17*	Non-stationary
	1965	0.09	1	0.901 (15.20)	0.006 (1.58)	0.038 (0.75)	0.316 (3.92)	0.35	0.27	*-1.67*	Non-stationary, despite one-time structural break
	1993	0.59	1	0.883 (13.58)	0.006 (1.47)	0.041 (0.88)	0.275 (3.28)	0.73	0.35	*-1.80*	Non-stationary
	2009	0.88	1	0.794 (9.07)	0.014 (2.26)	-0.080 (-1.40)	-0.148 (-1.60)	0.15	0.29	*-2.35*	Non-stationary
Oil revenue	1986	0.46	0	0.712 (7.64)	0.012 (2.83)	-0.440 (-3.01)	-0.433 (-1.95)	0.71	0.28	*-3.09*	Non-stationary
	1998	0.68	0	0.837 (11.52)	-0.001 (-0.62)	0.102 (0.97)	-0.487 (-2.25)	0.41	0.51	*-2.24*	Non-stationary
	2004	0.79	0	0.840 (11.00)	-0.001 (-0.78)	0.073 (0.68)	0.638 (3.03)	0.68	0.79	*-2.10*	Non-stationary

Table 4.8 (cont.) Coefficient values for Perron-test for a one-time jump (P) or a one-time permanent change in the intercept (L) in an otherwise stationary series. Values in parenthesis are t-ratios. LM() are the p-values from the test of serial correlation. The $Y_{t-1} = 1$ column is the t-value for $\alpha_1 = 1$. The (L) sign next to the break year identifies the year where a permanent break was identified.

	Break time	λ	lags	Y t-1	Time trend	DL	DP	LM1	LM2	Y t-1 = 1	Conclusion
Household wealth	1983 (L)	0.41	0	0.873 (11.92)	0.003 (1.02)	0.047 (0.91)	-0.067 (-0.68)	0.48	0.74	*-1.73*	Non-stationary
	2007 (L)	0.84	0	0.892 (12.68)	0.005 (2.29)	-0.125 (-2.88)	0.182 (1.96)	0.08	0.06	*-1.54*	Non-stationary
	2008	0.86	0	0.941 (14.04)	0.004 (1.67)	-0.118 (-2.86)	-0.157 (-1.69)	0.23	0.06	*-0.88*	Non-stationary
	2010	0.89	0	0.937 (16.82)	0.004 (1.85)	-0.094 (-2.55)	-0.363 (-4.47)	0.78	0.08	*-1.13*	Non-stationary, despite one-time structural break
Tourism	1977 (L)	0.30	0	0.770 (8.31)	0.001 (0.65)	-0.141 (-2.14)	0.202 (1.42)	0.15	0.11	*-2.48*	Non-stationary
	1980	0.36	0	0.834 (9.24)	0.001 (0.78)	-0.118 (-1.82)	-0.496 (-3.82)	0.11	0.19	*-1.84*	Non-stationary, despite one-time structural break
	1986	0.46	1	0.718 (7.38)	-0.0007 (-0.33)	-0.069 (-0.97)	0.363 (2.68)	0.85	0.83	*-2.90*	Non-stationary
	1993	0.59	1	0.694 (6.49)	-0.001 (-0.84)	-0.038 (-0.49)	-0.272 (-1.98)	0.78	0.96	*-2.86*	Non-stationary
	1995	0.63	1	0.754 (7.07)	-0.002 (-0.96)	-0.008 (-0.11)	0.242 (1.73)	0.60	0.86	*-2.31*	Non-stationary
Broad money (M2)	1989 (L)	0.52	8	2.677 (7.24)	-0.083 (5.13)	1.678 (5.62)	-0.938 (-2.74)	0.09	0.22	**4.54**	Stationary with a one time permanent change in the intercept.
	1988	0.50	0	0.604 (6.56)	0.013 (2.99)	-0.158 (-1.67)	-0.916 (-8.33)	0.66	0.57	**-4.30**	Stationary with a one time change in the intercept.
	2001	0.73	0	0.726 (7.73)	0.003 (1.16)	0.147 (1.77)	0.237 (1.37)	0.71	0.71	*-2.92*	Non-stationary
Reserves	1977 (L)	0.30	0	0.343 (2.55)	0.037 (4.28)	-0.176 (-1.07)	0.147 (0.43)	0.72	0.61	**-4.88**	Trend stationary
	1982 (L)	0.39	0	0.345 (2.92)	0.030 (4.05)	0.084 (0.54)	-0.951 (-3.02)	0.56	0.77	**-5.54**	Trend stationary
	1983	0.41	0	0.450 (3.32)	0.024 (3.15)	0.128 (0.76)	0.438 (1.21)	0.35	0.34	**-4.06**	Trend stationary
	1988	0.50	0	0.451 (3.47)	0.032 (3.99)	-0.188 (-1.09)	-0.487 (-1.41)	0.28	0.31	**-4.22**	Trend stationary
	1994	0.61	0	0.383 (3.90)	0.029 (4.66)	0.102 (0.76)	-1.528*** (-5.88)	0.48	0.43	**-6.28**	Trend stationary, with one time change in time series.
	1995	0.63	0	0.462 (3.07)	0.020 (2.46)	0.264 (1.60)	0.348 (0.88)	0.82	0.78	*-3.58*	Non-stationary

Table 4.8 (cont.) Coefficient values for Perron-test for a one-time jump (P) or a one-time permanent change in the intercept (L) in an otherwise stationary series. Values in parenthesis are t-ratios. LM() are the p-values from the test of serial correlation. The $Y_{t-1} = 1$ column is the t-value for $\alpha_1 = 1$. The (L) sign next to the break year identifies the year where a permanent break was identified.

The *Perron-test* produced results confirming the unit-root for some variables despite the presence of structural breaks. The non-stationarity condition was confirmed for the time series about credit to the business sector, financial wealth, remittances, inflation, unemployment, housing wealth, revenue from the tourism industry, exports, and the national oil industry income.

The series on FDI, foreign reserves, broad money and government spending were identified as *otherwise stationary* if not for the structural break identified.

The time-series on household consumption was found to have multiple structural breaks. However, only one break in 1963 was found to have a significant effect. The permanent change in the intercept indicates that the series is stationary after 1963. A similar feature was found for the income series, with a structural break at the same time as consumption.

This finding confirms the idea of cointegration between both series as expressed by different researchers (i.e. Attanasio et al. 2012).

Not surprisingly the interest rate series, do present a structural break around the 1986-88 years when the *yearly* interest rate went above 160%. Suggesting the series is stationary before and after the turbulent 1980s. However, even after discounting the outlier values, the interest rate series was found to be still I(1).

Multiple breaks were found to exist around the federal reserves and broad money series. Two structural breaks were found to exist in terms of broad money: the first in 1982 during the onset of the *moratoria* declared by the Mexican government, and a second in 1994 during the so-called *tequila effect*. Similarly, multiple breaks were also found to exist for the series on federal reserves. The breaks coincided with the time of economic instability in Mexico during the years of 1982, 1988, and 1994.

The outcome from the structural breaks test indicates the series are a combination of I(0) with structural breaks and I(1) variables.

In order to confirm the finding from the Perron-test, the decision was made to perform the Zivot-Andrews test for multiple structural breaks. Zivot and Andrews (1992) developed a test they consider superior to the Perron-test by considering the break to be endogenous rather than exogenous as assumed by the latter's test.

According to Zivot and Andrews (ZA), under Perron once those exogenous breaks are discounted most macroeconomic time-series will be stationary—as confirmed by what has been found in this research so far. Meanwhile, under ZA-test, if those breaks are endogenous, then the correct unit-root testing procedure would have to account for the fact that the breakpoints are data-dependent. With the key difference—in ZA—that no assumption is made about where the break had occurred. This means, the ZA procedure by allowing for an estimated break in the trend function under the alternative hypothesis, allow for less conclusive evidence against the unit-root as found by Perron.

Table 4.9 presents the outcome of the Zivot-Andrews test. The results suggest several variables have a stationarity condition—by rejecting the null hypothesis of a unit root—once structural breaks were accounted for. These are the time-series on consumption, income, FDI, interest rate, and housing wealth.

Series	Break	Break year	ZA t-test
Ln Consumption *per capita*	*c*	1965	-6.25***
	tt	1965	-5.60***
	b	1968	-3.85
Ln Income *per capita*	*c*	1964	-5.49**
	tt	1974	-2.91
	b	1983	-4.86*
Interest rate	*c*	1992	-6.30***
	tt	1987	-4.12*
	b	1988	-5.17***
Ln broad money (M2) *per capita*	*c*	1985	-5.51***
	tt	1996	-3.35
	b	1988	-5.43**
Ln income national oil industry *per*	*c*	1986	-4.99**
	tt	1999	-2.25
	b	1986	-5.01*

Series	Break	Break year	ZA t-test
Ln FDI *per capita*	*c*	2009	-5.74***
	tt	2003	-5.46***
	b	1994	-6.38***
Ln Remittances *per capita*	*c*	1967	-3.59
	tt	1968	-3.33
	b	1966	-3.54
Ln Housing wealth *per capita*	*c*	2005	-5.76***
	tt	1989	-3.41
	b	2005	-5.72***
Ln government spending *per capita*	*c*	1965	-4.35
	tt	1966	-4.13*
	b	1965	-4.26

Table 4. 9. t-test results from the Zivot-Andrews test for unit-root in selected series. Letters in the column break indicates the terms allowed to break in the auxiliary regression: (c) allows for a break in the constant term only; (tt) break in the time trend; (b) both terms—the intercept and the trend—allowed to break.

For the government spending variable, the ZA-test rejects the unit-root null hypothesis at the 10% level of significance with a structural break in 1966. The ZA-test found two variables as stationary in addition to the ones already identified by the Perron test: the logarithmic value of broad money per capita, and the income from the national oil industry on the same basis. A structural break for both series was found to exist in the latter part of the 1980s. This finding offers two additional variables with good explanatory potential.

According to Enders (2015, p. 227), when there are structural breaks in the series, the various Dickey-Fuller test statistics 'are biased toward the non-rejection of a unit root'. The identification of a structural break implies that the series will be stationary if the effect of the structural break change is discounted. In other words, it is possible to assume a unit-root when a single shock alters the structure of an otherwise stationary series.

In order to confirm and explore further the stationarity condition of several variables considered in this analysis—including the dependent variable: consumption—the decision was made to run the ADF-test for the specific time periods where the empirical evidence suggest the structural breaks *hijack* the stationary condition. The ADF-test was performed for the split time-series before and after the period of time (τ) where the break in the series was identified. Table 4.10 presents the results.

Table 4. 10. Results for the ADF-test performed on split sections of the logarithmic form of the preferred specification variables in order to identify more than one structural break.

	Break time	Form	Time-series	Lags	ADF-test coefficient	Time-series	Lags	ADF-test coefficient
Ln Consumption per capita	1963	*c*	1963-2016	0	-3.44**			
		tt		0	-3.96**			
Ln Income per capita	1963	*c*	1963-2016	0	-2.99**			
		tt		0	-2.81			
Ln Housing wealth per capita	1968	*c*	1960-1967	1	8.81			
		tt		1	-15.93***			
	2006	*c*	1970-2005	0	-1.06	2007-2016	0	-3.76***
		tt		0	-3.91**		0	-3.32*
Ln Domestic credit per capita	1977	*c*	1960-1975	0	-2.42	1978-2016	0	-0.85
		tt		1	-0.01		0	-1.93
Ln Remittances per capita	1983	*c*	1960-1982	0	-3.47**	1984-2016	0	-0.72
		tt		0	-3.40*		0	-1.38
	2000	*c*	1982-2002	0	-3.01**	2003-2016	0	-3.71**
		tt		0	-2.91		0	-3.58*
Ln Gov. spending p.c.	1964	*c*	1965-2016	0	-4.43***			
		tt		0	-4.22***			
Ln FDI per capita	1973	*c*	1960-1972	0	-3.04**	1974-2016	0	-1.77
		tt		0	-2.97		0	-3.94***
Unemployment	1976	*c*	1960-1975	0	-0.63	1978-2016	0	-3.46**
		tt		0	-1.63		0	-2.16
Ln Exports per capita	1993	*c*	1960-1992	0	-0.57	1993-2016	0	-4.69***
		tt		0	-1.71		0	-5.54***
Oil Industry Income p.c.		*c*	1960-1985	0	0.76	1986-2016	0	-2.80*
		tt		0	-1.82		0	-4.09**

(c) constant only test; (tt) ADF-test includes time trend. (†) series suffers from serial correlation. (*) indicates significance at 10% level (**) significant at 5% level (***) significant at 10% level.

The results indicate that both the logarithmic value of consumption and income per capita at constant prices are trend stationary after 1963 at the 5% level of significance. Similarly, government spending was found to have a stationarity condition after 1964, when it shows a trend–like increase.

Foreign direct investment (FDI) was found to be stationary before the break time (1973) and trend stationary afterwards. Although the amount of real FDI level has had other important changes, its trend stationarity condition is confirmed before and after the structural break.

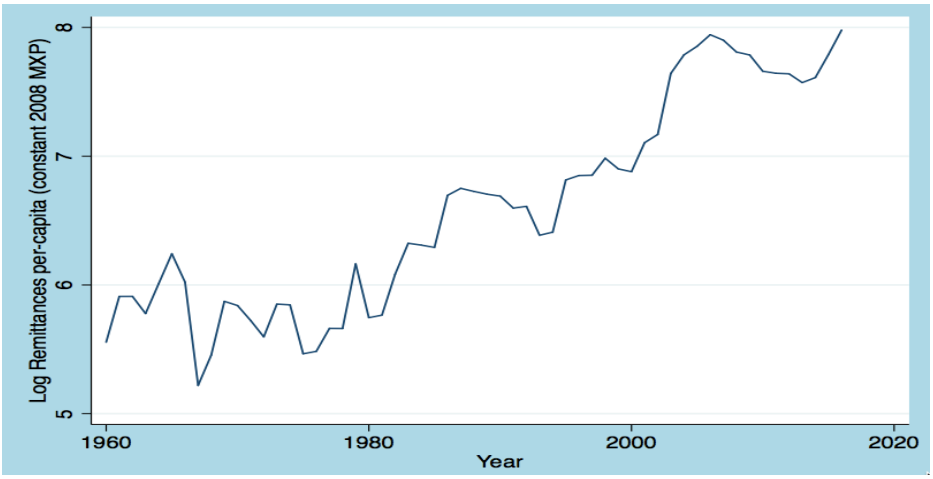


Figure 4. 9 Logarithmic value of remittances per capita in Mexico in 2008 *pesos* 1960-2016. Source: WDI (2017)

One interesting case is remittances, which has been found to be stationary if the whole series is split into three different segments. The time-series was found to be stationary before 1982—the first important crisis Mexico had after years of the so-called *stabilizing development stage* in Mexico. Then it was also found to be trend stationary between turbulent economic years of the 1982 and 2002 period. The final segment 2003-2016 is also stationary at the 5% level of significance. In a way, it is possible to discount the *structural breaks* the series shows (figure 4.9) in the years 1982 and 2002.

The one variable that offered some difficulties was the series on government spending per capita. This variable was found to have a permanent structural break in 1963. Afterwards, the level of government spending experienced a trending increase until the turbulent 1980s when the variable experienced large changes reflecting the state of the Mexican economy during those years. The ADF test for the segment time-series also confirms the stationarity condition after 1964 but not during the whole period of analysis.

Meanwhile, the series on unemployment and the *logarithmic* values of income from the national oil industry and total exports—both on a per capita basis—were found to be stationary after the turbulent 1980s and 1990s but not throughout the whole period of analysis, even after discounting the effect of one, or even two structural breaks. Unemployment shows stationarity conditions after 1978 but not before. Income from the oil industry and total exports showed the same condition after 1986 and 1993 respectively.

In opposition to the Perron-test, the ZA-test failed to confirm the stationarity condition on the remittances time-series. The ADF segment test confirms the stationarity with two structural breaks, which might explain the inconsistency between both tests.

Another variable deserving further analysis is the series on housing wealth (HW). The *segmented* ADF-test found the variable to be stationary. While the HW series was identified as *otherwise stationary* by the ZA-test, the Perron-test found such a condition but only at the 10% level of significance.

The stationarity condition of the housing wealth series is categorically confirmed before 1968. However, the empirical evidence suggests that once the government established a credit program for housing acquisition at the start of the 1970s, the variable shows a clear upward trend. Consequently, the series became trend stationary over the 1969-2006 period.

However, after the *credit crunch*, and especially given the effect for the housing sector, the series was found to be stationary, but the upward-trend is lost. Given this finding and considering the relevance of the wealth factor for consumption, the decision was to keep considering as having explanatory power and therefore to consider the series as being I(1) and keeping as a potential explanatory variable.

The variables found to be stationary once the structural break(s) is/are accounted for—income, the wealth components, government spending, FDI, interest rate, and remittances—were considered to have enough explanatory power while analysing consumption.

At that moment, a decision had to be made in terms of the analysis being described and two options remained:

1. The natural one was to proceed with what Enders (2015, p. 361) calls *standard time-series methods* assuming the stationary condition of most series.
2. To accept that the empirical evidence is not categorically irrefutable about the stationarity condition for all the variables, and in accordance with commonly accepted knowledge that both consumption and income are cointegrated, explore if there is empirical evidence for a long-run equilibrium (cointegrating) relation among the variables, and to proceed accordingly.

The decision was to explore both options. In the first case, the main risk was that of *spurious* regression. But the decision was to look for an adequate model to conduct the time-series analysis. For that purpose, Aydede (2008) presents an interesting time-series OLS-type analysis of consumption and its determinants for Turkey. Independently of the econometric procedure, some parallels could be drawn between Turkey (manufacturing nation

strategically located between Europe and Asia) and Mexico (manufacturing powerhouse in the Americas strategically located next to the US). Both nations being emergent economies, undergoing economic and social changes while trying to establish themselves in the right path of development.

Although Aydede's work is aimed at identifying the relevance of wealth—social security wealth in particular—in driving consumption, it offers some ideas that could be implemented for this study about Mexico. Therefore, the decision was to conduct the standard time-series econometric procedure for stationary variables.

While analysing Turkey's consumption determinant Aydede (2008) obtained similar post-estimation results, the standards OLS analysis produced a series of *spurious regression*. Therefore, the decision was made to proceed accordingly, given the post-estimation results obtained.

4.5. Cointegration analysis.

A cointegration relationship can be extremely useful in economic forecasting since it would imply rules of convergence towards a specific long-run equilibrium (Takala and Viren, 2002).

As explained by Murray (1994), 'the mathematics of cointegration and [the associated] error correction model, are sophisticated, but the concepts themselves are simple enough'.

In simple words, if two or more variables move together over the long-run, they are said to be cointegrated. Even if the series themselves are not stationary, but the distance—or difference, call it θ—between the two tends to be constant over time, then θ will be stationary. It is important to note that cointegration is a probabilistic concept. If two data series are cointegrated, it is highly likely one will be θ times away from the other. According to Enders (2015, p. 344), in the presence of cointegration, 'it is possible to model the long-run model and the short-run dynamics simultaneously'.

Since Granger first noted during the 1980s (Granger, 1986) ample empirical evidence exists about the cointegrated nature between income and consumption as supported by most of the evidence found during the literature search stage of this thesis (e.g. Vasilev, 2015, among other—see table 2.1).

Wag-Sing and Sinha (2000) found empirical evidence[37] indicating that a cointegration relationship does not always exist between income and consumption. Highlighting the importance of conducting the cointegration analysis of the time-series data.

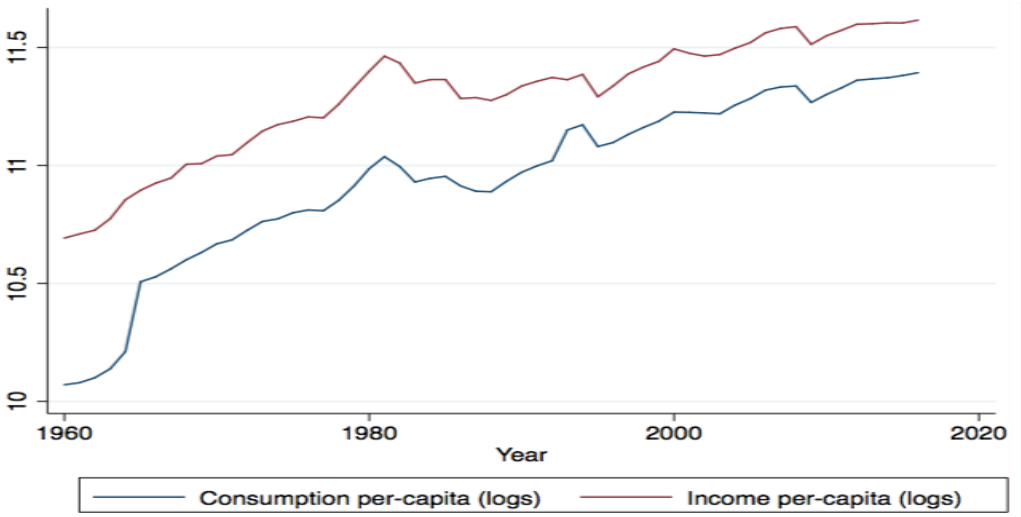


Figure 4. 10 Consumption and income per capita in logarithmic form for Mexico 1960-2016 at constant prices.
Source: Own calculations based on WDI (2017)

In Mexico's case, it has been shown (see figure 4.10) that over the last 57-year period, income and consumption have followed each other closely; making the cointegrated relationship a real possibility. The main assumption is that any time one variable departs from *equilibrium;* the other variable(s) adjust in order to maintain the distance from each other. A central element is the unexplained portion of consumption, represented by the disturbance term; which is an integral part of the theory. It must be temporary—any deviation should not be permanent—in nature, and it has to be stationary (Enders, 2015, p. 344) if a cointegration relationship between the variables exists.

The cointegration test is an extension of the Dickey-Fuller unit-root test, commonly known as the *Engle-Granger Augmented Dickey-Fuller* test (EG-ADF). It is a two-step process aimed at finding a cointegration relationship between two or more variables. It can be explained in the following terms:

Let us say we wish to identify and model the cointegrated relationship between two series: X and Y. If we know the best prediction for the value of X at time *t* it is based on the previous value of the same variable; the variable then can be modelled as an AR(1) process: $X_t = X_{t-1} + \varepsilon_t$; Similarly, for Y: $Y_t = Y_{t-1} + \nu_t$. If the variables are wondering in a similar fashion,

[37] Wan-Sing and Sinha (2000) argue, after they analysed USA data following the Johansen test, that over the long-run, if prices are not constant, there is the chance of no cointegration between consumption and income.

then there will be a common distance (θ) over time. Therefore, we can model the cointegrated meanderings—borrowing Murray's explanation (Murray, 1994)—as:

$$X_t - X_{t-1} = \varepsilon_t + c\,(Y_{t-1} - X_{t-1})$$

$$Y_t - Y_{t-1} = \nu_t + c\,(X_{t-1} - Y_{t-1})$$

Where ε_t and ν_t are the stationary white-noise distance between both series, the right-hand side terms are the error correction terms by which the two wandering series stay close together. With $\theta = X_{t-1} - Y_{t-1}$, that is the cointegration relationship between X and Y. If the error correction terms were not stationary, then the distance between the two series (θ) would also not be stationary.

Banerjee et al. (1993) explain that if there is a stable equilibrium between X and Y, such a relation can be described as $Y_t = \beta X_t$. Then the discrepancy $(Y_t - \beta X_t)$ contains useful information, as on average, the system will move towards equilibrium. This error term—defined as θ in this thesis—should be a useful variable in explaining the direction *Y* will move to next. When θ is positive Y_t is too large relative to X_t, and on average we can expect a fall in Y_{t+1}. The term $(Y_t - \beta X_t)$ is called an *error correction mechanism* (ECM) and is part of the dynamics regression.

Enders (2015, p. 353) explains that if the gap between both variables increases, there are three ways how the gap "can be closed": 1) by an increase in Y or a decrease in X, 2) by an increase in Y but a *commensurately* larger rise in X, or 3) by a fall in Y but a smaller reduction in X.

That is, 'the short-run dynamics must be influenced by the deviation from the long-run relationship' (Enders, 2015, p. 353). If we assume both X and Y are both I(1) a simple error correction model that could apply is:

$$\Delta X_t = \alpha_X\,(Y_{t-1} - \beta\,X_{t-1}) + u_{Xt} \qquad \alpha_X > 0$$

$$\Delta Y_t = -\alpha_Y\,(Y_{t-1} - \beta\,X_{t-1}) + v_{Yt} \qquad \alpha_Y > 0$$

Where u_{Xt} and v_{Yt} are white-noise disturbance terms and α_X, α_Y, and β are parameters to be estimated with the first two terms representing the *speed of adjustment* between variables. Therefore, both variables change in response to the value of the stochastic shocks (represented by the value of the disturbance terms), and in response to the previous period deviation from equilibrium the θ value given by the $(Y_{t-1} - \beta\,X_{t-1})$ term.

While conducting the cointegration test, a critical element is that the true value of θ is not known and has to be estimated.

If the series are cointegrated we can argue, in the economic sense, that a possible relationship between X and Y can be established and so, it is possible to determine Y as a function of X: $Y_t = \alpha + \beta X_t + u_t$ through OLS regression, and expect the estimated value of the error term ($\hat{u}$) to be stationary which can be tested through the standard ADF-test. However, the critical values are more stringent than the usual ones for the ADF-test as we do not know the actual value of β.

The ECM assumes that if two series are I(1), then we can establish a linear—*short-run*—relationship of the form:

$$\Delta Y_t = \delta_0 + \delta_1 \Delta X_t + \upsilon_t \qquad (4.12)$$

However, if the variables are cointegrated, then there is a *long-run equilibrium* relationship or long-run equilibrium –represented by the *E* power—as in 4.13:

$$Y^E = \alpha + \beta X^E \qquad (4.13)$$

Where the power *E* refers to the long-run equilibrium. If that is the case, then it is possible to do more than just the OLS regression of the first differences of both variables, as it will be ideal if a combination of both, short and long-run, relationships could be captured. Meaning that it is possible to determine how the observed value of Y_t might be different from the equilibrium value. Under the Autoregressive Distributed Lag (ARDL) the value of the dependent variable is being determined by present and lag values of the independent variable, plus lag values of the dependent variable itself:

$$Y_t = c + \delta_1 X_t + \delta_2 X_{t-1} + \mu Y_{t-1} + \varepsilon_t \qquad (4.14)$$

Where μ represents some degree of inertia, and ε_t is the error term. The problem with estimating (4.14) is two-fold; first, it does not tell us anything about the dynamics of the variables. The second problem, as explained by Lambert (2013), is that if both Y and X are non-stationary, we are close to run the risk of spurious regression, meaning that even if X and Y are not related the statistical procedure will tend to suggest there is a relationship when in fact there is none. The ECM is a way to side-step such problems.

From (4.14) the ECM subtracts Y_{t-1} from both sides of the equation to make Y_t stationary. In order to make X_t stationary as well, we add and subtract $\delta_1 X_{t-1}$ from the right-hand side of the equation. (4.15) is obtained:

$$Y_t - Y_{t-1} = c + \delta_1 X_t - \delta_1 X_{t-1} + \delta_1 X_{t-1} + \delta_2 X_{t-1} + \mu Y_{t-1} - Y_{t-1} + \varepsilon_t \quad (4.15)$$

Then it is possible to re-arrange (4.15) to become (4.16):

$$\Delta Y_t = c + \delta_1 \Delta X_t - \lambda(Y_{t-1} - \alpha - \beta X_{t-1}) + \varepsilon_t \quad (4.16)$$

With $\lambda = 1 - \mu$, and $\beta = \frac{(\delta_1 + \delta_2)}{1-\mu}$. If indeed, there is a long-run relationship between both variables the term in parenthesis: $(Y_{t-1} - \alpha - \beta X_{t-1})$ will be cointegrated, making this the cointegrating term.

If $Y_{t-1} > \alpha + \beta X_{t-1}$, this means *Y* is above its equilibrium value, then the cointegration term will be larger than zero. As a result, Y adjust downwards by the difference in the cointegrated term times the value of λ—or the speed of adjustment to equilibrium—will adjust down to achieve equilibrium.

Enders (2015, pp. 360) argues that there are three *ways* to test for cointegration identification:

a) The Engle-Granger methodology,
b) The Johansen methodology,
c) The Error Correction methodology.

The decision was made to conduct the three procedures. Each to be presented next.

4.5.1. The Engle-Granger Methodology.

The Engle-Granger methodology[38] consists in estimating (4.17):

$$y_t = \beta_0 + \beta_1 Z_t + \varepsilon_t \quad (4.17)$$

Where *y* is the independent variable and Z is the vector of independent variables, all having the same order of integration. If indeed there is a cointegration relationship, then the error

[38] For an explanation of The Engle-Granger methodology for cointegration test and error correction model (ECM) definition see Box 4.3 in Annex C

term will be the size of the distance between both variables. Therefore, the estimated value of the error term ($\hat{\varepsilon}$) will be stationary, which can be evaluated through the ADF-test.

Estimated equation: Ln Consumption per capita = β_0 + β_1Xt + ε_t

	Consumption	Constant	Reisdual ADF-test	lags	Cointegrated
Income	1.376*** (39.08)	-4.597*** (-11.56)	-2.966**	4	Yes
Housing wealth	0.751*** (12.72)	3.153*** (5.14)	-3.354***	1	Yes
Financial wealth	0.080*** (14.42)	10.421*** (246.52)	-2.971**	2	Yes
Government spending	0.5521*** (9.04)	9.310*** (51.15)	-2.362	3	No
Interest rate	-0.001 (-0.61)	10.972*** (167.03)	-3.086**	1	Yes
Exports	0.293*** (20.05)	8.296*** (62.31)	-3.229**	1	Yes
Remittances	0.340*** (9.40)	8.700*** (36.17)	-3.567***	2	Yes
Broad Money	0.643*** (12.68)	4.439*** (8.65)	-2.790*	0	No
Manufacturing sector value added output	1.157*** (32.19)	-0.065 (-0.19)	-2.952**	0	Yes
Reserves	0.317*** (9.38)	8.355*** (30.09)	-3.425***	1	Yes
FDI	0.348*** (12.77)	8.513*** -44.39	-3.634***	2	Yes
Oil industry income	0.064 (0.52)	10.806*** (44.74)	-2.77*	0	No

Table 4. 11. OLS estimated parameter value of the regression for the cointegrated test, and results of the ADF-test of the respective estimated residual value of that regression.

The first two columns in table 4.11 report the estimated coefficients ($\hat{\beta}_1$ and $\hat{\beta}_0$) in (4.17). The final two columns report the results of the ADF-test[39] for the estimated value of the respective residual term ($\hat{\varepsilon}_t$) and the conclusion based on this analysis.

As expected, the econometric procedure yields *super-consistent* estimators. As explained by Enders (2015, p.361) if the variables are cointegrated the estimated error term contains the estimated value of the deviation from long-run equilibrium, and if the sequence is stationary a cointegrated relationship has been identified.

The independent variable is the logarithmic value of consumption per capita at constant 2008 prices for Mexico. Among the independent variables, all monetary ones—income,

[39] The stationarity test is commonly known as the *Engle-Granger Augmented Dickey-Fuller* test (EG-ADF).

wealth, exports, remittances, among others—are provided on the same basis as consumption.

The cointegration analysis indicates a cointegrated relationship between consumption and the respective variable shown in the first column with the exception of government spending, broad money, or the income for the national oil industry where a stable—cointegration relationship—was not found to exist.

Once the cointegration nature of several variables in this study has been confirmed, then the next stage will be to estimate the ECM model represented by (4.18) and (4.19) which allow the identification of the short-run and long-run adjusted terms of the preferred specification model.

$$\Delta y_t = \alpha_1 + \alpha_y[\, y_{t-1} - \beta_1 Z_{t-1}\,] + \sum_{i=1} \alpha_{11}\,(i)\Delta y_{t-i} + \sum_{i=1} \alpha_{12}\,(i)\Delta Z_{t-i} + \varepsilon_{yt} \quad (4.18)$$

$$\Delta Z_t = \alpha_2 + \alpha_Z[\, y_{t-1} - \beta_1 Z_{t-1}\,] + \sum_{i=1} \alpha_{21}\,(i)\Delta y_{t-i} + \sum_{i=1} \alpha_{22}\,(i)\Delta Z_{t-i} + \varepsilon_{Zt} \quad (4.19)$$

In order to estimate the ECM, an important task is to determine the independent variables composing the vector *Z*. The decision was made to evaluate the preferred specification model as composed by a combination of the time-series on income, housing wealth, FDI, broad money and the interest rate is relevant given the cointegrated relationship among those variables and consumption.

Enders (2015, p. 359) explains how in cases of n-variables 'little is altered' compared to the bi-variable case already explained, and that in cases of cointegrated variables the OLS regression produces *"super-consistent"* estimator of the cointegrated parameters β_0 and β_1 in step 1 as explained in box 2.2.

Proceeding in an explorative fashion Table 4.12 reports the estimated coefficients for multivariate Engle-Granger long-run equilibrium relation (4.17) as well as the ADF-test for the estimated value of the error term $(\widehat{\varepsilon_t})$ whose significance indicates the existence of a cointegration relationship.

Estimated equation: $C_t = \beta_0 + \beta_1 \mathrm{X}_t + \upsilon_t$; X is the vector of cointegrated regressors and ν is white-noise residual.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln Income per capita	1.265***	1.192***	0.315**	0.260***	1.194***	1.195***	0.728***	1.194***
	(13.72)	(13.46)	(2.53)	(4.25)	(16.27)	(15.95)	(6.59)	(16.18)
Ln Housing wealth per capita	0.075	0.002	0.225***	0.241***				
	(1.47)	(0.08)	(4.99)	(11.32)				
Interest rate	-0.0012***	-0.0014***	-0.0006*	-0.0005***	-0.0014***	-0.0013***	-0.0017***	-0.0014***
	(-3.08)	(-4.03)	(-2.34)	(-3.89)	(-4.86)	(-4.27)	(-6.28)	(-4.56)
Ln Broad money per capita	-0.011						0.076*	
	(-0.33)						(1.99)	
Ln FDI per capita						0.013		
						(1.12)		
Ln Financial wealth per capita		0.011***	0.002		0.011***	0.008*	0.023***	0.012**
		(2.87)	(0.46)		(2.95)	(1.85)	(6.32)	(2.14)
Ln Manufacturing value add per c.			0.465***	0.529***				
			(3.56)	(9.53)				
Ln Remittances per capita								-0.005
								(-0.22)
Ln Government spending per capita							0.116***	
							(3.31)	
Constant	-4.150***	-2.770***	0.456	0.314	-2.762***	-2.770***	1.310	-2.733***
	(-8.97)	(-3.52)	(0.99)	(1.26)	(-3.40)	(-3.34)	(1.31)	(-3.47)
R_square	0.970	0.973	0.987	0.987	0.973	0.973	0.979	0.973
ADF-test ($\widehat{\varepsilon}$)	-3.344	-3.46	-3.882	-4.323	-3.589	-3.611	-3.403	-3.568
Lags (#)	4	1	1	1	1	2	3	2

Table 4. 12. OLS results of long-run equilibrium relationship coefficients and results of ADF-test of residuals and the number of lagged values of the residual term used in the stationarity test.

The exercise was used as an exploratory starting point to determine a parsimonious and consistent long-run equilibrium equation. The outcome of such exploratory analysis allowed the identification of variables with potential explanatory power and met the cointegrated condition, and therefore to be part of a relevant error correction model. These were the *logarithmic* value of per capita income, financial wealth, foreign direct investment, and federal government reserves.

The inclusion of income, interest rate, financial wealth, and the output of manufacturing sector offered the most relevant option. The seventh scenario offers a specification with correct signs and values. However, the ADF-test of the residual term was not able to reject the null of a unit-root.

In any scenario where the broad money or remittances variables were included, both variables were found to be not significant in any combination. The inclusion of the wealth

components allowed to identify the financial wealth variable as being statistically significant making housing wealth statistically not-significant. Finally, the scenario analysis allowed to identify that anytime the time-series on the value-added from the manufacturing sector was included, the financial wealth series was not found to be statistically significant.

	(A)	(B)	(C)	(D)	(E)
$\hat{\varepsilon}_{t-1}$	-0.469**	-0.630***	-0.755***	-0.771***	-0.600***
	(-2.10)	(-2.87)	(3.19)	(-3.18)	(-2.18)
Δ C t-1	0.267	0.242	0.281	0.298	0.408
	(1.10)	(0.95)	(1.13)	(1.17)	(1.52)
Δ C t-2	-0.679**	-0.065	-0.079	-0.78	-0.690**
	(-2.60)	(-0.57)	(-0.69)	(-0.68)	(-2.53)
Δ C t-3			0.168*	0.171*	0.433
			(1.77)	(1.78)	(1.42)
Δ Y t-1	0.355	0.491*	0.572*	0.548*	0.237
	(1.00)	(1.69)	(1.80)	(1.69)	(0.64)
Δ Y t-2	0.182	-0.053	-0.089	-0.098	-0.027
	(0.56)	(-0.29)	(-0.49)	(-0.53)	(-0.08)
Δ HW t-1	0.045	-0.004	-0.044	-0.043	0.022
	(0.63)	(-0.06)	(-0.54)	(-0.53)	(0.26)
Δ HW t-2				-0.033	-0.044
				(-0.43)	(-0.56)
Δ r t-1	-0.0003	-0.003	-0.0004	-0.0004	-0.0002
	(-0.90)	(-0.92)	(-1.35)	(-1.20)	(-0.73)
Δ FW t-1	0.019	0.018	0.044	0.038	0.024
	(0.74)	(0.72)	(1.36)	(1.08)	(0.70)
Δ FW t-2	-0.068**	-0.064**	-0.077***	-0.070**	-0.064**
	(-2.62)	(-2.49)	(-2.91)	(-2.29)	(-2.13)
Δ FW t-3			-0.019	-0.019	-0.001
			(-0.63)	(-0.63)	(-0.05)
Δ Manuf t-1	0.290	0.410	0.485*	0.450	0.182
	(0.85)	(1.40)	(1.67)	(1.48)	(0.51)
Δ Manuf t-2	0.177				0.347
	(0.57)				(1.01)
Δ Manuf t-3	0.137				-0.172
	(1.07)				(-0.66)
_cons	0.024***	0.024***	0.022***	0.023***	0.019**
	(3.42)	(3.24)	(2.70)	(2.70)	(2.25)
BG test (p>chi-sq)	0.2304	0.1222	0.5826	0.5818	0.9832

Table 4. 13. Group specific ARDL estimates for the cointegration relationship for the chosen specification.

For the sake of *parsimony,* the best-fit model is the one represented by scenarios three to five. Based on the existing literature highlighting the relevance of income, the real interest rate, the value added of the manufacturing sector and the wealth components—both housing and financial—the decision was made to estimate the cointegration relationship among those variables, which as confirmed by the ADF-test of stationarity of the error

term—marked as *ADF-test residual term* in table 4.12—were found to have a cointegrating relationship.

According to Enders (2015, p. 363), it is important to make sure the estimated ECM is appropriate, which explain why the Breusch-Godfrey test for serial correlation was performed and reported in table 4.13.

The decision was made to select the ARDL-specification E[40] in the previous table. The results allowed to establish the following cointegration relationship (4.20):

$$\begin{aligned}\Delta C_t = & -0.60\ \varepsilon_{Ct-1} + 0.4\ \Delta C_{t-1} - 0.69\ \Delta C_{t-2} + 0.43\ \Delta C_{t-3} + 0.23\ \Delta Y_{t-1} - 0.27\ \Delta Y_{t-2} \\ & + 0.02\ \Delta HW_{t-1} - 0.04\ \Delta HW_{t-2} - 0.0002\Delta r_{t-1} + 0.02\ \Delta FW_{t-1} - 0.06\ \Delta FW_{t-2} \\ & - 0.001\ \Delta FW_{t-3} + 0.18\ \Delta ManufVA_{t-1} + 0.34\ \Delta ManufVA_{t-2} \\ & - 0.17\ \Delta ManufVA_{t-3} + 0.019 \qquad (4.20)\end{aligned}$$

The speed of adjustment coefficient (α_y) in (4.18) represented by the coefficient of ε_{Ct-1}—the lagged value of the residual from the equilibrium relationship using consumption as the independent variables—also shown table 4.13 and in the first of the previous equations is negative and significant as expected, the fact the point estimates are high representing supporting evidence of cointegration among variables.

The error-correction term is therefore given by (4.21):

$$\begin{aligned}\varepsilon_{Ct-1} = & \ Ln\ C_{t-1} - 0.456 - 0.315\ Ln\ Y_{t-1} - 0.225\ Ln\ HW_{t-1} + 0.0006\ r_{t-1} - 0.002\ FW_{t-1} \\ & - 0.465\ Ln\ Value\ Added\ Manuf_{t-1} \qquad (4.21)\end{aligned}$$

The long-run coefficients have all the right signs and are all statistically significant: The change in the logarithmic value of consumption per capita is positively related with the changes in the logarithmic value of income, both wealth components, and the value-added of the manufacturing sector all on a per capita basis, and—consumption—being negatively and significantly related with the change in the real interest rate value.

Based on the estimated LR coefficients if the log per capita value of consumption is above than the other elements in the cointegrated term ($C_{t-1} > 0.315\ Y_{t-1} + 0.225\ HW_{t-1} - 0.0006\ r_{t-1} + 0.002\ FW_{t-1} + 0.465 Manuf\ VA_{t-1} + 0.456$), then the cointegrated term will be

[40] The optimal number of lags was determined by the diagnostic test for serial correlation using the Breusch-Godfrey test.

larger than zero—and out of equilibrium. As a result, consumption will change next period. In this case, consumption will adjust by going down by 0.6 times the size of the deviation from equilibrium.

In the economic sense if income increases in a given year by 1% while both wealth components and the value-added of the manufacturing sector all remained unchanged, and assuming the interest rate is 5%, then consumption will go up by 0.19% next period closing the gap between income and consumption.

Given the initial estimated VECM, it is possible to obtain the first-order VAR augmented equations with the single error correction term ε_{Ct-1} as[41]:

$$\begin{aligned}\Delta\, HW_t \;=\; & 1.30\;\varepsilon_{Ct-1} - 0.03\;\Delta HW_{t-1} - 0.05\;\Delta HW_{t-2} - 0.02\;\Delta C_{t-1} - 0.27\;\Delta C_{t-2} + 0.49\;\Delta Y_{t-1} \\ & + 0.48\;\Delta Y_{t-2} - 0.0005\;\Delta r_{t-1} + 0.02\;\Delta FW_{t-1} - 0.0004\;\Delta FW_{t-2} \\ & + 0.18\;\Delta Manuf\;VA_{t-1} + 0.011 \qquad (4.22)\end{aligned}$$

$$\begin{aligned}\Delta\, FW_t \;=\; & 2.73\;\varepsilon_{Ct-1} + 0.29\;\Delta HW_{t-1} + 0.45\;\Delta HW_{t-2} + 0.2\;\Delta HW_{t-3} + 0.78\;\Delta C_{t-1} - 0.5\;\Delta C_{t-2} \\ & + 0.54\;\Delta Y_{t-1} + 0.8\;\Delta Y_{t-2} + 0.002\;\Delta r_{t-1} - 0.56\;\Delta FW_{t-1} + 0.001\;\Delta Manuf\;VA_{t-1} \\ & - 0.008 \qquad (4.23)\end{aligned}$$

$$\begin{aligned}\Delta\, Y_t \;=\; & -0.43\;\varepsilon_{Ct-1} - 0.43\;\Delta Y_{t-1} + 0.16\;\Delta C_{t-1} - 0.13\;\Delta C_{t-2} + 0.22\;\Delta C_{t-3} + 0.005\;\Delta HW_{t-1} \\ & - 0.0003\;\Delta r_{t-1} + 0.0002\;\Delta r_{t-2} + 0.03\;\Delta FW_{t-1} - 0.06\;\Delta FW_{t-2} - 0.01\;\Delta FW_{t-3} \\ & + 0.49\;\Delta Manuf\;VA_{t-1} + 0.014 \qquad (4.24)\end{aligned}$$

$$\begin{aligned}\Delta\, Manuf\;VA_t \;=\; & -0.52\;\varepsilon_{Ct-1} + 0.84\;\Delta Manuf\;VA_{t-1} + 0.01\;\Delta C_{t-1} - 0.10\;\Delta C_{t-2} + 0.20\;\Delta C_{t-3} \\ & + 0.11\;\Delta C_{t-4} - 0.84\;\Delta Y_{t-1} - 0.18\;\Delta Y_{t-2} - 0.031\;\Delta HW_{t-1} - 0.0008\;\Delta r_{t-1} \\ & + 0.07\;\Delta FW_{t-1} - 0.07\;\Delta FW_{t-2} - 0.03\;\Delta FW_{t-3} + 0.018 \qquad (4.25)\end{aligned}$$

For all the first-order VAR equations the sign of the speed of adjustment is in accordance with convergence towards the long-run equilibrium. That is, if consumption at time *t-1* is above equilibrium, it will adjust down at time *t*. Meanwhile, if income is above equilibrium ($Y_{t-1} > 3.174\;C_{t-1} - 0.714\;HW_{t-1} + 0.0019\;r_{t-1} - 0.006\;FW_{t-1} - 1.476 Manuf\;VA_{t-1} - 1.428$) then income will reduce 0.43 times the size of the gap at time *t+1*.

[41] Table 4.A in Appendix D presents the estimated coefficients for the first order VAR augmented cointegrated relations with the single lagged value of the regression residual (ε_{t-1}) for the cointegration equation using the logarithmic value of consumption per capita as the dependent variable.

Meanwhile, both wealth components—housing and financial wealth—if they are found off equilibrium, they will increase by 1.3 and 2.73 times the size of the gap. This means consumption will increase by more than 4.44 times the size of the increase in HW, which will allow consumption to catch up with wealth and close the gap between the two.

Meanwhile, the short-run relation indicates how the change in the value of consumption is given by changes in the past levels of itself, income, both of the wealth components, changes in the real interest rate and the change in the value-added of the manufacturing sector in Mexico.

The estimation for the SR relation confirms that in Mexico largest consumption elasticities relative to income are almost four times higher than both wealth components. Interestingly enough, the SR dynamics highlight the relevance of the value-added from the manufacturing sector and its effect on consumption. Particularly, given the fact, its effect has a longer-lasting effect than income.

In the economic sense, the results indicate that for most of the variables in the short run relation the group-specific OLS estimates using ARDL approach may not provide us with precise estimates of the consumption elasticities as only a handful of the estimated coefficients were found to be statistically significant and when significant the sign of the coefficients is actually contrary to intuition.

It is important to highlight the fact that finding not significant parameters and/or counter-to-intuition coefficients using the ARDL has been found by other researchers (e.g. De Bonis and Silvestrini, 2012) analysing the effect of financial wealth as co-determinant of consumption in ten European nations plus the USA.

Based on the not significant estimations obtained and based on the assertion by Enders (2015, p.399) that the Engle-Granger speed of adjustment parameter does not indicate which variable (or variables) makes the adjustment. The decision was to proceed with Johansen methodology and the error correction model to identify the cointegration vectors and contrast the respective finding with the results of the Engle-Granger procedure.

4.5.2. Johansen Methodology.

In order to estimate the long-run relationship existing between the variables found to have a cointegration relationship under the Johansen methodology. The first decision is, in the case

of multiple regressors, that it is possible to have multiple cointegrating vectors, as many as *n-1,* commonly known as the cointegration rank.

Considering the same specification model identified by the Engle-Granger methodology, the first stage was to determine the number of lag values to be included in order to determine the number of cointegrating vectors. This analysis was performed using *STATA* software. Table 4.14 presents the outcome in the usual software format.

Selection-order criteria
Sample: **1969 - 2016** Number of obs = **48**

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-70.2474				9.7e-07	3.17697	3.26537	3.41087
1	268.69	677.87	36	0.000	3.2e-12*	-9.4454*	-8.82666*	-7.8081*
2	304.672	71.965	36	0.000	3.5e-12	-9.44466	-8.29558	-6.40396
3	337.515	65.687	36	0.002	4.8e-12	-9.31314	-7.63371	-4.86904
4	366.447	57.863*	36	0.012	9.6e-12	-9.01861	-6.80883	-3.17111

Table 4. 14. STATA outcome used to determine the number of lags to be included in the rank determination for the preferred specification cointegration model.

The STATA outcome indicates a single lag should be included while defining the rank of the ECM. The standard rank identification procedure using the same software produces the outcome offers shown in table 4.15.

Johansen tests for cointegration
Trend: constant Number of obs = **51**
Sample: **1966 - 2016** Lags = **1**

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	6	204.12119	.	164.9948	94.15
1	17	245.7935	0.80489	81.6502	68.52
2	26	261.25687	0.45469	50.7235	47.21
3	33	272.19794	0.34888	28.8413*	29.68
4	38	280.33564	0.27322	12.5659	15.41
5	41	284.63033	0.15500	3.9765	3.76
6	42	286.61861	0.07501		

Table 4. 15. STATA outcome used to determine the number of cointegrated equations (rank) that exist among the variables in the preferred specification model, considering all variables have the same order of integration.

The outcome of the procedure confirmed the VECM analysis should include a number of one lag, and three cointegration equations.

According to Baltagi (2003), the VECM has the general form (4.25a) complementing (4.18), with the time trend represented by *tt.*

$$\Delta Y_t = \alpha(\beta Y_{t-1} + \mu + \rho\, tt) + \sum_{i=1}^{p-1} \gamma_i\, \Delta Y_{t-1} + \Omega + \tau\, tt + \varepsilon_t \quad (4.25a)$$

With the following options—restrictions—allowed while estimating the parameters:

- Trend: no restrictions
- A restricted trend: $\tau = 0$
- A constant: $\rho = 0;\ and\ \tau = 0$
- A restricted constant: $\Omega = 0;\ \rho = 0;\ and\ \tau = 0$

With a rank of three under the unrestricted option above. The estimated cointegrated vector[42] following Johansen methodology was given by the following three equations:

$$\Delta C_t = -0.608\ \varepsilon_{t-1} + 0.28\ \Delta C_{t-1} - 0.678\ \Delta Y_{t-1} - 0.0004\ \Delta r_{t-1} + 0.049\ \Delta FW_{t-1} - 0.067\ \Delta HW_{t-1} + 0.413\ \Delta Manuf\ VA_{t-1} + 0.013 \quad (4.26a)$$

$$\Delta FW_t = 2.23\ \varepsilon_{t-1} + 0.074\Delta C_{t-1} - 0.279\ \Delta Y_{t-1} - 0.002\ \Delta r_{t-1} - 0.274\ \Delta FW_{t-1} - 0.397\ \Delta HW_{t-1} + 1.247\ \Delta Manuf\ VA_{t-1} + 0.003 \quad (4.26b)$$

$$\Delta Y_t = -0.475\ \varepsilon_{t-1} + 0.365\ \Delta C_{t-1} - 0.404\ \Delta Y_{t-1} - 0.001\ \Delta r_{t-1} + 0.066\ \Delta FW_{t-1} - 0.094\ \Delta HW_{t-1} + 0.151\ \Delta Manuf\ VA_{t-1} + 0.012 \quad (4.26c)$$

$$\Delta HW_t = 0.771\ \varepsilon_{t-1} + 0.081\ \Delta C_{t-1} + 0.328\ \Delta Y_{t-1} - 0.0003\ \Delta r_{t-1} - 0.021\ \Delta FW_{t-1} + 0.067\ \Delta HW_{t-1} + 0.235\ \Delta Manuf\ VA_{t-1} + 0.016 \quad (4.26d)$$

$$\Delta ManufVA_t = -0.224\ \varepsilon_{t-1} - 0.045\ \Delta C_{t-1} - 0.617\ \Delta Y_{t-1} - 0.0004\ \Delta r_{t-1} + 0.099\ \Delta FW_{t-1} - 0.102\ \Delta HW_{t-1} + 0.62\ \Delta Manuf\ VA_{t-1} + 0.018 \quad (4.26e)$$

The estimated *speed of adjustment terms* for consumption, income, and financial wealth obtained are not much different in size and significance to the produces by the ARDL-Engle-Granger methodology.

The *speed of adjustment* coefficients for consumption ($\propto_C = -0.608$) has the right sign and was found to be statistically significant. To place the previous result in the light of the first long-run relationships: Whenever consumption is above the level of equilibrium ($C_{t-1} > 0.05FW_t - 0.011\ r_t - 1.97\ ManufVA_t + 7.57$) it reduces by 60.8% times the size of the divergence until equilibrium is restored.

[42] The results were obtained through the STATA software (vec command, rank 3, lag 2).

On the other hand, if income is above the level of equilibrium, then income reduces by 47.5% of the size of the income deviation from equilibrium. Certainly, the gap is not closed completely within the immediate period of time but closes almost completely within the second year.

Where the error correction terms are given by:

$$\varepsilon_t = C_t + \ 0.05FW_t - 0.011\ r_t - 1.97\ ManufVA_t + 7.573 \quad (4.27)$$

$$\upsilon_t = Y_t + \ 0.077FW_t - 0.017\ r_t - 2.14\ ManufVA_t + 8.79 \quad (4.28)$$

$$\nu_t = HW_t + \ 0.202FW_t - 0.049\ r_t - 4.77\ ManufVA_t + 34.112 \quad (4.29)$$

The previous equations indicate there one equilibrium relationship between the rate of growth of each one of the following variables all on a per capita basis: consumption, financial wealth, and the value added of the manufacturing sector, as well as with the level value of the real interest rate.

As indicate based on (4.28) a second equilibrium relationship was found to exist among income, financial wealth and the real interest rate. With a third and final equilibrium relationship was found to be relating the interest rate, both wealth components, and the value added of the manufacturing sector.

The post-estimation results shown in table 4.16 confirmed the no serial-autocorrelation condition in the error terms. With the LM-test values ($p > \chi^2$) equal to 0.50 and 0.44 for the lag values of one and two periods, it is not possible to reject the null of *no autocorrelation at the lag order*.

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	**35.3323**	**36**	**0.50015**
2	**36.5436**	**36**	**0.44342**

H0: no autocorrelation at lag order

Table 4. 16. STATA output after performing the test for serial correlation in the vector error correction model residuals.

The analysis of the desired stability condition of estimates for the predicted cointegrated equation is required to assure that the cointegrated equation is stationary and that the number of cointegrated equations is correctly specified.

Eigenvalue stability condition

Eigenvalue	Modulus
1	1
1	1
1	1
.9361749	.936175
.6253419 + .4376438*i*	.763272
.6253419 - .4376438*i*	.763272
.05997497 + .4984186*i*	.502014
.05997497 - .4984186*i*	.502014
-.43293	.43293
.1147373 + .3427299*i*	.361426
.1147373 - .3427299*i*	.361426
-.1382065	.138207

The VECM specification imposes 3 unit moduli.

Table 4. 17. STATA output after performing the test for estimator stability.

The output obtained using STATA[43], identifies the three imposes unit modulus associated with the three cointegrated equations. The criterion is such that if any of the remaining moduli are too close to one, 'either the cointegrating equations are not stationary, or there is another common trend, and the rank is too high' as there is no general distribution theory to determine when an estimated root is too close to zero (Enders, 2015, p.398). The value 0.93 could be accepted as evidence of stability in estimated parameters.

Finally, the post-estimation analysis of the error term normality confirmed the error terms associated with the household income time series are not normally distributed and suffering from kurtosis and skewness. The rest of the error terms are normally distributed.

Once the VECM has been found to be rightly specified it is possible to estimate the impulse-response functions (IRF) as a way to identify if the effect from any of the consumption co-determinants dies out over time. Figure 4.11 presents the effect of orthogonalized changes to the variables related in the cointegrated relationships.

[43] Obtained through the STATA *vecstable* command.

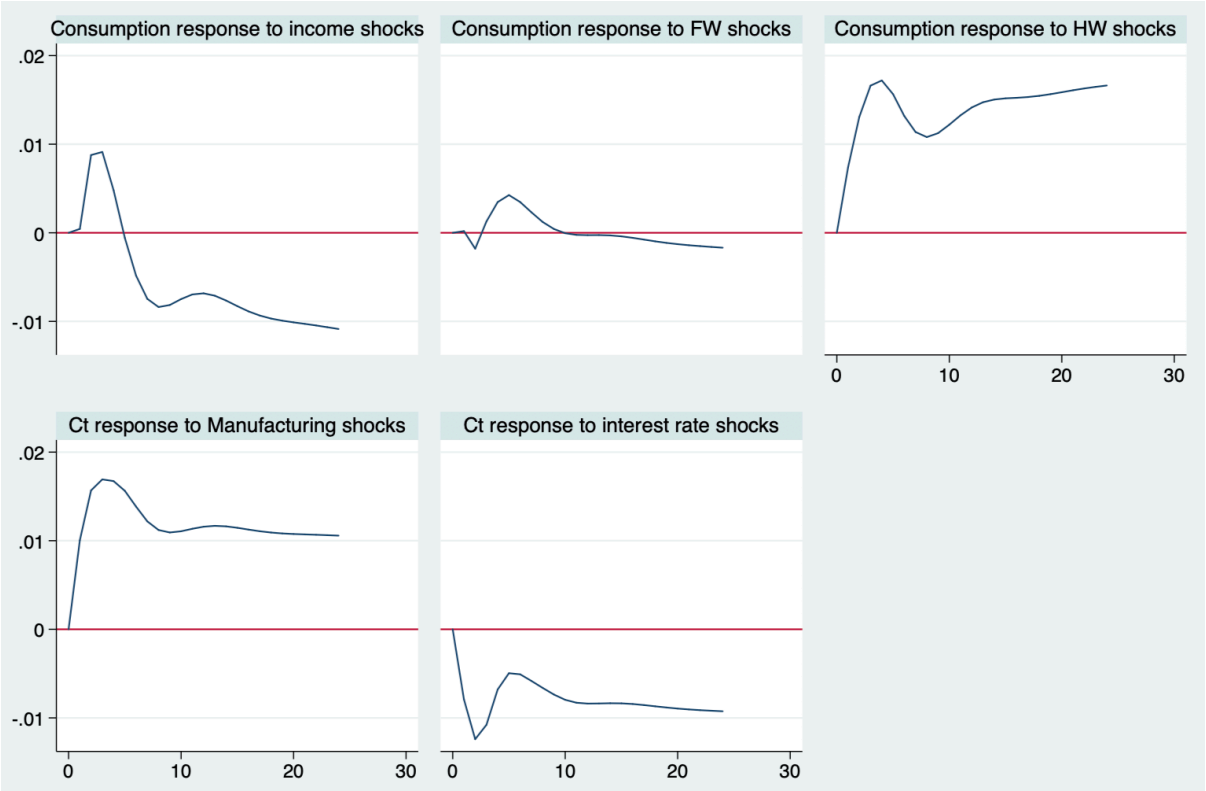


Figure 4. 11 Impulse-response functions. Consumption per capita response to different variables shocks.
Source: Own calculations using STATA standard procedures.

The most interesting finding from the previous table is that orthogonalized shocks in housing wealth and in the value-added from the manufacturing sector have longer-lasting and more positive effects for consumption. Meanwhile, income shocks have been found to have a short-lived positive effect but eventually resulted in reductions on consumption.

Not surprisingly, the reductions in the rate of interest have positive and lasting beneficial effects for consumption. Finally, the benefit of financial wealth has only transitory benefits for consumption.

Although the previous findings will be discussed further after the next stage, they have important policy implications, as they serve as a testimony that any house acquisition programmes and the economic transformation to an important manufacturing hub have been found to be influential in driving consumption in Mexico.

4.5.3. The Error Correction Methodology (ECM).

According to Enders, the ECM—assuming a cointegrated relationship between X, Y, and Z—implies the estimation of an equation in the form of (4.30):

$$\Delta X_t = \beta_0 + \beta_1 X_{t-1} + \beta_2 Y_{t-1} + \beta_3 Z_{t-1} + \beta_4 \Delta Y_t + \beta_5 \Delta Z_t + \gamma_1 (L)\Delta X_{t-1} + \gamma_2 (L)\Delta Y_{t-1} + \gamma_3 (L)\Delta Z_{t-1} + \nu_t \quad (4.30)$$

Where $\gamma\ (L)$ is the lag length and ν_t is a White-noise residual.

Although, the possibility of endogeneity exists for the income variable to be associated with other factors influencing consumption, the different wealth components in particular, or access to credit. All those factors are not part of the information collected in the income and consumption household survey in Mexico.

Nonetheless, when it comes to decompose income and consumption, the risk of endogeneity increases and therefore, will be an important element of the econometric analysis undertaken herein. The use of instrumental variables is an accepted option.

For the specific case of cointegration analysis of consumption, some of the research available about the time series analysis of consumption (e.g. Vasilev, 2015) dealt with the potential problem of endogeneity by incorporating the residuals of an auxiliary regression obtained by regressing lag values of the dependent variable—as instruments—and regress income on them. The estimated error-terms were included in the estimation of the OLS model and added them to the prefer specification model. As it was not found be statistically different from zero (see equation 4.31) the estimated coefficients were assumed to be BLUE.

The decision was to use the same specification model as the one estimated under the Engle-Ganger and the Johansen methodologies. Enders (2015, p. 399) makes clear there is no need to constraint the lag length to be the same for all variables, as 'we are not treating all variables symmetrically'. The ECM outcome is represented by 4.31 (*t-ratios* in parenthesis) with the added residual terms (RESID).

$$\Delta C_t = \underset{(0.46)}{0.225} - \underset{(-3.20)}{0.447} C_{t-1} + \underset{(3.04)}{0.376}\, Y_{t-1} + \underset{(2.47)}{0.0094} FW_{t-1} - \underset{(-1.93)}{0.0009} r_{t-1} - \underset{(-0.32)}{0.014} HW_{t-1}$$

$$+ \underset{(0.41)}{0.056} MAN_{t-1} - \underset{(-0.83)}{0.123}\, RESID_t \quad (4.31)$$

Where C stands for the logarithmic value of consumption per capita, Y is the *log* value of domestic income per capita. The wealth components are FW (financial wealth) and HW (housing wealth) both in the same basis logarithmic value on a per capita basis, as it is MAN the log value of the value-added of the manufacturing sector and r is the real interest rate.

The highly statistically significant and negative *t-ratio* for the lagged value of the dependent variable confirms the cointegrating nature of the model. The lag values of the regressors, which will compose the error correction terms are statistically significant and have the correct sign. Equation (4.32) was obtained after re-parameterizing (4.31).

$$\begin{aligned}\Delta C_t = &-0.447(C_{t-1} - 0.503 - 0.841Y_{t-1} - 0.021FW_{t-1} - 0.031HW_{t-1} + 0.002r_{t-1} \\ &- 0.125MAN_{t-1}) + 0.325\,\Delta Y_t + 0.02\,\Delta FW_t - 0.023\,\Delta HW_t - 0.0004\,\Delta r_t \\ &+ 0.45\,\Delta MAN_t - 0.024\Delta Y_{t-1} - 0.014\Delta FW_{t-1} + 0.029\Delta HW_{t-1} + 0.219\Delta MAN_{t-1} \\ &+ 0.0004\Delta r_{t-1} + \nu_t \qquad (4.32)\end{aligned}$$

The economic sense of the previous results can be explained in the following terms:

- A one unit increase in income per capita ($\Delta Y_t = 1$) – one per cent in this case— *ceteris paribus,* produces an increase in consumption (ΔC_t) of 0.32%. Given this change, the discrepancy from long-run equilibrium has increased by 0.725% (0.325 - 1). Consumption is now below the *usual distance* between both variables (θ). To compensate and return to equilibrium consumption reacts by increasing 0.324% = (-0.725% * -0.447) starting at time t+1 until it reaches the long-run equilibrium in under three time periods.
- Likewise, if financial wealth increases by one percentage point, consumption increases by 0.02% at time t. As a result, the gap between HW and consumption widens by 0.98%. Consumption is below the equilibrium level. In order to restore long-run equilibrium, consumption increases by 0.438% every period until long-run equilibrium is restored in just over two periods of time.

Equation 4.31 could also be re-parameterized to produce (4.33):

$$\begin{aligned}\Delta C_t = &\ 0.376\,(Y_{t-1} + 0.598 - 1.188C_{t-1} + 0.025FW_{t-1} - 0.037HW_{t-1} - 0.023r_{t-1} \\ &+ 0.148MAN_{t-1}) + 0.680\,\Delta Y_t + 0.003\,\Delta FW_t - 0.0003\,\Delta r_t - 0.032\,\Delta FW_{t-1} \\ &- 0.031\,\Delta FW_{t-2} + \nu_t \qquad (4.33)\end{aligned}$$

Now, it is possible to see how if income is above equilibrium, consumption increases by 0.376 times the size of the disequilibrium, closing the gap in order to restore the long-run equilibrium.

The outcome from this procedure confirms the cointegrated relationship between income, financial wealth, housing wealth, the interest rate, and the value-added from the manufacturing sector with consumption. Therefore, it is possible to establish that whenever

consumption is above the long-term equilibrium value, it reacts by adjusting downwards, represented by the negative and significant value of the error correction term.

However, and as expected, a negative relationship was found to exists between the interest rate and consumption, meaning that if the interest rate reduces by one point, then consumption goes up by 0.003%.

These findings indicate—in the economic sense—that changes in income, both wealth components, the value-added from the manufacturing sector and the real interest rate do stimulate short-run changes in consumption. Enders (2015, p. 399) explains how it is possible to obtain similar cointegrating relationship decision under the three methodologies used—Engle-Granger, Johansen, and the error correction—albeit with some differences in the specific value of the speed of adjustment parameter. While the Engle-Granger procedure identifies the parameter to be equal to 0.600, the Johansen methodology and the error correction term identify it as 0.603 and 0.447, respectively.

In terms of (4.15), the *speed of adjustment term* is represented by (λ). This term has been defined as $\lambda = 1 - \mu$

In the specific case under analysis if we take the value of $\lambda = 0.6$—the point value for two of the cointegrating procedures—then $\mu = 0.4$. Meaning that forty per cent of C_t will be largely determined by C_{t-1}. Which does not necessarily confirm the idea that consumption is a long-run *martingale* as established by many researchers (e.g. Muellbauer, 1994; Zeldes, 1989; Campbel and Mankiw, 1991).

The empirical evidence is that income, wealth—financial and housing—and long-term sound economic policies represented by the low value of the interest rate and the economic transition to a manufacturing hub have been found to move to be consumption co-determinants.

The empirical evidence conforms to Blinder and Deaton (1985) who rejected the hypothesis that only income innovations matter for consumption; similar to their findings this piece of research has found the interest rate and the wealth components to have a statistically significant influence for consumption.

While analysing consumption increases in Norway, Jansen (2013) concluded that up to the mid-1980s it was the consensus view that the aggregate consumption could be well

explained by real disposable income both in the short and long-run. However, after the advent of financial deregulation, financial wealth did play a role in influencing consumption.

This research reaches a similar conclusion: the change in economic policy from a closed economy during the 1970s, fostering import substitution, to the post-1988 fully open economy allowing the free flow of capital and repositioning the nation as a manufacturing hub, has produced spectacular changes in consumption terms, along with the prudent macroeconomic management of the Mexican economy.

The descriptive analysis allows the conclusion that irresponsible use of credit—whenever it has been above 40% of the nation's GDP—has driven the economy to overheat and collapse, as it did during the large peso-crisis/default in 1982 and 1994. The role played by domestic credit to fuel consumption in Mexico is consistent with the findings of researchers such as Brady (2008) or Fernandez-Corugedo and Muellbauer (2006) but was not found to be cointegrated with consumption or have a real effect in driving it over time.

Likewise, some of the income-generating variables such as foreign direct investment, remittances or income from the national oil industry—recognized to have an impact for economic growth and to foster consumption (Magee et al., 2015)—were not found to be in a cointegrated relationship with consumption and therefore could not be explorer further under the respective statistical procedure.

The literature reviewed in this chapter established how some researchers have argued for the specific relevance of income and wealth innovation for consumption (i.e. Fisher et al., 2012). Other researchers (e.g. Stephens, 2008; Browning and Collado, 2001) have failed to identify such a relationship exists. This research has found evidence in support of the role of income and wealth.

This research has found support to the idea set by different researchers (i.e. Hendry, 2013; Erlandsen and Nymoen, 2008) that current and lagged values of variables such as the interest rate or the wealth components have a role in defining changing consumptions levels.

In a highly didactical paper, Murray (1994) explains the cointegration relationship in terms of the distance that exist between a drunk and his dog while walking back home after a good *pub* night-out. Any time, Murray explains, the dog is out of the master's sight he whistles, the dog gets closer reducing the distance between the two.

Interesting and relevant as the explanation is, the question is still what variables are the one(s) making the call to make the dog—consumption in this case—come closer. The cointegration equations indicate that income, the wealth components and the interest rate are the ones steering consumption. The income-response functions, in particular, highlight the long-lasting and positive from housing wealth and the value-added from the manufacturing sector.

The first element—positive and lasting effect associated with housing wealth—highlights the effect the construction industry has both in terms of promoting income, and eventually consumption, as well as the relevance that increased levels of equity have to stimulate consumption historically in Mexico.

The second element—value added from the manufacturing sector—will suggest that Mexico has taken advantage of its strategic position—next to the world's largest consumer market—which has allowed its thriving export manufacturing sector to be associated with increasing levels of consumption per capita.

Different researchers (i.e. De Bonis and Silvestrini, 2012) who have done the cointegrated analysis of consumption have found the *speed of adjustment* factor to oscillated between 0.156 for Finland to 0.605 for the USA. In Mexico's case the point estimate for the cointegrating coefficients identified (0.6 under the Engle and Ganger or Johansen procedures and 0.48 under the OLS-ARDL procedure) are consistent with those findings.

4.6. Conclusions.

Consumption per capita in Mexico has increased steadily over the last six decades. A similar behaviour has been found on variables related with income, wealth, the international trade flows, and resources coming from abroad in the form of either investment, exports from the manufacturing sector, exports of labour (remittances), goods (the manufacturing or national oil sector) or services (income from tourism).

The study of consumption in Mexico offers an interesting case given the circumstances around the economic process the country has endured the recent past, as it has made the transition from a once *crisis-prone* economy to a manufacturing powerhouse and one of the most open economies in the world.

Given the availability of information on time-series data, it was possible to construct 57 years of macroeconomic history for Mexico; offering the possibility to perform the econometric analysis of macroeconomic time-series information aimed at identifying what the main drivers of consumption have been.

The research proceeded initially to work under the assumption that the data series met the stationarity condition with structural breaks. Working under that assumption, several estimations were performed using different regression models based on existent theory and relevant variables for the Mexican economy such as remittances, foreign direct investment, exports, or the output of the manufacturing sector—in addition to the consumption, income and wealth variables.

Given the abundance of existing literature on the cointegrating nature between consumption and income, the decision was made to explore the cointegration possibility.

Based on different methodologies identified as suitable options for cointegration analysis: The Engle-Granger methodology, the Johansen procedure, and the error correction methodology, this research performed the three procedures. The empirical evidence confirmed the cointegration nature of the consumption function with income, the interest rate, the wealth components and the value-added from the manufacturing sector.

Given the empirical evidence indicating the cointegration relationship that was found to exist between consumption and income, the wealth components, the value-added of the manufacturing sector output and the interest rate, the decision was made to proceed forward to establish if a long-run equilibrium relationship could be identified among those variables.

The results indicated a strong cointegrating relationship, with a speed of adjustment parameter equal to -0.600, indicating that any time consumption is out of equilibrium—above the level of income, as an example—it adjusts by reducing down. If consumption is below equilibrium, it will reduce next time around—closing the gap by 60% of the gap in one period of time.

The second econometric procedure conducted was the performance of the Johansen model—performed with the help of STATA software. The results obtained confirmed the cointegrated nature of the main dependent variable (consumption) and the already referred independent variables.

Three cointegration relationships were identified, allowing to conclude that any time consumption has been out of equilibrium the lagged error correction term will be below average. This will be corrected by an increase in consumption in the subsequent periods—the size of the increase based on the empirical evidence obtained that consumption will react by reducing and closing 47% of the size of the deviation from equilibrium—eventually closing the gap between consumption and the equilibrium variables: income and the interest rate.

The main finding has been that orthogonalized shocks in housing wealth and in the value-added from the manufacturing sector have longer lasting and more positive effects for consumption. Income shocks meanwhile were found to have a positive but short-lived effect in consumption which eventually resulted on consumption reductions.

The speed of adjustment parameter was found to be very close to the one estimated by the Engle-Granger procedure (-0.603). The empirical evidence obtained confirms that for the specific case of Mexico, variables other than income matter for consumption. Similar to their findings by different researchers, the interest rate, the value-added from the manufacturing sector and the wealth components were found to be consumption co-determinants.

The VECM procedure produced positive and statistically significant short-run relations between income and consumption, a similar positive relationship between consumption and the wealth components, and a negative one between consumption and the interest rate.

Through the statistical analysis process, it was possible to establish how some variables, such as government spending and output from the manufacturing sector have potential explanatory power. However, their inclusion produced no statistically significant parameters—foreign direct investment—or to produce an insignificant effect—broad money—when both wealth components were included in the regression model.

The ECM confirms that as much as 40% of the current level of consumption is determined by the lag level of consumption itself. Such finding is not necessarily in support of the ideas that consumption is a long-run martingale.

In other words, it was found that innovations to income, wealth (both financial, and housing mainly), the value-added from the manufacturing sector and the interest rate have been

found to have a role in steering consumption in Mexico. Very much in support to what has been stated by different researchers (e.g. Jansen, 2013; Attanasio and Borella, 2006).

Considering the ups and downs the Mexican economy went through for the better part of the 1980s and 1990s and considering that the actual value of financial wealth only picked up after Mexico liberalised its economy, it is clear consumption benefitted from the sound macroeconomic management policies and from the industrialization process enhancing the manufacturing capabilities of the country. Which have been statistically related to the increases in consumption Mexico has experienced.

Certainly, economic development in Mexico is still very much a *work in progress*. If indeed consumption is a good reflection of welfare as argued by different researchers (i.e. Attanasio and Weber, 2009), the Mexican population, or at least some segments, must have seen significant increases in the levels of well-being associated with higher levels of consumption. The benefits of higher consumption at the aggregate level might not have benefitted everybody. Similarly, this is why this research now moves on to analyse the impact of consumption at the microeconomic level.

5. Consumption and well-being changes at household level: winners and losers.

5.1. Introduction.

A relevant aspect of today's economy relates to the contribution of emerging economies to global economic growth and their role in driving consumption and production (Bortz and Kaltenbrunner, 2018).

A characteristic feature of most emerging economies is that of a combination of economic growth with increasing levels of inequality, where the proceedings of economic expansion have benefitted disproportionally those having higher/better abilities, qualifications, capital—financial mainly—or political muscle to capitalise on economic growth (Mason, 2015).

Mexico's recent modest but consistent economic progress has been related to its insertion in a global economy, its strong and growing manufacturing base and stern economic reforms (Martin et al., 2016).

Politicians, analysts and researchers (e.g. Iglesias, 2018; Pilling, 2018) have questioned the current model of integration and globalisation. Mexico has not been an exception. Different analysts (e.g. Calva and Salazar, 2012; Moreno-Brid and Bosch, 2018) have raised their concerns mainly in terms of diminishing wages for larger cohorts of Mexican society.

The second chapter of this thesis has revealed how Mexico has experienced increasing levels of consumption married with reductions in income inequality (Cortes, 2013).

The previous chapter has shown how consumption in Mexico has been increasing in real terms at level and on a per capita basis, while consumption at constant USD has more than doubled since 1998 (World Bank, 2017). However, as indicated by Winters et al. (2004), under the surface of aggregate outcomes, there are winners and losers.

An important question about aggregate consumption and income studies is the fact that it is not possible to identify if the increases in consumption spending have been incurred only by the households that experienced wealth or income increases, or if the benefits have been similar for all households (Bostic et al., 2009).

The second chapter of this thesis has revealed how Mexico's economy has evolved from a commodities seller (oil mainly) to one of the world's manufacturing hubs. The free trade agreement with the largest market in the world has brought some economic blessings but also more than a few social challenges—migration and drug trafficking, to name a few. Therefore, this chapter aims to understand how the benefits of economic growth have been shared in Mexico by a population undergoing a demographic transition.

That is what this piece of research aims to identify if specific cohorts of the Mexican society have similarly felt aggregate consumption increases.

5.2. Consumption at the microeconomic level.

According to different researchers (e.g. Deeming, 2010; Sun and Wang, 2013; Chitnis and Hunt, 2011), there are factors, other than the economic ones—tastes and preferences, socio-demographic and geographic factors—which are better able to explain variation for specific consumption components.

Attanasio and Weber (2010) explain that higher rates of growth imply larger differences between savers—usually those better-off—and dis-savers—most of the time, the elder and poor. The connection between income and consumption inequality has been established by Huggett et al. (2011) who concluded that variations in income do explain most of the variance in consumption over the life-cycle as found on different studies (e.g. Slesnik and Ulker, 2005; Aguiar and Hurst, 2008).

According to Brandolini and Smeeding (2009), consumption rather than income is a preferred measure of economic advances in developed nations, while the latter will be the option for developing countries. Deaton and Grosh (2000) assert consumption is smoother and less volatile than income.

Abdel-Ghany et al. (2002) meanwhile, have found a statistically significant and positive relationship between relative consumption and the relative place a household has in relation to the income ladder.

The most interesting element surrounding consumption is that, as explained by (Crossley and Pendakur, 2002) the 'shape of the two profiles [income and consumption] co-vary across different groups in the population'. Actually, according to Aguiar and Hurst (2013), the

disaggregation of consumption allows us to account for changes in the agent's changes in preferences, lifetime resources, or opportunity cost of time.

In a highly relevant piece of work, Palley (2010) tried to reconcile Keynes' aggregate consumption function, with Modigliani's *permanent income hypothesis (PIH)* and Friedman's *Life-cycle Theory (LCM)*. The main conclusion was that people spend not only based upon rationale/quantitative elements such as implied by their permanent income, their income expectancies along the life-cycle (LCM), or on the relative position people have on the income ladder but in order to *"keep up with the Joneses".*

That is, at the microeconomic level, people spend based on factors other than income. Have different age cohorts, geographical regions, or do socio-economic factors such as age, location, education, and others can be associated with consumption differences?

For Nolan and Marx (2009) current income does not necessarily reflect the impact of savings, debt or previous spending. Therefore, to understand inequality, the two variables most commonly studied are household income and household consumption.

It has been documented in this thesis how the per capita values of both, consumption expenditure and income have shown an upward trend over the best part of the most recent sixty years despite the *ups-and-downs* the Mexican economy has had over such period of time.

The second and third chapter of this thesis revealed that how Mexico has experienced increased levels of consumption and reduction in income inequality. While as shown in the previous chapter consumption at the aggregate level has increased, it seems relevant to find out what the *story* has been in terms of consumption at the microeconomic level particularly if certain groups have benefitted more than others.

Therefore, this chapter aims to understand who the beneficiaries of increased levels of consumption have been. The decomposition of consumption by demographic, geographical, and other discriminating variables (i.e. household composition and consumption components) is what this piece of research proposes in order to identify such differences between different groups of the population.

Decomposition has been used before to understand better consumption evolution and change over the life-cycle. As an example, Attanasio and Davis (1996) analysed the evolution of consumption for different education groups, in order to evaluate the correlation between 'the type of insurance markets agents have access to and the evolution of consumption inequality'.

Given the multi-dimensional nature of Mexico, in terms of economic development, differences between the more developed north of the country and the less-developed South, and given the large differences of a still largely unequal nation, it is relevant to enquire if the average improvements in terms of income and consumption have been felt similarly among different cohorts of society.

The research aim is to identify how the benefits of increased levels of consumption at the macro-level have been distributed among the Mexican population.

5.3. The empirical data.

According to Deaton (1997), household expenditure surveys represent an adequate base for research in order to test theories about household behaviour and how people react to economic shocks. The same author argues the study of survey data is ideal in order to link economic events and individual welfare, making it possible to track outcomes or behaviour for groups of individuals with *repeated cross-sectional surveys*.

Given the availability of the National Survey of Household Income and Expenses (ENIGH) the decision was made to pool together a dataset based on the bi-annual ENIGHs from 2008 to 2016.

The ENIGH is a survey conducted every two years to obtain information about the distribution and structure of the household's consumption and income. It provides information on the socio-demographic and occupational characteristics of the household members as well as household's structural characteristics and the availability of specific household goods and appliances. It presents the income obtained by each household member over a three-month period and the total household expenses over the same period.

The ENIGH dates back to 1984. The same methodological procedure was used on a consistent basis from 1986 until 1992. Some adjustments were introduced in 1992, and the same methodology was followed until the 2006 ENIGH.

The decision to start the pooled dataset used in this thesis with the 2008 edition was based on the availability of similar socio-economic data. Although the data on income and expenditure exists for all editions of the ENIGH since the first edition (1984), information on household composition and characteristics is homogeneous and readily available from the 2008 edition and those afterwards.

According to INEGI (2015), in 2008, Mexico had 26.8 million households, the figure grew on a consistent basis to 27.3, 28.9, and 31.0 million for 2008, 2010, and 2012 respectively. The number of dwellers passed from 4.0 in 2006 to 3.7 in 2012 with the average number of income takers passing from 2.1 to 2.4 over the same period.

Table 5.1 presents information on the ENIGH sample size, number of individuals living in them, the average household size, and the average household head's age and information on the values of income and consumption in constant (2008) prices.

It was interesting to corroborate how the levels of income and consumption have not returned to the *pre-2008 crisis* values. Mean household income and consumption were in 2016, 20% and 14% below their level in 2008.

If the values of income and consumption—in real terms—is considered on a per capita basis, the 2016 levels are also yet to catch the levels of 2008. Income per capita and consumption per capita were 15% and 9% below the pre-crisis values.

As expected, given the high levels of inequality Mexico has[44], the data shows the characteristic right skewness of the distribution represented by the smaller readings for the median values relative to the mean values.

An interesting finding is the fact that the ratio of the median to the mean changed over the sampled period as it passed from 0.65 in 2008 to 0.71 in 2016.

[44] According to Cortes (2010) even though it has been at its lowest level as of late the value of the total income *Gini* coefficient has fluctuated between 0.49 and 0.55 during the 1984-2010 period of time. On a per capita basis income inequality has also reduced recently, but the income *Gini* coefficient value on that basis (per capita) has never been below 0.44 over the same period of time.

	2008	2010	2012	2014	2016
Households in survey	29,465	27,647	9,002	19,477	70,303
Mean household size	4.03	3.89	3.74	3.77	3.66
Mean income earners	2.37	2.32	2.47	2.43	2.47
Mean household head's age	48.1	48.4	49.1	48.4	48.9
Mean total household income (2008 MXP)	37,467	30,291	28,292	29,058	30,219
Median total household income (2008 MXP)	24,484	20,767	19,139	20,317	21,446
1st decile income (2008 MXP)	8,317	7,006	6,644	7,412	8,091
10th decile income (2008 MXP)	74,572	60,644	56,722	57,441	56,858
1st decile consumption (2008 MXP)	5,632	4,984	4,526	5,154	5,127
10th decile consumption (2008 MXP)	43,012	40,840	37,079	37,195	35,193
Mean total household consumption (2008 MXP)	22,065	20,685	19,078	19,392	18,393
Median total household consumption (2008 MXP)	16,109	14,591	13,591	14,227	13,867
Mean household income *per capita* (2008 MXP)	11,774	9,830	9,623	9,577	10,041
Mean household consumption *per capita* (2008 MXP)	6,652	6,616	6,394	6,274	6,092

Table 5. 1. Descriptive statistics ENIGH 2008-2016 datasets.

Mexico is set to become one of the ten countries with the largest elderly population in the world by 2050 (Antman, 2010) as a result of the combination of lower birth rates, improvements in its life-expectancy and the fact the country has the 10th largest population in the world at 132 million people in 2019 (INEGI, 2019). Figure 3.2 shows the steady decline in the birth rate between the 1970s and the 2010s. Meanwhile, the life expectancy for the country's residents has passed from 65 (in 1976) to 76 years in 2012.

As a result, from these demographic changes the expectation is that by 2051, 59% of the Mexican population will make the working force a similar figure to the one in 2005. The big difference is that in 2005, those working paid for the pensions of 5% of the population—5.3

million elders—by 2051 they will be supporting 21% of the population (table 5.2). No wonder the pension reform in Mexico was needed (Sinha and Yañez, 2007).

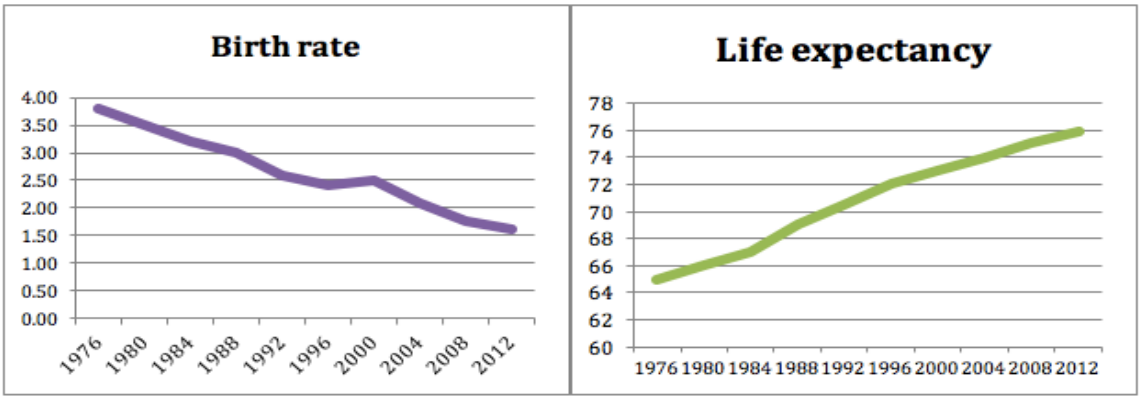


Figure 5. 1 Birth rate and life expectancy in Mexico 1976-2012. Source: CONAPO (2008), INEGI (2014)

The expected number for elder and working population age cohorts in Mexico are in line with what has happened in economically developed countries like the UK or Germany about 15 years ago (Bernard and Scharf, 2007). Meaning that the transformation from a rather *young* to a *greying* country is about to happen.

	2005		2051	
	Population (000s)	*% Total population*	Population (000s)	*% Total population*
65 and over	5,315	*5%*	26,124	*21%*
75 and over	2,045	*2%*	12,565	*10%*
85 and over	511	*0.5%*	3,642	*3%*
17 to 65	61,189	*59%*	72,399	*59%*
Total Population	103,947		121,855	

Table 5. 2. Percentage of total population by age cohorts in 2005 and 2050. Source: CONAPO (2008)

All the previous elements, coupled with the fact that Mexico is a net exporter in migration terms. It does not come as a surprise that the number of younger generations are smaller than their parents' cohort while at that age. These factors will put pressure, not only in the public provision of pensions—which have already changed from a publicly funded scheme to an individual account (or *pay-as-you-go*) scheme—but also in the living standards of those who will be retiring after 2025 (Cotlear and Tornarolli, 2011).

An additional source of concern at the microeconomic level, particularly in terms of living standards, is the limited coverage of pensions and health care cover among the Mexican

population which disproportionally affects the elders who 'find themselves in a weakened position, particularly when they are ill, disabled or living in extreme poverty' (Gomes and Montes, 2004).

Pensions along health improvements, home ownership, and better medicine have been the elements which had allowed today's old generation to experience decisive progress in comparison to the one their own parents had (Moody, 2007).

Considering that Mexico has one of the lowest levels of pension coverage among its population among Latin-American nations (figure 5.2). It is therefore, quite relevant to study how the living standards of those at the end of the life-cycle have benefitted, if ever, from improved levels of income and consumption for the country as a whole.

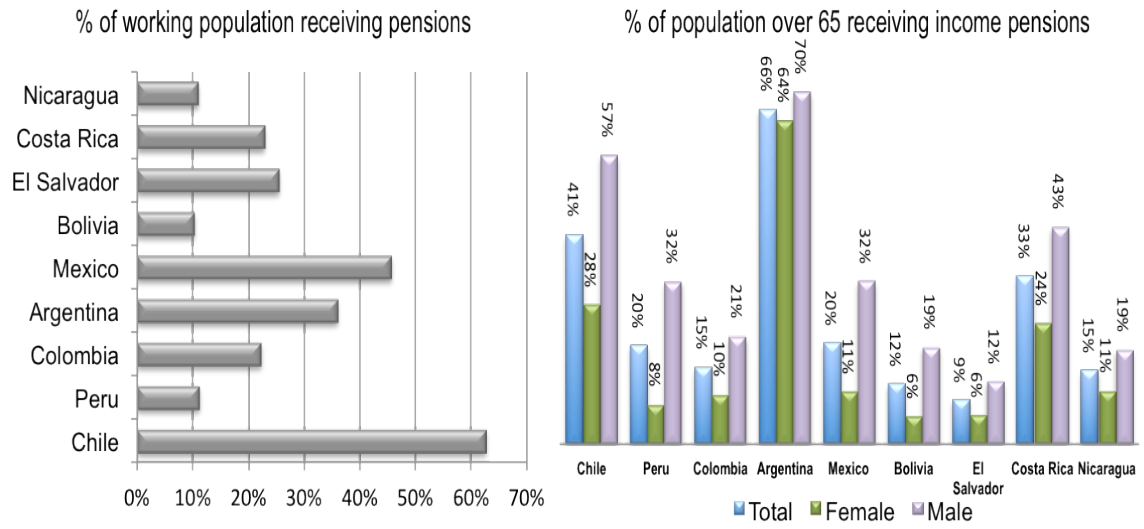
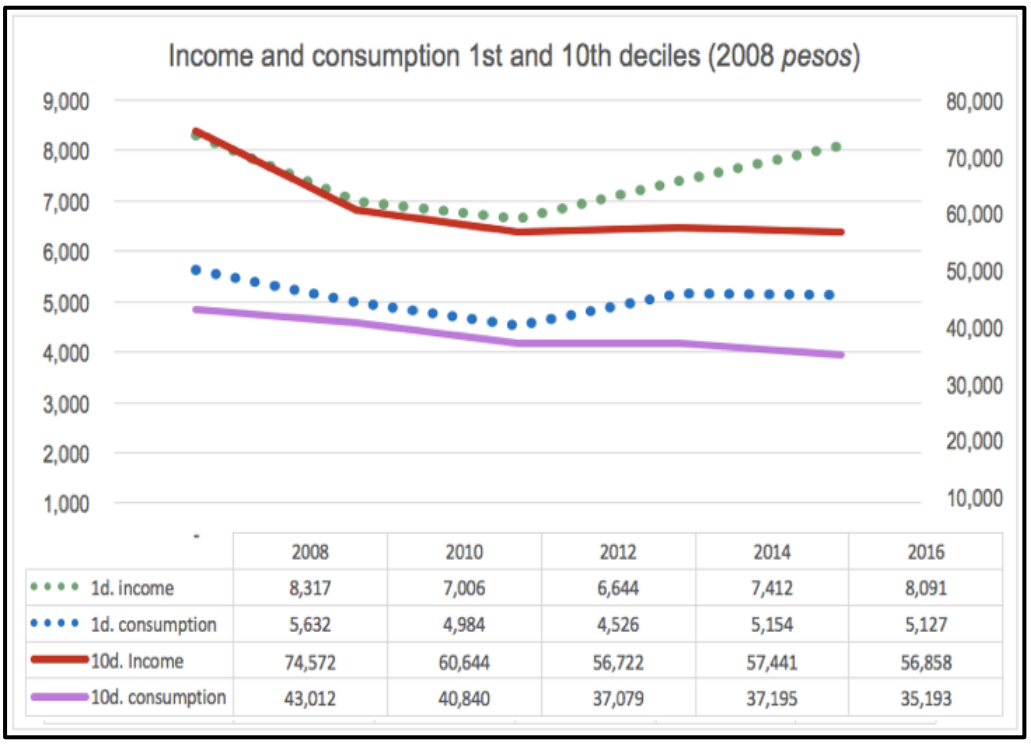


Figure 5. 2 Percentage of the working-age population and percentage of population over the age of 65 by gender receiving pensions in selected Latin-American countries. Source: Gill et al. (2004)

Along the demographic transformation Mexico is living through, the country has also been undergoing through a process of improvements in terms of inequality, even if modestly.

While in 2008, the poorer decile had an income level that amounted to 11% of the mean income level of the richer lot in Mexico, the same figure was over 14% eight years after. The relation did not move as much in terms of consumption. The level of consumption made by the poorer decile passed from 13.1% to 14.6% of the level enjoyed by the richer decile in the household surveys.

Figure 5.3. presents the mean values of income and consumption at constant prices for the first and tenth deciles. As shown in that figure, household consumption was getting closer to pre-crisis levels, while income levels are still lagging behind as explained already.



	2008	2010	2012	2014	2016
1d. income	8,317	7,006	6,644	7,412	8,091
1d. consumption	5,632	4,984	4,526	5,154	5,127
10d. Income	74,572	60,644	56,722	57,441	56,858
10d. consumption	43,012	40,840	37,079	37,195	35,193

Figure 5. 3 Mean household consumption and income at constant 2008 prices for the 1st and 10th deciles 2008-2016. Source: Author's own calculations based on ENIGH 2000-2012.

Table 5.3 presents the share of total income associated with labour and transfers for each of the different income deciles based on the information contained in the pooled 2008-2016 dataset to be analysed in this chapter. The information shows how much poorer households rely on transfers.

According to Deaton and Grosh (2000), household composition plays a significant role in household consumption. Therefore, it is relevant to consider both household income and consumption on a per capita basis.

Income decile	% total income from LABOUR	% total income from TRANSFERS
1st	35.2%	40.1%
2nd	50.7%	31.1%
3rd	58.6%	24.9%
4th	63.1%	21.5%
5th	66.8%	18.6%
6th	69.0%	16.8%
7th	71.4%	15.0%
8th	72.5%	13.9%
9th	72.3%	13.8%
10th	68.3%	13.9%

Table 5. 3. Share of household total income associated with labour and transfers by income decile. Source: Own calculations based on ENIGHs 2008-16.

Figure 5.4 presents the mean values of income and consumption of both variables in the bi-annual datasets analysed in this piece of research. The way income and consumption have developed at the microeconomic over time is partially told in that graph. The main finding is that consumption per capita—the most common way to express consumption while researching about it—has been decreasing on a permanent basis. Income per capita meanwhile has picked up during the most recent edition of the household survey after constant reductions in real term levels.

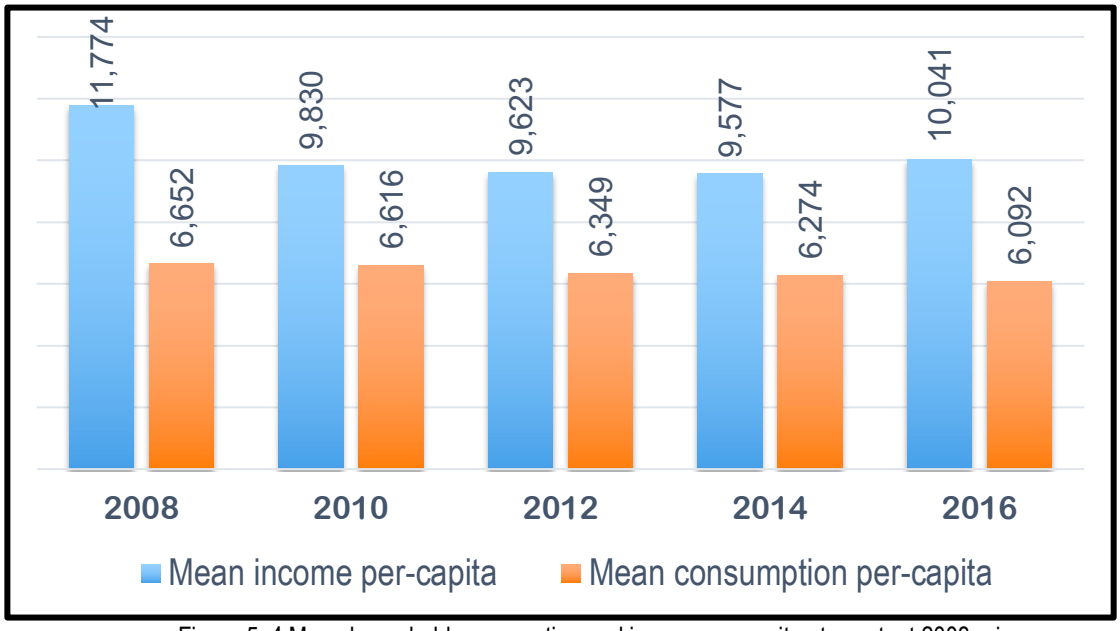


Figure 5. 4 Mean household consumption and income per capita at constant 2008 prices. Source: Own calculations based on ENIGH 2000-2012.

The fact that microeconomic data contrast with the conclusions obtained after analysing macroeconomic data is relevant, regardless of the time frame been different in both cases.

Meanwhile, figure 5.5 presents the value of average income per capita at constant prices for different percentiles for each of the different cross-section surveys. The information reveals the common right-*skewness* feature of the income distribution.

Beyond the skewness of the distributions, an interesting feature of the information available is that the lower-income groups have seen levels of income and consumption above the ones they enjoyed before the crisis. Meanwhile, the richer cohorts are yet to return to their pre-crisis levels. Particularly, those at the highest end of the distribution[45].

The fact that there have been distributional differences over time among different income groups at the microeconomic level, while income has increased at the aggregate level for a number of years, makes relevant to research about those micro-level changes in consumption.

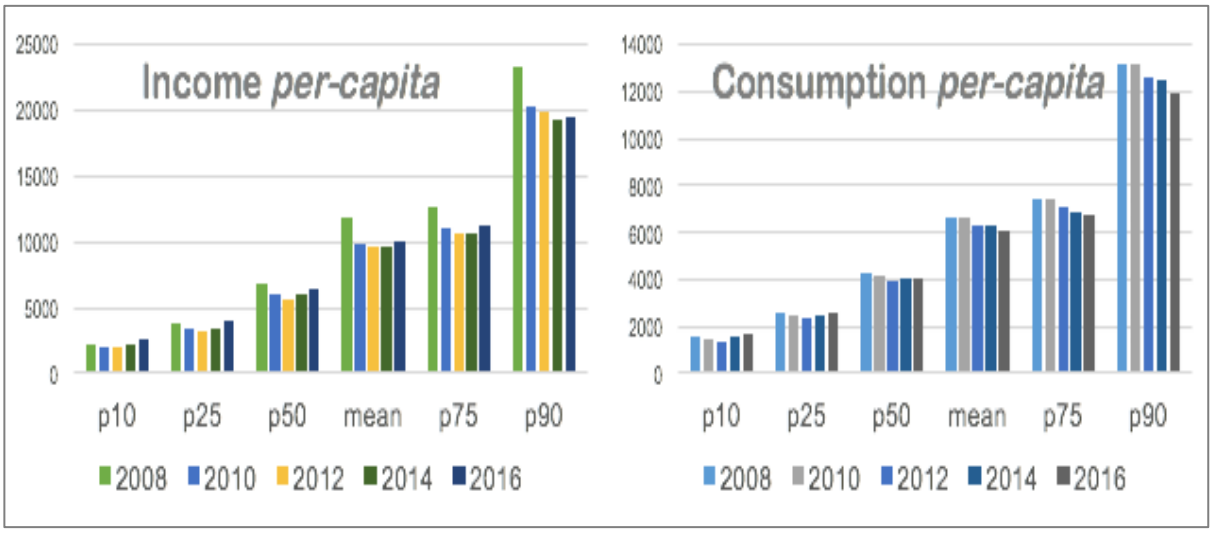


Figure 5. 5 Household income and consumption per capita for selected percentiles in the 2008-2016 ENIGHs. Source: Own calculations based on 2008-2016 ENIGH.

The pooled dataset contains over 155,000 observations. Figure 5.6 presents some descriptive statistics about it. There are two noteworthy elements:

1. Over 40% of the poorer households have levels of expenditure above the level of income they received over the period of analysis. Meanwhile, less than 5% of the richer households in Mexico presented any levels of overspending.

[45] The levels of income and consumption per capita for the 99th percentile in 2016 were 17% and 11% below the 2008 level. The same figures for the 1st percentile were in 2016, 32% and 12% higher than in 2008.

2. The richer households are the ones enjoying pensions. The analysis reveals that 25% of households in the top decile receive a form of pensions, while only 4% of households belonging to the poorer decile receive them.

Age Cohort household head	Frequency	Percent
Under 20	788	0.5%
20-24	5,416	3.5%
25-29	10,764	6.9%
30-34	15,069	9.7%
35-39	18,146	11.6%
40-44	18,923	12.1%
45-49	17,756	11.4%
50-54	16,133	10.3%
55-59	13,613	8.7%
60-64	11,651	7.5%
65-69	9,257	5.9%
70-74	7,274	4.7%
75-79	5,194	3.3%
80-84	3,259	2.1%
85 or over	2,651	1.7%

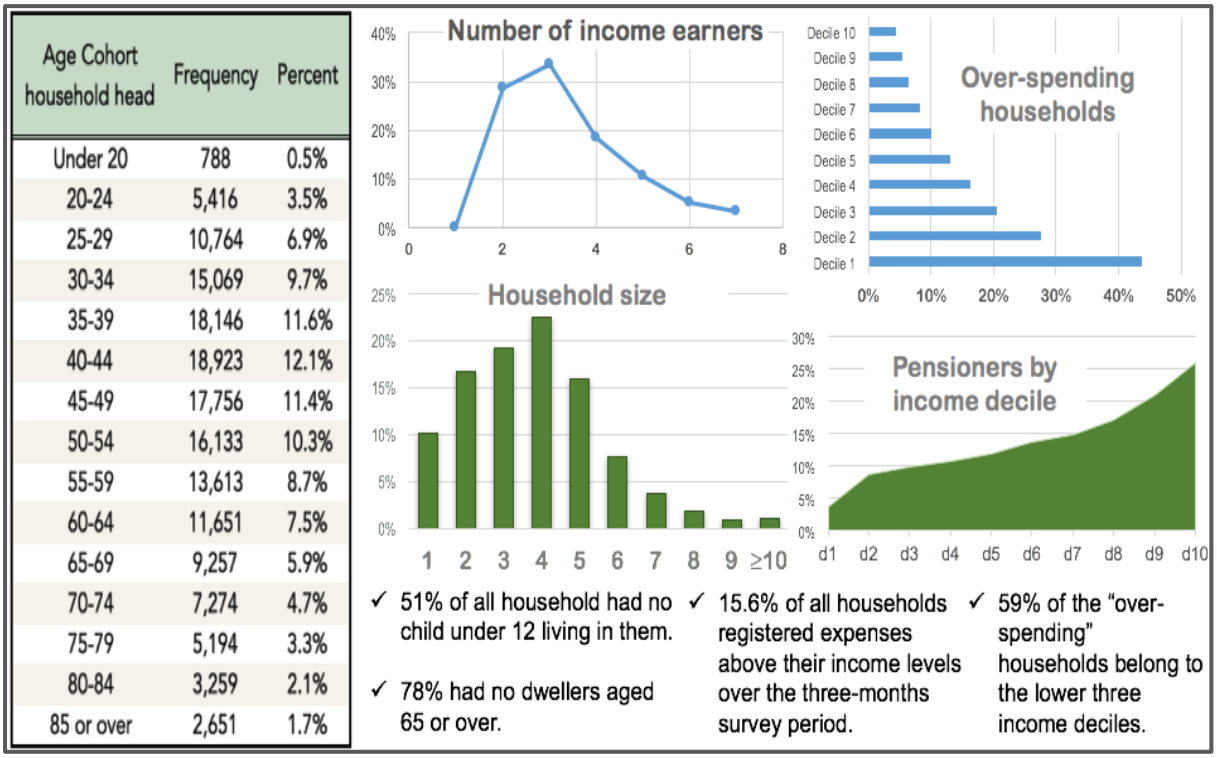


Figure 5. 6 Household size and profile description of pooled dataset. Source: Own calculations based on ENIGHs. Source: Own calculations based on ENIGHs 2008-2016.

Figure 5.7 presents information about the household head's age and income profile in the dataset. It is not a surprise to find confirmation that the younger-most and the elder households tend to be part of the lowest income decile in Mexico.

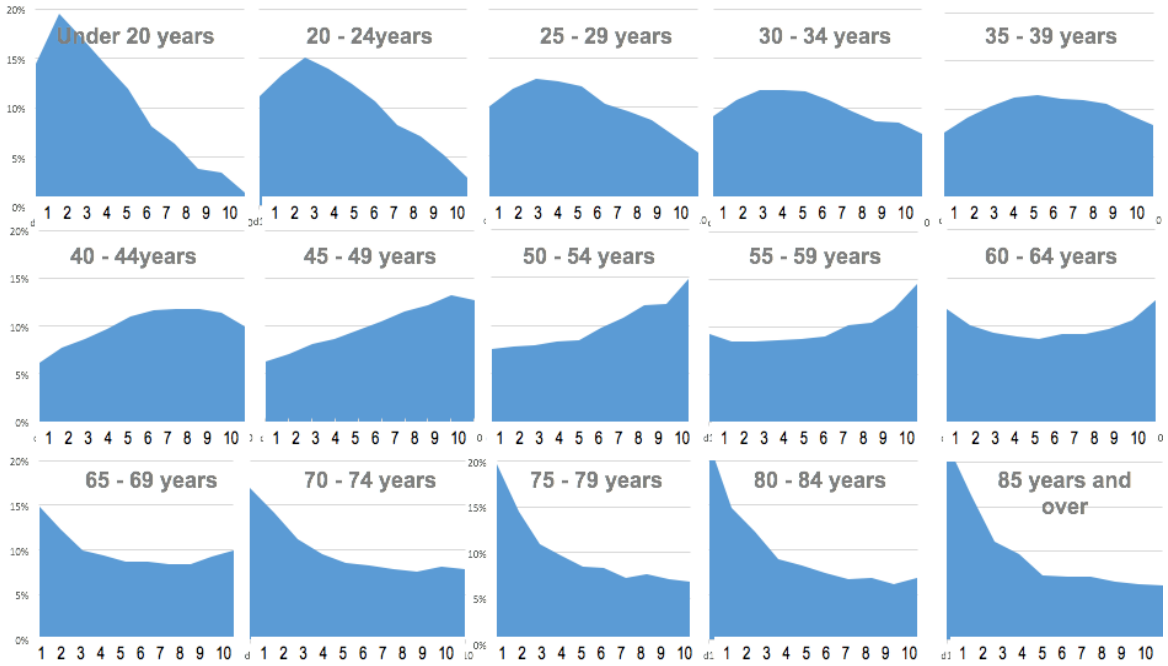


Figure 5. 7 Percentage of household in each income decile by the age of the household head.
Source: Own calculations based on ENIGHs 2008-2016.

Out of the total number of households headed by young individuals—under the age of twenty—51% belong to the lowest three income deciles, only 9% of them are part of the richer income decile.

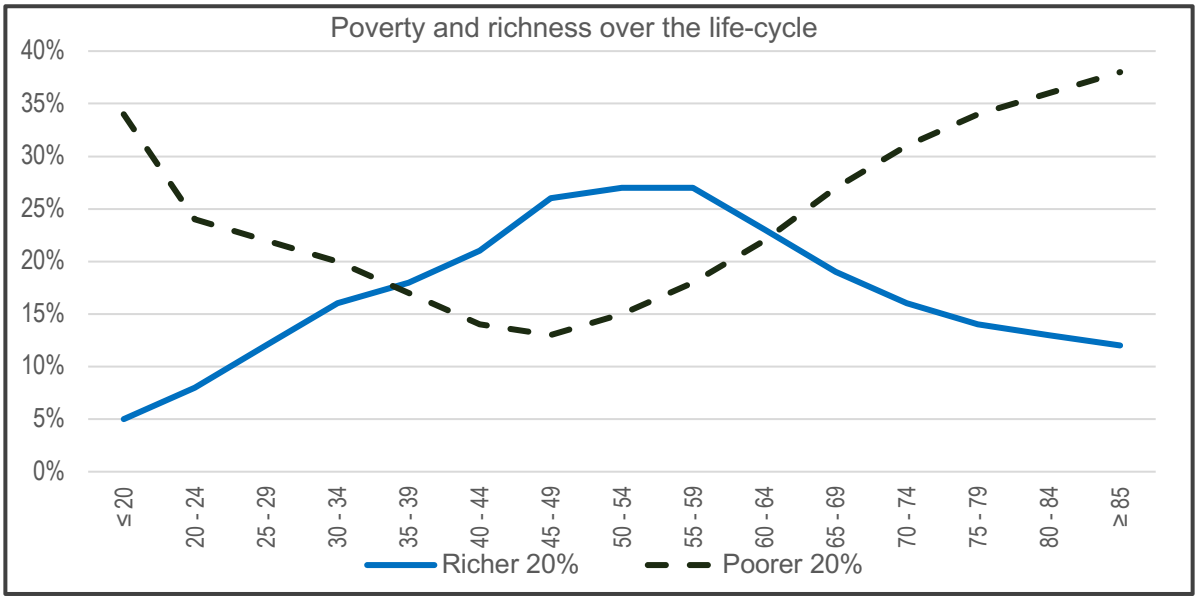


Figure 5. 8 Percentage of households in the lower and higher two income deciles by the age of the household head in the pooled dataset. Source: Own calculations based on ENIGHs 2008-2016.

Figure 5.8 shows the age distribution of the lowest and highest income quintile in the dataset by the age of the household head. The data corroborates the idea that the middle-age

household heads enjoy a higher chance of being not poor, while the old and young disproportionally belong to the lowest income quintile.

On a different note figure 5.9 presents a description of some expenditure concepts over the period of time covered by the pooled micro-datasets.

The percentage of food consumption as a proportion of total expenditure—at 42% on average—has remained almost constant over time. The consumption category that shows a decrease, over time, in both absolute and relative terms is education expenditure. Due in part to the fact that the public provision of education— provided free of charge—has increased its coverage and quality (Solis, 2018).

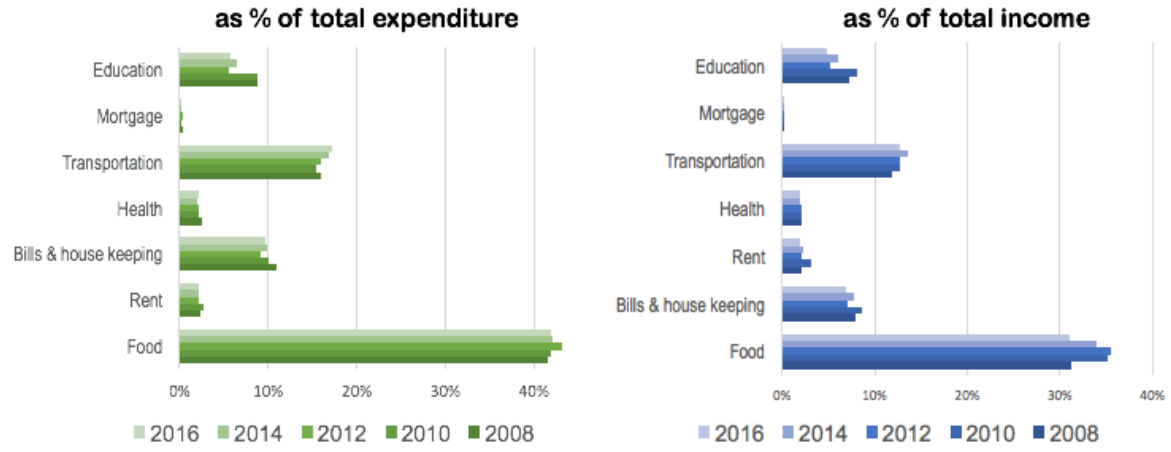


Figure 5. 9 Levels of monetary consumption as a proportion of total household income and as a proportion of total household expenditure for selected consumption components in 2008-2016 ENIGHs.
Source: Own calculations based on ENIGHs 2008-2016.

The consumption category increasing the most is the amounts spent in transportation, including expenditure on petrol, public transportation, road tolls and road taxes. This factor is easily understood by the level of urbanization of the Mexican population and the size of megalopolis, where the largest share[46] of the Mexican population lives.

Figure 5.10 presents the scatter plot of the individual household level of income and consumption in each household surveys. As expected, the data corroborate the positive association between income and consumption.

[46] 49.9% of the Mexican population lives in cities with 100,000 inhabitants or more. While 30.1% of them live in cities with 500,000 or more inhabitants (INEGI, 2018).

Figure 5. 10 Scatter plot of log values of total household income and consumption for each of the individual ENIGHs at constant 2008 prices. Source: Own calculations based on ENIGHs 2008-2016.

After inspecting the dataset, it was found that 21 households—0.015% of total observations—in the pool-dataset declared a consumption value of zero, while 405 households—representing 0.26% of all households in the pooled cross-section—declared a three-months level of income equal to zero. Five households declared income and consumption equal to zero. All of them (421 observations) were eliminated from the dataset.

Figure 5.11 presents the income profiles at constant (2008) prices for each of the different income deciles as it is possible to see the richer 10% of all households in the dataset have had the largest decline in real terms after the financial crisis of 2008-09. Meanwhile, the income levels for the poorer 10% did not reduce much and had average income values above pre-recession levels.

For the middle-income cohorts, income level has recovered but is yet to reach the same levels as the ones enjoyed in 2008. The size of the income reduction for households in the eighth and nine deciles have not improved much over the eight-year time-span covered by the pooled date.

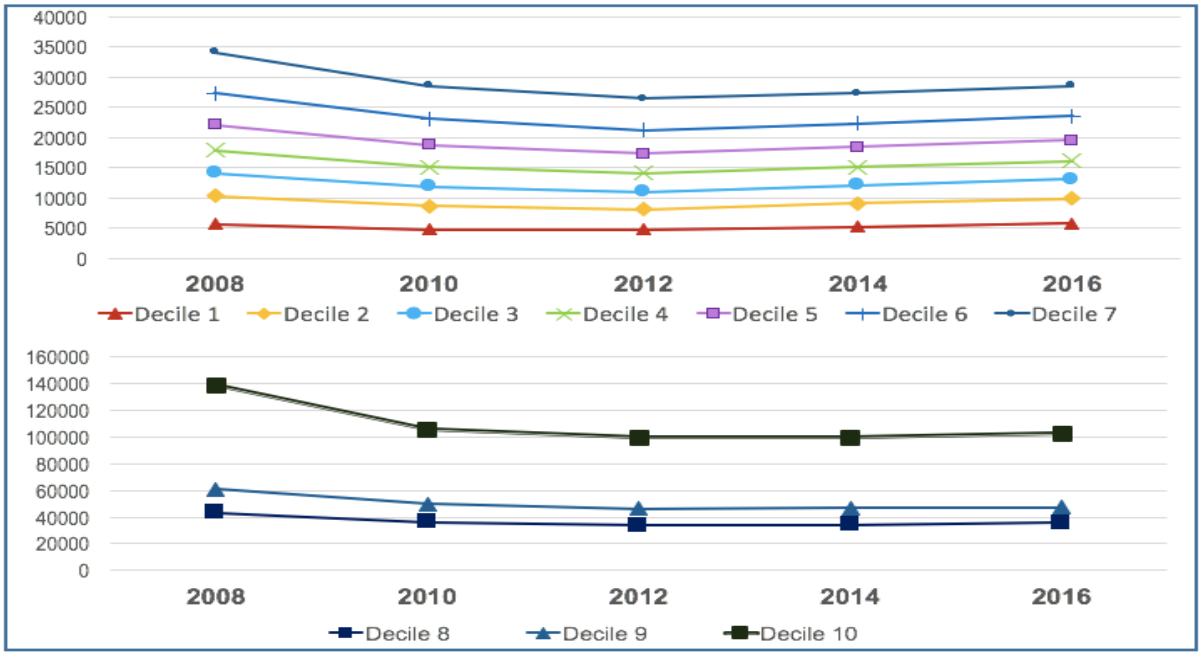


Figure 5. 11 Mean income level for each income decile on pooled data in constant 2008 Mexican pesos. Source: Own calculations based on ENIGHs 2008-2016.

One of the objectives for this piece of research is to understand how households within different cohorts of the population have adjusted their consumption profiles over-time given the macroeconomic trends of higher consumption.

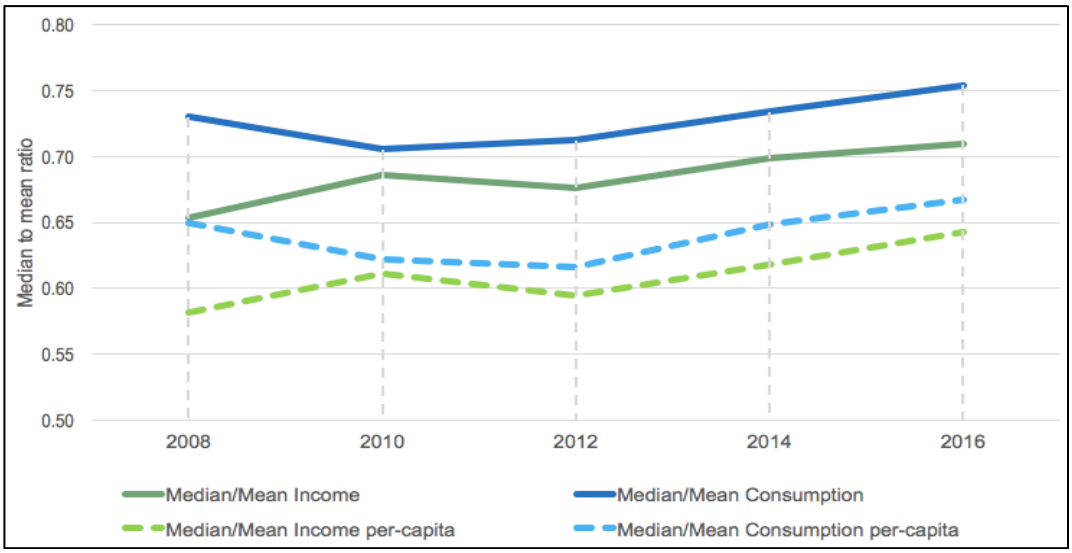


Figure 5. 12 Ratio of median to mean income and consumption at constant prices. Source: own calculations based on ENIGH 2008-2016.

Inequality can be determined in a different number of ways. One simple way is to compare the mean and the median of a distribution. Given the information available in the Household Income and Consumption Surveys for Mexico (ENIGHs) figure 5.12 present the income and consumption ratios of median to mean values at both, level and per capita basis. In an

egalitarian society, the mean value of the income distribution should coincide with the value of the median.

The previous figure reveals how the ratio of median to mean income has increased signalling a more egalitarian distribution of income. The median to mean ratio of consumption also shows signs of reduced inequality.

Sometimes not all reductions in inequality are good news, as it could be the product of what is known as the *race-to-the-bottom* that occurs when the better-off see a reduction in their levels of income, consumption, and/or wealth, which means nothing for the worst-off in society. The analysis of consumption under changing inequality condition is the matter of the next chapter in this thesis.

The subject matter of this chapter is to find out, through empirical econometric analysis, if the increases in both income and consumption at the macroeconomic level have *lifted-all-boats*. In plain words, the aim is to find if the story of improved levels of consumption at the micro—household—level has been in consonance with the improvement at the aggregate level.

The econometric analysis intends to use the household consumption level as the dependent variable while controlling for different household composition, socio-demographic and economic variables.

5.4. The econometric model.

According to Attanasio and Browning (1993), consumption evolves over time as family composition changes. Different researchers (e.g. Lloyd-Sherlock, 2010; Attanasio and Weber, 2010) have highlighted the relevance of demographics for consumption. Household composition, and some other *non-monetary* household characteristics, have been used as covariates in addition to *economic variables* while analysing consumption at micro-level.

Table 5.4 presents a brief description of the outcomes of the literature on consumption research at the microeconomic level reviewed in this thesis. The table contains only those studies found to have used a linear econometric model relating household levels of consumption with income and a number of different other regressors.

Author(s)	Dependent variable	Independent variables
Lise *et al* (2014)	Consumption per capita	Disposable income, hours worked, *dummies* age cohorts.
Fernandez Curegedo (2003)	Consumption *per capita* (constant prices)	Income, demographic dummies (sex, age).
Aguiar and Hurst (2004)	Log Consumption	Dummy retirements, year, region, family size, education dummies, race dummies, log income, age, age square, hours worked, hours worked square.
Laitner and Silverman (2005)	Log Consumption	Income, wife's age, dummy for married.
Aguiar and Bils (2006)	Log Consumption	Demographics adjusted log expenditure of income for age group, *dummies* for age, number of earners per household, family size.
Denton et al (2006)	Savings	Ln (Ci/Pi), Ln prices, dummies for region and age, dummies for "degree of retirement", city dummies, time trend.
Crossley and Pendakur (2002)	Deflated non-durable consumption	Income real terms, wealth.
Fernandez Villaverde and Krueger (2007)	Log Consumption per adult equivalent	Age cohort dummies, time dummies.
Aguiar and Hurst (2008)	Log Consumption	Time dummies, marital status, household size dummies, deflated expenditure.
Lurhman (2007)	Non-durable consumption *per_capita* (constant prices)	Cohort age and time dummies, dummy for retirement status, four dummies for near retirement.
Gourinchas and Parker (2002)	Log Consumption	Family dummies, age dummies, region unemployment rate, dummy for retirement.
Jin et al (2011)	Log Consumption net of education	Peer-Gini; log Income; Age; Family size; Group average income, Dummies for: middle class, rich; interacting variable middle class*log income.
Fernandez and Krueger (2002)	Consumption *per-adult equivalent*	Age; age cohort dummies; time variable.
Skinner (1987)	Consumption	Food consumption at home; food consumption away from home; house value; rent expenditure; number of automobiles; utility bills.
Abdel-Ganhy *et al.* (2002)	Ratio consumption components to permanent income	Permanent income, regional *dummies,* age, accupation, gender, marital status.
Fisher and Marchand (2014)	Log Consumption	Income, retired *dummy,* age cohorts; gender, race and marital status *dummies.*

Table 5. 4. Econometric models in a selection of empirical studies on consumption.

Among the number of studies analysed, two empirical models gave an interesting option given the similitudes with the information available for Mexico.

In order to evaluate the possible impact of income distributional changes in Mexico an initial option was to use the consumption function as suggested by Sun and Wang (2013), that is, including as many independent variables related with household composition and demographics, as they were commonly available in all of the 2008-2016 ENIGH versions[47].

An initial option was the use of a linear model of consumption regressed on total household income, household size and composition, the age and sex of the household's head as done by Deaton and Paxson (1994). They studied the relationship between income and consumption inequality and found that within-cohort consumption and income inequality increased with age.

[47] Certain demographic variables such as the level of education of the household head, or the number of income receivers were not available for the earlier versions of ENIGH.

Another attractive starting point was to use a model similar to that used by Jin et al. (2011) researching about the impact of inequality increases in China. In that model, the logarithmic form of consumption is regressed on the log form of income, as well as on the Peer-Gini coefficient, or peer level of inequality, and a vector of independent variables representing different covariates representing different household composition elements. The decision was to evaluate that econometric model as an option for the next chapter of empirical work.

Deaton and Paxson (1994) introduced a model (5.1) considered as the stepping-stone for the econometric model used in this research. The adoption of such a model was deemed convenient as all of the variables were available for Mexico, which allowed the possibility to identify a well-specified consumption model for the current econometric analysis.

$$C_i = \beta_0 + \beta_1 HH\_Y_i + +\beta_1 Sex_i + +\beta_1 Age\_Y_i + +\beta_1 Reg_i + +\beta_1 Size_i + +\beta_1 Overs_i + \varepsilon_i \quad (5.1)$$

Where *HH_Y* stands for total household income, *Sex* if the sex of the household's head, *Age* is the sex of the person identified as household head, *Reg* is the region the household is located in, *Size* is the number of people living in the same roof irrespective of age, and *Overs* is the number of individuals over the age of 65 living in that household.

The use of the logarithmic form—or the transform option—of a model of consumption and income has been identified as a more adequate option when regressing both variables in many consumption and income studies (e.g. Gujarati, 2011).

Additionally, according to Neal and Rosen (2000), using the logarithmic form offers a way to deal with the *heteroskedastic* nature of economic data as income over the life-cycle tends to show different rates of dispersion. This is accentuated by the fact that earnings during the early years are more similar among different agents than the dispersion observed in prime working years or later in life.

Based on those elements, in this chapter, the decision was made to use the log-transformed model as in (5.1), considering the household composition variables and decomposing consumption by its components.

One relevant element associated with consumption differences is that of regional differences. Mexico is a country eight times the size of the UK and regional differences do exist.

While analysing income inequality reductions in Brazil, Menezes et al. (2006) found regional income convergence among the older cohorts. However, regional differences existed for younger cohorts. Similarly, Silveira and Azzoni (2011) have identified that a higher marginal productivity of capital in poorer states imply a higher rate of accumulation and growth and as a consequence, a reduction on inequality levels. Regional consumption differences offer another element for analysis for this research.

Figure 5.13 presents the geographical distribution of the 32 federal states that made up the Federal Republic of Mexico. They are grouped in eight regions based on a definition used by Mexico's Federal Government (Scott, 2011a). Each region shares certain economic commonalities.

Figure 5. 13 Economic regions of Mexico. Source: Own construction based on Scott (2011a).

Regional differences in Mexico are stark. Running the risk of oversimplification, it can be said that the north of Mexico resembles more the southern part of the neighbouring USA, while the southern states in Mexico are more alike to Mexico's southern neighbours. Table 5.5 presents information on income and consumption by region (2008 prices).

In order to illustrate the point of regional differences in Mexico, and just as an example, the average level of consumption in the richest region in Mexico (Mexico City and the surrounding area—region VIII) is 70% higher than in the less developed—southern-most—region of the country (region I). Price differential could partially explain those differences. If the comparison is made on a per capita basis, the differences stay practically the same.

Region	2008				2010			
	Average income	Average consumption	Average income *per-capita*	Average consumption *per-capita*	Average income	Average consumption	Average income *per-capita*	Average consumption *per-capita*
I	22,773	14,562	6,946	4159	21,537	15,076	6,601	4610
II	29,517	19,274	8,701	5536	25,889	18,979	8,017	5763
III	34,526	20,937	11,155	6511	29,058	20,380	9,464	6597
IV	37,480	22,616	11,024	6466	27,136	18,918	8,324	5720
V	38,733	22,417	11,703	6536	30,479	21,015	9,773	6745
VI	44,995	24,465	14,471	7547	37,048	24,312	12,407	7934
VII	38,602	20,705	13,203	6434	29,569	18,517	9,851	6034
VIII	42,411	25,446	13,692	8004	38,739	26,216	13,027	8664

Region	2012				2014			
	Average income	Average consumption	Average income *per-capita*	Average consumption *per-capita*	Average income	Average consumption	Average income *per-capita*	Average consumption *per-capita*
I	15,426	10,930	4,592	3275	17,941	13,480	5,317	4000
II	21,542	15,979	6,869	5027	22,507	17,286	7,153	5233
III	29,342	19,427	9,637	6383	28,852	19,563	9,417	6276
IV	27,525	18,507	9,432	6183	28,160	18,862	8,913	5924
V	28,395	19,795	10,007	6520	29,872	20,541	9,733	6734
VI	35,945	21,764	12,345	7431	35,035	20,755	12,471	7188
VII	29,421	20,256	10,011	6821	33,268	20,373	10,914	6684
VIII	33,713	22,776	12,014	7890	31,751	21,280	10,929	7233

Region	2016				2008-2016			
	Average income	Average consumption	Average income *per-capita*	Average consumption *per-capita*	Average income	Average consumption	Average income *per-capita*	Average consumption *per-capita*
I	18,090	12,366	5,810	3980	19,819	13,631	6,136	4170
II	24,324	16,656	7,819	5212	24,869	17,468	7,810	5339
III	28,706	17,837	9,437	5856	29,894	19,305	9,762	6228
IV	31,326	18,930	9,907	5994	31,494	19,732	9,775	6062
V	29,694	18,902	9,959	6316	31,601	20,151	10,274	6479
VI	36,152	20,957	12,781	7250	37,721	21,943	12,996	7373
VII	33,217	18,238	10,825	6108	33,199	18,941	10,954	6247
VIII	29,960	19,620	10,218	6601	35,657	23,154	11,963	7616

Table 5. 5. Average total household income and consumption by region at constant (2008) prices, and average household size in 2008 and 2012 ENIGHs in each region. Source: Own calculation based on ENIGHs 2008 and 2012.

Figure 5.14 presents a general snapshot of the differences in the states' GDP per capita, and a country with about a similar level of GDP per capita is listed as a way to portray regional differences in Mexico.

GDP per capita in Mexico's regions

	GDP per capita [1] (constant 2008 USD)	GDP per capita [2] (current USD)	Similar country
Region A:	5,015	7,122	Ukraine, Algeria
Region B:	7,294	10,358	Thailand
Region C:	10,614	15,072	Turkey
Region D:	9,519	13,517	Bulgaria
Region E:	9,041	12,838	Romania
Region F:	10,695	15,187	Belarus
Region G:	13,928	19,778	Hungary
Region H:	15,645	22,217	Portugal, Slovakia

Figure 5. 14 GDP per capita for Mexico's regions in current and constant USD. Source: IMF (2016)

A critical element while defining the preferred specification model is the decision about the specific form that both consumption and income will be considered on. Several authors (e.g. Attanasio and Weber 2010) regard the use of consumption per capita as an adequate form

to capture the real dynamics of household consumption given the *hump-shape* profile of household composition.

Figure 5.15 present the income and consumption distribution—average household income, household income per capita, and household income *per-adult-equivalent*—at constant prices over the whole period of analysis.

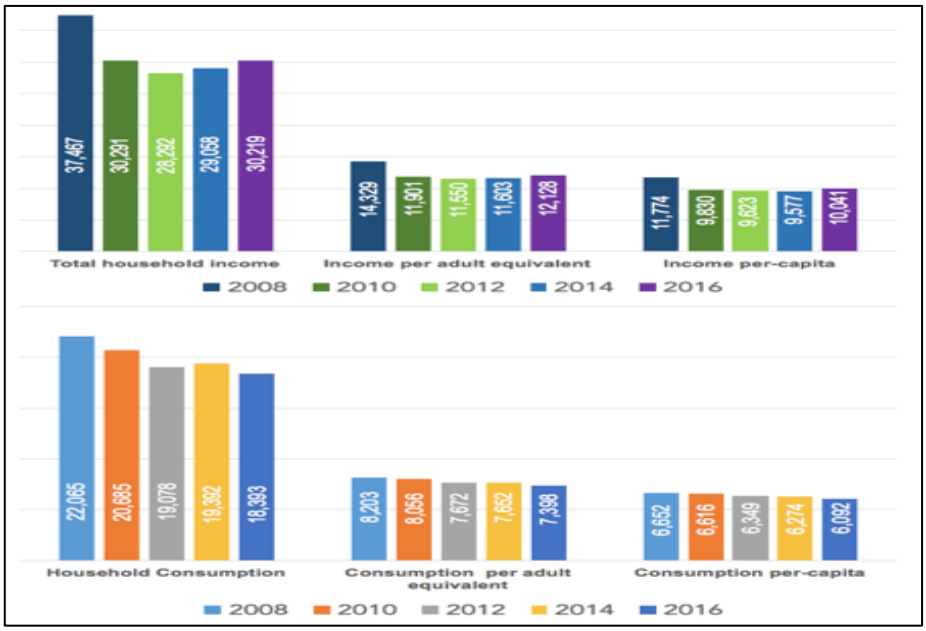


Figure 5. 15 Total household income, household income per capita and household income *Per-adult equivalent* on survey households in ENIGHs 2008-2016. Source: Own calculations.

In order to identify the most adequate specification for both income and consumption, the decision was made to perform the OLS analysis for some variations of a relatively simple model based on Deaton and Paxson (1994) considering the log form of household consumption at level, per capita, and *per-adult equivalent* basis (Table 5.6).

The estimated values for the coefficient in the previous table are based in (5.1) including the number of working income earners (*Earners*), the age of the household head (*Age*) as reported in the dataset, its square value (*Age*Age*), and a pension dummy variable equal to one if the house reports to have received any amount of income from pensions or zero otherwise.

Table 5. 6. Coefficient values for main specification model.

Estimated equation: $Ln(C_i) = \alpha + \beta(Ln\,Y_i) + \gamma(Earners_i) + \psi(Age_i) + \tau(Age^2)_i + \varphi(Pension_i) + \varepsilon_i$

$Ln(C\ per_i) = \alpha + \beta(Ln\,Y\ per_i) + \gamma(Earners_i) + \psi(Age_i) + \tau(Age^2)_i + \varphi(Pension_i) + \varepsilon_i$

$Ln(C\_m_i) = \alpha + \beta(Ln\,Y\_m_i) + \gamma(Earners_i) + \psi(Age_i) + \tau(Age^2)_i + \varphi(Pension_i) + \varepsilon_i$

	LN Total Consumption	LN Consumption *per-capita*	LN Consumption *per-adult equivalent*
LN *TOTAL* Household Income	0.715***		
	(296.26)		
LN Household income *PER-CAPITA*		0.737***	
		(395.33)	
LN Household Income *PER-ADULT equivalent*			0.719***
			(364.34)
Household earners	0.032***	-0.054***	-0.046***
	(19.11)	(-40.01)	(-33.83)
Household head age (age)	0.013***	0.009***	0.008***
	(17.86)	(16.78)	(15.06)
Age * Age	-0.0002***	-0.0001***	-0.0001***
	(-27.95)	(-27.59)	(-27.34)
Dummy pension	0.086***	0.024***	0.038***
	(16.60)	(5.64)	(8.85)
_constant	2.255***	1.901***	2.161***
	(87.98)	(96.77)	(103.36)

Values in parenthesis are t-ratios of robust standard errors. * indicates a 10% level of significance, ** indicates a 5% level of significance, *** indicates a 1% level of significance. Values associated with *dummy* variables are the coefficient estimates.

The objective of this initial regression was just to identify what form the regressand should be considered in the econometric model. The results obtained allow to conclude that the consumption to income elasticity is similar regardless of the specific basis consumption and income are accounted for.

In the economic sense, the results presented in table 5.6 indicate the elasticity of total consumption to income to be 0.71. Suggesting an increase in total consumption of 0.715% if household total income increases by 1%. The *elasticities* of household total consumption to total income and income *per adult equivalent* were found to be 0.719% and 0.737% respectively.

Interestingly enough the initial regression, confirms that consumption increases with age, but having found the coefficient for the age square variable to be negative and statistically significant, made clear consumption increases with age but at a decreasing rate, consistent with a hump-shape consumption function found by different researchers (e.g. Deaton and Paxson, 1994).

Finally, and just as an initial exercise, it has been found that household receiving any form of income from pensions—only 21% of all households in the pooled data set—were found to

have a larger level of consumption. Highlighting the relevance of pensions for the households whose income depend on it.

Based on the results obtained and in order to have consistency with the previous chapter of this thesis, the preferred specification model was defined as (5.2):

$$Ln\,(C\ per\ capita_i) = \alpha + \beta(Ln\,Y\ per\ capita_i) + \psi(X_i) + \varepsilon_i \quad (5.2)$$

Where *C* per capita and *Y* per capita are respectively, the logarithmic values of total household consumption and total household income considered on a per capita basis at constant 2008 prices. *X* is a vector of specific household covariates (income level, age of the household head, household geographical location, the number of young or elders living at home) and ε is the *white-noise* disturbance term.

5.5. Empirical results.

Once the decision was made to include different household composition and structure variables, the initial analysis consisted of running several estimations in order to identify the preferred specification model.

The results presented in table 5.7 correspond to the preferred specification model under each of those scenarios incorporating different household covariates. The estimated coefficient values indicate—under practically all but one of the scenarios—the elasticity of total consumption to income to be 0.7. In the economic sense, it means we can expect a per capita consumption increase of 0.7% if household total income increases by 1%.

The results confirm that one additional household dweller was found to be negative and significantly related with consumption. That is consumption per capita reduces by 0.03% with each additional individual living under the same roof. Increased economies of scale could explain this phenomenon as found in the literature (i.e. Attanasio and Browning, 1993).

The use of the household head's age and the square of the same variables allow the conclusion that consumption increases over the time cycle. The non-linear effect of age, associated with the quadratic form such variable, was found to be negative and statistically significant, suggesting that the *rate of increased consumption* reduces over time. That is, consumption increases at a diminishing rate. The estimated values for both variables produced the expected hump shape profile over the life-cycle identified in the literature.

Table 5. 7. Coefficient values for different scenarios of the preferred model.

Estimated equation: $Ln\ (C\ per\ capita_i) = \alpha + \beta(Ln\ Y\ per\ capita_i) + \psi(X_i) + \varepsilon_i$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LN Income *per-capita*	0.609***	0.703***	0.698***	0.703***	0.706***	0.710***	0.707***
	(296.26)	(340.28)	(337.89)	(340.28)	(300.97)	(298.67)	(298.79)
Household size	-0.053***	-0.038***	-0.030***	-0.038***	-0.034***	-0.036***	-0.035***
	(-50.52)	(-46.29)	(-43.66)	(-46.29)	(-36.42)	(-37.98)	(-37.11)
Household head Age (age)	0.010***	0.008***		-0.005***	-0.004***	-0.005***	-0.005***
	(13.72)	(14.19)		(41.90)	(-34.70)	(-38.51)	(-35.71)
Age square	-0.0001***	-0.0001***					
	(-15.46)	(-22.43)					
Dummy pension	0.053***	0.065***	0.032***	0.062***	0.048***	0.049***	0.048***
	(10.09)	(15.29)	(7.74)	(14.76)	(10.08)	(10.35)	(10.20)
Over 65s	-0.025***	-0.022***	-0.153***	-0.067***	-0.066***	-0.064***	-0.064***
	(-5.39)	(-6.07)	(-57.50)	(-21.27)	(-18.11)	(-17.55)	(-17.75)
Education Household Head	0.023***						
	(7.55)						
Education HH square	0.002***						
	(11.66)						
Dummy Renting house					0.165***		
					(38.93)		
Dummy Paying Mortgage						0.004	
						(0.96)	
Dummy Own House							-0.056***
							(-17.69)
_constant	2.794***	2.339***	2.397***	2.582***	2.533***	2.553***	2.593***
	(92.38)	(105.80)	(120.53)	(128.65)	(110.05)	(109.51)	(110.87)
n	98691	155572	155572	155572	145976	145976	145976
R-square	0.6153	0.6129	0.6061	0.6111	0.6337	0.6292	0.6302
VIF	15.94	14.68	1.20	1.48	1.41	1.40	1.42

Values in parenthesis are t-ratios of robust standard errors. *indicates a 10% level of significance, **indicates a 5% level of significance, ***indicates a 1% level of significance. Values associated with *dummy* variables are the coefficient estimates.

Given the availability of information about the schooling of the household head, the decision was made to include the level and squared value of that variable. The results indicate a higher level of consumption associated with better schooling. The positive and significant value found for the square term for schooling confirms that consumption accelerates—increases at a quicker rate—with each additional year of education. These results indicate the beneficial effect of education for consumption.

All scenarios also confirm, through the *positive* and *statistically significant* value of the *dummy* variable associated with pensions, that household receiving any amount of income from such a source have a larger level of consumption about 0.05% higher relative to those households receiving no money from pensions.

The positive and significant effect from pensions can be expected despite the limited coverage[48] and meagre pensions in Mexico (Segura-Ubiergo, 2007, p.15). An unexpected

[48] Only 13.7% of all household in the pooled dataset declared receiving some form of pension income. Meanwhile 22% of all household have one or more dweller aged 75 years or more.

finding was that based in the dataset pensions were found to be received by the better-off cohorts in society (figure 5.16).

A phenomenon partially explained by the large share of people working in the informal sector, usually the poorer cohorts of the society with no access to any form of social security.

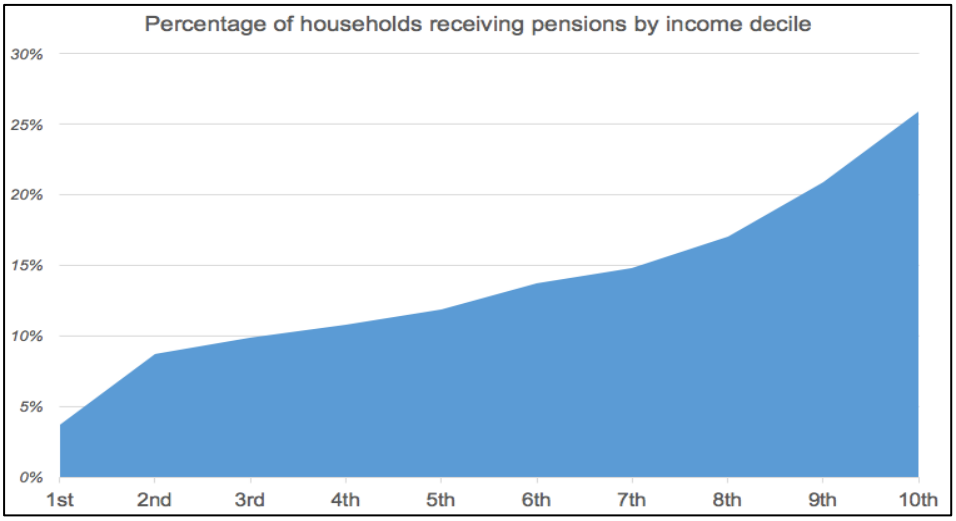


Figure 5. 16 Percentage of households in the pooled dataset receiving any form of monetary pension by income decile in Mexico in the dataset. Source: own calculations based on ENIGH 2008-16.

The previous finding is confirmed by the negative and significant estimated value for individuals over the age on 65 years. Households, on average, having individuals over such an age have lower levels of consumption than households having a similar level of income do. The consumption level was found to be between 0.02% to 0.06% lower for each elder individual living in a given household.

Given the possibility of *multicollinearity* among the regressors, indicated by the high value of the VIF factor. The decision was made to look for alternative *parsimonious* models with a lower factor. Estimation number four was chosen as the preferred specification (5.3).

$$Ln\ (Ln\ HH\ C\ pc_i) = \alpha + \beta(Ln\ HH\_Y\ pc_i) + \gamma(HHH\ Age_i) + \vartheta(Dummy\ pension_i) + \varphi(Over\_65_i) + \varepsilon_i \quad (5.3)$$

Where *Ln HH C pc* is the logarithmic value of total household consumption divided by the number of individuals irrespective of age. *Ln HH_Y pc* represents the logarithmic value of total monetary perceptions and transfers received by all dwellers divided by the number of living under the same roof. Meanwhile, *HHH Age* is the age of the person identified as the household head. *Dummy pension* is a dummy variable equal to one if the household

received any amount in the form of pensions[49] and zero otherwise. Finally, *Over_65* is the number of individuals over the age of sixty-five living within the household premises.

The decision to choose that specification, not including the homeownership variable was also based on the fact that such variables, as well as the household head level of education, were only available for the cross-section data after 2012.

Despite the limitations in the availability of information in all cross-sectional datasets about the form of home ownership, it is possible to draw some conclusions: a positive and statistically significant relationship was found between consumption and renting the house dwellers live in. The empirical evidence confirms that those dwellers paying rent spend 0.16% more than their fellow compatriots living in owned housing or paying mortgage.

Meanwhile, those owning the house they live in—even though an imputed rent is considered—were found to consume 0.05% less relative to those who do not own their house. Interestingly enough, no statistical differences were found to exist between the households paying mortgage and those who do not.

Once the potential issues of multicollinearity and homoscedasticity have been dealt with by the analysis of the variance-inflating factors (VIF) and the used of robust standard errors in the respective regressions respectively, one important assumption while performing ordinary least square (OLS) regression analysis is that of the *endogeneity* problem with the regressors resulting in what is known as *omitted variable bias* resulting in bias and inconsistent estimated parameters.

Once the preferred specification model has been identified, and the results conform to existing empirical evidence, the decision was made to perform the econometric analysis while controlling for some of the covariates in the model.

The analysis will include the inclusion of several interaction variables relating income, region, and age. Different researchers have found that within-cohort consumption and income inequality increased with age (Deaton and Paxton, 1994). In contrast, other researchers predict different consumption profiles based on household composition (Attanasio and Browning, 1995), income levels (Bostic et al., 2009; Gourinchas and Parker, 2002), or their job situation (Stephens and Unayama, 2011).

[49] 13.7% of all households in the dataset received income from pensions.

5.5.1. Consumption changes controlling for income levels.

According to Bostic et al. (2009), 'households in the upper and lower tails of the income distribution are most likely to experience transitory shocks to current income', making their consumption profiles to be different compared to those people with different income levels.

As shown in figure 5.11 before, the reduction in consumption has been more drastic and continuous for the richer cohorts of Mexican society over the period of study. The drop in total income and income per capita was found to have reverted recently, but are far from the level they were in 2008. However, for the cohorts of the population in the lower half of the distribution, the levels of consumption have practically returned to the 2008 (pre-crisis) level.

Different researchers (e.g. Fisher and Marchand, 2014; Abdel-Ghany et al., 2002) have found a positive and statistically significant relationship between relative consumption and the relative place a household has in relation to the income ladder. Figure 5.17 presents the marginal propensities to consume (MPC) by income decile considering all observations in the pooled data set. The results conform with existent knowledge confirming lower MPC for richer cohorts.

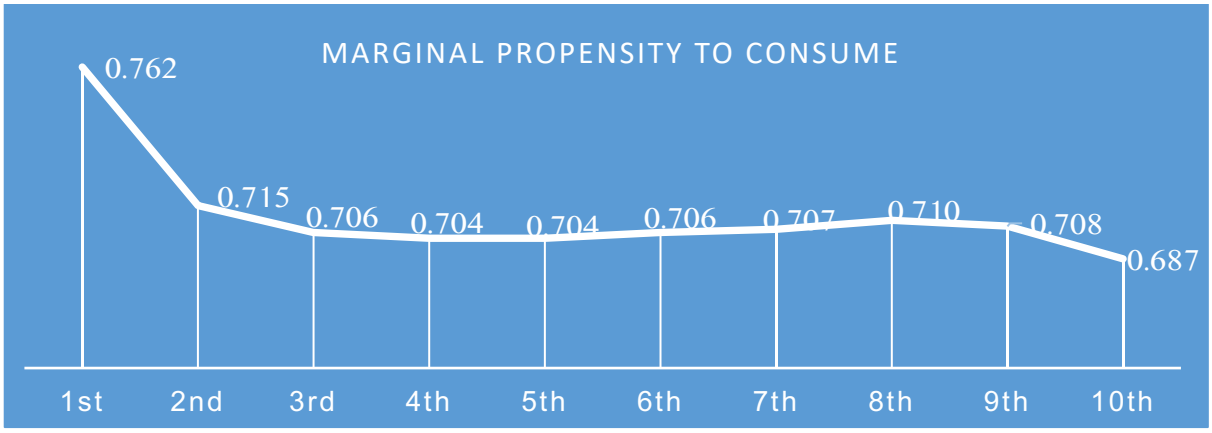


Figure 5. 17 Marginal propensity to consume by income per capita decile. Source: Own calculation based on ENIGH (2008-2016).

The basic idea for this section was to understand the consumption patterns for each group if the differences between groups were significantly different, and how each regressor affects each income group in particular. In order to determine if income changes have been equally distributed among certain cohorts of society three procedures were undertaken,

i. By adding, one at a time, a series of *dummy* variables associated with each income decile (*dummy* = 1 for the income decile each household belongs to in the respective cross-section survey, zero otherwise) interacted with the logarithmic value of per capita household income. This would allow identifying how each income group stands-out from the rest. If statically significant, the results obtained will indicate a significant difference in the slope of consumption per capita for a particular group relative to the rest of the population.
ii. Through the inclusion of income decile *dummies*—excluding one to avoid a multicollinearity problem. The results will indicate if statistically significant consumption differences were found to exist between each income decile and all other income cohorts.
iii. The restricted regression of each income decile. It will allow to identify the specific impact each of the regressors has on consumption for each income group.

The results in table 5.8 presenting the preferred specification model with the addition of the interacted *dummy* variables indicate a positive and statistically significant relationship for those households at both ends of the income distribution, conforming to the evidence previously found by Bostic et al. (2009).

In the economic sense, households belonging to the lowest ten per cent of the distribution have a higher consumption to income elasticity. That is, they are the group with higher consumption sensibility to income changes. The empirical evidence indicates they consume 2% more relative to households outside the first income decile.

It is important to contextualise the rest of the estimated coefficient values, as the previous finding does not mean the poorer consume more. What this indicates is that they are more likely to spend a larger portion of an additional unit of income. While a 1% increase in income received by a household outside the first income decile, *produces* a 0.74% increase in consumption. A household among the poorer will be consuming just over 0.762% of that extra one per cent in income. However, their level of consumption sits at a lower point given by the value of the intercept.

Table 5. 8. Coefficient values for main specification model incorporating income decile interacting terms.

Estimated equations: $\boldsymbol{Ln(C\_percapita_i) = \alpha + \beta(Ln\ Income\_percapita_i)} + \gamma(Age_i) + \psi(HHSize_i) + \varsigma\ (Ln\ Income\ per\ capita_i * dummy\ income\ decile_i) + \varepsilon_i$

LN Income per capita	0.741*** (324.88)	0.713*** (332.67)	0.708*** (346.36)	0.709*** (349.75)	0.710*** (353.16)	0.712*** (353.91)	0.713*** (352.43)	0.713*** (346.38)	0.709*** (331.31)	0.677*** (277.41)
Household size	-0.036*** (-44.29)	-0.036*** (-44.62)	-0.036*** (-44.52)	-0.036*** (-44.47)	-0.036*** (-44.41)	-0.036*** (-44.56)	-0.036*** (-44.73)	-0.036*** (-44.72)	-0.036*** (-44.49)	-0.036*** (-45.35)
Household head Age	-0.006*** (-68.47)	-0.006*** (-68.37)	-0.006*** (-68.45)	-0.006*** (-68.43)	-0.006*** (-68.43)	-0.006*** (-68.21)	-0.006*** (-68.18)	-0.006*** (-68.34)	-0.006*** (-68.37)	-0.006*** (-67.84)
Dummy *(decile 1)* * *LN_Y*	0.021*** (27.83)									
Dummy *(decile 2)* * *LN_Y*		0.002*** (3.81)								
Dummy *(decile 3)* * *LN_Y*			-0.002*** (-5.45)							
Dummy *(decile 4)* * *LN_Y*				-0.005*** (-10.76)						
Dummy *(decile 5)* * *LN_Y*					-0.006*** (-14.13)					
Dummy *(decile 6)* * *LN_Y*						-0.006*** (-13.91)				
Dummy *(decile 7)* * *LN_Y*							-0.006*** (-13.97)			
Dummy *(decile 8)* * *LN_Y*								-0.003*** (-6.80)		
Dummy *(decile 9)* * *LN_Y*									0.001*** (3.62)	
Dummy *(decile 10)* * *LN_Y*										0.020*** (33.64)
_constant	2.268*** (103.01)	2.531*** (121.17)	2.566*** (127.10)	2.570*** (129.62)	2.563*** (130.46)	2.550*** (130.00)	2.537*** (128.79)	2.535*** (127.25)	2.565*** (125.23)	2.922*** (129.83)
R-square	0.6118	0.6096	0.6097	0.6098	0.6100	0.6100	0.6101	0.6097	0.6096	0.6130

Values in parenthesis are t-ratios of robust standard errors. * indicates a 10% level of significance, ** indicates a 5% level of significance, *** indicates a 1% level of significance.

The empirical evidence confirms the 10% richer households also have a higher marginal propensity to consume compared to the average household. The marginal propensity to consume (MPC) is almost as large as the one found to exist for the lowest income decile. In a few words, the poorer and the richer deciles are the ones benefitting the most any time income goes up, or alternatively they are the ones who reduce consumption more when income goes down.

An interesting element is that the coefficient values over the income distribution offer a *mirror image* around the mid-income deciles. The first and the tenth income decile were found to have a similarly larger and positive MPC. The second and ninth decile were found to have a similar positive, but smaller MPC. For third to the eight income deciles the interacted coefficient value was found to be negative and statistically significant. With the size of the income effect been larger for households sitting on the middle of the distribution (fifth and sixth deciles). Meaning these are the groups having a larger propensity to save and that they are better insured against income changes.

Table 5. 9. Coefficient values for main specification model incorporating income decile interacting terms.

Estimated equations: $Ln(C\_percapita_i) = \alpha + \beta(Ln\ Income\_percapita_i) + \gamma(Age_i) + \psi(HHSize_i) + \omega\ (A_k) + \varepsilon_i$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
LN Income p.c.	0.623***	0.619***	0.618***	0.618***	0.619***	0.621***	0.623***	0.628***	0.636***	0.651***
	(60.50)	(64.55)	(66.75)	(68.60)	(70.32)	(72.21)	(74.22)	(76.98)	(80.69)	(88.35)
Household size	-0.036***	-0.036***	-0.036***	-0.036***	-0.036***	-0.036***	-0.036***	-0.036***	-0.036***	-0.036***
	(-44.64)	(-44.64)	(-44.64)	(-44.64)	(-44.64)	(-44.64)	(-44.64	(-44.64)	(-44.64)	(-44.64)
Household head Age	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***
	(-67.67)	(-67.67)	(-67.67)	(-67.67)	(-67.67)	(-67.67)	(-67.67)	(-67.67)	(-67.67)	(-67.67)
Dummy d1		0.003***	0.004***	0.004	0.003**	0.001	-0.0002	-0.005**	-0.012***	-0.028***
		(3.61)	(3.65)	(3.05)	(2.32)	(0.97)	(-0.13)	(-2.53)	(-5.10)	(-9.28)
Dummy d2	-0.003***		0.0008	0.0006	0.00002	-0.002*	-0.004***	-0.009***	-0.016***	-0.032***
	(-3.61)		(1.11)	(0.77)	(0.02)	(-1.71)	(-3.00)	(-6.09)	(9.11)	(-13.73)
Dummy 3	-0.004***	-0.008		-0.0001	-0.0008	-0.002***	-0.004***	-0.010***	-0.017***	-0.032***
	(-3.65)	(-1.11)		(-0.23)	(-1.04)	(3.14)	(-4.60)	(-8.22)	(-11.55)	(-16.35)
Dummy d4	-0.004***	-0.0006	0.0001		-0.0006	-0.002***	-0.004***	-0.010***	-0.017***	-0.032***
	(-3.05)	(-0.77)	(0.23)		(-0.98)	(-3.59)	(-5.40)	(-9.69)	(-13.39)	(-18.42)
Dummy d5	-0.003**	-0.00002	0.0008	0.0006		-0.002***	-0.004***	-0.009***	-0.016***	-0.032***
	(-2.32)	(-0.02)	(1.04)	(0.98)		(-3.09)	(-5.60)	(-10.67)	(-14.94)	(-20.27)
Dummy d6	-0.001	0.002*	0.002***	0.002***	0.002***		-0.002***	-0.007***	-0.014***	-0.029***
	(-0.97)	(1.71)	(3.14)	(3.59)	(3.09)		(-3.07)	(-9.76)	(-15.25)	(-21.43)
Dummy d7	0.0002	0.004***	0.004***	0.004***	0.004***	0.002***		-0.005***	-0.012***	-0.027***
	(0.13)	(3.00)	(4.60)	(5.40)	(5.46)	(3.07)		(-8.09)	(15.42)	(-22.90)
Dummy d8	0.005**	0.009***	0.010***	0.010***	0.009***	0.007***	0.005***		-0.007***	-0.022***
	(2.53)	(6.09)	(8.22)	(9.69)	(10.67)	(9.76)	(8.09)		(-10.37)	(-21.85)
Dummy d9	0.012***	0.016***	0.017***	0.017***	0.016***	0.014***	0.012***	0.007***		-0.015***
	(5.10)	(9.11)	(11.55)	(13.39)	(14.94)	(15.25)	(15.42)	(10.37)		(-18.58)
Dummy d10	0.028***	0.032***	0.032***	0.032***	0.032***	0.029***	0.027***	0.022***	0.015***	
	(9.28)	(13.73)	(16.35)	(18.42)	(20.27)	(21.43)	(22.90)	(21.85)	(18.58)	
_const	3.291***	3.291***	3.291***	3.291***	3.291***	3.291***	3.291***	3.291***	3.291***	3.291***
	(42.95)	(42.96)	(42.96)	(42.96)	(42.96)	(42.96)	(42.96)	(42.96)	(42.96)	(42.96)
R^2	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615	0.615

Values in parenthesis are t-ratios of robust standard errors. * indicates a 10% level of significance, ** indicates a 5% level of significance, *** indicates a 1% level of significance. *A* is a vector of the different dummy variables associated with each of the different income deciles.

In the economic sense, all households will increase their levels of consumption with a 1% increase in income, consistent with literature the lower-income cohorts have a larger MPC, suggesting that income changes have a larger effect on the lower-income deciles.

The previous findings do not explain if households among the poorer or, the richer spend more or less than households at another specific income decile. They only identify what households in each decile are likely to spend if income goes up relative to other households.

In order to find out if statistically significant differences exist between different income deciles, the decision was made to estimate the preferred specification model including nine *dummy* variables associated with each of the different income deciles—used as a factor variable—with one dummy variable omitted (the base scenario) to avoid a *multicollinearity* problem. If significant, the coefficient values will indicate a higher intercept value for the reference group. Table 5.9 presents the results.

The estimated coefficients indicate that statistically significant differences in consumption exist between the lowest income decile relative to all other deciles in the lower half of the distribution. Considering that households in the first income decile have the highest consumption elasticity, they are the group who benefits the most when income increases, but also the ones seeing the highest reduction when income reduces.

The consumption *elasticity* for the lowest income decile was not found to be significantly different from the one for the sixth and seventh deciles. However, it was statistically significantly lower than the consumption elasticity of the eight and higher income deciles.

It is important to note that the previous finding does not mean the lowest income group consumes more than the second- or third-income deciles just that the poorer lot have a larger marginal propensity to consume compared to the next four adjacent income decile groups along with the income distribution.

The empirical evidence indicates that households in the lowest income decile will consume any increase in income almost completely, while households in the next four deciles will save slightly more with that difference being significantly different in statistical terms.

For the rest of the households in the lower half of the distribution, the empirical evidence is that the differences in the slope of the consumption function is not statistically different among them. That is, for Mexican households whose level of income places them in the

lower half of the distribution—but not to the first decile—their propensity to consume were not found be statistically significant. In the economic sense, a 1% increase in income produces no significant differences in the level of consumption of households in the 2nd to the 5th income deciles.

For households in the upper half of the income distribution, the evidence presents a consistent *picture* in terms of the consumption to income *elasticity*: households in the 6th decile have a statistically significant higher marginal propensity to consume than all income deciles below them, but smaller than all income cohorts above them. The same applies to the households in the remaining—upper—income cohorts. To illustrate the point, consider the households in the eighth decile, they have significantly higher elasticity than any household below them has, but lower than households in the 9th or 10th decile.

As a summary of the econometric analysis, it has been found that the consumption to income *elasticity* is higher for the higher income groups. However, it has been found that the lowest income decile was found to have significantly higher consumption elasticity, relative to other income groups in the lower half of the distribution. No statistically significant differences were found to exist among the households in the second to fifth income deciles.

Decile:	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
LN Income per capita	0.484***	0.628***	0.541***	0.552***	0.437***	0.543***	0.531***	0.653***	0.824***	0.735***
	(32.37)	(22.48)	(14.15)	(12.46)	(8.79)	(11.12)	(11.41)	(16.04)	(26.49)	(52.65)
Household size	-0.073***	-0.045***	-0.042***	-0.031***	-0.030***	-0.019***	-0.018***	-0.025***	-0.012***	-0.051***
	(-29.06)	(-9.98)	(-19.62)	(-15.44)	(-12.92)	(-11.45)	(-7.11)	(-7.50)	(-3.90)	(-13.56)
Household head Age	-0.001***	-0.002***	-0.003***	-0.004***	-0.003***	-0.005***	-0.006***	-0.007***	-0.008***	-0.008***
	(-3.22)	(-14.24)	(-10.08)	(-9.95)	(-11.61)	(-14.88)	(-15.75)	(-20.02)	(-20.33)	(-18.23)
Dummy pension	0.153***	0.075***	0.076***	0.065***	0.081***	0.086***	0.084***	0.089***	0.089***	0.071***
	(8.94)	(8.04)	(6.81)	(5.01)	(6.63)	(7.09)	(6.76)	(7.46)	(7.29)	(5.27)
Dummy Remittances	0.143***	0.086***	0.058***	0.079***	0.071***	0.060***	0.039**	-0.016	-0.040	-0.039
	(8.51)	(7.65)	(3.93)	(5.17)	(4.38)	(3.60)	(2.19)	(-0.82)	(-1.63)	(-1.15)
Over 65s	-0.083***	-0.083***	-0.062***	-0.078***	-0.085***	-0.063***	-0.070***	-0.060***	-0.052***	-0.038***
	(-5.87)	(-7.55)	(-7.78)	(-8.39)	(-7.38)	(-6.55)	(-7.59)	(-5.99)	(-4.84)	(-5.23)
_constant	4.277***	3.087	3.831***	3.673***	4.755***	3.924***	4.060***	3.091***	1.498***	-0.061***
	(40.41)	(20.95)	(12.16)	(9.72)	(11.26)	(9.04)	(9.58)	(8.10)	(4.95)	(-5.23)
n	15584	15563	15576	15577	15578	15572	15567	15575	15561	15576
R-square	0.2924	0.2371	0.1492	0.1952	0.1318	0.1194	0.1329	0.1257	0.2012	0.3317

Table 5. 10. Coefficient values for main specification model restricted by income decile. Values in parenthesis are t-ratios of robust standard errors. * indicates a 10% level of significance, ** indicates a 5% level of significance, *** indicates a 1% level of significance.

Once it was found that statistically significant differences exist in terms of consumption *elasticity* between the different income groups, the next level of analysis consisted of restricting the econometric analysis by income deciles. This allows to evaluate if the different covariants in the model, have a statistically significant effect on consumption.

The decision was to add to the restricted regression the dummy variables associated with households receiving any monetary amount of income from pensions and remittances, as well as disaggregating the household composition in terms of the number of individuals over the age of 64 living under the same roof. Table 5.10 presents the coefficient values.

The main outcome from this analysis is in terms of the effect from covariants on the consumption level for households in the specific income decile. The empirical results confirm larger economies of scale exist for households at the lower end of the income distribution. Whilst adding another dweller in a *poor household*—belonging to the 1st income decile—translates into an 11% reduction in consumption per capita, for a household in the 8th or 9th deciles the expected *savings* is only 2% and 1% respectively.

The age covariant has been found to be negative and strongly significant for all households across the distribution. Suggesting consumption drops over the life-cycle, with the reduction in consumption over the life-cycle being more drastic as we move along the income distribution. Suggesting the richer cohorts of the population are able to reduce their consumption level earlier in life compared to their *less-fortunate* fellow co-nationals can.

Likewise, the presence of elder individuals in the household is associated with lower levels of consumption per capita. The economies of scale are larger for households in the lower half of the distribution while an additional dweller is a household part of the highest income decile producing *efficiencies* nine times higher relative to the savings achieved at the lower end of the distribution.

Not surprisingly, the empirical evidence confirms that a similar increase in income from pensions has a significantly larger effect for the poorer households. While an increase of 1% in pensions income represents as much as 0.15% increase in consumption for the poorer most; a similar increase for the richer most translates into a 0.07% increase in terms of consumption. That is, in consumption terms, the poorer cohorts benefit twice as much as the richer most do from a similar change—increase—in pensions.

The most relevant finding, however, is in terms of the positive effect remittances have for the lower-income deciles of the Mexican population. An additional 1% in income from remittances means 0.14% higher levels of consumption for households in the lowest income decile. The benefit diminishes as we move along the income distribution until the seventh decile for whom a similar 1% increase in remittances is associated with a 0.04% increase in consumption. The interesting element is that no statistically significant relationship has been found to exist between income from remittances and consumption levels for the three upper income deciles.

As a corollary from the previous analysis, it has been found that statistically significant differences were found to exist in terms of the consumption to income elasticity per capita between different income groups among the Mexican society with the marginal propensity to consume following a downward trend over the income distribution.

The low value of the *goodness of fit*—represented by the R^2 value—indicates that considering only those households in the same income decile, consumption per capita presents wider variation than income does (see table 5.11).

Income *per-capita* decile	Ln income *per-capita*		Ln consumption *per-capita*		Average propensity to consume (APC)	Consumption per-capita	Income *per-capita*
	Mean	St. deviation	Mean	St. deviation		Mean	Mean
1st	7.291	0.422	7.370	0.653	1.378	1,951	1,581
2nd	7.926	0.134	7.744	0.519	0.953	2,639	2,793
3rd	8.217	0.099	7.923	0.487	0.836	3,101	3,724
4th	8.444	0.085	8.067	0.490	0.767	3,568	4,667
5th	8.650	0.080	8.203	0.500	0.718	4,104	5,731
6th	8.856	0.080	8.351	0.517	0.682	4,793	7,044
7th	9.077	0.086	8.514	0.526	0.644	5,645	8,788
8th	9.336	0.103	8.736	0.539	0.624	7,099	11,411
9th	9.682	0.138	9.035	0.563	0.601	9,704	16,185
10th	10.428	0.487	9.681	0.706	0.559	20,681	40,572

Table 5. 11. Consumption and Income statistics by income per capita deciles. Source: Own calculations based on ENIGH 2008-2016.

What table 5.11 reveals is the propensity to overspend among the poorer households when income increases. Which is associated with the use of credit, not necessarily from financial institutions but from personal or family loans at best or reliance on loan sharks that are a common feature among the poorer in society.

The previous analysis found the drop in consumption over the life-cycle was a function of income, with the size of the drop being larger for the richer cohorts of the population.

Once the consumption analysis over the income distribution has been conducted the next stage in the research process consists in the analysis of consumption over the life-cycle.

5.5.2. Consumption over the life-cycle.

As explained before the consumption function has been dominated by an ongoing controversy between Keynes's idea that consumption is very much determined by current levels of income; with the consumption profile following a *hump-shaped* pattern over the life-cycle as shown by Carroll and Summers (1991). On the other side of the controversy, there is Modigliani's and Friedman's Permanent Income/Life-cycle Model (LCM/PIH) stating that people smooth consumption along the life-cycle in order to prevent a large drop in consumption and well-being, after retirement.

The decision was made to introduce the age variable through different *dummy* variables signalling specific age cohorts. This is based on the fact that the pure parametric use of age variables 'delivers a non-smooth consumption profile that is difficult to use as an empirical benchmark… [as] it is not robust to model misspecification problems' (Fernandez-Villaverde and Krueger, 2006).

There is mixed empirical evidence in the literature about the age-profile of consumption. While some researchers have found evidence in support to the LCM/PIH (e.g. Aguiar and Hurst, 2013; Hurst, 2008). In contrast, other researchers (e.g. Shapiro, 2005; Mastrobuoni and Weinberg, 2009) have found empirical evidence indicating otherwise. The main reason is that, as those in the latter camp argue, consumers do not save enough to achieve the aim of smoothing consumption.

Some researchers have reported empirical support for what is known as the *consumption puzzle*[50] (e.g. Fisher et al., 2012) bringing into question the tenants of the LCM/PIH. Other researchers (e.g. Stephens and Unamaya, 2011) have found evidence to reject the life-cycle hypothesis and conclude households at the lower end of the income scale show large fluctuation in consumption levels.

Creedy and Guest (2008) argue that the different needs of the older population—mainly in terms of health shocks—do result in different consumption levels after retirement. Chamon and Prasad (2010) found that urban China younger and older cohorts tend to save more.

[50] It is meant to describe a drop in consumption as individuals approach and transit through retirement age.

Attanasio and Weber (2010) documented large evidence about the sharp fall in consumption about retirement age in the United Kingdom, the USA, Italy and Japan. Stephens and Unayama (2011) found that the largest change in income occurs after retirement. While Huggett et al. (2011) found higher inequality levels among the younger households.

Given the ongoing controversy about the effect of consumption over the life-cycle, the decision was made to analyse the life-cycle consumption profile. Table 5.12 presents descriptive statistics for the mean value of income and consumption on a per capita basis at constant prices for different age cohorts of the household heads in the dataset.

Constant prices (2008 mxp)

Dummy name	Housheold age	n	% Pop	Income	Consumption
young	age < 23	4,654	3.0%	20,209	14,868
mid_age1	23 ≤ age ≤ 35	30,645	19.7%	26,326	18,557
mid_age2	36 ≤ age ≤ 49	51,563	33.1%	33,207	22,336
pre_ret1	50 ≤ age ≤ 59	29,746	19.1%	37,296	22,141
pre_ret2	60 ≤ age ≤ 65	13,952	9.0%	35,786	18,487
retirement	66 ≤ age ≤ 75	15,537	10.0%	27,700	15,089
over75	age ≥ 76	9,797	6.3%	23,924	12,655

Dummy name	Household income *per capita*	Household consumption *per capita*	Household size	Ratio median to mean Income	Ratio median to mean Consumption
young	8,846	6,679	2.81	79.9%	79.8%
mid_age1	8,897	6,222	3.80	73.3%	76.7%
mid_age2	9,534	6,365	4.28	72.4%	75.0%
pre_ret1	11,736	6,925	3.90	68.4%	71.0%
pre_ret2	12,362	6,446	3.49	61.2%	70.3%
retirement	11,002	5,835	3.12	64.1%	68.3%
over75	10,194	5,102	2.77	63.0%	65.9%

Table 5. 12. Total and per capita levels of mean income and consumption at constant prices for selected groups of the population in ENIGH surveys 2008-2016. Source: Own calculations based on ENIGH 2008-2016.

The descriptive statistics stage revealed that the level value of household income and consumption present the characteristic hump shape identified in the literature (e.g. Carlin and Soskice, 2006). The evidence shows how the group of people over the age of 75 have income levels only higher than their younger fellow citizens.

However, more critically, the consumption level—for the elders in Mexico—shows the lowest level among all age groups. It is true that they represent a small cohort of the population (6.3% in the pooled dataset). The worrying element, however, is not only that this specific

age group is getting larger—due to longer life expectancy—but that their income level has been reducing over time.

The descriptive statistics showed that the highest income group over the life-cycle are the group of households headed by individuals in their 50s. With the group with the highest levels of consumption are those in their mid-life years—between 36 to 49 years—at a time when most household's children are of school age.

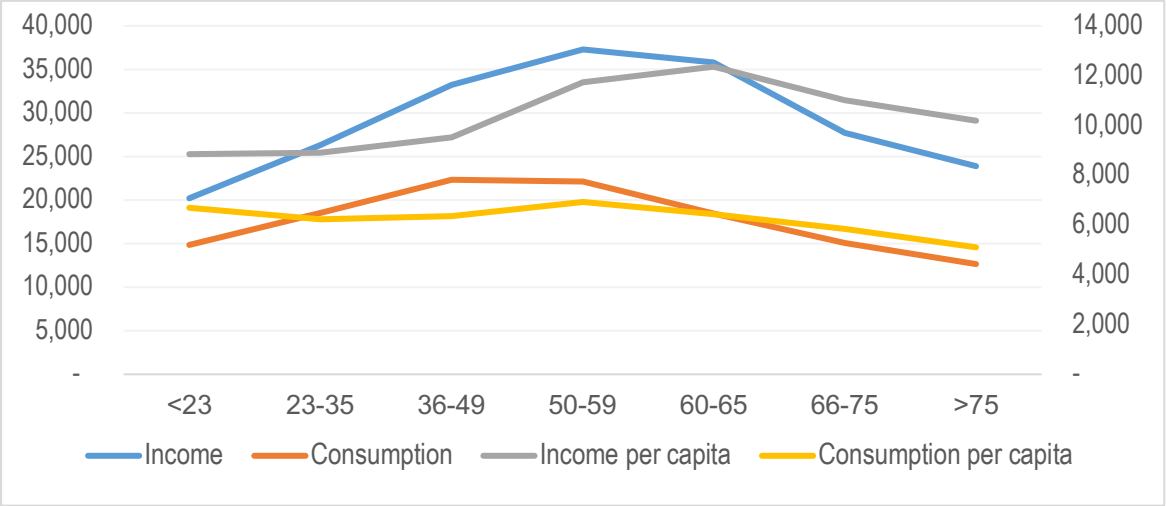


Figure 5. 18 Mean value of total household income (left-hand side-axis) and consumption (right-hand side-axis) per capita over the life-cycle. Source: Own calculations based on ENIGH 2008-2016.

A drop in both per capita *levels* of income and consumption has been found to exist for households after retirement age. The drop was found to be close to 23% and 19% respectively, relative to the level of households headed by pre-retirement individuals.

The evidence indicates a hump-shaped distribution over the life-cycle on both, the level and per capita basis. However, as predicted by different researchers (e.g. Fernandez-Curegedo, 2004), the per capita profile is flatter (see figure 5.18).

Given the observed differences in income and consumption over the life-cycle, the decision was made to analyse if those differences were statistically significant for certain age groups.

The first element to be taken into consideration was to determine the different age groups—number and ranges—to be used in the regression model. The decision was made to conduct the analysis including dummy variables associated with each age cohort as suggested by different researchers (e.g. Lise et al., 2014; Lurhmann, 2007).

Table 5.13 presents the estimated coefficients for an adjusted[51] version of the preferred specification model incorporating dummy variables associated with the age of household heads, excluding—for multicollinearity purposes—the age cohort *dummy* variables.

Estimated equation: $Ln(C\_per\_capita_i) = \alpha + \beta(Ln\_per\ Y_i) + \varsigma(age\_cohort_i) + \vartheta\ (Year\ dummies) + \varepsilon_i$

	Log consumption per capita				
	A	B	C	D	E
Log Income per capita	0.743*** (402.60)	0.743*** (402.60)	0.743*** (402.60)	0.743*** (402.60)	0.743*** (402.60)
Dummy teenagers (**age <19**)	0.036*** (15.81)		0.0191*** (8.52)	0.0243*** (10.72)	0.0286*** (12.46)
Dummy young (**20 < age <29**)	0.0321*** (43.43)	-0.0038* (-1.75)	0.0152*** (23.53)	0.0204*** (-28.80)	0.0247*** (31.04)
Dummy mid-age lower (**30 < age <39**)	0.0313*** (46.27)	-0.0047** (-2.16)	0.0144*** (25.03)	0.0195*** (30.45)	0.0238*** (32.35)
Dummy mid-age upper (**40 < age <49**)	0.0289*** (43.00)	-0.0071*** (-3.23)	0.0120*** (21.15)	0.0172*** (26.97)	0.0215*** (29.30)
Dummy mature (**50 < age <59**)	0.0226*** (32.79)	-0.0134*** (-6.04)	0.0057*** (9.82)	0.0109*** (16.69)	0.0152*** (20.33)
Dummy pre-retirement (6**0 < age <64**)	0.0168*** (21.07)	-0.0191*** (-8.52)		0.0051*** (6.70)	0.0094*** (11.10)
Dummy retirement (**65 < age <69**)	0.0117*** (13.76)	-0.0243*** (-10.72)	-0.0051*** (-6.70)		0.0043*** (4.78)
Dummy (**70 < age <74**)	0.0074*** (8.01)	-0.0286*** (-12.46)	-0.0094*** (-11.10)	-0.0043*** (-4.78)	
Dummy over 75 (**age >75**)		-0.0360*** (-15.81)	-0.0168*** (-21.07)	-0.0117*** (-13.76)	-0.0074*** (-8.01)
Dummy 2008	0.012*** (3.40)		-0.037*** (-5.69)	-0.044*** (-9.21)	-0.058*** (-13.24)
Dummy 2010	0.071*** (18.74)	0.058*** (13.24)-	0.021*** (3.25)	0.014*** (2.96)	
Dummy 2012	0.049*** (8.11)	0.037*** (5.69)		-0.006 (-1.02)	-0.021*** (-3.25)
Dummy 2014	0.056*** (13.44)	0.044*** (9.21)	0.006 (1.02)		-0.021*** (-3.25)
Dummy 2016		-0.012*** (-3.40)	-0.049*** (-8.11)	-0.056*** (-13.44)	-0.014*** (-2.96)
_const	1.569*** (90.83)	0.942*** (70.86)	1.787*** (98.89)	1.743*** 98.94)	1.714*** (95.86)
R_square	0.6058	0.6058	0.6058	0.6058	0.6058

Table 5. 13. Coefficient values for main specification model with age dummies. Income and consumption per capita at current prices. (n=155,752 in all scenarios). Values in parenthesis are t-ratios of robust standard errors. * indicates a 10% level of significance, ** indicates a 5% level of significance, *** indicates a 1% level of significance.

[51] The preferred specification model has the age (household head's age) variable as a regressor. Given the fact the analysis includes different age-related dummy variables, the decision was made to adjust the model to avoid a *collinearity* issue.

The first variation of the model—scenario A—confirms that all income groups have statistically significantly larger consumption to income elasticity that the elder-most age cohort.

In the economic sense, the elder-most household heads in Mexico benefit the least in terms of consumption when income goes up. The empirical evidence indicates that consumption for the group of households at the initial-end of the life-cycle actually increases their consumption by more than 1% when income increases by 1%. Suggesting that this age group relies on the use of credit to buy the goods and services they consume.

A clear downward trend in the elasticity of consumption to income was found to exist over the life-cycle. When income increases by 1%, household head in their 20s will consume the increase in income whole, as do the households headed by individuals aged between 20 and 49 years of age. Consumption levels then reduce as household heads transit over the life-cycle. The empirical evidence suggests consumption increases by 0.97% if the household head is between 50 and 59 years of age; then the elasticity of consumption is predicted to be 0.91% for the pre-retirement age cohort (60 to 64 years of age), and 0.85% as households enter retirement age. Meanwhile, households headed by individuals aged between 70 to 74 years will increase consumption by 0.81% if income increases by 1%.

When the base scenario, or reference group, is the youngest age group—scenario B—the empirical evidence confirms that consumption *elasticity* is significantly lower as households transit over the life-cycle with the youngest cohorts having the larger consumption to income *elasticity*. The scenario reveals how the *elasticity* for the group of households in their 20s is only statistically significantly different to the younger-most (households headed by people under the age of 20) at a 10% level of significance. Therefore, this evidence suggests consumption levels for the younger two age cohorts are similar.

In the economic sense, it has been found that households at the start of the life-cycle consume 0.3% more than those at the opposite end of the life-cycle with a similar 1% increase in total household income.

The evidence from scenario C indicates that consumption follows a hump-shape with the turning point occurring when household heads approach retirement age.

The results confirm statistically significant differences between this age group and all other age cohorts. The empirical evidence confirms that households headed by individuals

approaching retirement—60 to 64 years of age—have larger consumption per capita elasticity than any older age groups, but at the same time have statistically significantly lower values than any other younger groups.

Scenario D confirms this finding: as we move along the life-cycle, the 65-69 age bracket has a lower level of consumption *elasticity* than any of their younger fellow citizens, but the respective value is higher relative to their older fellow citizens.

The introduction of the year *dummy* variables associated with the specific cross-section dataset indicates that consumption per capita was at its lowest in 2016. The empirical evidence also indicates the 2010 survey were statistically significantly higher than any other cross-sectional data. Meanwhile, the consumption elasticity in 2012 was not found to be statistically significantly different from the ones in 2014.

The fact that all estimated coefficients are *strongly* statistically significant, suggest that the differences are clear between different age groups. The question at this point was where exactly over the life-cycle is the tipping point in consumption elasticity found. In order to find an answer, scenarios D and E present the empirical evidence associated with the consumption elasticity “in and around” retirement age.

The estimated coefficients suggest the lowest point in consumption occurs for the age group before retirement age—65 years—but it is not possible to pinpoint where the change occurs. Therefore, the decision was made to use one *dummy* variable to identify any difference in the intercept of the simplified version of the preferred specification regression model.

Table 5.14 presents the estimated coefficients for adjusted preferred specification incorporating individual *dummy* variables for the specific household head’s age between the ages of 45 to 64 years. Before the age of 53, all households have been found to have increased levels of consumption relative to the average household in Mexico.

The previous analysis confirms households, before the age of 54, have significantly higher consumption to income per capita *elasticity* than the average household has.

Figure 5.19 presents the estimated coefficient values for the *dummy* variables associated with the specific age of the household heads[52].

Table 5. 14. Coefficient values for the modified specification model with age dummies.

Estimated equation: $Ln(C\_per\_capita_{im}) = \alpha + \beta(Ln\_income\_percapita_{im}) + \varsigma(age\_dummy_{im}) + \varepsilon_i$

	Dummy 45	*Dummy 46*	*Dummy 47*	*Dummy 48*	*Dummy 49*
Log Income *per-capita*	0.732***	0.732***	0.732***	0.732***	0.732***
	(394.97)	(395.00)	(394.93)	(394.91)	(394.89)
Age_dummy	0.064***	0.060***	0.041***	0.020**	0.037***
	(7.73)	(6.91)	(4.87)	(2.38)	(4.20)
_contant	1.920***	1.920***	1.921***	1.921***	1.921***
	(117.54)	(117.57)	(117.60)	(117.61)	(117.62)
R square	0.5919	0.5918	0.5918	0.5917	0.5918

	Dummy 50	*Dummy 51*	*Dummy 52*	*Dummy 53*	*Dummy 54*
Log Income *per-capita*	0.732***	0.732***	0.732***	0.732***	0.732***
	(394.91)	(394.80)	(394.91)	(394.89)	(394.91)
Age_dummy	0.008	0.021**	0.018**	-0.010	0.0004
	(0.99)	(2.20)	(2.12)	(-1.09)	(0.05)
_contant	1.921***	1.921***	1.921***	1.921***	1.921***
	(117.61)	(117.62)	(117.61)	(117.60)	(117.61)
R square	0.5917	0.5917	0.5917	0.5917	0.5917

	Dummy 55	*Dummy 56*	*Dummy 57*	*Dummy 58*	*Dummy 59*
Log Income *per-capita*	0.732***	0.732***	0.732***	0.732***	0.732***
	(394.80)	(394.80)	(394.88)	(394.89)	(394.98)
Age_dummy	-0.015	-0.015	-0.031***	-0.035***	-0.043***
	(-1.58)	(-1.50)	(-2.90)	(-3.49)	(-4.05)
_contant	1.921***	1.921***	1.920***	1.920***	1.920***
	(117.57)	(117.57)	(117.57)	(117.57)	(117.57)
R square	0.5917	0.5917	0.5917	0.5818	0.5918

	Dummy 60	*Dummy 61*	*Dummy 62*	*Dummy 63*	*Dummy 64*
Log Income *per-capita*	0.732***	0.732***	0.732***	0.732***	0.732***
	(394.	(395.01)	(394.96)	(395.05)	(395.12)
Age_dummy	-0.040***	-0.058***	-0.054***	-0.079***	-0.112***
	(-4.01)	(-4.74)	(-4.90)	(-6.58)	(-9.75)
_contant	1.921***	1.920***	1.920***	1.921***	1.921***
	(117.58)	(117.57)	(117.56)	(117.61)	(117.61)
R square	0.5918	0.5918	0.5918	0.5919	0.592

Values in parenthesis are t-ratios of robust standard errors. * indicates a 10% level of significance, ** indicates a 5% level of significance, *** indicates a 1% level of significance.

The evidence identifies a negative and statistically significant *elasticity* once the household heads turn 57 years old. The negative and statistically significant relationship remains as household heads keep ageing. In the economic sense, a household headed by a person aged 49, will be consuming 0.03% more (0.76%) than the average household when income increases by 1%.

[52] In the pooled data set of the ENIGHs 2008-2016 two observations indicate the age of the household head was 12 years of age. Those two observations were removed. As a wrongly registered information constitute a possibility.

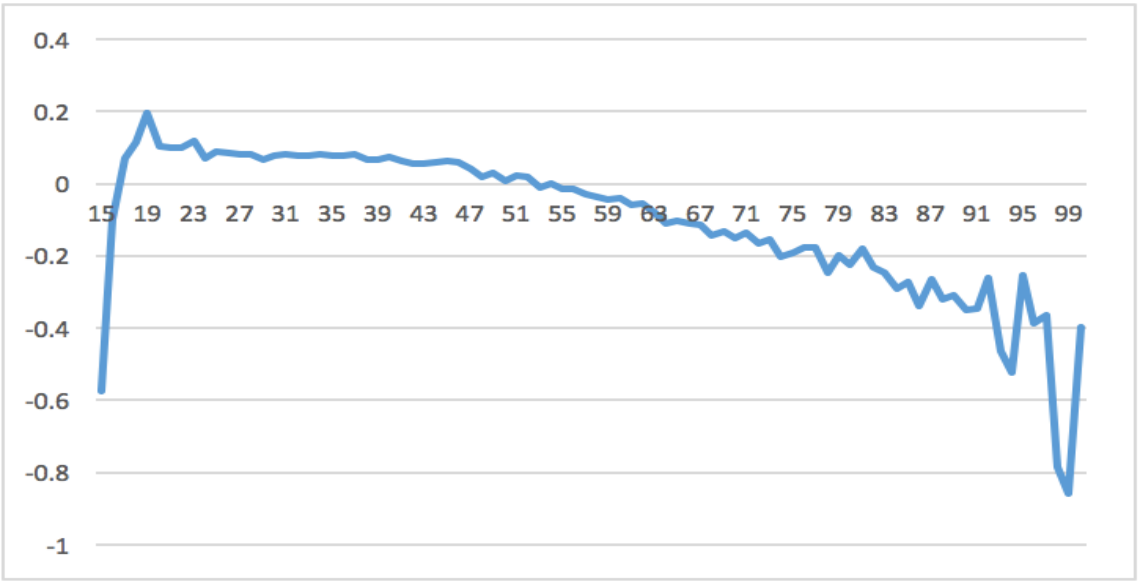


Figure 5. 19 Estimated coefficient values for the different *dummy* variables associated with the age of the household head (horizontal axis).

Meanwhile, a household headed by a 64 years old individual will be expected to spend 0.62% of a similar income increase. Although not reflected in the previous table, a household headed by a 75-years old person will spend only over a half (54%) of the increase in income. The value of consumption to income *elasticity* keeps reducing further and further until the end of the life-cycle.

As done before, during the analysis of consumption over the income distribution, the decision was made to restrict the preferred specification model by age of the household head. The idea was also to identify if other co-variants such as household composition, the effect of pensions or remittances have a statistically different effect over the life-cycle.

Table 5.15 presents the estimated coefficient values for the preferred specification model restricted by the age of the household head for a selected group of ages.

The statistical evidence confirms a downward trend in the elasticity of consumption to income per capita over the life-cycle. As an example: at the age of 45 the elasticity was found to be equal to 0.73—that is, households headed by individuals of that age increase their consumption level by 0.73% when they obtain a 1% increase in income—while the figure is around the 0.65 mark once the household's head is well into retirement age over the age of 70. Although, the elasticity increases slightly and plateaus just after retirement—between 65 to 70 year of age—at around the 0.70 value.

Table 5. 15. Coefficient values for the preferred specification model with age dummies.

Estimated equation: $Ln(C\_percapita_i) = \alpha + \beta(Ln\ Income\_percapita_i) + \psi(HHSize_i) + \vartheta(\#\ over\ 65_i) + \tau\ (Dummy\ pension_i) + \varepsilon_i$

	Dummy 45	*Dummy 46*	*Dummy 47*	*Dummy 48*	*Dummy 49*	*Dummy 50*	*Dummy 51*	*Dummy 52*	*Dummy 53*	*Dummy 54*
Log Income *per-capita*	0.732***	0.670***	0.719***	0.676***	0.719***	0.732***	0.686***	0.685***	0.689***	0.701***
	(53.83)	(46.72)	(59.17)	(52.60)	(47.06)	(57.33)	(46.91)	(51.36)	(45.84)	(47.93)
Household size	-0.047***	-0.060***	-0.045***	-0.060***	-0.043***	-0.042***	-0.047***	-0.050***	-0.047***	-0.043***
	(-8.90)	(-11.35)	(-8.33)	(-11.63)	(-8.24)	(-8.73)	(-8.56)	(-10.31)	(-8.96)	(-8.73)
Over 65	-0.056*	-0.072**	-0.066*	-0.024	-0.022	-0.048	-0.127***	-0.068**	-0.065	-0.057
	(-1.72)	(-2.31)	(-1.85)	(-0.75)	(-0.61)	(-1.44)	(-2.89)	(-2.15)	(-1.64)	(-1.43)
Dummy pension	0.245	-0.019	0.063*	0.025	-0.018	0.050*	0.089***	0.075***	0.029	0.097***
	(0.71)	(-0.53)	(1.96)	(0.76)	(-0.54)	(1.81)	(2.81)	(2.74)	(1.02)	(3.30)
_contant	2.185***	2.793***	2.259***	2.695***	2.263***	2.108***	2.552***	2.560***	2.485***	2.370***
	(16.33)	(20.01)	(19.23)	(21.10)	(15.32)	(16.73)	(18.07)	(19.77)	(17.07)	(16.78)
R square	0.6458	0.6078	0.6505	0.6085	0.6421	0.661	0.6413	0.6176	0.6241	0.6286
n	3,793	3,591	3,430	3,752	3,185	3,796	2,702	3,486	3,087	3,056

	Dummy 55	*Dummy 56*	*Dummy 57*	*Dummy 58*	*Dummy 59*	*Dummy 60*	*Dummy 61*	*Dummy 62*	*Dummy 63*	*Dummy 64*
Log Income *per-capita*	0.707***	0.676***	0.678***	0.710***	0.693***	0.676***	0.707***	0.668***	0.661***	0.691***
	(50.24)	(46.55)	(39.40)	(47.34)	(43.81)	(40.71)	(39.40)	(42.13)	(32.01)	(43.29)
Household size	-0.046***	-0.042***	-0.043***	-0.043***	-0.035***	-0.033***	-0.031***	-0.030***	-0.029***	-0.020***
	(-9.18)	(-8.18)	(-7.53)	(-8.48)	(-6.23)	(-6.70)	(-5.05)	(-5.35)	(-4.75)	(-3.67)
Over 65	0.081**	-0.073*	-0.077**	-0.080**	-0.036	-0.088**	-0.004	-0.066**	-0.011	-0.006
	(2.22)	(-1.93)	(-2.05)	(-2.23)	(-0.99)	(-2.46)	(-0.14)	(-1.97)	(-0.34)	(-0.20)
Dummy pension	0.064**	0.064**	0.079***	0.105***	0.101**	0.131***	0.094***	0.082***	0.143***	0.064***
	(2.34)	(2.25)	(2.84)	(4.02)	(3.84)	(5.62)	(3.52)	(3.38)	(5.63)	(2.68)
_contant	2.295***	2.571***	2.529***	2.229***	2.341***	2.483***	2.169***	2.527***	2.529***	2.226***
	(16.71)	(18.20)	(15.21)	(15.66)	(15.48)	(15.74)	(12.79)	(17.08)	(13.15)	(15.00)
R square	0.6276	0.5918	0.6175	0.657	0.6202	0.599	0.633	0.6078	0.5476	0.5989
n	2,970	2,973	2,471	2,707	2,485	2,986	1,936	2,219	2,321	2,176

	Dummy 65	*Dummy 66*	*Dummy 67*	*Dummy 68*	*Dummy 69*	*Dummy 70*	*Dummy 71*	*Dummy 72*	*Dummy 73*	*Dummy 74*
Log Income *per-capita*	0.647***	0.662***	0.706***	0.702***	0.6912***	0.697***	0.631***	0.651***	0.644***	0.662***
	(37.13)	(34.28)	(32.38)	(33.42)	(34.86)	(35.49)	(24.15)	(28.24)	(27.27)	(25.82)
Household size	-0.029***	-0.034***	-0.029***	-0.004	-0.012*	-0.012*	-0.020**	-0.028***	-0.013*	-0.002
	(-5.54)	(-5.91)	(-4.08)	(-0.79)	(-1.68)	(-1.88)	(-2.20)	(-3.89)	(-1.83)	(-0.34)
Over 65	-0.064**	-0.049*	-0.014	-0.052*	-0.014	-0.050*	-0.010	-0.027	0.013	-0.019
	(-2.46)	(-1.73)	(-0.51)	(-1.92)	(-0.54)	(-1.90)	(-0.29)	(-1.02)	(0.48)	(-0.63)
Dummy pension	0.082***	0.104***	0.083***	0.048*	0.077***	0.128***	0.163***	0.098***	0.133***	0.091***
	(3.36)	(3.64)	(2.66)	(1.68)	(2.62)	(4.29)	(4.55)	(3.20)	(4.00)	(2.58)
_contant	2.720***	2.577***	2.121***	2.109***	2.143***	2.146***	2.697***	2.562***	2.522***	2.337***
	(16.55)	(14.56)	(10.14)	(10.94)	(11.18)	(11.67)	(11.12)	(11.76)	(11.53)	(9.71)
R square	0.5705	0.5773	0.5716	0.5541	0.5737	0.5348	0.4874	0.5537	0.5098	0.4777
n	2,297	1,877	1,782	1,808	1,479	1,890	1,136	1,537	1,358	1,337

Values in parenthesis are t-ratios of robust standard errors. * indicates a 10% level of significance, ** indicates a 5% level of significance, *** indicates a 1% level of significance.

The empirical evidence indicates statistically significant economies of scale exist throughout the life-cycle. The benefit of having one additional dweller was found to reduce as household transit through the life-cycle. As expected income from pensions was found to be positively related with consumption but only after the age of 51. This is partly explained by the fact that 65% of the households receiving pensions, in the pooled dataset, are headed by individuals over the age of 60. It is important to consider that only 13.7% of all households in the dataset received any form of pension.

The previous section has found that pension-receiving households, in the lower half of the income distribution have a larger consumption to income elasticity. While a similar effect was found to exist among pension-receiving households headed by individuals after they celebrate their fiftieth year of life.

As a corollary from this section, it has been found that younger households have larger consumption to income *elasticity* that is, they have higher propensities to consume than their more mature fellow Mexican residents. The tipping point has been found to occur just before retirement age—57 years. With significant economies of scale associated with household composition and a positive and significant effect of pensions for households headed by individuals over the age of 50, not before.

5.6. Consumption disaggregation for specific sub-groups of the population.

So far, the econometric analysis has revealed statically significant difference in consumption propensities for certain groups relative to others: Richer cohorts have been found to have lower average propensities to consume—in line with existing empirical research. While, the marginal propensities to consume have been found to increase—at a diminishing rate—over the income distribution, a finding that is consistent with what the literature indicates.

The analysis about consumption differences over the life-cycle has revealed how the consumption to income *elasticity* is higher for households headed by younger individuals relative to the more matured fellow countrymen and women. However, an important drop was found to exist just before retirement age, consistent with the so-called *consumption puzzle*.

The most relevant finding has been that the drop in consumption occurs just before retirement age. The empirical evidence confirms it is at the age of 57 years that consumption propensities have a statistically significant drop.

In order to better understand how those differences have affected specific groups of the population, the decision was to interact a number of variables associated with some groups of the population.

The idea is to understand if the households approaching retirement age in one region share the same consumption to income *elasticity* as their fellow countrywomen living in other parts

of the country, or how pensioners do—in consumption terms—relative to households receiving remittances. These and other questions are meant to be addressed in the next stage of this research by adding different interacting variables associated with different subgroups of the households in the pooled *cross-section* dataset.

5.6.1. The life-cycle profile of consumption over the income distribution.

In order to identify how the whole sample is composed by those different groups, figure 3.21 presents a description of the age profile over the income distribution. In there it is possible to appreciate the distribution of households in the first- and fifth-income quintile over the life-cycle.

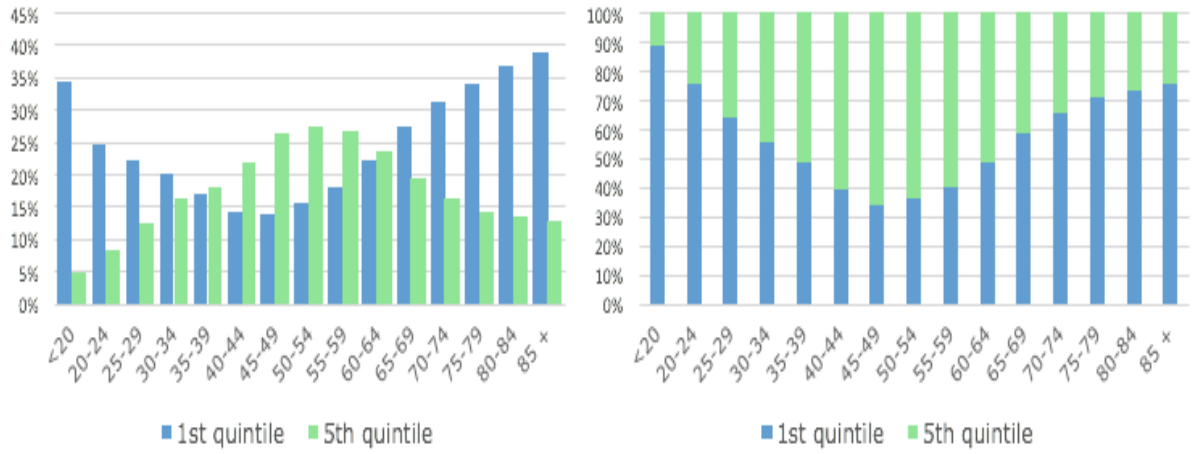


Figure 5. 20 Percentage of households in the first- and fifth-income quintiles by age. Source: own calculations based on ENIGH 2008-2016.

A clear convex profile in the first part of the figure exists for the poorer households making clear the prevalence of poverty among the younger and older the richer households in Mexico. The data shows that almost 35% of all households headed by individuals under the age of 20 belong to the poorer 20% households in Mexico. Meanwhile, only 5% of those younger households have income levels that position them among the richest income quintile.

A similar feature occurs for those households at the end of the life-cycle. Almost 40% of them are poor, while just over 12% will be rich. That is, a household headed by an individual over the age of 85 is three times more likely to live in poverty—first income decile—than the chances of being part of the top decile.

Another interesting dimension of analysis relates to whether or not statistically significant regional differences exist in terms of consumption that could be associated with the influence of income sources such as remittances, pensions, and housing wealth.

Table 5.16 shows the percentage of total households in each region of the country receiving any amount of remittances, pensions and housing wealth, as well as the share in each region of nationwide households receiving those income sources. The information in that table shows that certain regions in Mexico are more prone to receive remittances, which is consistent with common knowledge about the heavy-migration area in the central agricultural areas of Mexico, where the problem of poverty is more acute (Levy, 2010).

Region	# Households (HHs) receiving **remittances**	% HHs receiving **remittances** region	# HHs receiving **pensions**	% HHs receiving **pensions** region	# HHs receiving **housing wealth**	% HHs receiving **housing wealth** region
1	972	11.4%	780	0.5%	1102	5.1%
2	651	7.0%	995	0.6%	1505	7.0%
3	328	3.8%	1466	0.9%	2616	12.2%
4	2470	28.9%	1852	1.2%	3007	14.0%
5	1830	21.4%	1887	1.2%	2243	10.5%
6	646	7.6%	1864	1.2%	3589	16.8%
7	1146	13.4%	1627	1.0%	4102	19.2%
8	502	5.9%	1405	9.0%	3246	15.2%

Table 5. 16. Regional distribution of households receiving any amount of remittances, pensions, and housing wealth and the percentage of all households benefitting from those income sources. Source: Own calculations based on ENIGHs 2008-16.

Pensions, meanwhile, have been found to be more equally distributed. Finally, income from housing wealth tends to go to households in the richer areas of the country.

Meanwhile, table 5.17 shows how housing wealth is, not surprisingly, a form of income for the richer households as they are the ones who actually benefit from any form of wealth. It shows how remittances are going to poorer income groups.

Income quintile	Remittances	Pensions	Housing wealth	Remittances	Pensions	Housing wealth
1st	25%	9%	7%	1.4%	1.2%	0.6%
2nd	24%	15%	10%	1.3%	2.1%	0.8%
3rd	21%	19%	14%	1.2%	2.6%	1.1%
4th	17%	23%	21%	1.0%	3.2%	1.6%
5th	12%	34%	48%	0.7%	4.7%	3.7%

Table 5. 17. Distribution of households receiving any amount of remittances, pensions, and housing wealth by income quintile and the percentage of all households benefitting from those income sources. Source: Own calculations based on ENIGHs 2008-16.

A relevant element, surprising to some extent, is that pensions are disproportionally going to households at the top of the distribution. About 57% of pension-money goes to households whose income level positions them among the 40% richer in Mexico.

This is partly explained by the fact that the poorer cohorts rely more on jobs within the informal sector with no access to job benefits. In Mexico, half of all employment takes place in the informal sector (Delgado-Wise and Cypher, 2012).

Figure 5.21 presents the income distribution for selected age-cohorts of the population. The data confirms the dis-proportional distribution of income over the life-cycle. The young and the old have a much larger propensity to be poor, relative to other age cohorts. This finding highlights the need to understand better what goes on in terms of income and consumption for those *worst-off* groups of society, as they are the ones enjoying lower levels of well-being.

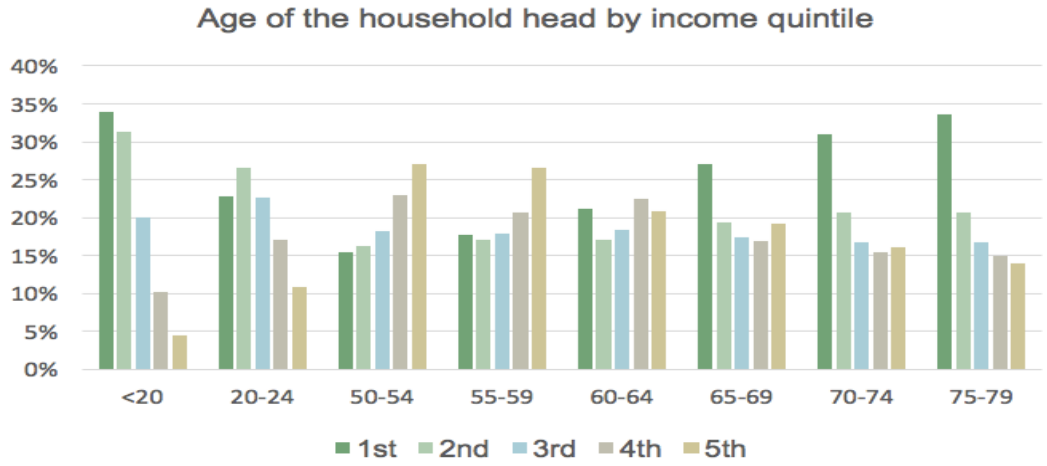


Figure 5. 21 Age of household heads by income decile for selected age cohorts in ENIGHs 2008-2016.
Source: Own calculations based on ENIGH 2008-2016.

The empirical analysis of consumption for these and other groups will allow to understand what is the reality they face in terms of consumption relative to other groups of society.
To complement this information figure 5.22 provides information about the recipients of remittances, pensions and housing wealth by the age of the household head.

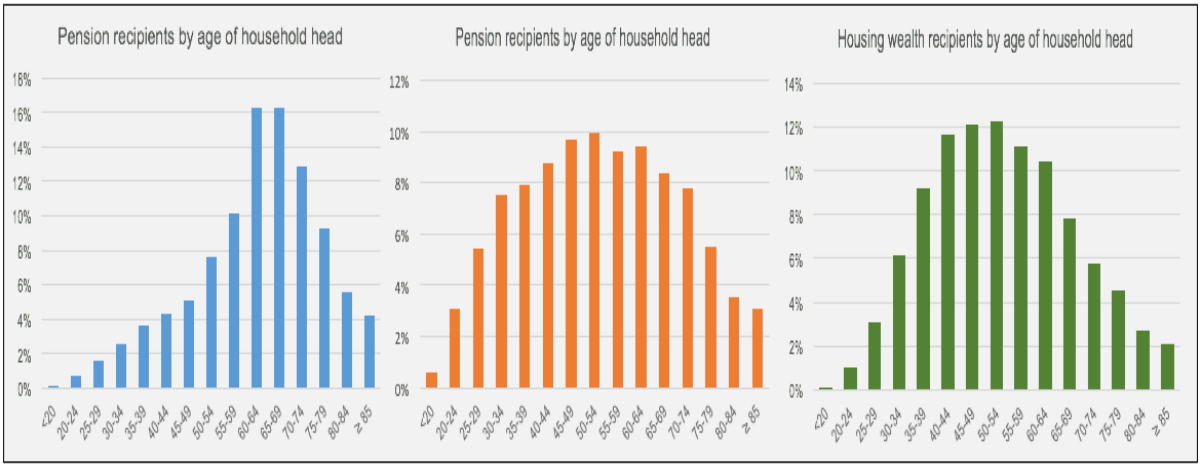


Figure 5. 22 Remittances, pensions and housing wealth recipients by the age of the household head.
Source: Own calculations based on ENIGHs 2008-2016.

In order to conduct the econometric analysis different interacting *dummy* variables—were created. Table 5.18 presents a description of each group associated with them.

By interacting the dummy variables of those groups, a number of resulting *interacting* sub-groups were determined. The description, size, and prevalence of each sub-group are contained in Annex 3A.

The econometric analysis was based on a variation of the preferred specification model (5.1) incorporating the interacting variables as described as in (5.4):

$$Ln\ (C\ per\ capita_i) = \alpha + \beta(Ln\ Y\ per\ capita_i) + \gamma(Z_i) + \varepsilon_i \quad (5.4)$$

Where *C* per capita and *Y* per capita are respectively, the logarithmic value of consumption and income considered on a per capita basis. Z is a vector of interacting terms as contained in Annex 5A. The results are shown in Table 5.19.

Age			
Variable name	Description	n	% total
Teenagers	Household headed by individuals aged 19 years or less	788	0.5%
Young	Household headed by individuals aged between 20 and 30 years	16,180	10%
50-54	Household headed by individuals aged between 50 and 54 years	16,133	10%
55-59	Household headed by individuals aged between 55 and 59 years	13,613	9%
60-64	Household headed by individuals aged between 60 and 64 years	11,651	7%
65-69	Household headed by individuals aged between 65 and 69 years	9,257	6%
70-75	Household headed by individuals aged between 70 and 74 years	7,274	5%
Over 75	Household headed by individuals aged 75 years or more	9,797	6%

Regions			
Var. name	Description	n	% total
Region 1	Households in the least developed area of Mexico	15,283	10%
Region 7	Households in the manufacturing strong area of Mexico	22,870	15%
Region 8	Housheolds in the most prosperous area of Mexico	21,037	13%

Income			
Var. name	Description	n	% total
Low income	Household with income levels in the lowest income quintile	31,176	20%
Mid low income	Household with income levels in the second income quintile	31,180	20%
Mid income	Household with income levels in the third income quintile	31,181	20%
Mid-high income	Household with income levels in the third income quintile	31,184	20%
High income	Household with income levels in the upper income quintile	31,183	20%
Poorer 10%	Households with a level of income in the lowest income decile	15,572	10%
Richer 10%	Households with a level of income in the highest income decile	15,592	10%

Income			
Var. name	Description	n	% total
Remittances	Household have received any ammount of remittances over period of 3 months	8,545	5%
Pensions	Household have received any ammount of pensions over period of 3 months	21,410	14%
Housing wealth	Household have received any ammount of rent from housing wealth over 3 mth	11,876	8%

Table 5. 18. Groups associated with used to determine the interaction terms in the analysis. (n is the number of observations in each group. % represent the percentage of total households in the dataset).

The first of the different scenarios indicated a positive and statistically significant elasticity of consumption for the youngest group of households if they are part of the lower two income quintiles. In the economic sense, it means these groups benefit by consuming 25% more than the average household in Mexico when income increases.

Table 5. 19. **OLS regression for preferred specification model with interacting terms income and age.**

Ln Income per capita	0.733*** (394.92)	0.736*** (383.65)	0.734*** (385.67)	0.736*** (380.66)	0.737*** (380.44)
Under 20 years & 1st quintile	0.255*** (7.20)				
Under 20 years & 2nd quintile	0.099*** (2.59)				
Under 20 years & 3th quintile	0.059 (1.47)				
Under 20 years & 4th quintile	-0.050 (-0.55)				
Under 20 years & 5th quintile	0.034 (0.29)				
20-24 years & 1st quintile		0.172*** (17.45)			
20-24 years & 2nd quintile		0.079*** (10.91)			
20-24 years & 3th quintile		0.045*** (5.65)			
20-24 years & 4th quintile		0.060*** (6.17)			
20-24 years & 5th quintile		0.125*** (9.31)			
25-29 years & 1st quintile			0.161*** (13.44)		
25-29 years & 2nd quintile			0.066*** (7.49)		
25-29 years & 3rd quintile			0.030*** (3.18)		
25-29 years & 4th quintile			0.051*** (4.51)		
25-29 years & 5th quintile			0.132*** (8.68)		
30-34 years & 1st quintile				0.172*** (16.06)	
30-34 years & 2nd quintile				0.071*** (8.98)	
30-34 years & 3rd quintile				0.047*** (5.99)	
30-34 years & 4th quintile				0.047*** (5.19)	
30-34 years & 5th quintile				0.107*** (9.65)	
35-39 years & 1st quintile					0.188*** (16.84)
35-39 years & 2nd quintile					0.081*** (10.50)
35-39 years & 3rd quintile					0.041*** (5.96)
35-39 years & 4th quintile					0.028*** (3.93)
35-39 years & 5th quintile					0.103*** (11.17)
_cons	1.918*** (117.32)	1.879*** (110.99)	1.896*** (112.86)	1.878*** (109.94)	1.871*** (109.40)
R_square	0.5919	0.5932	0.5926	0.5931	0.5932

Table 5.19. (cont). OLS regression for preferred specification model with interacting terms.

Ln Income per capita	0.738*** (380.44)	0.765*** (384.08)	0.735*** (384.99)	0.735*** (386.15)	0.735*** (388.15)
40-44 years & 1st quintile	0.187*** (15.93)				
40-44 years & 2nd quintile	0.092*** (14.76)				
40-44 years & 3th quintile	0.038*** (7.11)				
40-44 years & 4th quintile	0.006 (1.26)				
40-44 years & 5th quintile	0.065*** (7.88)				
45-49 years & 1st quintile		0.157*** (11.78)			
45-49 years & 2nd quintile		0.080*** (8.99)			
45-49 years & 3th quintile		0.027*** (3.43)			
45-49 years & 4th quintile		-0.012* (-1.73)			
45-49 years & 5th quintile		0.048*** (6.10)			
50-54 years & 1st quintile			0.714*** (11.71)		
50-54 years & 2nd quintile			-0.007 (-0.73)		
50-54 years & 3th quintile			-0.019** (-2.27)		
50-54 years & 4th quintile			-0.049*** (-6.35)		
50-54 years & 5th quintile			0.006 (0.74)		
55-59 years & 1st quintile				0.076*** (5.63)	
55-59 years & 2nd quintile				-0.036*** (-3.43)	
55-59 years & 3th quintile				-0.069*** (-6.94)	
55-59 years & 4th quintile				-0.066*** (-7.76)	
55-59 years & 5th quintile				-0.041*** (-4.55)	
60-65 years & 1st quintile					0.006 (0.47)
60-65 years & 2nd quintile					-0.092*** (-8.14)
60-65 years & 3th quintile					-0.106*** (-10.03)
60-65 years & 4th quintile					-0.112*** (-11.09)
60-65 years & 5th quintile					-0.071*** (-6.92)
_cons	1.863*** (108.75)	1.894*** (112.47)	1.895*** (112.85)	1.899*** (113.46)	1.906*** (114.44)
R_square	0.5931	0.5925	0.5923	0.5921	0.5924

Values in parenthesis are robust standard errors. * Significance at 10% level of confidence, ** significance at 5% level of confidence, *** significance at 1% level of confidence.

Table 5.19. (cont). OLS regression for preferred specification model with interacting terms.
Estimated equation: Ln(Ci per capita constant prices) = α +β *Ln(Yi per capita constant prices) + γ Zi +ei

Ln Income per capita	0.734*** (391.01)	Ln Income per capita	0.733*** (392.37)	Ln Income per capita	0.732*** (394.16)	Ln Income per capita	0.732*** (394.50)
65-69 years & 1st quintile	-0.062*** (-4.77)	70-74 years & 1st quintile	-0.125*** (-8.86)	75-79 years & 1st quintile	-0.179*** (-10.78)	80-84 years & 1st quintile	-0.221*** (-11.61)
65-69 years & 2nd quintile	-0.148*** (-11.63)	70-74 years & 2nd quintile	-0.202*** (-13.33)	75-79 years & 2nd quintile	-0.281*** (-14.63)	80-84 years & 2nd quintile	-0.353*** (-14.13)
65-69 years & 3rd quintile	-0.160*** (-13.09)	70-74 years & 3th quintile	-0.193*** (-13.26)	75-79 years & 3rd quintile	-0.205*** (-10.86)	80-84 years & 3th quintile	-0.219*** (-8.23)
65-69 years & 4th quintile	-0.178*** (-13.83)	70-74 years & 4th quintile	-0.210*** (-13.99)	75-79 years & 4th quintile	-0.198*** (-10.61)	80-84 years & 4th quintile	-0.207*** (-7.22)
65-69 years & 5th quintile	-0.116*** (-8.77)	70-74 years & 5th quintile	-0.147*** (-8.85)	75-79 years & 5th quintile	-0.145*** (-6.63)	80-84 years & 5th quintile	-0.145*** (-4.81)
_cons	1.912*** (115.61)	_cons	1.920*** (116.60)	_cons	1.926*** (117.57)	_cons	1.926*** (117.69)
R_square	0.5931	R_square	0.5936	R_square	0.5937	R_square	0.5935

Values in parenthesis are robust standard errors. * Significance at 10% level of confidence,
** significance at 5% level of confidence, *** significance at 1% level of confidence.

Income changes disproportionally benefit or affect the younger and poorer groups more than any other group of the Mexican society.

As already referred, better-off young households—those in the top three income quintiles—have been found to have no statistically consumption elasticity relative to the rest of the Mexican population.

The next four 5-years-gap age-cohorts—ranging from 20 to 40 years of age—have been found to have positive and significantly higher consumption elasticity regardless of the particular income level each household belongs to. That is younger households have higher consumption to income elasticity relative to the average household regardless of how poor or rich they are. Interestingly enough, the consumption to income elasticity reduces over the life-cycle regardless of income levels.

As an example, for a household headed by an individual aged between 20 to 24 years of age belonging to the highest income quintile, consumption increases by 0.12% when income goes up by 1%. The elasticity goes down as they transition into their mid-age and then drops to as little as 0.04 when they are aged 45 to 49 years. The consumption *elasticity* then becomes negative and significant once they pass the age of 55.

On the other hand, a *poorer* household belonging to the first quintile has the highest consumption elasticity relative to all other income cohorts throughout the life-cycle, and the elasticity does not get to a negative and significant value, at least not until retirement age.

The reduction in the elasticity of consumption is, however, more acute for households in the fourth income quintile. For this income-age group the evidence confirms that the consumption to income elasticity was not found to be statistically different—compared to other age/income households—after the age of 40, and was found to be negative and significant—at the 10% level of significance though—as they turn 45 years of age. Afterwards, there is no doubt they reduce their levels of consumption once they reach their fifth decade of existence.

As a summary from this section is that the elasticity of consumption for the poorer group in Mexico is significantly higher than for any other groups of the Mexican society. Meanwhile, households enjoying higher levels of income have been found to have smaller consumption to income elasticity relative to all income groups throughout the life-cycle.

However, the most relevant finding is that the reduction in consumption for households in the upper half of the distribution occurs once they were approaching 50 years of age, at an age when the poorer groups were still consuming significantly higher shares of their income in relative terms.

Consumption was found to decrease as households' heads approach retirement. When exactly depends on the income levels. The better-off "take the foot off" consumption at a younger age as they surpass their 50 years of life. The poorer lot cannot afford to do so. They need to wait for about another 20 years to see reductions in consumption, probably because they cannot consume less.

5.6.2. The effect of pensions, remittances, and housing wealth effect over the life-cycle.

The econometric analysis presented in this chapter has highlighted the relevance of remittances and pensions for the poorer cohorts. The empirical evidence identified two regularities: a reduction in consumption as household heads approach retirement and the prevalence of lower levels of income among households at both ends of the life-cycle.

The relevance of pensions to ring-fence consumption levels for those at the lower end of the distribution has been highlighted in this thesis. However, the available information for Mexico revealed that pensions tend to go to households in the upper part of the income distribution.

This thesis has also highlighted the importance of remittances as a source of income for the country, but also the relevance they play for migrant-prone households, usually those located in the impoverished-rural areas of Mexico.

Based on those elements, the decision was made to analyse the impact both remittances and pensions have in terms of consumption. However, the researcher decided to the effect of another relevant source of income: rents from housing wealth.

% of Household in respective income decile receiving income from housing wealth			
Income decile	% in income decile	% total households	Mean value income from HW
1st	2.4%	3.2%	44.89
2nd	3.2%	4.2%	89.07
3rd	3.6%	4.7%	139.90
4th	4.2%	5.5%	200.76
5th	4.9%	6.5%	280.79
6th	5.6%	7.3%	393.34
7th	6.8%	8.9%	586.58
8th	8.9%	11.7%	953.98
9th	12.2%	16.0%	1,785.30
10th	24.3%	31.9%	15,661.51

Table 5. 20. Percentage of households by income decile receiving any level of monetary income from housing wealth and the average value received.

The main reason to analyse the impact of income from housing wealth (HW) is related with the fact HW tends to be concentrated in a few *rich* hands in most nations of the world (Saez and Zucman, 2016). Table 5.20 presents the percentage of households receiving income from housing wealth over the income distribution, as well as the percentage of the average level of income that HW income represents.

The analysis of the dataset reveals that only 7% of all households in Mexico receive income from HW income. However, out of those only 2% of households in the lowest income decile receive income from HW. 48% of all household receiving HW belong to the top two income deciles.

The problem is not just that 76% of the households receiving income from HW belong to the upper half of the distribution. The main problem is that income from housing wealth for a rich household in 350 times larger than what a poor household receives from the same concept.

Actually, the level of income received by a household in the top decile from household wealth alone will be good enough to position any household in the fourth income decile.

	Receiving pensions	Non-pension receivers	Remittance receivers	Non-remittances receivers	Income from HW receivers	Non-HW receivers
LN Income per capita	0.740***	0.692***	0.611***	0.708***	0.658***	0.694***
	(129.60)	(310.18)	(63.94)	(339.26)	(95.66)	(321.25)
Household size	-0.028***	-0.046***	-0.046***	-0.042***	-0.049***	-0.043***
	(-14.89)	(-49.51)	(-15.37)	(-47.96)	(-15.90)	(-49.68)
Age	0.003**	0.012***	0.006***	0.009***	0.002	0.009***
	(2.00)	(19.41)	(3.06)	(17.15)	(0.94)	(16.53)
Age square	-0.00008***	-0.0001***	-0.0001***	-0.0001***	-0.00009***	-0.0001***
	(-6.17)	(-29.32)	(-5.51)	(-28.04)	(-4.88)	(-27.26)
_cons	2.035***	2.337***	3.151***	2.225***	2.833***	2.352***
	(30.99)	(101.46)	(33.49)	(101.51)	(32.26)	(105.23)
R_square	0.5967	0.6065	0.4773	0.618	0.6162	0.5971
n	21,403	134,349	8,543	147,209	11,875	143,877

Table 5. 21. Restricted sample estimated coefficients for the preferred specification model incorporating different interacting variables associated with specific levels of income and selected age cohorts. * Significance at 10% level of confidence, ** significance at 5% level of confidence, *** significance at 1% level of confidence.

In order to conduct the empirical analysis, it was found that an econometric procedure using *dummy* variables interacting age cohorts with a *dummy* for households receiving pensions (*dummy* = 1 if the household receives any income from pensions, or zero otherwise) could capture the age affect rather than the pension effect—highly likely given the clear drop in consumption over the life-cycle. Therefore, the decision was to run a restricted OLS regression for the specific groups of households receiving any amount of income from those three sources as a *treatment group* and then compared to the *control group* not receiving it.

The idea, after all, was to measure the impact of these sources of income on consumption. Table 5.21 presents the values for the estimated coefficients for the preferred specification model restricted regression by groups of households divided by those receiving and the ones not receiving pensions, remittances, or income from housing wealth.

The empirical evidence confirms pension receiver households have larger propensities to consume compared to households not receiving it. The life-cycle profile is smoother for the pension receivers, but the speed of the reduction is at a slower pace.

Meanwhile, remittance receiver households have a lower consumption to income elasticity compared to those who do not receive remittances but tend to spend more given the intercept value of the *best-fit* predicted level of expenditure. The life-cycle profile, for remittance receivers, shows consumption increases more slowly than for non-remittance receivers, and the downwards *speed* of adjustment is practically the same for remittance receivers and non-receivers.

Finally, and as expected, households receiving income from housing wealth have larger levels of consumption, the consumption *elasticity* is smaller (they are less *sensitive* to income shocks), and their consumption life-cycle profile is flatter and decreases slower.

5.6.3. Who consumes what: Disaggregation by consumption categories.

The empirical evidence obtaining so far confirms the so-called *consumption puzzle* referring to the observed differences in the marginal propensities to consume over the life-cycle, this phenomenon is well documented in the literature (e.g. Fisher and Marchand, 2014).

The drop in consumption over the life cycle has been attributed to changes in work-related expenses (Hurst, 2008), or higher leisure time (Battistin et al., 2009). This research has found the drop to occur at an earlier age—late 50s—well before retirement age. However, the disaggregation analysis has shown that when the reduction in consumption occurs depends on the household position along the income distribution: The richer households were found to have smaller consumption elasticity after their household heads turn 50 years of age. For the poorer households, consumption drops, on average ten or more years after.

According to Aguiar and Hurst (2013), it is possible to expect changes in spending categories for which ‘work time and expenditure are substitutes. However, it is possible to find several consumption categories which keep increasing throughout the life-cycle (e.g. health expenditure), while others decline (transportation or clothing), and some stay steady (housing services).

Meanwhile, Aguiar and Hurst (2005) found a reduction in worker-related expenditures (transport to and from work, canteen meals and business clothing) after retirement, as they

are no longer needed. Aguila et al. (2012) claim that the decline in food expenditure is compensated by increases in non-food items, so that total consumption remains roughly constant over the life-cycle.

On the other hand, Chitnis and Hunt (2011) contend that certain non-economic factors (socio-demographic or geographical) do have a higher explanatory power than the economic ones—income or prices—in explaining the level of expenditure on certain consumption components such as housing, communication, health, or education.

The main problem about trying to disaggregate by consumption categories is that some households—almost all for some consumption categories—manifested a level of expenditure equal to zero on specific consumption categories (see table 5.22).

	Percentage of households declaring zero expenditure on specific consumption category	Number of households
Mortgage	98.9%	154,215
Debt repayment	91.7%	143,007
Car (acquisition, maintenance, fuel)	55.8%	87,033
Health	46.6%	72,704
Education	46.2%	72,063
Clothes	22.7%	35,414
Meat consumption	19.4%	30,286
Transportation	8.1%	12,695
House services (rent and services)	3.7%	5,716
Vegetables consumption	2.2%	3,482
Food	0.6%	1,001

Table 5. 22. Percentage of households reporting zero expenditure over the survey period of time in the pooled dataset (2008-2016) for selected consumption categories. Source: Own calculations.

Given such inconsistency, if all observations were considered, the OLS would produce inconsistent estimators. A possible solution is the use of a *censored regression analysis*. Out of the different options, *Tobit* analysis was deemed an adequate option.

Tobit regression is described as ‘a maximum likelihood estimation technique that combines *probit* analysis with regression analysis’ (Dougherty, 2002, pp. 295). Given the low number of “zero expenditure” reports related with food consumption, the estimator value might not be too different between the OLS and the *tobit* procedures, but for all other categories, a significant difference can be expected.

Table 5. 23. Expected marginal effects of income on specific consumption categories.

Estimated equation: $Ln\ (CtC\ per\_capita\ _{hi}) = \beta_0 + \beta_1\ Ln\ (Income\ per\_capita\ _i) + \beta_2(Dummy\_pension_i) + \beta_3(Dummy\_remittances_i) + \beta_4(Dummy\_housingwealth_i) + \beta_5(Dummy\ 45-49_i) + \beta_6(Dummy\ 50-54_i) + \beta_7(Dummy\ 55-59_i) + \beta_8(Dummy\ 60-64_i) + \beta_9(Dummy\ 65-69_i) + \varepsilon_i$

	Ln **Food** per capita	Ln **Transportation** per capita	Ln **House Care** per capita	Ln **Mortgage** per capita	Ln **Education** per capita	Ln **Health** per capita	Ln **Clothing** per capita	Ln **Car** per capita	Ln **Meat** per capita	Ln **Vegetable** per capita	Ln **Debt** per capita
Ln Income per capita	0.496*** (184.97)	1.211*** (219.91)	0.825*** (191.41)	-0.00002 (-0.01)	0.345*** (37.38)	0.580*** (79.28)	0.625*** (87.79)	1.561*** (158.65)	0.220*** (24.55)	0.088*** (24.00)	1.515*** (24.55)
Dummy pension	-0.007 (-1.06)	0.037*** (2.64)	0.166*** (15.00)	0.004* (1.72)	-0.267*** (-11.24)	-0.023 (-1.26)	-0.429*** (-23.32)	0.015 (0.60)	0.347*** (15.20)	0.187*** (19.85)	0.601*** (4.01)
Dummy remittances	-0.001 (-0.19)	0.019 (0.95)	0.059*** (3.72)	0.036*** (5.92)	-0.199*** (-5.84)	0.541*** (20.00)	-0.065** (-2.51)	-0.035 (-0.97)	-0.213*** (-6.47)	0.101*** (7.44)	0.406* (1.83)
Dummy housing wealth	0.028*** (3.25)	0.191*** (10.71)	0.029** (2.08)	0.0006 (0.11)	0.647*** (21.60)	0.630*** (26.56)	0.255*** (11.06)	1.106*** (34.65)	0.165*** (5.75)	-0.014 (-1.17)	-0.207 (-1.09)
Dummy age 45-49	0.026*** (3.57)	0.362*** (24.02)	0.018 (1.61)	-0.025*** (-5.45)	0.411*** (16.26)	-0.100*** (-2.94)	0.097*** (5.00)	0.429*** (15.95)	0.379*** (15.60)	0.080*** (8.03)	0.524*** (3.26)
Dummy age 50-54	0.013* (1.77)	0.280*** (17.83)	0.014 (1.15)	-0.018*** (-3.79)	-0.107*** (-4.09)	-0.061*** (-2.94)	-0.169*** (-8.35)	0.266*** (9.51)	0.336*** (13.28)	0.101*** (9.67)	0.435*** (2.60)
Dummy age 55-59	0.003 (0.47)	0.168*** (9.95)	0.010 (0.82)	-0.011** (-2.17)	-0.719*** (-25.40)	-0.025 (-1.15)	-0.374*** (-17.16)	0.126*** (4.18)	0.231*** (8.51)	0.117*** (10.41)	-0.336* (-1.82)
Dummy age 60-64	-0.014 (-1.62)	-0.001 (-0.06)	0.023 (1.64)	-0.002 (-0.41)	-1.126*** (-36.84)	-0.077*** (-3.18)	-0.593*** (-25.18)	-0.033 (-1.03)	0.036*** (1.24)	0.115*** (9.51)	-1.224*** (-5.88)
Dummy age 65-69	-0.051*** (-5.18)	-0.225*** (-11.09)	0.014 (0.90)	0.012** (2.00)	-1.448*** (-42.47)	-0.047* (-1.77)	-0.928*** (-35.33)	-0.426*** (-11.75)	-0.236*** (-7.15)	0.093*** (6.89)	-1.247*** (5.36)
_const	2.987*** (128.03)	-4.817*** (-100.53)	-1.769*** (-47.17)	0.057*** (3.93)	0.325*** (4.05)	-2.832*** (-44.51)	-1.261*** (-20.38)	-10.757*** (-125.70)	2.275*** (29.20)	5.507*** (172.02)	-28.98*** (-49.90)

* indicates significance at the 10% level, ** indicates significance at the 5% level, indicates significance at the 1% level. (t-ratios are shown in parenthesis).

To reduce the risk of *heteroskedasticity* and to be consistent with the previous analysis, the decision was made to use the logarithmic form of consumption and expenditure per capita for each of the consumption categories analysed. Table 5.23 presents the estimated values for the marginal effect (from each explanatory variable) on the expected per capita logarithmic value of the specific consumption category (CtC).

The values associated with the first dependent variable in the *tobit* regression model is the expected value for the *latent variable*—the specific consumption category—to be greater than zero. That means if expenditure increases by 1%, the respective consumption category (take food as an example) will be expected to increase by 0.49%.

The results reveal that the Mexican population is prone to increase their expenditure levels of public transportation, car acquisition or maintenance, as well as to use the extra streams of income to pay back debt. The empirical evidence shows the income elasticity of those

three consumption categories is above 1.00, making them *superior goods*. Not surprisingly, the income elasticity level of fruits and vegetables at 0.08 indicates that those are the type of goods the Mexican population cut the consumption of—in relative terms—as they get richer.

No statistically significant differences were found to exist in terms of the amount spent on mortgages when income changes. This can partly be explained by the fact that mortgages are, in most cases, set amounts to be paid on a monthly basis.
The empirical evidence confirms that a typical Mexican household will spend extra income on things other than paying or reducing mortgages.

The inclusion of different *dummy* variables associated with the age of the household head confirms the drop in consumption as household transit through retirement. However, when the reduction occurs depends on the specific consumption category:

Expenditure in health—medicines and medical expenses—is the category having the smallest income variation over the life-cycle. Meanwhile, the reduction in clothing expenditure is so dramatic that it is possible to establish that clothing is the CtC households reduce almost entirely at the end of the life-cycle.

All of the previous findings are consistent with what has been found by different researchers (i.e. Sun and Wang, 2013).

Expenditure on food is the consumption category with a positive elasticity for the younger and middle-aged groups of the population. That is, they spend more on food as they increase their income level. However, the evidence obtained here fails to identify a significant relationship for the households approaching and transiting through retirement. It is only for the elder groups of society that a negative and significant relationship has been found to exist between income and food expenditure. That is, they—the elders—have been found to reduce their food expenditure, through a *substitution* effect rather than cutting the food intake.

In the economic sense, while middle-age households (45 to 49 years) increase their expenditure in food by 0.52% when income increases by 1%; a household headed by 65 to 69 years-old individuals will increase their food expenditure by 0.49%; meanwhile, a post-retirement age household will actually see a reduction in food expenditure of 0.05% with a similar increase in income.

The more detailed analysis found evidence to conclude how as households get older—post-retirement age—they cut their level of expenditure on meat, and increase the expenditure of fruit and vegetables. Being the later products usually cheaper and in some cases, examples of *giffen-goods*, the reduction in food expenditure among the older households was in line with intuition.

Expenditure in house care goods—cleaning goods, bedding, personal care, etc.—has been found to have a strong positive income elasticity with no significant change over the life-cycle.

The econometric analysis confirms that the elder cohorts of the Mexican society reduce their expenditure levels in most CtCs considered in the analysis. Evidence has been found to suggest the elder households increase their consumption of fruit and mortgage payments as they transit towards the end of the life-cycle. The categories they practically reduced to zero is their expenditure on education and clothing.

The inclusion of different *dummy* variables associated with households receiving any level of monetary income from pensions, remittances and housing wealth allows for the following findings:

Households receiving any amount of money from pensions—public or private—have higher propensities to spend on transportation and house care. Consistent with widely documented empirical evidence, this thesis has found reduced levels of expenditure in clothing and education among pension-receiving households.

On the other hand, it was found that pension-receiving households use them to increase their spending in meat, vegetables, house care, as well as in paying back any debt they have.

The econometric results also suggest that households receiving money from either pensions, remittances, or housing wealth do increase their expenditure levels in house care and maintenance.

Remittance receiving households tend to use income for education and health purposes, which was an expected outcome considering that most remittances to Mexico come from a

large diaspora in the USA[53] most of them work in harsh condition in the agricultural and the low-skilled sector. It is not a surprise their loved ones back home use those resources to pay for education that create a platform for their children's future.

Finally, the group of households obtaining monetary income from housing wealth—usually the richer cohorts of the population—have twice as many chances of spending their income on cars, education and health.

In order to corroborate if any significant differences exist for the same consumption categories between different income groups, the decision was made to expand the previous analysis introducing different dummy variables associated with the income level. Table 5.24 presents the estimated coefficient values obtained from censored regression analysis rotating the income quintile as the *base scenario*.

The results obtained from the *tobit* econometric procedure indicate strong significant differences did exist between certain consumption categories and the income level the households receive.

It has been found that in support to the Engel's law[54], richer households in Mexico devote a smaller fraction of their income to pay for food. In the economic sense, the poorer quintile households have been found to use 25% more of their income to pay for food relative to the amount expended by the richer households.

Meanwhile, higher levels of income are associated with higher levels of expenditure on goods such as public transportation, education, health services, clothing, car acquisition and maintenance, and the consumption of meat.

[53] According to a report by Mexico's INEGI (INEGI, 2011), 89% of the country's migrants do so to the USA. According to Passel and Cohn (2010), 58% of them work illegally in Mexico's north neighbour nation. Although *net migration* from Mexico to the USA was measure at zero in 2012, the number of Mexican-born population living in the USA was recorded at 12 million people according to the Pew Institute (2012).
[54] The Engel's Law states that 'the percentage of income allocated for food purchases decrease as income rises'. (Kenton, 2018).

Table 5. 24. Expected marginal effects of income on specific consumption categories.

Estimated equation: $Ln\ (CtC\ per\_capita\ _{hi}) = \beta_0 + \beta_1\ Ln\ (Income\ per\_capita\ _i) + \gamma(Dummy\ Y\ quintile_i) + \varepsilon_i$

	Ln **Food** per capita	Ln **Public Transp.** per capita	Ln **House Care** per capita	Ln **Mortgage** per capita	Ln **Education** per capita	Ln **Health** per capita	Ln **Clothing** per capita	Ln **Car** per capita	Ln **Meat** per capita	Ln **Vegetable** per capita
Ln Income per capita	0.568*** (154.21)	0.777*** (96.55)	0.920*** (149.44)	0.891*** (4.31)	-2.221*** (-94.41)	0.385*** (20.64)	-0.237*** (-19.01)	0.857*** (28.91)	-0.334*** (-27.47)	0.111*** (21.99)
Dummy 2nd income	-0.068*** (-9.22)	0.958 (59.33)	0.068*** (5.57)	-0.259 (-0.65)	3.328*** (69.71)	0.382*** (10.04)	0.994*** (39.38)	2.101*** (32.06)	1.206*** (49.51)	0.060*** (5.98)
Dummy 3rd income	-0.101*** (-13.03)	1.407*** (82.98)	0.051*** (3.99)	-0.653 (-1.56)	5.042*** (100.15)	0.634*** (15.95)	1.595*** (60.18)	3.824*** (57.21)	1.700*** (66.42)	0.087*** (8.16)
Dummy 4th income	-0.168*** (-20.14)	1.679*** (92.11)	-0.033** (-2.43)	-1.316*** (-2.88)	6.594*** (120.94)	0.927*** (21.79)	2.163*** (75.92)	5.552*** (78.33)	1.981*** (71.94)	0.059*** (5.19)
Dummy 5th income	-0.254*** (-25.43)	1.888*** (86.38)	-0.232*** (-13.90)	-4.485*** (-7.58)	9.275*** (140.79)	1.722*** (33.89)	3.094*** (90.53)	8.311*** (99.42)	2.290*** (69.29)	-0.003 (-0.25)
_const	2.473*** (83.71)	-2.142*** (-33.20)	-2.551*** (-51.70)	-38.349*** (-20.34)	16.073*** (87.25)	-3.233*** (-21.54)	4.239*** (42.41)	-11.497*** (-47.69)	5.851*** (59.97)	5.335*** (131.07)

	Ln **Food** per capita	Ln **Public Transp.** per capita	Ln **House Care** per capita	Ln **Mortgage** per capita	Ln **Education** per capita	Ln **Health** per capita	Ln **Clothing** per capita	Ln **Car** per capita	Ln **Meat** per capita	Ln **Vegetable** per capita
Ln Income per capita	0.568*** (154.21)	0.777*** (96.55)	0.920*** (149.44)	0.891*** (4.31)	-2.221*** (-94.41)	0.385*** (20.64)	-0.237*** (-19.01)	0.857*** (28.91)	-0.334*** (-27.47)	0.111*** (21.99)
Dummy 1st income	0.068*** (9.22)	-0.958 (-59.33)	-0.068*** (-5.57)	0.259 (0.65)	-3.328*** (-69.71)	-0.382*** (-10.04)	-0.994*** (-39.38)	-2.101*** (-32.06)	-1.206*** (-49.51)	-0.060*** (-5.98)
Dummy 3rd income	-0.033*** (-4.60)	0.449*** (28.67)	-0.016 (-1.41)	-0.394 (-1.02)	1.713*** (39.29)	0.251*** (6.90)	0.600*** (24.71)	1.732*** (29.63)	0.493*** (20.99)	0.026*** (2.67)
Dummy 4th income	-0.100*** (-13.34)	0.720*** (44.17)	-0.102*** (-8.20)	-1.057*** (-2.58)	3.265*** (71.53)	0.544*** (14.38)	1.168*** (46.18)	3.450*** (57.48)	0.774*** (31.60)	-0.001 (-0.11)
Dummy 5th income	-0.186*** (-21.39)	0.929*** (48.91)	-0.301*** (-20.67)	-4.226*** (-8.05)	5.947*** (109.72)	1.340*** (30.49)	2.100*** (71.15)	6.209*** (89.13)	1.084*** (37.87)	-0.064*** (-5.34)
_const	2.404*** (76.33)	-1.183*** (-17.21)	-2.482*** (-47.18)	-38.609*** (-19.55)	19.402*** (97.93)	-2.850*** (-17.84)	5.234*** (49.06)	-9.395*** (-36.90)	7.057*** (67.86)	5.396*** (124.30)

	Ln **Food** per capita	Ln **Public Transp.** per capita	Ln **House Care** per capita	Ln **Mortgage** per capita	Ln **Education** per capita	Ln **Health** per capita	Ln **Clothing** per capita	Ln **Car** per capita	Ln **Meat** per capita	Ln **Vegetable** per capita
Ln Income per capita	0.568*** (154.21)	0.777*** (96.55)	0.920*** (149.44)	0.891*** (4.31)	-2.221*** (-94.41)	0.385*** (20.64)	-0.237*** (-19.01)	0.857*** (28.91)	-0.334*** (-27.47)	0.111*** (21.99)
Dummy 1st income	0.101*** (13.03)	-1.407*** (-82.98)	-0.051*** (-3.99)	0.653 (1.56)	-5.042*** (-100.15)	-0.634*** (-15.95)	-1.595*** (-60.18)	-3.824*** (-57.21)	-1.700*** (-66.42)	-0.087*** (-8.16)
Dummy 2th income	0.033*** (4.60)	-0.449*** (-28.67)	0.016 (1.41)	0.394 (1.02)	-1.713*** (-39.29)	-0.251*** (-6.90)	-0.600*** (-24.71)	-1.732*** (-29.63)	-0.493*** (-20.99)	-0.026*** (-2.67)
Dummy 4th income	-0.66*** (-9.27)	0.271*** (17.31)	-0.085*** (-7.11)	-0.662* (-1.68)	1.552*** (39.29)	0.292*** (8.09)	0.568*** (23.44)	1.717*** (30.97)	0.280*** (11.94)	-0.027*** (-2.78)
Dummy 5th income	-0.153*** (-18.89)	0.480*** (27.18)	-0.284*** (-20.95)	-3.831*** (-7.76)	4.233*** (86.32)	1.088*** (26.77)	1.499*** (54.86)	4.476*** (71.67)	0.590*** (22.23)	-0.090*** (-8.10)
_const	2.371*** (72.72)	-0.734*** (-10.32)	-2.499*** (-45.89)	-39.003*** (-19.18)	21.115*** (102.60)	-2.598*** (-15.72)	5.834*** (52.80)	-7.663*** (-29.15)	7.551*** (70.12)	5.422*** (120.66)

	Ln **Food** per capita	Ln **Public Transp.** per capita	Ln **House Care** per capita	Ln **Mortgage** per capita	Ln **Education** per capita	Ln **Health** per capita	Ln **Clothing** per capita	Ln **Car** per capita	Ln **Meat** per capita	Ln **Vegetable** per capita
Ln Income per capita	0.568*** (154.21)	0.777*** (96.55)	0.920*** (149.44)	0.891*** (4.31)	-2.221*** (-94.41)	0.385*** (20.64)	-0.237*** (-19.01)	0.857*** (28.91)	-0.334*** (-27.47)	0.111*** (21.99)
Dummy 1st income	0.168*** (20.14)	-1.679*** (-92.11)	0.033** (2.43)	1.316*** (2.88)	-6.594*** (-120.94)	-0.927*** (-21.79)	-2.163*** (-75.92)	-5.552*** (-78.33)	-1.981*** (-71.94)	-0.059*** (-5.19)
Dummy 2nd income	0.100*** (13.34)	-0.720*** (-44.17)	0.102*** (8.20)	1.057*** (2.58)	-3.265*** (-71.53)	-0.544*** (-14.38)	-1.168*** (-46.18)	-3.450*** (-57.48)	-0.774*** (-31.60)	0.001 (0.11)
Dummy 3rd income	0.66*** (9.27)	-0.271*** (-17.31)	0.085*** (7.11)	0.662* (1.68)	-1.552*** (-39.29)	-0.292*** (-8.09)	-0.568*** (-23.44)	-1.717*** (30.97)	-0.280*** (-11.94)	0.027*** (2.78)
Dummy 5th income	-0.086*** (-11.40)	0.208*** (12.65)	-0.195*** (-15.66)	-3.168*** (-6.78)	2.681*** (59.87)	0.795*** (21.12)	0.931*** (36.62)	2.758*** (48.98)	0.309*** (12.94)	-0.063*** (-6.03)
_const	2.304*** (68.06)	-0.463*** (-6.27)	-2.585*** (-45.72)	-39.666*** (-18.85)	22.668*** (105.85)	-2.306*** (-13.44)	6.402*** (55.79)	-5.945*** (-21.82)	7.832*** (70.05)	5.395*** (115.63)

	Ln **Food** per capita	Ln **Public Transp.** per capita	Ln **House Care** per capita	Ln **Mortgage** per capita	Ln **Education** per capita	Ln **Health** per capita	Ln **Clothing** per capita	Ln **Car** per capita	Ln **Meat** per capita	Ln **Vegetable** per capita
Ln Income per capita	0.568*** (154.21)	0.777*** (96.55)	0.920*** (149.44)	0.891*** (4.31)	-2.221*** (-94.41)	0.385*** (20.64)	-0.237*** (-19.01)	0.857*** (28.91)	-0.334*** (-27.47)	0.111*** (21.99)
Dummy 1st income	0.254*** (25.43)	-1.888*** (-86.38)	0.232*** (13.90)	4.485*** (7.58)	-9.275*** (-140.79)	-1.722*** (-33.89)	-3.094*** (-90.53)	-8.311*** (-99.42)	-2.290*** (-69.29)	0.003 (0.25)
Dummy 2nd income	0.186*** (21.39)	-0.929*** (-48.91)	0.301*** (20.67)	4.226*** (8.05)	-5.947*** (-109.72)	-1.340*** (-30.49)	-2.100*** (-71.15)	-6.209*** (-89.13)	-1.084*** (-37.87)	0.064*** (5.34)
Dummy 3rd income	0.153*** (18.89)	-0.480*** (-27.18)	0.284*** (20.95)	3.831*** (7.76)	-4.233*** (-86.32)	-1.088*** (-26.77)	-1.499*** (-54.86)	-4.476*** (-71.67)	-0.590*** (-22.23)	0.090*** (8.10)
Dummy 4th income	0.086*** (11.40)	-0.208*** (-12.65)	0.195*** (15.66)	3.168*** (6.78)	-2.681*** (-59.87)	-0.795*** (-21.12)	-0.931*** (-36.62)	-2.758*** (-48.98)	-0.309*** (-12.94)	0.063*** (6.03)
_const	2.218*** (60.75)	-0.254*** (-3.19)	-2.783*** (-45.65)	-42.835*** (-18.79)	25.349*** (109.60)	-1.510*** (-8.16)	7.334*** (59.25)	-3.186*** (-10.85)	8.141*** (67.53)	5.331*** (105.97)

* indicates significance at the 10% level, ** indicates significance at the 5% level, indicates significance at the 1% level. (t-ratios are shown in parenthesis).

In Mexico, better standards of health provision, higher standard education, and quality/safe transportation are provided by private companies with the richer being able to access them. According to Levy (2010, pp. 207), richer households rely completely in the private provision of health. This piece of research has found strong statistical evidence to support such a claim.

Luxury goods (i.e. clothing) and expenditure on vehicles not surprisingly have been found to increase significantly with income. A household in the top two deciles will spend four times more in clothing, eight times as much in vehicles, and nine times more in education compared to the 20% poorer households in Mexico.

5.6.4. Specific consumption categories disaggregation over the life-cycle.

The final level of analysis is related to the actual level of specific consumption categories over the life-cycle for different income groups.

The decision was made to analyse the consumption of four specific categories: food, education, health and clothing. Table 5.25 presents the estimated coefficient values of this econometric procedure using interaction variables related with different income groups over the life-cycle.

The empirical evidence confirms that the poorer quintile of the Mexican society uses the largest share of the income to pay for food. Expenditure in food was found to increase as they grow old, but the share of income used for this purpose has been found to show a statistically significant reduction as they approach retirement age.

Once they pass their 70th birthday, their income elasticity of food consumption reduces significantly. For the second and third quintile, food to income elasticity has a pattern similar to the poorer cohort; but the elasticity reduces earlier in life. The households in the second income quintile will reduce their relative food expenditure just after retirement age.

These findings allow to conclude that all households in Mexico increase their share of income used to acquire food as they grow older, but this level reaches a turning point over the life-cycle in support to the *consumption puzzle* referred in the literature (e.g. Carroll and Summers, 1991; Aguiar and Hurst, 2013).

Table 5. 25. **Expected marginal effects of income on specific consumption categories.**
Estimated equation: $Ln\ (CtC\ per\_capita\ _{hi}) = \beta_0 + \beta_1\ Ln\ (Income\ per\_capita\ _i) + \gamma(Dummy\ Age_i * Income\ quintile_i) + \varepsilon_i$

Ln **Food** household consumption per capita					
Ln Income per capita	0.530*** (178.46)	0.505*** (193.67)	0.499*** (195.47)	0.500*** (193.59)	0.527*** (170.10)
	*Dummy 1st quintile * Age cohort*	*Dummy 2nd quintile * Age cohort*	*Dummy 3rd quintile * Age cohort*	*Dummy 4th quintile * Age cohort*	*Dummy 5th quintile * Age cohort*
Age 20-24	0.225*** (9.11)	0.124*** (5.51)	0.085*** (3.37)	-0.042 (-1.37)	-0.104** (-2.41)
Age 25-29	0.196*** (10.36)	0.117*** (6.82)	0.038** (2.08)	0.017 (0.84)	-0.080*** (-3.24)
Age 30-34	0.173*** (10.22)	0.098*** (6.47)	0.056*** (3.63)	0.026 (1.53)	-0.068*** (-3.64)
Age 35-39	0.169*** (10.00)	0.102*** (7.02)	0.069*** (4.89)	-0.009 (-0.67)	-0.064*** (-3.96)
Age 40-44	0.185*** (10.36)	0.102*** (6.64)	0.050*** (3.64)	-0.006 (-0.46)	-0.078*** (-5.38)
Age 45-49	0.182*** (9.72)	0.013 (0.61)	0.017 (0.85)	-0.022 (-1.16)	-0.108*** (-7.82)
Age 50-54	0.206*** (11.30)	0.075*** (4.31)	0.032** (1.97)	-0.030** (-2.04)	-0.126*** (-8.89)
Age 55-59	0.167*** (9.04)	0.054*** (2.95)	-0.006 (-0.38)	-0.001 (-0.06)	-0.143*** (-9.22)
Age 60-64	0.125*** (6.99)	0.0000 (0.00)	-0.020 (-1.03)	-0.050*** (-2.65)	-0.130*** (-7.35)
Age 65-69	0.080*** (6.99)	-0.055*** (-2.61)	-0.045*** (-2.06)	-0.126*** (-5.55)	-0.165*** (-7.67)
Age 70-74	-0.127 (-0.67)	-0.142*** (-6.19)	-0.128*** (-5.03)	-0.115*** (-4.32)	-0.174*** (-6.60)
Age 75-79	-0.091*** (-4.26)	-0.229*** (-8.45)	-0.114*** (-3.78)	-0.161*** (-5.03)	-0.233*** (-7.00)
Age 80-84	-0.126*** (-4.87)	-0.353*** (-10.39)	-0.228*** (-5.79)	-0.368*** (-8.74)	-0.300*** (-6.93)
_const	2.662*** (98.92)	2.898*** (124.28)	2.959*** (130.76)	2.961*** (130.54)	2.739*** (102.936)

* indicates significance at the 10% level, ** indicates significance at the 5% level, indicates significance at the 1% level. (t-ratios are shown in parenthesis).

Table 5.25. (cont.) Expected marginal effects of income on specific consumption categories Estimated equation: $Ln\ (CtC\ per\_capita\ _{hi}) = \beta_0 + \beta_1\ Ln\ (Income\ per\_capita\ _i) + \gamma(Dummy\ Age_i * Income\ quintile_i) + \varepsilon_i$

Ln **Education** household consumption per capita					
Ln Income per capita	-0.357*** (-19.21)	0.323*** (19.37)	0.367*** (22.42)	0.254*** (15.42)	-0.561*** (-28.39)
	*Dummy 1st quintile * Age cohort*	*Dummy 2nd quintile * Age cohort*	*Dummy 3rd quintile * Age cohort*	*Dummy 4th quintile * Age cohort*	*Dummy 5th quintile * Age cohort*
Age 20-24	-3.800*** (-19.21)	-1.686*** (-11.25)	-0.530*** (-3.23)	0.305 (1.54)	2.471*** (9.31)
Age 25-29	-2.267*** (-22.73)	0.004 (0.04)	0.764*** (6.67)	1.118*** (8.77)	2.754*** (18.01)
Age 30-34	-1.028*** (-18.94)	1.040*** (11.04)	1.771*** (18.54)	2.149*** (20.39)	3.849*** (33.80)
Age 35-39	--0.969*** (-9.90)	1.317*** (14.70)	1.966*** (22.58)	2.574*** (29.08)	4.722*** (48.44)
Age 40-44	-1.600*** (-9.35)	0.972*** (10.18)	1.560*** (18.22)	2.474*** (29.78)	4.507*** (51.38)
Age 45-49	-2.844*** (-14.35)	-1.040*** (-7.47)	-0.676*** (-5.38)	-0.694*** (-5.92)	4.180*** (50.25)
Age 50-54	-3.872*** (-23.40)	-1.392*** (-12.06)	-0.070 (-0.67)	0.978*** (10.49)	3.567*** (41.33)
Age 55-59	-5.273*** (-31.23)	-2.234*** (-17.74)	-1.227*** (-10.20)	0.093 (0.86)	2.479*** (25.93)
Age 60-64	-6.373*** (-39.21)	-3.361*** (-24.39)	-1.760*** (-13.28)	-0.466*** (-3.75)	1.930*** (17.51)
Age 65-69	-7.270*** (-45.42)	-3.816*** (-24.97)	-2.299*** (-15.04)	-0.798*** (-5.37)	1.437*** (10.59)
Age 70-74	-8.189*** (-48.02)	-4.434*** (-25.79)	-2.608*** (-14.73)	-1.495*** (-8.37)	1.326*** (7.98)
Age 75-79	-8.669*** (-42.31)	-5.278*** (-24.78)	-2.762*** (-13.09)	-0.951*** (-4.52)	1.391*** (6.65)
Age 80-84	-9.524*** (-35.11)	-5.774*** (-20.96)	-2.699*** (-9.84)	-1.400*** (-4.97)	0.646*** (2.33)
_const	5.308*** (31.66)	-1.237*** (-8.29)	-1.851*** (-12.74)	-1.040*** (-7.17)	5.724*** (9.31)

* indicates significance at the 10% level, ** indicates significance at the 5% level, indicates significance at the 1% level. (t-ratios are shown in parenthesis).

Table 5.25. (cont.) Expected marginal effects of income on specific consumption categories Estimated equation: $Ln\ (CtC\ per\_capita\ _{hi}) = \beta_0 + \beta_1\ Ln\ (Income\ per\_capita\ _i) + \gamma(Dummy\ Age_i * Income\ quintile_i) + \varepsilon_i$

Ln **Health** household consumption per capita					
Ln Income per capita	0.770*** (51.45)	0.845*** (63.77)	0.863*** (66.75)	0.860*** (65.92)	0.615*** (39.05)
	*Dummy 1st quintile * Age cohort*	*Dummy 2nd quintile * Age cohort*	*Dummy 3rd quintile * Age cohort*	*Dummy 4th quintile * Age cohort*	*Dummy 5th quintile * Age cohort*
Age 20-24	-0.405*** (-3.14)	-0.124 (-1.09)	-0.296** (-2.32)	-0.029 (-0.19)	0.370* (1.75)
Age 25-29	-0.341*** (-3.47)	-0.037 (-0.43)	0.047 (0.51)	0.110 (1.09)	0.940*** (7.73)
Age 30-34	-0.091 (-1.05)	-0.071 (-0.92)	0.240*** (3.11)	0.196** (2.31)	1.157*** (12.61)
Age 35-39	-0.349*** (-3.96)	-0.075 (-1.02)	-0.050 (-0.70)	0.162** (2.26)	0.953*** (11.95)
Age 40-44	-0.403*** (-4.32)	-0.351*** (-4.43)	-0.175** (-2.52)	-0.056 (-0.82)	0.925*** (12.93)
Age 45-49	-0.650*** (-6.60)	0.014 (0.12)	-0.122 (-1.20)	-0.020 (-0.21)	0.834*** (12.33)
Age 50-54	-0.537*** (-5.61)	-0.236*** (-2.64)	-0.199** (-2.38)	-0.018 (-0.24)	0.800*** (11.48)
Age 55-59	-0.561*** (-5.79)	-0.419*** (-4.39)	-0.126 (-1.38)	0.139* (1.65)	0.886*** (11.65)
Age 60-64	-0.634*** (-6.72)	-0.429*** (-4.30)	-0.219** (-2.20)	-0.078 (-0.82)	0.910*** (10.48)
Age 65-69	-0.697*** (-7.33)	-0.472*** (-4.34)	-0.125 (-1.11)	0.121 (1.07)	1.061*** (10.05)
Age 70-74	-0.605*** (-6.06)	-0.195* (-1.67)	-0.211 (-1.63)	-0.007 (-0.06)	1.008*** (7.81)
Age 75-79	-0.516*** (-4.59)	-0.167 (-1.21)	0.174 (1.15)	0.193 (1.21)	1.286*** (7.94)
Age 80-84	-0.709*** (-5.18)	-0.482*** (-2.75)	-0.038 (-0.19)	0.565*** (2.71)	1.381*** (6.57)
_const	-5.784*** (-42.57)	-6.491*** (-54.44)	-6.676*** (-57.80)	-6.681*** (-57.88)	-4.697*** (-34.62)

* indicates significance at the 10% level, ** indicates significance at the 5% level, indicates significance at the 1% level. (t-ratios are shown in parenthesis).

Table 5.25. (cont.) Expected marginal effects of income on specific consumption categories Estimated equation: $Ln\ (CtC\ per\_capita\ _{hi}) = \beta_0 + \beta_1\ Ln\ (Income\ per\_capita\ _i) + \gamma(Dummy\ Age_i * Income\ quintile_i) + \varepsilon_i$

Ln **Clothing** consumption per capita					
Ln Income per capita	0.436*** (43.29)	0.621*** (62.49)	0.632*** (72.04)	0.586*** (66.08)	0.297*** (28.00)
	*Dummy 1st quintile * Age cohort*	*Dummy 2nd quintile * Age cohort*	*Dummy 3rd quintile * Age cohort*	*Dummy 4th quintile * Age cohort*	*Dummy 5th quintile * Age cohort*
Age 20-24	-0.035 (-0.43)	0.473*** (6.17)	0.903*** (10.51)	1.207**** (11.47)	1.586*** (10.90)
Age 25-29	0.099 (1.56)	0.526*** (8.97)	0.728*** (11.71)	1.000*** (14.45)	1.852*** (22.02)
Age 30-34	0.004 (0.08)	0.523*** (10.10)	0.789*** (14.96)	0.977*** (-16.74)	1.761*** (27.68)
Age 35-39	0.0142 (0.25)	0.428*** (8.65)	0.672*** (13.96)	0.986*** '(20.04)	1.635*** (29.70)
Age 40-44	-0.163*** (-2.69)	0.276*** (5.27)	0.474*** (10.08)	0.745*** (16.13)	1.467*** (29.67)
Age 45-49	-0.629*** (-9.84)	-0.311*** (-4.11)	-0.182*** (-2.65)	-0.201*** (-3.09)	1.375*** (29.44)
Age 50-54	-1.069*** (-16.93)	-0.641*** (-10.57)	-0.174*** (-3.05)	0.282*** (5.55)	1.242*** (25.83)
Age 55-59	-1.555*** (-24.10)	-0.874*** (-13.54)	-0.453*** (-7.21)	0.074 (1.28)	1.103*** (20.99)
Age 60-64	-1.910*** (-30.11)	-1.166*** (-17.16)	-0.814*** (-11.86)	-0.099 (-1.52)	0.822*** (13.65)
Age 65-69	-2.445*** (-37.68)	-1.633*** (-21.89)	-1.046*** (-13.44)	-0.452*** (-5.76)	0.446*** (6.06)
Age 70-74	-2.810*** (-40.60)	-1.969*** (-23.99)	-1.205*** (-13.46)	-0.565*** (-6.11)	0.321*** (3.56)
Age 75-79	-3.020*** (-38.26)	-2.420*** (-24.62)	-1.507*** (-14.10)	-0.558*** (-5.03)	0.337*** (2.96)
Age 80-84	-3.606*** (-36.73)	-2.746*** (-22.08)	-1.846*** (-13.17)	-1.295*** (-8.75)	-0.063 (-0.43)
_const	0.104 (1.15)	-1.682*** (-21.03)	-1.853*** (-23.81)	-1.526*** (-19.58)	0.862*** (9.47)

* indicates significance at the 10% level, ** indicates significance at the 5% level, indicates significance at the 1% level. (t-ratios are shown in parenthesis).

When that turning point occurs is determined by income level, the richer they are, the earlier—around the age of 40 for the richer, 70 for the poorer households—they reduce the relative share of food expenditure. The more detailed evidence shown by this analysis confirms the fact that richer households devote smaller shares of income to the food-related consumption category.

In terms of education expenditure, the richer cohorts spend far much more than their less fortunate, income-wise, fellow countrywomen do.

The empirical evidence on health consumption expenditure *speaks* volumes about the large differences that exist between the richer most who spend—on average—as much as ten times in health and medicines as the poorer households in Mexico. No clear pattern was found to exist for the middle-income quintiles.

Households in the second income quintile do spend significantly less than the third or fourth quintiles, but the share of income spent on this consumption category has not been found to follow a particular pattern over the life-cycle.

The story is different for the 20% poorer and 20% richer households in Mexico. The share of income spent on health-related concepts does change significantly, as they transit over the life-cycle. The difference is more acute at the end of the life-cycle, while the poor significantly have reduced levels of expenditure in health relative to income; the better-off almost duplicate their level of expenditure when they were younger.

In terms of clothing, there is no surprise, the young (people in their 20s) and the rich spent the most, while the poor and old devoting very little to pay for clothes. For the non-poor (above the second income decile) the drop in clothing consumption elasticity has been found to exist when households transit during their fourth decade in life. Some researchers have argued that drop occurs once they retire. The evidence obtained in this research confirms the drop occurs earlier in life, but indeed the drop is larger at retirement age for the richer households, for the poorer cohort the drop in almost constant once they pass the age of 40.

The fact that the richer cohorts of the Mexican society spend more on health places them in a self-reinforcing cycle that allows them to take advantage of the opportunities economic development brings along. Given the fact that the public free provision of both education and health is plagued with anomalies and long waiting times. This comes as a little surprise given Mexico's high level of opportunity inequality.

After retirement, the poorer households are likely to reduce all consumption categories, even though they substitute consumption of meet for staples and vegetables. Richer households could afford increases in education and cultural services, health, and insurance expenses. The rich were found to be better able to enjoy life after retirement.

5.7. Conclusions.

This chapter was aimed at identifying if the macroeconomic evidence of higher consumption has had a similar effect at the microeconomic level, and how the benefits have been distributed in society. The analysis was conducted by pooling together the six most recent versions of the household survey on income and consumption in Mexico.

Based on the literature review, the decision was made to define the preferred specification model, using the logarithmic form of the dependent and independent variables on a per capita basis. This specific form has been identified in the literature review as an adequate way to better reflect the reality of household dynamics. Although the risk of endogeneity exists—associated with income being correlated with factors not included in the regression (e.g. education)—the use of a canonical form of the consumption function was deemed adequate as it will allow international comparison of the results obtained.

Using a regression model with three different specification forms of consumption and income—total, per capita, and *per-adult equivalent*—it was found that the different specifications did not make much of a difference in terms of both significance and sign value for the variables in the model.

The marginal propensity to consume for Mexico was found to be just over 0.7%. The analysis revealed a positive and significant relationship between consumption and age, with consumption increasing at a diminishing rate over the life-cycle. The evidence obtained from descriptive analysis confirmed how the hump-shaped profile of consumption is less pronounced when income and consumption are considered on a per capita basis.

The descriptive analysis showed that as expected, the average propensity to consume (APC) shows a clear reduction as household income increases. The analysis allowed to find out that households in the upper end of the income distribution receive pensions, mainly: 74% of households receiving any amount from pensions are part of the richer half in Mexico. Pensions act to ring-fence consumption.

Meanwhile, no statistically significant relationship was found to exist between consumption and remittances for households in the top 30% of the distribution. The relevance of remittances was found to reduce among households at the top end of the distribution.

As expected, housing wealth is associated with the richer most. The empirical evidence confirmed a positive and significant effect of the income components on consumption.

Given the research aims of finding out if the benefits of increased levels of consumption have benefitted different groups of society, the decision was made to decompose the dataset in order to dig deeper and find out if a significant relationship existed for specific groups of the population.

The results also confirmed the expected downward trend in marginal propensity to consume (MPC) over the income distribution. With the poorer income cohorts having the largest MPC. The empirical evidence confirms there was a higher sensitivity to income shocks at both ends of the income distribution.

The fact that the poorer-most cohorts have higher consumption to income *elasticity* means they are the group of the population having the largest sensitivity to income changes. The estimated coefficients for those households in the second to the fifth income deciles were not found to be statistically different among themselves. For households in the upper half of the distribution, the story has been found to be consistent with the existing body of knowledge: the richer a household is the higher the level of savings.

The richer-most have been the ones more affected by income shocks, followed by the poorer cohort. At the micro-economic level, the largest benefit of increased consumption has gone to the richest 30%, followed by the 10% poorest.

The evidence obtained in this thesis has found support for the so-called consumption puzzle, that is consumption over the life-cycle follows a hump-like function documented in the literature (e.g. Aguiar and Hurst, 2013).

The econometric analysis of consumption over the life-cycle confirmed that households headed by individuals over the age of 75 are the ones with the lowest consumption to income elasticity, while those in middle-aged households enjoy the highest consumption level. A clear downward trend in the elasticity of consumption to income was found to exist over the life cycle.

For the younger cohorts, consumption will increase by more than the increase of income. The story was not found to be much different for household heads in their 20s up until they get into their fourth decade; that is, they will be expected to consume the increase almost

whole. The empirical evidence confirms a clear hump-shaped consumption profile over the life-cycle. The tipping point was found to be the 60 to 64 years age cohort.

The introduction of age-specific dummy variables allowed to identify a negative and statistically significant consumption to income elasticity once the household heads turn 57 years old, with the estimated levels reducing further and further until the end of the life-cycle.

Consistent with findings of different researchers (e.g. Fischer and Marchand, 2014) the empirical evidence provides support for the consumption-puzzle, it confirmed the non-linear analysis of the consumption profile over the life cycle. The use of interaction terms relating age and income suggested that MPC drops earlier as households have larger income levels.

The descriptive statistical analysis has shown that poverty is disproportionally distributed along the life-cycle. While 35% of the young households are part of the lowest income decile, only 5% of them made up part of the highest quintile. The figures for post-retirement individuals are even worse: almost 40% of them are among the poorer 20% in Mexico.

Income rather than age was found to be the main discriminating factor in terms of consumption elasticity: poorer cohorts are more sensitive to income changes, with older households being almost equally affected regardless of income levels.

It was found how, regardless of the income, the consumption to income elasticity decreases as they grow old. Consumption has been found to decrease as households' heads approach retirement. When exactly depends on the income levels. The better-off "take their foot off" consumption at a younger age as they surpass their 50th year of life. The poorer cohorts cannot afford to do so; they need to wait for about another 20 years.

The stream of income associated with housing wealth has been found to have the largest and positively significant effect for consumption throughout the life-cycle. As expected, income for housing wealth benefits the richer cohorts of Mexican society. It has been found that the income from housing wealth received by the top decile will be enough, on its own, to place that household in the 4^{th} income decile.

The literature review stage revealed how the consumption puzzle is explained as a condition emerging because of the reduction of consumption of specific expenditure categories (clothes, transportation, etc.) and an increase in leisure time. The econometric analysis of different consumption categories revealed that while more affluent households in their early

50s are more likely to reduce their consumption levels in general, less well-off similarly aged households are likely to increase their expenditure on food, telecommunications, clothing, and insurance expenses.

This piece of research has found support to the so-called *Engel's Law*, where richer households devote a smaller fraction of their income to pay for food, even though they do enjoy higher quality food compared to other households. Likewise, the evidence presents a clear picture in terms of the levels of expenditure in health and education: the richer are the ones spending for both.

The micro-level data suggest that income has increased, but consumption has not really increased on a consistent basis. The analysis revealed that the poorer, the younger, and the middle-income regions of Mexico have higher propensities to consume on a per capita basis. The story however, has been found to be different for older cohorts of the Mexican society who are likely to have reduced levels of consumption.

It has been recognized that Mexico has seen important developments at the macro level. However, the benefits have not been equally distributed (Schettino, 2011). This research has found support for such an idea. The richer group—mainly composed of middle-aged individuals—has benefitted the most, while the younger cohorts of society and particularly the older have not enjoyed the proceeds of increased levels of income in Mexico.

6. Consumption and Income inequality evolution in Mexico: A Pseudo-Panel Data Analysis.

6.1. Introduction.

One of the most pressing issues in today's global economy is to reconcile the benefits of longer, fruitful life with the pressures of rising income inequality in both the developed[55] in both develop and developing[56] world (Tanzi, 2019; Tanzi 2018; Graham, 2018; Balestra and Torbin, 2018; Asteriou et al., 2014; Krugman, 2014; Passé-Smith, 2008). According to the OECD (2019) 'inequalities are its highest levels in 30 years and widening'. The World Inequality Report (Alvaredo et al., 2018) explains how 'in recent decades, income inequality has increased in nearly all countries, but at different speeds', with larger shares of income going to the top 10% richer households, particularly in the developing world.

After conducting a review about the dynamics of global wealth inequality, Zucman (2019) found it has increased dramatically, with an additional problem: the rise in inequality tends to be underestimated 'as financial globalization makes it increasingly hard to measure wealth at the top'.

According to Houle (2018), inequality does affect economic development in the long-run at least. Meanwhile, Rajan (2010) contends that economic inequality is a phenomenon related to an economy's reduced capacity to sustain growth, as well as with high levels of household debt.

Income inequality has been found to have a negative effect of education dropout among teenagers (Kearney and Levine, 2011) and to affect all nations, irrespective of how rich/poor they are, or the form of government in place (Herzer and Vollmer, 2012).

Different researchers (e.g. Easterly, 2007; Glaeser et al., 2003) have shown that high levels of inequality, particularly in the developing world, allow the rich and powerful to bend the rules and the country's institutions to their own favour, slowing the democratisation process

[55] According to Balestra and Torbin (2018), across the OECD nations the wealthiest 10% households hold 52% of total wealth, while the 60% least wealthy own little over 12%. With a quarter of all households—in their analysis—reporting negative equity: liabilities exceeding the value of their assets. All of that among the world's richest nations only. Even since Kuznets seminal work, it has been recognized that inequality is greater in the developing world.
[56] According to Davies (2011), while income inequality has been rising strongly in the richer world—OECD nations—mainly, there has only been a small upward trend in inequality of marketable wealth, mainly due to the omission of pension wealth, the effect of house price increases, and increase incentives for the less-fortunate to save more.

and preventing the implementation of economic reforms (Fogel, 2006). In an interesting piece of research, Marin (2019) establishes there is a relationship between increasing inequality and the lack of social mobility with lower innovation and entrepreneurship.

However, according to the literature surveyed, not all effects of inequality are negative: according to Voitchovsky (2011), economic growth is the result of a higher level of savings, with the latter being a by-product of a higher inequality at the top end of the distribution. The problem is when inequality interacts with poverty. Such a combination produces self-reinforcing effects of low levels of demand, low levels of investment, and low wages (Matsuyama, 2002).

For other researchers (e.g. Deaton, 2013) inequality—even though still experienced by millions suffering from complete destitution—is just a natural consequence of economic growth, as not everybody develops at the same pace. Welch (1999) goes further by arguing that some degree of inequality is not only inevitable but functional.

Nonetheless, it is important to proceed with care even after accepting the *positive incentives* associated with inequality particularly when inequality produces polarisation, unrest and uncertainty (Alesina and Perotti, 1996).

6.2. Income inequality.

According to Nolan and Marx (2009), current income does not necessarily reflect the impact of savings, debt or previous spending. Therefore, in the way to understand inequality the two variables most commonly studied are household income and household consumption. According to Brandolini and Smeeding (2009) "if one is interested in *deep-seated long-run inequality*, permanent income, and hence consumption is what matters".

Although no consensus exists[57] on whether inequality affects growth 'positively, negatively, or at all' throughout the different stages of growth (Herzer and Vollmer, 2012; Voitchovsky, 2005). It is possible to establish a negative link between inequality and growth once nations and regions achieve a certain degree of development (Persson and Tabellini, 1994).

[57] There is an array of research output (see Seligson and Passé-Smith, 2008) where different authors found themselves divided on whether or not the actual inequality gap if widening or closing.

It has been recognized that the relative level of income in relation to that of others has 'strong implications for the consumption and savings decisions of individuals and households' (Sun and Wang, 2013) and that income distribution 'is only one element of broader inequality' (Atkinson and Bourguignon, 2007).

Some authors (e.g. Folbre, 2011; Brewer and O'Dea, 2012) have identified consumption, rather than income, as the best indicator of household living standards, particularly when the effect of inequality is accounted for in the developing world (Ferreira and Ravallion, 2011).

Other researchers (e.g. Bandolini and Smeeding, 2011; Johnson et al., 2005) question the superiority of consumption as a better measure of welfare as, they contend, income offers the *possibility* to consume, and therefore it is a better measurement of inequality as some people might decide not to consume for frugality reasons, making them not less fortunate than a shopping-lover counterpart.

Nonetheless, regardless of which of them are used in order to determine inequality or well-being levels, it is clear that consumption and income—which track each other along the life-cycle (Haushofer and Fher, 2014)—offer an interesting dimension to be analysed while trying to understand the dynamics of welfare. As explained by Crossley and Pendakur (2002), the 'shape of the two profiles co-vary across different groups in the population'.

Inequality was found to have reduced in different Latin-American nations[58] during the first decade of the new millennium with an average decline in inequality of 1.1% per year measured in terms of the Gini coefficient. One of those cases was Mexico's, where a decrease in 'the earnings gap between skilled and low-skilled workers and an increase in government transfers to the poor' were the main factors leading to inequality reduction (Lopez-Calva and Lustig, 2010).

An important question about aggregate consumption and income studies is the fact that it is not possible to identify if the increases in consumer spending have been incurred only by the households that experienced wealth or income increases, or the benefits have been similar for all households (Bostic et al. 2009).

[58] According to Lustig and Lopez-Calva (2010) over the 2000-2006 period, twelve out of seventeen Latin-American countries have experienced inequality decline since 2000. Only Honduras, Nicaragua, Costa Rica, Uruguay and Guatemala had inequality increases.

Considering that income is not static over time, different researchers (e.g. Salverda and Atkinson, 2007) have identified the importance of adopting a dynamic perspective. It includes the analysis of household composition and migration patterns, particularly given the changes in global trade and capital flows, demographic changes and household composition; where special attention should be given to changing birth rates, increasing female work participation and migration patterns (Leigh et al., 2011; Burtless, 2009).

As explained by Salverda et al. (2011) 'Life chances, the opportunities, obstacles, and misfortunes that different people face in striving for the sort of life they want to lead, are the fundamental arena where economic inequalities operate'. Daudey and Garcia-Penalosa (2007) define income to individuals to come from two sources: capital and labour, making it is important to understand the different experience for inequality between workers and rentiers.

The interest in the concept and effects of inequality dates back to the second half of the last century. But why another study on inequality? The answer is country-specific. As explained by Voitchovsky (2009), the effect of inequality varies greatly between samples of countries and not in a systemic way. Mexico being an emerging middle-high income nation, where increases in real terms of income and consumption have taken place while the country has fully immersed in the global free-trade economy.

The globalisation phenomenon has been linked to reductions in *between-country* inequality, but increasing within-country inequality (Autor, 2015; Freeman, 2011), sometimes associated with the *winner take all* phenomenon associated with globalisation (Davies, 2011). Mexico is certainly an example of economic integration[59]. The benefits and drawbacks of the international trade and open-market economic policies have been discussed widely—the analysis of this issue goes beyond the scope of this research—but Mexico does represent a paradigmatic case if the relationship between globalisation and inequality is to be understood further.

The analysis of income and consumption inequality is of particular interest in the context of Mexico because having been at the turn of the millennium the OECD nation with the highest level of inequality[60] (Brandolini and Smeeding, 2011), it has seen inequality reductions since

[59] Mexico is the country with the highest number of free-trade agreements (Calderon, 2012b). The only country—by 2016—having free trade agreements with the North-American region, the European Union, and the Pacific Rim nations.
[60] By the year 2000 Mexico's poorer decile had a level of income equal to 32% of the national median income, while the top decile's figure was 331 times that value (Brandolini and Smeeding, 2011).

the year 2000 (Lopez-Calva and Lustig, 2012) and is a nation that has made the transition from a commodity-exporting economy to a manufacturing-lead nation nowadays (The Economist, 2013).

Mexico represents a peculiar case: an emerging economy, fully open to globalisation and international trade, a country in demographic transition where consumption and income have increased in real terms. But also, a nation with high levels of poverty and a nation where not everybody has benefitted from those improvements in consumption as shown in the previous chapter of this piece of work.

The literature review stage revealed that according to Palley (2010) the overall effect of increased income inequality depends on the sizes of the absolute and relative income effects. However, as people - particularly those at the lower end of the income scale – tend to spend in order to "*keep up with the Joneses*", then it is possible than the relative income effects dominate the absolute income effect, so that "widened income inequality could raise aggregate consumption.

According to Winters et al. (2004) in the long-run open economies fare better than closed ones in terms of achieving economic development, but in the shorter run economic and trade openness hurt the poorer harder. This piece of research will not go as far as to argue for or against this idea, but it aims to provide the empirical evidence from an emergent economy, fully open and integrated—trade-wise—with the largest world's economy (Calderon, 2012; Schettino, 2018).

6.2.1. Consumption and income inequality in Mexico.

The emerging economies have been praised by their contribution to global economic growth and their role in driving consumption and production (O'Neil, 2017).

Over the previous decades, China has had an impressive record in terms of economic growth. However, although residing, they have been paired with higher levels of income inequality and relatively low consumption (Jin et al., 2011; Sun and Wang, 2013).

While analysing the Chinese urban household survey from 1997 to 2006 Jin et al. (2011) found that rapid increases in income inequality at national level have been marked along wider variations in inequality across regions had resulted in increased consumption inequality. Their main finding was that the urban inequality Gini coefficient rose from 0.23 in

1997 to 0.29 in 2009 on average. With the average propensity to consume (APC) declining by 2.54%.

Meanwhile, in the southern part of the Americas, inequality reduced during the first decade of this Century with an average decline in inequality of 1.1% per year (Lopez-Calva and Lustig, 2010).

A common feature of most emerging economies in the Latin-America region is that of economic growth combined with high levels of inequality as the proceedings of economic expansion have disproportionally benefitted those with the right abilities, qualifications, capital—financial mainly—or the political muscle to take advantage of economic growth (Gasparini and Lustig, 2014).

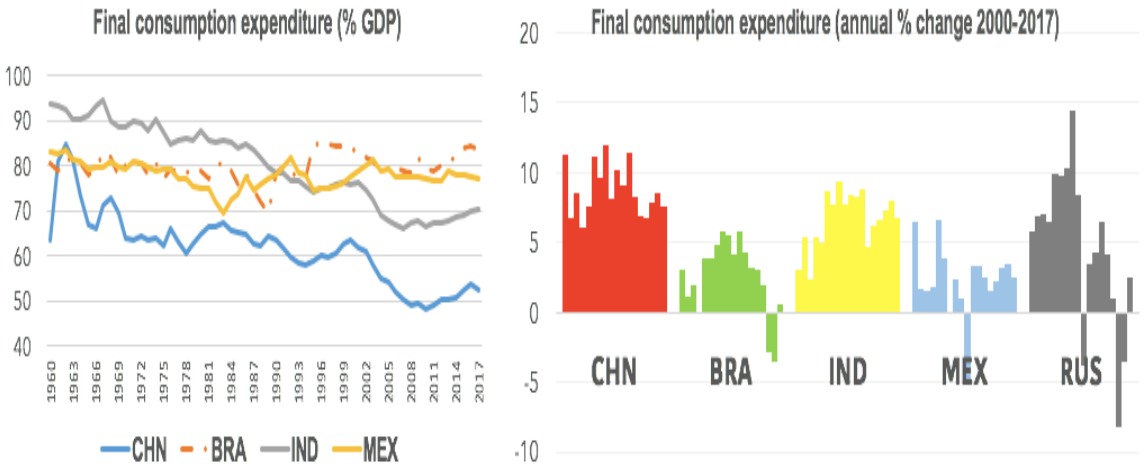


Figure 6. 1 Consumption expenditure as percentage of GDP 1960-2017 and annual percentage change 2000-2017 for a selected group of countries. Source: WDI (2019)

As a way to contrast the changes in consumption in some emerging economies, figure 6.1 presents the change in final consumption. Although consumption in absolute terms has increased for China and India, its share of the respective country's GDP has decreased. Meanwhile, consumption in Mexico has decreased, but the share of GDP it represents has stayed practically the same over time.

According to the OECD (2011), Mexico's inequality increased during the 1980s until 1994 and was then found to decrease steadily. The reduction over the period was such that inequality in 2012 was even smaller than what Mexico had in 1984 (Schettino, 2007; Camberos-Castro, 2012). According to Mexico's National Council for Social Policy

Evaluation (*Consejo Nacional de Evaluación de la Política Social*—CONEVAL), the Gini coefficient for Mexico came down from 0.560 in 1990 to 0.552 in 2000 to 0.500 in 2010.

After Mexico adopted an open-trade economic policy in the early part of the 1990s along the privatization and deregulation of the economy coincided with an expansion of wages and employment which resulted in increasing differences in wages between those having the skills and those lacking them, as the economy became more skill-intensive (Cragg and Epelbaum, 1996). The authors found that the highest-paid workers experienced the largest wage growth.

The author's own calculations based on the household consumption and income survey (ENIGH) from 2000 to 2016 show how the income gap between the richer 10% and the poorer decile has closed over the last ten years (Figure 6.2).

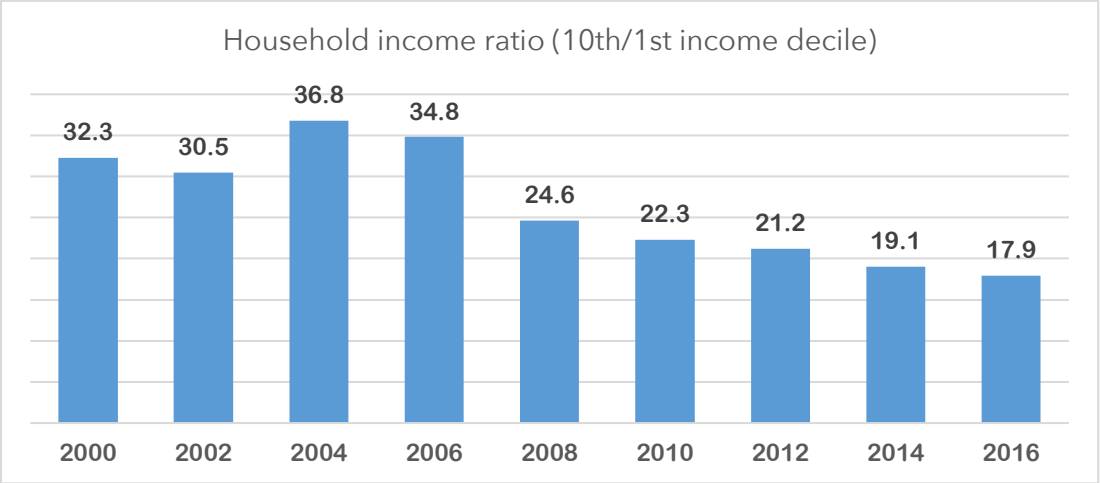


Figure 6. 2 Mexico's household mean income ratio 10th to 1st income decile 2000-2016.
Source: Own calculations based in ENIGH 2000-2016 (INEGI, 2018).

According to the National Council for Public Policy (CONEVAL), the Gini coefficient has come down from 0.560 in 1990 to 0.552 in 2000 to 0.500 in 2010. Cortes (2013) states that the Gini coefficient based on household total income, has decreased 10% in two decades (from 0.491 in 1994 to 0.446 in 2010). The Gini coefficient per-capita[61] has come down from 0.546 to 0.495 over the same period. The ratio of total household income of the 10th decile to the 1st decile has passed from 16 in 1994 to 12 in 2010. Meanwhile, mean *per-capita* income of the 10% richer households relative to the 10% poorer was 32 times larger in 1994. The same ratio was 23 times higher in 2010.

[61] That is considering total household income divided by household equivalent size.

The Gini coefficient might not be a perfect reflection of well-being inequality (Crossley and Pendakur, 2002; Lambert, 2008; Nolan and Marx, 2009). It might be short in explaining the inequality of opportunities (Nuñez and Tartakowsky, 2011) fully. Therefore, changes in inequality might not be, on its own, a signal of better or worst times for a group of individuals, but understanding how income inequality influences the standard of living (i.e. life expectancy, or poverty mobility) or if it finds itself being reinforced by them is an important task of research (Salverda et al., 2009).

It is important to mention that there was a methodological change[62] in the way the 2008 survey was collected and processed. The important fact is that, based in this single inequality measure, there is a reduction in income inequality. As referred before, actions such as the government transfers, the implementation of the universal health coverage, and level of economic growth in certain regions of Mexico have been found to be the main factor behind the reduction in inequality (Schettino, 2018b; Calderon, 2012; Lopez-Calva and Lustig, 2010).

According to Jenkins and Van Kerm (2009), the comparison between the mean and the median is an adequate tool to identify the actual income distribution. Figure 6.3 presents than information based on the different cross-section datasets.

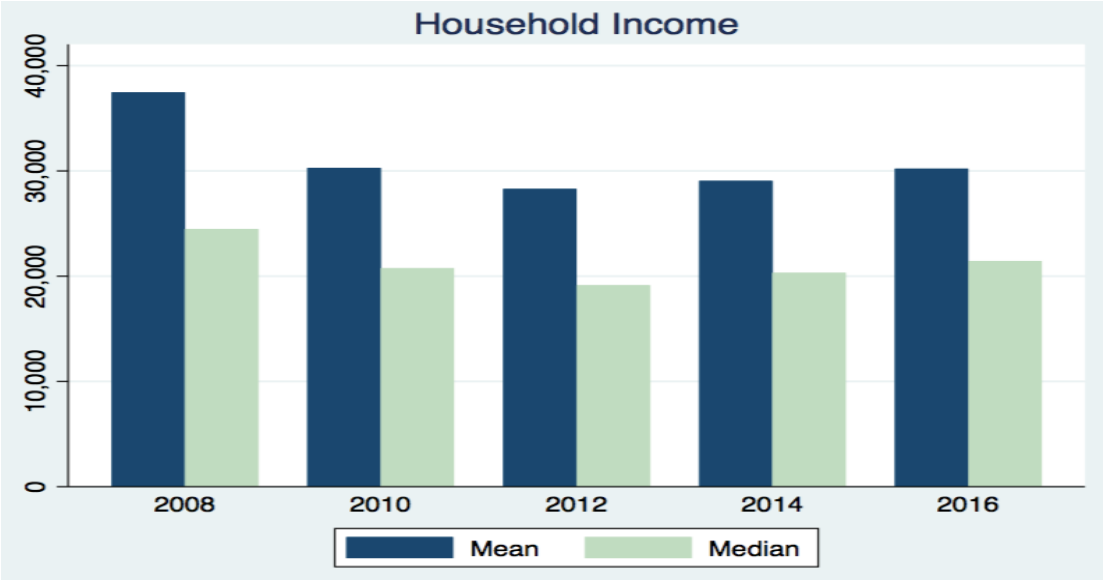


Figure 6. 3 Mean and median value in each ENIGH 2008-2016. Source: Own calculations based in ENIGH 2008-2016 (INEGI, 2018).

[62] According to the INEGI's webpage (https://www.inegi.org.mx/programas/enigh/nc/2008/default.html) the change was conducted to meet the standards required by the UN's 17th Conference in Work-related statistics known as the *Canberra Group*. For the main changes introduced for all edition of the ENIGH starting in 2008 (see Annex 5A).

Some of the conclusions that could be drawn from the previous graph are the distance between the income mean and median decrease in every one of the survey's editions between 2008 and 2016. The mean to median ratio passed from 1.53 in 2008 to 1.41 in 2016.

Several authors (e.g. Deaton, 1997) argue that consumption inequality gives a better picture of well-being than the commonly used income inequality measures.

Although Crossley and Pendakur (2002) based their research about inequality in Canada on the premise that consumption inequality is a better measure than income inequality while measuring well-being. They concluded that neither of them is a perfect reflection of inequality of well-being, but that the two complement each other. Table 6.1 presents information on income and consumption inequality in Mexico.

The information on the mean to median ratio confirms the reduction in income inequality. Meanwhile, the use of consumption data indicates the level of inequality is lower than the respective values for income inequality.

The coefficient of variation—the standard deviation divided by the mean—suggest the dispersion in the distribution of both income and consumption has not improved much. The survey dispersion in income reduced from 2008 to 2012 but then increased in the last available edition of the household survey. Meanwhile, the analysis has found a reduction in relative dispersion of consumption.

Household total income				
	Mean	Median	Mean to Median ratio	Coefficient of variation
2008	37,467	24,484	1.53	1.56
2010	30,291	20,767	1.46	1.19
2012	28,292	19,139	1.48	1.17
2014	29,058	20,317	1.43	1.40
2016	30,219	21,446	1.41	2.48

Household income *per-capita*				
	Mean	Median	Mean to Median ratio	Coefficient of variation
2008	11,774	6,850	1.72	2.82
2010	9,830	6,012	1.64	1.50
2012	9,623	5,717	1.68	1.61
2014	9,577	5,921	1.62	1.57
2016	10,041	6,451	1.56	2.53

Household total CONSUMPTION				
	Mean	Median	Mean to Median ratio	Coefficient of variation
2008	22,065	16,109	1.37	1.04
2010	20,685	14,591	1.42	1.12
2012	19,078	13,591	1.40	1.10
2014	19,392	14,227	1.36	1.05
2016	18,393	13,867	1.33	0.99

Household CONSUMPTION *per-capita*				
	Mean	Median	Mean to Median ratio	Coefficient of variation
2008	6,652	4,319	1.54	1.36
2010	6,616	4,114	1.61	1.48
2012	6,349	3,940	1.61	1.46
2014	6,274	4,067	1.54	1.32
2016	6,092	4,066	1.50	1.28

Table 6. 1. Mean and median values of income and consumption at level and per capita value in the 2008-2016 ENIGHs.
Source: Own calculations based on ENIGHs 2008-2016.

However, the income gap has closed between all income deciles and the richer decile, as shown in figure 6.4. Household average income of the 10th decile passed from being 14 times bigger than that of the second decile in 2008 to 10 times bigger in 2016. Meanwhile, the income level of the richer 10% relative to the level earned by the two adjacent decile groups—8th and 9th—has stayed the same over the 2008 to 2016 period. It can be argued that the poorer half of the income distribution were better off relative to the richer 10% households over the same period of study.

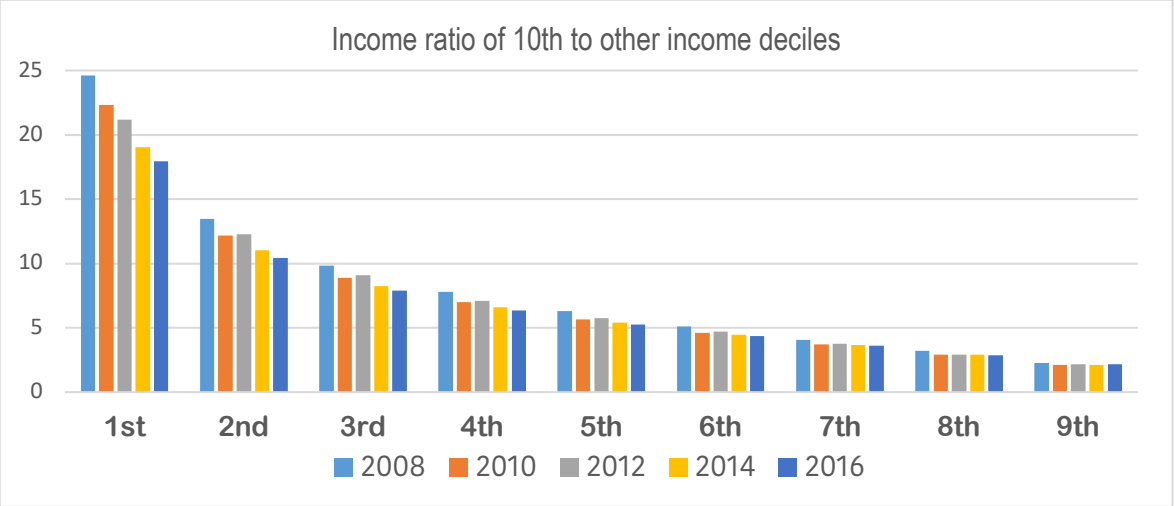


Figure 6. 4 Household income of richer 10% to that of other deciles in Mexico. Source: Own calculations based on ENIGHs 2008-2016.

Even at the extremes of the distribution, there has been a reduction in inequality. Brandolini and Smeeding (2009) suggest the use of the decile ratio (d99/d1) as an adequate measure of inequality. The evidence confirms that the average household income for the top 1% was 72.4 times higher than that of the bottom 1% in 2008. By 2016, it was 57.3 times higher.

	2008	2010	2012	2014	2016
99th/1st	72.4	87.6	88.4	69.7	57.3
99th/10th	25.0	29.4	29.3	24.9	22.0
99th/50th	9.4	10.3	10.3	9.6	8.9

Table 6. 2. Mean income ratio between selected income percentiles.
Source: Own calculations based on ENIGHs 2008-2016.

The evidence obtained confirms there was an increase in the gap between the richest percentile (richer 1%) and relative to both the poorer decile and those at the middle of the income distribution.

The most common measure for inequality is the Gini coefficient. It might not be a perfect reflection of well-being inequality (Hulie, 2018; Crossley and Pendakur, 2002; Lambert,

2008; Nolan and Marx, 2009) particularly because it might be short in fully explaining the inequality of opportunities (Nuñez and Tartakowsky, 2011).

Changes in inequality might not be, on their own, a signal of better or worst times for a group of individuals. Nonetheless, tracking income inequality through the Gini coefficient allows to understand how income inequality influences the standard of living (i.e. life expectancy, or poverty mobility) of individuals.

Camberos-Castro (2012) shows that the Gini coefficient in Mexico today is even smaller than at any time during the last four decades. It passed from 0.518 in 1977 growing almost constantly up to its highest level in 1994 at 0.584, reducing then to 0.506 in 2008.

Different researchers have analysed the effect of inequality changes amidst periods of economic expansion they have found that increases in terms of income inequality have been related to increased levels of consumption inequality. Ravallion (2017) meanwhile, found that the benefits of inequality improvements are not necessarily distributed neutrally.

The literature review stage has revealed that poor in developing nations do share the benefits of rising aggregate affluence as well as the losses from aggregate contraction. But the effects tend to be country-specific and that under the surface of aggregate outcomes are winners and losers (Winters et al*.,* 2004).

Cortes (2013) states that the Gini coefficient based on household total income decreased 10% in two decades (from 0.491 in 1994 to 0.446 in 2010). While the income Gini coefficient on a per capita[63] basis went down from 0.546 to 0.495 over the same period.

6.2.2. Measuring inequality in Mexico 2008-2016.

Accepting the idea that the Gini coefficient is not the perfect way to measure inequality, but also given the availability of data on both income and consumption, through the different editions of the ENIGH the decision was made to use it as an adequate measure for comparison purposes

According to Atkinson and Bourguignon (2007) in an economy composed of *i* individual units—either persons or households—each endowed with a vector of productive factors,

[63] That is considering total household income divided by household equivalent size.

with components (α_{im}), where *m* is the number of components. With K being the number of firms, each with some fixed factors of production f_K; with Θ standing for the company ownership; Θ_{ik} is the share of individual *i* in firm *k*. The vector of factor prices is represented by *W*. Where π_K is the profit of the firm. Then the primary income of individual *i* is given by (6.1):

$$Y_i = \sum \alpha_{im} W_m + \sum \Theta_{ik} \pi_K \qquad (6.1)$$

Under this "static" vision the individual's income is the product of the multidimensional distribution of endowments A = ($\alpha_{11} + \alpha_{12} + \cdots + \alpha_{1m}$; $\alpha_{21} + \alpha_{22} + \cdots + \alpha_{2m}$) and the *per-unit* return of these endowments *W*, plus the distribution of the ownership of the firm, or financial wealth (Θ) times the profit they produce. Its reduced form (6.2) makes the distribution of income (Y) a function of endowments (A), wealth (Θ) and the technological factors (F).

$$Y = H\,(A,\Theta,F) \qquad (6.2)$$

Histograms and cumulative distributions are the main forms of representing income distributions. Among them, the most common is the *"Lorenz curve"* (figure 6.6).

> "[It] cumulates people below a given income and shows on the vertical axis the cumulative share in total income of the bottom x% of the population. Where incomes are unequal, this curve lies below the 45-degree line". (Atkinson and Bourguinon, 2007)

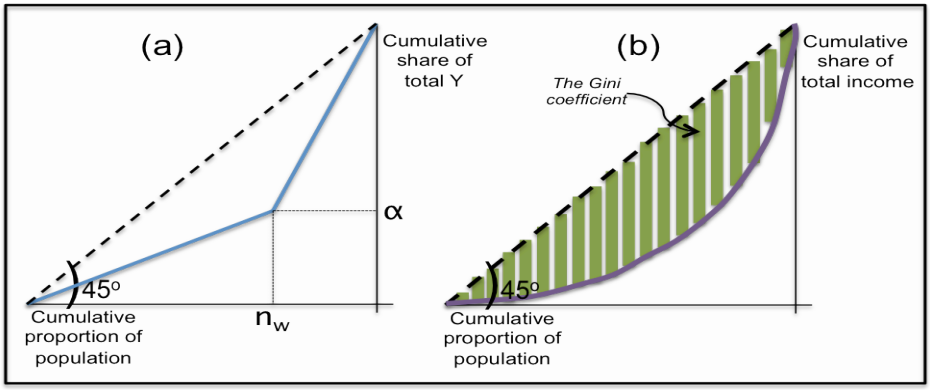


Figure 6. 5 The Lorenz curve and the Gini coefficient. Source: Atkinson and Bourguignon (2007)

Most income distributions are right-hand skew distributions meaning that large portions of the population earn low levels of income and a few earn larger shares of income. Simon Kuznets found that the income distribution curve was different in underdeveloped and developed countries. Where the poorer receive about the same share of national income everywhere, but the richer in underdeveloped countries get a higher share of national income than do the richer cohorts of more developed societies.

Jenkins and Van Kerm (2011) explain how the area between the perfect equality line and the Lorenz curve. Among the several ways to express the Gini coefficient, the one based on the seminal work by Pattel (1976) was considered as adequate as it brings out the relationship of the coefficient to interpersonal comparisons. It is given by (6.3):

$$G = \left. (1/2(n^2)) \sum_{i=1}^{n} \sum_{j=1}^{n} \left| Y_i - Y_j \right| \right/ (1/n) \sum_{i=1}^{n} Y_i \qquad (6.3)$$

The Gini coefficient will be given by the ratio of the mean absolute difference between all pairs $(Y_i - Y_j)$ to twice the mean level of the income level received by household i in this case.

As explained by Pattel (1976), for all individuals except for the richest one, the previous equation returns the positive gain from moving up the income ladder and being such highest income earning household. Such differences are then averaged over all individuals. The decision to use this specific equation was based on the fact that the decomposition of the Gini coefficient is possible as it offers the possibility of comparing one's level of income relative to a particular *Peer* group, which as shown in the literature review (e.g. Jin et al., 2011) is how we intuitively feel and experience inequality: comparing ourselves with people around us.

Based on the previous definition the decision was made to use (6.3) considering the ratio of the average difference of income per capita for each household (Y_i) relative to all other households in the respective year survey.

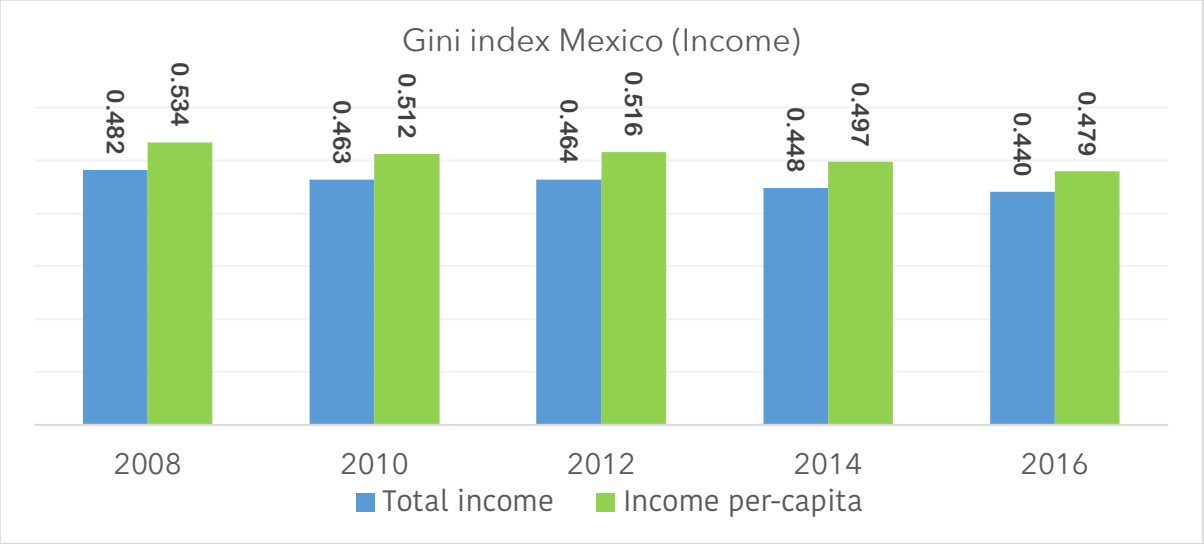


Figure 6. 6 Income *Gini* index for Mexico based in ENIGH survey 2008-2016. Source: Own calculations.

The use of (6.3) confirms the evolution of the *Gini* coefficient over the period of study considering total household income in the pooled dataset. A similar trend was found to exist in terms of income per capita, but the actual level of inequality is higher (figure 6.6).

According to Nolan and Marx (2009), current income does not necessarily reflect the impact of savings, debt or previous spending. Therefore, in the way to understand inequality, the two variables most commonly studied are household income and household consumption.

In order to understand if consumption inequality has followed a similar trend, figure 6.7 presents the consumption *Gini coefficients* based on the dataset used in this analysis.

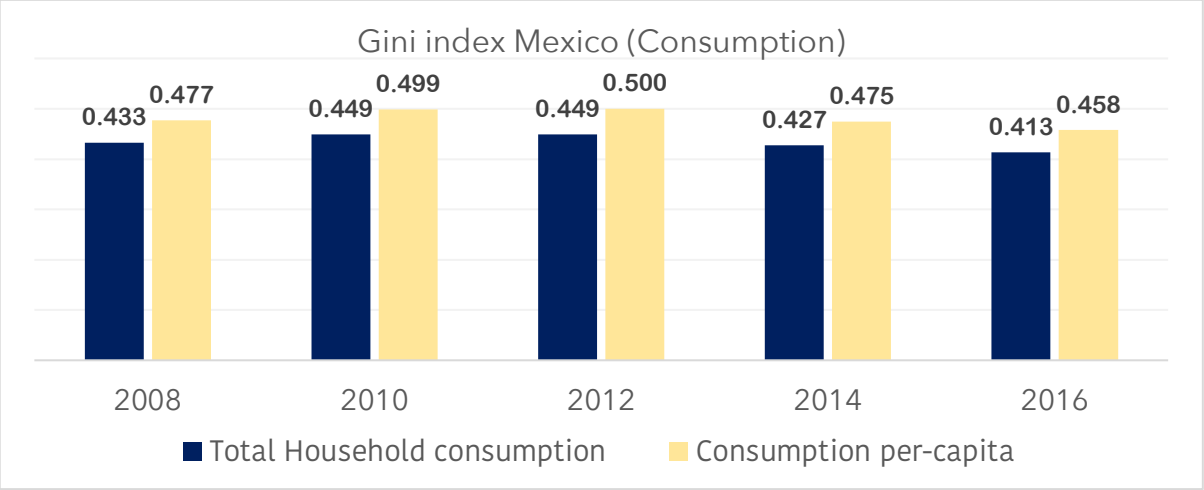


Figure 6. 7 Consumption *Gini* index for Mexico based in ENIGH survey 2008-2016. Source: Own calculations.

The previous figure confirms several findings:

a) Inequality is larger if considered on a per capita basis,
b) Despite the downward trend in consumption inequality after 2012, it is still at a level higher than in 2008.
c) Consumption inequality has been found to be smaller than income inequality and,
d) Inequality exhibits similar dynamics regardless of the form it is considered: at level or on a per capita basis.

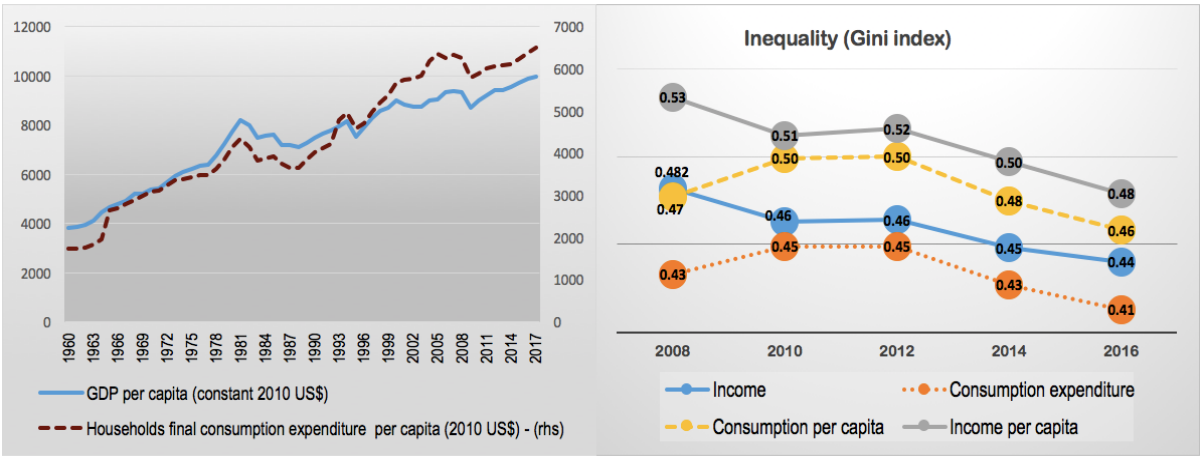


Figure 6. 8 Consumption and income per capita in Mexico 1960-2017 and Mexico's Gini indices 2008-2016. Sources: WDI (2019) and own calculations.

Based on the Gini coefficient the descriptive analysis has found that household consumption inequality has tracked income inequality with consumption inequality being smaller in relation to income inequality as predicted by Palley (2010) who contends that consumption inequality and income inequality are different, with the former being *less* than the latter. The evidence for Mexico confirms such a conclusion.

This potential lagging effect from income on consumption could potentially be explained by the imperfection of the financial markets or credit constraints (Szekely, 1995) which make the poorer groups to adopt a frugal attitude during and after the period of economic contraction.

At the micro-level, the idea is to have a close look at the *ENIGH* datasets from 2000 to 2012 pooled together to form a synthetic-panel study. According to Sun and Wang (2013) "the microanalysis of households' relative consumption is eventually important for macroeconomic analysis and policy analysis that aims to optimise economic growth and social welfare", which is the research aim: to understand better the consumption trends amid increase consumption and a little more egalitarian society in Mexico over the last decade.

At the macro level, the idea is relatively simple in conceptual terms; it is about the time series analysis of multiple variables over 55 years of economic evolution in Mexico. However, the project in econometric terms should not be straight forward given the fact that most macroeconomic are not stationary at the level value (Enders, 2010, p. 209), which implies an econometric procedure that cannot simply be conducted under the ordinary least-square (OLS) procedure.

Table 6.3 presents the ratio of income and consumption between the 10th and all other income deciles. The descriptive analysis confirms the overtime reduction in the income gap between the richer cohort and all other income deciles. Meanwhile, in terms of consumption, the analysis confirms consumption inequality increased from 2008 to 2012 and decreased afterwards in all cases.

	Mean household income decile ratio					Mean consumption expenditure decile ratio				
	2008	2010	2012	2014	2016	2008	2010	2012	2014	2016
1st	24.6	22.3	21.2	19.1	17.9	12.1	14.1	19.8	11.8	10.2
2nd	13.5	12.2	12.3	11.0	10.4	5.9	6.5	9.1	5.8	5.1
3rd	9.9	8.9	9.1	8.2	7.9	5.0	5.5	7.5	4.7	4.4
4th	7.8	7.0	7.1	6.6	6.4	4.1	4.7	5.9	4.2	3.8
5th	6.3	5.6	5.8	5.4	5.3	3.6	4.1	5.3	3.7	3.3
6th	5.1	4.6	4.7	4.4	4.4	3.2	3.5	4.7	3.1	3.0
7th	4.1	3.7	3.8	3.6	3.6	2.8	3.1	3.9	2.8	2.6
8th	3.2	2.9	2.9	2.9	2.9	2.3	2.5	3.3	2.4	2.2
9th	2.3	2.1	2.1	2.1	2.2	2.0	2.0	2.3	1.9	1.8

Table 6. 3. Ratio of household income and consumption of richer 10% households to that of other income deciles in Mexico. Source: Own calculations based on ENIGH (2008-2016)

As a corollary from this section, it has been found that both income and consumption inequality in Mexico has reduced over the 2008-2016 period. Income inequality has shown a consistent downwards trend, while consumption inequality has followed a hump shape behaviour that had its summit in 2012.

The relevant bibliography on inequality suggests that consumption inequality is less than income inequality. The empirical evidence, based on repeated household surveys cross-sectional data in Mexico conforms to it. The evidence found so far, confirms that inequality is larger if either consumption or income inequality is considered on a per capita basis.
As explained before, Mexico has embraced the open economy agenda for the best part of the last three decades.

Empirical evidence from different nations indicates economic openness has been positively linked to increasing inequality (Kraay, 2006; Asteriou et al*.,* 2014). However, the recent evidence for Mexico suggests that this has not been the case. Different researchers have highlighted Mexico's robust economic performance and a positive outlook (Rapoza, 2012; Moreno-Brid and Brosch, 2018; OECD, 2013b). Making the study of inequality and its impact on consumption in Mexico an interesting case to be investigated further.

According to Huggett et al. (2011) variations in income associated with different initial conditions in human capital—education attainment—rather than income shocks—explain most of consumption variance along the life-cycle as found on different studies (i.e. Deaton and Paxson, 1994b; Slesnik and Ulker, 2005; Aguiar and Hurst, 2008).

So far in this chapter has evidenced about increases in both income and consumption per capita, while inequality—in terms of both income and consumption—have reduced[64], even if modestly (figures 6.6 and 6.7).

The previous chapter of this thesis has found empirical evidence against the life-cycle model of consumption as the empirical evidence have provided support for the so-called "consumption puzzle" (Hurst, 2008).

The *puzzling* element, however, is that when consumption increases at the aggregate level, it is not possible to identify if only the households that experience wealth have incurred the increases in consumption or income increases or the benefits have been similar to all households (Bostic et al., 2009).

Mexico recent economic progress, modest but consistent for an emerging economy, has been related to its insertion on a global economy, its strong and growing manufacturing base and stern economic reforms (The Economist, 2012). For Attanasio and Weber (2010) higher rates of growth imply larger differences between savers—usually the better-off in society—and dis-savers—most of the time, the elder and poor.

[64] The reduction in inequality found is consistent with the findings of different researchers (e.g. Cortes, 2013; Lopez-Calva and Lustig, 2010) whose estimations are not as updated as current available data allows to conclude.

The relevance of this project goes beyond the living standards as according to different researchers (e.g. Gottschalk and Smeeding, 1997; Salverda et al., 2009) the actual changes in income inequality while consumption has been increasing has important political and ideological implications.

6.3. The *pseudo* Panel Data.

According to Deaton (1994), household expenditure surveys represent an adequate base for research in order to test theories about household behaviour and how people react to economic changes in order to link economic events and individual welfare.

Deaton and Paxson (1994b) suggest the use of repeated cross-sectional data or longitudinal data to estimate the evolution of consumption inequality for a given cohort of the population. The great attraction of panel data—the multiple observation of individuals over time—is that it allows the study of the dynamics of the living standards of individual households:

> 'They can be used to address such issues as the persistence of poverty and to see who benefits and who loses from general economic development or from a shock or policy change' (Deaton, 1994).

Panel dataset requires observations about the same individual over several periods of time (Maddala, 2002, p.573). Sometimes, however, obtaining data from the same individual is either too costly or impractical. Under those circumstances, the best option available is to assume the entries on cross-section data is a good representation of an individual agent, as long as there some shared characteristics among them. Pooling together cross-sectional data sets allows to construct a *pseudo*-panel data without any adjustment (Baddeley and Barrowclough, 2009, p.254).

Pooling datasets might be an acceptable option when actual panel data does not exist, even though it will not be possible to track the same household over time as required in a genuine panel dataset. Deaton (1985) regards its use as an adequate option for tracking cohorts and estimating 'economic relationships based on cohort means rather than cohort estimations' (Baltagi, 2003, p.190).

The *pseudo*-panel data assumes the existence of a *representative agent* whose actions, behaviour and decisions stand for those of individuals sharing a similar set of characteristics

(Black et al., 2009). Among the benefits of *pseudo*-panel data Batagi (2003) cite the lower *attrition*. The trade-off is that the larger the number of cohorts are, the smaller the individuals in them and the larger possibility of biased estimators.

Wooldridge (2002, p.128) identifies the use of pooled cross-sections over time as useful for 'a variety of purposes, including policy analysis'. Based on this idea and given the availability of the National Survey of Household Income and Expenses (ENIGH[65]) the decision was made to create a pseudo-panel dataset based on the 2008 to 2016[66] editions of the ENIGH. The previous chapter of this thesis (section 3.3) presents a descriptive statistical analysis of the pooled data set. More than 155,000 households are part of the dataset (Table 6.4).

	2008	2010	2012	2014	2016
Households in survey (n)	29,465	27,647	9,002	19,477	70,303
Mean household size	4.03	3.89	3.74	3.77	3.66
Mean income earners	2.37	2.32	2.47	2.43	2.47
Mean household head's **age**	48.1	48.4	49.1	48.4	48.9
Mean total household **income**	37,467	30,291	28,292	29,058	30,219
Median total household **income**	24,484	20,767	19,139	20,317	21,446
1st decile income	8,317	7,006	6,644	7,412	8,091
10th decile income	74,572	60,644	56,722	57,441	56,858
1st decile consumption	5,632	4,984	4,526	5,154	5,127
10th decile consumption	43,012	40,840	37,079	37,195	35,193
Mean total household **income**	22,065	20,685	19,078	19,392	18,393
Median total household **consumption**	16,109	14,591	13,591	14,227	13,867
Mean household **income *per capita***	11,774	9,830	9,623	9,577	10,041
Mean household **consumption *per capita***	6,652	6,616	6,394	6,274	6,092

Table 6. 4. Descriptive statistics for each edition of ENIGHs 2008-2016.
(All monetary quantities express at constant 2008 local currency)

[65] The *ENIGH* is a biannual survey conducted to obtain information about the 'distribution, amount and structure of household's consumption and income'. It provides information on the socio-demographic and occupational characteristics of the household members as well as household's structural characteristics and the availability of specific household goods. The survey presents the income obtained by each household member over a three-month period and the total household expenses over the same period of time—three months. All information is collected through diaries where the household members themselves and collected from them. The decision to start the dataset with the 2008 edition was based on the fact the governmental agency of collecting and processing the information adjusted the actual datasets in order to attend a number of recommendations as explained in section appendix 5A.

[66] The latest surveys available at the time of writing this thesis: December 2018.

Meanwhile, table 6.5 presents the portion of total household expenditure for some consumption categories.

	2008	2010	2012	2014	2016
Food	41.5%	41.9%	43.2%	42.1%	41.9%
Health	2.5%	2.1%	2.1%	2.0%	2.2%
Local transportation	15.9%	15.4%	15.8%	16.9%	17.1%
Education	8.8%	8.8%	5.5%	6.3%	5.7%
Tourism	0.5%	0.4%	0.4%	0.3%	0.4%

Table 6. 5. Percentage of total expenditure for selected consumption categories in ENIGHs 2008-2016.

As explained by Baddeley and Barrowclough (2009, p.256), pooling is valid as long as the model's parameters are constant across space.

However, there is the potential for time invariant unobservable effect associated with the individual households, such as household's head education or entrepreneurial attitude which remain the same; making some of the variables difficult to measure or practically unobservable. If those fixed-effects are not accounted for, their effect is accounted by the error term, which is meant to account for truly random factors. This could lead to a potential endogeneity[67] problem.

Alternatively, the error terms can be correlated, as a systemic effect has been left out of the empirical model. Therefore, there is a need to account for them as a way to avoid a form of omitted variable bias known as heterogeneity bias. Two options exist in order to deal with this potential problem: either to capture or to remove such fixed effect. Baddeley and Barrowclough (2009, p.257) identify three different ways to remove the time constant cross-section specific effects: the difference estimator, the fixed-effect estimator, and the random-effect estimator.

Box 6.1 in annex E explains the *demeaning* process associated with the fixed effect estimator. The standard procedure for the econometric analysis of panel data—or pseudo-panel data in this case—is to use either the fixed-effect or the random-effect model.

A panel data with *T* repeated observation for each of the individuals, if analysed under a pooled OLS solution is not practical, and the model is often 'overly restrictive and can have a

[67] The explanatory variable(s) and the error term will be correlated and OLS estimators will be both biases and inconsistent.

complicated error process (e.g. *heteroskedasticity* across panel units, serial correlation within panel units)' (Baum, 2006, p 219).

As a remedial measure—to deal with endogenous regressors—Baum (2006) suggests the use of the *Fixed-effects* (FE) or the *random-effects* (RE) models as both confine the *heterogeneity*[68] to the intercept term of the relationship.

Through the structure of (6.4) the slope coefficient is restricted to be constant over both units and time, but the intercept coefficient varies by unit or by time.

$$Y_{it} = \beta_k X_{it} + \delta Z_i + u_i + \varepsilon_{it} \qquad (6.4)$$

X_{it} is a *1 x k* vector of variables that vary over individuals—specific cohort of the population in the present case—and time. *β* is the *k x 1* vector of coefficients on X_{it}. Meanwhile, Z_i is the *1 x p* vector of time-invariant variables that vary only over individuals, δ is the *p x 1* vector of coefficients on Z, u_i is the individual level effect, with ε_{it} being the disturbance term.

Baum (2006, p. 220) explains that the u_i terms are either correlated or uncorrelated with the regressors X_{it} and Z_i. While u_i and ε_{it} are uncorrelated. The key is:

- ✓ If the u_i is **uncorrelated** with the regressors, they are known as RE (**random effects**).
- ✓ If the correlation exists, the effects are known as **FE**—fixed effects.

In the initial case—random effect—the individual level effects u_i are parameterized as additional random disturbances.

The FE model relaxes the assumption that the regression function is constant over time and space as it allows each cross-sectional unit to have its own constant term, transforming (6.4) into (6.4a) by removing panel-level averages from each side of the model—demeaning. Meanwhile, the slope estimates (*β*) and the variance (σ_ε^2) are constrained across units.

$$Y_{it} - \bar{Y}_i = \beta_k (X_{it} - \bar{X}_i) + \delta (Z_i - Z_i) + u_i - u_i + \varepsilon_{it} - \bar{\varepsilon}_i \qquad (6.4a)$$

[68] If a regressor violates the zero-conditional mean assumption E [u | X] = 0: if the variable is correlated with the error term, it is *endogenous* (Baum, 2006, p. 132).

The transformed equation (6.4) will produce consistent estimates of β. S*weeping out* the u_i also removes the δ coefficient. As Baum (2006, p. 221) explains:

> "This model will have explanatory power only if the individual's Y above or below the individual's mean is significantly correlated with the individual's X values above or below the individual's vector of mean X values".

As explained already, if the individual effect (u_i) is specified as a random effect and therefore uncorrelated with the regressors (X_{it} and Z_i) and the overall disturbance term (ε_{it})—the random effect condition is present. This makes the individual effect (u_i) to be part of a composite error term given by ($u_i + \varepsilon_{it}$).

According to Baum (2006, p. 227) the *orthogonality* element just defined, allows the model's parameters to be consistently estimated by OLS but they will not be efficient. One benefit is that if the uncorrelated condition is met, it greatly reduces the number of estimated parameters. However, as the key condition for the RE model, the condition of the individual being uncorrelated with the regressors must be tested.

The main objective of the FE model is to remove the pernicious effect of omitted variable bias by observing if the effect of a variable *within* the same unit—a condition similar to a cohort of households in this case—is different to the effect observed for the panel data as a whole.

Baum (2006) identifies the Hausmann test as the way to determine whether the FE or the RE is the adequate procedure to analysis the panel data, which is run as a post-estimation test. Therefore, the next step was to define the econometric model to be estimated.

6.4. The Econometric Model.

While evaluating the impact of inequality changes on consumption, the main challenge is to determine what form inequality will be measured at, as well as the method used to determine it. Given the dynamic nature of inequality (Salverda et al., 2009), particularly when the main aim is to track how it evolves over time, requires care while defining it (Jenkins and Van Kerm, 2009). As shown before—see figures 6.6 and 6.7—both income and consumption inequality in Mexico have decreased recently as a consequence of income

reductions among the richer cohorts of society after the financial crisis, and the benefits of governmental transfers for the poorer households in Mexico (Cortes, 2013).

In an interesting piece of work Palley (2010), concluded that people make the decision to spend based not only upon rationale/quantitative elements such as their permanent levels of income (PIH), or their income expectancies along the life-cycle (LCM) or based on the relative position people have on the income ladder, but in order to "keep up with the Joneses":

During the literature review stage of this thesis, discussed in the previous chapter, the empirical model of Jin et al. (2011) was identified as relevant in order to analyse the relationship between inequality and consumption. The model (6.5) is relevant given the dynamic nature of inequality and suitable option for a panel-data analysis.

$$Ln\left(C\ percapita_{i,t}\right) = \alpha + \beta\ Ln\left(Y\ percapita_{i,t}\right) + \gamma\ Peer\_Gini_{k,l,t} + \delta X_{i,t} + \varepsilon_{i,t} \quad (6.5)$$

Where *C* per capita is the logarithmic value of total household consumption per capita, Y per capita stands for the log value of total household income on the same per capita basis. *Peer_Gini* is the "sub-group" inequality coefficient for all households belonging to the same age cohort and X a vector of household-specific covariates. ε is the white-noise error term.

The Gini coefficient is probably the most widely accepted measure of inequality (Atkinson and Bourguignon, 2007, p.33). However, as Shorrocks (2013) warns, particular care must be exercised while using it, if the aim is to decompose the benefits of inequality changes for specific cohorts of society. Therefore, the determination of the *Gini* coefficients was of critical importance while decomposing the pooled data set.

According to Todorova (2009), citing the work of Veblen—at the start of the Twentieth century, and augmented by the contributions from Deusenberry—historically, it has been understood that the motivation to consume stems from the desire to emulate the behaviour of others. More recent empirical findings (e.g. Sun and Wang, 2013; Jin et al., 2011) have shown that consumers do derive utility from doing better-off than their *peers*.

> 'Standard economic theory assumes that individuals derive utility from absolute levels of income and consumption, it is well documented that people also derive positive utility from doing better than others' (Sun and Wang, 2013).

While analysing inequality in China, Jin et al. (2011) calculated the Gini coefficient *within the reference province-age* group given by the household head age $\pm$ 5 years.

Age Cohort	Frequency	Percentage
Under 20	788	0.5%
20-24	5,416	3.5%
25-29	10,764	6.9%
30-34	15,069	9.7%
35-39	18,146	11.6%
40-44	18,923	12.1%
45-49	17,756	11.4%
50-54	16,133	10.4%
55-59	13,613	8.7%
60-64	11,651	7.5%
65-69	9,257	5.9%
70-74	7,274	4.7%
75-79	5,194	3.3%
80-84	3,259	2.1%
85 or over	2,651	1.7%

Table 6. 6. Age cohort distribution in pooled dataset.

Based on that idea, a similar procedure was adopted in this research project in order to define the population cohorts the Gini-coefficients were based on. However, the age cohorts were defined by groups of 5-year gap cohorts starting with household-heads under 20 years of age up until household-heads aged over-85 years old. For illustration purposes table 6.6 presents the age-distribution for the whole pooled-data set, the Peer-Gini factors were determined using age cohorts on each individual survey.

Each peer group is defined by the specific age cohort each household belongs to and the respective Mexican state the house was located. As Mexico is composed by 32 states, and with 15-age cohorts, a total of 480 Peer-Gini factors per cross-section survey were determined—a grand total of 2,625 factors. Each household in the dataset was associated with one Peer-Gini factor.

Figure 6.9 presents the distribution of the Peer-Gini factor calculated using (6.3) by year of the survey. The graph confirms that inequality values have been clustering, over time, around lower values indicating, in general, reduced levels of inequality. A similar procedure was used to determine the reference group level of consumption inequality.

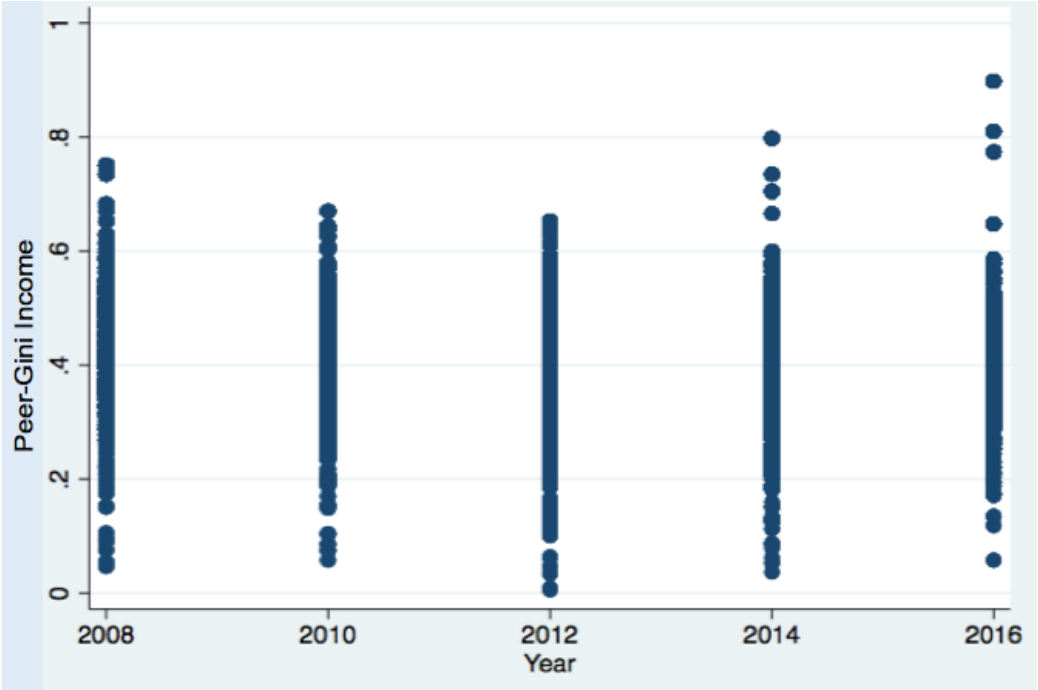


Figure 6. 9 Peer-Gini coefficients by year of ENIGH survey.

Table 6.7 presents some additional information about the Peer-Gini values.

	2008	2010	2012	2014	2016
Mean P-Gini Income	0.441	0.424	0.395	0.403	0.404
St.Dev	0.071	0.063	0.087	0.072	0.065
Mean P-Gini Consumption	0.4	0.414	0.385	0.392	0.391
St.Dev	0.063	0.058	0.084	0.064	0.049
Total household income	37,467	30,291	28,292	29,058	30,219
Income per adult eq.	14,329	11,901	11,550	11,603	12,128
Income *per-capita*	11,774	9,830	9,623	9,577	10,041
Household Consumption	22,065	20,685	19,078	19,392	18,393
Consumption per adult equivalent	8,203	8,056	7,672	7,652	7,398
Consumption *per-capita*	6,652	6,616	6,349	6,274	6,092

Table 6. 7. Peer-Gini coefficients summary statistics. Average household income by year of survey.

The focus of this chapter—research objective—has been stated as: to identify if the benefits of income inequality reduction *have lifted all boats* in Mexico. Figure 6.10 presents the correlation coefficient between income and consumption inequality measured both in terms of the Peer-Gini factor, as explained before.

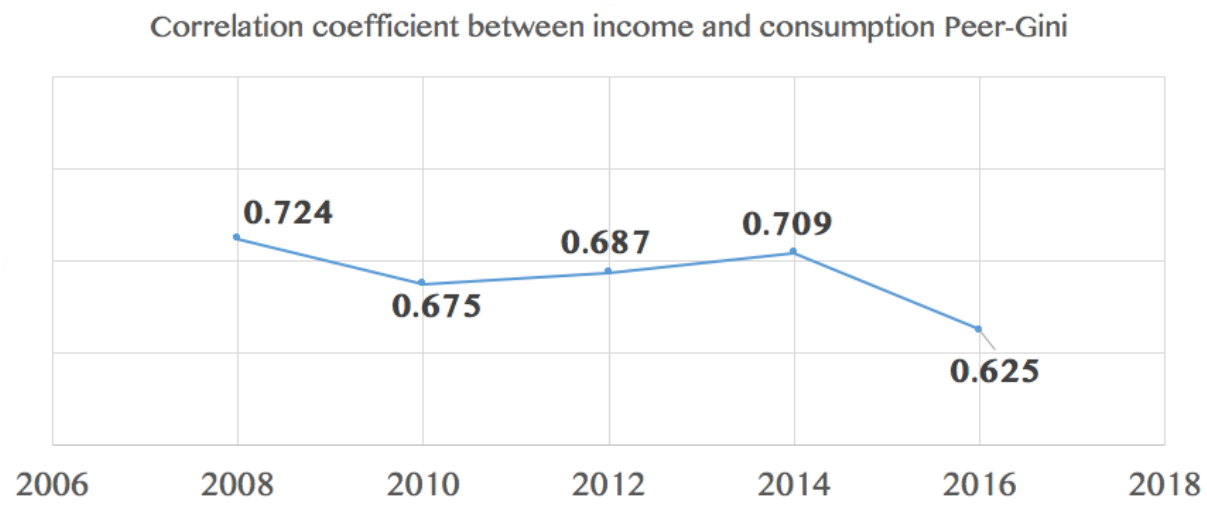


Figure 6. 10 Correlation coefficient between Peer-Gini income and consumption inequality 2008-2016. Source: Own calculations based on ENIGH 2008-2016.

Given the availability of the Peer-Gini factors, the decision was made to analyse the distribution of such factors over the life-cycle. Figure 6.11 presents the average value of the income Peer-Gini coefficient in the pseudo-panel dataset.

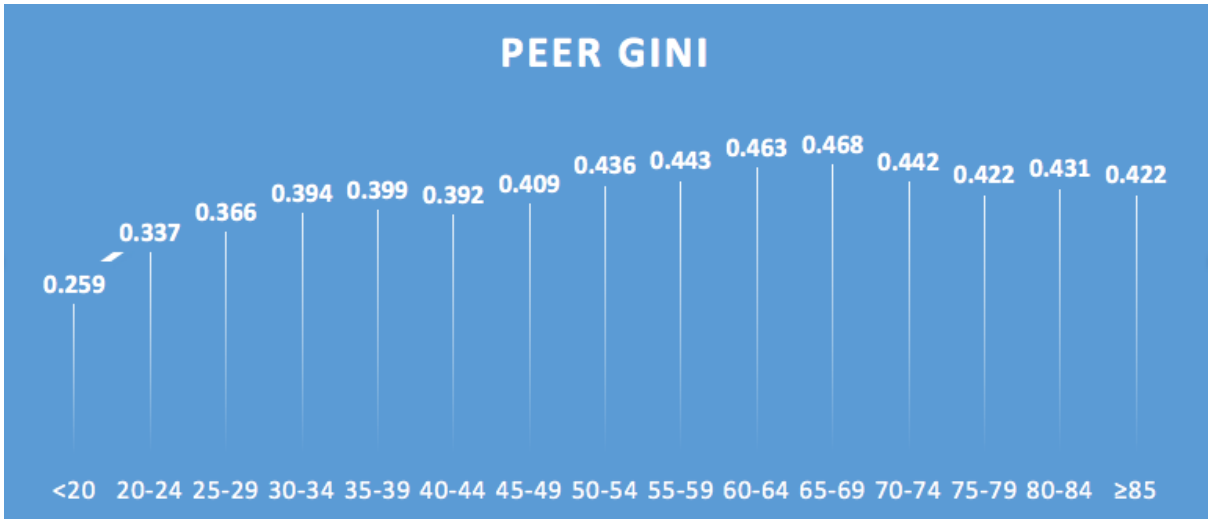


Figure 6. 11 Income Peer-Gini factor over the life-cycle, considering the pooled data set 2008-2016. Source: Own calculations based on ENIGH 2008-2016.

An interesting feature is the increase in inequality over the life-cycle. The analysis suggests a clear upwards trend, picking up after retirement and declining afterwards.

Figure 6.11 presents the time evolution of the income Peer-Gini coefficients for the different age cohorts of Mexican society. The visual analysis confirms a downward trend for all age cohorts. The trend is clear and continuous for all age groups between 25 and 49.

For the younger households—those under the age of 20 years—and those approaching and surpassing retirement age, income inequality among the respective peer group[69] shows a clear reduction from 2008 to 2012, it the increased afterwards.

The evidence obtained from the dataset suggests a downward trend in both inequality and consumption. When income and consumption are considered on a per capita basis, the reduction is not as clear, particularly around the year 2012, but shows a decline over the 2014-2016 period.

Going back to the econometric model used by Jin et al. (6.5), it included a vector of covariates (X) associated with the household characteristics and composition. Several options were considered while defining the model to be used in this piece of research.

The first decision was to use the logarithmic per capita value of both, consumption—dependent variables—and income as one of the regressors, as a way to take care of household size composition.

The location and the age variables have been considered trough the Peer-Gini factor. Nonetheless, the life-cycle analysis was a dimension that to be analysed further through the regression analysis controlling for age.

While analysing income inequality reductions in Brazil, Menezes et al. (2006) found regional income convergence among the older cohorts in society. However, regional differences existed for younger cohorts. Similarly, Silveira and Azzoni (2011) identified that a higher marginal productivity of capital in poorer states imply a higher rate of accumulation and growth, and as a consequence a reduction on inequality levels.

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[69] Households headed by individuals within the same age cohort living in the same state.

existed for younger cohorts. Similarly, Silveira and Azzoni (2011) identified that a higher marginal productivity of capital in poorer states imply a higher rate of accumulation and growth, and as a consequence a reduction on inequality levels.

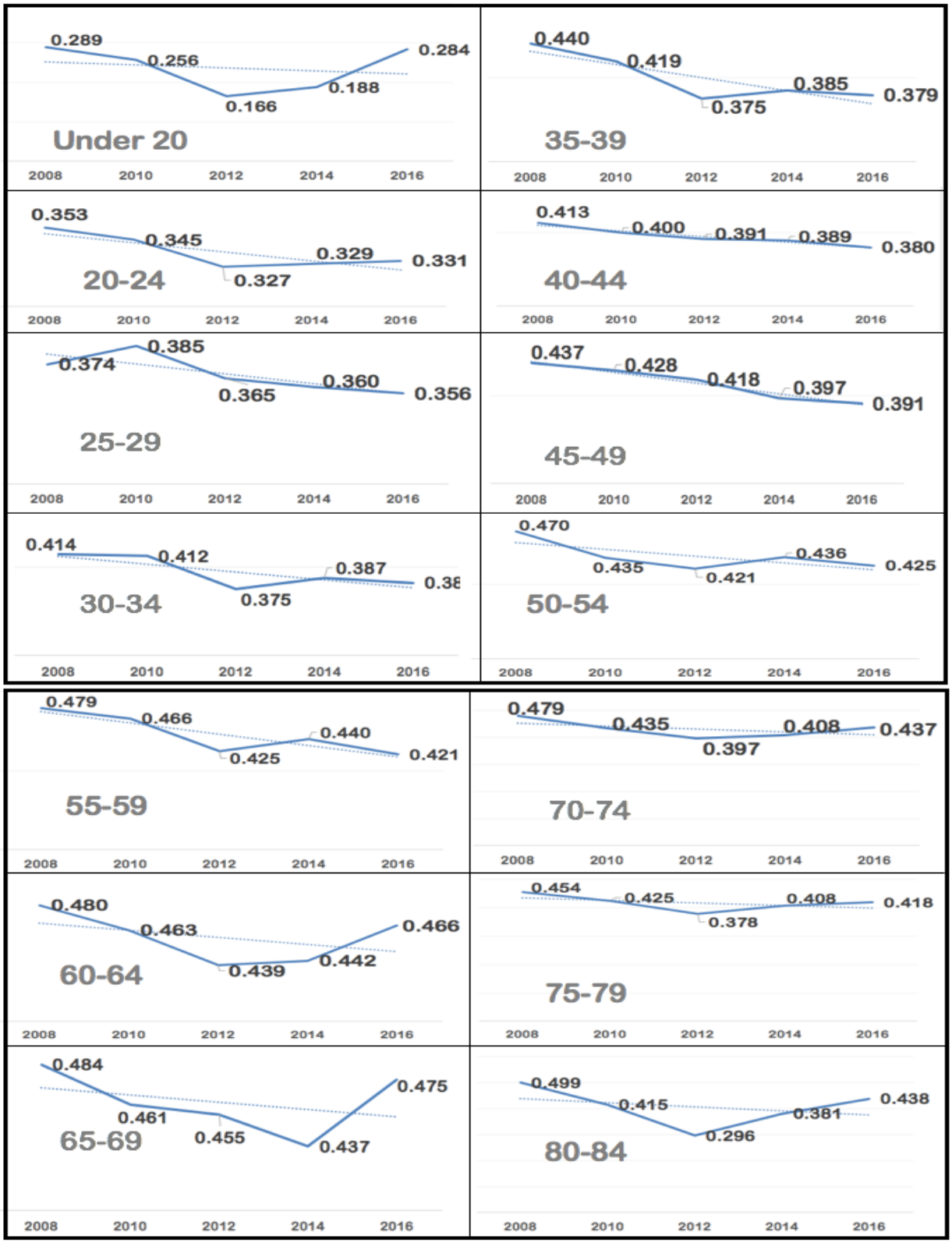

Figure 6. 12. Evolution of the income Peer-Gini coefficient for Mexico over the life-cycle 2008-2016.
Source: Own calculations based on ENIGH 2008-2016.

Regional economic differences exist among Mexico's regions (see section 5.14 in the previous chapter). While the northern-industrialized area of Mexico has living standards—based on GDP per capita—similar to those of Portugal, the poorest region of Mexico—Southern region—enjoys levels of income equivalent to Ukraine's or Algeria's.

The decision was made to control for regional variations in order to identify if inequality changes have translated into consumption differences.

Another variable found to have explanatory potential was associated with the findings by Abdel-Ghany et al. (2002) who found a statistically significant and positive relationship between relative consumption and the relative place a household has in relation to the income ladder.

Clearly, the household's level of income is a central explanatory variable in the econometric model considered. However, it is interesting to analyse if the experience of inequality changes has produced a heterogeneous effect over the income distribution.

According to Nolan and Marx (2009), poverty and inequality changes, at the aggregate level, can mask major underlying shifts for different groups. This is why the decision was made to identify the impact inequality changes have had for specific groups of the population.

Historically pensioners have been highly exposed to poverty (Gill et al., 2004). Therefore, the decision was made to identify what the effects of inequality fir the group of households receiving pensions, remittances and housing wealth.

According to Wooldridge (2003, p.129) while using pooled cross-sections we should include year dummies to account for aggregate changes over time. Therefore, the decision was made to use (4.3) with the addition of the respective year *dummy* variables (6.6):

$$LnCper_{i,t} = \alpha + \beta\, Ln(Y\ per_{i,t}) + \gamma\ Peer\_Y\_Gini_{k,l,t} + \delta X_{i,t} + \varphi\ (dummyyears) + \varepsilon_{i,t} \quad (6.6)$$

Where Ln(*C* per) is the logarithmic value of total household consumption per capita, Ln(Y per) stands for the log value of total household income on the same per capita basis. *Peer_Y_Gini* is the year's (t) "sub-group" income inequality coefficient for the group of households belonging to the same age cohort (k) living in the same state (l) and the

dummyyears are the dummy variables associated with each one of the editions of the pooled-dataset, ε is the white-noise error term.

Once the decision was made about the econometric model, the next stage is to identify if the FE or RE procedure is the right one given the *pseudo*-Panel data used to conduct the present analysis.

6.5. Panel data analysis.

Table 6.8 presents the estimated value for the coefficients in (6.6) under the BE, RE and FE forms. They were used in order to select an adequate model to conduct the econometric analysis of the *pseudo*-panel dataset.

The *between-estimator* (BE) model regresses the means of the group's *dependent* variable—the logarithmic value of consumption per capita in this case—on the group's mean independent variables. According to Baum (2006, pp. 226), it is a suitable option whenever the variables are assumed to contain long-run variations from its means. The BE coefficients state how much consumption has differed from its "historical" mean value as each one of the regressors deviated from the over-time average level for individual households.

The results—from the BE model—indicate that both household income and the Peer-Gini coefficient have a statistically significant effect on consumption. However, while over time changes in the mean income have a positive effect on consumption, a reduction in the peer level of inequality is associated with higher consumption levels.

In the economic sense, the empirical evidence indicates that an increase of 1% in the cohort's mean level of income makes the group's mean consumption to increase by 0.65%. Meanwhile, a reduction of 0.1 in the group's mean level of inequality—measured by the income Peer-Gini coefficient—is associated with an increase of 6.87% in the group mean level of consumption per capita.

The yearly dummies were found to be significant, indicating that the differences in consumption over the period of study are statistically different, with consumption increasing until 2012 then reducing in 2014 and then to increase again in 2016.

Meanwhile, the *Fixed-Effect* (FE) model confirms the positive effect of income on consumption. In the economic sense, a 1% increase in income per capita is predicted to produce a 0.738% increase in consumption per capita.

Interestingly enough, it identifies a positive and statistically significant effect between over time changes in income inequality and consumption variations, in opposition to the negative relationship found by the BE model. The empirical evidence indicates that a 0.1 reduction in the Peer-Gini inequality coefficient is associated with a 0.66% reduction in consumption. This latter finding, even though counter to intuition, was similar to what was found by Jin et al. (2011), while researching about inequality and consumption variations in China.

Table 6. 8. Consumption impact of income inequality changes under the FE and RE panel data models. Estimated equation: $Ln\left(C\ percapita_{i,t}\right) = \alpha + \beta\ Ln\left(Y\ percapita_{i,t}\right) + \gamma\ Gini_{k,l,t} + \tau\ Time\ dummies_t + \varepsilon_{i,t}$

	Ln Household consumption *per-capita*		
	(BE)	**(FE)**	**(RE)**
Ln Household Income *per-capita*	0.652*** (42.77)	0.738*** (457.03)	0.737*** (460.45)
Income Peer Gini	-0.687*** (-8.35)	0.066** (2.32)	-0.037 (-1.40)
_cons	2.765*** (19.67)	1.820*** (98.84)	1.818*** (98.32)
2008	0.105*** (2.60)	0.003 (0.82)	0.007* (1.94)
2010	0.233*** (5.49)	0.063*** (15.96)	0.065*** (16.69)
2012	-0.209*** (-2.90)	0.044*** (7.52)	0.043*** (7.40)
2014	0.147*** (2.94)	0.053*** (12.32)	0.054*** (12.57)
2016			
R-square (within)	0.558	0.577	0.577
R-square (between)	0.427	0.401	0.406
R-square (overall)	0.58	0.592	0.593
sigma_u		0.292	0.232
sigma_e		0.524	0.524
rho		0.236	0.164
corr (u_i, Xb)		-0.029	0.000

(*) Indicate significance at the 90% level of confidence, (**) Indicate significance at the 95% level of confidence, (***) Indicate significance at the 99% level of confidence. Values in parenthesis are t-ratios.

The *within* and *between* estimator indicate that 56% of the variation in consumption is associated with the specific group's variation around their means. Whereas 42% is associated with the variations between the different groups' means.

The estimated value for the *rho* fraction indicates that 23% of the variation in consumption is associated with the different characteristics associated with population cohorts—peer-group—own characteristics.

Finally, the Random Effect (RE) model—in agreement with both, the BE and FE processes—identified a similarly positive and significant effect between income and consumption. The estimated coefficient value is similar to the one estimated by the FE model: Consumption per capita will be expected to increase by 0.737% increase any time in income per capita goes up by 1%.

The evidence from the RE model found that the changes in the level of inequality over time had a negatively but not statistically significant on consumption.

The measures of fit for the RE model suggest that as much as 57% of the variation in consumption per capita is explained by differences within the cohorts. Meanwhile, 40% of the household consumption per capita variations can be explained by differences between the *peer* groups. The estimates value for a fraction of total variance due to the residual term (ε)—rho in table 4.3—was found to be equal to 16%. That is 16% of the consumption differences are related to inter-cohort differences not captured by the regressors.

The fact that the time indicator variable associated with each of the different surveys—cross-section data—indicates a statistically significant difference in terms of the intercept value for each of them. The test for joint significance for the time—year—variables were found to be jointly significant. Suggesting, according to Baum (2006, p. 226), that they should be included in a properly specified model.

The correlation between the error term referred at the foot of table 4.3, and the regressors [*corr (u_i, Xb)*] were found to be small within the FE model (0.03) and equal to zero in the RE model, suggesting that differences across the defined cohorts of households are not correlated with the error term. In addition, the *F-test* for all time-invariant error terms being equal to zero is categorically rejected. Indicating the pool data offers enough variation to justify the use of the *pseudo*-panel data.

The estimated coefficient values obtained from the FE indicate that after *holding fixed* the average effect of income per capita, consumption increases by 0.7% for every 1% that income goes up. This finding is also confirmed by the RE model.

However, while the RE fails to identify an effect from the over-time variation in income inequality on consumption, nonetheless, according to the FE model, the relationship is positive at the 5% level of significance, suggesting consumption reduces when inequality goes down.

That latest finding meant no agreement existed among the three models implemented about the relationship between the reference group (peer) level of inequality and consumption expenditure.

Given the significant differences—in terms of the effect of inequality for consumption—the decision was made to use the Hausman-test for the appropriateness—in terms of consistency and efficiency—of both models.

The Hausman-test uses the difference between the two estimated covariance matrices to weight the differences that exist between the FE and RE's vector of slope coefficients. It tests the null hypothesis that 'the extra orthogonality conditions imposed by the RE estimator is valid' (Baum, 2006, p.230). Table 6.9 presents the outcome of the test.

Table 6. 9. Results from the Hausman-test.

	coefficients			sqrt (diag (V_b - V_B))
	FE= (b)	RE= (B)	(b-B)	S.E.
Ln Household Income *per-capita*	0.7386	0.7379	0.0007	0.0002
Income *Peer-Gini*	0.0664	-0.0378	0.1042	0.0094
2008	0.0032	0.0076	-0.0043	0.0005
2010	0.0630	0.0654	-0.0024	0.0004
2012	0.0448	0.0438	0.0009	0.0005
2014	0.0534	0.0542	-0.0007	0.0004
Test of difference in coefficients not systematic chi2 (6) = 141.10				
Prob > chi2 = 0.0000				

Under the Hausman-test the null hypothesis—that the RE estimator is consistent—was categorically rejected. That is the RE model's u_i term in (6.6) was not found to be orthogonal to the individual-level error. The FE under the previous test has been confirmed as the model of choice.

Given the objective of the current research—to identify the impact of inequality changes on consumption—and based on the fact that neither consumption nor inequality are constant

over time, the FE model was found to be the most adequate option to conduct the panel data analysis.

As a reminder, the FE model controls for all time-invariant[70] differences between individuals. This means the fixed effect capture stable differences between the dependent variable and the independent variables, including stable differences in the way all variables are measured.

Time variables fixed-effects capture the influence of shocks that affect consumption in multiple households at the same time (like an income shock—economic crisis—or something similar).

Fixed effects cannot eliminate all possible sources of omitted variable bias, but they are more likely to do so than either time-series study of a single country or cross-sectional studies of multiple countries at a single point in time.

Before this research proceeds forward the decision was made to interact the time dummies with *peer income* inequality, in order to evaluate if the effect found to exist herein, has significantly changed over the period of study.

Table 6. 10. **The over-time effect of inequality changes on consumption.**
Estimated equation: $Ln\left(C\ percapita_{i,t}\right) = \alpha + \gamma\ Peer\ Gini_{k,l,t} + \vartheta\ (Year\ dummy_k * Peer\ Gini_{k,l,t}) + \varepsilon_{i,t}$

Ln Household consumption per-capita					
Peer income *inequality*	Dummy 2010 * Peer income *inequality*	Dummy 2012 * Peer income *inequality*	Dummy 2014 * Peer income *inequality*	Dummy 2016 * Peer income *inequality*	_cons
0.212***	0.040**	-0.107***	-0.013	-0.058***	8.285***
(5.00)	(2.53)	(-4.41)	(-0.71)	(-4.41)	(451.35)
sigma_u = 0.291	sigma_e = 0.524	rho = 0.235	corr (u_i, Xb) = -0.027		

The results indicate a significantly different effect of income inequality on consumption over time. While in 2008, a 0.1 reduction in the Peer-Gini coefficient was associated with a reduction of 2.1% in consumption per capita over-time. By 2010, the effect was found to be higher as consumption changed by 2.5% with a similar reduction in inequality. Two years later, in 2012, the same reduction in the Peer-Gini coefficient meant a 1.1% reduction in consumption per capita. In 2014 changes in inequality were not found to be statistically

[70] Unobservable factors that might simultaneously affect the LHS and the RHS of the regression are time-invariant.

different from the over-time value of 2008. Finally, the effect in 2016 was significantly smaller than the effect in 2008. This means the effect between inequality changes and consumption increased during the period of time inequality diminished in Mexico.

Now this research moved forward in order to evaluate if the impact of inequality reduction has translated into increases in inequality for different cohorts of society.

6.6. Distributional effects of inequality.

In terms of income and consumption, Huggett et al. (2011) found higher inequality levels exist for the younger households. Meanwhile, Attanasio and Browning (1993) found that consumption evolves as household/family composition changes and suggest that the simplest way to address this issue is by considering consumption per capita or consumption per adult equivalent. These considerations, the authors reckon, would produce a much flatter consumption profile as the household heads aged. The empirical evidence obtained in the previous chapter has found support for such a claim.

Attanasio and Weber (2010) found evidence about the sharp fall in consumption about retirement age in the United Kingdom, the USA, Italy and Japan, in support of what is commonly known as *the retirement consumption puzzle*, the one-time drop in the mean and median of consumption as individuals or households approach and lived over retirement. This research has also found empirical support in support to such drop in consumption.

Fisher and Marchand (2014) used a *pseudo*-panel dataset by pooling together the 1990 to 2017 editions of the USA Consumer Expenditure Survey. They use quantile regression in order to test if there were significant differences in such a drop along the consumption or income distribution. Their conclusion was that a progressive distributional component to the retirement consumption puzzle exists. That is the drop in consumption being significantly larger at the higher end of the distribution, but insignificant at the lower end of the distribution.

The empirical evidence for Mexico, found herein, indicates the differences are statistically significant for the income cohorts at the lower end of the income distribution—first income decile—as well as for households in the upper half of the distribution. With the drop in consumption occurring at an earlier stage for the richer cohorts of the population.

Given the evidence obtained so far from the literature review as well as from the empirical evidence in this thesis, this section makes use of the preferred specification model in order to evaluate the evolution of consumption heterogeneity by different sub-groups in Mexico.

The decision was made to analyse consumption changes controlling for variables such as age, income, retirement status and household composition. For that purpose, several interacting variables and restricted regressions were imposed onto the preferred specification model. All analyses have been conducted using the FE model as defined in the previous section.

6.6.1. Consumption and inequality over the income distribution.

The initial analysis was aimed at evaluating whether or not inequality produces significant consumption differences over the income distribution. The literature review has revealed how different researchers (e.g. Stephens and Unayama, 2011; Bostic et al., 2009; Abdel-Ghany et al., 2002; Gourinchas and Parker, 2002) have found a positive and significant relationship between relative consumption and the relative place a household has in income level terms, making their consumption profiles to vary according to place households have over the income distribution or over the life cycle.

Table 6.11 presents the estimated value for the coefficients in the preferred specification model the addition of different interacting terms associated with each of the different income deciles.

Table 6. 11. Effect of inequality changes on consumption over the income distribution.
Estimated equations: $Ln\left(C\ percapita_{i,t}\right) = \alpha + \beta\ Ln\left(Y\ percapita_{i,t}\right) + \gamma\ Peer\ Gini_{k,l,t} + \omega(Dummy\ income\ decile * Peer\ Gini) + \tau\ Time\ dummies_t + \varepsilon_{i,t}$

Ln Household income	1st decile * peer inequality	2nd decile * peer inequality	3rd decile * peer inequality	4th decile * peer inequality	5th decile * peer inequality	6th decile * peer inequality	7th decile * peer inequality	8th decile * peer inequality	9th decile * peer inequality	10th decile * peer inequality
0.726***	0.230***	0.028	-0.047	-0.095***	-0.095***	-0.113***	-0.090***	-0.013	0.109***	0.322***
(96.69)	(5.46)	(0.76)	(-1.35)	(-2.74)	(-2.78)	(-3.29)	(-2.59)	(-0.36)	(2.85)	(7.18)

Dummy 2010	Dummy 2012	Dummy 2014	Dummy 2016	_const
0.058***	0.036***	0.045***	-0.008*	1.948***
(12.24)	(5.13)	(8.39)	(-1.88)	(28.80)

R_sq (within)	0.594	sigma_u	0.448
R_sq (between)	0.575	sigma_e	0.523
R_sq (overall)	0.597	rho	0.424
corr (u_i, X)	-0.019		

(*) Indicate significance at the 90% level of confidence, (**) Indicate significance at the 95% level of confidence, (***) Indicate significance at the 99% level of confidence.
Values in parenthesis are t-ratios.

The specific decile each household belongs to was defined in terms of the household income levels as presented on the individual cross-section ENIGHs. For this purpose, the income decile *dummy* variables were interacted with the Peer-Gini coefficient.

The main finding is that income inequality changes produce statistically significant differences in consumption along the income scale. However, the sign of the relationship offers puzzling- counter-to-intuition evidence.

The empirical evidence suggests that after controlling for income, consumption per capita reduces for the poorer 10% households as well as for the richer 20% when income inequality goes down. While, for the households located in the middle of the—income—distribution (those households in the fourth to the seven deciles) consumption has gone up when inequality reduces over-time. That is if, as has been found, the income inequality reductions in Mexico have benefited those middle to middle-high income earning households.

In the economic sense, for households among the 10% poorer in Mexico, a 0.1 reduction in the level of reference group inequality over time—measured by the Peer-Gini factor—was found to be associated with a 2.3% reduction in consumption per capita. For households in the highest decile, the drop in consumption per capita is expected to be 3.2%.

The estimated coefficient values indicated that for a household in the fourth decile consumption per capita increases by 0.9% when the Peer-Gini coefficient reduces by 0.1 over time. The benefit reduces slightly for households in the sixth, but the actual size of the benefit is almost the size—in consumption per capita terms—for households in the fourth, fifth, sixth and seven deciles.

6.6.2. Consumption and inequality over the life-cycle.

Huggett et al. (2011) found higher inequality levels exist among the younger households in terms of both income and consumption. The previous chapter of this thesis has found statistically significant differences exist in terms of consumption over the life-cycle. Here the idea is to evaluate the partial effect of inequality on consumption over the life-cycle.

In order to conduct this analysis, the decision was made to interact a number of *dummy* variables associated with the specific age group each household belongs to with the value of the respective Peer-Gini coefficient. This will allow identifying if the changes in the level of

inequality among the peer reference group had any impact on consumption changes for the specific age group.

The estimated values for the coefficients of the interacting terms reveal there was a significant positive effect for households headed by individuals between 40 to 49 years of age. For households in that age group, the empirical evidence indicates consumption per capita decreases by 1.8% compared for the rest of the population if the Peer-Gini coefficient reduces by 0.1 over time.

Table 6. 12. **The over-time effect of inequality changes on consumption.**
Estimated equation: $Ln\left(C\ percapita_{i,t}\right) = \alpha + \gamma\ Peer\ Gini_{k,l,t} + \vartheta\ (Age\ dummy_{k,t} * Peer\ Gini_{k,l,t}) + \varepsilon_{i,t}$

	All age cohorts	Dummy Age < 20	Dummy Age 20-29	Dummy Age 30-39	Dummy Age 40-49	Dummy Age 50-59	Dummy Age 60-64	Dummy Age 65-69	Dummy Age 70-74	Dummy Age > 75
Ln Household income *per capita*	0.742***	0.742***	0.742***	0.742***	0.742***	0.742***	0.742***	0.742***	0.742***	0.742***
	(341.01)	(341.01)	(341.00)	(341.02)	(341.01)	(341.03)	(341.01)	(341.01)	(341.01)	(341.02)
Income Peer inequality	0.045	0.045	0.045	0.022	0.018	0.079**	0.05	0.038	0.046	0.066**
	(1.50)	(1.49)	(1.41)	(0.65)	(0.55)	(2.35)	(1.57)	(1.21)	(1.45)	(2.03)
Dummy Age * Peer inequality		-0.0006	0.008	0.120	0.183**	-0.182**	-0.050	0.097	-0.0008	-0.151*
		(-0.00)	(0.08)	(1.56)	(2.14)	(-2.32)	(-0.48)	(0.84)	(-0.01)	(-1.71)
_cons	1.818***	1.818***	1.818***	1.817***	1.812***	1.819***	1.817***	1.818***	1.818***	1.813***
	(79.81)	(79.68)	(79.79)	(79.78)	(79.02)	(79.84)	(79.79)	(79.82)	(79.77)	(79.11)
R_sq (within)	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587
R_sq (between)	0.568	0.568	0.568	0.57	0.57	0.566	0.568	0.566	0.568	0.572
R_sq (within)	0.591	0.591	0.591	0.592	0.592	0.59	0.591	0.59	0.591	0.593
sigma_u	0.452	0.425	0.452	0.451	0.451	0.453	0.452	0.453	0.452	0.45
sigma_e	0.527	0.527	0.527	0.527	0.527	0.527	0.527	0.527	0.527	0.527
rho	0.424	0.424	0.423	0.422	0.423	0.425	0.423	0.424	0.424	0.421
corr (u_i, X)	-0.023	-0.023	-0.022	-0.016	-0.022	-0.02	-0.023	-0.023	-0.023	-0.023

(*) Indicate significance at the 90% level of confidence, (**) Indicate significance at the 95% level of confidence, (***) Indicate significance at the 99% level of confidence. Values in parenthesis are t-ratios.

The empirical evidence shows that for the 50 to 59 age cohort the case is the opposite: consumption per capita increases by 1.6% compared for the rest of the population if the Peer-Gini coefficient reduces by 0.1 over time.

The previous chapter of this thesis found evidence for the so call *consumption puzzle*. The evidence obtained from this analysis confirmed that for the households headed by individuals in their late fifties, consumption and inequality were negatively related. The relationship, however, was found to be significant only for the age cohorts between 40 to 49

and 50-59 years of age. No other group were found to have consumption per capital revels associated with Peer inequality changes. This can be explained by the fact that the peer inequality factor is defined as the income differences for the same age-cohort, living in the same Mexican state, making its inclusion practically irrelevant for most age cohorts as it has been found.

The research then moved on to analyse the effect of inequality, if any, for households receiving pensions. For this purpose, dummy variables associated with pensions—with a value of one if the household receive pensions and zero otherwise —was interacted with the year dummies and then multiplied by the income Peer-Gini coefficient.

Giving the relevance of remittances have for the Mexican economy, a similar procedure was used in order to analyse the impact of inequality changes on consumption for remittances-receiving households. Table 6.13 presents the output of the econometric procedure.

Table 6. 13. Effect of inequality changes on consumption for households receiving income from pensions and remittances.

Estimated equation remittances: $Ln\left(C\ percapita_{i,t}\right) = \alpha + \beta\ Ln\left(Y\ percapita_{i,t}\right) + \gamma\ (Peer\ Gini_{k,l,t}) + \varphi(Dummy\ remittances_t * Peer\ Gini_{k,l,t}) + \varepsilon_{i,t}$

Estimated equation pensions: $Ln\left(C\ percapita_{i,t}\right) = \alpha + \gamma\ Peer\ Gini_{k,l,t} + \varphi(Dummy\ pensions * Peer\ Gini_{k,l,t}) + \varepsilon_{i,t}$

	Pensions		Remittances
Ln Household income *per capita*	0.738*** (333.33)	Ln Household income *per capita*	0.742*** (340.93)
Income Peer inequality	0.024 (0.81)	Income Peer inequality	0.042 (1.38)
Dummy pension * Peer inequality	0.121*** (8.82)	Dummy pension * Peer inequality	0.057*** (2.92)
_cons	1.852*** (80.20)	_cons	1.816*** (79.71)
R_sq (within)	0.588	R_sq (within)	0.587
R_sq (between)	0.566	R_sq (between)	0.568
R_sq (within)	0.591	R_sq (within)	0.591
sigma_u	0.453	sigma_u	0.425
sigma_e	0.527	sigma_e	0.527
rho	0.425	rho	0.424
corr (u_i, X)	-0.027	corr (u_i, X)	-0.022

(*) Indicate significance at the 90% level of confidence, (**) Indicate significance at the 95% level of confidence, (***) Indicate significance at the 99% level of confidence. Values in parenthesis are t-ratios.

The empirical evidence found that a positive and significant relationship existed between households receiving remittances or pensions when inequality changes. It has been found that households receiving remittances have larger consumption levels whenever inequality goes up. The previous finding confirms that inequality reductions have a detrimental effect for the poorer household, which are the ones usually receiving remittances.

In the economic sense, if the Peer-Gini factor increases by 0.1, consumption increases by 0.79% (0.074 + 0.057) for those households receiving remittances—generally the poorer in Mexico—relative to all other households. Likewise, pension receiving households were found to have larger levels on consumption—0.85% higher—when the inequality factor increased by 0.1.

The empirical evidence also confirms that changes in the inequality level of the reference group do have a stronger effect on the level of consumption for those households receiving pensions.

The empirical evidence confirms that inequality changes have a detrimental effect in the consumption level among the households receiving pensions—usually the elder[71]—and those receiving remittances—usually the poorer[72].

The empirical evidence also confirms the effect has increase over-time for those receiving remittances, while the effect for the pensioners has had significant differences, but they have not followed a constant trend.

So far, the empirical evidence suggested that inequality reductions do not benefit the poorer in society. That is, inequality reductions have a detrimental effect in consumption terms for the poorer households in Mexico, the *disaggregation* of the dataset provides evidence about the contrasting effect of inequality changes over the distribution in Mexico.

[71] An average of 35% of households headed by individuals over retirement age in the pooled-data set receiving monetary pensions. 49% of households receiving pensions are headed by individuals over the age of 65.
[72] In the pooled dataset 6.6% of households in the lower half of the income distribution receive any form of remittances. Meanwhile, only 4.4% of households in the upper income half receive them. 7% of the households belonging to the first income decile receive remittances; while only 3% of households in the top decile do so. Only 10% of the total number of households receiving remittances belong to the top third of the income distribution.

6.6.3. Consumption and inequality for the specific income cohorts over the life-cycle.

The next analysis consisted of analysing the life-cycle effect of inequality changes for specific income groups. The previous sections have found that the population cohorts at both ends of the income distributions have not benefitted from inequality reductions in Mexico. Table 6.14 presents the estimated coefficient values for those groups.

Table 6. 14. Effect of inequality changes on consumption for specific cohorts of the population.
Estimated equation remittances: $Ln\left(C\ percapita_{i,t}\right) = \alpha + \beta\ Ln\left(Y\ percapita_{i,t}\right) + \gamma\ Peer\ Gini_{k,l,t} + \varphi(Dummy\ decile * Income\ percentile\ dummies) + \varepsilon_{i,t}$

	1st income decile	5th income decile	10th income decile
Ln Household income per capita	0.773*** (30.69)	0.741*** (34.07)	0.701*** (27.15)
Income Peer inequality	-0.026 (-0.86)	0.055* (1.81)	-0.015 (-0.49)
Peer inequality * Age < 20	1.045*** (3.27)	-0.697** (-2.14)	-0.093 (-0.26)
Peer inequality * 20 ≤ Age < 30	0.389*** (8.20)	-0.252*** (-4.61)	0.816*** (14.14)
Peer inequality * 30 ≤ Age < 40	0.319*** (10.67)	-0.106*** (-3.21)	0.573*** (15.09)
Peer inequality * 40 ≤ Age < 50	0.334*** (10.22)	-0.127*** (-4.26)	0.498*** (14.48)
Peer inequality * 50 ≤ Age < 60	0.381*** (10.88)	-0.116*** (-3.58)	0.383*** (12.70)
Peer inequality * 60 ≤ Age < 65	0.543*** (10.66)	-0.159*** (-3.22)	0.408*** (9.12)
Peer inequality * 65 ≤ Age < 70	0.440*** (7.58)	-0.155*** (-2.80)	0.310*** (5.96)
Peer inequality * 70 ≤ Age < 75	0.451*** (6.65)	-0.189*** (-2.99)	0.341*** (5.40)
Peer inequality * Age ≥ 75	0.707*** (11.51)	0.026 (0.49)	0.129** (2.36)
_cons	1.553*** (6.90)	1.827*** (8.15)	2.184*** (8.49)
R_sq (within)	0.591	0.588	0.591
R_sq (between)	0.570	0.568	0.574
R_sq (within)	0.593	0.591	0.596
sigma_u	0.451	0.452	0.449
sigma_e	0.525	0.527	0.525
rho	0.424	0.424	0.422
corr (u_i, X)	-0.023	-0.023	-0.023

(*) Indicate significance at the 90% level of confidence, (**) Indicate significance at the 95% level of confidence, (***) Indicate significance at the 99% level of confidence. Values in parenthesis are t-ratios.

The empirical evidence allows to establish that after controlling for income, inequality reductions have a detrimental effect, in terms of consumption, for the poorer most throughout the life-cycle. If income inequality does reduce, consumption will follow suit for the group at the lower end of the income distribution, with the younger most taking the

largest reduction in consumption. That means inequality improvements do not help the poorer at any point throughout the life-cycle, the younger most in particular.

The empirical evidence confirms the detrimental effect peer inequality reductions have for all households among the poorest quintile throughout the life cycle. It has been found that the detrimental effect reduces as household heads transit through life.

In the economic sense, as an example, it has been found that for household head under the age of 20 part of the poorer income quintile if the Peer-Gini factor of income inequality reduces by 0.01, consumption per capita will be expected to reduce by as much as 10.4%—this group of households have been found to be the worst-hit by inequality reductions in Mexico. Meanwhile, for households headed by individuals at the other end of the life-cycle—those over the age of 75 in the same income cohort—a similar reduction of 0.01 in the value of the peer Gini coefficient will be predicted to result in “only” a 0.7% reduction in consumption.

The income inequality effect on consumption has been found to be negative and stronger moving upwards the income distribution. For the households at the middle of the distribution inequality reduction were found to have a beneficial effect in terms of consumption per capita. The evidence obtained in this latest analysis confirms the benefit is felt by all age cohorts but the eldest one for which no statistical evidence was obtained.

For the poorer households the effect is stronger for younger households. The evidence obtained for the richest cohort confirms that the detrimental effect of inequality reductions for the richer-most reduces as households transit over the life cycle.

The empirical evidence confirms the youngest households are the worst-hit by inequality reduction if they are part of the poorer 10%. For the same age cohort, part of the middle-income group, the story is the opposite, they are the ones benefitting the most.

Meanwhile, for households headed by individuals at the other end of the life cycle (over the age of 75), the empirical evidence has found they do not benefit from lower levels of inequality even if they are part of the middle-income group.

After all the previous analysis and given the research objective—namely, to identify if the reduction in income inequality *has lifted all boats* in terms of consumption—it is possible to state that:

- Inequality improvements are associated with higher levels of consumption for households in the upper half of the income distribution.

- For the poorer groups—the bottom two income deciles—they benefit from higher levels of income and not associated with income inequality reductions.

- If welfare is what matters, then social policy should be targeted at ensuring better levels of income for the poor. Inequality—in the form it has changes in Mexico—has been found to be irrelevant, if not detrimental for the poorer cohorts in Mexico

This chapter started by highlighting the general uproar about increasing levels of inequality in individual nations from China to the USA. Based on the empirical evidence obtained, it can be argued that in Mexico, public policy should be directed at promoting better-paid jobs for the poor, or increasing their entitlement-set—as referred by Sen (1998). If better-paid jobs bring reduced levels of inequality along, then so be. However, reducing inequality on its own should not be the aim of policy-makers, if they are to help those left behind.

A race to the bottom reduces inequality, however that does not help the poorer cohorts of society. For the group of households with a level of income in the second income quintile reduced levels of inequality help those who are approaching and enjoying retirement, but not the younger cohorts in the same income bracket.

Poverty and old age are inextricably linked, explains Walker (2011). There is a clear relationship between poverty and inequality (Goldberg and Pavnick, 2004). The evidence obtained in this piece of research confirms such an association between old age and poverty. The evidence in the pooled dataset shows that 60% of the households headed by individuals over the age of 70 belong to the poorest two income quintiles.

The empirical evidence obtained for Mexico suggests that the elder groups of the population do not enjoy from higher levels of consumption as inequality reduces.

6.7. Conclusions

The main objective for this research has been the identification of the drivers and benefits of consumption in Mexico, as well as to identify the effects of income inequality changes have on consumption.

A consistent argument found in the literature is that consumption rather than income has been regarded as a better measure of welfare. With that basis, this chapter has presented evidence that in Mexico income inequality has receded over the course of the current Century (Cortes, 2013). The literature reviewed has shown how income inequality did reduce in Mexico, measured by the Gini-coefficient by 0.8% per year over the period between 2000 to 2006.

Existing research on inequality (e.g. Goñi et al., 2011; Lopez-Calva and Lustig, 2010; Taylor et al., 2007) has found the reduction in income inequality in Mexico is associated with the governmental transfers for the poor, the benefits of NAFTA for the middle-income groups and the effects of the financial crisis for the richer most. The fourth chapter of this thesis has found that indeed, the macroeconomic stability—reflected in a tamed interest rate—and the value-added of the manufacturing sector have been steering consumption in Mexico.

The literature review stage of this chapter revealed that the impressive rate of output growth in China had been married with higher levels of both income *and* consumption inequality. This chapter has shown that based on the available household income and consumption surveys, income inequality—measured by the *Gini* coefficient—has reduced over the 2008-2016 period. Meanwhile, consumption inequality in Mexico has followed a hump-shaped profile after the financial crisis.

The aim of the research process described in this chapter was to identify if the reduction in income inequality had any impact in terms of consumption and how those benefits have been felt among different cohorts of the Mexican population.

The preferred specification econometric model based on models used by researchers in other developing nations analysed the impact of income inequality increases on consumption incorporating the use of a Peer-inequality factor, associated with the differences among groups of households of similarly aged household heads living in the same state. Deemed to be an adequate form to measure the perceived level of inequality as people consume in order *to keep up with the Joneses*.

Once the econometric specification and the form were chosen—the fixed effect model—the initial analysis found a positive and statistically significant relationship between peer-income inequality and the logarithmic value of household consumption per capita. This implied a detrimental effect—consumption-wise—of inequality reductions. In the economic sense, a reduction over time of 0.1 in the Peer-Gini factor was associated with a 0.66% reduction in household consumption per capita once income is accounted for.

If an argument for the benefits of reduced levels of inequality was to be made, the previous finding was not what would be expected. The positive and statistically significant relationship between consumption and inequality was similar to the result found by Jin et al. (2011) or by Sun and Wang (2013) for China.

However, while in China income inequality has been growing, and so has consumption, it has receded in Mexico. Meaning, in practical terms, that while in China higher income inequality has been married with increasing disparities in consumption, in Mexico, lower inequality means the Mexican population, in general, has been consuming less.

Consistent with the different consumption patterns across the income distribution identified in the literature. This thesis in the previous chapter has found that indeed that has been the case in Mexico: the consumption profile over the life-cycle is different for different income cohorts of the population.

The empirical evidence presented a clear picture: inequality is positively and significantly related with consumption for the 10% poorer and for the 10% richer households, but it was found to be negatively and significantly related for households in the middle part of the distribution—households belonging to the fourth to the seventh deciles.

For households among the 10% poorer in Mexico, a 0.1 reduction over time in the reference level of inequality—measured by the Peer-Gini factor—was found to be associated with a 2.3% reduction in consumption per capita and a reduction of 3.2% for the richer-most. For households in the middle of the distribution if peer inequality reduces, then an increase of 0.9% in consumption will be expected.

The conclusion is that for the poorer groups in society, income increases rather than inequality reductions is what matters. Better paid jobs, rather than efforts to reduce inequality, offer higher returns in terms of improved levels of consumption per capita.

The empirical analysis of the pseudo-panel data analysis found a statistically significant effect over time of inequality on consumption for the middle-aged cohorts. The relationship between inequality and consumption was found to be positively related for the households headed by individuals aged between 40 to 49 years, and negatively related with the consumption level of households headed by individuals between the age of 50 to 59. No other statistically significant association was found to exist between inequality changes and the level of total household consumption per capita.

The descriptive analysis shows that 60% of the households headed by individuals over the age of 70 belong to the poorest four income deciles. Meanwhile, for household heads in their age prime—between 35 and 55 years of age—under 30% of them belong to the lower half of the income distribution.

Meanwhile, two-thirds of households headed by individuals aged 80 years or more, belong to the lower half of the income distribution. The empirical evidence obtained in this piece of research not only confirms such an association between old age and poverty, but also that poorer households do not benefit in consumption terms when inequality reduces. At least not the way inequality has reduced in Mexico. What the empirical evidence confirms is that reductions in income inequality among *peers* have not been found to benefit—in terms of consumption— not the poorest, neither the elders regardless of income.

An interesting finding requiring further attention is the revelation that households receiving pensions or remittances do not benefit from over time reductions in inequality. It has been found that pensions are disproportionately benefitting households in the upper half of the distribution, while remittances tend to go to the poorer-most.

It has been stated that the poorer-most do not benefit from inequality improvements. If remittances are going to that group of households, then a similar relationship can be expected.

From the public policy point of view, this piece of research has found that higher-income through better-paid jobs and higher wages are what matters for the less fortunate.

The econometric procedure has produced an answer to the research question: inequality reductions do benefit more than of the population but mainly those sitting in the middle cohorts of the income distribution.

7. Conclusions, limitations and further research.

7.1. The research project.

There is a long-standing political and academic debate about the benefits and consequences of free trade, liberalisation and globalisation[73]. However, the main question remains to be whether or not the benefits of economic growth "trickle-down" to improve the living standards for the worst off on a consistent basis (Winters et al., 2004; Goldberg and Pavnick, 2004).

Over the past half-century, the Mexican population has enjoyed better living standards measured by increasing life expectancy on the one hand and higher per-capita levels of income and consumption on the other. However, several challenges remain in terms of large levels of poverty (abject poverty measured at 7.6%[74] of the total population), high inequality (despite some improvements, the Gini coefficient was 0.440[75] in 2018), corruption and security concerns.

In such context, this research embarked upon a quest to find out *what* the main drivers of consumption have been, and whether or not those higher levels of income at the aggregate level have translated into higher benefits at the microeconomic level.

This thesis has presented the economic analysis of consumption which is regarded by different researchers as a better measure of living standards. The analysis has been conducted through the econometric analysis of economic data at the macro and microeconomic level.

The relevant econometric procedures undertaken have presented the two sides of a story told over three chapters of empirical statistical analysis of consumption in Mexico: on the positive note sound macroeconomic policies have coincided with increased levels of income, consumption, and improving levels of inequality. However, underneath the face of success at the aggregate level, there have been winners and losers. The *story* takes an inconvenient turn as the evidence suggests those at the lower end of the income distribution and those at

[73] For an international perspective on globalization's challenges, see Khor (2000); Newell et al. (2013) or Stiglitz (2013). Levy (2010) offers a perspective on Mexico's challenge lying ahead. Perry (2005) argue the case for the benefits of development policies championed by different institutions such as the World Bank and the International Monetary Fund.
[74] As measured by CONEVAL (2017).
[75] Own calculations based on the National Households Income and Expenditure Survey prepared by INEGI (INEGI, 2018).

the end of the life-cycle have not benefitted, in terms of higher levels of consumption, from the economic benefits highlighted before.

7.2. The research findings.

The research projected was aimed at finding an answer to each of the following questions:

i. What have been the main drivers of consumption over time?
ii. Have the benefits of increased consumption benefitted all / most / some cohorts of society?
iii. Have the reduced levels of income inequality resulted in better levels of consumption, and therefore welfare, for all?

Each question has been tackled, one at a time, in each of the three chapters of empirical work that compose this thesis. Each one represents a particular econometric procedure adopting and adapting proven econometric models found during the literature review stage presented in each chapter. The instigating econometric models were chosen as different researchers used them, particularly in terms of their applicability in the context of other developing nations.

The first chapter of the empirical work (chapter four) presents the time-series analysis of macroeconomic data. The time-series dataset of several macroeconomic variables identified in the literature as having an explanatory effect for consumption was constructed based on available information data. Different covariates were considered based on their relevance for the Mexican economy; among them, the per capita value of remittances[76], the amount of foreign direct investment, and the income from the national oil industry that have all had an important influence on driving Mexico's recent economic development (Wen, 2019).

The main finding was that income innovations, as well as changes to the interest rate and financial wealth and the output from the manufacturing sector, have played a role in steering consumption in Mexico.

[76] Mexico is the highest USA-originating remittance recipient nation in the world. According to the Pew Research Institute (Pew Research Center, 2019), Mexican diaspora sent over 30 billion US dollars in 2017. That was 20% of all remittances sent from the USA to other nations.

In order to address the second research question, this piece of research pulled together the five most recent editions of the cross-sectional data from the National Household Income and Expenditure Survey (ENIGH) in Mexico. Some other variables reflecting the household composition and location were introduced as regressors in the preferred specification model.

The econometric procedure decomposed the dataset by income, age, and consumption categories. That model would allow, in the researcher's mind, to test for statistically significant differences at the regional level, as well as the relevance of variables associated with the household composition and other demographic variables.

It has been found that the marginal propensity to consume to be slightly over 0.7. The decomposition of consumption for specific income, age, and regional cohorts revealed statistically significant differences among different cohorts of the population.

The main contribution from the micro-dataset analysis was the empirical evidence in support of the so-called retirement consumption puzzle. The econometric procedure showed strong statistical evidence of a *hump-shaped* consumption pattern over the life cycle with a clear drop in consumption as household heads approach retirement age. The introduction of dummy variables allowed to identify that consumption drops at the age of 57, considering the whole sample.

A relevant finding was the realisation that there was a statistically significant difference in the life-cycle consumption profile over the income distribution as found by other researchers (e.g. Fisher and Marchand, 2014). The empirical evidence confirmed how the wealthier cohorts in society do reduce their consumption levels earlier in life, while the poorer households cannot afford to do so as they need to wait for as much as 20 years to reduce their consumption levels.

While conducting the descriptive statistical analysis of cross-sectional data, the researcher realised that income inequality has been reducing in Mexico over the last sixteen years (2000-2016). However, the reduction has not been impressive by any stretch of the imagination as the income Gini coefficient has gone down from 0.491 in 1994 to 0.440 in 2016.

This over time reduction has occurred as both income and consumption have increased. The literature review stage allowed to identify different pieces of research about the effect of

increased levels of income on consumption. Therefore, the decision was made to analyse if there has been any impact from income inequality changes for household consumption.

The decision to adopt the econometric model as used by Jin et al. (2011) was mainly connected with the use of the reference group level of inequality concept (Peer-Gini factor) as a way to reflect the changing inequality patterns at the household level. Adopting such measurement of inequality was in line with the findings by different researchers (e.g. Palley, 2010) who have found how people consume in order to *keep up with the Joneses,* making the peer reference a relevant motivation driving consumption at household level.

The pseudo-panel dataset was created by pooling together the available cross-sectional data, and a parsimonious version of the original Jin et al. (2011) econometric model was adopted.

The empirical evidence confirmed that reductions in income inequality have benefitted—in terms of increased levels of consumption—the middle-aged households as well as households located in the middle of the distribution. A detrimental effect was found to exist for the poorer cohorts in society who were found not to have benefitted—in consumption terms—whenever income inequality has gone down in Mexico.

The main findings from the three pieces of empirical work are:

a) The sound macroeconomic conditions encouraging investment in the manufacturing sector, promoting jobs and creating economic stability have been the steering force behind the increased levels of consumption.
b) At the microeconomic level, the increased levels of consumption have benefitted almost all population groups—not the oldest—but the benefits have had a larger effect for the better-off in society.
c) The form of inequality reductions Mexico experimented with after the turn of the millennium have produced higher benefits in terms of consumption for the middle-income cohorts of society. For the poorer-most, better-paid jobs are more relevant rather than inequality reductions. That is what the empirical evidence has indicated.

7.3. Policy implications.

Income innovations, the value-added from the manufacturing sector, as well as changes to the interest rate and financial wealth, were found to have an influence in steering consumption.

Considering financial wealth picked up after the economic reform implemented at the start of the 1990s, which is also the moment the country managed to tame inflation and also the period of time when FDI flew into the country; then it can be argued that the sound macroeconomic policies implemented at the time have had a role in driving-up consumption in Mexico.

The empirical evidence found in this piece of research has given support to the findings of other researchers (e.g. Jansen, 2010) who have argued that the change in economic policy from that of a closed economy—fostering import substitution, fuelled permanently by credit and heavy government spending, coupled with high levels of corruption—to a fully open economy, as Mexico is today, has produced spectacular changes in consumption terms.

The economic path followed by Mexico has occurred not without some casualties along the way. The country is in a far-from-ideal situation. Poverty remains high, inequality is significant, and Mexico is one of the nations with the lowest social mobility in the world (CONEVAL, 2019). Which is the reason why this thesis moved on in order to find what the reality has been like at the microeconomic household level.

Despite the current tide of nationalism and populism that is expanding in many parts of the world, the empirical evidence suggests that macroeconomic stability and embracing globalization—through a thriving manufacturing sector—are associated with increased levels of consumption per capita.

Even after considering that at the micro household-level income and consumption for the poorer most—lowest income decile—are yet to return to the pre-2008 levels on a per capita basis, it has been found that households among the poorest 10% households are more affected by income changes than any other households in the lower half of the distribution.

The analysis regarding the changes in consumption over the life-cycle provided strong statistical evidence of a reduction in consumption as household heads approach retirement age, consistent with the so-called consumption puzzle.

These findings highlight the importance of protecting the weaker in society: those at both ends of the life cycle and those at the lower end of the income distribution through governmental transfers for the poorer, and pensions for the elder.

Mexico is a country with an almost inexistent safety net for the elder or the poorer. The country's PROGRESA programme has received international praise in terms of shielding the poorer-most from falling even further. This piece of work suggests that once the income variable has been partially taken care of, the next step requires public policy actions aimed at improving the public provision of health and education services, which have been found to be the two consumption categories Mexicans spend most in once they are outside the lowest income decile.

One striking realisation was the right-skewed distribution of pensions. That is, pensions were going to the upper income deciles. This simple fact, not often quoted in the literature, added to the already *complex* reality lived by the older and poorer in Mexico. This is associated with the large share and size of the *underground* economy—about half of all employments.

The main problem is that most of those working in the informal sectors of the economy do not contribute to pensions or have access to public health services. This a huge challenge, not only for the developing nations, but public policy changes are required if the country hopes to bring the benefits of economic development for all Mexicans.

Throughout the econometric analysis of the microeconomic dataset, particular emphasis was placed on the role of three sources of income: remittances, and pensions.

Pension-receiving households have larger consumption elasticities than households not receiving income from that source. Their consumption level was found to be lower than non-pension receivers, but consumption over the life-cycle was found to reduce at a slower pace, that means the empirical evidence confirms that pensions act to ring-fence consumption for dropping as much as it does for non-pension receiving households.

All the previous findings highlight the importance of pensions for the less-fortunate as they transit over the life-cycle. The pension scheme in Mexico changed from a defined-benefit model (pay from the public purse) to a defined-contribution (DC)—individual accounts—option. With the pay-out stage to arrive within the next ten years, special attention has to be given to this issue, as it is becoming clear from the Chilean experience—the first country to

adopt the DC scheme—that most households are relying on pensions unlikely to make ends meet.

This research identified that consumption drops as household heads approach retirement age—commonly known as the consumption puzzle. Such a reduction was found to occur at an earlier age, late 50s, well before retirement age. However, the disaggregation analysis has shown that when the drop in consumption occurs depends on the household position over the income distribution. The worrying factor is that such reduction occurs mainly in terms of expenditure on health-related concepts. While the poor significantly reduced their expenditure on health relative to income; the better-off duplicate their own "young level" health expenditure. It will be hard to think the poorer do not spend in health as they get older because they do not fall ill. It is basically and income availability problem for them.

Given the fact that the public free provision of both education and health is plagued with anomalies and long waiting times, public policy and action is required for those at the lower end of the income distribution. In a country characterised by an inefficient tax system, the creation of universal health cover—still at an inception stage at the moment of writing this thesis—need to received financial backing if the health of all Mexican citizens is of importance.

While working with the microeconomic dataset, it was found that despite Mexico's high level of inequality, it has receded over the course of the current century.

Governmental transfers for the poor, benefits of economic integration in terms of better paid jobs in the manufacturing industry, more the middle-income groups and the negative effects of the financial crisis affecting the richer-most, have been cited as the elements explaining such changes in income inequality.

Using the different cross-sectional data available, the descriptive analysis of this thesis has shown that income inequality—measured by the *Gini* coefficient—has reduced over the 2008-2016 period.

The conclusion is clear: inequality reductions has benefitted the middle-income households but not those at both ends of the income distribution. The poorer have benefitted from increased levels of consumption through the different transfer programmes that have been running in Mexico for the best part of the last 30 years.

Macroeconomic stability in terms of tamed levels of inflation, a fully-open economy promoting investment, and increased levels of output from the currently thriving manufacturing base that Mexico is, have been the policies that could be associated with increased levels of consumption.

The microeconomic empirical evidence indicates most households in Mexico have benefitted in consumption terms, but the benefits have been far from equally distributed. While the poorer households can afford to increase their consumption of meat, the middle-income cohorts can afford better health and education services. The richer meanwhile can afford better, faster and more luxurious cars and foreign travel.

Therefore, public policies aimed at ring-fencing the poorer and the elder from large drops in consumption are of critical relevance if all people in Mexico are to enjoy from the benefits of economic progress that integration has brought to the country over the most recent decades.

7.4. Research limitations

This research is based on the econometric analysis of consumption at the macroeconomic level using time-series data, and at the micro-level using data obtained from cross-sectional surveys of household income and consumption in Mexico.

Deaton (2000) warns that the analysis of cross-sectional surveys 'do not come from controlled experiments in which the effects of a *treatment* can be unambiguously and convincingly determined'. Therefore, all claims made throughout this piece of research are statements about the statistical association, not causation, between consumption and its determinants.

Deaton and Paxson (1994a) state that older households tend to be underrepresented in household surveys. Other researchers (e.g. Brandolini and Smeeding, 2009) contend that it is the richer households that are not well represented by income surveys.

According to Deaton and Grosh (2000), there is selection bias produced by the non-cooperation effect from respondents that makes certain household types to be over-represented in a given sample. There is also the underreporting on income and the underrepresentation of richer households in surveys in general. Meanwhile, according to Palley (2010), the use of cross-sectional data to estimate consumption function induces a

bias as it shifts up income when it rises over time. All of these possible bias sources do calls into question any generalisation made based on survey data analysis.

Having income, in the regression model, as the main determinant of consumption implies the risk of endogeneity, as it is clear income levels are also related to factors such as the level of education, ability, access to capital, both financial and *social capital*; all those factors, in the regression model, are part of the innovation term in the regression equation. Although the model used for the microeconomic analysis has been based in the literature, this simple fact does not cancel out the risk of endogeneity, which represents an important limitation to this research's results.

At the macroeconomic level, the statistical analysis of non-stationary time-series represents a violation of the assumptions of classical statistical analysis. The use of a vector error correction model is a way to deal with such a condition. Nonetheless, the exclusion of other variables found to be cointegrated with consumption, and possibly having an influence in steering consumption, require further attention.

Finally, among the many questions and criticisms about econometrics probably Rodrik's (Rodrik, 2008) stands out: '…economists are subject to the same cognitive biases as others: overconfidence, tendency to join the herd, and proclivity to overlook contradictory evidence'.

It cannot be argued that this piece of research is bias-free, although output from econometric research has been reported thoroughly and truthfully. Nonetheless, the researcher's own cognitive limitations do constitute a limitation of this research.

7.5. Further research.

The role of credit for fuelling consumption in Mexico found by researchers such as Brady (2008) or Fernandez-Corugedo and Muellbauer (2006). The descriptive analysis stage of this thesis conforms with the idea that whenever credit per capita exceeds 50% of per capita GDP, the country has run into economic trouble. However, this relationship was not investigated further as the credit series was found to be not cointegrated with consumption. The analysis of this relationship deserves to be analysed further.

Certainly, much more can be done in terms of observing how income inequality evolves in Mexico and to analyse the impact it has on consumption inequality. This constitutes a clear

option for further research. One interesting angle to adopt in terms of consumption inequality will be to analyse the impact of inequality reduction in Mexico for consumption at community or even at the neighbourhood level.

Sun and Wang (2013) found that increases in village income inequality measured by the Gini coefficient increased household consumption rate. The most recent editions of the survey on household consumption and income in Mexico allow identifying the specific neighbourhood each household belongs to, making it possible to evaluate the income differences at that level, offering the possibility for further refined research about income inequality and consumption.

Tcherneva (2014) found that income inequality has increased after the financial collapse of 2008 in the USA. This research has found evidence of income inequality reduction in Mexico before 2010, over time characterised by modest economic growth. The fact income inequality had increased after 2012 makes it very interesting to continue the research conducted in this thesis, using the latest edition of the cross-sectional data in order to evaluate the impact of income inequality.

Similarly, Fields et al. (2015) found that in Mexico, as in Venezuela and Argentina, the poorer tend to be the cohort benefitting the most when the economy grows. However, they found using panel data that the benefits are not equally distributed for all income cohorts. In this thesis, it has been argued that the lower-income cohorts are more sensitive to income changes and that they have not benefitted as much as the richer cohorts have from inequality reductions. Nonetheless, much more research is required in order to determine if income distribution changes have any power to explain consumption variation in Mexico for the poorer most.

Finally, Elson (2013) argues that inequality is understood, basically, in terms of the existence of equality of opportunities for the whole nation's population. However, Elson argues, the gender issue has not been carefully considered. This research had found evidence that female-headed households, when significant, spent less than male-headed households, but not much analysis has been conducted about the gender issue. This offers an interesting angle to look deeper into this aspect of gender inequality.

7.6. Concluding remarks.

If a single paragraph could encapsulate all the learning elements obtained from the econometric statistical analyses conducted herein, it can be said that the benefits of increased consumption in Mexico can be attributed to the sound macroeconomic policies the country has experienced over the last 25-plus years.

At the microeconomic level, the increased levels of consumption have not been felt similarly across different society cohorts and regions of Mexico. The middle-aged and mature cohorts, as well as the non-poor, have benefitted, but those at both ends of the life-cycle have not.

What matter for the poorer in Mexico, are higher levels of income, which could be in the form of better-paid jobs or governmental transfers.

This research has shown that the average Mexican consumer does not exhibit a *forward-looking* approach while defining their consumption pattern along the life-cycle and that credit and investment have been found to affect consumption in the long-run.

If the idea of consumption smoothing is understood as the inter-temporal optimisation path over the life-cycle to accommodate the drop in income after retirement, then, this research has found ample evidence against the consumption-smoothing hypothesis even after consumption per capita is considered.

This research has found a flatter profile of consumption when the level and per capita values of consumption are considered, but a drop in consumption has been found to exist anyway regardless of the form of household composition. When exactly consumption drops is mainly determined by the level of household income. The poorer cohorts keep expenditure levels until later in life, but consumption drops anyway.

There is work ahead to be done in terms of further research. The limitations of this research are more than a few. However, some progress has been obtained in order to understand what elements have influenced consumption increases in Mexico and who has benefitted the most.

The study of consumption in Mexico offered an interesting case given the circumstances around the economic process the country has gone through over the recent past as it has

made the transition, still in process, from a once *crisis-prone* economy to a manufacturing powerhouse and one of the most open economies in the world. Long gone seem the days of an inflation rate of 160% the country had around the mid-1980s or the recurrent currency crises associated with the balance of payments deficits created by exuberant government spending and irresponsible monetary policies.

Promoting economic stability and certainty has been found to have an important role in steering increased levels of consumption. This form of development might increase inequality, and could be the source of social *unrest* and unhappiness, as is the case in the current geopolitical arena worldwide. However, the empirical evidence for Mexico is such that if improved levels of welfare and consumption are the policy-makers' concern, certainty, and stability is the way forward.

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Annex 2A.

Table A. Results from the ADF-test for level value variables.

			Level value series						
	ρ	Lags	∂	BG test LM1	BG test LM2	tt	drift	AIC	BIC
Ln Consumption expenditure per capita	Drift	0	-2.86*	0.88	3.04		0.596	-179.50	-175.45
	Drift + time trend	0	-2.62	1.18	3.35	0.001*	1.46**	-180.57	-174.49
	No const, trend	0	3.36	2.69	3.21			-172.99	-170.97
Ln Domestic Income per capita	Drift	0	-2.58	0.97	1.2		0.561	-215.20	-211.15
	Drift + time trend	0	-2.09	1.42	1.53	0.00	1.214**	-215.06	-208.99
	No const, trend	0	3.3	2.22	2.22			-210.28	-208.25
Ln Housing wealth per capita	Drift	0	-0.34	0.71	1.18		0.11	-126.70	-122.65
	Drift + time trend	0	-2.80	0.04	0.09	0.005***	2.27	-132.51	-126.43
	No const, trend	0	1.92	0.79	1.31			-128.52	-126.50
Ln Financial wealth per capita	Drift	2	-1.50	0.65	1.11		0.115	-20.28	-12.33
	Drift + time trend	2	-0.74	0.91	1.18	0.00	0.10	-18.42	-8.48
	No const, trend	2	0.04	1.01	1.43			-18.67	-12.70
Ln FDI per capita	Drift	2	-0.83	0.25	3.14		0.423	45.31	53.27
	Drift + time trend	2	-2.72	0.17	1.01	0.024**	2.730***	40.46	50.40
	No const, trend	2	1.48	0.32	0.338			44.42	50.39
Ln Remittances per capita	Drift	2	-0.09	0	0.23		0.076	-9.45	-1.50
	Drift + time trend	1	-3.23*	0.14	4.59	0.015***	1.576***	-13.26	-5.23
	No const, trend	2	1.76	0	0.17			-11.35	-5.38
Unemployment rate	Drift	1	-2.81*	0.03	0.05		0.821	133.8	139.8
	Drift + time trend	1	-2.76	0.05	0.21	-0.01	0.962***	135.2	143.2
	No const, trend	0	-0.44	1.73	1.94			140.7	142.7
Ln Credit to Private sector	Drift	0	-1.58	0	0.02		1.055	-38.33	-34.28
	Drift + time trend	0	-2.09	0.02	0.03	0.00	1.593*	-38.31	-32.23
	No const, trend	0	1.11	0.27	0.55			-37.66	-35.64
Ln Broad Money (M2) *per capita*	Drift	0	-1.41	1.35	2.62		0.758	-34.39	-30.34
	Drift + time trend	0	-2.73	0.28	0.69	0.005**	2.365***	-37.77	-31.69
	No const, trend	0	1.33	1.9	3.54			-34.18	-32.16
Ln National oil industry income per capita	Drift	0	-2.01	0.08	0.62		0.297	-11.84	-7.86
	Drift + time trend	0	-2.05	0.08	0.62	0.00	0.293*	-9.85	-3.88
	No const, trend	0	-0.33	0.67	0.71			-9.67	-7.68
Ln Income Tourism Industry per capita	Drift	0	-1.88	3.10	3.84		0.976*	-61.3	-57.2
	Drift + time trend	1	-2.84	0.08	1.12	-0.002*	2.187***	-61.3	-53.3
	No const, trend	0	0.16	1.35	3.53			-59.7	-57.7
Ln Exports per capita	Drift	0	-1.03	1.69	2.35		0.16	-110.0	-105.9
	Drift + time trend	0	-1.31	3.07*	3.13	0.01	0.68	-109.4	-103.3

	No const, trend	0	4.91	2.19	2.56			-109.2	-107.2
Ln Government Spending per capita	Drift	1	-2.86*	3.81*	3.99		0.461	-33.33	-27.30
	Drift + time trend	0	-2.34	0.29	0.79	0.00	0.412***	-32.94	-26.86
	No const, trend	0	0.86	0.22	0.32			-29.41	-27.39
Interest rate	Drift	0	-2.32	0.01	0.02		4.146	457.5	461.5
	Drift + time trend	4	-2.04	0.75	0.76	-0.15	9.65	437.1	450.7
	No const, trend	4	-1.28	0.25	0.53			436.4	446.1
Inflation rate (CPI)	Drift	0	-2.55	0.62	5.77*		4.676	474.5	478.5
	Drift + time trend	2	-1.78	0.00	0.70	-0.13	8.15	458.7	468.5
	No const, trend	4	-1.28	0.25	0.53			436.4	446.1
Ln Reserves per capita	Drift	2	-0.08	2.85*	4.21		0.126	46.0	53.9
	Drift + time trend	3	-2.81	0.91	2.98	0.031***	3.826***	37.6	49.5
	No const, trend	0	-4.95***	0.34	1.48			33.8	39.8
Ln Wealth per capita	Drift	0	-0.49	0.57	0.78		0.132	-102.7	-98.6
	Drift + time trend	0	-2.05	0.13	0.61	0.005*	0.366**	-104.7	-98.6
	No const, trend	0	2.00	0.63	0.79			-104.3	-102.2
Ln Debt per capita	Drift	1	-2.31	1.96	2.64		0.771**	-25.9	-19.88
	Time trend	1	-1.97	2.11	2.76	-0.002	0.763**	-23.92	-15.9
	No const, trend	1	0.75	2.16	2.73			-23.04	-19.02

Table A Dickey Fuller test (*∂*) for time-series variables in the logarithmic form for the prefer specification consumption function in Mexico. Values for the Breusch-Godfrey test of serial correlation with one and two lagged values of the error term (LM1 and LM2) with Ho of serial correlation. The last two columns are the Akaike Information Criteria (AIC) and the Bayes Information Criteria (BIC) in order to determine the adequacy of the number of lag values used in the model. (*) indicates significance at the 10% level (**) indicates significance at the 5% level (***) indicates significance at the 1% level.

Table B. Results from the ADF-test for first difference values.

	p	Lags	*∂*	BG test LM1	BG test LM2	tt	drift	AIC	BIC
∆ Ln Consumption expenditure per capita	Drift	0	-5.87***	0.59	0.61		0.018**	-170.09	-166.08
	Drift + time trend	0	-6.25***	0.55	1.58	-0.000*	0.043**	-171.37	-165.34
	No const, trend	0	-5.07***	0.01	1.04			-165.97	-163.96
∆ Ln Domestic Income per capita	Drift	0	-5.97***	0.00	0.09		0.013**	-206.00	-201.98
	Drift + time trend	0	-6.25***	0.03	0.06	-0.0004	0.028*	-206.51	-200.50
	No const, trend	0	-5.21***	0.60	0.91			-202.11	-200.10
∆ Ln Housing wealth per capita	Drift	0	-8.19***	0.61	0.68		0.022**	-124.12	-120.10
	Drift + time trend	0	-8.14***	0.66	0.88	0.0002	0.013	-122.33	-116.31
	No const, trend	0	-7.68***	0.00	0.00			-121.73	-119.70

Δ Ln Financial wealth per capita	Drift	1	-2.00	0.52	1.29		0.038	-19.9	-13.92
	Drift + time trend	1	-2.34	0.46	1.12	-0.0024	0.122*	-19.81	-11.85
	No const, trend	1	-1.72*	0.97	1.43			-20.67	-16.69
Δ Ln FDI per capita	Drift	1	-8.69***	0.33	3.41		0.078	44.06	50.03
	Drift + time trend	1	-8.60***	0.33	3.41	0.000	0.080	46.06	54.02
	No const, trend	1	-8.41***	0.03	1.99			44.69	48.67
Δ Ln Remittances per capita	Drift	1	-7.45***	0.00	0.20		0.052*	-11.44	-5.47
	Drift + time trend	1	-7.46***	0.00	0.07	0.0014	0.008	-10.09	-2.13
	No const, trend	1	-7.09***	0.15	0.56			-10.22	-6.24
Δ Unemploy-ment rate	Drift	1	-4.97***	1.11	1.11		0.04	139.66	145.63
	Drift + time trend	0	-6.19***	0.40	1.05	-0.0058	0.217	140.87	146.89
	No const, trend	0	-6.20***	0.17	0.17			137.68	139.69
Δ Ln Credit to Private sector	Drift	0	-7.80***	0.55	0.60		0.027	-34.53	-30.51
	Drift + time trend	0	-7.74***	0.67	0.72	0.0005	0.012	-32.65	-26.63
	No const, trend	0	-7.70***	0.57	0.58			-35.17	-33.16
Δ Ln Broad Money (M2) *per capita*	Drift	0	-8.77***	1.71	1.97		0.038	-32.65	-28.64
	Drift + time trend	0	-8.69***	1.71	1.97	0.0000	0.036	-30.66	-24.63
	No const, trend	0	-8.51***	0.98	0.98			-32.10	-30.09
Δ National oil industry income per capita	Drift	0	-7.96***	0.03	0.41		0.002	-7.07	-3.12
	Drift + time trend	0	-7.88***	0.03	0.33	0.0002	-0.004	-5.08	0.82
	No const, trend	0	-8.10***	0.03	0.37			-9.06	-7.09
Δ Ln Income Tourism Industry per capita	Drift	0	-6.08***	2.17	2.18		0.004	-56.98	-52.96
	Drift + time trend	0	-6.06***	2.14	2.15	0.0005	-0.011	-55.18	-49.15
	No const, trend	0	-6.13***	2.2	2.21			-58.9	-56.92
Δ Ln Exports per capita	Drift	0	-6.04***	0.53	0.71		0.050**	-107.7	-103.68
	Drift + time trend	0	-6.05***	0.48	1.12	-0.0005	0.068	-106.29	-100.27
	No const, trend	0	-4.55***	0.53	2.66			-98.76	-96.8

Δ Government Spending per capita	Drift	4	-3.29**	0.26	1.18		0.016	-40.17	-28.58
	Drift + time trend	0	-7.98***	1.25	1.27	-0.0019	0.094*	-26.86	-20.80
	No const, trend	0	-7.66***	0.12	0.13			-27.29	-25.29
Δ Interest rate	Drift	4	-3.17**	0.57	2.72		-0.28	432.85	444.44
	Drift + time trend	3	-3.86**	0.01	0.07	-0.093	2.70	439.71	451.42
	No const, trend	2	-4.98***	0.03	0.08			441.40	447.36
Δ Inflation rate	Drift	1	-7.80***	0.02	0.29		0.03	461.31	467.28
	Drift + time trend	1	-7.79***	0.05	2.41	-0.099	3.078	462.82	470.78
	No const, trend	2	-5.32***	0.21	0.34			453.83	459.74
Δ Ln Reserves per capita	Drift	2	-6.58***	1.1	5.22*		0.10*	43.35	51.23
	Drift + time trend	4	-5.98***	0.43	1.27	0.005*	-0.019	40.96	54.49
	No const, trend	4	-5.98***	0.43	1.27			41.00	54.49
Δ Ln Wealth per capita	Drift	0	-8.08***	0.05	0.11		0.029**	-100.23	-96.22
	Drift + time trend	0	-8.00***	0.05	0.11	0.0004	0.027	-98.23	-92.21
	No const, trend	0	-7.53***	1.12	1.16			-97.50	-95.52
Δ Ln Debt per capita	Drift	0	-5.23***	2.25	2.74		0.023	-23.30	-19.28
	Time trend	1	-5.21***	0.10	0.26	-0.001	0.087	-21.39	-13.40
	No const, trend	0	-5.16***	1.81	2.65			-24.46	-22.45

Table B. Dickey Fuller test (∂) for time-series variables in prefer specification consumption function for Mexico. Values for the Breusch-Godfrey test of serial correlation with one and two lagged values of the error term (LM1 and LM2) with Ho: no serial correlation. The last columns are the Akaike Information Criteria and the Bayes Information Criteria. (*) significance at the 10% level (**) significance at 5% level (***) significance at 1% level.

Annex 2B.

Estimates coefficients for ECM.

Estimated equation: $C_t = \beta_0 + \beta_1 \varepsilon_{t-1} + \beta_2 \mathrm{X}_t + \upsilon_t$; X is the vector or regressors and ν is white-noise residual.

- model including 3 lagged values of the cointegrated variables.

D.Ln_Ct_Exp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
err4						
L1.	-.4523844	.2148602	-2.11	0.043	-.8890328	-.015736
Ln_DomY_per						
LD.	-.2389226	.3896669	-0.61	0.544	-1.030821	.5529758
L2D.	.1615482	.3750208	0.43	0.669	-.6005857	.9236822
L3D.	-.1322305	.3825714	-0.35	0.732	-.9097093	.6452482
r						
LD.	-.000299	.000379	-0.79	0.436	-.0010692	.0004712
L2D.	4.95e-06	.000371	0.01	0.989	-.0007489	.0007588
L3D.	-.000203	.0003654	-0.56	0.582	-.0009456	.0005395
Ln_Man_VAT_per						
LD.	.3962147	.3761337	1.05	0.300	-.3681809	1.16061
L2D.	-.2157833	.3466719	-0.62	0.538	-.9203053	.4887387
L3D.	.1792519	.3199678	0.56	0.579	-.4710008	.8295046
Ln_HW_per						
LD.	.013992	.0740498	0.19	0.851	-.1364953	.1644792
L2D.	-.0750149	.0742763	-1.01	0.320	-.2259625	.0759328
L3D.	.0302663	.0753554	0.40	0.690	-.1228744	.183407
_cons	.0140573	.0077575	1.81	0.079	-.0017077	.0298224

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. estat bgodfrey , lags(1/6)
```

Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	1.396	1	0.2374
2	15.083	2	0.0005
3	15.301	3	0.0016
4	15.334	4	0.0041
5	18.252	5	0.0026
6	19.588	6	0.0033

H0: no serial correlation

- Model including 2 lagged values of the cointegrated variables.

D.Ln_Ct_Exp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
err4						
L1.	-.4735295	.1963	-2.41	0.021	-.8705838	-.0764752
Ln_DomY_per						
LD.	-.1805833	.3329138	-0.54	0.591	-.8539649	.4927984
L2D.	.0925053	.3412102	0.27	0.788	-.5976574	.782668
r						
LD.	-.0002414	.0003442	-0.70	0.487	-.0009377	.0004549
L2D.	.0000572	.0003464	0.17	0.870	-.0006435	.0007578
Ln_Man_VAT_per						
LD.	.33938	.3168981	1.07	0.291	-.3016068	.9803669
L2D.	-.0974367	.2955957	-0.33	0.743	-.6953354	.5004619
Ln_HW_per						
LD.	.0113406	.0682466	0.17	0.869	-.1267012	.1493824
L2D.	-.0707023	.067512	-1.05	0.301	-.2072582	.0658535
_cons	.0154923	.0061701	2.51	0.016	.003012	.0279725

```
. estat bgodfrey , lags(1/6)
```

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	2.570	1	0.1089
2	10.337	2	0.0057
3	10.467	3	0.0150
4	10.522	4	0.0325
5	10.908	5	0.0532
6	11.883	6	0.0646

H0: no serial correlation

- **Model including 1 lagged values of the cointegrated variables.** (Selected specification for the ECM)

D.Ln_Ct_Exp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
err4						
L1.	-.4300723	.1822248	-2.36	0.023	-.7973222	-.0628225
Ln_DomY_per						
LD.	-.2008347	.280333	-0.72	0.478	-.7658086	.3641393
r						
LD.	-.0002671	.0003201	-0.83	0.408	-.0009121	.0003779
Ln_Man_VAT_per						
LD.	.3387102	.2549063	1.33	0.191	-.1750196	.8524401
Ln_HW_per						
LD.	.022209	.0632364	0.35	0.727	-.1052357	.1496537
_cons	.0139544	.0052846	2.64	0.011	.003304	.0246049

```
. estat bgodfrey , lags(1/6)
```

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	2.267	1	0.1322
2	4.654	2	0.0976
3	4.816	3	0.1858
4	5.553	4	0.2351
5	5.845	5	0.3216
6	7.442	6	0.2819

H0: no serial correlation

Annex 3A.

Description of the subgroups obtained after interacting terms.

Variable	Description	n	% total
Teenagers - low income	Households headed by individuals under 20 years of age, with a level of income in 1st quintile	268	0.2%
Teenagers - middle-low income	Households headed by individuals under 20 years of age, with a level of income in the 2nd quintile	247	0.2%
Teenagers - middle income	Households headed by individuals under 20 years of age, with a level of income in the 3rd quintile	158	0.1%
Teenagers - middle-high income	Households headed by individuals under 20 years of age, with a level of income in the 4th quintile	80	0.1%
Teenagers - high income	Households headed by individuals under 20 years of age, with a level of income in the 5th quintile	35	0.0%
Young - low income	Households headed by individuals aged between 20 and 29 years of age, with a level of income in the 1st quintile.	3681	2.4%
Young - middle-low income	Households headed by individuals aged between 20 and 29 years of age, with a level of income in the 2nd quintile.	4306	2.8%
Young - middle income	Households headed by individuals aged between 20 and 29 years of age, with a level of income in the 3thquintile.	3662	2.3%
Young - middle-high income	Households headed by individuals aged between 20 and 29 years of age, with a level of income in the 4th quintile.	2775	1.8%
Young - high income	Households headed by individuals aged between 20 and 29 years of age, with a level of income in the 5th quintile.	1756	1.1%
Mid age - low income	Households headed by individuals aged between 50 and 54 years of age, with a level of income in the 1st quintile.	2487	1.6%
Mid age - middle-low income	Households headed by individuals aged between 50 and 54 years of age, with a level of income in the 2nd quintile.	2633	1.7%
Mid age - middle income	Households headed by individuals aged between 50 and 54 years of age, with a level of income in the 3th quintile.	2942	1.9%
Mid age - middle-high income	Households headed by individuals aged between 50 and 54 years of age, with a level of income in the 4th quintile.	3702	2.4%
Mid age - high income	Households headed by individuals aged between 50 and 54 years of age, with a level of income in the 5th quintile.	4369	2.8%
Mature - low income	Households headed by individuals aged between 55 and 59 years of age, with a level of income in the 1st quintile.	2415	1.5%
Mature - middle-low income	Households headed by individuals aged between 55 and 59 years of age, with a level of income in the 2nd quintile.	2334	1.5%
Mature - middle income	Households headed by individuals aged between 55 and 59 years of age, with a level of income in the 3rd quintile.	2432	1.6%
Mature - middle-high income	Households headed by individuals aged between 55 and 59 years of age, with a level of income in the 4th quintile.	2820	1.8%
Mature - high income	Households headed by individuals aged between 55 and 59 years of age, with a level of income in the 5th quintile.	3612	2.3%
Pre-retirement - low income	Households headed by individuals aged between 60 and 64 years of age, with a level of income in the 1st quintile.	2547	1.6%
Pre-retirement - middle-low income	Households headed by individuals aged between 60 and 64 years of age, with a level of income in the 2nd quintile.	2125	1.4%
Pre-retirement - middle income	Households headed by individuals aged between 60 and 64 years of age, with a level of income in the 3th quintile.	2064	1.3%
Pre-retirement - middle-high income	Households headed by individuals aged between 60 and 64 years of age, with a level of income in the 4th quintile.	2203	1.4%
Pre-retirement - high income	Households headed by individuals aged between 60 and 64 years of age, with a level of income in the 5th quintile.	2712	1.7%

Retired - low income	Households headed by individuals aged between 65 and 69 years of age, with a level of income in the 1st quintile.	2506	1.6%
Retired - middle-low income	Households headed by individuals aged between 65 and 69 years of age, with a level of income in the 2nd quintile.	1797	1.2%
Retired - middle income	Households headed by individuals aged between 65 and 69 years of age, with a level of income in the 3th quintile.	1612	1.0%
Retrired - middle-high income	Households headed by individuals aged between 65 and 69 years of age, with a level of income in the 4th quintile.	1559	1.0%
Retired - high income	Households headed by individuals aged between 65 and 69 years of age, with a level of income in the 5th quintile.	1783	1.1%
Old - low income	Households headed by individuals aged between 70 and 74 years of age, with a level of income in the 1st quintile.	2251	1.4%
Old - middle-low income	Households headed by individuals aged between 70 and 74 years of age, with a level of income in the 2nd quintile.	1509	1.0%
Old - middle income	Households headed by individuals aged between 70 and 74 years of age, with a level of income in the 3th quintile.	1223	0.8%
Old - middle-high income	Households headed by individuals aged between 70 and 74 years of age, with a level of income in the 4th quintile.	1120	0.7%
Old - high income	Households headed by individuals aged between 70 and 74 years of age, with a level of income in the 5th quintile.	1171	0.8%
Elders - low income	Households headed by individuals aged between 75 and 79 years of age, with a level of income in the 1st quintile.	1749	1.1%
Elders - middle-low income	Households headed by individuals aged between 75 and 79 years of age, with a level of income in the 2nd quintile.	1078	0.7%
Elders - middle income	Households headed by individuals aged between 75 and 79 years of age, with a level of income in the 3th quintile.	868	0.6%
Elders - middle-high income	Households headed by individuals aged between 75 and 79 years of age, with a level of income in the 4th quintile.	775	0.5%
Elders - high income	Households headed by individuals aged between 75 and 79 years of age, with a level of income in the 5th quintile.	724	0.5%
Young - Poor region	Households headed by individuals aged under 20 years of age living in the poorest ares of Mexico (Oaxaca, Guerrero, and Chiapas *states)*	1,687	1.1%
Young - Rich region	Households headed by individuals aged under 20 years of age living in the richest ares of Mexico (States in and around Mexico City*)*	1,830	1.2%
Pre-retirement - Poor region	Households headed by individuals aged between 60 and 64 years of age living in the poorest ares of Mexico (Oaxaca, Guerrero, and Chiapas *states)*	1,099	0.7%
Pre-retirement - Rich region	Households headed by individuals aged between 60 and 64 years of age living in the richest ares of Mexico (States in and around Mexico City*)*	1,681	1.1%
Retirement - Poor region	Households headed by individuals aged between 65 and 69 years age living in the poorest ares of Mexico (Oaxaca, Guerrero, and Chiapas *states)*	889	0.6%
Retirement - Rich region	Households headed by individuals aged between 65 and 69 age living in the richest ares of Mexico (States in and around Mexico City*)*	1,287	0.8%
Pension - Poor region	Households located in the poorest ares of Mexico (Oaxaca, Guerrero, and Chiapas *states) receiving any amount of monetary pensions.*	1,102	0.7%
Pension - Rich region	Households located in the richest ares of Mexico (States in and around Mexico City*) receiving any amount of monetary pensions.*	3,246	2.1%

Remittances - Poor region	Households located in the poorest ares of Mexico (Oaxaca, Guerrero, and Chiapas *states) receiving any amount of remittances from abroad.*	972	0.6%
Remittances - Rich region	Households located in the richest ares of Mexico (States in and around Mexico City) *receiving any amount of remittances from abroad.*	502	0.3%
Housing wealth - Poor region	Households located in the poorest ares of Mexico (Oaxaca, Guerrero, and Chiapas *states) receiving any amount of income from housing wealth.*	780	0.5%
Housing wealth - Rich region	Households located in the richest ares of Mexico (States in and around Mexico City) *receiving any amount of income from housing wealth.*	1,405	0.9%
Pension - 1st quintile	Households receiving any amount of monetary pensions and whose level of income possitions them in the lowest income quintile.	1,939	1.2%
Pension - 3rd quintile	Households receiving any amount of monetary pensions and whose level of income possitions them in the middle (3rd) income quintile.	3,993	2.6%
Pension - 5th quintile	Households receiving any amount of monetary pensions and whose level of income possitions them in the upper (5th) income quintile.	7,298	4.7%
Remittances - 1st quintile	Households receiving any amount of remittances from abroad and whose level of income possitions them in the lowest income quintile.	2,142	1.4%
Remittances - 3rd quintile	Households receiving any amount of remittances from abroad and whose level of income possitions them in the middle (3rd) income quintile.	1,821	1.2%
Remittances - 5th quintile	Households receiving any amount of remittances from abroad and whose level of income possitions them in the upper (5th) income quintile.	1,040	0.7%
Housing wealth - 1st quintile	Households receiving any income from housing wealth and whose level of income possitions them in the lowest income quintile.	881	0.6%
Housing wealth - 3rd quintile	Households receiving any income from housing wealth and whose level of income possitions them in the middle (3rd) income quintile.	1,636	1.0%
Housing wealth - 5th quintile	Households receiving any income from housing wealth and whose level of income possitions them in the upper (5th) income quintile.	5,697	3.7%
Pension - Mature	Households headed by individuals aged between 55 and 59 years of age receiving any form of monetary pensions.	2,171	1.4%
Pension - Pre-retirement	Households headed by individuals aged between 60 and 64 years of age receiving any form of monetary pensions.	3,479	2.2%
Pension - Retired	Households headed by individuals aged between 65 and 69 years of age receiving any form of monetary pensions.	3,497	2.2%
Remittances - Mature	Households headed by individuals aged between 55 and 59 years of age receiving any amount of remittances from abroad.	790	0.5%
Remittances - Pre-retirement	Households headed by individuals aged between 60 and 64 years of age receiving any amount of remittances from abroad.	807	0.5%
Remittances - Retired	Households headed by individuals aged between 65 and 69 years of age receiving any amount of remittances from abroad.	715	0.5%
Housing wealth - Mature	Households headed by individuals aged between 55 and 59 years of age receiving any income from housing wealth.	1,321	0.8%
Housing wealth - Pre-retirement	Households headed by individuals aged between 60 and 64 years of age receiving any income from housing wealth.	1,234	0.8%
Housing wealth - Retired	Households headed by individuals aged between 65 and 69 years of age receiving any income from housing wealth.	928	0.6%

Annex 5A.

Main changes introduced for the 2008 and later editions of the National Household Income and Consumption Survey.

1. The non-monetary income and the non-monetary expense, are no longer presented separately.
2. Household income is disaggregated into a) Income from work; b) Rent of the property; c) Transfers; d) Imputed rent, and e) Other current income.
3. Income in kind is now presented within the income category to which they belong; Thus, transfers in kind are included in the transfer line, remunerations in kind, within the line of remunerations for subordinate work and self-consumption is included in the calculation of income from independent work.
4. The bonus is included for the first time within the income from work, under the heading of remunerations for subordinate work. The bonus, which was captured in annual terms, is added quarterly in the income calculation.
5. The self-consumption (and self-supply) carried out by the households of the goods they produce or market no longer appears within the tabulated income sources, as it is a component, among others, of the income from independent work. However, this variable is published in the new tabulated income from the businesses of households.
6. The gifts received by the homes of other households on a single occasion were excluded from current income, as they did not satisfy the requirement of regularity of the entries, necessary to consider them as income. These transfers are recorded within the section on financial and capital perceptions.
7. The Rent Estimation item for the home is presented as an independent item of income, since conceptually it is an entry different from the others, as it is an income from the production of services in the home for own consumption.

Annex B.

Box 4.1 The Breush-Godfrey test explained.

The Breusch-Godfrey test starts with an AR(1) process for the error term:

$$\widehat{\varepsilon_t} = \gamma_0 + \gamma_1 \varepsilon_{t-1} + \nu_t$$

By including the regressors (e.g. X_{1t} *and* X_{2t}) from the original equation into the auxiliary regression the error term (ε) is allowed to be determine by the independent variables' regressors, so (2.9) becomes (2.10):

$$\widehat{\varepsilon_t} = \gamma_0 + \gamma_1 \varepsilon_{t-1} + \delta_1 X_{1t} + \delta_2 X_{2t} + \nu_t$$

Making the test for γ_1 to be robust for the presence of endogenous regressors, particularly if we substitute X_{2t} for Y_{t-1} to allow our dependent variable to be part of the equation. It is possible to correct our model for the possibility of higher order AR process in (2.9) as it allows the error term at *t* to be correlated with the error terms at *t-5* as in (2.11)

$$\widehat{\varepsilon_t} = \gamma_0 + \gamma_1 \varepsilon_{t-1} + \gamma_2 \varepsilon_{t-2} + \gamma_3 \varepsilon_{t-3} + \ldots + \gamma_5 \varepsilon_{t-5} + \delta_1 X_{1t} + \delta_2 X_{2t} + \nu_t$$

In this case we have an interest to show that for all values of γ are equal to zero ($\forall\, \gamma = 0$) to show there is no serial correlation. That can be proved through an LM-statistic as (2.12)

$$LM = (N - p) * R^2$$

Where N is the number of observations, p is the p-*th* order expected in our serial correlation, and R^2 is the value of the auxiliary regression's *goodness of fit*. So under the null hypothesis of no serial correlation LM statistic is expected to be greater than the chi-squared distribution with p degrees of freedom, to conclude there is no serial correlation between the error term at time *t*, or any other errors at *t-1*, *t-2*, up until *t-5*.

Source: Lambert (2013)

STEP 1: As there is no direct way to restrict the coefficients of the alternative so as to obtain the null hypothesis. As such, we need to combine the null and the alternative as follow:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2\, tt + \mu_1 D_P + \mu_2 D_L + \varepsilon_t$$

STEP 2: Estimate the regression formed in step 1. Under the ***null*** of a **unit root**, the theoretical value of α_1 is unity. Whose value depends on the proportion of observations occurring prior to the break (λ) with $\lambda = \tau/T$. Where T is the total number of observations and τ the year of break occurrence.

STEP 3: Perform diagnostic checks to determine if the residuals from step 2 are serially uncorrelated. Otherwise use the augmented form:

$$y_t = a_0 + a_1 y_{t-1} + a_2 t + \mu_1 D_P + \mu_2 D_L + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_t$$

STEP 4: Calculate the *t-statistic* for the *null* of $\alpha_1 = 1$. With critical values slightly higher, in absolute terms to the corresponding Dickey-Fuller statistic.

Box 4.2. Perron test of stationarity with one time jump in the intercept

Annex C.

Box 4.3. The Engle-Granger methodology for cointegration test and error correction model (ECM) definition.

STEP 1: Pretest the variables for their order of integration. If the variables have not a similar order of integration they cannot be cointegrated.

STEP 2: Estimate the long-run equilibrium relationship in the form:

$$y_t = \beta_0 + \beta_1 Z_t + e_t$$

If the variables are cointegrated, an OLS regression yields "super-consistent" estimators of both parameters.

Estimate the value of the disturbance term $\{\hat{e}_t\}$ which contains the estimated values of the deviations from the long-run relationship. If this deviation is *stationary* then the variables are said to be cointegrated.

There is no need to include the intercept term. If we cannot reject the null hypothesis $(\beta_1 = 0)$, we *cannot reject the null hypothesis that the variables are not cointegrated.*

For the purpose of the previous analysis (ADF-test) consider a *t-critical* value of -3.398 at a 5% level of significance. If the residual do not appear to be *white-noise,* an augmented form of the test can be used by adding lag values of $\hat{e}_t$.

STEP 3. Estimate the error correction model of the form:

$$\Delta y_t = \propto_1 + \propto_Y [\, y_{t-1} - \beta_1 Z_{t-1}] + \sum_{i=1} \propto_{11} \Delta y_{t-i} + \sum_{i=1} \propto_{12} \Delta Z_{t-i} + \varepsilon_{yt}$$

$$\Delta Z_t = \propto_2 + \propto_Z [\, y_{t-1} - \beta_1 Z_{t-1}] + \sum_{i=1} \propto_{21} \Delta y_{t-i} + \sum_{i=1} \propto_{22} \Delta Z_{t-i} + \varepsilon_{Zt}$$

Where β_1 is equal to the parameter of the cointegrating vector in (1). Considering the magnitude of $\{\hat{e}_{t-1}\}$ is the deviation from long-run equilibrium at (t-1), it is possible to use it in (2) and (3). Making the ECM a VAR in first differences and the parameters can be estimated through OLS, the lags lengths can be determined using a χ^2-test, and the restriction that all $\propto_{jk} = 0$ can be checked using an F-test.

STEP 4. Assess model adequacy. Perform diagnostic checks regarding residuals are *white-noise*. $\propto_Y$ has to be negative and $\propto_Z$ has to be positive.

Box 2.3. The Engle-Granger methodology for cointegration test and error correction model (ECM) definition.

Annex D.

	$\hat{\varepsilon}_{t-1}$	Δ C t-1	Δ C t-2	Δ C t-3	Δ C t-4	Δ Y t-1	Δ Y t-2	ΔHW t-1	ΔHWt-2
Δ Ln Consumption per capita *t-1*	-0.600**	0.408	-0.690**	0.433		-0.237	-0.027	0.022	-0.044
	(-2.18)	(1.52)	(-2.53)	(1.42)		(-0.64)	(-0.08)	(0.26)	(-0.56)
	Δ FW t-1	Δ FW t-2	Δ FW t-3	Δ Manuf t-1	ΔManuf t-2	ΔManuf t-3	_cons	Δ r t-1	BG-test
	0.024	-0.064**	-0.001	0.182	0.347	-0.172	0.019**	-0.0002	0.9832
	(0.70)	(-2.13)	(-0.05)	(0.51)	(1.01)	(-0.66)	(2.25)	(-0.73)	
		Δ HW t-1	Δ HW t-2	Δ C t-1	Δ C t-2	Δ Y t-1	Δ Y t-2	Δ r t-1	
	1.305**	-0.032	-0.050	-0.029	-0.272	0.496	0.488	-0.005	
Δ HW *t-1*	(2.49)	(-0.19)	(-0.27)	(-0.05)	(-0.98)	(0.65)	(1.14)	(-0.61)	
	Δ FW t-1	Δ FW t-2	ΔManuft-1	_cons	BG-test				
	0.024	-0.0004	0.188	0.011	0.6707				
	(0.34)	(-0.00)	(0.27)	(0.61)					
	$\hat{\varepsilon}_{t-1}$	Δ FW t-1	Δ FW t-2	Δ FW t-3	Δ C t-1	Δ C t-2	Δ Y t-1	Δ Y t-2	
	2.736**	0.296*	0.454***	0.203	0.781	-0.508	0.543	0.806	
Δ FW *t-1*	(2.07)	(1.75)	(3.14)	(1.19)	(0.54)	(-0.77)	(0.31)	(0.80)	
	Δ r t-1	Δ HW t-1	ΔManuf t-1	_cons	BG-test				
	0.002	-0.567	0.001	-0.008	0.3478				
	(1.07)	(-1.24)	(0.00)	(-0.19)					
	$\hat{\varepsilon}_{t-1}$	Δ Y t-1	Δ C t-1	Δ C t-2	Δ C t-3	ΔFW t-1	ΔFW t-2	Δ FW t-3	
	-0.430*	-0.435	0.16	-0.139	0.225**	0.037	-0.066**	-0.010	
Δ Ln Income per capita *t-1*	(-1.74)	(-1.25)	(0.61)	(-1.40)	(-2.24)	(1.02)	(-2.37)	(-0.29)	
	Δ HW t-1	Δ r t-1	Δ r t-2	ΔManuf t-1	_cons	BG-test			
	0.005	-0.0004	0.0002	0.495	0.014	0.8172			
	(0.06)	(-1.10)	(0.62)	(1.61)	(1.64)				
	$\hat{\varepsilon}_{t-1}$	Δ Manuf t-1	Δ C t-1	Δ C t-2	Δ C t-3	Δ C t-4	Δ FW t-1	Δ FW t-2	
	-0.529**	0.847**	0.011	-0.103	0206*	0.113	0.077**	-0.077***	
Δ Ln Value Added Manufturing *t-1*	(-2.02)	(2.60)	(0.04)	(-0.79)	(1.78)	(0.98)	(2.13)	(-2.67)	
	Δ FW t-3	Δ r t-1	Δ Y t-1	Δ Y t-2	Δ HW t-1	_cons	BG-test		
	-0.036	-0.0008**	-0.842**	-0.185	-0.031	0.018*	0.1830		
	(-1.08)	(-2.06)	(-2.23)	(-0.92)	(-0.35)	(1.87)			

Table 4.A. Estimated coefficients for the first order VAR augmented cointegrated relations with the single lagged value of the regression residual (ε_{t-1}) for the cointegration equation using the logarithmic value of consumption per capita as the dependent variable. Values in parenthesis are t-values for standard errors. BG-test is the result from the Breusch-Godfrey test for serial correlation.

Annex E.

The *pseudo*-panel dataset composed by *T* independent cross-sections will be given by:

$$Y_{it} = \beta x'_{it} + \mu_i + \nu_{it}$$

With *i* corresponding to a new and most likely different set of *N*–randomly surveyed– households in each period *t*. Where *t* = 1, …, *T*. Meanwhile, x is the vector of covariates, with β is the set of estimators defined from the econometric procedure.
Considering a *C number of* cohorts, where each individual belongs to exactly one cohort, it is possible to average each group to get:

$$\bar{Y}_{ct} = \beta \bar{x}'_{ct} + \bar{\mu}_{ct} + \bar{\nu}_{ct} \qquad c = 1, \ldots, C\ ;\ t = 1, \ldots, T$$

Where $\bar{Y}_{ct}$ is the average of Y_{it} over all individuals belonging to cohort *c* at time t. Since the econometric relationship for the individual household includes a time invariant individual fixed effect, the corresponding relationship for the cohort will include a fixed cohort effect as well. Now $\bar{\mu}_{ct}$—the average number of individuals belonging to cohort *c* at time *t*—varies with *t* as it is now most likely correlated with x_{it} and a random effect specification could lead to inconsistent estimates.

Treating the $\bar{\mu}_{ct}$ as fixed effects leads to an identification problem, unless $\bar{\mu}_{ct} = \bar{\mu}_c$ and its invariant over time.

Box 6.1 *The* Fixed-Effect econometric procedure. Source (Baltagi, 2003, pp.189-192)