**Threshold Effects of Housing Affordability and Financial Development on the House Price-Consumption Nexus**

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**Abstract**

The study explores the asymmetric effect of housing and financial wealth on household consumption behavior using panel data from 24 OECD countries, spanning the period 2000 to 2016 by employing a financial development (FD) index (proxy for financial deepening) and the house price-to-income (HPI) ratio (proxy for housing affordability) through a threshold empirical framework. The analysis tests certain hypotheses, such as: (i) the housing wealth effect on consumption is stronger than its financial counterpart, (ii) overall wealth effects increase (decrease) during bubble (post bubble) periods, (iii) the higher level of financial development and the lower level of housing affordability ratio both result in stronger wealth effects, (iv) increasing wealth effects show a bubble formation. The results suggest that housing wealth has generally a greater positive effect on consumption. The effect of housing and financial wealth on consumption increases, depending on higher financial development and declining housing affordability. The evidence also suggests that the impact of housing and stock market wealth has increased during the dot.com and housing bubble periods.

**Keywords:** Housing prices, consumption behavior, housing affordability, financial development, panel threshold

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# **1. Introduction**

Housing and financial wealth are the major components of household’s wealth and tend to move along with household’s consumption (Poterba, 2000; Case et al., 2005; Marquez et al., 2013 among others). This framework was in the particular interests of policymakers, specifically after the mid-1990’s in the US and other major economies who were focusing on the bright side of the positive wealth effect arising from stock and housing markets and inducing personal consumption expenditure (Case and Shiller, 2003). However, the dot.com bubble and the housing bubble events have collectively showed that using wealth effect as a tool for short-term consumption and economic growth may eventually result in a bubble formation. Buiter (2008) discusses that there is a pure wealth effect on consumption from a change in house prices if this reflects a change in the speculative bubble component of house prices. From the perspective of the consumption-wealth effect nexus, Martin and Ventura (2012) document that although bubbly episodes may expand consumption, their ultimate result is fall in consumption, the capital stock, and output. Moreover, a positive relation between housing wealth, stock wealth and consumption would be larger in developed financial markets (Case et al., 2005; Poterba, 2000; Iacoviello, 2011; Šonje et al., 2014).

A rich prior literature generally estimates the positive linkage between housing/financial wealth, income and consumption. However, the existing empirical literature does not provide a clear answer on the variations in the magnitude of both wealth effects during different stages of the economies, such as the pre/post bubble periods, based on specific thresholds. This paper addresses two complimentary sets of questions. The first set of questions concerns with the series of interrelated field classical and innovative research questions; such as does the housing wealth effect is more prominent than the stock market wealth effect? How wealth-driven consumption may change depending on the changing magnitudes of housing and stock market prices? How, and to what extent, do housing and stock wealth effects show different patterns during pre- and post-bubble periods? Does different levels in financial development and housing affordability matter for the wealth transmission channels? The second set of questions concern the attempts to measure the relation between the wealth effect and the formation of bubbles. Hence, this paper furtherly asks whether changing patterns in wealth effects during bubble periods have specific impacts on household’s consumption and eventually on bubble formation? Does the level of financial development and housing affordability would contribute to the wealth transmission channels and bubble formation?

The paper fills the two research gaps currently present in the literature. In this respect, following Hansen (1999), Caner and Hansen (2004), and Kremer et al. (2013), this work is the first, to the best of our knowledge, in the wealth effect-consumption nexus to implement threshold regression estimations with the GMM approach, to test asymmetric effects of housing prices on household consumption across different regimes by using the financial development index (FD), as well as the house price-to-income (HPI) ratio (housing affordability) as explicit thresholds. Secondly, it also addresses how housing and stock wealth channels vary during pre/post-bubble periods. Therefore, the analysis presents a new venue of discussion in the relevant literature by combining the relations among overvaluations in housing/stock markets, the growth in the wealth effect components, income, and hence household consumption, and the periods of bubble.

The main findings indicate the following evidence: (i) income, housing wealth and stock wealth had a positive relation with household consumption, (ii) income was the predominant variable to explain household consumption, (iii) housing wealth had a greater positive effect on households’ consumption vis-a-vis the stock wealth effect, (iv) higher financial development/deepening and declining housing affordability had a significantly positive impact on housing/stock wealth effects, (v) similarly to the impact of income, the impact of housing/stock wealth effect had increased during bubble periods (namely, during dot.com and housing bubble periods) in comparison with the entire sample, in the global financial crisis (GFC) and post-GFC periods, (vi) in the post-GFC period, consumption patterns have not increased to their pre-crisis levels, probably depending on the increase in inequality and its potential outcomes affecting consumers’ behavior, (vii) the findings did not support the two phenomena known as the “Ratchet effect” and “keeping up with the Joneses” for the post-GFC period, (viii) the sensitivity of household consumption to both thresholds (financial development and housing affordability) increased based on declining threshold values. Overall, our key findings imply that specifically for the housing as the generally stronger asset transmission channel, wealth effect induced consumption may contribute imbalances such as asymmetric consumption and price bubble formations. This paper also argues that the best way to deal with uncertainty periods in an economy would be to develop some income and wealth effect related social responses.

The remainder of the paper is organized as follows. The next section documents the outlook for the economy in selected countries. The following section provides the literature review related to the asymmetric relationship between household consumption and its explanatory variables, in particularly, house price/housing wealth. Thereinafter, data and the modelling strategy are explained. Section 5 analyses model results and provides a brief discussion with several implications, while the last section concludes.

# **2. Macroeconomic Conjuncture During the Observation Period**

In many countries during the housing bubble period (2003-2007Q2), both financial and housing wealth increased in conjunction with the increase in financial development/deepening. However, in the same period, housing affordability declined which is denoted by an increasing house price-to-income (HPI) ratio. After the global financial crisis (GFC), two key aspects draw attention. First, financial deepening dramatically declines after the GFC period. Second, the case of housing affordability has a reverse situation in contrast with the housing bubble period. For instance, affordability increased[[4]](#footnote-4) only in a few, mostly developed, countries before GFC; by contrast, after GFC, affordability increased only in a few, mostly less developed or developing countries. Nevertheless, housing affordability has a general tendency to decline in most countries in both prior and after the GFC period.

Moreover, in the relevant literature, it has long been recognized that the total effect of changes in the rate of interest on the readiness to spend on present consumption is complex and uncertain (Coskun et al., 2018). Keynes (1936) discussed how it was convenient to assume negative relations between consumption and interest rates according to the classical theory; however, the empirical literature also reveals that the evidence is mixed for the impact of interest rates on consumption. Although, we did not include interest rates in our empirical model; it can be seen from Figures A3a and A3b that interest rates declined both prior and after the GFC period. In other words, the interest rates have the same declining tendency across all countries in the overall period. Below, we summarize how financial wealth, financial development, housing wealth, housing affordability and interest rate change during housing bubble period (2003-2007Q2) and post GFC period (2011-2016).

***Housing bubble /prior GFC period (2003-2007Q2)***

1. Financial wealth: In all countries, financial wealth increases in the housing bubble period (Figure A1).
2. Financial development: During bubble period, financial development index increases in all countries, except in Switzerland (Figure A1).
3. Housing wealth: In Figure A2, it can be seen that housing wealth increases in the majority of countries (i.e., Australia, France, UK). Housing wealth is positively correlated with the HPI ratio and negatively correlated with housing affordability. During bubble period, housing wealth declines only in Austria, Germany, Israel, Japan and Portugal.
4. Housing Affordability: The higher HPI, the lower housing affordability and vice versa. In parallel with the above statement, only in Austria, Germany, Israel, Japan and Portugal, housing affordability increases, while housing wealth declines (Figure A2).
5. Interest rates: Figures A3a and A3b illustrate real interest rates on 10-year Government Bonds. As we can see from Figure A3a, in mostly developed and high income countries, real interest rates have a tendency to decrease. However, it appears to be more volatile in the case of the GIIPS, Israel, and South Africa. In all countries it declined in the bubble period and increased remarkably in the GFC period.

***Post-GFC period (2011-2016)***

1. Financial wealth: During the post-GFC period financial wealth is greater than its bubble period levels in the majority of countries. Only in Greece, Italy, Finland, Netherlands, Portugal and Spain, there is a remarkable decline in financial wealth. For other countries, in the bubble and post-GFC periods financial wealth levels are approximately the same (Figure A1).
2. Financial development: It can be seen from figure A1 that there is a dramatically decline in financial development index (FD) in the post-GFC period, particularly, in Australia, Germany and the UK. Moreover, there is mostly a decline in FD in the remaining countries as well, in the same period. Only in Korea, New Zealand, South Africa and the US, financial development increases after the GFC period.
3. Housing wealth: Figure A2 indicates that in 15 countries, there is an increase in housing wealth along with the decline in affordability. Comparing to the bubble period, the housing wealth is higher in the post-GFC period. An increase in housing prices might have affected affordability negatively (Mengjie et. al., 2008; Meen, 2008; Duan, 2011; Lin et al., 2014; Bourussa and Haurin, 2017) and housing wealth positively. Due to various factors such as housing ownership ratios[[5]](#footnote-5), access to mortgage credits[[6]](#footnote-6) this may have result with an increase in inequality[[7]](#footnote-7).
4. Housing Affordability: Figure A2 illustrates that in 15 countries (i.e., Austria, Canada, Germany, Norway, the UK, the US) HPI/housing wealth has been increasing, which indicates that housing affordability has been decreasing in the post-GFC period. In Austria, Germany, Israel, Japan and Portugal, housing affordability tends to decline, while housing wealth tends to increase vis-a-vis to the bubble period. In Finland, Greece, Italy, Korea and South Africa, housing affordability has a tendency to increase, while housing wealth decreases vis-a-vis the bubble period.
5. Interest rates: In the post-GFC period, real interest rates show lower volatility and tend to decline across all countries. The countries in Figure A3a display lower real interest rates than those in Figure A3b after the GFC period.

Overall, based on the increasing housing affordability, housing wealth decreases with simultaneously decreasing financial wealth only in Finland, Greece and Italy in the post-GFC period. In addition to these countries, financial wealth decreased only in the Netherlands, Portugal and Spain, while housing wealth decreased only in Korea and South Africa. In other words, in the rest of 16 countries both financial and housing wealth increased after GFC, while both types of wealth were higher in that period vis-a-vis the bubble period. As it can be seen from Figures A3a and A3b, real interest rates declined in both periods prior and after GFC.

In a theoretical basis, the analysis indicates a higher marginal propensity to consume over the post-GFC period, based on the higher levels of both financial and housing wealth levels (Case et al., 2005; Carroll et al., 2011; Alp and Seven, 2019, among others). On the other hand, based on the relevant empirical literature, we may expect an inequality-induced declining consumption, depending on the dramatically decline in financial development (i.e. Greenwood and Jovanovic, 1990; Beck et al., 2007; Seven and Coskun, 2016, among others). In the post-GFC period, in the majority of countries, along with the decline in housing affordability, home ownership ratios, financial development and residential loans to GDP ratio, the increase in both housing and financial wealth may suggest an increase in wealth inequality[[8]](#footnote-8). Based on the general overview of the selected indicators, the expected result from our framework is twofold: i) increase in wealth may result with an increase in consumption in parallel with the literature ii) consumption may not increase sufficiently if the wealth distribution does not approach equality. However, it is not easy to measure the distribution of wealth, because people do not report their total wealth routinely (Drăgulescu and Yakovenko, 2001), the analyze of consumption behaviour may give some insights to make an inference on the case of wealth inequality.

# **3. Literature Review**

From a theoretical perspective, the analysis of the relationship between consumption, income and wealth is based on the life cycle model proposed by Modigliani and Brumberg, (1954; 1979), Ando and Modigliani (1963) and the permanent income hypothesis suggested by Friedman (1957). Accordingly, households are assumed to use both labour income and financial and non-financial assets for their lifetime consumption expenses.

As it is summarized in table 1, a number of studies have examined the household consumption and wealth channels by employing several methods. Furthermore, a considerable amount of the literature has been published on the asymmetric effects of various factors on household consumption. Apergis and Miller (2006) examine the role of ratchet effects between U.S. stock market values and consumption by using cointegration and error-correction methods. Their results confirm that stock-market values asymmetrically affect real per capita consumption. Negative “news” affects consumption more than positive “news”. Van Treeck (2008) analyses the relationship between personal consumption, income and wealth by using a single data set for the US to test the effects of loss aversion or liquidity constraints. It has been shown that in the short run, a decline in income and wealth can have very substantial negative effects on consumption, and hence, on economic activity. However, in the long run, households seem to have managed to translate income and wealth increases into relatively large increases in consumption expenditure. Chen et al. (2010) investigate the asymmetric effect of house prices on various categories of consumption under constrained and unconstrained regimes by presenting a simple theoretical model based on Iacoviello (2004) and Luengo-Prado (2006). Their study reveals that LC-PIH holds only under the unconstrained regime through a threshold regression model based on Caner and Hansen (2004) and a seasonal error-correction model (ECM) based on Johansen and Schaumberg (1999). Moreover, their findings imply that durable consumption exhibits a very strong asymmetric effect in response to changes in house prices, while other categories of consumption do not support this asymmetry.

To determine the effects of age, Tobing (2012) examines whether the marginal propensity to consume out of housing wealth is constant across age. His study applies threshold estimations, as in Hansen (1999), to investigate the presence of threshold effects with respect to age. His results imply that there are three significant threshold age groups, those of 49, 55 and 65. It has been suggested that for individuals aged between 49 and 55, an increase in housing wealth by $1 increases consumption by 2.9 cents, while it reduces consumption by 2.3 cents for individuals older than 65 years. If age is below 49 and between 55 and 65 years, the effect of housing wealth on consumption is insignificant.

In an analysis of the housing wealth effect on private consumption in European post-transition countries (i.e., Bulgaria, Croatia, Estonia and Czech Republic), Šonje et al. (2012) apply vector error correction and threshold error correction models to analyse the threshold impacts of changes in housing wealth and to determine the short- and long-run marginal propensities to consume out of housing wealth. According to their findings, the response of private consumption to changes in income and housing wealth is characterized by non-linear properties in three countries (i.e., Bulgaria, Croatia and Estonia). Marquez et al., (2013) investigate the presence of wealth effects in the UK economy, taking into account the credit conditions of financial markets and whether consumption responds asymmetrically to positive or negative financial and housing wealth shocks by employing M-TAR methodology (as in Enders and Siklos (2001) and Stevans (2004)). Their results imply that UK consumption responses to wealth shocks seem to have been asymmetric for the considered period (1976:q1-2009:q4). Khalifa et al. (2013) study the housing wealth effect of households across different income levels. In order to split the sample by income levels endogenously, the threshold estimation method, developed by Hansen (1999), has been applied for non-dynamic panels with individual-specific fixed effects. It has been found that there are two significant threshold income levels of $74,046 and $501,000. Housing wealth has a significant effect on consumption, if income is below $74,046. It is also significant if income is between $74,046 and $501,000. For incomes above $501,000, the coefficient turns out to be not statistically significant.

The relationship between housing prices and consumption has been investigated by Dong et al. (2017) for 35 major Chinese cities and with respect to the presence of heterogeneity regarding housing and financial markets. Their study employs a threshold regression model to analyze two important effects: wealth and substitution effects. Two threshold variables have been identified: the ratio of housing price to income as a proxy variable to the “affordability” status of the housing market and the ratio of deposits of financial institutions to GDP as a proxy variable to the regional financial development. Based on their results, the wealth effect is significant in the healthy housing market regime where the housing price-to-income ratio is smaller than 5.0882. In contrast, the substitution effect becomes dominant in the regime where the housing price-to-income ratio lies between 5.0882 and 5.9625. Hui et al. (2018) analyze how housing prices and housing market sentiments affect non-housing consumption distributions among owners and renters during their life cycles in China by employing a quantile regression for panel data (QRPD). Their findings document that the positive effect of housing prices on consumption is stronger at the higher and lower parts of the distribution, with the differences being caused by ages; these findings are more significant for the case of homeowners. Moreover, the housing market sentiment plays a significant role in owners' and highest-consuming renters' consumption. Table 1 summarizes the literature review.

**[Place Table 1 Here]**

As it is stated above, in the existing literature there are several studies that focus on the asymmetric relationship between consumption and various explanatory variables, such as income and certain wealth components. Most studies on the asymmetric responses of consumption to changes in wealth have only been carried out in a small number of areas. A few of them investigate the asymmetric effect of income or wealth increases/decreases on consumption, while the rest of them address the other possible reasons of such an asymmetric behaviour of individuals, such as age, stock market news, and housing prices. Although some research has been carried out on the asymmetric behaviour of consumers based on numerous factors, there have been only a handful of them investigating the asymmetric effects of housing prices on consumption (i.e., Dong et al., 2017; Hui et al., 2018). In addition, to the best of our knowledge, no research has been found that employs the threshold regression model which is developed by Hansen (1999) and extended by Caner and Hansen (2004) and Kremer et al. (2013) to investigate the asymmetric effects of housing prices on consumption across a wide range of countries. The goal of this study is to shed new light on these debates through an examination of the threshold effects arising from financial development and housing affordability. Moreover, it attempts to offer an insight into the underlying behavioral aspects.

# **4. Data and Modelling Strategy**

## **4.1. Data**

This section describes the data and outlines the selection of data. The analysis involves an unbalanced panel of 24 countries[[9]](#footnote-9), spanning the period 2000Q1–2016Q4. The time span and selection of countries used are constrained by data availability. The research data in this study is quarterly and drawn from two main sources: International Monetary Fund (IMF) and the Organization for Economic Co-operation and Development (OECD). The consumption data are households’ final consumption and the proxy variable for income is GDP per capita. Both types of data are collected from the IMF and are seasonally adjusted.

The two wealth components of households are financial and housing wealth. The stock price index and the real house price index[[10]](#footnote-10) are used as proxy variables for financial and housing wealth, respectively. Stock price indices are calculated from the prices of common stock of companies traded on national or foreign stock exchanges. Real house price index series are seasonally adjusted. The data are obtained from the OECD database. This study employs two threshold variables to analyze the effect of housing affordability and financial deepening (FD) on households’ consumption. The standardized house price to income ratio[[11]](#footnote-11) indicates the housing affordability which is provided by OECD. The FD ranking retrieved from IMF, is a relative ranking of countries on the depth, access, and efficiency of their financial institutions and financial markets (Sahay et al., 2015; Svirydzenka, 2016). FD is used as a threshold to determine the financial deepening, while the data are retrieved from IMF. The index is interpolated as quarterly data from annual data based on quadratic/average method.

All series are deflated by the IMF consumer price index. Consumption and income series are converted into US Dollar terms by using exchange rates provided by IMF and expressed in per capita terms. The population series are interpolated from annual data, and the source is World Bank. All variables are expressed in natural logarithms. This transformation has certain advantages as the mitigation of the role of potential outliers, given that the residuals mostly suffer from the presence of a skewed distribution the transformation obtains residuals that are approximately symmetrically distributed around zero, obtaining closer to homoscedastic residuals, and when we need to better interpret the results in terms of percentage changes or elasticity. Table 2 provides some summary statistics.

**[Place Table 2 Here]**

## **4.2. Modelling Strategy**

First, the analysis sets the estimated consumption as a function of income, housing wealth and financial wealth. The model is shown as follows:

The subscripts i and t denote the country and time, respectively. lncons denotes the logarithm of household consumption per capita, as the proxy of housing wealth lnhp is the logarithm of housing prices, lnypc is the logarithm of income per capita, and lnsp denotes the logarithm of stock prices as the proxy of financial wealth. αi captures country fixed effects, while ε denotes the error term. *αi* denotes the country-specific fixed effects. In order to test the asymmetric effects of housing prices on consumption under different market conditions, the analysis implements the threshold regression estimation method developed by Kremer et al. (2013), which is essentially an extension of the Hansen (1999) static set up. They identify the presence of certain thresholds in the relationship between household consumption and housing prices, after controlling for the role of income per capita and stock prices as crucial regressors. In their model, by applying the forward orthogonal deviations transformation to eliminate individual effects, they combine the instrumental variable estimation of the cross-sectional threshold model introduced by Caner and Hansen (2004) with the panel threshold model of Hansen (1999). The equation is as follows:

or,

ln

where, the regime dependent variable is the log of housing prices,[[12]](#footnote-12) lnhpit, I(·) is the indicator function indicating the regime defined by the threshold variable (either the FD or HPI). δ1 is the regime intercept common to all cross-sections, as suggested by Bick (2010). Equation (2) illustrates that when the financial index is smaller than the estimated threshold value γ1, the elasticity of consumption to housing prices is θ1, while if it is larger than the estimated threshold value γ1, the elasticity of consumption to housing prices is θ2. Equation (3) shows that when the logarithm of housing price to income ratio is smaller than the estimated threshold value γ2, then the elasticity of consumption to housing prices is θ5, while if this log ratio is larger than the estimated threshold value γ2, then the elasticity of consumption to housing price is θ6.

Following Caner and Hansen (2004) and Kremer et al. (2013), the analysis first estimates a reduced form regression of the endogenous variables on a set of instruments. The predicted values of the endogenous variables are then substituted into Equation (2) or Equation (3). In step two, Equation (2) or Equation (3) with these predicted values is estimated repeatedly by least squares for each value of the thresholds, γ. Then, the corresponding least square estimates of the parameters and the sum of squared errors, denoted by S(γ) are recorded. The estimator for the threshold parameter, γ, is chosen which minimizes the sum of squared errors, i.e., . In accordance with Hansen (1999) and Caner and Hansen (2004), the critical values for determining a 95% confidence interval of the threshold value are where C(α) is the 95% percentile of the asymptotic distribution of the likelihood ratio statistic LR(γ). Finally, the slope coefficients are estimated by the GMM for the previously used instruments and the previous estimated threshold ˆγ. The important feature of this threshold model is that it captures the impact of housing prices on household consumption based on two different regimes.

# **5. Model Results and Discussion**

## **5.1. Panel Unit Root Test Results**

A second-generation panel unit root test is employed to determine the degree of integration of the respective variables. The Pesaran (2007) panel unit root test does not require the estimation of factor loading to eliminate cross-sectional dependence. Specifically, the usual ADF regression is augmented to include the lagged cross-sectional mean and its first difference to capture the cross-sectional dependence that arises through a single-factor model. The null hypothesis is a unit root for the Pesaran (2007) test. The results of this test are reported in Table 3 and support the presence of a unit root across all panel variables.

**[Place Table 3 Here]**

## **5.2. Threshold Estimation Results for Entire Period**

To decide the number of thresholds of the financial development index and the house prices to income ratio, the fixed effect model is estimated under the hypothesis of zero, one and two thresholds. Table 4 highlights that both threshold variables have one threshold. Τhe findings for the benchmark model (as described by Equations (2) and (3)), presented in Table 5, document that the marginal impact of housing prices on household consumption is regime-specific, with a significant FD (or alternatively, the HPI ratio) threshold value of around 0.58 (1.88) in the second column and first row at the 95% confidence interval ranging from [0.54–0.61] ([1.86-1.90]). The single estimated threshold value of FD (0.58) split the sample into two regimes: the low level of financial development regime and high level of financial development regime. Similarly, the single estimated threshold value of HPI (1.88) split the sample into two regimes: low affordability regime and high affordability regime. The confidence intervals are very tight, which implies that the threshold estimates have been precisely estimated. The p-value for the Hansen J-test is 0.48 (0.43) at the end of the second column, implying that we do not reject the null hypothesis that the instruments are valid.

**[Place Table 4 Here]**

**[Place Table 5 Here]**

The explanatory variables are estimated with expected signs and significance. The outcomes suggest various conclusions and interesting implications. First, they illustrate that income, housing wealth and stock market wealth have a positive relation with household’s consumption. Second, the evidence suggests in parallel to theoretical/empirical expectations that income is a predominant variable to explain household’s consumption. In this respect, income per capita has a significant positive coefficient, which confirms a Keynesian type of consumption. In general, the impact of income (and also of the housing/stock market wealth) on consumption varies, depending on the regime and the stage of the global economy and more importantly it significantly increased during bubble periods according to both thresholds criteria.

Although the baseline estimates are reasonable, it is necessary to check for robustness. We do this by empirically assessing the baseline results reported in Table 5 through the use of the panel smooth transition regression (PSTR) modelling framework, developed by González et al. (2005), who assume that the behavior of a series changes smoothly, depending on the value of the transition variable. The PSTR model is defined through two linear parts linked by a non-linear transition function, while it allows the variable under investigation to move within two different regimes with a smooth transition process, depending on the value of a specific transition variable. The PSTR model is particularly useful for situations in which the non-linear dynamics are driven by a common regime-switching component, but where the response to this component can be different across variables. According to Wu et al. (2013), PSTR modelling can simultaneously resolve any non-linearity and heterogeneity problems. Most importantly, PSTR models can endogenously determine the threshold value of the transition variable.

Based on PSTR modelling, Equation (1) yields:

where β4, β5 and β6 are the coefficients of the controls in a different regime. W(zit; γ, c) is the transition function bounded between 0 and 1 and describes the smooth switching process of consumption. zit is the transition variable as in González et al. (2005). γ>0 is the smoothing parameter, describing the slope of the transition function, while c is the threshold value of the transition variable. Both γ and c are endogenously estimated. Notably, this study uses alternatively FD or HPI as the transition variables. The optimal lag length of the transition variable is determined by the minimum Akaike information criterion (AIC). González et al. (2005) indicate that from an empirical point of view, it is sufficient to consider only the cases of m = 1 or m = 2 to capture the non-linearities due to regime switching.

First, the analysis conducts the linearity testing to investigate whether consumption satisfies the linearity condition. Once the linearity is rejected, it determines the number of transition functions. Finally, after the exclusion of individual-specific means, it can apply non-linear estimates to the parameters of Equation (4). Following Colletaz and Hurlin (2006), it replaces the transition function W(zit; γ, c) with the first order Taylor expansion of the transition function at γ = 0 to perform the linearity testing of Equation (4). Thus, we have the following auxiliary equation:

vit = πi + Σπk xikt + Σπ’k xikt zit + ηit (5)

k=1 k=1

where vit and xikt are the residuals and explanatory variables of the linear components in Equation (4), respectively. The linearity testing is to perform the test of H0: π’k = 0. When the linearity testing is rejected, a sequential approach is used to test of no remaining non-linearity in the transition function. Let PSR0 be the panel sum of squared residuals under H0 (i.e., the linear panel model with individual effects), and PSR1 the panel sum of squared residuals under H1 (i.e., the PSTR model with two regimes). The corresponding F statistic is then given by the following:

LM = [(PSR0 – PSR1) / mK] / [PSR0 / (TN –N–mK)] (6)

where K is the number of explanatory variables. Under the null hypothesis, LM statistic follows an asymptotic chi-square distribution x2(K) and the F statistic has an approximate F(mK, TN–N–mK) distribution, with (r + 1) being the number of regimes.

Table 5a reports the linearity tests which lead to the rejection of the null hypothesis of linearity for the PSTR specifications with different numbers of location parameters (m = 1, 2).

**[Place Table 5a Here]**

Table 5b presents the results of the no remaining non-linearity tests. Following González et al. (2005), this part of the analysis allows the number of location parameters (m) to be either one or two. Both the PSTR model with one location parameter (m=1), one transition function (r=1), and FD as the zit variable, and the PSTR model with r=m=2 and the HPI as the zit variable can clearly describe the non-linear process of consumption growth.

**[Place Table 5b Here]**

According to the minimum AIC criterion, the optimal model for evaluating the non-linear dynamics of consumption growth is the PSTR model with r=m=2. Table 5c reports the new estimation results. These new findings clearly provide robust support to the baseline results displayed in Table 5. More specifically, income, housing wealth and stock market wealth continue not only to exert a positive effect on household’s consumption, but also their numerical estimates remain close to those obtained previously; at the same time, income remains a predominant variable explaining this consumption, confirming again a Keynesian type of consumption. Finally, these effects continue to be regime-dependent, with a stronger effect in the second regime.

**[Place Table 5c Here]**

## **5.3. Threshold Estimation Results for Sub-Periods**

Table 6 presents the threshold effects tests results, while Table 7 presents the dynamic threshold estimation results across sub-periods. The first period (dot.com bubble: 2000Q1-2003Q4) refers to the time span the burst of the bubble affected the deteriorated performance of the real economy in terms of consumption (Barrell et al., 2015), the second one (housing bubble period: 2003Q1-2007Q2) refers to the period where US housing prices substantially increased before the ‘housing bubble burst in 2008 (Attanasio et al., 2009; Calomiris et al., 2009), the third period (global -sub-prime- financial crisis period: 2007Q3-2010Q4) is the so known the sub-prime housing crisis period (Calomiris et al., 2012), and finally the fourth period (post-crisis period: 2011Q1-2016Q4) is the period after the crisis to the end of the sample period.

For each of 4 sub-periods, both threshold variables financial development index (FD) and house price to income ratio (HPI) have one threshold which split the sample into two regimes as indicated: the low level of financial development regime and high level of financial development regime, similarly, low affordability regime and high affordability regime. Below, we discuss the results from the perspective of model variables and also furtherly develop some behavioral implications.

**[Place Table 6 Here]**

**[Place Table 7 Here]**

### ***5.3.1. Income***

While the coefficient values of income are (0.575-0.539) during the post GFC period, these values were (0.698-0.675) during the dot.com bubble period, and (0.738-0.694) during the housing bubble period, according to FD, HPI thresholds, respectively in table 7. Therefore, the impact of income on household’s consumption has increased during the housing bubble period, vis-à-vis the previous bubble period and has significantly declined during the GFC period (2007Q3-2010). Although the impact of income on household’s consumption has increased in the post-crisis period (2011-2016), its level is below the pre-crisis levels. This evidence implies that increasing income levels have significantly contributed consumption (-driven growth), specifically during the bubble periods. The above findings may also clarify the policies of low interest rates and positive wealth effect-oriented consumption (and economic growth) in US and UK specifically. In this context, we may argue that the FED (and other major central banks) has pursued low-interest-rate policies during the bubble periods, because of the consumption-driven short-term growth policies, based on income growth and increases in housing/stock market wealth. Moreover, the coefficients of income in equation (2) are greater than the coefficients in equation (3) in all sub-periods. Financial development index, greater than “0.64” enhances more the impact of income on consumption rather than the impact of housing affordability.

As the policy implication, we suggest that policy-makers should be careful on the linkage between income and consumption specifically during rising period of the economy taken into account the asymmetric nature of this relation may eventually contribute price bubble formation.

### ***5.3.2. House Prices, Housing Wealth and Stock Wealth***

Countries having a FD greater than the threshold level experience a positive and statistically significant effect of housing prices on household consumption, whereas there is a positive, albeit an insignificant link, between household consumption and housing prices below this threshold level. For instance, in the dot.com bubble period, when housing wealth increases one unit, consumption increases 0.138 unit, if FD index is above the “0.64” threshold level and a significant link doesn’t exist between housing wealth and consumption if FD is below the “0.64” threshold level. The same also holds in the case of the housing prices to income ratio employed as the threshold level. In the housing bubble period, if HPI is above the threshold “79.91”, housing wealth induced consumption increases 0.108 unit however, a significant link doesn’t exist between housing wealth and consumption if HPI is below the threshold. Therefore, we may conclude that positive housing wealth effects may rise from the financial development criterion (FD > threshold), which suggests that the more developed financial system is, the stronger the wealth effect is. By contrast, a positive wealth effect arising from the affordability criterion (HPI > threshold) may imply that the higher the HPI (or declining housing affordability) is, the stronger the stock/housing wealth effect is. Moreover, in the housing bubble period, the difference between the coefficients of housing wealth below and above the threshold (θ1- θ2; θ5- θ6) is greater than other periods. This finding implies that housing bubble may contribute an excessive consumption through the consumption-wealth channel, which may also deepen the impact of the housing bubble. In such periods, policy makers should contemplate on consumption driven economic growth and its consequences.

It can be seen below in Table 8 that both threshold values decline in the housing bubble and the GFC periods. This evidence implies that the sensitivity of household consumption to both thresholds (financial development and housing affordability) increases, based on the declining threshold values. For instance, household consumption responds positively to an increase in financial development when the index is equal or above 0.64 in the dot.com bubble period, while in the housing bubble period, an index at 0.61 level is sufficient to positively affect consumption. We may speculate that these estimated thresholds for the bubble and crisis periods may be considered as a signal of bubbles indicating the associated critical levels. In this respect, we suggest that policy-makers should closely follow the dynamics affordability measurements (i.e. HPI, housing affordability index) and financial deepening variables (from banking, stock market, and insurance sectors) as the early warning tools to timely detect formation of asymmetries in wealth effect and potential price bubbles.

Housing wealth has a greater positive effect on household consumption vis-a-vis the effect of stock market wealth during the entire and post GFC periods in both threshold criteria. Therefore, the findings suggest that the positive housing wealth effect scenario is also in accordance with our case. Accordingly, following the rise in house prices, households’ wealth (through additional credit line or capital gains from housing investment), consumption, and economic growth increase subsequently. On the other hand, easing credit constraints and fast securitization may implicitly cause an increase in primary/secondary mortgage market risks in the given circumstances. However, the magnitudes and primary channels of wealth effects vary in sub-periods, depending on the selected threshold criterion. In this respect, while FD (HW above) threshold criterion suggests that housing wealth was the primary wealth effect channel, the HPI threshold suggests that stock wealth was the primary channel during both bubble periods. Nevertheless, even if the stock wealth would be the stronger effect, according to HPI thresholds, housing wealth was still sizable and very close to it. This result also confirms the importance of housing wealth during bubble periods. The policy implications of this evidence are in line with the existing discussions in the literature. We briefly suggest that policy makers should aware of the asymmetric impacts of housing/financial wealth effects during different stages of the economy. Although it is difficult to manage wealth effect-related macroeconomic variables, policy makers may note that easing credit conditions in housing and stock market may eventually contribute to the several wealth effects risks.

Similarly, the impact of income on consumption, the impact of housing and stock market wealth has increased during the dot.com bubble period, vis-à-vis the entire sample period and the other sub-periods. Increases in stock wealth are particularly higher, which suggests that bubble periods have specifically made the stock wealth effect stronger as observed during the periods 2000-2003 and 2003-2007Q2. Interestingly, the housing wealth effect is insignificant and there is only a relatively small stock wealth effect during the GFC period. This may be explained by the increasing uncertainty during this specific crisis period and it might have been resulted in a higher liquidity-preference and hence a negative impact on the wealth effect related consumption.[[13]](#footnote-13) As the policy implication, we suggest that policy-makers in developed markets should be careful on the downside risks of positive stock market wealth effects. In this respect, although it does not look like a politically correct or financially attractive policy goal, cooling stock markets before their peaks seem to be the best policy option to support less asymmetric responses of income and wealth effect components.

### ***5.3.3. Behavioral changes in consumption patterns***

In comparison with dot.com bubble and housing bubble periods, the coefficients which denote the impact of income, housing wealth and stock wealth on consumption, are smaller in the post-GFC period. Notwithstanding that the coefficients increased after the GFC period, they are smaller than their levels in the aforementioned bubble periods. This evidence implies that the marginal propensity to consume (MPC) out of income and housing/financial wealth has decreased after GFC. In other words, MPC levels have not increased to their pre-crisis levels. This result may be explained from a behavioral perspective. Palley (2010) states that household consumption increases with increases in household income, but the increase is mitigated if the increase in household income raises a household’s relative income position. Therefore, households’ MPC falls, in other words doesn’t increase sufficiently, along with insufficient increase in relative permanent income (RPI). This is explained in Duesenberry’s (1949) consumption theory which suggests a distinction between absolute and relative income effects.

Empirical findings imply that households with higher income have a higher marginal propensity to save with the accumulation and bequest motive. It is also argued in both the theoretical and empirical literature on well-being, happiness and behavioral aspects of consumption. If all household incomes rise together, the only utility gain comes from increased absolute income. If both absolute income and income inequality are rising, the public could, on average, report diminished happiness if the relative income effect dominates the absolute income effect (Veblen, 1898; Hollander, 2001; Alpizar et al., 2005; Palley, 2010, among others). Therefore, it is imperative to distinguish whether increases in income is absolute or relative. Additionally, it is also important to define the impacts of income inequality on the behavior of consumption and saving. Hence, inequality could matter for macroeconomics if households with different amounts of wealth respond differently to the same aggregate shock (Carroll et al., 2017).

As mentioned before, according to the comparison between the pre- and post-GFC periods the main difference is the declining FD across all countries. Empirical studies reveal that the growth in financial development helps to reduce income inequality and vice-versa (Greenwood and Jovanovic, 1990; Beck et al., 2007; Seven and Coskun, 2016, among others). The empirical results imply that inequality might be increased in the period under this study due to declining financial development (FD) and housing affordability. This evidence suggests that the difference in MPC levels may be explained with some behavioral aspects and the increase in income inequality. Consequently, we may speculate that the accruement in income and wealth during the bubble periods and declining financial development and housing affordability resulted in an increase in inequality. After GFC, since relative income effect dominates the absolute income effect because of the increasing inequality, households with higher income may have higher marginal propensity to save through the accumulation and bequest motive, as it is argued in the related literature (Hollander, 2001; Alpizar et al., 2005; Palley, 2010, among others). This result may be the reason of lower levels of MPC out of income and both housing and stock wealth in the post-GFC period vis-a vis the bubble periods.

Our results contradict with the well-known “keeping up with the Joneses” phenomenon and also the “Ratchet effect”. Accordingly, when competitive pressures are strong and the social status depends on conspicuous consumption, it can be expected that individuals will benefit from any increase in income or wealth to expand consumption and “keep up with the Joneses”, but will be reluctant to reduce consumption, risking to “fall behind the Joneses” (Van Treeck, 2008). In the period under study, consumption increases before GFC and declines or remains stable after GFC in the most of the countries. Mainly, GDP per capita is also lower in the post-GFC period, vis-a-vis with the pre-GFC period, which confirms rising inequality trends.

Additionally, households’ debt[[14]](#footnote-14) has the same trend with consumption in the same period. Based on these inferences, we can conclude that in the post-GFC period, in the most of the countries, households “fall behind the Joneses” in connection with three reasons: i) depending on the increase in both stock and housing wealth and rising inequality, the relative income effect dominates the absolute income effect and households with higher income are more likely to save than consume through the accumulation and bequest motive, ii) although inequality rises, households with lower income do not prefer to increase their consumption and finance it by borrowing; in other words, they do not “keep up with Joneses” at the cost of borrowing, and iii) another possible explanation may be the declining FD in the post-GFC period; even though households prefer to borrow and increase their consumption, credit constraints may have constrained them from doing so. By contrast, our sample consists mostly of developed countries. The Ratchet effect or “keeping up with Joneses” may be found primarily in emerging countries (i.e., Peltonen et al., 2012).

Above evidence set suggests numerous implications. First, macroeconomic policies effective on income, housing, and stock market should recognize that behavioral aspects and uncertainty may have strong effects on consumption asymmetry during different economic periods. The missing point in policy-making would be the lack of sufficient income and wealth effect related social responses during the previous post-crisis periods. Therefore, we suggest that wealth effects would be higher and more sustainable during post-crisis periods, if policy-makers would effectively use distributional channels rather than declining interest rates to induce consumption. In this respect, intensive social aspects of policies in Covid-19 period were also a better tool in previous post-crisis periods. Therefore, supporting housing and stock market investments of lower income groups would be a supportive policy tool in the post-crisis period to stabilize consumption asymmetries. Second, taken into account the impacts of wealth effects tend to decline after bubble periods, policy-makers may focus on some long-term objectives to induce consumption. In this context, the recent bubble lessons also suggest that declining income/wealth inequalities and eliminating credit-fueled consumption growth policies may help to reduce possible income and wealth effect-related asymmetries in consumption. Third, the evidence also implies that policy-makers may develop some income distribution sensitive wealth effect policies. In this respect, nuanced wealth effect policies may create different policy targets for different socio-economic agents to manage possible saving and consumption behaviors. For example, supporting housing and stock market investments of low-income group may probably increase consumption in the short-term, whereas saving tendency of high-income groups may penalize if this policy is well with the other macroeconomic targets.

# **6. Summary and Concluding Remarks**

This paper explored the wealth (housing/stock) effect-consumption nexus using panel data from 24 OECD countries, spanning the period 2000Q1 to 2016Q4 and employing the financial development (FD) index and the house price-to-income (HPI) ratio within a threshold analysis framework. The main findings based on the model results (table 8) documented the following evidence:

1. income, housing wealth and stock wealth had a positive relation with household consumption,
2. (ii) income was the predominant variable to explain household consumption,
3. (iii) housing wealth had a greater positive effect on households’ consumption vis-a-vis the stock wealth effect,
4. (iv) higher financial development and declining housing affordability had a significantly positive impact on housing/stock wealth effects,
5. (v) similarly to the impact of income, the impact of housing/stock wealth effect had increased during bubble periods (namely, during dot.com and housing bubble) in comparison with the entire sample, global financial crisis (GFC) and post-GFC periods,
6. (vi) in the post-GFC period, consumption patterns have not increased to their pre-crisis levels, probably depending on the increase in inequality and its potential outcomes affecting consumers’ behavior,
7. (vii) the findings did not support the two phenomena known as the “Ratchet effect” and “keeping up with the Joneses” for the post-GFC period,
8. (viii) the sensitivity of household consumption to both thresholds (financial development and housing affordability) increased based on declining threshold values.
9. (ix) in the post GFC period 0.60 is the critical (threshold) level for FD and 79.04 for HPI. Below these levels, we don’t observe any significant link between housing wealth and consumption. Wealth channels become effective on consumption only above these thresholds.

**[Place Table 8 Here]**

Housing wealth is more influential than stock/financial wealth according to our findings and this result is consistent with a number of studies in the relevant literature (i.e. Mehra, 2001; Bertaut, 2002; Benjamin et al., 2004; Belsky and Prakken, 2004; Iacoviello, 2004, Case et al., 2005; Dvornak and Kohler, 2007 among others). Our findings are also in agreement with studies which claim that marginal propensity to consume changes over time (i.e. Engelhardt, 1996; Bertaut, 2002; Tan and Voss, 2003; Fisher and Voss, 2004; Iacoviello, 2004; Case et al., 2005; Labhard et al., 2005; Chen, 2006; Carroll et al., 2011). On the other hand, our results reveal that marginal propensity to consume out of income and housing/financial wealth remains lower in the post-GFC period vis-a-vis the bubble and pre-bubble periods. Therefore, we conclude that marginal propensity to consume out of income and wealth components appears to be lower in relation with the higher saving motive of households with higher income (since relative income effect dominates the absolute income effect). This result is parallel to the findings of Khalifa et al., (2013) which suggests that housing wealth effect on consumption is insignificant for incomes above $501,000 level. Our results contradict with the study of Dong et al., (2017) which finds an evidence of significant wealth effect where the housing price-to-income ratio is lower (housing affordability is higher).

This study does not claim to provide the full picture of the implications arising from the positive linkage between housing/stock wealth effects and bubble formation in housing/stock markets. Instead, the evidence of positive stock/housing wealth effects does not imply that wealth effect induced consumption and economic growth can actually operate in a healthy way in developed economies. Speculative bubble periods may feed high expectations of future price increases, with a strong investment motive in housing markets (Case and Shiller, 2003). Bubble periods also result similar irrational behaviors in stock markets. Potentially, the most critical suggestion would be that policymakers should develop an optimal consumption-growth model based on the utilizing positive wealth effect of housing and stock markets by avoiding quick asset price appreciations, which may generate a bubble in housing and stock markets. In this respect, special care must be given on whether there may be (abnormal) interactions between housing (and stock) prices and market fundamentals (Hui and Yue, 2006) during increasing wealth effect periods. The literature reveals that this policy choice may not be a politically correct one, but bubble experiences, at least, equally imply that post-bubble crisis periods may erode all expected gains from the bubble-associated wealth effects in a short period of time as observed in the post-GFC period sub-sample (Poterba and Samwick, 1995; Apergis et al., 2014).

In line with the literature the evidence of a strong housing wealth effect during the entire and sub-period panels suggests that housing is a powerful asset for transmission channels, irrespective of the size, the financial structure, and the geographic locations of the analyzed economies (Coskun et al., 2018). As the mostly field-classical advice, it seems that focusing on housing wealth rather than on stock wealth would be an improved policy option for the countries having both developed financial markets and refined housing markets. However, taken into account the well-established linkages between financial and housing markets, this policy advice would be very challenging to develop for those countries having well developed financial and real estate systems that may probably result in improvements of both wealth channels. The positive relation between a higher FD and higher wealth effects suggests that high stock market capitalization (Peltonen et al., 2012) and completeness of the mortgage market institutions (ECB, 2009; Coskun et al., 2018) may improve the magnitude of a positive housing and stock market wealth effect. Moreover, it is also important to note the positive linkage between increasing stock wealth for the above threshold of HPI. A higher HPI may imply declining affordability, weakening housing demand for the middle class that leads to the rise of inequality, and increasing housing price risks (i.e., a bubble). Therefore, policymakers should be extremely careful about rising HPI ratios and increasing housing and stock market wealth, specifically, during bubble periods.

Taking into consideration the fact that the households with lower income will benefit from any increase in income or wealth to expand consumption and “keep up with the Joneses” under credit constraints in relation with the FD level. Since FD decreased and income inequality increased in the post-GFC period, the aforementioned effect has not been observed. As a policy suggestion, growth in the financial development (FD) to reduce inequality may increase the consumption of households with lower income, while it may also contribute to economic growth.

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# **Appendix A: Figures**

**[Place Figure A1 Here]**

**[Place Figure A2 Here]**

**[Place Figure A3a Here]**

**[Place Figure A3b Here]**

**Table 1. The Summary of Literature Review**

|  |  |  |  |
| --- | --- | --- | --- |
| **Author** | **Sample& Period** | **Methodology** | **Result** |
| Apergis and Miller (2006) | United States.  Quarterly data from 1957 to 2002 | Cointegration based on Johansen and Juselius (1990) and error-correction methodology based on Perron and Vogelsang (1992) | Stock market affects real per capita consumption asymmetrically during the short-run adjustment process, where bad news exhibits a stronger effect than good news. |
| Van Treeck (2008) | United States.  1953Q1–2007Q3 | Asymmetric error correction model | Private households have managed to considerably expand consumption as income and wealth have increased, but they have not reduced their expenditure in a symmetric fashion following income and wealth declines. |
| Chen et al. (2010) | Taiwan.  1991Q3- 2007Q2 | Threshold regression model based on Caner and Hansen (2004) and seasonal error-correction model (ECM) based on Johansen and Schaumberg (1999) | The response of durable consumption to real house prices is statistically significant in constrained regimes; however, the impact on non-durable consumption and total consumption is mostly insignificant. |
| Tobing (2012) | United States. Panel Study of Income Dynamics (PSID)  Dataset during the waves of 2001, 2003 and 2005. | Threshold regression model, Hansen (1999) | There are three significant threshold age groups of 49, 55 and 65. If age is below 49 or between 55-65 years, the housing wealth effect is insignificant. |
| Šonje et al., (2012) | Bulgaria, the Czech Republic, Croatia and Estonia.  1997Q1-2010Q1 | Vector error correction and threshold error correction models | The response of private consumption to changes in income and housing wealth is characterized by non-linear properties. |
| Marquez et al., (2013) | United Kingdom.  1976:Q1-2009:Q4 | M-TAR methodology, (Enders and Siklos, 2001; Stevans, 2004) | UK consumption responses to wealth shocks is asymmetric. |
| Khalifa et al., (2013) | United States. Panel Study of Income Dynamics (PSID)  Dataset during the waves of 2001, 2003 and 2005. | Threshold regression model, Hansen (1999) | There are two significant threshold income levels of $74,046 and $501,000. Housing wealth effect is significant if income is below $74,046 or between $74,046 and $501,000. For incomes above $501,000 the coefficient is not statistically significant. |
| Dong et al., (2017) | 35 major Chinese cities. 2003-2014. | Threshold regression model, Hansen (1999) | The results imply that the housing market is highly important to the association between housing prices and consumption. The findings also confirm the vital role of the financial market in the transmission channels from housing wealth to consumption. |
| Hui et al., (2018) | China Family Panel Studies (CFPS), 2010, 2012, 2014 | Quantile regression for panel data (QRPD) | The evidence shows that housing prices and sentiments have significantly heterogeneous effects on the distribution of the consumption across different groups of households. |

**Table 2. Summary statistics**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variables Mean S.D. Min Max

*Dependent variable*

Real consumption per

capita 0.00020 0.00023 0.0000424 0.0003

*Independent variables*

Real housing prices 77.61 40.99 48.62 106.59

Stock prices 79.00 30.97 57.10 100.90

Real income per capita 0.00030 0.00032 0.000074 0.0005

Financial development index 0.73 0.045 0.42 0.98

Standardized housing

prices to income ratio 92.72 2.71 90.80 94.63

Observations 1,632

***Notes:*** All variables, except the interest rates, are expressed in logarithms. S.D. stands for standard deviation.

**Table 3. Panel unit root tests**

CIPS

Variables Levels 1st Differences

*Dependent variable*

Real consumption per capita -1.409 -5.984\*\*\*

*Independent variables*

Real housing prices -1.385 -5.774\*\*\*

Stock prices -1.355 -6.219\*\*\*

Real income per capita -1.373 -6.083\*\*\*

Financial development index -1.386 -6.147\*\*\*

Standardized housing prices to income ratio -1.386 -6.007\*\*\*

***Notes:*** All variables are expressed in logs. \*\*\*: p≤0.01.

**Table 4. Threshold Effects Test for Entire Period: 2000-2016**

**Threshold Financial Development Index Housing prices to income ratio**

Single 18.96\*\*\* 32.71\*\*\*

[0.00] [0.00]

Double 3.87 3.42

[0.28] [0.33]

Triple 3.16 2.73

[0.42] [0.51]

***Notes:*** Figures indicate the results of the F-test. Figures in brackets denote p-values. \*\*\*: p≤0.01.

**Table 5. The Effect of Housing Prices on Household Consumption: Dynamic Panel Threshold Model for the Entire Period: 2000-2016**

**Variable Equation (2) Equation (3)**

Threshold estimate

γ1 0.58

95% confidence interval [0.54-0.61]

γ2 1.88

95% confidence interval [1.86-1.90]

*Regime-dependent variables*

θ1 (coefficient below γ1) 0.043

[0.18]

No. of obs. 719

θ2 (coefficient above γ1) 0.095\*\*\*

[0.00]

No. of obs. 913

θ5 (coefficient below γ2) 0.038

[0.25]

No. of obs. 688

θ6 (coefficient above γ2) 0.065\*\*

[0.03]

No. of obs. 944

*Regime-independent variables*

ΔlnStock prices (θ3) 0.086\*\*\*

[0.00]

ΔlnStock prices (θ7) 0.062\*\*

[0.02]

ΔlnReal income per capita (θ4) 0.651\*\*\*

[0.00]

ΔlnReal income per capita (θ8) 0.618\*\*\*

[0.00]

δ1 2.94\*\*

[0.02]

δ2 2.77\*\*

[0.02]

Hansen J-test [0.48] [0.43]

***Notes:*** The dependent variable is the log of household consumption. The regime dependent variable is the log of housing prices and the threshold variable is either the log of financial development index (Equation 2) or the log of housing prices to income ratio (Equation 3). Each regime contains at least 5% of all observations. *n* indicates the number of observations in each regime. The Hansen test is distributed as χ2 under the null hypothesis that the over identifying restrictions are valid. Figures in brackets denote p-values. ∗∗: p<0.05, \*\*\*: p<0.01.

**Table 5a. Linearity Tests**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Number of location parameters (m)-FD Number of location parameters (m)-HPI

Test m=1 m=2 m=1 m=2

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

LM 0.693 0.904 0.614 0.857

[0.68] [0.41] [0.74] [0.37]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Notes**: Figures in brackets denote p-values.

**Table 5b. Test of no remaining non-linearity**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Number of location parameters (m)-FD Number of location parameters (m)-HPI

Test m=1 m=2 m=1 m=2

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

LM 0.924 1.133 0.842 0.976

[0.37] [0.26] [0.43] [0.31]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Notes**: Figures in brackets denote p-values.

**Table 5c. The Effect of Housing Prices on Household Consumption: PSTR Panel Threshold Model for the Entire Period: 2000-2016**

**Variable Equation (4)-FD Equation (4)-HPI**

Threshold estimate

γ 0.54

γ 1.85

c

c

*Regime-dependent variables*

β1 (coefficient below γ) 0.041

[0.22]

n 704

β’4 (coefficient above γ) 0.102\*\*\*

[0.00]

n 928

β1 (coefficient below γ) 0.036

[0.29]

n 643

β’4 (coefficient above γ) 0.070\*\*

[0.02]

n 989

*Regime-independent variables*

ΔlnStock prices (β3) 0.083\*\*\*

[0.00]

ΔlnStock prices (β’6) 0.065\*\*

[0.02]

ΔlnReal income per capita (β2) 0.679\*\*\*

[0.00]

ΔlnReal income per capita (β’5) 0.632\*\*\*

[0.00]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Notes:*** The dependent variable is the log of household consumption. The regime dependent variable is the log of housing prices and the threshold variable is either the log of financial development index or the log of housing prices to income ratio. Each regime contains at least 5% of all observations. *n* indicates the number of observations in each regime. Figures in brackets denote p-values. ∗∗: p<0.05, \*\*\*: p<0.01.

**Table 6. Threshold Effects Tests in Sub-Periods**

**Dot.com bubble era: 2000Q1-2003Q4 (No. of obs. = 384)**

**Threshold Financial development index Housing prices to income ratio**

Single 16.57\*\*\* 28.19\*\*\*

[0.00] [0.00]

Double 2.91 3.02

[0.39] [0.35]

Triple 2.68 2.44

[0.49] [0.56]

**Housing bubble period: 2003Q1-2007Q2 (No. of obs. = 432)**

Single 27.04\*\*\* 39.48\*\*\*

[0.00] [0.00]

Double 3.16 3.01

[0.37] [0.40]

Triple 2.84 2.48

[0.50] [0.57]

**Global financial crisis period: 2007Q3-2010Q4 (No. of obs. = 336)**

Single 11.08\*\*\* 23.10\*\*\*

[0.01] [0.01]

Double 3.20 3.06

[0.39] [0.41]

Triple 2.75 2.36

[0.49] [0.58]

**Post- global financial crisis period: 2011Q1-2016Q4 (No. of obs. = 576)**

Single 15.33\*\*\* 27.38\*\*\*

[0.00] [0.00]

Double 1.14 1.85

[0.44] [0.64]

Triple 1.05 1.39

[0.52] [0.69]

***Notes:*** Figures indicate the results of the F-test. Figures in brackets denote p-values. \*\*\*: p≤0.01.

**Table 7. The Effect of Housing Prices on Household Consumption: Dynamic Panel Threshold Model for Sub-Periods**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Dot.com bubble era:**  **2000-2003** | | **Housing bubble period: 2003-2007Q2** | | **GFC period:**  **2007Q3-2010** | | **Post-GFC period: 2011-2016** | |
| **Variable** | **Equation (2)** | **Equation (3)** | **Equation (2)** | **Equation (3)** | **Equation (2)** | **Equation (3)** | **Equation (2)** | **Equation (3)** |
| **Threshold estimate** | | | | | | | | |
| γ1  95% confidence interval | 0.64  [0.60-0.67] |  | 0.61  [0.56-0.64] |  | 0.59  [0.55-0.63] |  | 0.60  [0.54-0.64] |  |
| γ2  95% confidence interval |  | 80.16  [76.25-82.37] |  | 79.91  [75.37-83.46] |  | 78.20  [74.90-83.46] |  | 79.04  [75.37-84.36] |
| ***Regime-dependent variables*** | | | | | | | | |
| θ1 (coefficient below γ1) | 0.019  [0.41] |  | 0.032  [0.28] |  | 0.024  [0.35] |  | 0.029  [0.30] |  |
| *n* | 88 |  | 116 |  | 99 |  | 186 |  |
| θ2 (coefficient above γ1) | 0.138\*\*\*  [0.00] |  | 0.108\*\*\*  [0.00] |  | 0.039  [0.27] |  | 0.062\*\*  [0.03] |  |
| *n* | 296 |  | 316 |  | 237 |  | 390 |  |
| θ5 (coefficient below γ2) |  | 0.012  [0.48] |  | 0.032  [0.31] |  | 0.029  [0.34] |  | 0.032  [0.34] |
| *n* |  | 93 |  | 124 |  | 113 |  | 201 |
| θ6 (coefficient above γ2) |  | 0.094\*\*\*  [0.00] |  | 0.088\*\*  [0.02] |  | 0.038  [0.26] |  | 0.051\*\*  [0.04] |
| *n* |  | 291 |  | 308 |  | 223 |  | 375 |
| ***Regime-independent variables*** | | | | | | | | |
| ΔlnStock prices (θ3) | 0.108\*\*\*  [0.00] |  | 0.105\*\*\*  [0.00] |  | 0.041\*  [0.10] |  | 0.052\*\*  [0.03] |  |
| ΔlnStock prices (θ7) |  | 0.097\*\*\*  [0.00] |  | 0.093\*\*\*  [0.00] |  | 0.035  [0.14] |  | 0.048\*\*  [0.04] |
| ΔlnReal income per capita (θ4) | 0.698\*\*\*  [0.00] |  | 0.738\*\*\*  [0.00] |  | 0.497\*\*\*  [0.00] |  | 0.575\*\*\*  [0.00] |  |
| ΔlnReal income per capita (θ8) |  | 0.675\*\*\*  [0.00] |  | 0.694\*\*\*  [0.00] |  | 0.463\*\*\*  [0.00] |  | 0.539\*\*\*  [0.00] |
| δ1 | 3.25\*\*\*  [0.00] |  | 2.77\*\*  [0.03] |  | 1.68  [0.17] |  | 2.13\*\*  [0.03] |  |
| δ2 |  | 2.94\*\*\*  [0.01] |  | 2.59\*\*  [0.03] |  | 1.36  [0.28] |  | 2.38\*\*  [0.03] |
| *N* | 384 | 384 | 432 | 432 | 336 | 336 | 576 | 576 |
| Hansen J-test | [0.56] | [0.48] | [0.46] | [0.49] | [0.43] | [0.38] | [0.52] | [0.47] |

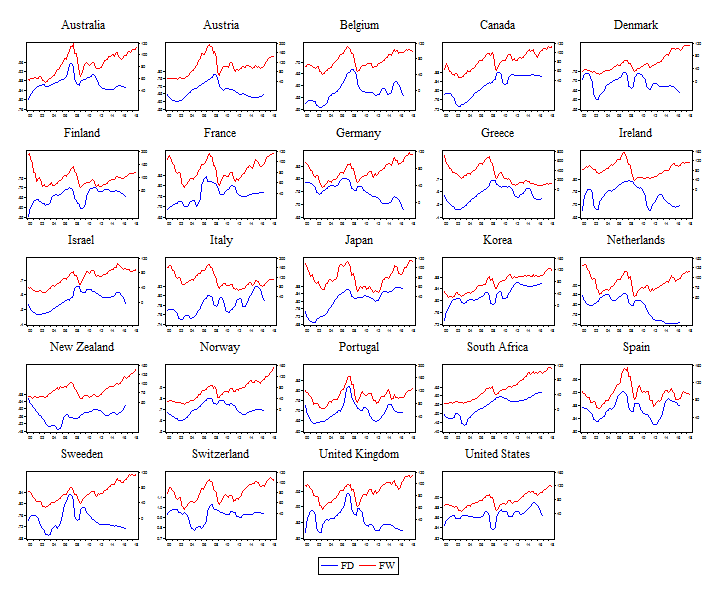
***Notes:*** The dependent variable is household consumption. The regime dependent variable is housing prices and the threshold variable is either the financial development index (Equation 2) or the housing prices to income ratio (Equation 3). Each regime contains at least 5% of all observations. *n* indicates the number of observations in each regime, while N denotes the total number of observations. The Hansen test is distributed as χ2 under the null hypothesis that the over identifying restrictions are valid. Figures in brackets denote p-values. ∗: p<0.10, ∗∗: p<0.05, \*\*\*: p<0.01.

**Table 8: The Effect of Housing Prices on Consumption: Entire Period and Sub-Periods**

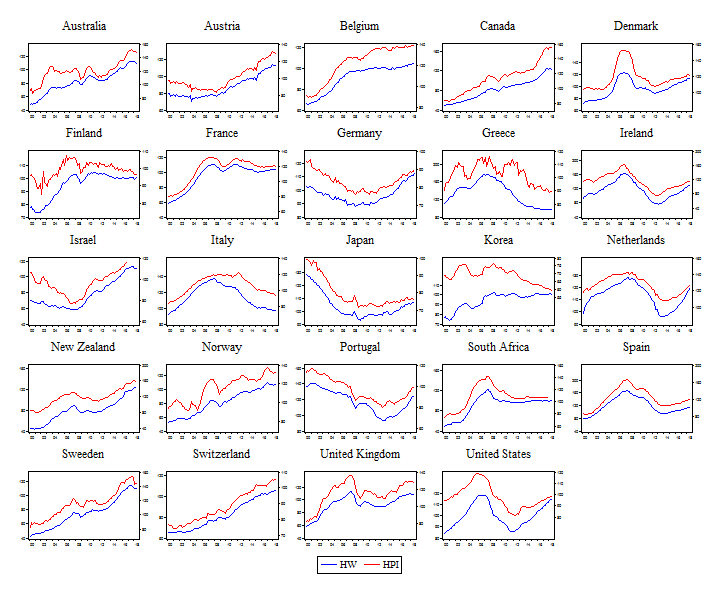
|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Entire Period**  **(2000-2016)** | | **Dot.com Bubble**  **(2000-2003)** | | **Housing Bubble**  **(2003-2007Q2)** | | **Global Financial Crisis (2007Q3-2010)** | | **Post-GFC period**  **(2011-2016)** | |
|  | FD | HPI | FD | HPI | FD | HPI | FD | HPI | FD | HPI |
| **Threshold** | 0.58 | 76.44 | 0.64 | 80.16 | 0.61 | 79.91 | 0.59 | 78.20 | 0.60 | 79.04 |
| **ΔlnIncome** | 0.651\*\*\* | 0.618\*\*\* | 0.698\*\*\* | 0.675\*\*\* | 0.738\*\*\* | 0.694\*\*\* | 0.497\*\*\* | 0.463\*\*\* | 0.575\*\*\* | 0.539\*\*\* |
| **HW Below** | 0.043 | 0.038 | 0.019 | 0.012 | 0.032 | 0.032 | 0.024 | 0.029 | 0.029 | 0.032 |
| **HW Above** | 0.095\*\*\* | 0.065\*\* | 0.138\*\*\* | 0.094\*\*\* | 0.108\*\*\* | 0.088\*\* | 0.039 | 0.038 | 0.062\*\* | 0.051\*\* |
| **ΔlnStock Wealth** | 0.086\*\*\* | 0.062\*\* | 0.108\*\*\* | 0.097\*\*\* | 0.105\*\*\* | 0.093\*\*\* | 0.041\* | 0.035 | 0.052\*\* | 0.048\*\* |

***Notes***: Thresholds: logs of financial development index and the housing prices to income ratio. Abbreviations: FD: log of financial development index, HPI: log of House price-to-income ratio, HW: log of housing wealth, GFC: Global Financial Crisis. \*: p<0.10, ∗∗: p<0.05, \*\*\*: p<0.01.

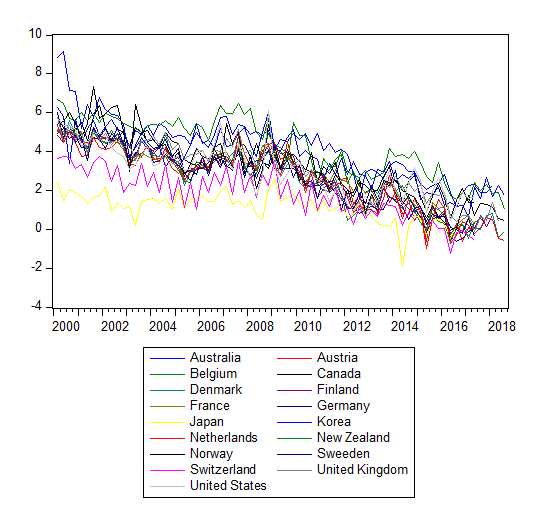
**Figure A1. Financial Wealth and Financial Development**



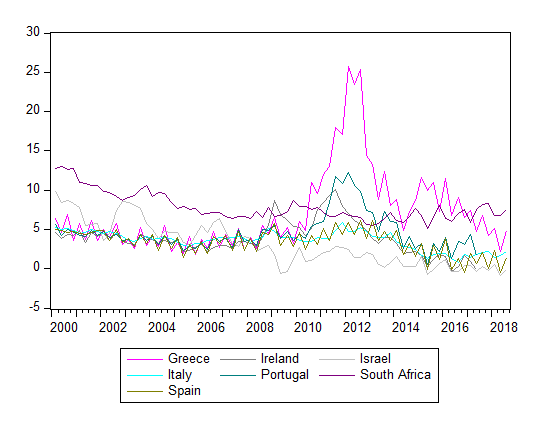
**Figure A2. Housing Wealth and House Price-Income Ratio**

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**Figure A3a. Real Interest Rates on 10-yr Government Bonds in Developed Countries**

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**Figure A3b. Real Interest Rates on 10-yr Government Bonds in GIIPS and Emerging Countries (Israel and South Africa)**

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2. University of Derby, Kedleston Road, Derby, DE22 1GB, UK. E:mail: [n.apergis@derby.ac.uk](mailto:n.apergis@derby.ac.uk) [↑](#footnote-ref-2)
3. ♠ The University of Sheffield, Western Bank Sheffield S10 2TN, UK. E-mail: [y.coskun@sheffield.ac.uk](mailto:y.coskun@sheffield.ac.uk) [↑](#footnote-ref-3)
4. House price to income (HPI) ratio decreased before GFC period therefore housing affordability increased. When HPI ratio increase, it means that the change in house price is greater than the change in income which stimulates the decreasing affordability. Vice versa, when HPI ratio decrease, it means that the change in house price is smaller than the change in income which triggers the increase in affordability. [↑](#footnote-ref-4)
5. There is a decline in the homeownership ratio in the majority of countries in the post-GFC period. (Eurostat, 2018. <http://appsso.eurostat.ec.europa.eu/nui/show.do> , accessed on 06/23/2019). [↑](#footnote-ref-5)
6. In mostly developed countries such as Denmark, Germany, Ireland, UK and US, the ratio of residential loans to GDP declines in the post-GFC period. Source: Total Outstanding Residential Loans to GDP Ratio, (percent), Hypostat, 2018). [↑](#footnote-ref-6)
7. [↑](#footnote-ref-7)
8. According to limited data, there is also an increase in wealth inequality in Korea, the UK and the US. (See, <https://wid.world/data/> , accessed on 06/23/2019). [↑](#footnote-ref-8)
9. Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, UK, US. [↑](#footnote-ref-9)
10. Real house prices are described by the ratio of seasonally adjusted nominal house prices to the seasonally adjusted consumers’ expenditure deflator in each country and obtained from the OECD national accounts database. This provides information on how nominal house prices have changed over time relative to prices in the general economy. (Source: [https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE\_PRICES#](https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE_PRICES) accessed on 03/20/2019). [↑](#footnote-ref-10)
11. The standardized house price-income ratios show the current price-income ratios relative to their respective long-term averages. The long-term average, which is used as a reference value, is calculated over the whole period available when the indicator begins after 1980 or 1980 if the indicator is available over a longer time period. The standardized ratio is indexed to a reference value equal to 100 over the full sample period. Values over 100 indicate that the present price-income ratio is above its long-run norms. This provides an indication of potential housing market pressures. (Source: [https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE\_PRICES#](https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE_PRICES) , accessed on 03/20/2019). [↑](#footnote-ref-11)
12. Searle (2011) suggested that housing wealth is increasingly being used as a financial safety net across the life course and that different economic periods may have significant effects on housing-related behaviours. [↑](#footnote-ref-12)
13. Keynes (1936) indicated that during abnormal situation propensity to consume may be sharply affected by the development of extreme uncertainty concerning the future. [↑](#footnote-ref-13)
14. Source: BIS debt service ratios statistics. (about credit statistics for households see, <https://www.bis.org/statistics/about_credit_stats.htm> accessed on 06/11/2019). [↑](#footnote-ref-14)