ERASMUS UNIVERSITY ROTTERDAM

MASTER THESIS

The Wealth Effects of Housing- and Stock Market Wealth on Consumption Expenditure: A Cross Country Analysis

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ABSTRACT

Since the housing- and stock market seem to be recovering after the crash caused by the financial crisis of 2008, the interest in the relationship between housing- and stock market wealth effects and consumption expenditure has revived. As such, this thesis takes a macroeconomic approach to address those linkages. A panel of 16 industrialized countries with annual observations from 1975 to 2016 is constructed, in which the housing market wealth variable is imputed using country specific homeownership rates. The housing- and stock market wealth effects are estimated by regression models in fixed effects levels, first differences and in an error correction model. A statistically significant and large housing market wealth effect is found with an elasticity of at least 0.1. On the other hand, no significant stock market wealth effect is found. Furthermore, no increase in wealth effects over time is found, however, the most recent time period (2001-2016) shows that wealth effects are near an all-time high. In addition, it hasn't been found that the household behavior regarding wealth effects has significantly changed after experiencing the financial crisis. Moreover, it is found that wealth effects are symmetrical and thus house price decreases have significant effects on decreases in consumption expenditure. Those findings combined give a vital perspective as to how households behave with respect to wealth effects and give wider implications for the aggregate economy. Finally, some policy advice is given with regards to consumption expenditure and wealth effects.

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1. INTRODUCTION

The dramatic volatility in both stock prices as well as housing prices experienced in the last two decades has renewed interest into their relationship with consumption expenditure, and thereby, their impact on the economy. Most researchers find a positive relationship between changes in either housing market wealth or stock market wealth and changes in consumption. Therefore, in periods of economic booms, this can result in increased economic activity. However, in periods of economic downturns, a collapse of housing prices can lead to a deep recession, a significant increase in unemployment rates, a slowdown of economic activity and reduced consumer spending (Ludwig and Slok, 2002).

As the global economy seems to have recovered from the financial crisis, it's of importance to know whether in a next crisis, in which house- and stock prices would decrease, the housing market- and stock market wealth effect (the relationship between housing market- and stock market wealth and consumption expenditure) will have a similar impact on the economy. However, most of the studies date from before the global financial crisis of 2007-2009. There is reason to believe that the behavior of households, and therefore, the ''wealth effects'', have changed after the financial crisis. Moreover, the results obtained by earlier studies done on this topic vary significantly and ultimately can be seen as inconclusive. For example, Case, Quigley and Shiller (2005) analyze wealth effects for both the stock- and housing market and find a strong significant effect of housing market wealth, while finding almost no evidence for a stock market wealth effect. On the other hand, Tan and Voss (2003), found an insignificant housing wealth effect, however, they did find a sizeable significant long-run effect of stock market wealth, which again is different from the findings of Dvornak and Kohler (2007). They find for both housing- and stock market wealth a significant effect, however, a stronger effect is found for stock market wealth.

In order to address the inconclusivity of previous research, this thesis aims to gain insight in what the wealth effects, of both the housing market and the stock market, are on consumption expenditure. Furthermore, this thesis addresses whether a change in effects is observable after the financial crisis, which hasn't been researched yet and whether effects have changed over time. Finally, this thesis researches whether wealth effects are more prominent in economic downfalls than in upswings.

1.1 LITERARY CONTEXT

At the moment, most studies that estimate both the effect of a change in housing wealth as well as a change in stock market wealth generally result in one of the coefficients being insignificant. First of all, Dvornak and Kohler (2007), who use a panel of Australian States to research how changes in household wealth affect consumption expenditure, find a significant effect for both housing market wealth as well as stock market wealth. However, it is found that stock market wealth has a significantly larger effect than housing wealth, which is in contrast with other studies. For example, Case et al. (2005), who conduct both an international cross-country analysis as well as an additional US state level study, find a statistically significant large effect of housing wealth on consumption for both the international- as well as the US dataset. However, they find at best weak evidence of a stock market wealth effect. Another study, by Ludwig and Slok (2002), finds the opposite result, namely, a significant positive long-run impact of stock market wealth on private consumption. They split up countries in bank-based and market-based economies and conclude that the stock market wealth

effect is larger in market-based economies and they find an ambiguous effect of housing market wealth on consumption expenditure.

Moreover, all those studies date from before the financial crisis. Case et al. (2013) redid their 2005 study in 2013 with more recent data, in this newer study, however, they only focused on US-state level data and did not conduct an international analysis. Another research, by Carroll, Otsuka and Slacalek (2011), seems to be a post-financial crisis paper, however, similar to Case et al. (2013) it only analyses US data, albeit in a different method.

1.2 RELEVANCE

Within the current context in the literature, a couple of problems arise that have not been properly addressed by previous studies. **First** of all, the current literature is inconclusive regarding the wealth effects. Most research find one of the wealth effects insignificant and most studies disagree on which wealth effect this is. **Second**, even though the literature on wealth effects on consumption is not necessarily scarce, there has barely been any research on the topic after the global financial crisis. This is of importance since financial development in the form of second loans, which are generally used when extracting wealth from housing wealth, peaked with the financial crisis. **Third**, in light of a possible next financial crisis, none of the studies have properly addressed whether wealth effects in economic busts are stronger than in economic booms and whether this effect has increased over time. If it's the case that the wealth effects have increased over time and are stronger in downturns than in upswings, those might be worrying signs for a next financial crisis and the economic impact of collapsing housing prices. **Finally**, most of the research that has been done doesn't appropriately address a possible endogeneity problem. Case et al. (2005) regress the current change in consumption on the current change in income, housing market- and stock market wealth. It is possible that correlations in both variables are determined by an external factor, such as macroeconomic prospects, while it is of interest to isolate the wealth effects from other factors (Calomiris, Longhofer and Miles, 2009). This can lead to an endogeneity problem, which, in turn, will lead to inconsistent estimates.

1.3 THESIS AIM

This thesis takes a macroeconomic view to investigate the effect of international housing wealth and stock market wealth on consumption (expenditure). As in previous studies, the wealth effect is going to be tested in an international framework by using datasets on international housing markets. This cross-country analysis aims to add renewed empirical evidence on the relationship between wealth effects and consumption expenditure by analyzing what the effects are, whether they have changed over time, whether a difference is observable after the financial crisis and whether effects are stronger in economic downturns than in upswings.

To address the topics of interest, as expressed above, the following research question is defined:

''What are the effects of housing market- and stock market wealth on consumption expenditure?''

Furthermore, three sub-question are formulated:

- *''Have the wealth effects significantly changed over time?''*

- *''Is there a significant difference in wealth effects between pre- and post-financial crisis?''*

- *''Are the wealth effects stronger in economic downfalls than in upswings?''*

To answer those questions a panel of 16 industrialized countries is assembled, with annual observations from 1975 through 2016. Largely following the methods of Case et al. (2005), this thesis imputes the aggregate value of owner-occupied housing, the value of stock market capitalizations and aggregate consumption for each country. The regression models are estimated in levels and first differences using fixed effects. By using an estimated measure of housing wealth, which is based on actual house price indices and the number of owner-occupied houses, the number of observations are increased in this thesis, which increases the power of the tests. Furthermore, instrumental variables are used to address possible endogeneity.

In addition to providing theoretical relevance, this study provides important policy implications as well because different wealth effects require different policies. For example, Barrell, Costantini and Meco (2015) researched the housing wealth effects in both the UK and Italy and found significant housing wealth effects for the UK, however, none for Italy. They stated that for the UK policy implications concern limits on loan to value and loan to income ratios, as those are seen as the drivers of cycles in house prices. Those limits could contribute to reducing the cycle in economic activity in the UK. Furthermore, it might constrain bad lending by banks and reducing the probability of a banking crisis, which would have a bigger impact in countries with high housing wealth effects. Since in Italy the housing wealth effect is not significant, those measures are less needed.

1.4 ROADMAP

The next section gives a literature review of previous studies on consumption and wealth. **Section 3** takes a temporary microeconomic view to explain the transmission channels from wealth to consumption, after which the conceptual framework is outlined that is crucial to understanding the relationships between consumption, income, stock market- and housing market wealth as well as savings behavior of households. **Section 4** describes the empirical approach of this thesis, the data and its sources, imputations and computations of the data to construct the panel, in addition some estimation concerns are addressed after which the estimation strategy will be elaborated on. **Section 5** presents the statistical results whereas **section 6** discusses those results in relationship with other findings and the earlier specified conceptual framework and gives some policy implications of wealth effects. **Section 7** concludes.

2. LITERATURE REVIEW

In this chapter the literature is reviewed for both studies that only research either a stock market wealth effect or a housing market wealth effect as well as studies that research both simultaneously. The chapter first starts broadly by explaining the life cycle theory hypothesis and then gradually moves towards studies that are similar to this thesis. The chapter concludes by summarizing the literature and identifying gaps that are found, which eventually are the basis for the research questions of this study.

LIFE CYCLE THEORY

One of the earlier theories which address the effect of changes in wealth on changes in consumption is the life cycle savings hypothesis, going back to Ando and Modigliani (1963). The general idea of this theory is that consumers react in the same way to any kind of wealth increase. This means that consumers will distribute increases in wealth over time and, whether the increased wealth is expressed in increased housing market wealth, stock market wealth or else, the marginal propensity to consume out of this increased wealth is the same, a number slightly larger than the long run risk-free real interest rate. However, quantifying the exact wealth effects of both the housing- as well as the stock market in this way is rather simplistic and would not be a substitute for research dedicated specifically to the empirical relationship between consumption and wealth.

2.1 EVIDENCE FOR A STOCK MARKET WEALTH EFFECT

The literature on a stock market wealth effect can, broadly, be split up in two categories. Studies done base on micro data, where most of the studies use data from surveys in combination with economic data to assess household behavior towards changes in stock market wealth, and studies that are done based on aggregate time series data, of which this thesis is one.

STUDIES BASED ON MICRO DATA

Dynan and Maki (2001) used data at the household-level from the Consumer Expenditure Survey (1983-1989) to analyze household behavior regarding stock market wealth and consumption. They hypothesize two different possible links between wealth and consumption, a direct wealth effect and an indirect wealth effect. The direct wealth effect suggests that stock market wealth directly influences households' budget sets, while the indirect wealth effect, which is non-causal, is where households experience changes in the stock market as a signal of future changes in income of which they base their consumption (confidence channel). Based on this analysis, they found the direct wealth effect to be significant and to increase consumer spending for a number of quarters. However, the indirect wealth effect was not found to be significant. Aside from this, Dynan and Maki (2001) estimate the marginal propensity to consume out of wealth, for households with reported holdings of $100,000 or more, to be between 5 cents and 15 cents for every additional dollar in wealth.

Starr-McCluer (2002) studies data on individual households from a 1997 Michigan SRC Survey of Consumers. This survey asked qualitative questions about consuming and saving behavior of households following increases in stock market prices. The majority of the respondents reported that their consumption behavior did not change following any trend in stock prices. However, respondents with reported holdings in excess of $250,000 were more likely to increase their consumption expenditure following an increase in stock prices. Based on the latter finding, this research concluded

that there is a modest wealth effect of the stock market on consumption expenditure. Another research that uses the 1997 Michigan Survey is by Otoo (1999), where no significant difference is found between the sentiment of stockholders and the sentiment of non-stockholders regarding stock market movements. Even though research based on micro-data hasn't been done in a large quantity, the results still seem to vary significantly. Moreover, there isn't a conclusive answer as to what the stock market wealth is estimated to be.

STUDIES BASED ON AGGREGATE TIME-SERIES DATA

One of the earlier studies done based on aggregate time series data, by Laurence Meyer and Associates (1994), provides a set of estimates for four different components of consumption: nondurables, services, non-auto durables and durables. Their results suggest that a $1 increase in equity values raises consumption in the next quarter with 2 cents, while a $1 increase in non-stock market wealth would raise consumption with 1.4 cents in the next quarter. However, the long-run impact of a $1 increase in stock market wealth increases consumption with 4.2 cents, while an analogous increase in non-stock market wealth raises consumption with 6.1 cents. A similar result is found by Brayton and Tinsley (1996), who suggest that the marginal propensity to consume out of non-equity (.075) is indeed larger than out of other components of wealth (.030).

Since each model may have other assumptions and other ways to measure explanatory and independent variables the estimates for marginal propensities to consume out of wealth varies across models, and thus, studies. Ludvigson and Steindel (2002), for example, find different estimates. They estimate the effect (or elasticity) of wealth on consumption to be .040 for their full sample (1953-1997). When splitting their dataset in different sub-periods, they estimate a larger effect for the period of 1976-1985 (.106) than for the adjacent periods.

A different approach for assessing a direct wealth effect is taken by Poterba and Samwick (1995). They examine whether increases in stock prices influence the share of aggregate spending devoted to goods that are consumed mainly by high-income households, luxury goods. They identify several goods that can be classified as luxury goods – new cars, hotel and motel spending, domestic services and entertainment. From those goods, they only find a significant relationship between spending on new cars and stock price movements. They argue that a possible reason for this could be that the stock market serves as a predictor, or forecasts, consumer demand.

Case et al. (2005) examine the link between increases in financial wealth and consumer spending by assembling a panel of 14 countries over a period of 25 years, with annual observations, and a panel of US states, quarterly observed. They find different results depending on the econometric specifications, however, they find at best weak evidence of a stock market wealth effect. On the other hand, Dvornak and Kohler (2007) find that a permanent $A1 increase in stock market wealth increases consumption in the long run by 6-9 cents. Similar to Case et al. (2005) they use state level data, however, they assemble a panel of Australian states. Even though the results are Australia-specific, their findings show the heterogeneity in findings in the literature.

Most of the research done based on aggregate time series data seems to be less heterogeneous than the studies done based on micro-data. There seems to be a consensus of a presence of a stock market wealth effect, except for Case et al. (2005). However, as said above, the estimates vary since different studies uses different methods to estimate the stock market wealth and there is debate as to whether a stock market wealth effect is stronger than a non-stock market wealth effect.

2.2 DIFFERENCE BETWEEN STOCK MARKET- AND HOUSING MARKET WEALTH EFFECTS

Going back to the life cycle savings theory by Ando and Modigliani (1963), which is mentioned earlier, one might expect the marginal propensity to consume out of stock market wealth to be similar to that of housing wealth. However, there are many reasons why households may react differently towards different types of wealth. Both Case et al. (2005) and Dvornak and Kohler (2007) list various arguments as to why stock market wealth may be perceived differently than housing market wealth.

First, different kinds of wealth may have differences in liquidity. For example, it might be easier to quickly sell or buy shares while, in contrast, it may be difficult to liquidate or sell a house quickly. Moreover, the transaction costs involved with liquidating a house, or a part of it, tend to be high (Dvornak and Kohler, 2007). However, financial innovation, which has made extracting home equity loans easier, has likely increased the liquidity of housing assets, which, in turn, is found to have increased housing equity withdrawals (Muellbauer and Lattimore, 1999).

Second, households consider housing both as an asset as well as a consumption item. Increases in house prices do not necessarily mean that households are able to consume more of other goods, since the cost of housing services increases at the same time (Poterba, 2000). Only if households are willing to move into smaller or less expensive housing, they can realize the increased value of housing. However, not many households seem to be willing to do this, most are rather intending to leave their houses as bequests.

Third, housing wealth and stock market wealth are disproportionally concentrated across income groups. Stock market wealth tends to be mainly held by the high income groups, while housing wealth is often held by consumers from all income classes. This is best portrayed by the often larger stock market wealth effects found for the US than for Europe, as US share ownership is more distributed across income classes (Dvornak and Kohler, 2007). A more evenly distributed housing wealth, across all income classes, would cause the housing wealth effect to have a larger impact on consumption.

Fourth, different kinds of wealth may be experienced in a different way by households as to whether they view certain increases in wealth as permanent or temporary and uncertain. This could be because of past experiences of consumers with certain types of wealth. If an increase is seen as permanent, only then it is more likely that households would increase their long run consumption (Dvornak and Kohler, 2007).

Fifth, depending on the type of wealth it might not be easy for households to measure their (increased) wealth. For example, households may not always know what the value of their house is at any given time while asset prices can be measured with more precision and ease. At the same time, some argue that some asset prices, such as pension funds, are difficult to measure for consumers until they are close to retirement age (Dvornak and Kohler, 2007).

Finally, consumers may frame certain assets differently, from a physiological point of view. Accumulation of housing wealth, for example, may be considered as an end itself, an asset that can be seen as a sign of status (Dvornak and Kohler, 2007), or that can be considered as a hedge against uncertainties in life. Schifrin and Thales (1988) argue that consumers may physiologically frame certain assets to be appropriate for current consumption expenditures, while other are framed as long-term savings.

Each of these factors suggest that there is a distinction between the housing wealth effect and the stock market wealth effect on consumption. Ultimately, it is an empirical question which of those effects is more prominent, and thus whether there is a difference between both wealth effects.

2.3 EVIDENCE FOR A HOUSING MARKET WEALTH EFFECT

Similar to the studies done a stock market wealth effect, the studies on a housing market wealth effect consist of both studies done using micro data or based on data with aggregate time series data.

STUDIES BASED ON MICRO DATA

An increasing number of studies is using household-level data to research the relationship between changes in housing wealth and changes in consumption. One of the main topics of interest in this research is to study how households react to changes in their housing wealth. Over time, empirical studies have found differing marginal propensities to consume out of housing wealth.

One of the more recent studies, by Bostic, Gabriel and Painter (2006), which uses US micro-data over the 1989-2001 period, estimates the elasticities of consumption out of both housing- and stock market wealth. They find the marginal propensity to consume out of housing wealth (0.06) to be significantly larger than the MPC for stock market wealth (0.02).

Campbell and Cocco (2007) used micro data on the United Kingdom obtained from the UK Family Expenditure Survey, in addition to data on regional home price indexes, to study what the household response is on changes in home values. They made a distinction between responses of homeowners and renters and a distinction between young homeowners and old homeowners. They didn't find a significant impact among renters. However, for the homeowners, they found a small, positive, significant consumption response of young homeowners to changes in house prices and a large positive response for old homeowners.

Similar to Campbell and Cocco (2007), Attanasio, Blow, Hamilton and Leicester (2009) use data at the household level obtained from a British survey, however, they do not find a wealth effect related to house prices. Thereby, in particular, dismissing the notion of a large housing wealth effect. Three main hypotheses are proposed for the correlation between housing and consumption: a direct housing wealth effect, the relaxation of credit constraints and common factors that influence house prices and consumption at the same time. In contrast to Campbell and Cocco (2007), it is found that the impact of house prices on consumption is stronger for younger than for older households. Since among older households more own their houses than among the younger households, who are more likely in a position to be saving for buying a home, this finding cast doubt on a straightforward wealth effect. Even more so, in theory, the younger households might experience a negative wealth effect in the future. Since increased house prices makes purchasing a home more expensive for them, and therefore, younger renters must increase their savings, which will offset increased consumption caused by current owners.

This possibility, that current house price increases increase savings of renters who, because of the increased house prices face higher down payment requirements to purchase a house, was researched by Sheiner (1995). However, the results found were inconclusive. Yoshikawa and Ohtake (1989) found a more suggestive relationship. Their results suggest that Japanese renter households who were planning to purchase homes had higher savings rates with increasing land prices. However, the amount of households planning to purchase homes was significantly lower with higher land prices.

Therefore, the net effect of higher land prices was increased consumption by both renters as well as owners.

Engelhardt (1994) researched the same relationship, however, in Canada. He found that in the case of higher house prices, renters significantly saved less for a down payment. An increase in house prices of $4000 was found to decrease the probability of saving for a down payment by one percentage point. Furthermore, households who are saving for purchasing a home were found to have S1200 less in accumulated assets for a $4000 increase in house prices. From those studies, it appears that higher house prices, instead of increasing, may reduce net savings of renters.

Furthermore, Engelhardt (1996) tested whether there was a direct link between house price appreciation and the consumption of current homeowners, using the Panel Study of Income Dynamics (PSID). The marginal propensity to consume out of housing wealth increases, for homeowners, was estimated to be around 0.03. However, this result arose from asymmetry in behavior responses to housing capital gains. Households experiencing real capital losses reduced their savings, while households experiencing capital gains did not change either their savings or consumption behavior.

Most of the above stated micro studies rely upon estimates of housing values made by homeowners themselves. Even though there is evidence that bias in owners' estimates is, relatively, small, it is also found that those same estimates usually have high sampling variances (Kain and Quigley, 1972; Goodman and Ittner, 1992). Therefore, those studies might leave ambiguity in the interpretation of their results, even though most of the studies seem to agree that there is presence of a positive housing wealth effect. Therefore, next to studies based on micro data, there is a sizeable amount of work done based on aggregate time-series data, which follows hereafter.

STUDIES BASED ON AGGREGATE TIME-SERIES DATA

One of the most well-known studies that research the link between housing wealth and consumption with aggregate time-series data is the FRB/US model, used by the Federal Reserve to analyze the US economy. A part of the model describes household consumption behavior as a function of total wealth. The marginal propensity to consume out of wealth is estimated to range between 5 and 10 cents for an additional dollar of wealth (Brayton and Tinsley, 1996).

Poterba (2000) reviews a variety of prominent studies that have researched and provided estimates of the housing wealth effect. The consensus from the literature based on time-series data is similar to the conclusions of the earlier mentioned FRB/US model. Most studies find a significant housing wealth effect, where some find smaller elasticities for housing wealth and others find the opposite.

Studies that have been done more recently, in general, find similar results to the empirical literature from the 1990s, those reviewed by Poterba (2000). Using US data Carroll et al. (2011) employ a time-series based method that exploits the stickiness of consumption growth to differentiate between immediate and eventual wealth effects**.** They estimate the immediate marginal propensity to consume from a $1 change in housing wealth to be around 2 cents, with a final effect estimated to be around 9 cents, which is found to be larger than wealth effects arising from financial wealth.

Case, et al. (2005) estimate the relationship between housing wealth, financial wealth and consumption expenditure in two panels: a panel of developed countries and a panel of US states. According to the estimates for the panel of developed countries a 1 percent increase in housing wealth increase consumption by 0.11 percent. For the panel of US states, and updated version was conducted

by Case et al. (2013) and elasticities of consumption to housing wealth were estimated to range from 0.03 to 0.18 with a central estimate of 0.08.

Despite evidence suggesting there to be a significant housing wealth effect, which is often found to be larger than the stock market wealth effect, the literature does not speak with one voice. Ludwig and Slok (2004) estimate the effects of both financial- as well as housing wealth in a panel of 16 OECD countries. They find a larger effect of financial wealth than housing wealth and find some evidence of increasing wealth effects over time. A study by Dvornak and Kohler (2007), which estimates the wealth effects of financial as well as housing wealth, however, only using Australia state-level data, also finds a larger financial wealth effect than housing wealth effect. Furthermore, Girouard and Blondal (2001) don't find consistent results across countries. In some countries the housing wealth effect seems stronger, while in others the financial wealth effect is found to be stronger. Moreover, in some countries neither wealth effect was found to be significant.

Others argue that some estimates are overstated because credit liberalization is not taken into account and controlled for when estimating. Aron and Muellbauer (2006) took this into account and found a lower estimated elasticity out of housing wealth. They concluded by reporting that the marginal propensity out of housing wealth increased with credit liberalization.

Even though there is a sizeable amount of research done using time-series data, there are good reasons to be skeptical of the results. First of all, movements in asset prices are not fully exogenous fluctuations. Many of the factors affecting asset prices are the same factors that affect consumption, with one of the main factors being overall macroeconomic prospects. For example, Case et al. (2005) regress current changes in consumption on the current change in income, housing and stock market wealth, without controlling for shocks related to permanent income. According to Calomiris et al. (2009) this causes a problem of endogeneity because in this specification they do not control for shocks related to permanent income (such as overall macroeconomic prospects), while it is possible that the estimated results are driven by correlations between permanent income shocks and house price fluctuations. This means that when house prices are rising, it is in addition to being an indicator of past income growth also an indicator of expectations of future income growth, which may cause increasing house prices.

Hence, using current changes in housing or stock market wealth as regressors leads to inconsistent estimates since changes in expected permanent income (and in current income) will be in the residual, which is expected to be highly correlated with changes in housing and stock market wealth. Calomiris et al. (2009) controlled for this bias by using instrumental variables and they found a small, insignificant, housing wealth effect on consumption.

2.4 CONCLUDING REMARKS

Stepping back from the various studies that have been done on the housing wealth effect, perhaps the simplest conclusion is that most of the evidence seems to point towards there being a presence for a housing market wealth, even though there is significant debate as to whether it is larger than the financial wealth effect and whether the right conditions are controlled for (endogeneity, credit liberalization). However, it remains not easy to give a decisive empirical answer. The difficulty in finding an answer depends on which statistical techniques have been used, mainly with respect to controlling for the conditions that arise with an endogeneity problem. This, in part, also explains why the results for both the financial- as well as the housing market wealth effect vary and there is

significant disagreement as to whether there is a difference in the size of the effect, and thus, which is stronger. Next to the need of assessing what the wealth effects are, another concern that becomes clear after reviewing the literature is whether the wealth effects have changed over time and whether they have increased over time, since most studies don't specifically test for increasing wealth effects over time. Furthermore, a gap in the literature is found in studies that have been done after the financial crisis, most studies date from before 2008-2010. The concerns that arise from the literature lead to a number of questions that this thesis will address and will, ultimately, provide both economic policy makers and businesses with valuable information about the relationship between wealth and consumption.

3. TRANSMISSION CHANNELS & CONCEPTUAL FRAMEWORK

Even though this study takes a macroeconomic approach to research the housing- and stock market wealth effects on consumption expenditure, it's vital to understand how wealth exactly flows towards consumption. Therefore, this chapter, briefly, zooms into the microeconomic view, in which it is explained how consumers might react towards increases in their wealth. Those transmission channels make it clear how wealth flows from the housing market or stock market to consumption and whether the links are expected to be either positive or negative. Thereafter, it's possible to assemble a conceptual framework, in which the links between all the variables in this thesis are hypothesized, which has its fundaments in the transmission channels of wealth. Finally, this chapter concludes with the formal hypotheses with respect to the research question and the sub-questions.

3.1 TRANSMISSION CHANNELS OF WEALTH TO CONSUMPTION

Ludwig and Slok (2002) list four different transmission channels for stock market wealth and five different transmission channels for housing market wealth, all of which will be elaborated below.

CHANNELS OF TRANSMISSION FOR STOCK MARKET WEALTH

Realized wealth effect: If consumers realize the gains they have made when their stock holdings have increased then they can increase their level of consumption. This is especially the case when the stock holdings of consumers are defined as liquid assets. It is indeed found that marginal propensity to consume out of illiquid assets, for instance retirement accounts, is lower than for liquid assets (Ludwig and Slok, 2002).

Unrealized wealth effect: Increasing stock prices can influence the expectations of consumers of which they base their future consumption. Consumers expect the value of their retirement accounts (and other locked-in accounts) to go up and without realizing the gains they base their increased consumption (Ludwig and Slok, 2002).

Liquidity constraints effect: Investors can take out loans against the value of the portfolios they hold. In case of an increase in stock market prices their portfolio values increase as well, which allows them to borrow more against the value of this portfolio (Ludwig and Slok, 2002).

Stock option value effect: Next to regular stock holders, stock options owners also benefit from increased stock prices, since an increase in stock prices increases the value of their stock option portfolio. As a result, this can lead to increased consumption for stock option owners. Similar to regular stock holders, the increased consumption can be channeled through both realized and unrealized capital gains (Ludwig and Slok, 2002).

The transmission channels listed above mainly point towards a positive wealth effect of increased stock prices on consumption. Each of those channels has a different marginal propensity to consume out of additional stock market wealth. However, overall it seems that an increase in stock prices would, in theory, lead to an increase in consumption.

CHANNELS OF TRANSMISSION FOR HOUSING MARKET WEALTH

Realized wealth effect: The lifecycle model of household consumption argues that a permanent increase in housing wealth leads to an increase in household consumption and borrowing when

homeowners smooth consumption over the life cycle. Next to this wealth effect, there is an associated effect of increased house prices: since using houses as collateral for loans is common practice, homeowners are enabled to enhance their borrowing capacity, which induces them to spend and borrow more as a consequence (Goodhart and Hoffman, 2008).

Unrealized wealth effect: If homeowners don't take out loans to refinance or sell their house they won't realize their capital gains. However, similar to the unrealized wealth effect for stock market wealth, this can play a role in the 'expectation' channel. This means that homeowners expect their net wealth to have increased and they expect themselves to be ''richer'' of which they base their consumption expenditure (Ludwig and Slok, 2002).

Budget constraint effect: An increase in house prices does not only have a positive wealth effect for landlords and homeowners, it also has a negative impact on the private consumption of non-homeowners (renters). As house prices increase, rents are expected to increase as well, this means that budget constraints for renters become tighter. As a result, this leads to decreased consumption which can also be reasoned as a realized capital loss channel. This channel is also relevant for homeowners, since increased house prices are expected to increase housing services/expenditures as well, which offsets some of the increased consumption as a consequence of increasing house prices (discussed above: realized wealth effect) (Goodhart and Hoffman, 2008).

Liquidity constraints effect: The liquidity constraints effect is mainly related to whether the financial system is functioning well or not. Homeowners who want to take out loans against the increasing value of their homes are dependent on the accessibility of credit, which depends on the functioning of the financial system. A financial system where credit is constrained will ultimately lead to lower possibilities of consumption increase in the case of increasing house prices and thus lower housing wealth effects (Goodhart and Hoffman, 2008).

Substitution effect: Future first time homeowners who are saving to purchase a home, will have to increase their savings in the case of increased house prices. Their increased savings mean that future homeowners either decrease their (current) consumption or have to purchase a smaller house. Increased house prices will therefore only benefit current homeowners, while those who have yet to buy a home lose.[1] (Ludwig and Slok, 2002).

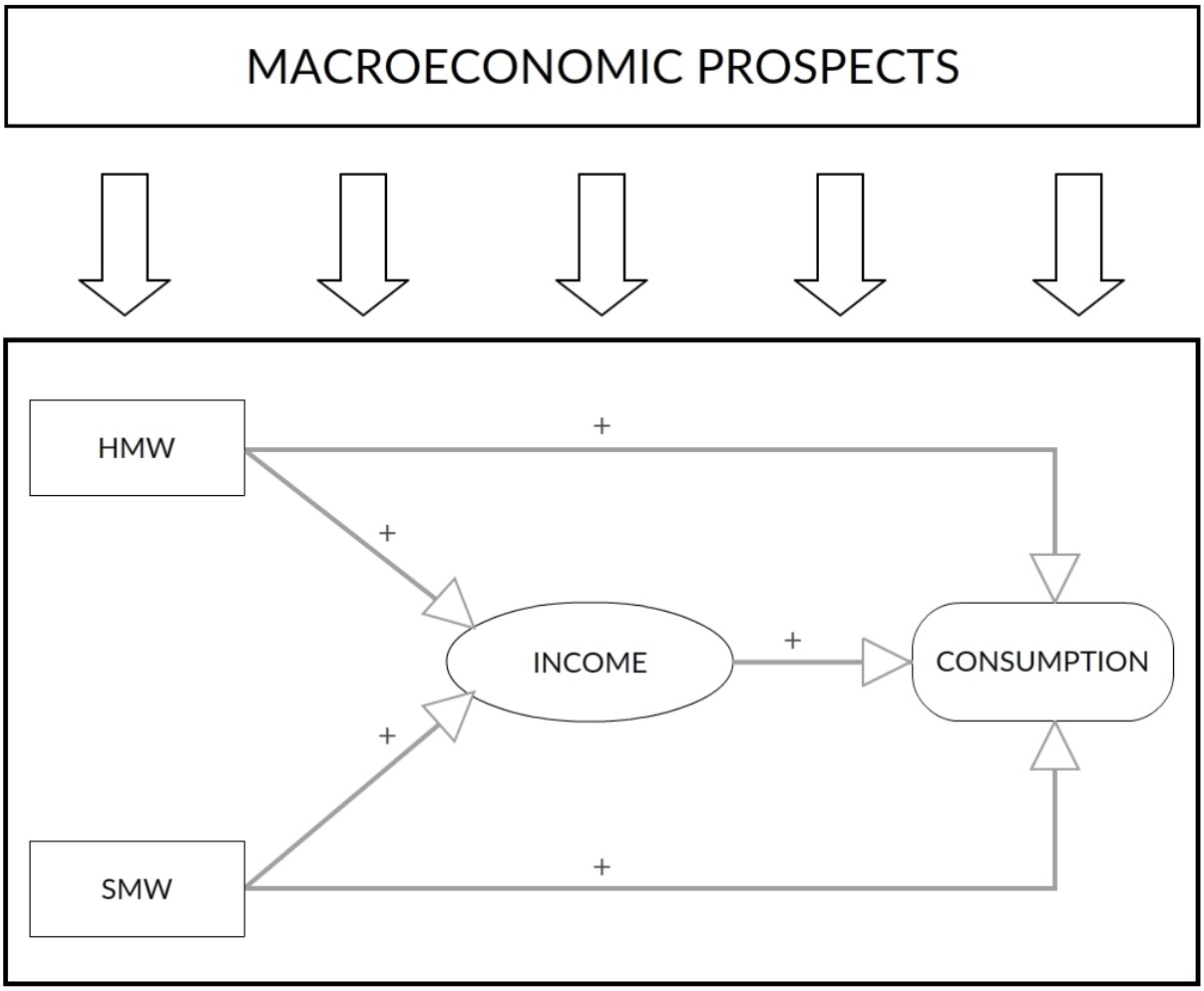
Both the realized and unrealized wealth effect are expected to increase consumption through increased house prices, however, the realized wealth effect is expected to have a higher marginal propensity to consume. On the other hand, the budget constraint and the substitution effect are expected to negatively impact consumption in the case of increased house prices.

All in all, while the stock market wealth transmission channels seem to point to a positive relationship between increases in stock market wealth and increases in consumption, the housing market wealth transmission channels seem more ambiguous. In the end, the above listed transmission channels are merely theoretical and don't allow for definitive conclusions about the relationships between wealth and consumption and ultimately, the issue has to be addressed empirically. The section hereafter explains the conceptual framework, in which the transmission channels are integrated into a theoretical model.

3.2 CONCEPTUAL FRAMEWORK

To give a clear overview of the above listed transmission channels, a conceptual framework, which shows the relations between the variables used in this study, is assembled. Ultimately, in this thesis, the main interest lies in the relationships between housing- and stock market wealth and consumption and how consumption is affected by changes in wealth. The framework, shown in **figure 1**, displays the independent variables (in a rectangle), however, since *income* is not of particular interest to research as it functions mainly as a control variable, this will be further elaborated on in chapter 4, it is displayed in an ellipse and finally the dependent variable (consumption). The independent variables are, respectively, income, stock market- and housing market wealth. According to Carroll et al. (2011) and Calomiris et al. (2009) all the variables (dependent and independent) are highly correlated because they are affected by the same factors: macroeconomic prospects.

Figure 1. Conceptual Framework of the Relationships between Income, Wealth and Consumption



*Where *HMW* stands for Housing Market Wealth and *SMW* stands for Stock Market Wealth.

To carefully explain the thoughts behind the conceptual framework, the variables are discussed one by one, starting with income. The relationship between income and consumption is an obvious one, higher income leads to higher consumption. The link between income and housing wealth is less obvious, an increasing income doesn't necessarily mean that a household's house price has increased as well. There is a possibility that when income increases, a household can decide to improve their house which increases their house price. However, as will later be explained in the methodology part

(chapter 4), improvements of houses are not taken into account in the housing wealth variable estimated in this study. The same goes for the link flowing from income to stock market wealth, an increasing income will not necessarily mean that one's asset holdings will increase in value.

From the transmission channels and the literature reviewed the expected relationship between housing wealth and consumption is expected to be positive. However, there are both positive and negative effects associated with increased house prices. In the end, the net effect is expected to be positive and therefore only a plus is shown in **figure 1**. Furthermore, the relationship between housing wealth and stock market wealth is expected to be neutral (no relationship), both are expected to be driven by similar factors, mainly macroeconomic prospects, which would cause there to be a high correlation between them. Finally, housing wealth may increase income if capital gains are realized and not consumed.

As explained before, the main expectation regarding stock market wealth and consumption is a positive relationship. However, no relationship is expected to exist with housing market wealth. Furthermore, if stock prices increase and individuals realize their capital gains without consuming, it may reflect in a higher income.

For consumption expenditure, it's not expected that an increase in consumption will result in increasing income, housing market wealth or stock market wealth. At best, one can argue that an increase in consumption implies either an increase in income or a decrease in savings, however the causal relationship is not expected to flow from consumption to income, rather the other way. Finally, to control for endogeneity between variables, this study uses the second, third and fourth lagged variables of the independent variables, which is suggested by current literature (Calomiris et al., 2009).

3.3 HYPOTHESES

To understand how the conceptual framework will contribute towards this study, it's important to re-iterate what the gaps in the literature are and what the main topics of interest in this research are. After carefully reviewing the literature in the previous chapter, it has become clear that there is disagreement on the size of the wealth effects and on which effect is stronger. Furthermore, since most of the literature don't specifically test for whether wealth effects have increased over time, this study will. Another concern that arises from the literature is that there is a gap in studies that have been done after the financial crisis, this study will research whether wealth effects have changed after the financial crisis. A similar concern is regarding whether wealth effects are stronger in downfalls or in upswings, as this has been rarely assessed by current literature, only once, by Case et al. (2005). Finally, to address the endogeneity problem, instrumental variables will be used. This leads to the following research questions and the accompanying hypotheses:

The main research question:

''What are the wealth effects of the housing- and stock market on consumption expenditure?''

Even though there is significant disagreement in the literature on whether there is presence of both wealth effects. This study hypothesizes that there is presence of both a housing market wealth effect as well as a stock market wealth effect. Furthermore, since the homeownership rate is higher in most

countries than the stock ownership rate, it is expected that the housing wealth effect is larger than the stock market wealth effect.

First sub-question:

''Have the wealth effects changed over time?''

Ludwig and Slok (2002) argue that due to deregulation of financial markets and innovation of financial markets it has become easier to extract loans out of housing wealth over time. Furthermore, since both deregulation and innovation of financial markets have increased over time, it is expected that both wealth effects have significantly increased over time.

Second sub-question:

''Is there a difference in wealth effects between pre- and post-financial crisis?''

It is arguable that deregulation and innovation in the financial sector peaked with the arrival of the financial crisis. In addition, one could expect household behavior to be different towards extracting wealth from housing particularly, since they might be more reluctant after experiencing a severe financial crisis. Therefore, it is hypothesized that the housing wealth effect is lower post-financial crisis than pre-financial crisis, however, no difference is expected for stock market wealth, since stock holders are able to make capital gains in both increasing and decreasing markets through various financial instruments.

Third sub-question:

''Is there a difference in the size of wealth effects in economic downfalls and upswings?''

In downfalls budget constraints become tighter for households. And relatively speaking, homeowners might be paying a mortgage that is well over the worth of their house. However, it is not expected that homeowners willingly move into a smaller house to maintain a steady buying power level. Therefore, it is expected that homeowners are willing to trade off less consumption for ''more'' housing in contracting times. Thus, in economic downfalls the wealth effects of housing are expected to be smaller than in economic upswings. However, since stock market capital gains can be made in both upswings and downfalls, no significant difference is expected for stock market wealth. **Table 1** gives a summary of the hypotheses.

Table 1. Summary of Hypotheses

Hypothesis 1	Positive and significant wealth effects and stronger housing market wealth effect.
Hypothesis 2	Increasing wealth effects over time.
Hypothesis 3	Pre-financial crisis housing wealth effect stronger, no difference for stock wealth effect.
Hypothesis 4	Stronger wealth effect for housing in upswings, no difference for stock wealth effect.

4. EMPIRICAL APPROACH

To explore the relationship and links between housing wealth, stock market wealth and consumption expenditure, this study conducts a quantitative analysis. To gather evidence for a robust answer to the research question, various models will be estimated using different specifications. The main concerns in wealth effects studies are whether there is presence of unit root (Case et al, 2005), whether co-integration methods should be used (Carroll et al, 2011) and whether instrumental variables are used in order to address an endogeneity problem (Calomiris et al, 2009). Furthermore, multiple model specifications will be used that are specifically addressed towards answering the research question and the sub-questions. This chapter proceeds in the following way. **First**, the data is described and the data collection process is explained. **Second**, each of the abovementioned concerns will be addressed and explained individually in order to obtain a clear view of the processes taken to achieve the results that have been found in this study. **Finally**, the econometric models used in this thesis are outlined.

4.1 DATA DESCRIPTION

In order to estimate the wealth effects, the data in this study consists of four economic variables, the dependent: consumption expenditure; and the independent variables: income, housing market wealth and stock market wealth. This study closely follows the methods employed by Case et al. (2005) for obtaining, constructing and estimating the data. The cross-section spans 16 industrialized countries over a period of 42 years (1975 – 2016) with annual observations, thereby making it one of the most extensive international datasets for researching wealth effects up until now. **Appendix A** shows the full list of countries used in this study and the data availability of each variable.

The dependent variable in this research is **consumption expenditure**. In the literature there is debate on whether to use total consumption expenditure or non-durable consumption, where much of the earlier consumption research uses the latter (Blinder and Deaton, 1985) and more recent research focuses on total consumption expenditure (Case et al., 2005; Dvornak and Kohler, 2007). The reasoning for using non-durable consumption is that it is assumed that consumption for non-durable goods occurs at the same time as expenditure, while services from durable goods don't occur at the same time as the expenditure, usually after. This makes it difficult to measure the exact flow of services for durable goods, while it is argued that non-durable goods are a sufficient proxy for consumption services since there should be no lag for non-durable goods (Dvornak and Kohler, 2007). Reverting back to the purpose of this research, it is of interest to research the wealth effects on the aggregate economy. For that purpose, using total consumption expenditure, which includes both non-durable and durable goods expenditure, is adequate. A shortcoming, however, of using total consumption expenditure is that expenditures on housing services are included. As a final note, the data is obtained from the World Bank database and can be found as '*Household Final Consumption* Expenditure'.

Regarding the **income** variable, ideally, one would like to use 'total disposable household income'. However, data for household disposable income is only available from 1995 and onwards. Therefore, disposable income could not be used. To measure household income as appropriately as possible, a couple other variables have been considered (gross national income; adjusted gross income). From those variables it appeared that GDP per capita was the most appropriate variable, with an average

correlation of 95%. Therefore, GDP per capita is used. The data is obtained from the database of the World Bank.

Estimates of **housing market wealth** were constructed by using the following formula, which was established by Case et al. (2005):

$$V_{it} = R_{it} N_{it} I_{it} \quad (1)$$

with:

V_{it} = aggregate value of owner occupied housing in country *i* in year *t*

R_{it} = homeownership rate in country *i* in year *t*

N_{it} = number of households in country *i* in year *t*

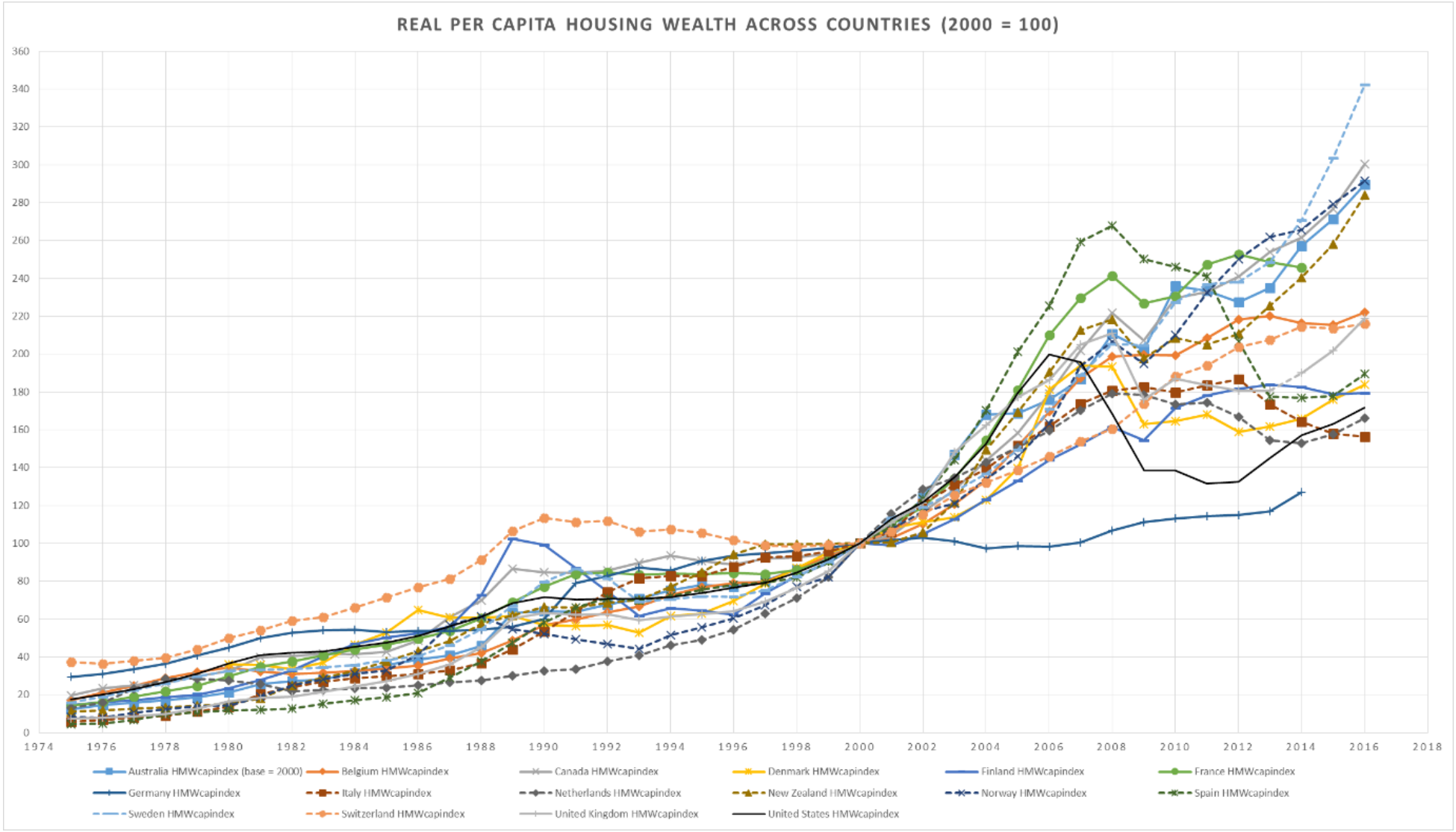
I_{it} = housing price index for country *i* in year *t* (base year = 1995)

The house price indices (I_{it}) were obtained from the Bank of International Settlements (BIS). In this database residential property prices (house prices) are consolidated and were available for the complete sample used in this study (1975 – 2016).

Data on homeownership was not easy to obtain, most of the data available are from censuses done by national governments. However, a census appeared to have been done infrequently and usually ranging from either once every 5 years for some countries or once every 10 years for other countries. Another problem with collecting homeownership data is that national statistics bureaus have multiple ways to calculate the homeownership rate, each one depending on the definition of the variable. This causes there to be different homeownership rates for the same years. However, in the case of multiple observations of a homeownership rate for the same year, the data chosen is from the method with the most complete dataset. Since, as explained, data was not available for every year of the sample, missing values had to be linearly interpolated, which is common practice in the literature. **Appendix B** shows the full table of homeownership rates. Finally, data on the number of households were either obtained via the database of the World Bank or national statistics bureaus.

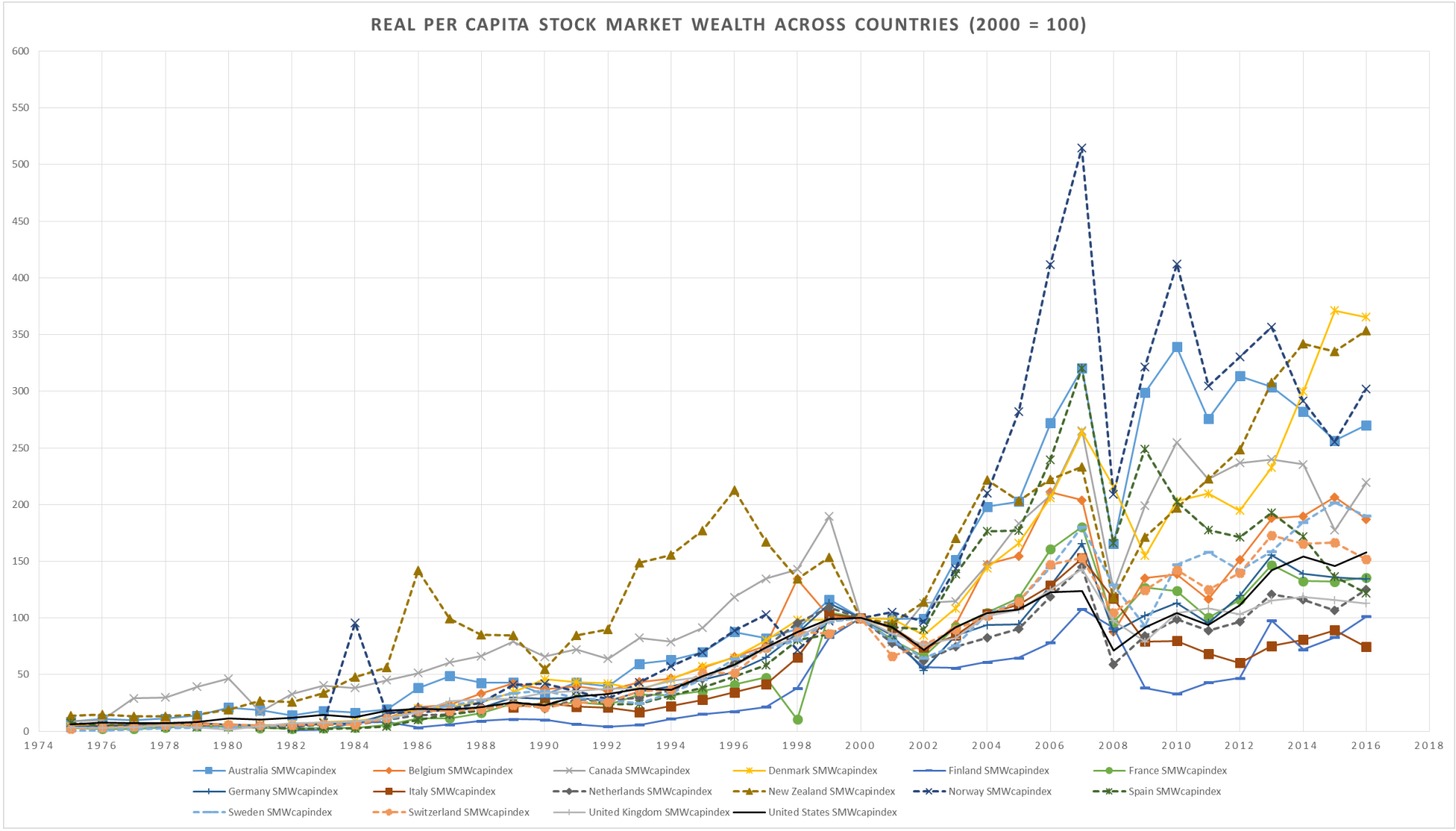
With the necessary data obtained and by using formula (1), it's possible to construct an estimation of housing wealth. By using house price indices instead of total value of homes, the measure of housing wealth (V_{it}) doesn't take the size or quality of housing nor does it take improvements in existing home into account. Instead, this measure can be described as *''wealth of homeowners assuming they own a standard, unchanging home''* (Case et al, 2005, p.9). Measuring housing wealth in this way is done in order to only focus on effects of changes in house prices on consumption. Since housing consumption is a component of aggregate consumption, using a measure of housing wealth that would have been defined as the total value of homes means there would, naturally, be a relationship between housing wealth and consumption. For example, should consumption increase, it's logical to expect that a part of this increased consumption is attributed towards housing consumption through changes in home size or quality, which would be attributable to improvements in houses. As a consequence, this might be reflected in a housing wealth measure which incorporates the total value of homes.

Figure 2. Estimated Housing Wealth (1975 – 2016)



Source: Author's own elaboration on data

Figure 3. Estimated Stock Market Wealth (1975 – 2016)



Source: Author's own elaboration on data

Figure 2 shows the estimated real per capita housing wealth across the 16 countries used in this study. In this graph the estimates are recalculated towards the base year of 2000, however, only for graphical purposes. What becomes clear from this graph is that initially across all 16 countries housing wealth peaked around 2008, which eventually lead to the financial crisis and a sharp decrease in house prices and housing wealth. However, as of 2016, for most countries in this panel, housing wealth is either at the 2008 house price level or higher than at the previous peak of 2008. This implies that volatility in the housing market has increased internationally and as a consequence strong housing wealth effects might increasingly contribute to higher economical volatility. Especially downfalls in housing prices might have serious consequences on consumer consumption expenditure.

For data of **stock market wealth**, the World Bank database had the most consistent dataset and is thus used. The variable is listed as ''*Market Capitalization of Listed Domestic Companies*'' and reports the data in annual observations. However, since the fraction of stockowners owning domestic stock varies across countries this had to be accounted for in estimating. By using fixed effects, which can function as country specific dummies, it was possible to control for the varying domestic stock ownership across countries.

Figure 3 shows the estimated stock market wealth per capita across the 16 countries in the dataset of this study. It becomes clear that in comparison with housing market wealth (**figure 2**), stock market wealth is more characterized by sharp peaks and dips. Simultaneously, it seems that the volatility of the stock market has increased over time. Finally, it seems that most countries have recovered from the financial crisis, at least if only measured by stock market capitalization, since stock market capitalization levels in 2016 are close to, or higher than, the level of 2008.

Furthermore, even though this international dataset is rather comprehensive and exploits a wide geographic variation, it doesn't fully rely on own imputations or data coming from one single source. The data is, largely, derived from national income accounts and there is reason to expect housing prices and housing wealth to be measured less accurately. Similar to the abovementioned variation in domestic stock ownership, the difference in calculation methods for data had to be accounted for by using fixed effects regression. As a final note, all variables listed above are expressed in real per capita terms and in logs.

4.2 ESTIMATION CONCERNS

Before continuing and establishing which models are necessary to estimate the wealth effects and address the research questions, it's of importance to address some issues that are widely acknowledged in the literature. Those are, whether there is presence of unit root (Case et al, 2005), whether co-integration methods should be used (Carroll et al, 2011) and whether instrumental variables are used in order to address an endogeneity problem (Calomiris et al, 2009).

UNIT ROOT

Unit root tests are common among the literature (Galli, 2016; Dvornak and Kohler, 2007; Case et al, 2005) and are used to test whether a time series is non-stationary. In the case of a presence of a unit root, a time series can be called non-stationary or stochastic. As a consequence, statistical inferences differ for time series with presence of a unit root and for those without. If a time series is described as a stationary process (rejecting the presence of a unit root), then shocks would have transitory

effects. On the other hand, if a time series is described as non-stationary, shocks have permanent effects (Verbeek, 2008).

There are various tests used in the literature to test for the presence of unit root. Most tests, however, are specifically designed for a single time series dataset instead of a panel. The test most suitable for the dataset employed in this research is the Im, Pesaran and Shin (2003) (IPS) panel unit root test, which is also proposed by the literature (Ludwig and Slok, 2002). This test is based on standardized averages of individual country augmented Dickey Fuller (ADF) tests and follows a normal distribution. The null hypothesis in IPS unit root tests states that all the series in the panel exhibit a unit root or put more simply, are non-stationary. While on the other hand, the alternative hypothesis states that some of the series included in the panel are stationary. Thus, rejection of the null hypothesis means that some series are stationary or converging to their means over time (Im, Pesaran and Shin, 2003).

Table 2 shows the results of the IPS unit root tests. It becomes clear that for all variables the presence of a unit root is rejected except for '*Stock Market Wealth'.* However, after including a time trend in the test specification, the unit root presence is also rejected for '*Stock Market Wealth'*. A common approach to address the presence of a unit root in time series, or panel data, is by using first differences. Moreover, some include the lagged ratio of consumption to income (Case et al, 2013), which is called the error-correction model (ECM). Even though the presence of unit root is rejected, this study has employed the error-correction model in various specifications throughout this study in order to increase the robustness of the results.

Table 2. IPS Unit Root Tests

Variable	Test Statistic	P-Value
Total Consumption Expenditure	-2.4385	.0013
Household Income	-5.3501	.0000
Housing Market Wealth	-2.6191	.0000
Stock Market Wealth	-1.6770	.2282
Stock Market Wealth**	-2.2626	.0012

***all variables are per capita and in logarithms; **controls for trend**

CO-INTEGRATION

If data series are found to be co-integrated, it's appropriate to use a co-integrated approach for estimation. Despite there being numerous studies[1] that have used a co-integrated approach for estimating wealth effects, concerns have been raised as to why this approach could be problematic. Carroll et al. (2011) name two reasons. **First**, co-integration models require there to be a stable long-run relationship between consumption, income and wealth. However, according to Carroll et al. (2011) such a stable relationship is not implied by basic consumption theory, since a change in the long run growth rate, the long run interest rate or the tax scheme is capable of changing the relationship between consumption, income and wealth, which is required to be stable. **Second**, because of those changing factors that affect the economy, to establish whether the relationship between consumption, income and wealth is stable, one would need very long data series, Carroll et

al. (2011) argue up to hundreds of years of data to obtain reliable estimates for determining whether time series are co-integrated.

As the literature points towards concerns with a co-integrated approach, this study has not estimated wealth effects in a co-integrated method. However, in multiple specifications, an error correction model has been employed to estimate wealth effects, in which the co-integrating vector between income and consumption is assumed to be one.

ENDOGENEITY

The study of Case et al. (2005) is one of the most cited researches on the topic of wealth effects. They find a strong housing wealth, which is found to be stronger than the financial wealth effect. If this is correct, housing wealth is an important channel that affects the aggregate economy and policymakers should take the housing market into account when formulating policy. However, if the results are not found to be correct, for example because of not taking endogeneity into account, this would have consequences on the policy that should be formulated.

While Calomiris et al. (2009) admit that Case et al. (2005) employ one of the most detailed measures of housing wealth, they are one of the first studies that criticize the results found by Case et al. (2005), specifically, because of not taking endogeneity into account. Case et al. (2005) estimate the wealth effects in multiple ways, including in levels, in first differences and an error correction model. In all those specifications a positive significant housing wealth effect is found, which is also found to be larger than the stock market wealth effect. However, Calomiris et al. (2009) state that there are problems with their empirical estimation approach.

Since Case et al. (2005) regress the current change in consumption on the current changes in income, housing market- and stock market wealth, without controlling for shocks related to permanent income, their estimations suffer from ''*a potentially severe problem of endogeneity*'' (Calomiris et al, 2009, p.11). Without controlling for shocks to permanent income, their results may be driven by correlations between permanent income shocks and house price changes. In other words, there might be a single force which causes changes in consumption not to be determined by changes in housing market- or stock market wealth, but rather by this single force. An example of such a force is 'macroeconomic prospects', which can be called a permanent income shock, and is expected to be the main driver of house price changes (Calomiris et al, 2009). Therefore, in countries where house prices are rising, this rise not only reflects past income growth, however, also expectations of future income growth, which in turn, may improve multiple market indicators, including rising house prices and may therefore cause a problem of endogeneity.

Hall (1978) states that if consumers follow the Permanent Income Hypothesis (PIH) and there are no market imperfections such as credit constraints, then consumption should follow a random walk as following:

$$C_t = C_{t-1} + \varepsilon_t \quad (2)$$

or

$$\Delta C_t = \varepsilon_t$$

Where the error term (ε_t) represents unexpected changes in permanent income. To test housing and stock market wealth effects, (2) is expanded by adding the variables of interest. If the PIH doesn't hold,

for example, because of the existence of credit constraints, then the error term represents a combination of expected- and unexpected changes in permanent income, in temporary income, and in housing market- and stock market wealth (Calomiris et al, 2009). However, as explained above, it is expected that changes in housing market- and stock market wealth are correlated with changes in expected and unexpected permanent and temporary income (macroeconomic prospects), which are also represented in the error term. Therefore, if in estimating wealth effects only the current changes in the dependent and independent variables are used, the estimates will be inconsistent (Calomiris et al, 2009).

In order to solve this problem, it is necessary to use instrumental variables. A common approach is using lagged variables of housing market- and stock market wealth as instruments. Accordingly, the models (later presented) in this study employed lagged variables as instruments in order to get consistent estimates.

4.3 ESTIMATION STRATEGY

In this part the estimation strategy will be discussed, in which the method for answering, both the main research question and the sub-questions, is elaborated on. In short, the wealth effects are tested and estimated in levels, first differences and in an error correction model. Furthermore, instrumental variables are used to address endogeneity. To answer the sub-questions, the wealth effects were tested in models which specifically address wealth effects over time by splitting the dataset up in multiple time periods, in addition the wealth effect difference between pre- and post-financial crisis is assessed. Finally, the strength of effects of increases in wealth are compared with those of decreases in wealth to analyze whether household behavior is asymmetric. The base model of estimating wealth effects is as following:

$$C_{it} = \alpha + \beta_1 Inc_{it} + \beta_2 HMW_{it} + \beta_3 SMW_{it} + \varepsilon \quad (3)$$

where:

Inc_{it} = Income in country *i* in year *t*

HMW_{it} = Housing market wealth in country *i* in year *t*

SMW_{it} = Stock market wealth in country *i* in year *t*

Since the wealth effects of both the housing- and stock market are of main interest in this study the income variable is considered as a control variable across all models. The objective is to measure the wealth effects in a variety of ways and thus the interest lies in β_2 and β_3 in this specific case, the base model.

As will become clear in the next chapter, where the results will be discussed, this model was estimated in a variety of ways in order for the findings to be robust. Next to the standard estimation in levels, this model was estimated taking serial correlation into account, by including a serial correlation coefficient. Furthermore, this model was tested in levels including instrumental variables. Another specification is where the model was tested in first differences. In addition the model was estimated

including instrumental variables to address endogeneity. Finally, this model was tested in an error correction model.

Next, the second model, which specifically analyzed what the wealth effects are over time. The dataset was split up in five periods (1975-1982; 1982-1992; 1992-2000; 2000-2008; 2008-2016) and a subsequent analysis where the dataset was split up in three time periods (1975-1985; 1985-2001; 2001-2016). This made it possible to give an answer to whether wealth effects have increased over time.

The specification is as following, where *Tn* stands for each specific time period:

$$C_{it} = \alpha + \beta_1 Inc_{it}^{Tn} + \beta_2 HMW_{it}^{Tn} + \beta_3 HW_{it}^{Tn} + \varepsilon \quad (4)$$

Similar to the second model, the dataset is split up in periods in the third model. However, since the third question of interest is specifically related towards whether wealth effects have changed in comparison between pre- and post-financial crisis, the dataset was only split up in two periods. This resulted in the following model:

$$C_{it} = \alpha + \beta_1 Inc_{it} + \beta_2 HMWpre_{it} + \beta_3 HMWpost_{it} + \beta_4 SMWpre_{it} + \beta_5 SMWpost_{it} + \varepsilon \quad (5)$$

The final model analyzed the difference in household behavior towards consumption between times of increases- and decreases in housing market- or stock market wealth. As such, the model that was estimated in the following way:

$$C_{it} = \alpha + \beta_1 Inc_{it} + \beta_2 HMWdown_{it} + \beta_3 HMWup_{it} + \beta_4 SMWdown_{it} + \beta_5 SMWup_{it} + \varepsilon \quad (6)$$

5. RESULTS

In this chapter the econometric specifications that have been estimated are shown and will be discussed. Tables 3 through 11 report all the results found to answer the main research question and the sub-questions. More specifically, tables 3 through 7 report the estimates found related to the main research question, whereas tables 8, 9, 10 and 11 report the estimates for, respectively, sub-questions 2, 3 and 4. At the end of this chapter some additional analyses are provided and elaborated on, however since those analyses are in addition to the research questions their results are provided in tables in **Appendix C**. All estimations are estimated in two models. Model I represents the base model in which both the housing market- and stock market wealth effects are estimated. Model II controls for time effects by adding year dummies in the specifications. Finally, the number of observations is approximately 672 (42 years, 16 countries) for almost all estimations.

In **table 3** the results are presented that address the main research question. The models are estimated in both least squares fixed effects as well as random effects. What immediately becomes clear is that across all specifications there is a significant housing wealth effect, whereas this is not the case for a stock market wealth effect. Furthermore, in none of the specifications do the effects equal each other, as can be seen by the *p-value for* H_0. Therefore, a stronger housing wealth effect is implied in each case. The elasticity for a housing wealth effect ranges from 0.12 to 0.24 and the elasticity for a stock market wealth effect ranges from 0.00 to 0.05. This implies that an increase in house prices or stock prices of 10% increases consumption with 1.2% - 2.4% or 0.0% - 0.5%, respectively. However, twice when time effects are controlled for, the stock market wealth estimate becomes insignificant. In itself, an insignificant stock market wealth effect is not necessarily surprising. Since the stock market wealth variable used in this study measures *domestic* stock market capitalization, it might be that increased stock market capitalization in country A is capitalized (and perhaps later consumed) by a person residing in country B. This is especially relevant since international capital mobility has increased over the years, due to financial liberalization (Goodhart and Hofmann, 2008).

Table 3. Results for Wealth Effects Estimation using Fixed Effects- (FE) and Random Effects (RE) regression

Variable	I (FE)	II (FE)	I (RE)	II (RE)
Income	.6161* (.0482)	.5098* (.0723)	.7734* (.0431)	.6600* (.0695)
Housing Market Wealth	.2376* (.0251)	.1698* (.0166)	.1227* (.0199)	.1319* (.0155)
Stock Market Wealth	.0443* (.0138)	.0039 (.0116)	.0468* (.0137)	.0076 (.0117)
Year Dummies	No	Yes	No	Yes
R^2	.9410	.9773	.9390	.9770
F-test/chi2	3272.33	562.17	9112.98	23248.91
p-value for H_0	0.000	0.000	0.002	0.000

*Significant at the 5% level. The p-value for H_0 tests whether the housing market wealth effect equals the stock market wealth effect, with the alternative hypothesis stating they differ. All variables are in real terms and measured per capita in logarithms.

Furthermore, since in **table 3** the models were estimated in both fixed effects as well as random effects, it is necessary to conduct a Hausman test to find out whether the random effects estimator can be used. In general, the random effects estimators are efficient, however, if the Hausman test doesn't hold, the estimators are biased. The Hausman test evaluates whether time invariant effects

are correlated with the independent variables, if they aren't then the random effects estimator is preferred. The null hypothesis states that the difference in coefficients (between the fixed effects and random effects estimators) is not systematic, therefore if not rejected, the random effects estimators are preferred. **Table 4** lists the results of the various Hausman tests that have been done in regards to the models shown in both **table 3** and **table 5**. Only in one occasion is the random effects estimator preferred, however, even then the evidence is weak with a p-value of 0.061.

Table 4. Hausman-test for models in Table 3 & 5

Model	Chi2	p-value
FE - I v. RE - I	62.64	0.000
FE - II v. RE - II	59.38	0.061
Serial Corr. FE - I v. Serial Corr. RE - I	49.58	0.000
Serial Corr. FE - II v. Serial Corr. RE - II	28.54	0.000

Where H_0: difference in coefficients is not systematic.

Table 5 presents the results when autocorrelation is taken into account and controlled for. Similar to the method employed in **table 3**, the models are estimated in both a fixed effects as well as a random effects estimator. Except for the strong housing wealth effect at model I (0.39), the results are in line with the earlier found results in **table 3** with an elasticity ranging from 0.10 to 0.24. Again, the stock market wealth is only found to be significant in two cases, only when time effects are not controlled for. The elasticity for the stock market wealth effects is estimated to be between 0.01 and 0.04, with the lower estimates being insignificant. Another similar finding is that in none of the cases the wealth effects are found to be equal, they differ in all cases and the housing market wealth is implied to be stronger. Finally, a Hausman test was done to compare the fixed effects and random effects estimators. In both cases, models I and II, the null hypothesis is rejected, as can be seen in **table 4**, and thus, the random effects estimators are biased and are not to be used as valid estimates.

Table 5. Results for Wealth Effects Estimation Controlling for Autocorrelation

Variable	I (FE)	II (FE)	I (RE)	II (RE)
Income	.3789* (.0821)	.2514* (.1183)	.7636* (.0566)	.7012* (.0942)
Housing Market Wealth	.3913* (.0486)	.2386* (.0332)	.1235* (.0295)	.1016* (.0230)
Stock Market Wealth	.0403* (.0146)	.0104 (.0119)	.0387* (.0141)	.0085 (.0117)
Serial Corr. Coefficient	.7977	.8151	.7977	.8151
Year Dummies	No	Yes	No	Yes
R^2	.5604	.8307	.9392	.9765
F-test/chi2	254.91	63.69	1721.98	4945.91
p-value for H_0	0.000	0.000	0.009	0.000

*Significant at the 5% level. The p-value for H_0 tests whether the housing market wealth effect equals the stock market wealth effect, with the alternative hypothesis stating they differ. All variables are in real terms and measured per capita in logarithms.

As mentioned in the previous chapter, endogeneity seemed a serious issue in the literature. At the same time, the literature proposes a rather simple solution to estimate with unbiased results, namely, by using instrumental variables and instrumental regression. The instruments proposed by the literature, and thus used in this study, are the second, third and fourth lagged variables for income, housing market wealth and stock market wealth. The results are presented in **table 6**.

Table 6. Results for Wealth Effects Estimation including Instrumental Variable (IV) regression

Variable	I (FE)	II (FE)	I (IV)	II (IV)
Income	.6161* (.0482)	.5098* (.0723)	.6093* (.0706)	.5675* (.0963)
Housing Market Wealth	.2376* (.0251)	.1698* (.0166)	.1446* (.0248)	.1260* (.0191)
Stock Market Wealth	.0443* (.0138)	.0039 (.0116)	.1101* (.0258)	.0587* (.0228)
Year Dummies	No	Yes	No	Yes
R^2	.9410	.9773	.9150	.9700
F-test/chi2	3272.33	562.17	5729.43	16034.99
p-value for H_0	0.000	0.000	0.320	0.023

*Significant at the 5% level. The p-value for H_0 tests whether the housing market wealth effect equals the stock market wealth effect, with the alternative hypothesis stating they differ. All variables are in real terms and measured per capita in logarithms.

In stark contrast with the results from fixed effects, random effects and serial correlation corrected regression, the instrumental variables regression shows a significant stock market wealth effect in both model I as well as model II, thus regardless of controlling for year dummies a significant stock market wealth effect is found. Moreover, the elasticity ranges from 0.06 when time is controlled for to 0.11 when time is not controlled for, both significant at the 5% level. The results from model I, with instrumental variables, even show that the null hypothesis stating that the housing market wealth effect equals the stock market wealth effect cannot be rejected, implying an equally sized effect. The housing market wealth effect elasticity is estimated to be approximately 0.13 – 0.14 and is in line with both earlier research (Case et al, 2005) and in general with the earlier estimates found in this study.

Next to regressing in levels, this study employed two additional methods for estimation: estimating in first differences and in an error correction model. First difference estimation is mainly used in the presence of unit roots, which implies non-stationairity, in the variables. Even though the presence of unit roots is largely rejected, as was estimated and elaborated on in the previous chapter (*Empirical Approach*), estimating in first differences adds to the robustness of the results. **Table 7** presents the results of first difference estimation and of the estimates of the error correction model, which adds the lagged change in the dependent variable and assumes a co-integrated approach of consumption and income resulting in the ratio of household consumption to household income (*HC/HI*).

Similar to the fixed effects results presented in **table 3** the results in both first difference estimation and in the error correction model show a strong significant housing wealth effect, both in models I and II. Except for the very strong housing wealth effect in model I of first difference estimation with an elasticity of 0.43, the remaining results vary with an elasticity range of 0.16 – 0.24, slightly higher than the earlier estimates of the fixed effects estimator. The stock market wealth, however, is only once found to be significant therefore signifying a weak effect. This result is even more relevant since the stock market wealth variable was the only variable which showed presence of a unit root, when

trend was not controlled for. Not surprisingly from those results, it appeared that in none of the cases the effects of housing market wealth and stock market wealth were estimated to equal each other. The lagged change in consumption coefficients are in both models significant and positive, which shouldn't be surprising since if a consumer was able to consume more in a previous period that means that same consumer is able to consume more now as well. The lagged ratio of consumption to income, however, is in both models negative and significant. This implies that consumers who experienced a higher consumption to income ratio in the previous period will have a lower consumption (to income ratio) in the current period. In essence, this means that consumers who ''over-consumed'' in the previous period, will have a lower consumption expenditure in the current period, unless the ''over-consumption'' is ultimately confirmed by a higher income.

Table 7. First Difference (FD) and Error Correction (ECM) Wealth Effect Models

Variable	I (FD)	II (FD)	I (ECM)	II (ECM)
Change in Income	.1982	.2121**	.2173**	.2632*
	(.1371)	(.1267)	(.1232)	(.1173)
Change in Housing Market Wealth	.4314*	.2387*	.2036*	.1623*
	(.0549)	(.0374)	(.0524)	(.0355)
Change in Stock Market Wealth	.0344*	.0091	.0164	.0048
	(.0144)	(.0118)	(.0131)	(.0109)
Lagged change in Consumption	-	-	.3876*	.2652*
			(.0369)	(.0399)
Lagged HC / HI	-	-	-.2543*	-.2239*
			(.0239)	(.0233)
Year Dummies	No	Yes	No	Yes
R^2	.1432	.7030	.3327	.7541
F-test/chi2	33.38	30.78	58.82	38.06
p-value for H_0	0.000	0.000	0.001	0.000

*Significant at the 5% level; ** Significant at the 10% level. The p-value for H_0 tests whether the housing market wealth effect equals the stock market wealth effect, with the alternative hypothesis stating they differ. All variables are in real terms and measured per capita in logarithms.

Even though the exact effects of both housing and stock market wealth vary depending on which econometric specification is used, it has become apparent that, overall, there is a strong and significant housing wealth effect. In contrast, a definitive stock market wealth effect cannot be found from the analysis done above. The results vary from small to large and from insignificant to significant. Whenever time is controlled for, by using year dummies, the statistical significance for the stock market wealth effect seems to be reduced to insignificance. This result might imply that the volatility in the stock market is too high for the statistical analysis to find any meaningful consistent relationships between stock market wealth and consumption expenditure. Furthermore, international capital mobility adds to the complexity of finding a significant stock market wealth effect, since capital gains might be reported, realized and consumed each in a different country.

Goodhart and Hofmann (2008) argue that money growth has a significant effect on house prices and credit, in addition this link was found to have increased over time, which they attribute to the effects of financial liberalizations. Therefore, financial liberalizations might have contributed to increased

house prices which in turn could have accelerated wealth effects over time. In concurrence with the findings of Goodhart and Hofmann, the wealth effects are analyzed over time and **table 8** and **9** present the corresponding results.

Table 8 presents the results when the dataset was split up in five different time periods which are approximately equal in terms of years. Across almost all specifications the income effect is significant and large, except for the most recent period, which involves the financial crisis and its aftermath. The housing market wealth effect is found to be significant and large in all time periods, however, nothing indicates that the housing market wealth effect has increased over time. Furthermore, one could have expected an increased volatility since financial liberalization has increased over time. However, neither volatility seems to have increased over time. Finally, the stock market wealth effect seems to vary from significance to insignificance from period to period, however, similar to the housing market wealth effect, no increasing effect is observable.

Table 8. Wealth Effects over Time using Fixed Effects Regression (I)

Variable	I (1975-1982)	II (1982-1992)	III (1992-2000)	IV (2000-2008)	V (2008-2016)
Income	.5969*	.6774*	.4369*	.8175*	.0812
	(.1547)	(.2336)	(.1747)	(.1964)	(.1626)
Housing Market Wealth	.4186*	.2741*	.1857*	.4643*	.1971*
	(.0988)	(.0864)	(.0818)	(.0852)	(.0884)
Stock Market Wealth	.0067	.1419*	-.0224	.0964*	.0425
	(.0325)	(.0383)	(.0315)	(.0407)	(.0415)
R^2	.8650	.8283	.4060	.8713	.0983
F-test/chi2	149.51	189.80	28.48	246.90	4.33
p-value for H_0	0.000	0.239	0.009	0.000	0.122

*Significant at the 5% level. The p-value for H_0 tests whether the housing market wealth effect equals the stock market wealth effect, with the alternative hypothesis stating they differ. All variables are in real terms and measured per capita in logarithms.

Table 9. Wealth Effects over Time using Fixed Effects Regression (II)

Variable	I (1975-1985)	II (1985-2001)	III (2001-2016)
Income	.1812 (.1242)	.6711* (.1226)	.5957* (.1747)
Housing Market Wealth	.3941* (.0844)	.2808* (.0554)	.4543* (.0567)
Stock Market Wealth	-.0245 (.0334)	-.0542** (.0282)	.1009* (.0299)
R^2	.6138	.7117	.8189
F-test/chi2	68.35	179.41	348.13
p-value for H_0	0.000	0.000	0.000

*Significant at the 5% level. **Significant at the 10% level. The p-value for H_0 tests whether the housing market wealth effect equals the stock market wealth effect, with the alternative hypothesis stating they differ. All variables are in real terms and measured per capita in logarithms.

In contrast to **table 8, table 9** presents the results of wealth effects over time when the dataset is split up in three different time periods. Again no increasing housing wealth effects were found, neither is an increase in volatility observable. However, the most recent period (2001 – 2016) seems to be the period with the strongest wealth effects. There seems to be an increasing stock market wealth effect,

with a strong effect in the most recent period, however, in combination with the results of **table 8**, the evidence is not enough to conclude there is an increasing stock market wealth effect over time. In sum, neither the housing market wealth- nor the stock market wealth effect seems to have increased over time, however, the results in **table 9** seem to indicate that both wealth effects are currently stronger than before.

Next to assessing the wealth effects over time, this study researches whether there is a difference in either the housing market- or the stock market wealth effect between pre- and post-financial crisis. **Table 10** presents the results for the pre- and post-financial crisis analysis. Three different models are employed to estimate the difference in wealth effects: least squares fixed effects, first differences and an error correction model. From **table 10** the most important results revolve around the bottom two rows of p-values. Each of those give the p-value for the formal test of whether the pre-financial crisis housing market wealth effect (or stock market wealth effect) equals the post-financial crisis housing market wealth effect (or stock market wealth effect).

Table 10. Pre- and Post-Financial Crisis Wealth Effects Analysis

Variable	I (FE)	II (FE)	I (FD)	II (FD)	I (ECM)	II (ECM)
(Change in) Income	.5664* (.0507)	.4999* (.0719)	.1216 (.1371)	.2124** (.1269)	.2015 (.1241)	.2631* (.1175)
(Change in) Housing Market Wealth Pre-2008	.2398* (.0254)	.1679* (.0169)	.4526* (.0569)	.2362* (.0408)	.1772* (.0559)	.1524* (.0387)
(Change in) Housing Market Wealth Post-2008	.2213* (.0286)	.1792* (.0196)	.2999* (.1324)	.2481* (.0976)	.3892* (.1190)	.2151* (.0900)
(Change in) Stock Market Wealth Pre-2008	.0488* (.0145)	.0026 (.0111)	.0667* (.0168)	.0075 (.0131)	.0365* (.0154)	.0042 (.0123)
(Change in) Stock Market Wealth Post-2008	.0634* (.0161)	.0117 (.0160)	-.0624* (.0284)	.0151 (.0265)	-.0261 (.0257)	.0054 (.0244)
Lagged (change in) Consumption	-	-	-	-	.3903* (.0380)	.2648* (.0400)
Lagged HC / HI	-	-	-	-	-.2549* (.0243)	-.2247* (.0234)
Year Dummies	No	Yes	No	Yes	No	Yes
R^2	.9423	.9774	.1651	.7031	.3419	.7543
F-test/chi2	2002.77	537.03	23.62	29.48	43.26	36.31
p-value for H_0^1	0.336	0.406	0.267	0.910	0.096	0.522
p-value for H_0^2	0.051	0.494	0.000	0.795	0.039	0.966

*Significant at the 5% level, **Significant at the 10% level. H_0^1: tests whether HW pre 2008 = HW post 2008; H_0^2: tests whether SMW pre 2008 = SMW post 2008. All variables are in real terms and measured per capita in logarithms.

In almost none of the cases, for the housing market wealth effect, does the null hypothesis get rejected, thus there doesn't seem to be a significant difference in the size of housing market wealth

effects between pre- and post-financial crisis. However, there does seem to be a difference in stock market wealth effects. In three of the six specifications the null hypothesis gets rejected, however, each time at the model I specification. When year dummies are added to control for time specific effects, each of those p-values increased and the null hypothesis couldn't be rejected. Therefore, with certainty, from the results above it seems that there are no apparent significant differences in wealth effects between pre- and post-financial crisis for neither the housing market nor the stock market.

The final assessment revolved around estimating the difference between the sizes of wealth effects in economic downturns compared to economic upswings. There is some evidence that the responses of households towards increases in asset values compared to decreases are asymmetric. Earlier research done by Case et al. (2005) found that, indeed, responses were asymmetric. Consumers didn't seem to significantly reduce their consumption expenditure when house prices decreased, while consumption expenditure was found to increase with increases in house prices. **Table 11** provides evidence of the estimates done in this study. Again the results were estimated in fixed effects, first differences and in an error correction model.

Table 11. Increasing- and Decreasing Wealth Effects Analysis

Variable	I (FE)	II (FE)	I (FD)	II (FD)	I (ECM)	II (ECM)
(Change in) Income	.6299* (.0495)	.4672* (.0728)	.1897 (.1368)	.2056 (.1270)	.2069** (.1234)	.2581* (.1179)
(Change in) Housing Market Wealth Decrease	.2544* (.0260)	.1743* (.0171)	.6782* (.1629)	.4152* (.1096)	.3961* (.1487)	.2082* (.1038)
(Change in) Housing Market Wealth Increase	.2397* (.0260)	.1799* (.0171)	.3749* (.0654)	.1959* (.0449)	.1589* (.0614)	.1517* (.0420)
(Change in) Stock Market Wealth Decrease	.0344* (.0149)	.0101 (.0112)	-.0069 (.0269)	-.0060 (.0207)	.0157 (.0243)	.0076 (.0194)
(Change in) Stock Market Wealth Increase	.0348* (.0145)	.0084 (.0113)	.0647* (.0225)	.0158 (.0159)	.0166 (.0206)	.0023 (.0148)
Lagged (change in) Consumption	-	-	-	-	.3905* (.0372)	.2628* (.0404)
Lagged HC / HI	-	-	-	-	-.2512* (.0243)	-.2232* (.0236)
Year Dummies	No	Yes	No	Yes	No	Yes
R^2	.9373	.9763	.1508	.7049	.3349	.7543
F-test/chi2	1798.24	514.15	21.21	29.56	41.93	36.30
p-value for H_0^1	0.001	0.101	0.109	0.087	0.167	0.638
p-value for H_0^2	0.750	0.131	0.073	0.431	0.980	0.835

*Significant at the 5% level, ** at the 10% level. H_0^1: tests whether HW decrease = HW increase; H_0^2: SMW decrease = SMW increase. All variables are in real terms and measured per capita in logarithms.

Overall, the elasticity for housing market wealth decreases ranges from 0.17 to 0.68, which is very high. However, the higher elasticities were mainly caused by simultaneous insignificant income effects, which caused the estimates for the housing market wealth effects to be overblown and was the case in first difference estimation. The instability of the variable *income* when using first differences is common and other studies have reported similar findings, at the same time it is suggested that adding a constant real interest rate matters for the size of this coefficient (Dvornak and Kohler, 2007). However, since this variable is not of interest to this study it is not included. Furthermore, adding a lagged variable of the dependent significantly ''*corrects*'' the results, as can be seen in the ECM models. On the other hand, the elasticity for housing market wealth increases ranges from 0.15 to 0.37, again a wide range. However, the main interest in this analysis lies in the formal tests which compares the decreasing effects with the increasing effects (*p-value for* H_0^1 *in* ***table 11***). Only once, in the fixed effects model I, was the null hypothesis rejected which tests whether decreasing effects equal increasing effects. There was some further evidence for different sizes in effects (model FD-II), however this evidence was weak and only significant at the 10% level. In sum, from this analysis it is not possible to conclude that housing market wealth effects differ significantly in size when house prices decrease or increase, respectively.

The elasticity for a stock market wealth decrease ranges from -0.01 to 0.03, with almost all coefficients estimated to being not significant. For a stock market wealth increase the elasticity was found to be slightly larger with a range from 0.00 to 0.06, however, again with most estimated coefficients being insignificant. Moreover, the estimated *p-value for* H_0^2, which tests whether a decreasing stock market wealth effect equals an increasing stock market wealth effect, all signified that the null hypothesis could not be rejected. Therefore, similar to the housing market wealth effect, there doesn't seem to be a difference in the size of effects between decreasing and increasing stock market wealth. Those results are in stark contrast with the results found by Case et al. (2005) and imply that wealth effects seem to be symmetric in nature, thus, if house prices significantly decrease this might have severe consequences on consumption expenditure.

ADDITIONAL ANALYSIS

In addition to the above shown results which are directly related to the research questions of interest in this thesis, some additional analyses were conducted. Those were related to test a specific component of the conceptual framework and towards analyzing the sensitivity of the homeownership rates in countries with respect to the housing wealth effect. The conceptual framework test looked at whether interaction variables, interactions between housing wealth and income and stock market wealth and income, were statistically significant. The homeownership rate sensitivity with respect to the housing wealth effect looked at whether countries with a high homeownership rate have a different housing wealth effect than countries with a low homeownership rate.

The results of the interaction variable analysis are shown in **Appendix C** and indicate that of both interaction variables only the stock market wealth income interaction is significant (at the 5% level) and positive. Such a result is initially not surprising since stock market wealth is more liquid than housing market wealth and can be easier and more quickly put into one's income account.

An additional analysis was done where the dataset was split up based on homeownership rates. The homeownership rates per country per year and the average over the time period can be found in the **Appendix B**. This analysis gives the possibility to make inferences on whether (households in)

countries with a high homeownership rate have different responses, with respect to housing market- and stock market wealth, than countries with a low homeownership rate. Therefore, countries with an 'average' homeownership rate were not taken into account, where the average was approximately 60%. The distinction was made where any country with a homeownership rate of 70% or higher was marked as high, whereas a country with a homeownership rate of approximately 50% or lower was marked as low. Australia, New Zealand, Norway and Spain were determined to have a high homeownership rate, whereas France, Germany and Switzerland were determined to have a low homeownership rate. For the exact average homeownership rates per country, see **Appendix B**.

Furthermore, **Appendix D** shows the regression results of the analysis done on basis of homeownership rates. The analysis was only done using fixed effects in two models, one controlling for time by using year dummies and one without, for both high- and low country homeownership rates. It becomes clear that for both models the housing market wealth effect is significant for high homeownership countries. Whereas for the low homeownership countries, there is either weak evidence for a housing market wealth effect in model I, which is only significant at the 10% level and there is an insignificant housing market wealth effect in model II. In conclusion, it appears that high homeownership rate countries are more affected by housing market wealth effects than low homeownership rate countries.

6. DISCUSSION

After having presented all the results of the analyses done in this study, this section discusses the results and relates it with earlier research that has been done on this topic. Furthermore, the results are compared with the earlier proposed conceptual framework (put forth in chapter 3) and a framework is proposed based on the combination of the concept and the actual results. Finally, some policy implications are discussed with regards to wealth effects and the wider macroeconomic view.

6.1 DISCUSSION

In this part each research question will be discussed separately, starting with the main research question, as posed below, and following up with the additional questions posed in this thesis, all of which will be re-iterated at the relevant part. First, the main research question:

''What are the wealth effects of the housing- and stock market on consumption expenditure?''

Before discussing the general assessment of the results regarding the main research question, the initial hypothesis set out in **chapter 3** is repeated. It was expected, based on the literature, that both the housing market and stock market wealth effects would be positive and significant, in addition it was expected that the housing market wealth effect would be stronger than the stock market wealth effect. Using multiple econometric specifications and models to find robust results, it appeared that there is significant presence of a housing wealth effect, with elasticities depending on the exact specification, however with at least an elasticity of 0.10, thereby implying a strong effect, which corroborates the findings of Brayton and Tinsley (1996) and especially Case et al. (2005). At the same time, those results are in contrast with Girourd and Blondal (2001), who don't find consistent results regarding the size of wealth effects and Carroll et al. (2011), who find a, relatively, weak housing wealth effect. Even when controlled for endogeneity the presence of a positive significant housing wealth was confirmed, which is not in line with the findings of Calomiris et al. (2009) who found a negligible effect. In contrast, a significant stock market wealth effect was not found in this thesis. Some specifications showed signs of significant presence of this effect, however, overall, a robust result was not found. Those results are in line with earlier findings by Case et al. (2005). Furthermore, the results showed that in almost all instances the housing wealth effect was implied to be larger than the stock market wealth effect, those findings don't corroborate with the results of Dvornak and Kohler (2007) and Ludwig and Slok (2002), who found the stock market wealth effect to be stronger than the housing wealth effect. In conclusion, it becomes apparent that most of the initial hypothesis set out can be confirmed, except for the fact that a robust result couldn't be found for a positive and significant stock market wealth effect. However, as mentioned before, since the variable used in this study specifically measures *domestic* stock market capitalization it is difficult to assess where capital gains are realized and consumed, since either can happen in different countries due to international capital mobility.

''Have the wealth effects changed over time?''

Next, this study analyzed the wealth effects over time with an expectation that wealth effects have increased over time, mainly due to financial liberalizations as argued by Goodhart and Hoffman (2008). However, no such effect was found, the main conclusion from this specific analysis was that even though no increasing trend was found over time, the wealth effects are at their highest in the period 2001-2016 (with a slightly stronger effect between 1975-1985). Moreover, even though the wealth effects haven't increased over time, both housing market- and stock market wealth are at their highest

levels *(see figures 2 and 3, chapter 4.1)*, therefore the aggregate impact of wealth effects is higher than before. Note, however, that this strong effect in the most recent period could have been caused by the extraordinary peak of wealth effects culminating in the financial crisis of 2008. Based on this the initial hypothesis can be rejected.

''Is there a difference in wealth effects between pre- and post-financial crisis?''

The third hypothesis stated that household behavior had changed due to the financial crisis and wealth effects would be lower in the period after the financial crisis, however, this was not found. Instead, it was found that household behavior, and thus wealth effects, hasn't changed after the financial crisis. No significant difference between the sizes of the wealth effects were found between pre- and post-financial crisis. In conclusion, the third hypothesis was rejected as well.

''Is there a difference in the size of wealth effects in economic downfalls and upswings?''

Finally, the difference between the sizes of wealth effects are compared between economic upswings and downturns. Initially, it was expected that wealth effects would be more prominent and stronger in economic upswings than in downfalls. Earlier research by Case et al. (2005), which is the only study that tested for symmetrical wealth effects, found such a result, more specifically, they found the housing wealth effect to be asymmetrical, house price decreases weren't found to have a negative effect on consumption expenditure. However, in this thesis, the wealth effects were found to be symmetric and thus, when house prices decrease the housing wealth effect has negative consequences on consumption expenditure, while at the same time the opposite is true for economic upswings, in times of house price increases. Additionally, no significant difference between the size of decreasing and increasing wealth effects were found. Similar to the second and third hypothesis, the fourth hypothesis was also rejected.

Table 12. Summary of Results on Hypotheses

Hypothesis	Expectation	Result	Confirmed / Rejected
H1	Both HMW- and SMW effects have a positive effect on consumption. In addition, a stronger HMW is expected.	Only HMW significant and positive. A stronger HMW is found.	Mostly Confirmed
H2	Increasing wealth effects over time.	No increasing wealth effects found. However, most recent period has strongest effects.	Rejected
H3	Pre-financial crisis wealth effects stronger than post-financial crisis wealth effects.	No significant difference found between the two periods.	Rejected
H4	Wealth effects stronger in economic upswings than in downfalls.	No significant difference found economic upswings and downfalls.	Rejected

*HMW = Housing market wealth; SMW = Stock market wealth

In sum, it is found that the results of the main research question corroborate findings of earlier research. However, since the additional questions haven't been researched as extensively it is difficult to make good comparisons. For example, whether wealth effects are stronger in economic upswings or downfalls, i.e. the symmetry or asymmetry of wealth effects, has only been specifically tested for

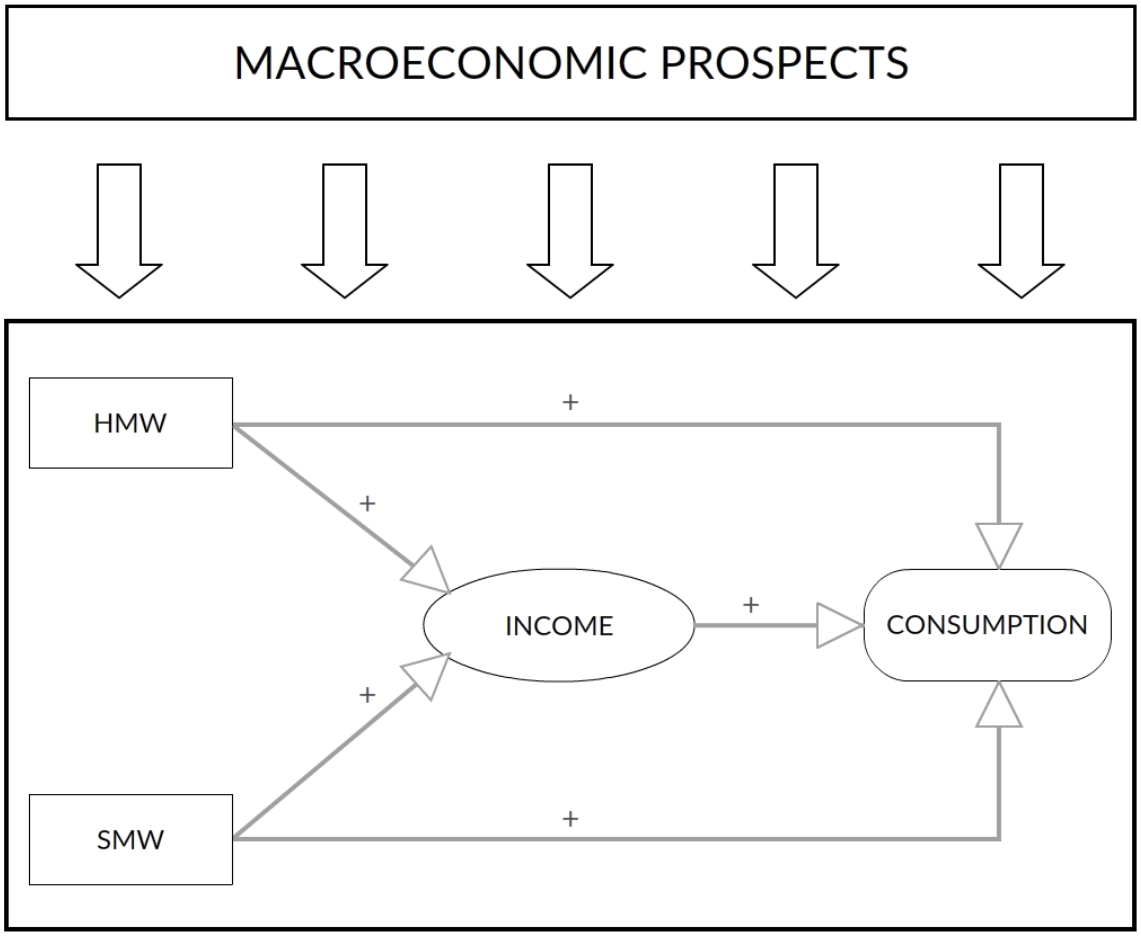
by Case et al. (2005). Similar to the symmetry of wealth effects, endogeneity has only been tested for by Calomiris et al. (2009). For both of those, however, the results of this thesis contradict the findings of earlier research. Regardless, the findings of this thesis are not necessarily extraordinary since Case et al. (2013) found similar results, however, their research was only on US-state level instead of an international cross country analysis. Finally, **table 12** briefly summarizes the main results of this thesis in combination with the hypothesis and whether they are confirmed or rejected.

To conclude, some final thoughts are discussed on causality. According to Leamer (1983) there naturally ought to be some skepticism about estimations derived from rather simple macroeconomic structural relations like the ones used in this thesis. Initially it is assumed that causality runs from the wealth variables to consumption and not by another variable such as macroeconomic prospects or confidence in the economy. Furthermore, it is reiterated that the housing market wealth variable constructed in this thesis specifically excludes changes in housing wealth caused by improving quality of one's house, since if improvements were included there would naturally be a correlation between consumption and housing wealth simply because home improvements expenses are a part of consumption expenditure.

6.2 FEEDBACK ON CONCEPTUAL FRAMEWORK

When constructing the conceptual framework (chapter 3), which had its basis in relevant related research and especially the micro economic transmission channels, the following was assumed.

Figure 4. Conceptual Framework of the Relationships between Income, Wealth and Consumption

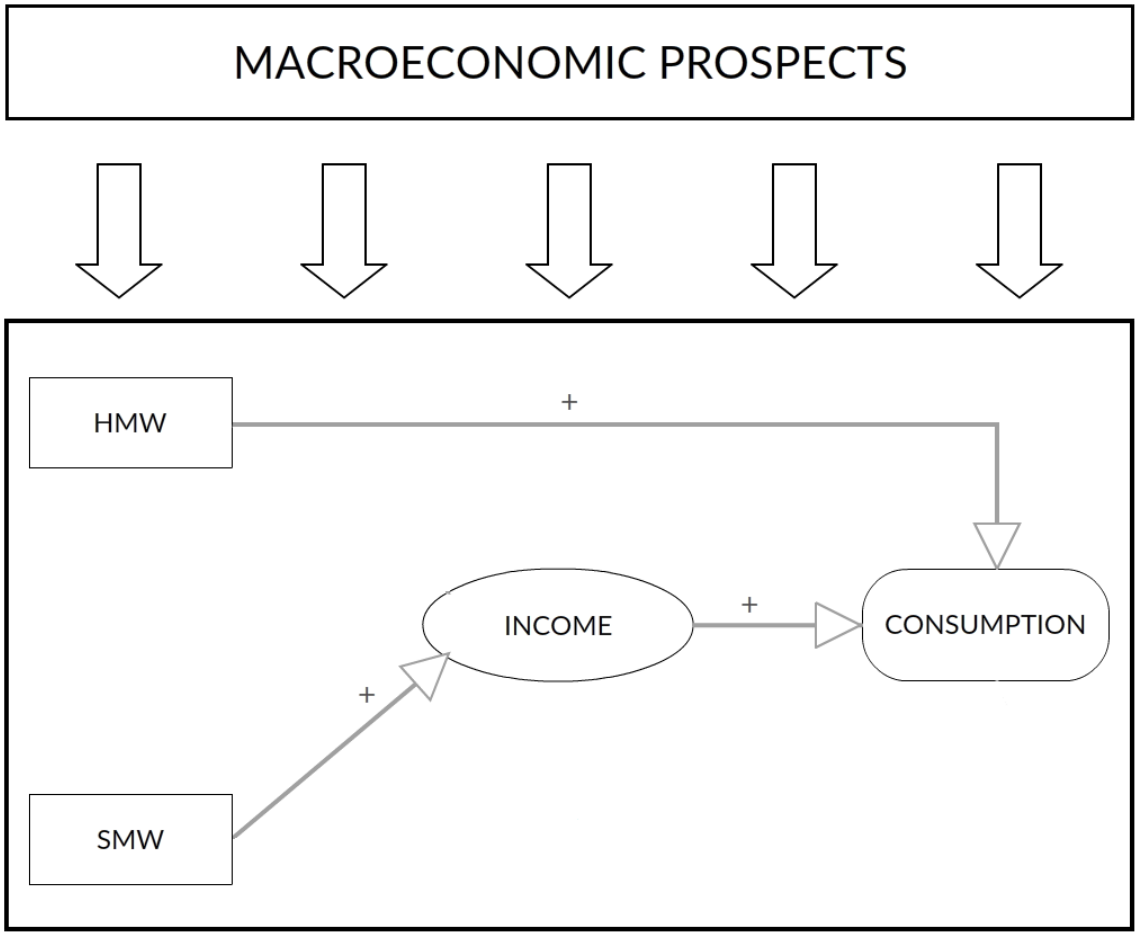


*Where *HMW* stands for Housing Market Wealth and *SMW* stands for Stock Market Wealth.

First of all, a positive direct relationship was expected between both housing market- and stock market wealth on the hand and consumption expenditure on the other hand. In addition, it was expected that if households realized their capital gains, but didn't spend any of it on consumption, their income would increase. Furthermore, even though the income variable wasn't of interest in terms of research since it was used as a control variable, a positive relationship was expected between income and consumption. **Figure 4** shows the conceptual framework which was earlier shown in chapter 3.

The results indicated that a positive significant result was found for a housing wealth effect, however, none was found for the stock market wealth effect. In addition, when interaction variables were added to the model (see Appendix C) only the interaction effect between stock market wealth and income turned out to be significant. This isn't necessarily surprising since stock market wealth has a higher liquidity than housing market wealth and can be easier turned into cash. The combination of the conceptual framework and the actual results, results in **figure 5** where the *actual* framework is shown.

Figure 5. Framework based on Results



*Where *HMW* stands for Housing Market Wealth and *SMW* stands for Stock Market Wealth.

6.3 POLICY IMPLICATIONS

Even when establishing that house prices and the aggregate economy are closely related via the housing wealth effects, what would be practical repercussions of this effect for policy makers? After all, in times of increasing housing market wealth consumption expenditure seems to increase as well, which has further positive consequences on the economy as a whole. However, the close association

with housing wealth and the sub-sequential home equity withdrawal by consumers raises some concerns. Belsky (2008) names four major concerns.

First of all, a stronger housing wealth effect has been shown to result in a substitution of mortgage debt for consumer debt (Belsky, 2008). As a consequence, during periods of price declines lenders are less protected against losses and defaults as borrowers. Furthermore, consumer debt is more easily to be bankrupted on than housing debt. This causes more borrowers to be vulnerable to financial meltdowns from which they cannot recover (Belsky, 2008). **Second**, homeowners in countries with a high housing wealth effect are more vulnerable to scam artists who try to pressure homeowners to keep refinancing their mortgages while including new fees into the mortgage (Belsky, 2008). **Third**, as people are borrowing against home equity, which would be freed up later in life, many will remain in debt even later into retirement, at a time when most are on a fixed income. This will increase the pressure on social safety nets, which would especially be relevant in countries with a high housing wealth effect. **Fourth**, in countries with a high housing wealth effect, consumer liquidity will be strongly tied to house values and, especially in times of house price declines, systemic risks can be exposed (Belsky, 2008). Furthermore, Smith and Searle (2008) observed that the proceeds of home equity borrowing are less being spent on housing and finding their way more into consumption. They argue that in the long term this can be corrosive of wealth accumulation.

All of those concerns are especially relevant in countries with a high homeownership rate and are ways through which households and consumers can be put into a vulnerable position. Shen, Holmes and Lim (2015) put forth important advice for policy makers. **First**, to prevent volatility and extreme fluctuations, which are accompanied by wealth effects on consumption, policy makers should focus more on rapid rises in asset prices to counteract inflationary pressure. More specifically, policy makers should follow asset markets more closely to identify possible asset bubbles in an early stage to prevent the significant consequences of an eventual bubble burst. At the same time, policy needs to prevent over-consumption by households when asset prices are increasing at a rapid rate. **Second**, since, as found in this thesis, housing wealth effects are stronger than stock market wealth effects, the housing market should receive priority from policy makers. In addition, countries which experience very high house price levels, such as Australia, Norway, Sweden and the UK to name a few (see figure 1), should especially focus on monetary stabilization policies.

7. CONCLUSION

In this thesis the effects of housing market and stock market wealth on consumption expenditure were analyzed. Doing so, a macroeconomic view was taken wherein both wealth effects were analyzed in an international framework using data on individual country homeownership rates and own imputed aggregate housing market wealth values. The main research question revolved around determining the size and the presence of wealth effects for both the housing- as well as the stock market on consumption expenditure. What makes this study especially relevant is that the global economy seems to have recovered from the financial crisis and house prices and housing wealth (*figure 2, chapter 4.1*) are at either approximately the same level as in 2007-2008 or even higher. Therefore, in consequential order this thesis set out to research the presence of wealth effects, whether wealth effects have increased over time, whether household behavior (and thus wealth effects) has changed between pre- and post-financial crisis and finally whether wealth effects portray asymmetric or symmetric effects, thus whether wealth effects are similar in size in economic booms compared to in economic busts (wherein house prices either, respectively, increase and decrease). The combined answer to those questions gives a vital view as to how consumption will be affected in countries if a next financial crisis (re-)occurs, in combination with significant house price decreases.

In sum, what has been found is that there is significant presence of a housing market wealth effect, no such presence was found for a stock market wealth effect. The exact size of the housing market wealth effect depends on specific models and econometric specifications, however, in general, a 10 percent increase in house prices is found to at least increase consumption expenditure by 1 percent, increasing up to roughly 2 percent (**see tables 3-7**). More importantly this result was confirmed even when controlling for endogeneity by using instrumental variables. In addition, no increasing wealth effects over time were found, however, the most recent period (2001 – 2016) showed signs of being the period with the strongest wealth effects up until now. Furthermore, household behavior wasn't found to have changed after the financial crisis. Finally, in contrast with earlier research, decreasing housing prices were found to have negative effects on consumption expenditure. Those results combined signify that if house prices were to decrease significantly, severe consequences might be expected for consumption expenditure and, thus, whole economies. In addition, it has been shown that high homeownership rate countries have higher wealth effects than countries with a relative low homeownership rate, therefore, for those countries this study is particularly relevant. Those analyses combined added to the literature by giving a conclusive answer to the presence of wealth effects, by addressing endogeneity in an appropriate manner and finally, this is one of the first studies that specifically tested whether wealth effects are stronger in downfalls than in upswings.

In short, driven by housing wealth effects, increasing or decreasing house prices make a difference to the balance sheets of households. Thus, housing wealth effects have a significant impact on the economy and knowing those exact effects is of increasing importance for policy makers. Their role is to avoid large swings in housing values. Thereby producing more stability in the economy while still providing an opportunity for homeowners to accumulate wealth in housing with less risk, however, potentially also with lower reward.

LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

Finally, several limitations of this thesis are addressed. **First** of all, as mentioned in chapter 4, the data for the housing market wealth variable was imputed following the method of Case et al. (2005). The

formula proposed is highly dependent on homeownership rates of individual countries. However, this data is hard to get by, which makes this research more difficult to replicate. In addition, every country and its respective national statistical bureau has a different method of calculating the homeownership rate, which affects the results. However, since there is no other way of obtaining the homeownership rates for all countries of interest from one direct source, any research trying to analyze housing market wealth effects will have to confront this issue. **Second**, this thesis didn't control for substantial institutional differences among countries, such as taxation laws of wealth and capital gains, or institutional constraints which affect borrowing and saving behavior. This was mainly the case because obtaining those variables is difficult and this thesis instead took an international macroeconomic approach. **Third**, in this thesis the household behavior was assessed in terms of whether it changed between pre- and post-financial crisis. However, the sample of the post-financial crisis era is relatively short and might not be conclusive enough for robust results. In addition, since the financial crisis is, relatively, not long ago, the strong wealth effects experienced in the build-up to the financial crisis might indicate stronger wealth effects for the whole sample than they actually are.

Further research can contribute on the above mentioned second limitation by splitting countries up based on whether their financial system operates in a market-based approach or in a bank-based approach, which indicates the relative level of financial liberalization among countries, and therefore also takes into account certain institutional differences in those countries. In a similar vein, further research could specifically assess country specific wealth effects, it might be that certain countries in the sample of this study have very weak or maybe no wealth effects, however, since this wasn't of specific interest to this research it hasn't been assessed. Therefore, marginal propensity to consume or elasticities of individual countries can be estimated and elaborated on in further research. Furthermore, since, as of December 2017 the Quantitative Easing program of the European Central Bank is slowly coming to an end, it is of importance to research how much this program contributed to increasing house prices and what the accompanying wealth effects could have been due to this program. Moreover, research could dedicate itself to establishing what the effects will be on both house prices, stock prices and the accompanying wealth effects when the Quantitative Easing program comes to an end.

BIBLIOGRAPHY

Ando, A., & Modigliani, F. (1963). The" life cycle" hypothesis of saving: Aggregate implications and tests. *The American economic review*, *53*(1), 55-84.

Aron, Janine, and John Muellbauer. (2006) "Housing Wealth, Credit Conditions and Consumption." Working Paper 9, Centre for the Study of African Economies, Oxford University.

Attanasio, O. P., Blow, L., Hamilton, R., & Leicester, A. (2009). Booms and busts: Consumption, house prices and expectations. *Economica*, *76*(301), 20-50.

Atterhög, M. (2005). Importance of government policies for home ownership rates: an international survey and analysis.

Barrell, R., Costantini, M., & Meco, I. (2015). Housing wealth, financial wealth, and consumption: New evidence for Italy and the UK. *International Review of Financial Analysis*, *42*, 316-323.

Belsky, E. (2008). Housing Wealth Effects and the Course of the US Economy: Theory. *Evidence, and Policy Implications, Joint Center for Housing Studies Working Paper W08-7.*

Bertaut, C. C. (2002). *Equity prices, household wealth, and consumption growth in foreign industrial countries: wealth effects in the 1990s* (No. 724). Board of Governors of the Federal Reserve System (US).

Blinder, A. S., Deaton, A., Hall, R. E., & Hubbard, R. G. (1985). The time series consumption function revisited. *Brookings Papers on Economic Activity*, *1985*(2), 465-521.

Bonvalet, C., & Lelièvre, E. (1997). The transformation of housing and household structures in France and Great Britain. *Population, Space and Place*, *3*(3), 183-201

Bostic, R., Gabriel, S., & Painter, G. (2006). Housing Wealth. *Financial Wealth, and Consumption: New Evidence from Micro Data, University of Southern California Working Paper*.

Brayton, F., & Tinsley, P. (1996). A Guide to FRB/US. *Finance and Economics Discussion Series*, *42*.

Byrne, J. P., & Philip Davis, E. (2003). Disaggregate wealth and aggregate consumption: an investigation of empirical relationships for the G7. *Oxford Bulletin of Economics and Statistics*, *65*(2), 197-220.

Calomiris, C., Longhofer, S. D., & Miles, W. (2009). *The (mythical?) housing wealth effect* (No. w15075). National Bureau of Economic Research.

Campbell, J. Y., & Cocco, J. F. (2007). How do house prices affect consumption? Evidence from micro data. *Journal of monetary Economics*, *54*(3), 591-621.

Carroll, C. D., Otsuka, M., & Slacalek, J. (2011). How large are housing and financial wealth effects? A new approach. *Journal of Money, Credit and Banking*, *43*(1), 55-79.

Case, K. E., Quigley, J. M., & Shiller, R. J. (2005). Comparing Wealth Effects: The Stock Market versus the Housing Market. *Berkeley Program on Housing and Urban Policy*.

Case, K. E., Quigley, J. M., & Shiller, R. J. Wealth effects revisited: 1975–2012. 2013. *NBER Working Paper*, *18667*.

Catte, P., N. Girouard, R. Price, & C. Andre. (2004) “Housing Markets, Wealth and the Business Cycle.” OECD Economics Department Working Papers 394.

Dvornak, N., & Kohler, M. (2007). Housing wealth, stock market wealth and consumption: a panel analysis for Australia. *Economic Record*, *83*(261), 117-130.

Dynan, K. E., & Maki, D. M. (2001). *Does stock market wealth matter for consumption?* (No. 2001-23). Board of Governors of the Federal Reserve System (US).

Engelhardt, Gary V., “House Prices and the Decision to Save for Down Payments,” *Journal of Urban Economics*, 36, 1994: 209-237.

Engelhardt, Gary V., “House Prices and Home Owner Saving Behavior,” R*egional Science and Urban Economics*, 26, 1996: 313-336.

Fernandez-Corugedo, E., Price, S., & Blake, A. (2003). *The dynamics of consumers' expenditure: the UK consumption ECM redux* (No. 204). Bank of England.

Galli, A. (2016). *How Reliable are Cointegration-based Estimates for Wealth Effects on Consumption?: Evidence from Switzerland* (No. 2016-03). Swiss National Bank.

Girouard, N. and Blondal, S. (2001), ‘House Prices and Economic Activity’, Organisation for Economic Cooperation and Development Economics Department Working Paper 279, OECD, Paris.

Goodhart, C., & Hofmann, B. (2008). House prices, money, credit, and the macroeconomy. *Oxford Review of Economic Policy*, *24*(1), 180-205.

Goodman, John L. and John B. Ittner, “The Accuracy of Home Owners’ Estimates of House Value,” *Journal of Housing Economics*, 2, 1992: 339-357.

Hall, R. (1978) “Stochastic Implications of the Life Cycle-Permanent Income Hypothesis”, *Journal of Political Economy*, 86, 971-987.

Hamburg, Britta, M. Hoffmann, and J. Keller. (2005) “Consumption, Wealth and Business Cycles in Germany.” Discussion Paper 16, Deutsche Bundesbank.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of econometrics*, *115*(1), 53-74.

Kain, John F. and John M. Quigley, “Note on Owners’ Estimates of Housing Values,” *Journal of American Statistical Association*, 67 (340), 1972: 803-806.

Leamer, Edward E., “Let’s Take the Con Out of Econometrics,” *American Economic Review*, 73, 1983: 31-43.

Lettau, M., Ludvigson, S., & Steindel, C. (2002). Monetary policy transmission through the consumption-wealth channel. *FRBNY Economic Policy Review*, *5*, 117-133.

Lettau, M., and S. Ludvigson. (2004) “Understanding Trend and Cycle in Asset Values: Reevaluating the Wealth Effect on Consumption.” American Economic Review, 94, 276–99

Ludwig, A., & Sløk, T. (2004). The relationship between stock prices, house prices and consumption in OECD countries. *Topics in Macroeconomics*, *4*(1).

Ludwig, A., & Sløk, T. (2002). The impact of changes in stock prices and house prices on consumption in OECD countries. New York: IMF Working Paper, 1, 43.

Meyer, L. H. (1994). The WUMM Model Book. *St. Louis: LH Meyer and Associates*.

Muellbauer, J. and Lattimore, R. (1999), 'The Consumption Function: A Theoretical and Empirical Overview', in Pesaran, M.H. and Wickens, M.R. (eds), *Handbook of Applied Econometrics*, Vol. I. Blackwell Publishers, Oxford, UK; 221–311.

Otoo, M. W. (1999). *Consumer sentiment and the stock market*. Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board.

Pichette, L., and D. Tremblay. (2003) "Are Wealth Effects Important for Canada?" Working Paper 30, Bank of Canada

Poterba, James M., "Stock Market Wealth and Consumption," *Journal of Economic Perspectives*, 14, 2000: 99-118.

Poterba, J. M., Samwick, A. A., Shleifer, A., & Shiller, R. J. (1995). Stock ownership patterns, stock market fluctuations, and consumption. *Brookings papers on economic activity*, *1995*(2), 295-372.

Sak, M. B., & Raponi, M. M. (2001). Housing statistics in the European Union 2002. *Population*, *1981*(1.1), 1980-2001.

Shefrin, Hersh and Richard Thaler, "The Behavioral Life-Cycle Hypothesis," *Economic Inquiry*, 26, 1988: 609-643.

Sheiner, Louise, "Housing Prices and the Savings of Renters," *Journal of Urban Economics*, 38, 1995: 94-125.

Shen, X., Holmes, M. J., & Lim, S. (2015). Wealth effects and consumption: A panel VAR approach. *International Review of Applied Economics*, *29*(2), 221-237.

Smith, S. J., & Searle, B. A. (2008). Dematerialising money? Observations on the flow of wealth from housing to other things. *Housing Studies*, *23*(1), 21-43.

Starr-McCluer, M. (2002). Stock market wealth and consumer spending. *Economic Inquiry*, *40*(1), 69-79.

Tan, A., & Voss, G. (2003). Consumption and wealth in Australia. *Economic Record*, *79*(244), 39-56.

Verbeek, M. (2008). *A guide to modern econometrics*. John Wiley & Sons.

Yoshikawa, Hiroshi and Fumio Ohtake, "An Analysis of Female Labor Supply, Housing Demand, and the Saving Rate in Japan," *European Economic Review*, 33, 1989: 997-1030.

APPENDIX

Appendix A – Data Availability

Variable	Consumption	Income	Housing Market Wealth	Stock Market Wealth
Australia	1975 – 2016	1975 – 2016	1975 – 2016	1975 – 2016
Belgium	1975 – 2016	1975 – 2016	1975 – 2016	1975 – 2016
Canada	1975 – 2016	1975 – 2016	1975 – 2016	1975 – 2016
Denmark	1975 – 2016	1975 – 2016	1980 – 2016	1975 – 2016
Finland	1975 – 2016	1975 – 2016	1975 – 2016	1982 – 2016
France	1975 – 2016	1975 – 2016	1975 – 2015	1975 – 2016
Germany	1975 – 2016	1975 – 2016	1975 – 2015	1975 – 2016
Italy	1975 – 2016	1975 – 2016	1975 – 2016	1988 – 2016
Netherlands	1975 – 2016	1975 – 2016	1975 – 2016	1975 – 2016
New Zealand	1975 – 2015	1975 – 2016	1975 – 2016	1975 – 2016
Norway	1975 – 2016	1975 – 2016	1975 – 2016	1981 – 2016
Spain	1975 – 2016	1975 – 2016	1975 – 2016	1975 – 2016
Sweden	1975 – 2016	1975 – 2016	1975 – 2016	1975 – 2016
Switzerland	1975 – 2015	1975 – 2016	1975 – 2016	1975 – 2016
United Kingdom	1975 – 2016	1975 – 2016	1975 – 2016	1975 – 2016
United States	1975 – 2016	1975 – 2016	1975 – 2016	1975 – 2016

Appendix B. Table of Homeownership rate across countries (1970 – 2016)

YEAR	Australia	Belgium	Canada	Denmark	Finland	France	Germany	Italy	Netherlands	New Zealand	Norway	Spain	Sweden	Switzerland	UK	USA
1970	*68,8*	55,9	*60,3*	-	60,4	45	33	*50,9*	35	*73,2*	52,6	66,7	49	28,5	50,1	64,3
1971	68,8	*56,2*	60,3	-	*61,1*	*45,2*	33,1	50,9	35	73,2	*54,0*	*67,6*	*49,6*	*28,6*	50,5	64
1972	*68,7*	*56,5*	*60,6*	-	*61,8*	*45,3*	33,5	*51,7*	*36*	*72,4*	*55,5*	*68,6*	*50,2*	*28,8*	51,5	64,3
1973	*68,6*	*56,8*	*60,9*	-	*62,6*	45,5	*34,2*	*52,5*	*37*	*71,6*	*56,9*	*69,5*	*50,8*	*28,9*	52,3	64,9
1974	*68,5*	*57,1*	*61,2*	-	*63,3*	*45,7*	*34,8*	*53,3*	*38*	*70,9*	*58,4*	*70,4*	*51,4*	*29,1*	52,7	64,8
1975	*68,4*	*57,5*	*61,5*	-	*64,0*	*46,0*	*35,5*	*54,1*	39	*70,1*	*59,8*	*71,4*	*52*	*29,2*	53	64,4
1976	68,3	*57,8*	61,8	-	*64,7*	*46,2*	*36,2*	*54,9*	*39,6*	69,3	*61,2*	*72,3*	*52,6*	*29,3*	53,3	64,6
1977	*68,7*	*58,1*	*61,9*	-	*65,4*	*46,5*	*36,8*	*55,7*	*40,2*	*69,6*	*62,7*	*73,2*	*53,2*	*29,5*	54,1	64,8
1978	*69,0*	*58,4*	*61,9*	-	*66,2*	46,7	37,5	*56,5*	*40,8*	*69,9*	*64,1*	*74,2*	*53,8*	*29,6*	54,7	64,8
1979	*69,4*	*58,7*	*62,0*	-	*66,9*	*47,4*	*38,1*	*57,3*	*41,4*	*70,2*	*65,6*	*75,1*	*54,4*	*29,8*	55,4	64,8
1980	*69,7*	*59*	*62,0*	62,8	67,6	*48,2*	*38,8*	*58,1*	42	*70,5*	67	76,0	55	29,9	55,8	65,5
1981	70,1	59	62,1	62,8	*67,6*	*48,9*	*39,4*	58,9	*42*	70,8	*68,1*	*76,7*	*55,2*	*30,0*	56,6	65,6
1982	*70,1*	*59,9*	*62,1*	62,8	*67,5*	*49,6*	40	*59,8*	42	*71,3*	*69,2*	*77,4*	*55,4*	*30,2*	58,1	64,8
1983	*70,2*	*60,8*	*62,2*	63	*67,5*	*50,4*	*39,9*	*60,7*	*42,5*	*71,8*	*70,4*	*78,1*	*55,6*	*30,3*	59,4	64,7
1984	*70,3*	*61,7*	*62,2*	63,3	*67,4*	*51,1*	*39,7*	*61,6*	*43*	*72,2*	*71,5*	*78,8*	*55,8*	*30,5*	60,5	64,6
1985	*70,4*	*62,6*	*62,3*	63,6	67,4	*51,8*	*39,6*	*62,5*	43	*72,7*	*72,6*	*79,5*	56	*30,6*	61,6	64,1
1986	70,4	*63,4*	62,3	63,7	67,5	*52,5*	*39,4*	*63,5*	*43,1*	73,16	*73,7*	*80,2*	*56,6*	*30,7*	62,6	63,6
1987	*72,4*	*64,3*	*62,4*	63,8	67,6	*53,3*	39,3	*64,4*	*43,4*	*73,3*	*74,8*	*80,9*	*57,3*	*30,9*	62,6	63,8
1988	*72*	*65,2*	*62,4*	63,7	68,2	54,0	*39,2*	*65,3*	*43,8*	*73,4*	*76,0*	*81,6*	*57,9*	*31,0*	64	63,7
1989	*71,6*	*66,1*	*62,5*	63,4	69,3	*54,2*	*39,1*	*66,2*	44,1	*73,5*	*77,1*	*82,3*	*58,5*	*31,2*	65,2	63,9
1990	*70,4*	67	*62,5*	62,8	69,3	54,4	*39,1*	*67,1*	45	*73,7*	78,2	83,0	59,2	31,3	65,8	64,0
1991	69,2	*67*	62,6	62,2	67,7	*54,6*	*39,0*	68	*45,8*	73,8	*78,1*	*83,5*	58,9	*31,6*	65,9	63,9
1992	*69,5*	*67*	*62,8*	62	67,0	*54,9*	*38,9*	*68,3*	*46,6*	73,5	*78,1*	*83,9*	58,7	*32,0*	66,3	64,0
1993	70,1	*67,2*	*63*	61	67,2	*55,1*	38,8	*68,7*	*47*	72,8	*78,0*	*84,4*	58,5	*32,3*	66,4	64,2
1994	71,4	*67,7*	*63,2*	60,8	66,2	55,3	36,3	*69,0*	47,5	72,2	*78,0*	*84,8*	58,4	*32,6*	66,7	63,8
1995	70,9	67,7	*63,4*	60,6	65,4	*55,2*	*37,5*	*69,4*	48	71,6	*77,9*	85,3	58,3	*33,0*	66,9	64,2
1996	69,6	*68*	63,6	60,4	63,9	*55,1*	*38,6*	*69,7*	*49*	70,9	*77,9*	*84,8*	58,2	*33,3*	67	65,1
1997	70,4	*68*	*64*	60,3	63,3	*54,9*	*39,8*	*70,0*	*50,2*	70,4	*77,8*	*84,3*	58,2	*33,6*	67,3	65,4
1998	*70,1*	*68*	*64,4*	61,5	63,6	*54,8*	40,9	*70,4*	51,1	69,8	*77,8*	*83,8*	58,2	*33,9*	67,8	65,9
1999	70,7	*68*	*65*	61,6	63,8	54,7	*41,3*	*70,7*	51,6	69,2	*77,7*	*83,2*	58,3	*34,3*	68,5	66,7
2000	70,3	68	*65,2*	61,6	64,2	54,8	*41,8*	*71,1*	52,5	68,6	*77,7*	*82,7*	58,6	34,6	68,9	67,1
2001	69,5	66,4	65,8	61,6	64,4	55,6	*42,2*	71,4	53,3	68,1	77,6	82,2	59,0	*35,6*	69,1	67,5
2002	69,5	68	*66,3*	61,3	65,0	*55,6*	42,6	*71,9*	54,6	67,7	*78,6*	*81,3*	59,2	*36,5*	69,3	67,8
2003	70	*69*	*66,8*	61,2	65,5	*56*	*42*	*72,5*	54,9	67,5	*79,6*	*80,4*	59,4	*37,5*	68,6	68,0
2004	69,5	70	*67,4*	61,2	66,0	56	41	73	55,6	67,3	*80,6*	79,5	59,6	38,4	69	68,6
2005	69,3	*71*	*67,9*	60	67,2	*56,5*	*41,6*	*72,8*	56,3	67,1	*81,6*	80,5	59,9	*39,4*	69	69,1
2006	69,8	*72*	68,4	60	67,3	57	41,6	72,7	56,9	66,9	*82,6*	79,5	60,0	*40,4*	68,3	68,5

YEAR	Australia	Belgium	Canada	Denmark	Finland	France	Germany	Italy	Netherlands	New Zealand	Norway	Spain	Sweden	Switzerland	UK	USA
2007	68,3	72,9	*68,1*	59,6	66,5	*57,3*	*42,2*	73,2	57,7	66,7	83,8	80,1	60,3	*41,4*	67,9	68,4
2008	*68,4*	73,1	*67,8*	60,4	67,7	*57,6*	43,2	72,8	58,3	66,4	86,1	79,6	60,7	*42,4*	67,2	67,8
2009	68,8	72,7	*67,4*	60,3	68,4	57,6	*44,4*	72,8	58,8	66,1	85,4	79,3	61,0	*43,4*	66,3	67,3
2010	*68*	71,6	67,1	59,5	67,9	*57,6*	45,7	72,6	59,3	65,8	82,9	79,4	61,4	44,4	65,5	67,1
2011	67	71,8	66,9	60,2	68,1	*57,6*	*44,8*	73,2	59,7	65,5	84	79,6	61,6	43,8	64,8	66,4
2012	*67*	72,4	65,6	59,8	67,3	*57,6*	*43,9*	74,2	60,0	65,2	84,8	79,2	61,6	43,8	64,1	65,4
2013	67,2	72,3	67,8	59,2	66,4	*57,6*	43	73,3	*60,0*	64,9	83,5	77,7	61,7	44	63,5	65,0
2014	*66,4*	72	66,5	58,6	65,9	57,6	45,5	73,1	*60,1*	64,5	84,4	78	61,8	44,5	63,1	64,8
2015	*65,5*	71,4	67	58,1	64,6			72,9	60,1	64,1	82,8	77,3	61,8	43,4	62,6	63,7
2016	65,5	71,3	67	57,7	64,6			72,9	*60,1*	63,7	82,7	77,1	62,0	*43,4*	*62,6*	63,5
AVG	69,4	66,5	64,4	61,3	66,4	53,7	40,3	67,3	49,8	69,4	76,5	79,8	58,2	35,2	63,7	65,5

**All numbers are in percentages; Italicized numbers are linearly interpolated; AVG stands for average homeownership rate. Sources: Australia: Australian Bureau of Statistics and Atterhög (2005). Belgium: Statistics Belgium and Sak & Raponi (2001). Canada: Statistics Canada and Atterhög (2005). Denmark: Statistics Denmark and Atterhög (2005) and Sak & Raponi (2001). Finland: Statistics Finland. France: Atterhög (2005) and Sak & Raponi (2001) and Bonvalet & Lelievre (1997). Germany: Federal Statistics Office and Atterhög (2005) and Sak & Raponi (2001). Italy: National Institute of Statistics and Sak & Raponi (2001). Netherlands: Central Agency for Statistics. Norway: Statistics Norway and Atterhög (2005). Spain: National Statistics Institute and Atterhög (2005) and Sak & Raponi (2001). Sweden: Statistics Sweden and Atterhög (2005) and Sak & Raponi (2001). Switzerland: Swiss Federal Statistics Office. United Kingdom: Office for National Statistics. United States: Census Bureau.*

Appendix C. Wealth Effects including Interaction Variables

Variable	I	II
Income	.3218* (.1043)	.3096* (.1066)
Housing Market Wealth	.4291* (.1343)	.3177* (.0985)
Stock Market Wealth	-.2751* (.1101)	-.2591* (.0834)
Housing Market Wealth x Income	-.0174 (.0132)	-.0131 (.0099)
Stock Market Wealth x Income	.0331* (.0112)	.0272* (.0085)
Year Dummies	No	Yes
R^2	.9420	.9777
F-test/chi2	1991.22	545.62

*Significant at the 5% level. Both regressions are estimated with the fixed effect estimator.

Appendix D. Homeownership Rate Sensitivity: High vs Low

Variable	I (HIGH)	II (HIGH)	I (LOW)	II (LOW)
Income	.4334* (.1159)	.0569 (.1503)	.6379* (.0927)	.1518** (.0838)
Housing Market Wealth	.3468* (.0609)	.2568* (.0498)	.1152** (.0638)	.0206 (.0244)
Stock Market Wealth	.0311 (.0317)	.0390 (.0312)	.1156* (.0327)	.0001* (.0296)
Year Dummies	No	Yes	No	Yes
R^2	.9445	.9840	.9412	.9967
F-test/chi2	873.66	158.19	613.65	525.42
p-value for H_0	0.000	0.001	0.996	0.669

*Significant at the 5% level, ** at the 10% level. H_0[1]: tests whether HW = SMW.