FINANCIAL AND HOUSING WEALTH EFFECTS
ON PRIVATE CONSUMPTION:
THE CASE OF GREECE

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Abstract

This paper investigates the effects of household wealth on consumption expenditure in Greece. Recognising the distinct and leading role of housing in the wealth portfolios of Greek households, we disentangle financial wealth effects from housing wealth effects, to assess the impact of these two wealth components separately. This type of analysis is being conducted for the first time for the case of Greece, and employs quarterly data for the time period 2000-2015, including a novel series on housing wealth constructed for the purpose of the paper. The results of the analysis point to the existence of a statistically significant cointegrating relationship between consumption and wealth, with positive financial and housing wealth effects in the long run. In the short run, both wealth components appear to play a role in determining consumption, with the effects of housing wealth being more pronounced.

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1. Introduction

The effects of household wealth on private consumption have traditionally been analysed in the framework of the permanent income hypothesis (Friedman, 1957) and the life-cycle model (Modigliani and Brumberg, unpublished, Ando and Modigliani, 1963). In this framework, private consumption is determined by the current and expected future labour income stream of households, plus their stock of wealth. In recent years, the relationship between wealth and private consumption has attracted renewed attention, with the relevant literature often placing emphasis on the differentiation between financial and housing wealth effects. This revived interest on wealth effects has been motivated by major developments in financial and housing markets worldwide and their significant impact on the volume of household wealth in several countries.

The empirical literature on the effects of household wealth on consumption has focused mostly on the cases of the USA and other advanced economies. To the best of our knowledge, there are, thus far, no studies investigating these effects for Greece, despite the fact that the Greek case is very interesting for a number of reasons. Considering the period from 2000 onwards, private consumption in Greece has persistently accounted for a particularly high share of the GDP and has played a far more decisive role in shaping GDP rates of change, compared to other European economies. In addition, changing conditions in financial and housing markets and their implications for household wealth have been rather dramatic in the Greek economy. Housing investment and prices progressed from an era of boom, up until 2008, to an era of unprecedented decline thereafter, and the ASE General Index underwent major shocks both prior to and in the course of the country's economic crisis. Furthermore, out of the two main household wealth components, housing has historically maintained a distinct and leading role in the wealth portfolios of Greek households, with major shifts in housing investment and prices inducing substantial changes in this role during the period under examination.

The considerations described above provide a clear motivation for investigating the relationship between household wealth developments and private consumption in Greece, as well as a strong incentive for attempting to disentangle housing from financial wealth effects in the Greek case. Importantly, in the current conjuncture, with Greece striving to overcome recessionary conditions and progress into an era of recovery and sustainable growth, the study of how consumption and wealth developments interact may provide useful insights with reference to the prospects of the economy. Moreover, the findings of such an analysis may contribute to the design of economic policies conducive to long-term viable growth.

In this framework, the objective of the present paper is to investigate the effects of household wealth on private consumption expenditure in Greece, with a focus on disentangling financial wealth effects from housing wealth effects, to separately

assess the impact of these two wealth components. This type of analysis is being conducted for the first time for the Greek case, and contributes both to the general empirical literature on wealth effects on consumption, and to the more recent body of studies examining the determinants and prospects of domestic demand in Greece.

The dataset used in our analysis covers the period from 2000Q1 to 2015Q3, and includes a novel quarterly series on household wealth in Greece, as well as publicly available data on private consumption expenditure, financial wealth, and income variables. The new housing wealth series has been constructed for the purpose of this paper, in order to overcome data availability constraints, which represented a fundamental cause for the lack of prior evidence on the Greek case. The derivation of the housing wealth series constitutes one of the main contributions of our paper and is crucial for the analysis conducted, since it is necessary for the calculation of a total household wealth series and the disentanglement of financial wealth effects from housing wealth effects.

Our empirical analysis applies a two-step empirical procedure, examining both the long and the short-run relationship between consumption and wealth through a cointegration and error correction model methodology. The results are in favour of the existence of a positive and statistically significant cointegrating relationship between consumption and wealth, with positive financial and housing wealth effects in the long run. In the short run, both wealth components play a role in determining consumption, with the effect of financial wealth being, however, less pronounced as compared to that of housing wealth.

The paper is organised as follows. Section 2 provides the theoretical background and reviews the relevant empirical literature. Section 3 discusses major developments in private consumption, as well as housing and financial wealth in Greece, and explains the construction of the housing wealth series. Section 4 outlines the empirical methodology applied in the analysis and presents the data employed. Section 5 reports the empirical results, and section 6 summarises the conclusions and policy implications of our paper.

2. Theoretical Background and Empirical Evidence

The analysis of the relationship between private consumption and wealth, and, more particularly, of the effects of wealth on consumption, is directly related to the framework of the permanent income hypothesis and the life-cycle model. According to Ando and Modigliani (1963), Friedman's permanent income hypothesis, even though well suited for testing against cross-section data, does not generate the type of hypotheses to be easily tested against time series data. As they indicate, almost contemporaneously with Friedman's work, Modigliani and Brumberg (unpublished) 'developed a theory of consumer expenditure based on considerations relating to the life-cycle of income and of consumption needs of households'. Modigliani and Brumberg also attempted to derive time series implications of their hypothesis.

In the life-cycle model, the utility of the individual consumer is assumed to be a function of his own aggregate consumption in current and future periods. It is maximised subject to resources available, these being the sum of current and discounted future earnings over his lifetime and current net worth. As a result, the individual's current consumption can be expressed as a function of his resources and the rate of return on capital, with parameters depending on age. To obtain the aggregate consumption function over all individuals, the individual functions are aggregated. In deriving the aggregate consumption function, assumptions relating to the characteristics of the individual's utility function and the age structure of the population are most crucial.

According to the model described above, the individual's consumption, c_t^T, is given by:

$$c_t^T = \omega_t^T y_t^T + \omega_t^T (N - T) y_t^{eT} + \omega_t^T a_{t-1}^T \tag{1}$$

where y_t^T is current non-property income, y_t^{eT} is the average annual expected income (T stands for the age of the individual and N denotes the earning span) and a_{t-1}^T is the current sum of net worth, carried over from the previous period. To obtain aggregate consumption, under specific assumptions, equation (1) is aggregated within each age group and over the age groups, resulting in:

$$C_t = \alpha_1' Y_t + \alpha_2' Y_t^e + \alpha_3' A_{t-1} \tag{2}$$

In their empirical least-squares approach applied to a single equation, and when applying first differences, Ando and Modigliani obtained a highly significant coefficient estimate of net worth. Overall, they concluded that tests seemed to support the hypothesis of the importance of net worth as a determinant of consumption.

Since the above contributions, a growing body of empirical literature has dealt with the examination of wealth effects on consumption.[1] A significant part of the relevant literature applies the cointegration and error correction model methodology to investigate the long and short-run relationship between wealth and consumption. The connection between the theoretical background and the cointegration applications is provided by Lettau and Ludvigson (2001) who note that (the logs of) aggregate consumption, asset holdings and labour income share a common long-term trend,

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1. The relevant empirical applications employ either macroeconomic or microeconomic data. Since, the present application follows the lines of similar empirical studies based on macroeconomic data, here we will not review the micro data literature. Carroll *et al.* (2011) offer a helpful review of that branch of the literature and also point to the heterogeneity characterizing the related work. Of relevance are also certain studies focusing on the role of credit conditions and the credit channel (see e.g. Iacoviello, 2004; Muellbauer, 2007; Musso *et al.*, 2011).

they are cointegrated, but may still substantially deviate from one another in the short run. This argument is derived on the basis of their definition of aggregate wealth (human capital plus asset holdings), and the work of Campbell and Mankiw (1989), showing that, if the consumption-aggregate wealth ratio is stationary, then the budget constraint may be approximated by taking a first-order Taylor expansion of the wealth accumulation equation.

Addressing net worth and total wealth, does not necessarily involve a distinction between different kinds of assets, and, hence, different wealth components. It might be expected from theory that the effects of financial and real, and, more specifically, housing wealth on consumption should be similar (Dvornak and Kohler, 2007). However, there are several reasons in favour of the argument that the responsiveness of consumers to different types of wealth may well be different. Such reasons include differences in liquidity, other utility associated with owning an asset (e.g. housing services, bequest motives), distribution across income groups, expected permanency of changes, mismeasurement of wealth and psychological factors (see e.g. Dvornak and Kohler, 2007, Dreger and Reimers, 2012, Guo and Hardin, 2014, Galli, 2016).

In the earlier empirical literature investigating wealth effects on consumption, one can distinguish between contributions not disentangling between financial and real/housing wealth and those focusing solely on financial wealth. However, more recent applications place emphasis on differentiating between financial and real (housing) wealth effects.

Overall, and even though the relevant literature is vast and underlying applications diverge in a number of terms (e.g. varying magnitudes of estimated effects, different estimation procedures applied, different time periods but also different sources for the derivation of financial and real wealth data), a considerable number of papers conclude that total wealth plays an important role in shaping consumption, but also detect significant individual effects brought about by either financial or housing wealth or both.

As can be expected, the majority of the relevant empirical applications refer to the cases of the USA, as, for example, Poterba (2000), Benjamin *et al.* (2004), Case *et al.* (2011) Carroll *et al.* (2011), and Bampinas *et al.* (2017), who all detect significant wealth effects. Similar applications for the USA with different points of emphasis include Lettau and Ludvigson (2004), who state that a surprisingly small fraction of the variation in household net worth is related to the variation in aggregate consumer spending, Guo and Hardin (2014), who focus on the relative composition of wealth, Holmes and Shen (2014), who investigate the effects of volatility on the wealth-to-income ratio, and Christelis *et al.* (2014), who investigate the effects of wealth shocks during the Great Recession. There is also a significant number of papers referring to other advanced individual economies, such as Barrell *et al.* (2003) and Márquez *et al.* (2013) for the case of the UK, Pichette and Tremblay (2003) for Canada, Tang

(2006), Dvornak and Kohler (2007) and Fisher *et al.* (2010) for Australia, Bassanetti and Zollino (2010) and Botazzi (2013) for Italy, Chauvin and Damette (2010) for France, Navarro and de Frutos (2015) and Sastre and Fernández (2010) for Spain, Hamburg *et al.* (2008) for Germany, Edelstein and Lum (2004) for Singapore, and Jansen (2010) for Norway, who all detect significant effects. In addition, varying evidence with reference to the significance of the effects is provided, for example, by Schmid (2013) on Switzerland, who detects a significant effect only in the long run, Galli (2016) on Switzerland, who does not detect significant effects when using the entire sample, but also notices some robustness issues, and O'Donnell (2007) on Ireland, who does not detect clear wealth effects.

Furthermore, a number of studies refer to country groups and incorporate panel analysis, such as Jaramillo and Chailloux (2015) and Shen *et al.* (2015). According to Labhard *et al.* (2005), there should be little theoretical rationale for wide dispersion in the marginal propensities to consume (MPCs). They provide evidence on a common long-run marginal MPC across 11 OECD countries, and argue that, in cases detected, the differences observed may, in fact, reflect difficulties in measuring wealth across countries and also a failure to take into account shocks causing changes in both consumption and wealth. Still, in most cases of studies investigating country groups, the evidence derived is mixed and significant differences are revealed. Such examples include Girouard and Blondal (2001) and Boone and Girouard (2002), who examine the G7 group (except Germany), Bertraut (2002) investigating 10 countries, Bayoumi and Edison (2003) estimating panel regressions for 16 advanced economies, Byrne and Davis (2003) for the G7 countries, Catte *et al.* (2004) studying 10 OECD countries, Case *et al.* (2005) relying on a panel of 14 OECD countries and a panel of US states, Dreger and Reimers (2006) examining a panel of EU countries, Aron *et al.* (2006) using data for the UK and South Africa, Slacalek (2009) investigating wealth effects at the country-level for various country groups and for 16 countries, Skudelny (2009) using two different euro area data sets for 8 countries, excluding Ireland, Luxemburg, Greece and Portugal, due to data availability restrictions, Kerdrain (2011) for the US, Japan and the Euro area, including Greece, De Bonis and Silvestrini (2012) using data for 11 OECD countries, Šonje *et al.* (2012) for four European post-transition economies, Šonje *et al.* (2014) for a group of 30 developed and emerging economies using different panels, and Barrell *et al.* (2015) for the UK and Italy. Note that, most often, varying results across the countries investigated are attributed to differing characteristics with respect to financial as well as housing and mortgage markets. For example, in countries such as the UK and the USA, the mechanism of housing equity withdrawal[2] appears to operate more strongly as compared to the cases of most European countries. The latter also seem to have more

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2. Housing equity withdrawal is new borrowing secured on dwellings that is not invested in the housing market (i.e. not used for house purchase or home improvements). For explicit reference to housing equity withdrawal, see, e.g., Girouard and Blöndal (2001) and Boone and Girouard (2002).

traditional bank-oriented structures and/or less deep financial markets, as compared to Anglo-Saxon economies (see e.g. Slacalek, 2009, De Bonis and Silvestrini, 2012).

Finally, there is a small number of studies conducted on a regional or state basis, while references to developing or emerging economies are scarce (Saad, 2011, for Lebanon, detects significant wealth effects; Ciarlone, 2011, for 17 emerging economies, detects partly significant wealth effects; Peltonen *et al.*, 2012, for 14 emerging economies, detect and outline differences among countries investigated). As noted earlier, for the case of Greece, and to the best of our knowledge, there exists no evidence on the potential effects of wealth on consumption on an individual country basis.

3. Major Developments in Consumption and Wealth and a Novel Housing Wealth Series

As mentioned earlier, the study of wealth effects on consumption assumes particular interest in the case of Greece, one reason being the crucial role of consumption in shaping developments in the Greek GDP. As illustrated in Figure 1, private consumption has persistently accounted for a particularly high share of economic activity in Greece, amounting to 70.3% of the GDP in 2015, versus 56.5% of the GDP on average in the EU28. Moreover, private consumption has over time maintained a decisive contribution to the country's rate of change of the GDP, representing the leading force behind the GDP rise over the 2000-2007 period, but also a key driver of the GDP downfall over the subsequent period of recession.

Figure 1. Share of private consumption in the GDP in Greece and the EU28, and contribution to the rate of change of the GDP in Greece
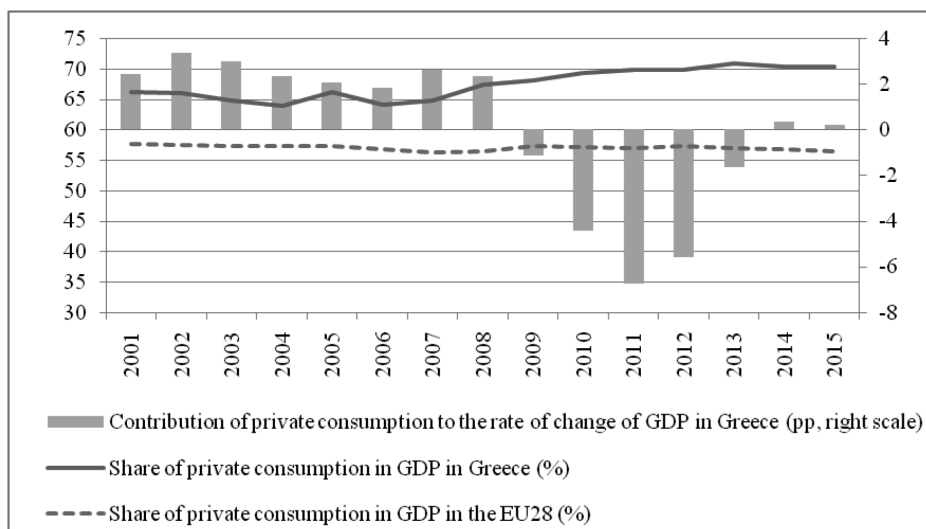

Sources: ELSTAT, Eurostat and authors' calculations.

Some preliminary indications of a possible significant role of wealth effects on private consumption in Greece are provided by the particularly pronounced changes in the country's housing and financial market conditions from 2000 onwards.

With respect to developments in the housing market, prior to the crisis, households invested heavily in housing, being encouraged by ample availability of credit, low interest rates and booming house prices (Figure 2). Investment in dwellings reached 41.6% of total gross fixed capital formation in Greece in 2007, from 36.4% in 2000, with the corresponding Euro Area averages amounting to 29.2% and 26.8%, respectively, according to Eurostat National Accounts data. Furthermore, indicatively, urban area house prices in Greece increased by 97.0% between 2000Q1 and 2007Q4, according to the relevant index of the Bank of Greece. This era of boom in housing investment and prices was followed by an era of unprecedented decline in the course of the crisis. From 2008 onwards, housing investment declined dramatically to reach a mere 6.6% of total investment by 2015, while house prices also experienced a persistent major downfall, with the urban house price index decreasing by -41.9% between 2008Q4 and 2015Q4.

Figure 2. ASE General Index, gross fixed capital formation in dwellings and index of house prices
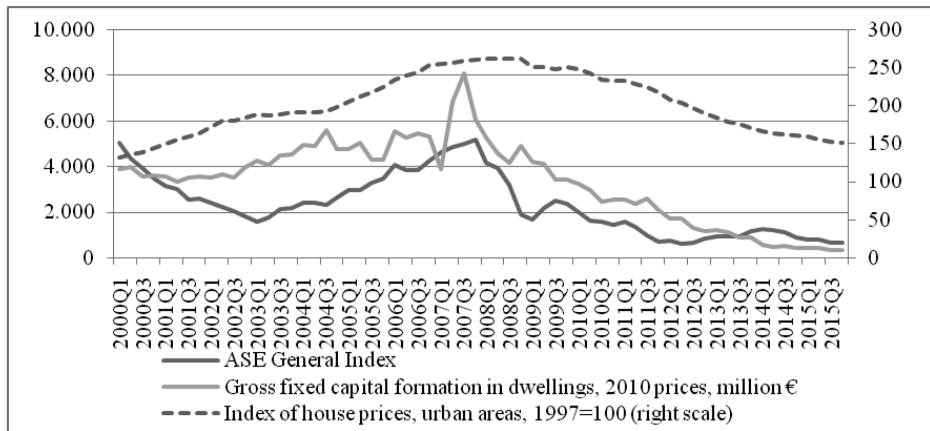
Sources: ELSTAT, Bank of Greece.

Concerning developments in the financial market, the ASE General Index went through major fluctuations up to 2008, entering a prolonged period of low performance thereafter. Furthermore, household deposits in domestic banks more than doubled between 2004 and 2009, but experienced heavy downward shocks afterwards, reflecting mainly a flight of funds in periods of escalating crisis conditions.

Further indications about the possible role of wealth effects on private consumption in Greece are provided by the very evolution of housing and financial wealth of Greek households, which is, of course, related to the market developments just mentioned.

With respect to housing wealth, dwellings have historically represented a primary wealth component for Greek households, being, until relatively recently, perceived as a safe form of investment, with significant potential long-term returns from the rise in real estate values. However, in the case of Greece, there are no official housing wealth data available. The lack of housing wealth data is a common problem in studies of the effects of household wealth on consumption. The way this problem has been resolved in the literature is via the construction of the housing wealth series (see e.g. Skudelny 2009, Slacalek 2009, Case *et al.* 2005) using other appropriate data, such as, for example, data on residential property prices, the dwelling stock and/or investment in dwellings.

Following a similar approach, in the present paper we construct a housing wealth data series for the Greek economy. The new series is based on (a) data for the housing stock (age and total surface in m^2), obtained from the published results of the 2011 census performed by the Hellenic Statistical Authority (ELSTAT), (b) data on private building activity on the basis of building permits issued, available in m^2 on a monthly basis from ELSTAT, (c) the index of prices of dwellings (historical series), available on a quarterly basis from the Bank of Greece, (d) the average price of new apartments sold in 2009Q1 per m^2 (Mitrakos, 2009) and (e) the assumption of a yearly depreciation rate of 1.3%, which is consistent with the range of housing depreciation rates reported in the literature and employed by statistical agencies in various countries (see, e.g., Bokhari and Geltner, 2014; Kostenbauer, 2001).

To construct the housing wealth series we take the total surface and age of housing from the 2011 census and use the depreciation rate to obtain a measurement of the total housing stock in 2011Q1 expressed in equivalents of new housing in m^2. Taking this measurement as a basis, we then use data on private building activity in m^2 and the depreciation rate to compile a quarterly series of the housing stock expressed in equivalents of new housing in m^2, assuming a period of two years from permit issuance to construction completion. Having, thus, obtained a housing stock series, we then use the index of prices of dwellings and the average price per m^2 in 2009Q1 to derive the housing wealth series in nominal terms. Finally, to obtain net housing wealth, we subtract mortgage debt (Bank of Greece data) from housing wealth.

Figure 3 displays the net housing wealth series constructed using this methodology, together with the corresponding series on private consumption (consumption of households and non-profit institutions serving households (NPISH)). As shown in this figure, housing wealth developments have followed a very similar trend with corresponding developments in private consumption, thus providing indications of possible significant wealth effects on consumption. More particularly, housing wealth

increased rapidly up to the beginning of 2008, as a result of high investment in new housing and increasing house prices. During the same period, private consumption followed a similar pattern, decisively contributing to GDP growth in Greece. From the beginning of 2010 onwards, housing wealth has followed a downward trend, as a sharp decline in housing investment coincided with continuous downfall in house prices. In parallel, private consumption contracted sharply, representing one of the main drivers of the recession in the country.

Figure 3. Private consumption and net housing wealth in Greece (billion €)
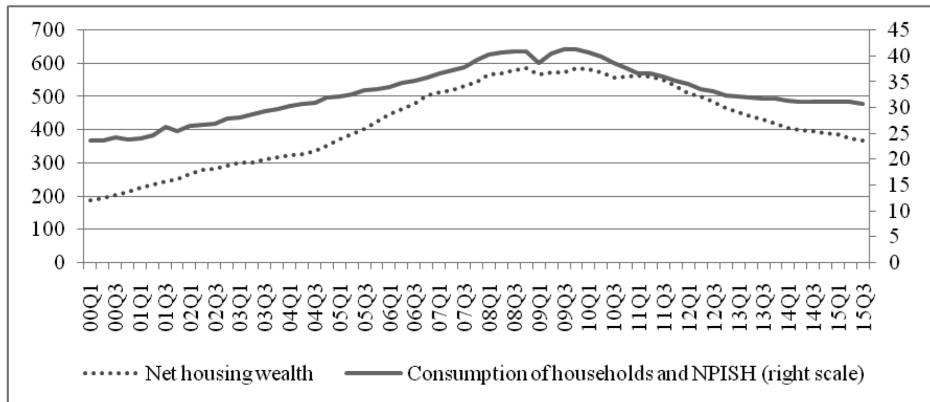
Sources: ELSTAT, Bank of Greece, authors' calculations.

Turning to financial wealth, available official data on financial assets and liabilities of households allow for the calculation of a net financial wealth series, illustrated in Figure 4. As it appears, on the basis of this series, household financial wealth seems to exhibit a higher degree of volatility compared to housing wealth and private consumption. Furthermore, while there have been extended periods where developments in financial wealth have been in the same direction as developments in consumption, there have also been periods with diverging developments. For example, from the second half of 2012 until the first quarter of 2014, consumption kept declining, but financial wealth appeared to recover due to the increase in the value of equity in a period of rising ASE General Index.

Figure 4. Net financial wealth in Greece (billion €)

Source: ELSTAT.

The addition of the net financial wealth series above to our novel net housing wealth series yields a net total household wealth series for the Greek economy. Notably, on the basis of our calculations, the share of housing wealth in total wealth amounted to 60% in 2002 in Greece, versus an average of 57% for the Euro Area as a whole and a range between 40% and 68% in various individual countries, respectively (Skudelny 2009). Furthermore, the ratio of financial and housing wealth to the annual compensation of employees in Greece in the same year was equal to 8.3 according to our data, being thus very close to the corresponding ratios reported by Slacalek (2009) for Italy, Spain, France and the UK. These observations indicate that, even when moving further away from the year 2011, for which we have an official estimate of the housing stock on the basis of the census, our calculations produce reasonable results with respect to the size of household wealth in Greece.

Finally, concerning the weight of housing in the portfolios of Greek households, it is worth noting that the share of net housing wealth to net total wealth in Greece increased from 41.9% in 2000 to 68.8% in 2008, the latter figure being particularly high by European standards. Furthermore, despite the major decline in housing investment and house prices in the course of the crisis, housing continues to represent the largest component of household wealth in Greece, with net housing wealth equalling 64.4% of the total in 2015Q3 according to our calculations. These figures are indicative of the leading role of housing in the wealth portfolios of Greek households and are consistent with Eurostat data on the distribution of the population by tenure status. According to these data, Greece remains a country with relatively high home ownership, with the ratio of home owners in 2014 amounting to 74.0%, versus 66.9% in the Euro Area.

4. Empirical Methodology and Data

Empirical methodology

Following the theoretical considerations set out in Section 2, and with the aim to enrich existing empirical evidence with an application to the case of Greece, in this paper we apply the standard cointegration and error correction model (ECM) approach to examine potential wealth effects on consumption. This two-step methodology is widely used in the relevant empirical literature in order to investigate the relationship between consumption and wealth. In a first step, it enables a straightforward investigation of the long-run link between the core variables examined. In a second step, it allows for the inclusion of short-run dynamics in the equations under estimation, in which stationarity is ensured by using variables in first differences.

More specifically, according to the basic long-run relationship, trends in consumption are linked to trends in income and wealth. Since we want to disentangle between potential effects related to financial and housing wealth, total wealth is further split into the financial and housing wealth components. We do that in order to enable separate identification of the reaction of consumption to both types of shocks. In the short run, deviations from the long-run equilibrium might be observed, assuming that this disequilibrium will be gradually corrected towards the long-run relationship. These basic features are captured by the cointegration and the ECM methodologies.

Given, further, that we want to directly obtain MPCs out of the long-run regression, we choose to estimate the equation in levels rather than in logarithmic form. In the alternative case of using logarithmic specifications, the coefficients obtained reflect elasticities which can be used, together with the sample averages of the wealth-to-consumption ratios, to obtain MPCs. Still, and as indicated by Chauvin and Damette (2010), the two measures are equivalent only in the case of a stable ratio of wealth to consumption over time. This, however, does not always seem to be the case. Given that one can expect wide variations in this ratio over time, and based on further theoretical considerations indicating the superiority of direct MPC estimation, as pointed out by Altissimo *et al.* (2005), the level representation is considered to be more satisfactory, especially when the aim is to disaggregate wealth into components.

In a first step, we estimate the cointegrating relation using total net wealth. Next, we estimate the relation using the disaggregated components of net financial and net housing wealth, but also conduct the analysis using only the net housing wealth component, as a robustness check. The long-run relationship between consumption, income and wealth is estimated using the Fully Modified Ordinary Least Squares technique (FMOLS) (Phillips and Hansen, 1990). This technique is based on a modification of least squares in order to account for both serial correlation effects and for endogeneity among regressors, resulting from the existence of a cointegrating relationship. In order to test the cointegration hypothesis, we apply the Engle-Granger (1987) and Phillips-Ouliaris (1990) tests.

The three distinct long-run equations are then formulated as follows:

$$C_{1t} = \alpha_0 + \alpha_Y Y_t + \alpha_T TW_t + \varepsilon_{1t} \tag{3}$$

$$C_{2t} = \beta_0 + \beta_Y Y_t + \beta_F FW_t + \beta_H HW + \varepsilon_{2t} \tag{4}$$

$$C_{3t} = \gamma_0 + \gamma_Y Y_t + \gamma_H HW + \varepsilon_{3t} \tag{5}$$

where equation (3) relates consumption to total wealth, equation (4) differentiates between the two distinct wealth components –financial and housing wealth– and equation (5) includes only housing as a wealth component. In the equations presented above, C_t denotes consumption expenditure at time t, Y_t stands for income, TW, FW, HW, indicate total, financial and housing wealth, respectively, α, β, γ refer to the corresponding coefficients and ε_t stands for the error term in each equation.

In the second step, we apply the ECM specification to estimate the short-run equation by OLS. We run the model in first differences, in order to investigate the adjustment process to the long-run equilibrium, which is estimated in the first stage, and the short-run dynamics. We use the long-run residuals obtained from the first stage equation and include them as an error correction term (ECT) lagged by one period. The short-run equation is formulated as follows:

$$\Delta C_t = \delta_0 + \sum_i^p \delta_i \Delta C_{t-i} + \sum_i^p \theta_i \Delta Y_{t-i} + \sum_{i=0}^p \varphi_{Fi} \Delta FW_{t-i} + \sum_{i=0}^p \varphi_{Hi} \Delta HW_{t-i} + \\ \vartheta ECT_{t-1} + u_t \tag{6}$$

where Δ denotes the first difference operator and ECT_{t-1} is the error correction term, lagged by one period. The coefficient on this term, ϑ, measures the speed of adjustment to the long-run relation, from a deviation in the short run caused by shocks to the system. It is expected to have a negative sign, so when consumption moves away from its equilibrium value, it then adjusts back to that value in the next period. When using quarterly data, ϑ reflects the adjustment within a period of one quarter; it, therefore, follows that the higher the coefficient in absolute terms, the quicker the corresponding adjustment will be. Note that we choose the lag lengths of the variables included on the basis of the Akaike information and/or the Schwarz criteria.

Data employed

The dataset used in the present paper is based on quarterly data for Greece over the period 2000Q1 to 2015Q3.

For consumption, we employ quarterly, seasonally adjusted data from ELSTAT for the category of households and NPISH, in nominal terms. For income, we use quarterly data for the compensation of employees and, alternatively, net disposable income, available from ELSTAT in nominal terms on a non-seasonally adjusted

basis. To derive seasonally adjusted income series, we perform seasonal adjustment using the X12 procedure.

For financial wealth we employ data from ELSTAT for the financial assets of households and NPISH in nominal terms. In the case of Greece, these assets consist primarily of deposits, shares and other equity, but also include other items, such as currency, other securities and equity in life insurance and pension fund reserves. To obtain net financial wealth, we subtract the financial liabilities of households (excluding mortgage debt, from the Bank of Greece) from nominal financial wealth.

Finally, for housing wealth we use the new net housing wealth series constructed for the purpose of the present paper and described in detail in Section 3.

5. Results of the Analysis

In the first step of our empirical analysis we test for the stationarity of consumption, compensation of employees[3], net financial wealth, net housing wealth and net total wealth using the Augmented Dickey-Fuller (ADF, Dickey and Fuller, 1979, Said and Dickey, 1984), the Phillips-Perron (PP, 1988) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) unit root and stationarity tests. Results are reported in Table 1. Based on testing results at the 5% significance level (and, in one case, at the 10% level), tests in levels indicate that the variables are non-stationary, while tests in first differences suggest stationarity. As a result, the evidence obtained is in favour of the argument that the underlying variables are integrated of the same order, i.e. of order one. On the basis of this finding we can proceed with the implementation of the two-step Engle-Granger cointegration and ECM analysis[4].

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3. Compensation of employees excludes property income, contrary to disposable income. Thus, for the basic estimations we choose to use compensation of employees as the variable representing income to avoid using a measure for income which could be directly related to the stock of wealth. See also the discussion and references in Kerdrain (2011). However, for the purposes of checking for the robustness of our results, we also employ disposable income. Note, that the corresponding stationarity test results for the disposable income series are similar as in the case of compensation of employees.
4. Note that in the case of uncertainty on whether the variables investigated exhibit different orders of integration, i.e. being I (0) and I (1), the Autoregressive Distributed Lag (ARDL) procedure is more suitable. As Pesaran *et al.* (2001) indicate, this approach is developed for the examination of the existence of a level relationship between a dependent variable and a set of regressors, when there is uncertainty as to the variables being trend- or first-difference stationary.

Table 1. Unit root and stationarity testing results

Testing procedure (series in levels, 1st differences)	Consumption	Compensation of employees	Net financial wealth	Net housing wealth	Net total wealth
ADF					
Levels	-0.07	-0.70	-2.35	0.12	0.02
	(0.99)	(0.97)	(0.40)	(0.99)	(0.99)
1st differences	-6.80*	-9.01*	-8.59*	-4.19*	-7.02*
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
PP					
Levels	-0.31	-0.62	-2.46	0.49	-0.18
	(0.99)	(0.97)	(0.34)	(0.99)	(0.99)
1st differences	-6.88*	-9.01*	-8.42*	-4.15*	-7.15*
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
KPSS					
Levels	0.24	0.25	0.13	0.24	0.23
1st differences	0.13	0.11	0.07	0.15	0.14

Note: p-values in parentheses. For the ADF and PP tests, * indicates that the null hypothesis of a unit root is rejected at 5% significance level. For the KPSS test, with the underlying hypothesis of stationarity, the asymptotic critical values are 0.12, 0.15 and 0.22 at the 10%, 5% and 1% critical levels, respectively. We report testing results including a constant and trend.

Following the stationarity tests, we proceed with the investigation of the long-run relationship between consumption, compensation of employees and wealth, using the FMOLS technique. Results are reported in Table 2. First, we estimate the relationship between consumption, compensation of employees and net total wealth with the results obtained suggesting that both income and total wealth have positive and statistically significant coefficients at the 1% level. As a next step, we proceed to estimate the long-run relationship, this time disaggregating net total wealth into its components, net financial wealth and net housing wealth. The results indicate that compensation of employees and net housing wealth have positive and statistically significant coefficients at the 1% level, while net financial wealth has a positive and significant coefficient at the 5% level. Removing the latter variable, we estimate a long-run relationship between consumption, compensation of employees and net housing wealth. The results confirm the positive and statistically significant coefficients of both compensation of employees and net housing wealth.

Table 2. Private consumption and wealth: estimates of the long-run relationship

| Variable	Coefficient (p-value)
Total wealth	
Compensation of employees	1.21* (0.00)
Net total wealth	0.01* (0.00)
Disaggregated wealth	
Compensation of employees	1.14* (0.00)
Net financial wealth	0.01** (0.04)
Net housing wealth	0.01* (0.01)
Housing wealth	
Compensation of employees	1.13* (0.00)
Net housing wealth	0.01* (0.01)
R^2=0.98 for all three equations. The Wald coefficient tests reject joint hypotheses of zero coefficients. In the second equation, the Wald test rejects the hypothesis also when excluding compensation of employees.	

Note: Equations include a constant and trend.
* and ** indicate significance at the 1% and 5% level, respectively.

Using the equation with disaggregated wealth as a benchmark case, actual consumption can be plotted against the resulting long-run equilibrium path of consumption, together with the corresponding cointegration residual. Note that positive residuals represent periods of above equilibrium, while negative residuals stand for periods of below equilibrium consumption levels. As becomes obvious from Figure 5, it was mainly the time period 2006-2012 (apart from the extreme value in 2001Q3) which was characterized by more remarkable fluctuations of the residuals around zero, indicating alternating periods of below and above equilibrium levels of consumption.

It is interesting to observe that during the first two years of economic crisis in the country, namely 2008 and 2009, consumption partly overshot relative to its equilibrium level, while it remained below equilibrium during the following three years of severe recession, namely from 2010 to 2012. The latter developments are most probably related to the corresponding significant decline in income. The subsequent smoother path of this crucial variable also seems to explain the relatively narrow fluctuations of the residual above zero in the more recent time period, including the years 2013-2015.

Figure 5. Actual, cointegration-implied equilibrium level of consumption and residual (million €)
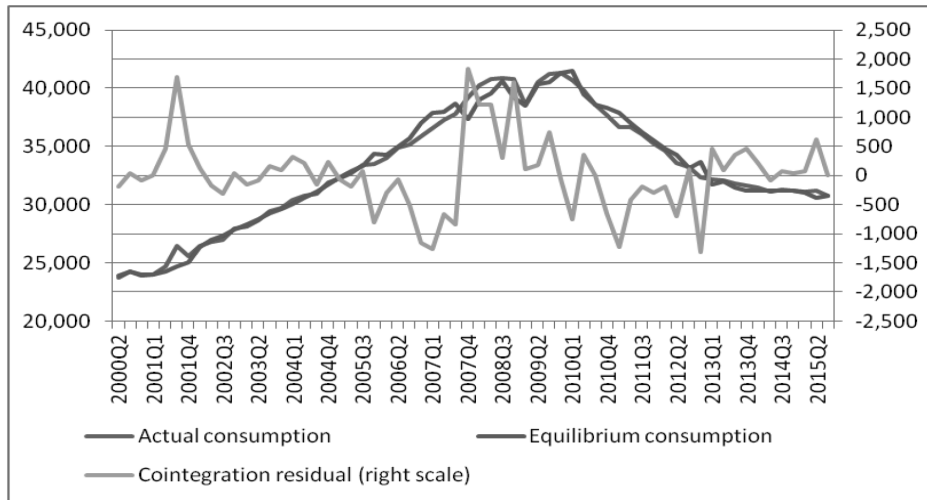
Sources: ELSTAT and authors' estimations.

The Engle Granger and Phillips-Ouliaris tests for cointegration are applied to the three specifications estimated above and the resulting statistics are reported in Table 3. In the specification employing total wealth, the null of no cointegration is rejected at the 1% significance level in all cases. In the specification with disaggregated wealth, cointegration is implied by rejection of the null at the 5% significance level in the cases of both tests. Finally, in the specification employing housing wealth only, the null of no cointegration is rejected at the 5% significance level in the case of the Engle Granger, and at the 1% level in the case of the Phillips-Ouliaris test.

Table 3. Tests for cointegration

	Total wealth	Disaggregated wealth	Housing wealth
Engle-Granger tau-statistic	-5.23*	-4.98**	-4.87**
Engle-Granger z-statistic	-38.09*	-35.49**	-34.12**
Phillips-Ouliaris tau-statistic	-5.37*	-5.11**	-4.95*
Phillips-Ouliaris z-statistic	-40.72*	-37.74**	-35.10*

Note: With constant and trend. * and ** indicate significance at 1% and 5% level, respectively.

Overall, the above empirical evidence is satisfactory, since it is in favour of a positive and statistically significant cointegrating relationship between consumption and wealth, with positive financial and housing wealth effects in the long run. The MPC out of net total wealth is estimated at 0.01, while the resulting MPCs for net financial and housing wealth, when using disaggregated wealth effects, also amount to 0.01, being consistent with other findings in empirical studies of the effects of total or disaggregated wealth on consumption.

One point of concern regarding the results of cointegration analysis presented above could be the underlying assumption of a linear adjustment mechanism.[5] In other words, if the variables under investigation display an asymmetric adjustment process, depending on the state of the business cycle, misspecification issues could emerge. To make sure that the issue of a potential non-linear adjustment has been adequately considered, we use the resulting residuals from the long-run equations to estimate Threshold Autoregressive (TAR) and Momentum-TAR (M-TAR) models (Enders and Siklos, 2001). Testing results are summarised in Table 4. They indicate that in all cases and for all three alternative models (using total, disaggregated or only housing wealth) the two hypotheses of linear co-integration and symmetry cannot be rejected. As a result, we can conclude that there is no evidence of an asymmetric adjustment process characterising the response of consumption to wealth shocks.

Table 4. Cointegration tests with TAR and M-TAR adjustment

Threshold model *Statistic* [critical value]	Total wealth	Disaggregated wealth	Housing wealth
TAR			
F-equal	0.56*	3.87*	1.17*
	[5.80]	[5.31]	[5.87]
F-joint (Φ)	4.15*	5.43*	3.99*
	[8.54]	[10.49]	[8.49]
M-TAR			
F-equal	4.75*	1.05*	0.64*
	[8.01]	[7.98]	[7.90]
F-joint (Φ)	6.54*	3.86*	3.70*
	[9.74]	[11.63]	[9.70]

Notes: The threshold and the number of lags are determined by the data. We rely on simulated critical values at the 5% significance level. * indicates that the underlying hypothesis of equal adjustment coefficients (F-equal statistic) and no cointegration in the residuals (F-joint statistic, Φ) cannot be rejected.

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5. As Marquez *et al.* (2013) indicate, the reasons for which consumption might respond asymmetrically to wealth shocks are discussed in the relevant literature from both a micro- and a macroeconomic point of view. In the latter case, liquidity constraints could be seen to present an important factor for explaining asymmetries. The authors offer a summary of related empirical findings, mostly for the US.

In order to further enrich our empirical application and for the purpose of conducting a robustness and sensitivity analysis, we also perform several additional estimations and tests. As a test of parameter stability, and relying on the equation with disaggregated wealth, we conduct the Hansen cointegration test and, based on the probability obtained, we cannot reject the null hypothesis of cointegrated series at conventional levels. As a check for the stability of the cointegrating relationship over time, we examine how the MPCs out of financial and housing wealth have evolved by applying recursive regression analysis. We start with a benchmark sample including observations for the period 2000Q1 to 2007Q4 and move on by extending the window of 32 observations by one in each step. We further use the residuals obtained from each step to conduct unit root tests. Based both on the estimated coefficients for net financial and housing wealth and the unit root testing results, we can conclude that the cointegrating relation does not exhibit signs of significant variation over time.

Further, to strengthen the evidence for the significant effect of wealth on consumption, we also use disposable income instead of compensation of employees and split the housing wealth variable into housing stock and housing prices.[6] In the first case, the resulting evidence from the equations using either total wealth or disaggregated wealth supports the significance of wealth in shaping consumption, as well as the hypothesis that the variables investigated are cointegrated. It is interesting to note that when using disaggregated wealth, financial wealth does not seem to be significant, while housing wealth has a positive and significant coefficient. When separating the housing stock from the housing price effect, and including net financial wealth alongside with compensation of employees in the long-run equation, it is remarkable that only the housing stock seems to play a role in shaping consumption in the long run, while housing prices appear to be non-significant.

Moving on with the short-run analysis, the dynamic specification using disaggregated wealth also yields satisfactory results with respect to the role of wealth in shaping consumption (see Table 5). More specifically, the lagged ECT –the lagged residual from the long-run regression of consumption on compensation of employees, net financial wealth and net housing wealth– has a significant coefficient with the expected negative sign. On the basis of this coefficient, the speed of adjustment towards equilibrium is 0.28% per quarter. Concerning the short-run effects of wealth components on consumption, the coefficients on both the change in net financial and housing wealth are positive and significant at the 5% level. For the change in net housing wealth the coefficient is estimated at 0.03, while for the change in net financial wealth the corresponding coefficient is estimated at 0.01. The lagged effects of changes in wealth components are also found to be significant at the 5% level.

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6. See Navarro and de Frutos (2015). For housing stock we employ housing surface in thousand m², while for housing prices we use the house price index for urban areas.

Table 5. Private consumption and disaggregated wealth: estimates of the short-run relationship

Variable	Coefficient	(p-value)
Δ Consumption (-1)	1.02*	(0.00)
Δ Compensation of employees	0.34**	(0.02)
Δ Compensation of employees (-1)	-0.39**	(0.02)
Δ Net financial wealth	0.01**	(0.02)
Δ Net financial wealth (-1)	-0.01**	(0.03)
Δ Net housing wealth	0.03**	(0.02)
Δ Net housing wealth (-1)	-0.03**	(0.02)
ECT (-1)	-0.28**	(0.03)

Note: * and ** indicate significance at 1% and 5% level, respectively.

Overall, the results indicate that in the short run both wealth components play a role in shaping consumption, with the effect, however, of housing wealth being at least twice as large as the effect of financial wealth. Interestingly, similar results are obtained when using disposable income instead of compensation of employees. More specifically, we also obtain a negative and significant coefficient on the lagged error correction term and positive and significant coefficients on the change in net financial and housing wealth, with slight differences concerning the significance of their lagged terms. The most important difference refers to the non-significance of the change in disposable income, which also holds for the first two lags of the variable. Finally, when separating between the change in housing stock and housing prices in the short-run equation (including the change in net financial wealth alongside the change in compensation of employees), there are indications that the housing price effect becomes significant in some cases and depending on the lagged terms included, while the housing stock effect turns out to be insignificant. Note, still, that in most of these cases, the incorporated error correction term also remains insignificant.

6. Discussion

The results of our analysis point to the existence of a statistically significant cointegrating relationship between consumption and wealth, with positive financial and housing wealth effects in the long run. In the short run financial and housing wealth also appear to play a role in determining consumption, with the importance of housing wealth being higher compared to that of financial wealth.

Notably, despite their relatively small size, the coefficients of the wealth variables in the relationships estimated above are translated into substantial wealth effects in the case of Greece. This holds particularly in the case of housing, where changes in household wealth in the course of the period examined were very large and wealth effects were present, according to our results, both in the short and in the long run.

Considering the developments during the period of crisis, our results suggest that the sharp decline in housing wealth has played a significant role in the rapid downward trend, followed by private consumption until recently. Furthermore, with private building activity still contracting, and house prices continuing their decline, the resulting persistent loss of housing wealth may be acting against a recovery in private consumption.

With respect to the impact of household financial wealth in the course of the crisis, our results indicate that negative developments in the value of household equity, via intense shocks in the ASE General Index, have contributed towards the decline in private consumption over this period. In parallel, a negative contribution to developments in private consumption has emerged due to the concurrent decline in household deposits. However, caution is recommended in assessing the exact impact of this decline, as in the case of Greece, movements in deposits in the course of the crisis do not always reflect a depletion of past savings (and, hence, of wealth) to meet needs in a period of falling incomes and rising tax burdens. Instead, at times, these movements are partly associated with the flight of deposits from Greece, in response to developments in economic uncertainty.

In view of the above considerations, policies that would contribute towards the stabilisation of housing investment and house prices could reinforce the path towards viable GDP growth through elimination of negative housing wealth effects on consumption. In this framework, the re-assessment of the system of taxation of real estate property in the direction of lifting excessive tax burdens features as a key policy recommendation, acting in favour of easing downward pressures on house prices.

In addition to the above, and with the objective of a speedy recovery in mind, fiscal and structural policies that will safeguard the stability of the economy and contribute to the recovery of investment, may enhance sustainable GDP growth also via positive financial market effects that can have a favourable impact on private consumption. However, attention is recommended with respect to policy choices involving the imposition of additional tax burdens on households. Since such policies are binding within the framework of the current economic adjustment programme, they could to a certain degree impede private consumption growth, not only via their negative effects upon disposable income, but also through a further depletion of household deposits and a corresponding negative wealth effect.

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