National Wealth-Income Ratio in Greece
1974 – 2013

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Abstract

Can the rise of Wealth-Income Ratios observed in the rich economies be found in the case of Greece as well? This paper uses a relatively novel approach, a generalisation of a two-good wealth accumulation equation, in order to estimate the evolution of this ratio. We find that the National Wealth-Income Ratio rose from about 250% in the 1970s to 500% in the eve of the current financial crisis. The characteristics of the rise in terms of the wealth growth rate, the short-run impact of asset price fluctuations versus the long-run dominance of savings in wealth evolution, and the differential between wealth and income growth rates are entirely aligned with the evidence found in other European economies. Our results remain robust to several alterations of the basic framework. Finally, we show that the valuation gain/loss in the foreign wealth of the country exhibits a pattern that may deserve further investigation.

Keywords: Wealth-Income Ratio, Greece, Net Foreign Asset Position

JEL codes: E21, E22, F30

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I Introduction

One of the most prominent, and recently documented, empirical observations in economics is the gradual rise of aggregate Wealth-Income Ratios[1] in the rich economies since the 1970s (Piketty and Zucman, 2014, Piketty, 2011, 2014). The rise from the level of 200%–300% to 400%–600% is more pronounced in four European economies rather than the USA. In the long run, existing evidence shows a U-shaped evolution of Wealth-Income ratios since the 19th Century. In theoretical terms, this evidence implies a strong comeback of the importance of capital in rich economies. Moreover, it sheds light on the possibility of a balanced growth path, the shape of aggregate production functions, and the structure of inequality. The documentation of the rise of wealth-income ratios since the 1970s is based on estimates for the stock of wealth obtained from National Balance Sheets compiled by Central Banks and Statistical Agencies.

In empirical terms, this evidence calls for a further investigation of the existence of that regularity in other economies. This paper investigates whether the rise of National Wealth-Income ratio can be also documented in the case of another European economy which has been in the eye of the storm during recent years, namely Greece. Considering the Greek economy is an interesting choice because profound changes in the economic structure took place during the four decades since the 1970s. From the high inflation of the 1970s and 1980s the economy moved to decades of prosperity and, recently, reached an unprecedented recession. Households' wealth rose significantly, the government shifted to highly negative debt structures, and the foreign asset position of the country, although resembling that of a closed-economy in the 1970s, became massively negative in the eve of the financial crisis.

Although estimates for the *financial wealth* of the Greek Economy can be found for a limited number of years, National Balance Sheets for the Greek economy have not been compiled so far because of the non-existence of estimates for the value of *non-financial wealth*[2]. Thus, we cannot proceed by using a methodology as straightforward as the above one. Nevertheless, the significance of the question of the long-run evolution of aggregate wealth is too important to wait for such data to become available. To that end, we use a generalisation of a two-good wealth accumulation

[1] The Wealth-Income Ratio shows the value of total wealth in the economy in terms of years of National Income; a ratio of 550% implies that the current value of wealth corresponds to five years and six months of National Income. Total Wealth is defined as the sum of tangible, intangible, and net financial capital in the economy.

[2] Non-financial wealth corresponds to non-financial assets – equivalently, *real assets* – which can be divided further in two categories (ESA 2010): (a) non-financial non-produced assets such as land and licenses, and (b) non-financial produced assets such as fixed capital (machines, equipment etc.), inventories, and valuables

equation which takes into account past savings after updating the price of wealth – a method that has not been used in that form so far in the literature – in order to estimate the evolution of the wealth-income ratio since 1974. That is, this paper still works with flows and estimates stocks but it manages to capture salient features of wealth dynamics.

Therefore, our contribution is twofold. First, we provide series for the evolution of wealth that cover four decades allowing one to draw conclusions in a long-run perspective, and decompose the wealth dynamics to a saving effect – the changes in wealth coming from new savings – and a relative price effect – the changes in wealth coming from capital gains and losses. Capital gains/losses are defined as the asset price inflation above the consumer price inflation. Secondly, the methodological approach followed here is relatively novel and its pros and cons are illustrated. The above-mentioned papers, after presenting their results, compare them with the estimates generated by various forms of the wealth accumulation equation[3]. Our interpretation of their evidence is that the wealth accumulation equation captures the long-run evolution but it misses the year-to-year variations in the levels of wealth. Nevertheless, the evolution of β (the National Wealth-Income Ratio) in the country level is a long-run phenomenon. Therefore, this paper is interested in the long-run evolution rather than in a short-run analysis, and uses the above *ex post* justification.

The mainstream approach used extensively so far to estimate capital-income ratios is the Perpetual Inventory Method (PIM) which focuses on the formation of domestic capital by accumulating past investments usually priced at historical cost. Contrary to PIM, the Wealth Accumulation allows to capture two salient features of wealth dynamics: the *National* component[4] of wealth and the *Capital Gains or Losses* in the accumulation process. The *National* component allows us to observe the (net) wealth held by Greek residents both domestically and abroad, whilst the *Capital Gains or Losses* capture the fluctuations of asset prices above the general price level.

The main finding of this paper is that National Wealth-Income Ratio in Greece exhibited a rise compatible with the evidence observed in other European countries. The ratio rose from a relatively constant level of 250% in the 1970s to levels close to 500% in the eve of the current economic recession. Up to the current recession, wealth was growing with an average rate of 4.2%, with savings inducing the largest part of it and capital gains having a small contribution. Taking into account the collapse of both asset prices and national savings during the unprecedented current recession reduces the wealth growth rate to 2.2%, with saving still exerting the largest influence and

[3]See the Appendix for a comparison of the Actual with Simulated Series for Wealth in the case of France.

[4]In the Appendix we also provide estimates for the Private and the Government's Wealth-Income Ratio.

capital gains changing to capital losses. In the long run, the average differential between wealth and income growth is estimated at 1.6%. These estimates are similar to the available observations for other rich economies. Overall, the series for the wealth evolution reflects the swings in the economic development of the country. A thorough sensitivity analysis is pursued in order to investigate the stability of the results. Changes in different parts of the accumulation equation such as the weighting schemes in the composite asset price index, the choice of indexes *per se*, the form of the accumulation equation, and others were applied. The estimates of the benchmark analysis remain robust across the different specifications. The rise of the wealth-income ratio can be observed in all the variations.

Seen with theoretical lenses, our case-study results imply that the long-run wealth evolution is mainly dominated by the saving effect whereas the relative price effect has a small contribution. Nevertheless, it is not entirely clear whether the one-good accumulation equation over-performs the two-good model in the period under study; the steady state formula that incorporates real valuation gains/losses for the wealth-income ratio performs better in terms of predicting its level in the recent years. That is, asset price effects may persist over long time periods such as four decades. Finally, the benchmark estimates for domestic and foreign real capital gains are compared with estimates for foreign capital gains generated based on a different dataset and an open-economy approach. Surprisingly enough, our estimates for capital gains in net foreign assets are close to the alternative ones, based on the Net Foreign Asset Position of the country, and strengthen our approach. Since 1974 and up to 2007, it seems that the capital gains in foreign assets were negligible but significant in the domestic assets implying a form of domestic asset price boom. On top of that, foreign capital gains were persistently positive until the convergence and the subsequent entry to the Euro-zone, a period in which they turned negative.

The following Section relates this work to different literatures. Section III describes the methodology used in the construction of the accumulation equation. Section IV presents the main estimates for β, decomposes them in relative price and saving effects, and shows a cross-country comparison. Section V conducts a thorough sensitivity analysis on the stability of the main series. Section VI integrates the main estimates in an open-economy framework. Section VII concludes.

II Related Literature

II.A A Bird's Eye View of the Theoretical Foundations

The Wealth-Income Ratio provides an overview of the macroeconomic importance of capital in the economy. This ratio is at the core of the balanced-growth path relationships since the first growth models of Harrod (1939), Domar (1947), and Solow (1956). In all these models, the equilibrium path that is characterised by balanced growth provides the same prediction for the wealth-income ratio, β, in the long run: $\beta = s/g$, where s is the national saving (net of depreciation) and g is the income growth. This could be understood as the steady state of an accumulation equation of the form: $W_{t+1} = W_t + s_t Y_t$, where W_t is the wealth level, s_t the saving rate and Y_t the national income. This relationship was used to describe the steady-state growth without explicitly modelling the interconnections among $\beta, s,$ and g. Although it was clear that a relationship in that form implies "knife-edge" predictions for steady growth, the constancy of the capital-output ratio, β, was viewed as a *Stylized Fact* of economic growth (Kaldor, 1961).This had to do with the use of production functions with fixed coefficients. Nevertheless, there were economists recognising the instability of the growth process; according to R.F.Harrod in 1939: "*More controversial points are [...], and the tendency of modern progress to depress rather than elevate the value of C*[5] ". Usually, a closed economy with savings equal to investment was considered. We consider the literature that allows borrowing and lending in section II.D. Furthermore, these were one-good models; or put differently, the relative price between consumption and capital goods was always constant.

Long-run relative price divergence was studied by Baumol (1967), and was empirically documented and incorporated into macro models by Greenwood et al. (1997) and, more recently, by Karabarbounis and Neiman (2014). In these cases, long-run relative price divergence is triggered by sustained productivity growth in some sector of the economy – in particular in the production of the capital good. The wealth accumulation equation for a two-good model, i.e. a model allowing for relative price divergence between capital and consumption goods in any frequency, is $W_{t+1} = \frac{Q_{t+1}}{Q_t}(W_t + S_t)$, where wealth W_t and savings S_t are priced according to the price of capital Q_t. As it is shown in Section III, in our methodology we consider multiple asset classes – or equivalently, different capital goods. The equation that we use can be interpreted as a generalization of a two-good model of wealth accumulation, in which the price of wealth Q_t is defined to be a

[5] The value of capital-to-output ratio

composite asset price index taking into account various price indexes for different forms of wealth. By considering the ratio of the fluctuations in the asset price to the fluctuations in the price of the consumption good, this framework captures the real capital gains and losses – which are absent from the one-good model. If asset prices move in the same way as prices of consumption goods in the long run then this equation boils down to the one-good model. Overall, this paper puts emphasis on the accumulation equation itself rather than on the implied steady state. Finally, notice that these identities hold independently both of the Motives for Saving[6] and of the behavioral assumptions for the utility preferences.

The Wealth-Income Ratio had also a prominent place in the literature of the Life Cycle Hypothesis (Modigliani, 1986, Modigliani and Brumberg, 1954). It was derived from micro-founded models capturing the individual incentives for thrift in order to account for the retirement period. The resulting Ratio is a function of the retirement length, to wit: $\beta \equiv W/Y = M/2$ in the simplest case, where M is the retirement length. Moreover, the nexus of wealth-income ratios and inheritance flows has significant implications for the structure of lifetime inequality (Piketty, 2011). The inheritance flow as percentage of the national income, B/Y, can be expressed as function of the wealth-income ratio[7] W_p/Y, the mortality rate m, and the ratio between aggregate wealth of the deceased and average wealth of the living μ as $B/Y = \mu m W_p/Y$. Finally, the wealth-income ratios might be able to contribute to the DSGE literature[8] as well. Usually, DSGE models anchor the log-linearised version of a model around a steady state balanced growth path. The evidence for the evolution and the periodicity of the ratio β may illuminate the choice of the steady state and the corresponding capital-income ratio.

II.B Estimating Capital-Income Ratios

It was mentioned early in the paper that having aggregate Balance Sheets in the country level is the most fruitful way to study the evolution of wealth. The Financial Accounts, compiled by the Bank of Greece, have figures for the value of the stocks of financial assets of all the institutional sectors of the Greek Economy but their time coverage is very limited starting in 1994 and, thus, do not suffice for our investigation. Usually in the literature, the Perpetual Inventory Method (PIM) has been the benchmark method used for the estimation of Capital-Income Ratios. More

[6] ex. Bequests, Precautionary Saving, Retirement, Liquidity Considerations etc.

[7] In particular, the private wealth-income ratio W_p/Y.

[8] See Lawrence and Christiano (2005), Smets and Wouters (2007)

recently, Caselli (2004) uses it extensively. The intuition why a Wealth Accumulation equation might be a more fruitful way to study the wealth dynamics has already been explained. In the Sensitivity Analysis, we show the results of the PIM; the general rise of the capital-income ratio is documented there as well, but the transition is much smoother because it does not capture the asset price fluctuations.

II.C Wealth in the Greek Economy

There are various papers estimating the value of wealth of different institutional sectors of the Greek Economy in the period of interest. With regards to the Household sector, recent studies based on survey data, such as the Survey on Health, Ageing and Retirement in Europe (SHARE)[9] and the survey on Household Finance and Consumption (HFCS) conducted by the ECB, showed that Greek households were relatively affluent at the onset of the current recession. According to the former study the private wealth-income ratio of individuals above 50 years old was around *seven* in 2004. The second study showed that the *median* Greek household was relatively wealthier than its respective counterpart in some northern economies (see HFCS Report on the Results from the First Wave (2013)). Nonetheless, one should be cautious with the way one interprets and generalizes this evidence. The latter refers only to the median household, whereas the wealth distribution is more skewed to the right in the northern EU countries[10]. With regard to the Government, there are estimates for the value of the Capital of the Government, produced by Kamps (2004)[11] (see also IMF, Country Report No. 09/245), generated by the Perpetual Inventory Method. Finally, the problems of the public debt are well known and documented for the Greek Economy. Furthermore, the press and economists usually question whether the economic development of the country was characterised by asset price bubbles. This paper, firstly, provides estimates for the *National* Ratio β which intrinsically includes all the above separate evidence and, secondly, shows that the short-run fluctuations of asset prices indeed played a major role but the decrease of national saving was a more structural explanation for the wealth evolution in the long run.

[9] See Christelis et al. (2006)

[10] These numbers are influenced by the values of the pension plans and the social protection but we do not touch these topics here – however, these do not differ significantly among the European countries.

[11] His estimates do not include the value of the land of the Greek Government or the property owned by the Church.

II.D Foreign Wealth

Our estimates concern the *National* β, but in the extension of the basic framework we integrate the evolution of the Net Foreign Asset Position – *The Foreign Wealth* – of the country. For advanced economies, the NFAP is a small percentage of National Income. For Greece the latter used to be the case up to the early 1990s but it was then followed by a large deterioration of the NFAP . The NFAP emanates from the accumulation of past current account deficits/surpluses. It is indeed the case that Greece had persistent current account deficits. In the first period of the Euro-era these deficits were not considered very dangerous (Blanchard and Giavazzi, 2002) but they led to a very large NFAP according to the estimates constructed by Lane and Milesi-Ferretti (2001, 2007): -7% in 1996, -123% in the eve of the financial crisis. We use their estimates to decompose our series for national wealth to a domestic and a foreign component. Finally, according to the literature on the *Valuation Effects* in the NFAP, the accumulation of past current accounts cannot explain entirely the NFAP on its own. Valuation Gains and Losses on the international assets of a country should be taken into account. These emanate from the asset price and exchange rate fluctuations, and are influenced by the composition of the international portfolio of a country. Gourinchas and Rey (2005, 2007) showed that these Valuation Effects may persist over long periods and play an important role in the stabilisation of the NFAP of the USA. Curcuru et al. (2008, 2013) provide a critical view. We compute the Valuation Gains and Losses for the case of Greece according to that literature and we compare them with the foreign capital gains/losses imputed by our composite asset price index.

III Methodology

In this section we describe the Wealth Accumulation Equation used to estimate the ratio β. In a world of no price inflation, i.e. a world of a homogeneous consumption and capital good, the Wealth, W_t, of each period comes from the accumulation of the previous (net) savings, S_t, to wit: $W_{t+1} = W_t + S_t$. Note that only net savings contribute to the rise of wealth, which implies that the amount of savings required to compensate for the wear and tear of the existing capital has already been subtracted. Although estimates based on that equation are presented in the sensitivity analysis (Section V), our approach stems from a model in which consumption and capital goods have a time-varying relative price.

This approach could be viewed as an extension of a two-good capital accumulation model. The change in the year-to-year real value of national wealth can be decomposed into two components: the addition of new wealth stemming from savings (*Volume Effect*), and the change in the value of wealth above the general price level, i.e. the real capital gain or loss (*Relative Price Effect*). Therefore, in order to generate estimates for the National Wealth-Income Ratio we accumulate the past (Net) National Savings and price them according to a Composite Asset Price which captures the prices of the different forms of wealth (equity, housing, bonds etc.). The benchmark references are Piketty (2011) and Piketty and Zucman (2014). The accounting identity that describes the evolution of wealth is the following:

$$W_{t+1} = \frac{Q_{t+1}}{Q_t}(W_t + S_t) \tag{1}$$

Where,

W_t is the National Wealth at the beginning of t, at current market prices for assets,
S_t is the Net Savings at current market prices for assets, and
Q_t is the Price of Wealth at the beginning of period t.

It is implicitly assumed that new savings, S_t, become capital at the beginning of period t at price Q_t. We could consider them becoming capital at the end of each period; then the accumulation equation would be $W_{t+1} = \frac{Q_{t+1}}{Q_t}(W_t) + S_t$. Given our long-run view the two equations generate almost identical results[12]. The above equation could be re-written as:

$$W_{t+1} = (1 + q_{t+1})(1 + \pi_{t+1})(W_t + S_t) \tag{2}$$

Where,

$q_{t+1} = (Q_{t+1}/Q_t)/(P_{t+1}/P_t) - 1$ is the Real Capital Gain or Loss on the value of Wealth, i.e. the asset price inflation relatively to the inflation in the price of the consumption good
$\pi_{t+1} = P_{t+1}/P_t - 1$ is the inflation rate
P_t = the Price Level

Dividing both parts with the (nominal) National Income, Y_{t+1}, and doing algebra by expressing all variables at their gross growth rates we obtain the following equation.

[12] See Sensitivity Analysis

$$\beta_{t+1} = \frac{(1+q_{t+1})(1+s_t/\beta_t)}{(1+g_{t+1})}\beta_t \tag{3}$$

Where,

$\beta_t \equiv W_t/Y_t$ is the National Wealth-to-National Income Ratio,
$s_t = S_t/Y_t$ is the Net Saving,
$g_t = (Y_{t+1}/Y_t)/(P_{t+1}/P_t) - 1$ is the *real* growth of National Income

Moreover, we can define the *saving-induced wealth growth rate* as $g_{ws,t} = s_t/\beta_t = S_t/W_t$. Then the above equation shows that the evolution of National Wealth-Income ratio is affected by two forces: the *volume effect* emanating from the addition of new savings, s_t/β_t, and the *price effect*, q_{t+1}, emanating from the changes in the market value of wealth above the price of the consumption good – *(real capital gain or loss)*. This *decomposition* is crucial in understanding the driving forces of the wealth evolution[13].

This relationship shows that the wealth-income ratio rises, $\beta_{t+1} > \beta_t$, even in the case which the new savings are little with respect to the income growth, $s_t/\beta_t < g_{t+1}$, as long as there are significant real capital gains, $q_t > 0$. The opposite scenario holds for real capital losses, $q_t < 0$. The steady state ratio in this framework is $\beta = \frac{(1+q)s}{g-q}$ and implies that relative price effects persist in the long run, whereas it boils down to the standard case, $\beta = s/g$, if $q = 0$. The following three subsections explain the data sources, the way the Composite Asset Price index, Q_t, is constructed and the way to obtain a starting value for the equation (3).

Bringing the Accounting Identity to the Data

The data series cover the period 1974-2013 and mainly come from National Sources; in particular from the Hellenic Statistical Authority (ELSTAT) and the Bank of Greece (BoG) [14]. Briefly, data after 2000 have been collected from electronic sources (see ELSTAT's website) whereas the data covering the period 1974-1999 have been taken from the physical publications of National Accounts (scanned PDF versions are available on-line at www.elstat.gr). This enables a long-run investigation along with a detailed decomposition of the driving forces of the evolution of wealth. All data are in current market prices, converted to Euros according to the fixed exchange rate that prevailed on the day of the introduction of the Euro. Data seem to exhibit continuity across

[13] In the one-good accumulation model, i.e. when $q_t = 0 \forall t$, $\beta_{t+1} = \frac{(1+s_t/\beta_t)}{(1+g_{t+1})}\beta_t$ with steady state $\beta = s/g$.

[14] I also thank Professor Nikos Philippas for providing me with the historic returns of the Athens Stock Exchange.

periods but there are some breaks reflecting data revisions that have not been extended backwards. We follow the guidelines of ELSTAT with respect to the classification of the five periods in which data are homogeneous. Nevertheless, in our accounting framework all variables are expressed as ratios with respect to National Income reducing the impact of revisions. Discrepancies remain in the growth rates between years in which revisions have been taken into account and those in which they have not. We use a very simple form of smoothing for the observations in question[15]. A thorough analysis of the available data, the way in which they have been collected as well as a comparison with data from International Agencies is pursued in the Appendix. For the National Saving we use the sum of Net Saving[16] and Net Capital Transfers from abroad because we are interested in the accumulation of capital. The Net Capital Transfers are however around $1\% - 2\%$ of the National Income in most cases and, hence, it does not make much of a difference. A summary of the main macro-data is presented in the following Table (1).

Table 1: Summary Statistics of the Greek Economy

Period	Real Growth	Net National Saving*	Inflation
1974-1979	4.6%	21.3%	14.1%
1980-1989	-0.5%	12.8%	19.4%
1990-1999	2.0%	9.8%	11.0%
2000-2009	2.6%	-3.0%	3.2%
2010-2013	-10.3%	-16.9%	2.1%
Pre-Crisis Average (1974-2007)	2.0%	10.1%	12.0%
Total-Period Average (1974-2013)	0.5%	6.4%	10.4%

Notes: Author's Computations based on National Accounts from ELSTAT. The table shows yearly (geometric) averages for Real Growth (above CPI) and Inflation (CPI), and (arithmetic) for Net National Saving.
*We included the Net Capital Transfers from abroad in this term.

Composite Asset Price Index

The use of the Composite Asset Price Index allows updating the market value of wealth each time period. Ideally we would like to have the allocation of the current wealth and savings in order to weight each asset price index with the magnitude of the corresponding asset class in the total value of wealth. Had we had that amount of information for the asset portfolio of the country we

[15] We smooth the series by taking the (arithmetic) average of the growth rate in the year after and the year before the break in series. For example, a revision took place in 1997 in order for the National Accounts to comply with the ESA 1995 standards, and which considered data only since 1988. For the 1988 nominal growth we take the arithmetic average of the growth rates of 1987 and 1989.

[16] Sum of the saving of all institutional sectors; Households, NPISH, Corporate, and Government (B.8n, ESA 1995)

would not need to bother estimating the ratio β in the first place. Therefore, we proceed in the following two ways; firstly, in our Benchmark Series we use a slight modification of the benchmark weights proposed by Piketty (2011, Appendix p.56) and, secondly, in the Sensitivity Analysis we construct time-varying weights from underlying data and under some assumptions. Table 2 summarizes the benchmark weights whereas Table (8) shows the time-varying weights. The two approaches produce fairly close weights while in the sensitivity analysis there is experimentation with alternative weighting schemes and the results seem robust in general. Our Composite Index, Q_t, has the following simple form[17]:

$$\frac{Q_{t+1}}{Q_t} = \sum_i w_i \left(\frac{P_{i,t+1}}{P_{i,t}} \right) \tag{4}$$

In other words, the (nominal) returns of the Composite Index, Q_t, are defined as the linear weighted sum of the returns of each individual asset price index, $\frac{P_{i,t+1}}{P_{i,t}}$[18]. According to Piketty (2011), attributing 30% on an Equity Index, 30% on a Housing Index, 20% on CPI, and 20% on assets that are held at constant prices forms a composite index which generates an evolution for private wealth that approximates the actual one for the case of France. The drawback of that approach is that the use of such weights induces too much year-to-year variation in wealth levels. Piketty and Zucman (2014) also provide evidence showing that the Wealth Accumulation equations can approximate the *long-run* evolution of β_t.

We do some modifications on the above weights. Including foreign assets leads to the consideration of five asset class in total and, therefore, five asset price indexes: Housing Assets and the corresponding Housing Price Index from the Bank of Greece, Equity Assets and the Athens Stock Exchange Index, assets with prices evolving like the consumer prices (CPI-type assets – these could include machines, equipment, public physical capital etc), Nominal assets such as Public Bonds and Debt, money holdings, and checking accounts which have a constant nominal price, and finally assets held abroad and priced according to the Morgan-Stanley World equity index (MSCI). Moreover, less weight is attributed on Nominal Assets (15% rather than 20%); this is because we are interested in the evolution of the *National* Wealth-Income Ratio rather than the *Private* Ratio. For instance, bond holdings of households constitute assets for them but liabilities for the government. In the National level the two should cancel each other out. A weight of 5% is attributed on a

[17] This could be seen as the log transformation of a multiplicative index: $Q_t = \prod_i P_{it}^{w_{it}}$

[18] See Arthur (2005) for a discussion of the construction of Composite Asset Price Indexes

Global Equity Index in order to capture the assets placed in international markets.

Table 2: Benchmark Weights in the Composite Asset Price Index

Asset Class	Asset Price Index Used	Benchmark Weights
Housing	Index of Prices of Dwellings, Bank of Greece	30%
Equity Assets	Athens Stock Exchange Index	25%
Foreign Assets	MSCI World, Morgan Stanley	5%
CPI-type Assets	CPI, from ELSTAT	25%
Nominal Assets	Constant Nominal Prices	15%

Notes: Between 1974 and 1993 the index for the Housing Prices is not available and, hence, we substitute it with the CPI index for these years.

Starting Value of the Accumulation Equation

In order to start the accumulation equation (3) an initial value for the wealth-income ratio in 1974, β_{1974}, is needed. This one is estimated based on the following. By definition the National Capital Share, α_k, satisfies $\alpha_k = \frac{Y_k}{Y}$, whereas the National Capital Income, Y_k, is defined as $Y_k = rK$. The latter implies that the net payments of capital income from abroad have been taken into account, and r is the aggregate return on the existing national capital structure K. By dividing the latter with Y, substituting in the former, and using $\beta \equiv \frac{W}{Y} \equiv \frac{K}{Y}$ the following formula is obtained:

$$\alpha_k = r\beta \tag{5}$$

This is, again, an accounting identity; it holds independently of the theoretical edifice but it does not establish any causal relationship among the three variables. It shows that a high wealth-income ratio is positively associated with a high capital share, but inversely related to the return of the capital structure. In order to compute β_{1974}, we estimate the capital share in 1974, $\alpha_{k,1974}$ and we calibrate a steady state interest rate. The following paragraphs illustrate these computations.

We calibrate an interest rate based on a standard Euler equation and given the available data. We assume the standard Dynastic model, with representative agents who maximise their lifetime utility, under perfect foresight in perfectly competitive markets. The economy has reached its balanced growth path (i.e. consumption grows with the same rate as income), the utility function has the CES form: $U(c) = \frac{c^{1-\sigma}}{1-\sigma}$, where σ is the inverse of the Intertemporal Elasticity of Substitution, and the discounting rate of agents is ρ. Under the above, the Euler Equation is $U'(C_t) = \frac{(1+r)}{(1+\rho)}U'(C_{t+1})$. The analytical solution for the interest rate is $r = (1+\rho)(1+g)^{\sigma} - 1$, where g is the growth rate of income. For the calibration the real average growth rate of national income between 1959 and 2013 is used (all the years in which CPI is available) at the level of 2.6%, whereas for the parameters standard values found in the literature are used, i.e. $\sigma = 2$ and $\rho = 1.5\%$. Finally, the interest rate is calibrated at the level of $r = 6.4\%$.

The factor shares reflect the distribution of income in the macro level between the two factors of production. One of the Kaldor's (1961) *Stylized Facts* is that the shares remain roughly constant in time. Gollin (2002) summarizes the various ways to compute them, and discusses the advantages and disadvantages of each way. Given data restrictions the labor share is estimated by the method which assumes the same average wage across all sectors. This assumption is usually employed in order to decompose the income from self employment and agriculture to a capital and a labor component. This assumption *prima facie* seems extreme in a multi-sector developed economy but considering Greece in 1970s – an economy with 80% of its production being consumption goods and 11-15% being low-technology capital goods from 1950s and up to 1980s[19] – it is not far-fetched. The procedure is the following. Firstly, the share of employees in the total labor force (employees, employers and self-employed), e_l, is computed. The labor data come from the Population Censuses in 1971 and 1981. In order to get the 1974 point we interpolate in the years between by using a linear function. Moreover, we exclude the unpaid workers (those employed at home or in a family business) and people under nineteen years old from the Labor Force . The rationale for both modifications is that for these categories a wage would not have been registered in the National Accounts and because population censuses at that time used only a loose concept of employment in the week before the census for someone in order to be considered employed. These modifications help avoid the notorious problem of the overestimation of the labor share in this method.

Given the above, e_l is computed at 47%. Its inverse is multiplied with the Wage Bill in order to get the Total Labor Income in the economy, which is divided by the National Income minus the Direct Taxes, i.e. $\alpha_l = \frac{WageBill*(1/e_l)}{NationalIncome-DirectTaxes}$. Finally, the Capital Share is induced at 17%[20] implying that capital was relatively scarce at that time and, thus, a high wealth-income ratio should not be expected. Bernanke and Gurkayank (2002) estimate the average labor and capital income shares for the period 1980-1995 at 86% and 14%, respectively, using the same technique. Given equation (5), $r = 6.4\%$, and $\alpha_k = 17$ the wealth-income ratio in 1974 is estimated at 265%.

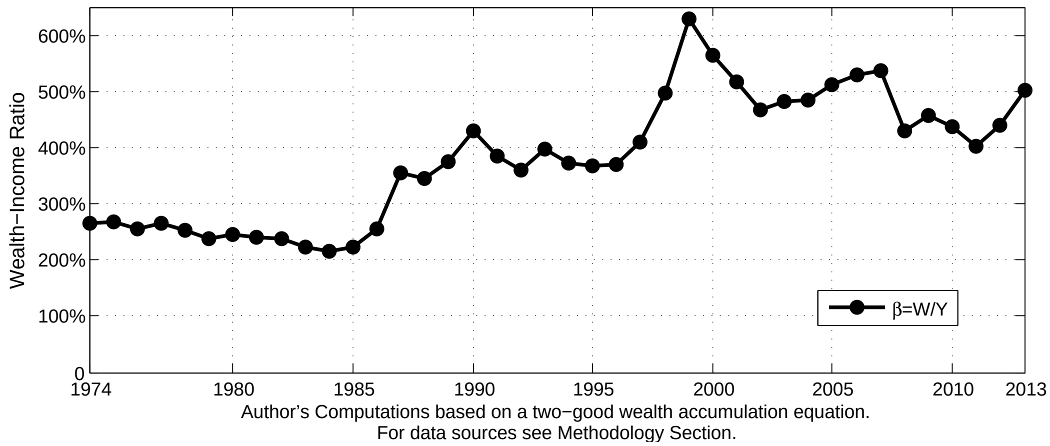
[19]See Germidis and Negreponti-Delivanis (1975).

[20]Had we used only the first modification, the capital share would be 21%, i.e. not very far from 17%. Nevertheless, the latter is closer to the estimates of Bernanke and Gurkayank (2002). In Sensitivity Analysis we show that such small differences in the starting point do not exert any significant influence on the whole path of wealth.

IV National Wealth-Income Ratio

This section contains our benchmark series. We use the initial observation, the Composite Asset Price Index, and we enter the data on the Wealth Accumulation Equation (3). In that way, we obtain the estimates of Figure (1).

Figure 1: National Wealth-Income Ratio, Greece 1974-2013



The main observation that answers the motivation of the paper is that indeed the Wealth-Income Ratio rose from the level of 200%-300% to the level of 400%-600%. In fact, the National Ratio β seems to exhibit three phases. The National Wealth in 1974 was roughly 250% times the National Income, and it remained around this level up to the late 80s. Since then and up to the current recession Wealth soared spectacularly reaching levels above 500%[21]. The rise in this period reflects deep changes in the Greek economy; the two stock market booms (late 80s and 90s), the tame of inflation (from 20% in 1980s to 3% in 2000s), the financialisation of the economy, and the complete openness of the capital account in 1994. Since the onset of the recession the Wealth-Income ratio exhibits a declining path[22]. Next, we decompose the evolution of wealth into its two components, namely saving and real capital gains/losses. For that matter, we divide both parts of equation (3) with β_t and by noting that $\beta_{t+1}/\beta_t = \frac{(W_{t+1}/P_{t+1})/(W_t/P_t)}{(1+g_{t+1})}$ we get:

$$(1 + g_{w,t+1}) = (1 + q_{t+1})(1 + g_{ws,t}) \tag{6}$$

Where,

[21] It is stated again that the emphasis is not on the exact level of these estimates but on the general evolution of β.

[22] However, there is an increase between 2012-13 which is the mere reflection of the coincidence of a small asset price rise and a large drop of income.

$g_{w,t+1} = (W_{t+1}/P_{t+1})/(W_t/P_t) - 1$ is the Real Growth of Wealth
q_{t+1} is the Real-Capital-Gain/Loss-induced wealth growth (*Relative Price Effect)*
$g_{ws,t}$ is the Saving-induced wealth growth (*Volume Effect)*

Using equation (6) we generate Table (3). The 70s and the 80s were characterised by capital losses which were counterbalanced by the high saving-induced wealth growth. In the subsequent decades, the asset price fluctuations became positive and along with the positive, yet declining, effect of saving led to a rise in wealth that was sustained up to the current recession. During the recession, the collapse of asset prices and the low national savings pushed towards successive declines in the value of wealth. Given the magnitude of the current economic recession we present the averages both up to 2007 and across the whole period. In the before-crisis period, wealth seems to be growing with a rate of 4.2% which was mainly driven by the saving effect (4%), whereas the asset price effect was approximately zero (0.3%). Including the recession and averaging across the whole period, the asset price effect becomes more persistent and negative (-0.8%) whereas the saving effect is reduced to 3%. Finally, in the long run, the wealth seems to rise with a rate of 2.2% exceeding by 1.6% the growth rate of national income.

Table 3: Decomposition of Wealth Growth, 1974-2013

Period	Wealth-Income Ratio at the beginning of the period	Decomposition of 1974-2013 Wealth Growth Rate			Average Excess Growth Rate of Wealth over Income
		Real Growth Rate of Wealth	Real-Capital-Gain/Loss-Induced Wealth Growth Rate	Saving-Induced Wealth Growth Rate	
	β_t	$g_{w,t}$	q_t	s_t/β_t	$g_{w,t} - g_t$
1974-1979	265%	2.5%	-5.2%	8.1%	-2.2%
1980-1989	245%	4.2%	-1.7%	5.9%	4.5%
1990-1999	430%	7.4%	4.4%	2.8%	5.4%
2000-2009	563%	-0.7%	-0.8%	0.1%	-3.2%
2010-2013	438%	-8.1%	-5.3%	-3.0%	2.3%
Pre-Crisis Average		**4.2%**	**0.3%**	**4.0%**	**2.1%**
Total-Period Average		**2.2%**	**-0.8%**	**3.0%**	**1.6%**

Notes: Author's Computations based on Equation (7) .

Alternatively, and in order to ease the exposition of our findings, we present the shares of the Volume Effect and the Price Effect in the total wealth growth rate, and in the total wealth accumulation in the period under study (the former looks the rates and the latter the levels by incorporating the impact of the starting value of wealth). Table (4) reveals that indeed the volume effect accounted for almost the entire wealth growth rate (93.3%) while it explained 69.5% of the wealth rise, during the pre-crisis years. The capital losses during the 70s, 80s, and the recession induced a negative impact on the wealth evolution, across the period 1974-2013.

Table 4: Shares of Volume and Price Effect in Wealth Evolution

Period	Shares of 1974-2013 Wealth *Growth Rate*		Shares of 1974-2013 Wealth *Rise*		
	Capital Gain/Loss $\frac{q}{q+g_{ws}}$	Savings $\frac{g_{ws}}{q+g_{ws}}$	Initial Wealth $s_{init}=\frac{\beta^*_{1974}}{\beta_{end}}$	Capital Gain/Loss $(1-s_{init})\frac{q}{q+g_{ws}}$	Savings $(1-s_{init})\frac{g_{ws}}{q+g_{ws}}$
Pre-Crisis (1974-2007)	6.7%	93.3%	25.5%	5.0%	69.5%
Total-Period (1974-2013)	-34.2%	134.2%	43.4%	-19.4%	76.0%

Notes: $\beta^*_{1974}=\frac{\beta_{1974}}{(1+g)^{33}}=\frac{W_{1974}}{Y_{2007}}$, *and* $\beta^*_{1974}=\frac{\beta_{1974}}{(1+g)^{39}}=\frac{W_{1974}}{Y_{2013}}$ in the Pre-Crisis and Total-Period cases, respectively. Here, g is the average real geometric growth rate.

Table (5) shows the *relevance* of the estimated wealth evolution in Greece with respect to the evidence observed in other European Countries and USA (these are obtained from Piketty and Zucman (2014), Tables 5 and A99). The wealth-income ratio in the early 70s was relatively close to the European standards, although its lower level probably reflects the fact that the economic, political, and social conditions after WWII in Greece did not allow the accumulation of capital. Moreover, the level of the ratio in 2010 is relatively close to the evidence for the developed countries – it would seem odd to be higher than them given the very large negative Net Foreign Asset Position of Greece in 2010 (-125%). The decomposition of the wealth growth rate is comparable across countries. The wealth growth rate is between 2.7% and 4%, the saving-induced wealth growth rate is around 2%-3% while the capital-gain/loss-induced wealth growth rate is close to zero. The estimate for the excess growth rate of wealth over national income in our case study is close to the respective evidence in the other countries as well.

Finally, we ask what would the predictions of the one-good and the two-good capital accumulation models be for the steady state in the case of Greece. According to the steady state formula of the one-good model, $\beta = s/g$, the predictions would be 499% and 1282% in the pre-crisis and in the whole period, respectively. According to the steady state formula of the two-good model, $\beta = s(1+q)/(g-q)$, the predictions would be 581% and 502%, respectively. Certainly, the estimates of the two-good model seem very plausible according to Figure (1). This implies that even

Table 5: Cross Country Comparison of Wealth Growth, 1970-2010

Country	National Wealth-Income Ratio in 1970 and 2010 β_t	Decomposition of 1970-2010 Wealth Growth Rate			Average Excess Growth Rate of Wealth over Income $g_{w,t} - g_t$
		Real Growth Rate of Wealth $g_{w,t}$	Real-Capital-Gain/Loss-Induced Wealth Growth Rate q_t	Saving-Induced Wealth Growth Rate s_t/β_t	
Greece*	(265%, 438%)	2.9%	-0.6%	3.5%	1.4%
Italy	(259%, 609%)	4.1%	1.5%	2.6%	2.2%
France	(351%, 605%)	3.6%	0.9%	2.7%	1.4%
Germany	(313%, 416%)	2.7%	-0.4%	3.1%	0.7%
UK	(314%, 523%)	3.5%	2%	1.5%	0.9%
USA	(404%, 431%)	3%	0.8%	2.1%	0.2%

Notes: *For Greece the relevant period is 1974-2010, and the estimates stem from this paper. The estimates for Italy, France, Germany, UK, and USA are taken from Piketty and Zucman (2014), Table 5 and Table A99 (Appendix).

though the evolution of the wealth-income ratio is dominated by the behavior of saving in the long run, capital gains do influence the level of the ratio to a certain extent and, thus, they should not be neglected. There is no doubt that testing the models for their steady state predictions is a simplistic approach especially when there is no information about the steady state of the Greek Economy. The European evidence shows a return of the Wealth-Income ratio to the levels observed in the early 20th century (around 500%-600%) but we do not posses a similar observation for the wealth of Greece one century ago in order to make a similar inference.

V Sensitivity Analysis

This section investigates the *Stability* of the Benchmark Estimates. Eleven alternative series for the Wealth-Income Ratio have been generated under variations of the main framework. Table (6) summarises and compares them with the Benchmark series in terms of $g_w, q_t,$ and, g_{ws}. The following paragraphs explain the variations and the figures depict the alternative estimates for β.

Table 6: Summary of Alternative Results

	Approach	Real Growth Rate of Wealth	Real-Capital-Gain/Loss-Induced Wealth Growth Rate	Saving-Induced Wealth Growth Rate
		Decomposition of 1974-2013 Wealth Growth Rate		
		$g_{w,t}$	q_t	s_t/β_t
	Benchmark Series	2.2%	-0.8%	3.0%
	Time-varying Weights, $w_{i,t}$, in the Composite Asset Price Index, Q_t			
(1)	*Case 1*	2.5%	-0.4%	3.0%
(2)	*Case 2*	2.3%	-0.4%	2.8%
	One-good model			
(3)	Perpetual Inventory Method	2.3%	-	2.3%
	Sensitivity to the Initial Observation			
(4)	"Lower Bound", $\beta(1974)$=200%	2.7%	-0.8%	3.6%
(5)	"Upper Bound", $\beta(1974)$=350%	1.7%	-0.8%	2.5%
	Wealth Accumulation Equation			
(6)	Multiplicative vs Additive Formulation	2.2%	-0.8%	2.9%
	Alternative Indexes			
(7)	CPI vs GDP Deflator for Real Values	2.2%	-0.7%	3.0%
	Alternative (Constant) Weighting Schemes			
(8)	Case 1: Only Domestic Indexes	2.1%	-0.9%	3.1%
(9)	Case 2: Weights of Private Wealth	1.8%	-1.2%	3.1%
(10)	Case 3: More Weight on Housing	2.1%	-0.7%	3.1%
(11)	Case 4: More Weight on ASE	2.6%	-0.3%	3.1%

Time-varying Weights

The reader may have noticed that the main disadvantage of the approach followed herein is that we use ad hoc constant weights in the Composite Asset Price Index. This implies that the importance (i.e. the percentage) of each asset class in the total value of wealth remains the same across time. There is no doubt that such an assumption is not realistic. Our claim is that such an assumption is sufficient in order to study a period of four decades when we focus on the long-run evolution rather than on the year-to-year variations.

Nevertheless, we use the limited information from the Financial Accounts (1994-2013) of the country, along with some mild assumptions, in order to construct *Time-varying Weights* which we, then, put in the Composite Asset Price index and, finally, re-estimate the evolution of β. Briefly, the Financial Accounts provide estimates for the Financial Wealth of the country in terms of stocks which is exactly what we want. Nonetheless, we do not have estimates for the value of the tangible capital (housing, machines, land etc) in the country and, hence, we cannot aggregate the two. Have we had this kind of information we would know directly the ratio β and we would not need to estimate it. Therefore, we approximate the percentage of housing wealth in the total value of wealth by using the percentage of the flow of investment going to residential construction in the total investment in fixed capital having in mind the idea that the flows approximate the stock. This is a relatively innocuous assumption given that this percentage does not vary a lot (with the exception of the years of recession). We use this ratio as the weight of the Housing Index in the Composite Asset Price index for each year – call it $\omega_{h,t}$. Then, by using the Financial Accounts, we compute the ratio of the value of the (gross) stock of each financial asset class, i, to the value of the (gross) stock of all the financial assets[23], $r_{i,t}$ with:

$$r_{i,t} = \frac{\text{Gross Value of Financial Assets of asset class } i}{\text{Gross Value of Total Financial Assets}}$$

Then we weight that value with $(1 - \omega_{h,t})$ in order to normalise the sum of the shares of housing and financial wealth to 1. For example, for the assets that follow the returns of the Athens Stock Exchange market – i.e. i=ASE – we compute their time-varying weights as: $\omega_{ASE,t} = (1 - \omega_{h,t}) r_{ASE,t}$. We group all the asset categories of the Financial Accounts in the five benchmark categories and use the same indexes which were described earlier – Table (7) describes the grouping. The classification is rather normal with an exception coming from the way we consider the Short- and Long-term Loans (F.4 in ESA95). In Case 1 we assume that their returns can be approximated by the returns of the Athens Stock Exchange index – the average return of the ASE index is 6.1% across the whole period under study – whereas in Case 2 they are approximated by the returns of the CPI index. The interplay has to do with placing more weight either on ASE or on CPI. Finally, for the period 1974-1993 during which Financial Accounts do not exist, we use the means of the weights of the 1994-2013 period[24]. Table (8) describes the means and the standard deviations of

[23] We use the Gross assets in order to capture the allocation of savings.

[24] The weight of the assets held in Nominal Prices is computed as a residual in the period 1974-93 in order to

the time-varying weights in comparison to the benchmark case. The weights generated from Case 1 are very close to our constant benchmark weights – which strengthens our choice – whereas the weights in Case 2 are also relatively close.

Table 7: Asset Class Classification

General Asset Class in Consideration	Asset Class of Financial Accounts
Equity Assets	Domestic Assets in: Shares and Other Equity, excluding Mutual Fund Shares (F.51) Mutual Fund Shares (F.52) Short-term and Long-term Loans (F.41, F.42) – only in Case 1 /not in Case 2
Housing	- (its weight is approximated by: residential investment/fixed investment)
CPI-type Assets	Domestic Assets in: Monetary Gold and Special Drawing Rights (F.1) Other Deposits (AF.29) Short-term and Long-term Securities (F.331, F.332) Financial Derivatives (F.34) Insurance Technical Reserves (F.6) Short-term and Long-term Loans (F.41, F.42) – only in Case 2/not in Case 1
Nominal Assets (Constant Prices)	Domestic Assets in: Currency and Sight Deposits (AF.21, AF.22) Other Accounts Receivable (F.7)
Foreign Assets	Foreign Assets in: AF.29, F.331, F.332, F.41, F.42, F.51, F.52

Table 8: Time-varying Weights

Asset Class	Benchmark Weights	Time-Varying Weights	
		Case 1: (mean, st.dev.)	Case 2: (mean, st.dev.)
Housing	30%	30.6%, 6.7%	30.6%, 6.7%
Equity Assets	25%	26.3%, 4.3%	13.3%, 5.2%
Foreign Assets	5%	8.1%, 2.3%	8.1%, 2.3%
CPI-type Assets	25%	23%, 3.5%	36%, 4.4%
Nominal Assets	15%	12%, 2.4%	12%, 2.4%

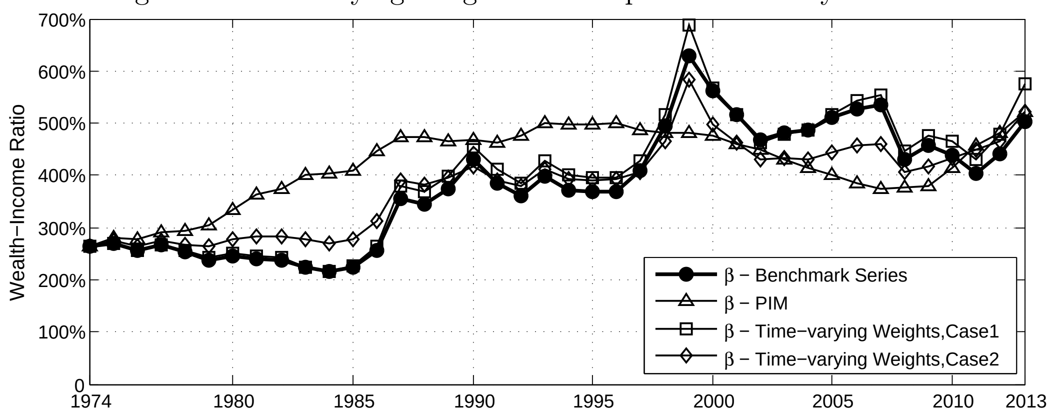
Notes: The two cases differ in the following: It is assumed that the returns of Short-term and Lon-term Loans (F.4 in ESA95) can be approximated by the returns of the Athens Stock Exchange in Case 1; by the returns of the CPI in Case 2.

Figure (2) shows that the estimates for Case 1 almost coincide with the Benchmark Series, whereas Case 2 lies above the benchmark series in the first two decades and below in the later period. This is because Case 2, by placing more weight on CPI raher on ASE, exhibits smaller capital losses in the first decades but it misses the subsequent stock market booms. On average, both series exhibit the same capital loss in the long run, -0.4%, which is comparable to the -0.8%

normalise the sum of the weights to 1 in each year.

of the Benchmark Series, while their differences in terms of the real wealth growth rate and the saving-induced wealth growth rate are rather small (2.5% vs 2.3% and 3% vs 2.8% - Table (6)). Overall, both series verify the rise of the Wealth-Income ratio.

Figure 2: Time-varying Weights and Perpetual Inventory Method



Author's Computations based on alternative specifications for the wealth accumulation equation.
For data sources see Methodology Section.

Perpetual Inventory Method

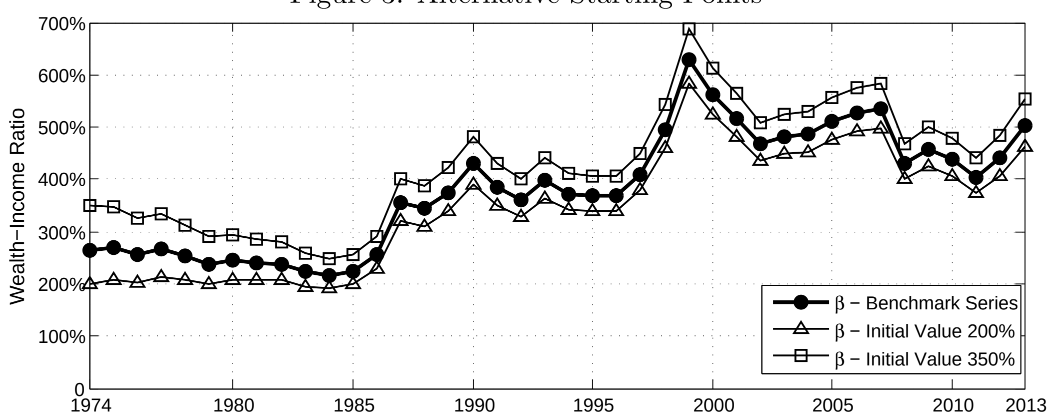
The standard method to estimate capital-income ratios in the literature is the Perpetual Inventory Method - see Caselli (2004) and Gourinchas and Jeanne (2007). The formulation of the equation usually takes the form $K_{t+1} = (1 - \delta)K_t + I_t$ and it is initiated using the value of capital in the steady state, $K = I/(g + \delta)$, with all the variables measured in constant prices. It can be expressed[25] in the form of the one-good wealth accumulation equation, $W_{t+1} = W_t + S_t$, using the identity of the Capital Account and the fact that the Wealth, W_t, is the sum of the Capital, K_t, and the Net Foreign Asset Position, $NFAP_t$. After dividing with National Income Y_{t+1}, it can be expressed as: $\beta_{t+1} = \frac{(1+s_t/\beta_t)}{(1+g_{t+1})}\beta_t$, where the definition of variables is the same as in the benchmark case. We initiate this equation with the same value as in the benchmark case and the estimated series are presented in Figure (2). The estimated long-run wealth growth , 2.3%, almost coincides with the benchmark case. In the Figure, the series from the one-good model lies persistently above the benchmark estimates during 1974-1998 and below during the rest period implying that the one-good model fails to capture the capital losses and gains of the two periods, respectively.

[25]See Appendix

Sensitivity to the Starting Point

Another issue to worry about is whether the benchmark estimates change a lot when the starting point of the accumulation equation, which was estimated at 265%, changes. For that matter, we rerun the estimation procedure, with the benchmark composite asset price index and use as starting points two observationally far-fetched values, namely 200% and 350%. The first series is considered as the lower bound whereas the second as the upper bound. To add some economic context; the lowest observed wealth-income value in rich countries in 1970 was 259% (Italy) and the highest was 404% (USA) – see Table(5). Figure (3) shows that the benchmark series fluctuates between the lower and the upper bound and that the two bounds converge to the benchmark estimates as time goes by, even though the initial distance between them was large.

Figure 3: Alternative Starting Points



Author's Computations based on alternative starting points for the wealth accumulation equation. Benchmark weights in the composite asset price index. For data sources see Methodology Section.

Multiplicative vs Additive Wealth Accumulation, and Alternative Price Index

In Section III we discussed that the formulation of the Wealth Accumulation Equation is based on the assumption that savings take place at the beginning of each year. Although this is unrealistic, assuming that savings, S_t, occur at the end of the year and, hence, used to buy assets at the price Q_{t+1} does not change by much the estimates. That transformation leads to the equation $W_{t+1} = (Q_{t+1}/Q_t)W_t + S_t$ which, in tun, can be re-written as: $\beta_{t+1} = \frac{(1+q_{t+1}+s_t/\beta_t)}{(1+g_{t+1})}\beta_t$. We do not show the estimates for this case because the series coincides with the benchmark case – something that can be seen from number (6) in Table (6). Therefore, our results are also soundproof to the formulation of the Accumulation Equation. Another concern might arise from the fact that the

CPI captures only the changes in the prices of the goods that are included in the consumer basket and not the general price level. Therefore, we run the basic framework substituting the CPI with the GDP Deflator[26]. The results are again in favor of our methodology because the estimated series coincide with the benchmark ones. Item (7) of Table (6) shows that the decomposition of the wealth growth rate is identical to the benchmark results.

Alternative (Constant) Weighting Schemes

Finally, we experiment with different weighting patterns in the Composite Asset Price Index – these are assumed to be time-invariant. In Case 1 (item (9) of Table (6)) only domestic asset price indexes are used by disregarding the MSCI World index and, thus, the assets held abroad. Case 2 considers the allocation of weights for private wealth proposed by Piketty (2011)[27]. This case implies that private and national wealth coincide or, equivalently, that the net wealth of the government is zero. Certainly, the public sector of Greece is highly indebted but one should not neglect the public assets in terms of public corporations, land and buildings in order to compute the net public wealth. Case 3 attributes more weight on Housing assets rather than on Equity, whereas Case 4 places more weight on Equity rather than on assets that exhibit returns close to the CPI returns. Table (9) shows the alternative specifications for the weights in Q_t.

Table 9: Alternative Weighting Schemes

		Alternative Schemes			
Asset Class	Benchmark Weights	Case 1: Domestic Indexes	Case 2: Private Wealth Weights	Case 3: More Weight on Housing	Case 4: More Weight on ASE
Housing	30%	30%	30%	35%	30%
Equity Assets	25%	30%	25%	20%	30%
Foreign Assets	5%	0%	5%	5%	5%
CPI-type Assets	25%	25%	20%	25%	25%
Nominal Assets	15%	15%	20%	15%	10%

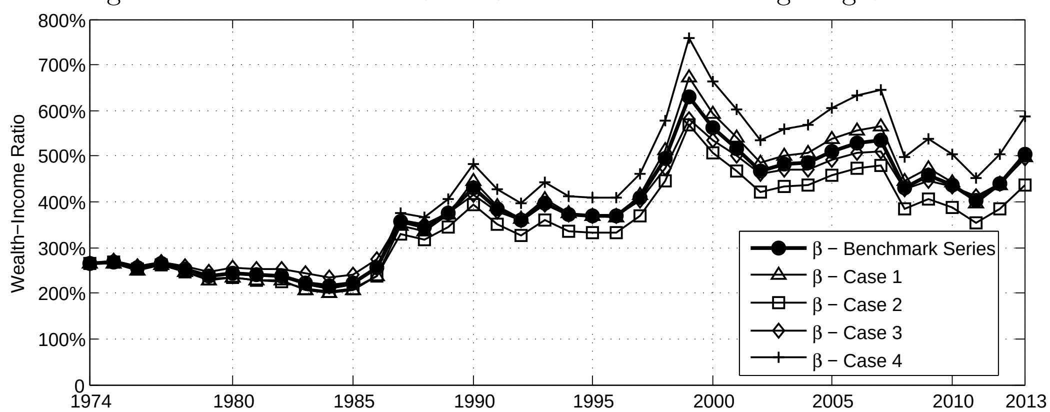
Figure (4) shows that the overall evolution of the alternatives series for β is not very different from the benchmark series. In particular, when only domestic asset price indexes are used or when the housing part is weighted more then the estimated series coincide with the benchmark β. Attributing more weight on ASE – Case 4 – leads to higher estimates for the wealth-income ratio

[26] Downloaded from the database of the World Bank.

[27] The author does not attribute the 5% on an external index; we chose to do that by reducing the weight on domestic Equity by the same %.

in later years. On the contrary, weighting more the Nominal Assets leads to lower estimates. Items (8)-(11) of Table (6) show more formally the similarity of the alternative series with the benchmark ones. Capital losses are higher when more weight is allocated on Nominal Assets (item (9)) and less on external assets. This is due to the fact that Nominal Asset values were eroded more heavily during the early decades whereas the external assets exhibited a positive return throughout the whole period. The evidence also shows that the wealth growth rate seems to be somewhere above 2% in the long run (when the period of the current recession is in included).

Figure 4: Wealth-Income Ratio Under Alternative Weighting Schemes



Author's Computations based on a two−good wealth accumulation equation.
Alternative weigthing schemes in the composite asset price index. For data sources see Methodology Section.

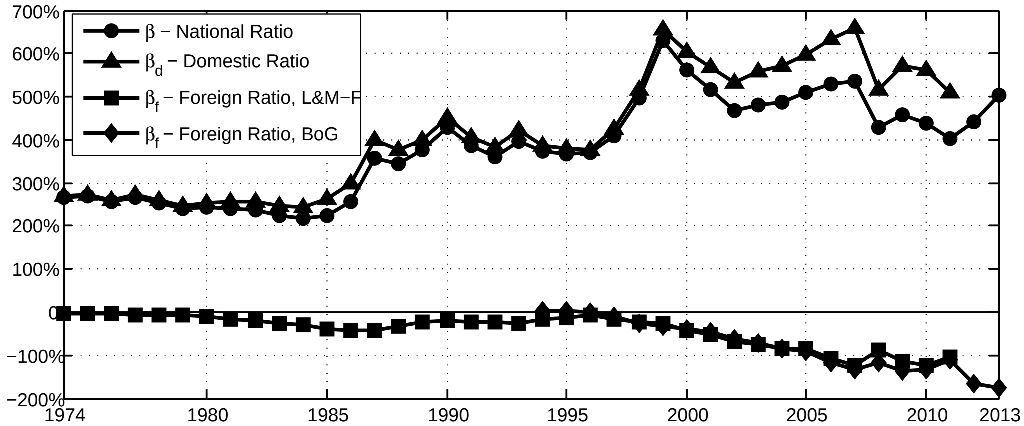
VI Extension: Integrating Foreign Wealth

In this section, we extend the main framework by decomposing the National Wealth, W_t, to the Capital held domesticaly, $K_{d,t}$, and the net wealth held abroad – the Net Foreign Asset Posisiton – NFA_t; $W_t = K_{d,t} + NFA_t$. This analysis places the evolution of national wealth in a more general perspective, studies the origin of the aggregate (imputed by our methodology) real capital gains/losses and compares them with the *Valuation Gains/Losses* of the International Macro literature. The striking observation of Figure (5) is that the rise of national wealth-income ratio coincided with the significant deterioration of country's net foreign wealth[28]. The Net Foreign Assets were relatively stable at -20% up to 1998, when a continuous deterioration started – $NFAP$ was about -125% in 2010. This observation implies a large rise of the value of wealth held domestically

[28]The estimates for the market value of year-end stocks of the Net Foreign Assets of the country are taken from the updated and extended version of dataset constructed by Lane and Milesi-Ferretti (2007) and cover the period 1974-2011. Estimates from the Bank of Greece are also included – these cover a more limited time period (1994-2013).

which, in turn, could be an indication of a significant recovery of domestic asset prices (given the decline of national savings). The reader may further notice that the deterioration of the NFA_t and the divergence between national and domestic wealth takes place in the Euro-era.

Figure 5: National, Domestic, and Foreign Wealth-Income Ratios



Author's Computations based on data from National Accounts, Bank of Greece, and Lane and Milesi−Ferretti (2007).

Next, the magnitude of real capital gains is expressed as percentage of national income (Tables (3) and (4) focused only on the decomposition of the wealth growth rate and on the shares of the wealth rise, respectively). In general, real capital gain, KG_t, can be found from Equation (2) re-written in real terms: $\tilde{W}_{t+1} = \tilde{W}_t + \tilde{S}_t + KG_t$, where $\tilde{W}_t = W_t/P_t$ is the real value of Wealth, $\tilde{S}_t = S_t/P_t$ is the real value of Savings, and $KG_t = q_{t+1} * (\tilde{W}_t + \tilde{S}_t)$ is the real capital gain/loss

Herein, we compute real capital gains, KG, from our estimates. Furthermore, capital gains are decomposed to domestic, KG_d, and to foreign capital gains, KG_f, with $KG = KG_d + KG_f$. By rewriting the return of the asset price index as $q_{t+1} = \sum_i w_i(\frac{Q_{i,t+1}/P_{CPI,t+1}}{Q_{i,t}/P_{CPI,t}} - 1) + w_f(\frac{Q_{f,t+1}/P_{CPI,t+1}}{Q_{f,t}/P_{CPI,t}} - 1)$ with i indexing all the domestic asset price indexes and Q_f the MSCI World index, we are able to compute both domestic and foreign capital gains on $(\tilde{W}_t + \tilde{S}_t)$. Lastly, we express the capital gains as % of National Income and we take their arithmetic average. Results are presented in the first three columns of Table (10). Total capital gains on the pre-recession period were corresponding to an average flow equal to 5.2% of the national income each year, and they were driven mainly by the domestic asset price fluctuations. That is, our estimates imply a considerable rise of the domestic asset prices. Averaging across the whole period under study, the huge impact of the recession changes the capital gains to losses.

Notice that these results stem from the construction of the composite asset price index and from the estimates of wealth – hence the term *Imputed*. Therefore, the imputed estimates for real

Table 10: Decomposition of Capital Gains

Period	Decomposition of the Average Imputed Real Capital Gain/Loss (% of National Income)			Average Valuation Gain/Loss (% National Income)
	Total Capital Gain/Loss KG	Domestic Capital Gain/Loss KG_d	Foreign Capital Gain/Loss KG_f	VG
Pre-Crisis Average (1974-2007)	5.2%	4.9%	0.3%	0.5%
Total-Period Average (1974-2011)	-1.6%	-1.7%	0.1%	3.5%

Sources: Valuation Gains/Losses are computed based on data for the Net Foreign Assets of the country from the updated and extended version of dataset constructed by Lane and Milesi-Ferretti (2007), and on the Net Borrowing/Lending (item B.9n) of the National Accounts found in ELSTAT.

capital gains on foreign assets are compared with foreign capital gains - called *Valuation Gains* - that are computed based on the International Macro literature. The valuation gains and, in general, their interplay with the cumulated current accounts as the two explanatory forces of the net foreign asset positions have been introduced by Lane and Milesi-Ferretti (2001,2007) and have been rigorously documented in Gourinchas and Rey(2005, 2007). Briefly, Valuation Gains, VG_t, are derived from the following law governing the evolution of Net Foreign Assets:

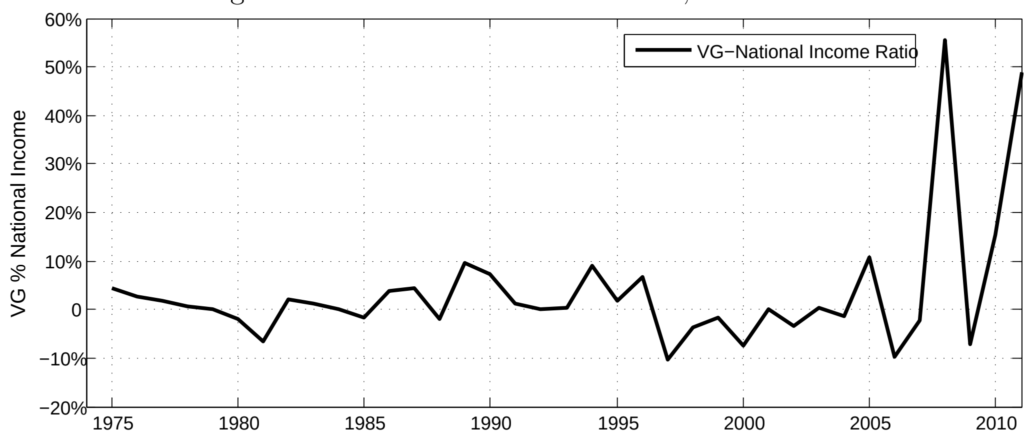
$$VG_{t+1} = N\tilde{FA}_{t+1} - N\tilde{F}A_t - C\tilde{A}_{t+1} \tag{7}$$

Where,

$C\tilde{A}_{t+1}$ is the real value of the Current Account at the end of period t+1,
VG_{t+1} is the real Valuation Gain/Loss at the end of period t+1
$N\tilde{F}A_t$ is the real value of Net Foreign Assets at the end of period t

One important caveat is that during the recession debt restructuring programs took place in various years including assets since 2008 and 2009. Therefore, we strongly suggest focusing on the pre-crisis average Valuation Gain and compare it with the average imputed foreign capital gain. It turns out that the imputed foreign capital gain, 0.3%, is qualitative and quantitative compatible with the valuation gain of 0.5%. This implies that our results are not far from what can be observed from alternative data sources and methodologies. Nevertheless, the evolution of VG_t is interesting on its own right. That is, even though Greece was a "persistent" debtor economy it managed to have a small positive – close to zero though – average capital gain on its foreign balance sheet. This, in turn, means that capital gains were acting to stabilise rather than de-stabilise the negative net foreign asset position of the country. The striking observation of Figure (6) is that the external portfolio of the country is characterised by capital gains during the period up to 1996, and by capital losses in the period of convergence to the Euro standards and the Euro-era[29]. In theory, the valuation gains come from a combination of exchange rate movements, asset price fluctuations, and the external portfolio synthesis. A comprehensive analysis of them goes well beyond the limits of this paper, but these preliminary results may deserve a further scrutiny.

Figure 6: Valuation Gains and Losses, 1974-2011



Author's Computations based on data from National Accounts and Lane and Milesi−Ferretti (2007).

VII Conclusion

The investigation pursued admittedly has its limits. Despite these, this paper showed that the rise of the Wealth-Income Ratio in Greece's modern economic history, and its similarities with the other European economies, are robust observations of our analysis. We consider this evidence as a small piece of the broader picture of the "*Rise of Wealth-Income Ratios*", which may reinforce the need for an empirical documentation across more countries and highlight further their prominent role in the developed economies. Moreover, it calls for the need to compile balance sheets in the country level, a more detailed analysis of the asset price fluctuations on domestic and foreign assets in the period under study, and a better understanding of the dynamics of the NFA of the country.

[29]The post-2007 fluctuations make clear why we chose not to put significant emphasis on the total-period averages.

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National Wealth-Income Ratio in Greece
1974 – 2013

Appendix

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1 Actual vs Simulated Series for France, 1970-2010

One critique against using a Wealth Accumulation Equation in order to estimate the evolution of the Wealth-Income in Greece is that it is impossible to assess the accuracy of the estimates. Put it in more formal terms: because we do not know the asset composition of the country's portfolio we are not able to, first, chose the correct asset price indexes and, secondly, to weight them appropriately.

There is no doubt that there is uncertainty inherited in our estimation procedure. Nevertheless, we claimed that the long-run evolution of β can be mapped. In the text, a reference to the evidence of Piketty and Zucman (2014) and Piketty (2011) was made. To strengthen and illustrate our argument we present how the estimates for β would look like for another country, in particular France, for which we can observe the actual series. The simulated series are constructed using the benchmark weights in the composite asset price index as in the case of Greece (30% in housing, 25% in the stock exchange, 5% in the external assets, 25% in the CPI-type assets, and 15% in the nominal assets). The indexes for the French Equity Market, the CPI, and Housing used are obtained from the complementary files of Piketty and Zucman (2014). We also included their simulation which was based on a multiplicative wealth accumulation equation as well, but with an imputed uniform capital gain of 1.2%.

The following Figure shows that indeed the simulated series misses the annual changes but captures the long-run evolution fairly well. The following Table summarises the evidence for the decomposition of the wealth growth rate in all three series. The simulated long-run g_w, q, and g_{ws} almost coincide with what the actual data reveal. We view this evidence in favor of our long-run view.

Figure 1: Comparison of Actual and Simulated Series, France 1970-2010

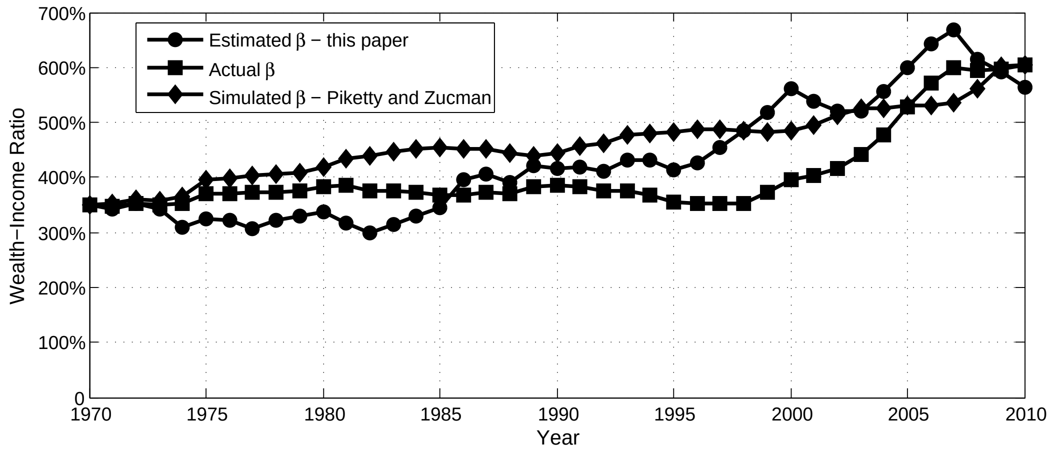


Table 1: Decomposition of Wealth Growth, Actual and Simulated Series

Period	Decomposition of 1970-2010 Wealth Growth Rate, France		
	Real Growth Rate of Wealth $g_{w,t}$	Real-Capital-Gain/Loss-Induced Wealth Growth Rate q_t	Saving-Induced Wealth Growth Rate s_t/β_t
Actual Series (Piketty and Zucman 2014)	3.6%	0.9%	2.7%
Simulated Series This Paper	3.4%	0.9%	2.5%
Simulated Series* (Piketty and Zucman 2014)	3.6%	1.2%	2.3%

Notes: * These estimates are taken from the excel spreadsheets that supplement their published paper (QJE 2014) in the form of an appendix, and can be found in the website of these authors.

2 Greek Economy, 1974 - 2013

2.1 Data Collection

Here we describe the exact sources we used in order to obtain the series for the macro-variables used in this paper. All macroeconomic variables are taken from the Hellenic Statistical Authority (ELSTAT, www.elstat.gr). The observations for the years 2000-2013 were downloaded from the xlsx.file of the National Accounts available on ELSTAT's website. For the all the previous years there is not any available electronic format of the data. Therefore, we used the physical publications of the National Accounts (their scanned versions are available on-line). Thus, we collected by hand the macroeconomic series we needed and entered them in a xlsx.spreadsheet. The response of the

ELSTAT to our request for data pointed towards the method of data collection that we adopted in this paper. The following bullets keep track of the publications we used during the collection process.

- From the publication: *National Accounts of Greece 1995-2004* we get the years 1995, 1998, 1999.
- From the publication: *National Accounts of Greece 1995-2003* we get the year 1997.
- From the publication: *National Accounts of Greece 1995-2002* we get the year 1996.
- From the publication: *National Accounts of Greece 1988-1997* we get the years 1988, 1989, 1990, 1991, 1992, 1993, 1994.
- From the publication: *National Accounts 1970, 1980, 1987-1992* we get the year 1987.
- From the publication: *National Accounts 1970, 1980-1991* we get the year 1986.
- From the publication: *National Accounts 1970, 1980-1990* we get the year 1985.
- From the publication: *National Accounts 1970, 1980-1989* we get the year 1984.
- From the publication: *National Accounts 1970, 1980-1988* we get the year 1983.
- From the publication: *National Accounts 1970, 1978-1985* we get the years 1978, 1979, 1980, 1981, 1982.
- From the publication: *National Accounts 1970, 1974-1981* we get the years 1974, 1975, 1976, 1977.
- The above NA publications concern the data used in the main paper. For the long-run estimates presented below in the Appendix the same procedure was followed and earlier versions of the NA were used.

Although the above way may seem cumbersome it guarantees that we have the latest available observation for each year. Nonetheless, in most of the cases the figures do not change across different publications and, thus, there is no reason for such cumbersome collection. Note that in the time period under study several data revisions took place. The problem is that these revisions were not extended sufficiently back in time which resulted in some breaks in the series. According to ELSTAT, the periods during which the data are consistent among them are: 1950-1987, 1988-1994, 1995-1999, 2000-2004, and 2005-2012. Two remarks are in order. First, the wealth accumulation equation uses saving rates which are ratios of variables measured in the same year. Because of that reason data revisions may have small impact. In any case we use the best available information. Second, the breaks in the series affect the growth rates of National Income between years in which revisions have been taken into account and those in which they have not. We smooth the series by taking the (arithmetic) average of the nominal growth rate in the year after and the year before that observation. The nominal growth is chosen instead of the real growth in order to account for the inflation of that year. For example, a revision took place in 1997 in order for the National Accounts to comply with the ESA 1995 standards, and which considered data only since 1988. For the 1988 nominal growth we take the arithmetic average of the growth rates of 1987 and 1989. Then we divide it with the gross inflation rate of 1988 (and subtract 1) in order to find the real growth of 1988. The same procedure is followed for the growth rates of 1995, 2000, and 2005.

2.2 Summary Data

The following table groups the main macroeconomic variables describing the Greek Economy during the period under study. The reader shall notice the persistently high Current Account Deficits reflecting the lack of competitiveness of the Greek Economy and the continuous foreign borrowing, the collapse of private saving and the rise of the depreciation of capital during the recent years.

The following two figures shed more light on the evolution of national saving and its two components (private and government saving) and the depreciation of national capital. The striking observation is that (Net) Private Saving was relatively stable at the level of 20% for two decades since 1974. After that period, Private Saving exhibited a huge and continuous decline reaching levels close to 0%. It remained at that plateau for all the Euro-era until the current recession during which it declined even further. The reasons of that decline and the low level of saving during the Euro-era might deserve a further exploration. Coeurdacier et al. (2013)[1]provide some evidence showing a decline of personal savings in the advanced OECD economies.

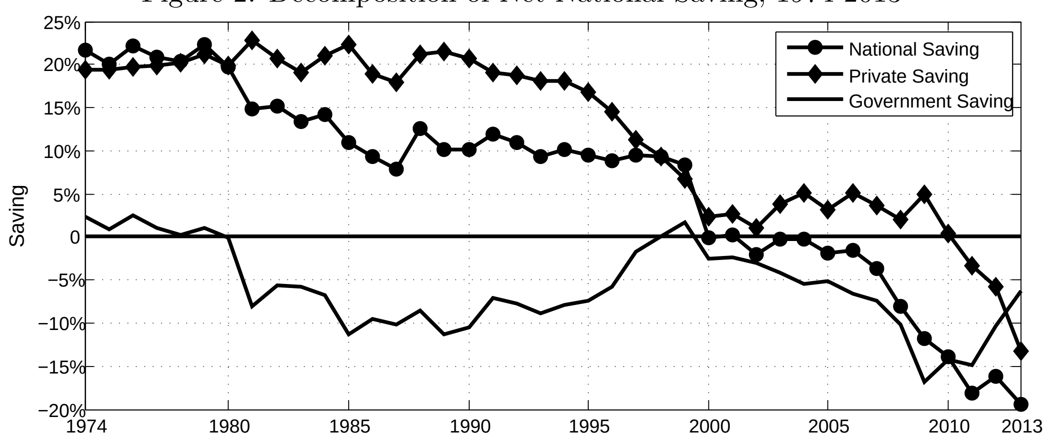
[1]Coeurdacier, N., G. Guibaud, and K. Jin, Credit Constraints and Growth in a Global Economy, Working Paper, 2013

Table 2: Main Macroeconomic Variables (%National Income)

Period	Real Growth	Net National Saving	Net Private Saving	Net Gov. Saving	Net Borrowing/ Lending	Capital Deprec.	Net Primary Inc.	Net Capital Transfers
1974-1994	1.1%	14.9%	20.1%	-5.2%	-3.3%	9.8%	1.6%	0.6%
1994-2013	-0.1%	-2.1%	4.4%	-6.5%	-8.5%	15.3%	-0.3%	2.0%
Pre-Crisis (1974-2007)	2.0%	10.1%	14.9%	-4.7%	-5.1%	10.7%	1.2%	1.1%
Total-Period (1974-2013)	0.5%	6.4%	12.2%	-5.8%	-5.9%	12.5%	0.7%	1.3%

Sources: Author's computations based on National Accounts taken from ELSTAT. For the nominal growth of 1988, 1995, 2000, and 2005 we consider the arithmetic average between the nominal growth of the year before and the year after these dates. We follow that simple smoothing procedure in order to cope with the revisions that took place in those years.

Figure 2: Decomposition of Net National Saving, 1974-2013



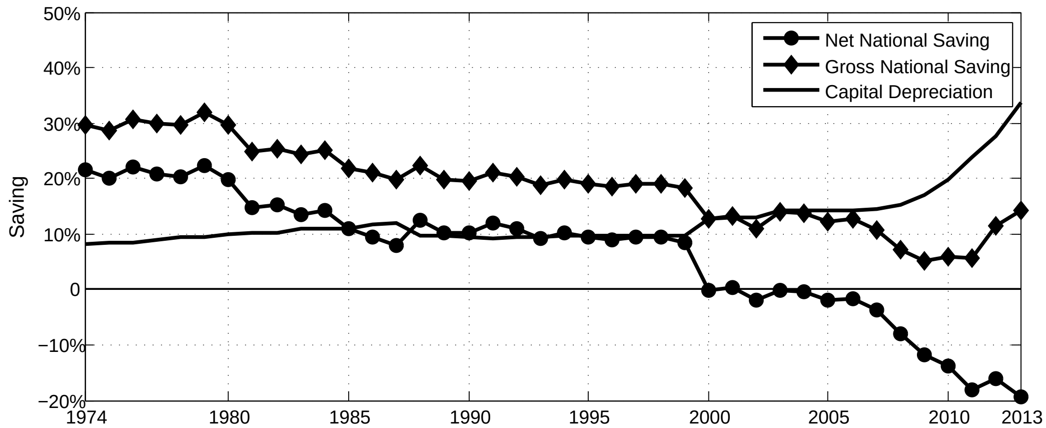
Author's computations using National Accounts from ELSTAT.

2.3 National vs International Data Sources

This paper used data from National Sources in order to cover a large time period, namely four decades since 1974. It was stressed from the beginning that there are data revisions in the Greek National Accounts that were not extended to all the years before them and, thus, inconsistencies and "jumps" may exist. To asses the importance of this issue, we compare our collected data with data downloaded from the World Bank. For that matter, we consider only key macroeconomic variables to our analysis: National Saving and Growth Rates.

The following two figures present the national saving rates as % of Gross National Income (GNI) as well as the Nominal Growth Rates of GNI from the National Accounts and the World Bank.

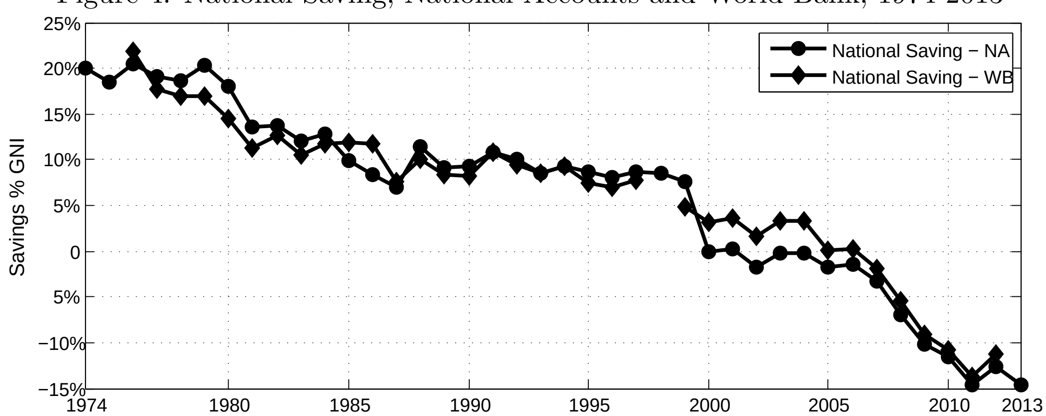
Figure 3: Gross and Net National Saving, 1974-2013



Author's computations using National Accounts from ELSTAT.

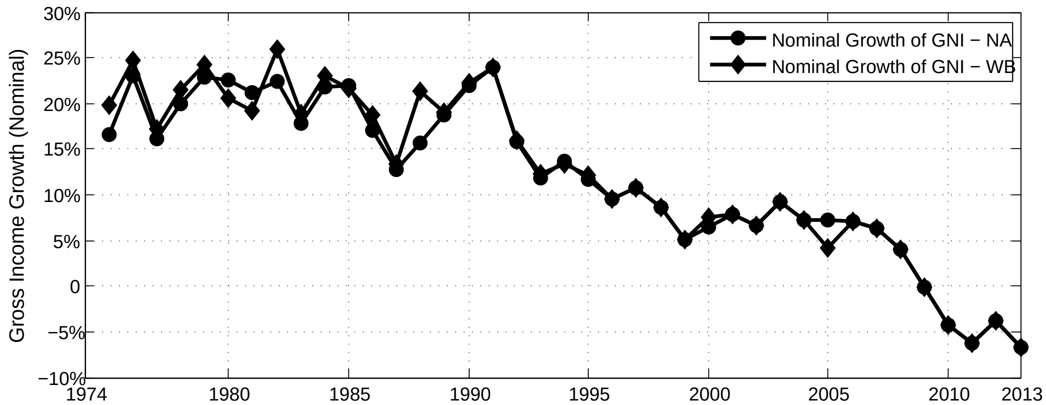
Note that the series for the Nominal Growth of GNI from the National Accounts includes the simple smoothing choices that we implemented and described above. The series for the Saving Rates does not include any smoothing. Small discrepancies have been detected but their overall importance is negligible. These emanate from the fact that the data-collecting departments of international agencies most likely have smoothed the series in order to incorporate the data revisions across all years during which data are available. On the other hand, the time coverage is shorter than what one can obtain from the National Accounts.

Figure 4: National Saving, National Accounts and World Bank, 1974-2013



Author's computations using data from National Accounts and World Bank (World Development Indicators).
The figure shows the National Savings as percentage of the Gross National Income (National Income+Capital Depreciation).

Figure 5: Income Growth, National Accounts and World Bank,1974-2013



Author's computations using data from National Accounts and World Bank (World Development Indicators).
The figure shows the nominal growth of the Gross National Income (Net National Income+Capital Depreciation)

3 Macroeconomic Accounting Identities

We show explicitly how one can transform the formulation of the Perpetual Inventory Method to the one-good wealth accumulation equation.

Perpetual Inventory Method:

$$K_{t+1} = K_t + I_t - KD_t$$

Where,

K_t the value of domestic capital at the begining of period t

I_t the investment flow in t

KD_t the size of the capital depreciation

Capital Account Identity:

$$NBL_t = (I_t - KD_t) - (S_t + NKT_t)$$

Where,

NBL_t the Net Borrowing/Lending term of the National Accounts in time t

S_t the National Savings in time t

NKT_t the Net Capital Transfers from abroad in time t

Law of Evolution of the Net Foreign Assets, NFA_t:

$$NFA_{t+1} = NFA_t + NBL_t$$

By noting that $W_t = K_t + NFA_t$ and grouping the net national savings with the net capital transfers in one term reflecting the total/augmented national savings, S_t, in the economy we can obtain the following.

Wealth Accumulation Equation

$$W_{t+1} = W_t + S_t$$

4 National, Private and Government Wealth-Income Ratio

In this section we decompose the National Wealth, W, to Private, W_p, and Government Wealth, Wg. The motivation is to disentangle the evolution of the private from the national wealth-income ratio by taking into account the wealth of the government.

Methodologically, we use the same wealth accumulation equation that we have extensively used so far by replacing the national saving with the private saving rate and by changing the weights in the composite asset price index in order to capture the different asset portfolio composition held by the private sector. For that matter, we reduce the weight on CPI-type assets and increase the weight on the Nominal assets; this reflects the fact that the private sector holds public bonds for example. Our weights coincide with the weights proposed by Piketty (2011)[2]. The following table shows the weights used.

In order to use the accumulation equation we still need a starting point for the private wealth. This is obtained for the year 2000 for reasons that become clear shortly. National Wealth is the sum of the domestic capital structure and the Net foreign Assets, to wit: $W = K + NFAP$. Both the domestic capital and the Net Foreign Assets can be decomposed further to a private and a government component: $K = K_p + K_g$ and $NFAP = NFAP_p + NFAP_g$. Combining the three

[2]The only difference is that we split the 30% that he attributes on a domestic equity index by attributing 25% on a domestic and 5% on a global equity index.

Table 3: Weights in the Composite Asset Price Index

Asset Class	Private Wealth Weights	National Wealth Weights
Housing	30%	30%
Equity Assets	25%	25%
Foreign Assets	5%	5%
CPI-type Assets	20%	25%
Nominal Assets	20%	15%

Notes: Between 1974 and 1993 the index for the Housing Prices is not available and, hence, we substitute it with the CPI index for these years.

last equations:

$$W = W_p + K_g + NFAP_g$$

Dividing with the National Income;

$$\beta = \beta_p + (K_g + NFAP_g)/Y$$

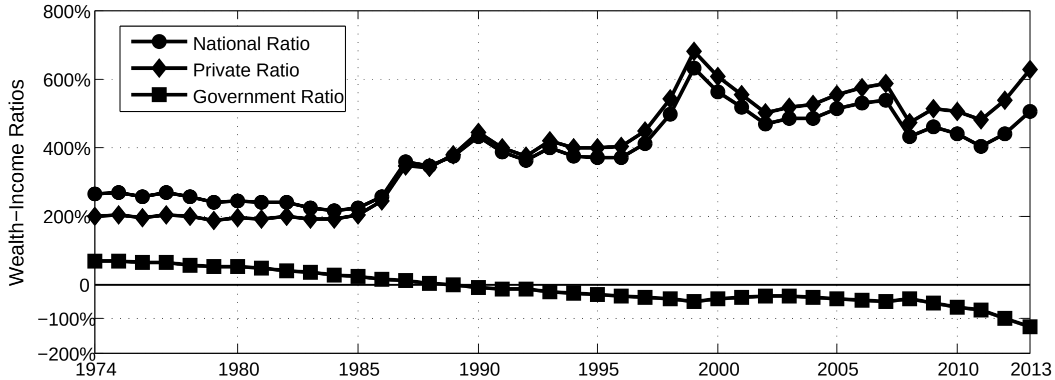
Kamps (2004)[3] provides estimates for the capital stock of the government. He finds it at the level of 51% of GDP in 2000. His estimates have been also used in other IMF reports[4]. A caveat is that his estimates are based on a perpetual inventory method which is very likely to miss the value of the wealth of the church and may suffer from the lack of a complete cadastre for the public property. The value of the stock of Net Foreign Assets of the Government is obtained from the Financial Accounts compiled by the Bank of Greece for the year 2000. Using these two estimates along with our estimate for β_{2000} we obtain an initial estimate for the private wealth, i.e. $\beta_{p,2000} = 605\%$. Based on that point we run the accumulation equation backwards and forwards. We consider the government wealth-income ratio as the difference between the national and the private wealth-income ratios. The following figure presents our results.

The general evolution of the private wealth-income ratio resembles the evolution of the national ratio. It was relatively stable until the late 1980s and then it rose significantly reaching levels above 550% in the eve of the financial crisis. This level is comparable to the ones observed in other

[3] Kamps, C., New Estimates of Government Net Capital Stocks for 22 OECD Countries 19602001, IMF Working Paper WP/04/67, 2004.

[4] See IMF Country Report No. 09/245, Greece, August 2009

Figure 6: National, Private, and Government Wealth-Income Ratio



Author's computations using wealth−accumulation equations for private and national wealth.
Different weights have been used in the composite asset price indexes of private and national wealth.
Government Wealth=National Wealth−Private Wealth

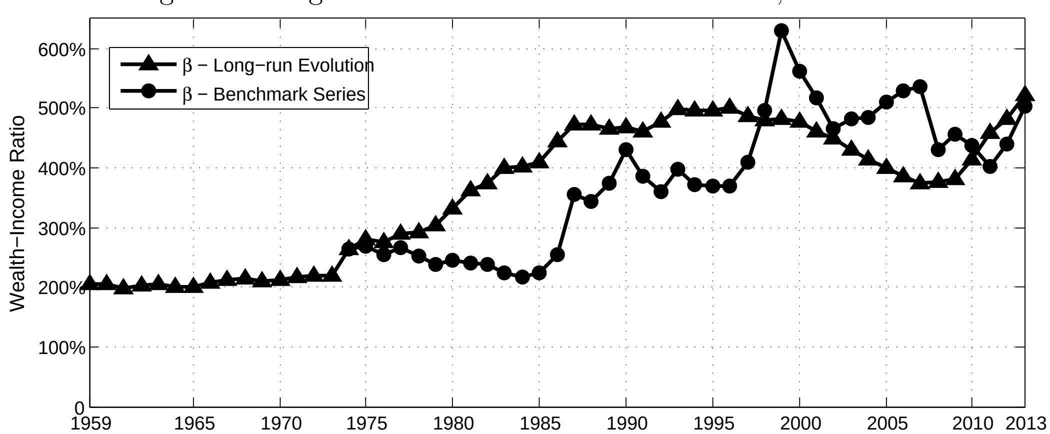
European countries; 550% in France, 630% in Italy, 380% in Germany. On the same time, the wealth-income ratio of the government was deteriorating significantly.

5 Long-run Estimates, 1959-2013

Finally, we attempt to provide a broader picture for the long-run evolution of wealth. To this end, we extend our estimates backwards up to 1959 (the first year of CPI). In such a long period we do not use a composite asset price index but the one-good wealth accumulation equation. There is a number of available indexes for assets but they exhibit huge fluctuations and they do not reflect a large part of wealth holdings and, thus, it is unclear how we should weight them. The one-good wealth accumulation equation seems more appropriate given the data limitations.

The following figure shows that the national wealth-income ratio was stable since 1959 and up to 1974. This, in turn, implies that the saving-induced wealth growth, $g_{ws} = s/\beta$ rate was roughly the same with the real income growth, g. This may reflect the low level of industrialisation of the economy, the emphasis on the production of consumption, rather than heavily industrialised, goods, the role of the agricultural sector, and the political and social turbulence of that period.

Figure 7: Long-run National Wealth-Income Ratio, 1959-2013



Author's computations using wealth accumulation equations and data from National Accounts.