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# MACROECONOMIC DETERMINANTS OF HOUSEHOLDS' INDEBTEDNESS IN PORTUGAL: WHAT REALLY MATTERS IN THE ERA OF FINANCIALISATION?<sup>1</sup>

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## ABSTRACT

The objective of this paper is to perform a time series econometric analysis in order to empirically assess the macroeconomic determinants and the corresponding drivers of Portuguese households' indebtedness in the period 1988 to 2016. During that period, the Portuguese economy experienced a process of financialisation that contributed to an increase in Portuguese households' indebtedness to unprecedented levels. The Portuguese households' indebtedness played a crucial role in the recent sovereign debt crisis. Based on the existing literature, we hypothesise that Portuguese households' indebtedness was due to seven macroeconomic determinants, notably housing prices, financial asset prices, the degree of personal income inequality, households' labour income, the importance of welfare state expenditures, the fraction of the working-age population and the level of interest rates. Our findings reveal that the housing prices busts, financial asset prices, the degree of personal income inequality, households' labour income and the fraction of the working-age population positively impact Portuguese households' indebtedness. Our findings also show that the increase in financial asset prices and the decline in housing prices were the main drivers of Portuguese households' indebtedness in the last few decades.

**KEYWORDS:** Portugal, Financialisation, Households' Indebtedness, Time Series, Nonlinear Autoregressive Distributed Lag Estimator

**JEL CLASSIFICATION:** C32, D10, E21 and R20

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## **ABSTRACT**

The objective of this paper is to perform a time series econometric analysis in order to empirically assess the macroeconomic determinants and the corresponding drivers of Portuguese households' indebtedness in the period 1988 to 2016. During that period, the Portuguese economy experienced a process of financialisation that contributed to an increase in Portuguese households' indebtedness to unprecedented levels. The Portuguese households' indebtedness played a crucial role in the recent sovereign debt crisis. Based on the existing literature, we hypothesise that Portuguese households' indebtedness was due to seven macroeconomic determinants, notably housing prices, financial asset prices, the degree of personal income inequality, households' labour income, the importance of welfare state expenditures, the fraction of the working-age population and the level of interest rates. Our findings reveal that housing prices busts, financial asset prices, the degree of personal income inequality, households' labour income and the fraction of the working-age population positively impact Portuguese households' indebtedness. Our findings also show that the increase in financial asset prices and the decline in housing prices were the main drivers of Portuguese households' indebtedness in the last few decades.

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## 1. INTRODUCTION

In 1986, Portugal initiated its process of integration with the European Economic Community, which required the dismantling of the constraints of its financial system. Consequently, the Portuguese financial system has undergone a strong transformation since that time through the privatisation of public financial institutions and the adoption of several liberalising measures. This new deregulatory framework, formed in order to fulfil the European rules, contributed to accelerating the process of financialisation of the Portuguese economy by promoting strong growth of the Portuguese financial system and an increase in Portuguese households' indebtedness to unprecedented levels (Barradas *et al.*, 2018). Portugal, like the other southern European countries and the Anglo-Saxon countries, have experienced a 'credit-financed consumption-led boom' and growth model supported by debt i.e. the so-called 'debt-driven demand regimes' (Stockhammer and Kohler, 2019). This evolution has made the Portuguese economy more vulnerable to any downside risks (e.g. increases in the interest rates and/or decreases in households' labour income), in a context where the Portuguese households' indebtedness played a central role to the emergence of the recent sovereign debt crisis (Barradas *et al.*, 2018).

Accordingly, one of the main challenges of the Portuguese economy involves the need to adopt public policies that could favour a decline in Portuguese households' indebtedness in order to promote higher financial and macroeconomic stability and resilience and to prevent the emergence of new financial and economic crises in the coming years. This requires a better understanding of the macroeconomic determinants and the respective drivers of Portuguese households' indebtedness.

From a theoretical point of view, Moore and Stockhammer (2018) provide a systematisation of the existing literature by identifying eight macroeconomic determinants of households' indebtedness, namely the rise in housing prices, the upward movements in financial asset prices, the increase in personal income inequality, the decline in households' labour income, welfare state retrenchment, the increase in the working-age population, the low level of interest rates and the greater availability of credit.

From an empirical point of view, these macroeconomic determinants of households' indebtedness have been assessed by several econometric studies focused on a single country (Kohn and Dynan, 2007; Oikarinen, 2009; Gimeno and Martinez-

Carrascal, 2010; Valverde and Fernandez, 2010; Meng *et al.*, 2013; Anundsen and Jansen, 2013) and centred on a group of countries (Rubaszek and Serwa, 2014; Klein, 2015; Malinen, 2016; Stockhammer and Wildauer, 2018; Moore and Stockhammer, 2018; Samad *et al.*, 2020; Dumitrescu *et al.*, 2022). Nevertheless, these econometric studies do not incorporate all the aforementioned eight macroeconomic determinants of households' indebtedness. Moore and Stockhammer's (2018) study is the only exception as it analyses all of them except for the greater availability of credit, which was omitted due to the inexistence of an available proxy. They perform a panel data econometric analysis for thirteen countries of the Organisation for Economic Co-operation and Development (Australia, Belgium, Canada, Finland, France, Germany, Italy, Japan, Norway, Spain, Sweden, the United Kingdom and the United States) for the period 1993 to 2011. They conclude that the most robust macroeconomic determinant of households' indebtedness is housing prices.

This paper analyses the macroeconomic determinants and the corresponding drivers of Portuguese households' indebtedness in the period 1988 to 2016 and makes a fivefold contribution to the existing literature. Firstly, this paper is focused on Portugal. Portugal is a very interesting case study. Portuguese households are some of the most indebted among European countries. In Portugal, housing credit represents more than 80% of that indebtedness (Barradas *et al.*, 2018). Secondly, this paper performs a time series econometric analysis by incorporating seven of the aforementioned eight macroeconomic determinants of households' indebtedness, which has only been done by Moore and Stockhammer (2018). This allows us to mitigate the problem linked to omitted relevant variables and obtain estimates that are more consistent and unbiased (Wooldridge, 2003; Kutner *et al.*, 2005; Brooks, 2009). Thirdly, this paper incorporates a higher sample variability by including periods of increase and periods of decrease in Portuguese households' indebtedness (Figure A1 in the Appendix). Fourthly, this paper assesses the potential asymmetric effects on households' indebtedness, particularly with regard to the variable of housing prices. This allows us to identify the effect of housing prices booms and busts in Portuguese households' indebtedness, for which the empirical evidence is relatively scarce and provides mixed results. Stockhammer and Wildauer (2018) do not identify a statistically significant asymmetric effect between the housing prices and households' indebtedness, albeit this conclusion is not supported by Moore and Stockhammer (2018). These authors find a positive relationship between housing prices and households' indebtedness, which occurs mainly in periods of housing price

booms. Fifthly, this paper identifies not only the macroeconomic determinants of Portuguese households' indebtedness but also the respective drivers. This allows us to identify the contribution of each macroeconomic determinant to the evolution of Portuguese households' indebtedness in the last few decades.

By relying on the Nonlinear Autoregressive Distributed Lag (NARDL) estimator in order to analyse the asymmetric effects of housing prices on households' indebtedness and due to the existence of variables that are stationary in levels and variables that are stationary in first differences, we conclude that the housing price busts, financial asset prices, the degree of personal income inequality, households' labour income and the fraction of the working-age population exert positive impacts on Portuguese households' indebtedness. We also conclude that the increase in financial asset prices and the decline in housing prices were the main drivers of Portuguese households' indebtedness in the last few decades.

The remainder of the paper is organised as follows. Section 2 contains a brief literature review of households' indebtedness in the era of financialisation. In Section 3, we present our model, hypotheses and the respective data set. Econometric strategy is described in Section 4. In Section 5, we present the results and the corresponding discussion. Finally, Section 6 concludes by emphasising some policy implications and suggestions for future research.

## **2. LITERATURE REVIEW OF HOUSEHOLDS' INDEBTEDNESS IN THE ERA OF FINANCIALISATION**

One distinctive feature in the era of financialisation is the higher and stronger engagement of households, including low-income and middle-class households, in the sphere of finance. This engagement has occurred through the acquisition of financial assets as well as the contracting of financial liabilities (Stockhammer, 2010; Lapavistas, 2011; Van der Zwan, 2014; Barradas, 2016). On the one hand, households are now holding more financial assets, such as life insurance pensions, other insurance products, money market funds, deposits, bonds, stocks and other financial assets. On the other hand, households are now also contracting more financial liabilities, such as credits, credit cards and overdraft bank charges.

As a consequence, households' indebtedness has seen a steep increase in the era of financialisation to unprecedented levels, particularly up to the Great Recession (Barradas *et al.*, 2018; Barradas, 2022). Households' indebtedness even played a central role in the emergence of the last financial and economic crisis (Mian and Sufi, 2014; Moore and Stockhammer, 2018).

This infers the need to identify the correct macroeconomic determinants and the respective drivers of households' indebtedness in order to design better public policies that could contribute to decreasing households' indebtedness, to ensuring higher financial and macroeconomic stability and resilience, and to preventing the emergence of new financial and economic crises in the coming years. This is particularly relevant because the conventional economic theory, mainly based on the life cycle and permanent income theories of consumption (Modigliani and Brumberg, 1954; Friedman, 1957; Ando and Modigliani, 1963), does not provide a reasonable explanation of the unprecedented and unsustainable levels of households' indebtedness reached in the last years because it underestimates the institutional and social contexts, the psychological factors and/or the existence of habits (Cynamon and Fazzari, 2008; Palley, 2010). Indeed, mainstream economics claims that households are rational, perfectly informed and forward-looking economic agents that maximise their utility functions over their entire life in order to smooth consumption (Modigliani and Brumberg, 1954; Friedman, 1957; Ando and Modigliani, 1963), in a context in which debt is treated as a neutral tool to transfer lifetime income and wealth across time (Barba and Pivetti, 2008; Kim *et al.*, 2014). Effectively, the widely situations of households' over-indebtedness or households' default in the last years seem to be quite incompatible with the theoretical predictions on rational decisions taken by households (Stockhammer, 2009).

Against this backdrop, Moore and Stockhammer (2018) extracted from the existing literature eight macroeconomic determinants of households' indebtedness, which are based on three different groups of explanations and supported by different strands of literature. Figure 1 illustrates these eight macroeconomic determinants and both the categories of explanations and the strands of literature that each one belongs to.

[Figure 1 around here]

The first macroeconomic determinant of households' indebtedness is linked to the rise in housing prices, which can be explained by two different mechanisms (Godley and Lavoie, 2007; Ryoo, 2016). Firstly, a surge in housing prices has a direct effect on the rise of households' wealth, which stimulates consumption that can be realised through mortgage equity withdrawals. This is the 'realised wealth effect' (Ludwig and Sløk, 2001). Secondly, a surge in housing prices implies an increase in the value of collateral, which relaxes households' credit constraints and allows them to acquire more debt. This is the 'liquidity constraints effect' (Ludwig and Sløk, 2001) and it rests on the financial accelerator theory, according to which asset price inflation increases the value of collateral by permitting more borrowing (Bernanke *et al.*, 1996).

The second macroeconomic determinant of households' indebtedness is related to the rise in prices of financial assets owned by households, which drive them to incur more debt as leverage to acquire more financial assets (Cooper and Dynan, 2016). Households are also holding more financial assets because of the emergence of remuneration schemes to employees in the form of stock options, in addition to purely cash, in the era of financialisation (Edison and Sløk, 2011). As emphasised by Hein (2012), housing and stock market price boom episodes have increased (notional or virtual) households' housing and financial wealth, against which they were willing to borrow in the era of financialisation.

The third macroeconomic determinant of households' indebtedness is associated with the rise in personal income inequality (Frank *et al.* 2014), which is mainly visible through the rise in income of the richest in recent years. This is a well-recognised stylised fact in the era of financialisation (Tridico and Pariboni, 2018), which has occurred due to the abandonment of full employment goals; the proliferation of the 'shareholder value orientation'; the excessive managerial focus on short-term profitability to satisfy impatient shareholders; the appearance of multinational corporations that systematically threaten to relocate their production to low-wage countries; the deregulation of labour markets in order to promote higher wage flexibility (e.g. less protection against firing and/or a lower level of unemployment benefits); the emergence of practices such as outsourcing; and the decline of the power of trade unions. De Vita and Luo (2021) confirm empirically the existence of a positive relationship between financialisation and personal income inequality. This has increased the vulnerability of unskilled labour and/or low-skilled labour and has given rise to asymmetries in income distribution, leading the poorest households to incur debt to copy the consumption standards of the



richest households. This is the ‘demonstration effect’ or ‘Duesenberry effect’ (Duesenberry, 1949). This ‘expenditure cascades’ behaviour (Frank *et al.*, 2014) or ‘keeping up with the Joneses’ behaviour suggests that households aspire to the lifestyle and consumption levels of their neighbours or other households, mainly through the acquisition of Veblen and other durable goods that allow them to satisfy conspicuous consumption through debt. Advertising, marketing and mass media has also fed this households’ behaviour (Cynamon and Fazzari, 2008), namely in relation to the emergence of new technological goods in recent years, which are considered irresistible among low-income and middle-class households (Barba and Pivetti, 2008).

The fourth macroeconomic determinant of households’ indebtedness is the decline in households’ labour income, which is essentially explained by technological progress, globalisation, neoliberalism and financialisation since the mid-1980s (Barradas and Lagoa, 2017; Tridico and Pariboni, 2018; Barradas, 2019). The fall in households’ labour income led them to incur more debt in order to prevent a loss in their standard of living. They had become accustomed to a certain standard of living and did not want other households to think they had lost it (Barba and Pivetti, 2008; Stockhammer, 2012, 2015). This is the ‘ratchet effect’ (Duesenberry, 1949). This is particularly relevant due to the general recognition of the consumption inertia or sluggishness due to the existence of households’ consumption habits (Barradas, 2022).

The fifth macroeconomic determinant of households’ indebtedness pertains to welfare state retrenchment in the era of neoliberalism and financialisation all over the world, which has implied a fall in the quantity and/or the quality of public provision in some social areas such as housing, health, education, pensions and transportation, among others. Against this backdrop, households incur debt in order to satisfy their basic needs that previously were fully satisfied by the State and/or to cover some risks that previously were fully covered by the State (Finlayson, 2009; Lapavistas, 2013). The welfare state retrenchment in the era of neoliberalism and financialisation reflects an increasing trend in market-financial interests in areas that were previously under the control of the State (Barradas, 2019).

The sixth macroeconomic determinant of households’ indebtedness is the increase in the working-age population, which is the fraction of the population that naturally incurs and accumulates debt (Modigliani and Brumberg, 1954). Non-working young people do not have any debt because they are fully credit-constrained, and the non-working elderly population tend to spend their savings. Moreover, the baby-

boomers, who are part of the current working-age population, have denoted a relatively relaxed attitude about debt, particularly in comparison with other generations (Cynamon and Fazzari, 2008).

The seventh macroeconomic determinant of households' indebtedness corresponds to the low level of interest rates, which naturally stimulates households to incur more debt due to the correspondingly cheaper costs of borrowing (Taylor, 2009).

The eighth and last macroeconomic determinant of households' indebtedness is related to the greater availability of credit in the era of financialisation, which has occurred due to financial innovation and engineering (e.g. debt securitisation and the 'originate to distribute' operations of banks) (Hein, 2012), greater competition among banks (Boone and Girouard, 2002) and the corresponding adoption of more aggressive commercial policies in the credit segment (Stockhammer, 2009), the emergence of new financial instruments (e.g. home equity loans and credit cards) (Hein, 2012) and the loosening of financial regulations (Justiano *et al.*, 2019). These features have resulted in a deterioration in creditworthiness standards and have made credit increases possible for the majority of households (Hein, 2012), which was exacerbated by the technological progress that has been allowing banks to improve the techniques to assess the risk of potential borrowers (Cynamon and Fazzari, 2008).

Empirically, there are already in the literature several works that perform time series econometric analyses focused on a single country (Kohn and Dynan, 2007; Oikarinen, 2009; Gimeno and Martinez-Carrascal, 2010; Valverde and Fernandez, 2010; Meng *et al.*, 2013; Anundsen and Jansen, 2013) and panel data econometric analyses centred on a group of countries (Rubaszek and Serwa, 2014; Klein, 2015; Malinen, 2016; Stockhammer and Wildauer, 2018; Moore and Stockhammer, 2018; Samad *et al.*, 2020; Dumitrescu *et al.*, 2022) to assess the macroeconomic determinants of households' indebtedness. Table 1 provides the main details of these empirical works.

[Table 1 around here]

Nonetheless, these empirical works do not incorporate all the aforementioned eight macroeconomics determinants of households' indebtedness, but only some of them isolated from each other, which suggests that they do not assess correctly and completely what the macroeconomic causes are for the unprecedented levels of

households' indebtedness reached in the last few years. In addition, by excluding some explanations, their results suffer from the problem linked to omitted relevant variables, which indicates that their estimates may be inconsistent and/or biased (Wooldridge, 2003; Kutner *et al.*, 2005; Brooks, 2009).

Moore and Stockhammer's (2018) study is the most complete empirical work because it includes seven of the aforementioned eight macroeconomic determinants of households' indebtedness. The macroeconomic determinant related to the availability of credit was the only one that needed to be excluded due to the inexistence of an available proxy to properly assess it. All of the remaining seven macroeconomic determinants were considered. They performed a panel data econometric analysis for thirteen countries of the Organisation for Economic Co-operation and Development (Australia, Belgium, Canada, Finland, France, Germany, Italy, Japan, Norway, Spain, Sweden, the United Kingdom and the United States) for the period between 1993 and 2011 by relying on the panel error correction models to produce their estimates. They found that housing prices are one of the most prominent macroeconomic determinants of households' indebtedness both in the long and short term. The remaining macroeconomic determinants were proven to not exert robust influences on households' indebtedness. These authors also find an asymmetric effect between housing prices and households' indebtedness, according to which this positive relationship occurs mainly in periods of housing price booms. A positive relationship between housing prices and households' indebtedness was also found by other empirical studies on this subject (Kohn and Dynan, 2007; Oikarinen, 2009; Gimeno and Martinez-Carrascal, 2010; Valverde and Fernandez, 2010; Meng *et al.*, 2013; Anundsen and Jansen, 2013; Rubaszek and Serwa, 2014; Stockhammer and Wildauer, 2018; Samad *et al.*, 2020; Dumitrescu *et al.*, 2022).

Our paper, resembling the empirical work of Moore and Stockhammer (2018), aims to assess the macroeconomic determinants and the concomitant drivers of Portuguese households' indebtedness by introducing five important novelties to the existing literature. Firstly, our empirical study is focused on Portugal. Secondly, our time series econometric analysis incorporates the majority of the aforementioned macroeconomic determinants of households' indebtedness. Thirdly, our sample includes periods of increase and periods of decrease in households' indebtedness. Fourthly, our econometric methodology allows us to identify the asymmetric effects of housing prices

on households' indebtedness. Fifthly, our empirical work also identifies the drivers of Portuguese households' indebtedness.

### 3. MODEL, HYPOTHESES AND DATASET

Against this backdrop, we propose estimating an equation according to which households' indebtedness is a function of the seven macroeconomic determinants identified previously, i.e. housing prices, financial asset prices, the degree of personal income inequality, households' labour income, the importance of welfare state expenditures, the fraction of the working-age population and the level of interest rates. Like Moore and Stockhammer (2018), we do not include in our equation the macroeconomic determinant related to the availability of credit due to the lack of a proxy that can properly assess this macroeconomic determinant for Portugal.

Our long-term equation for households' indebtedness takes the following form:

$$HI_t = \beta_0 + \beta_1 HP_t + \beta_2 FAP_t + \beta_3 IN_t + \beta_4 LI_t + \beta_5 WS_t + \beta_6 WP_t + \beta_7 IR_t + \alpha_t \quad (1)$$

where  $t$  is the time period (years),  $HI$  is the households' indebtedness,  $HP$  is the housing prices,  $FAP$  is the financial asset prices,  $IN$  is the degree of personal income inequality,  $LI$  is the households' labour income,  $WS$  is the importance of the welfare state expenditures,  $WP$  is the fraction of the working-age population,  $IR$  is the level of interest rates and  $\alpha$  is an independent and identically distributed (white noise) disturbance term with null average and constant variance (homoscedastic).

As discussed previously, we expect that the housing prices, financial asset prices, the degree of personal income inequality and the fraction of working-age population will exert a positive influence on households' indebtedness, whereas the households' labour income, the importance of the welfare state expenditures and the level of interest rates are expected to exert a negative influence. Our hypotheses therefore suggest the following signs for the coefficients of our variables:

$$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 < 0, \beta_5 < 0, \beta_6 > 0, \beta_7 < 0 \quad (2)$$

In order to fulfil this purpose, we collect annual data for Portugal for the period 1988 to 2016. The frequency and the period were chosen according to the data available for all the variables. Households' indebtedness is measured by the total credit to households and non-profit institutions serving households in percentage of the gross domestic product, available in the Fred St. Louis database. Housing prices corresponds to the natural logarithm of the real housing price index (2015 = 100), available in the analytical housing prices indicators in the OECD database. Financial asset prices are proxied by the natural logarithm of the total share prices (for all shares) index for Portugal (2015 = 100) from the Fred St. Louis database. We assessed the degree of personal income inequality through the top 1% income share, available in the World Inequality database. Households' labour income is quantified by the adjusted labour share, i.e. the ratio of the compensation of employees per employee to the gross domestic product at current market prices per employee, available in the AMECO database. We measured the importance of the welfare state expenditures by the ratio of the government spending on education, health and social security to the gross domestic product. Both variables were collected from the PORDATA database. The fraction of the working-age population corresponds to the activity rate, i.e. the total active population divided by the total population aged between 15 and 64 years, extracted directly from the PORDATA database. The level of interest rates is assessed by using the real short-term interest rates, available in the AMECO database.

Plots of these variables are provided in Figure A1 in the Appendix, the descriptive statistics are in Table 2 and the correlation matrix is presented in Table 3. With regard to correlations, the majority of them are less than 0.8, which is the traditional rule of thumb for excluding the existence of multicollinearity between the variables (Studenmund, 2005). For the remaining ones, we proceed with the calculation of the variance inflation factors, and the hypothesis of multicollinearity was also rejected because all of them proved to be less than 10, which is the traditional rule of thumb for excluding the existence of multicollinearity between the variables (Kutner *et al.*, 2004).<sup>1</sup> At the traditional significance levels, all the independent variables are correlated with the households' indebtedness, with the exception of the fraction of the working-age population. As expected, the correlation between the financial asset prices and households' indebtedness is positive, and the correlations between households'

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<sup>1</sup> Results of the variance inflation factors are available upon request.

labour income and households' indebtedness and between the level of interest rates and households' indebtedness are both negative.

[Table 2 around here]

[Table 3 around here]

We start by employing the Harvey and Leybourne (2007) test in order to test the (non-)linearity properties of the variables. Table 4 provides the respective results. The results of this test indicate that the variables of households' indebtedness, the house prices, financial asset prices, the importance of welfare state expenditures and the fraction of the working-age population exhibit evidence of non-linearity because the null hypothesis of linearity is rejected at the 10% significance level. The degree of personal income inequality, households' labour income and the level of interest rates exhibit evidence of linearity because the null hypothesis is not rejected at the traditional significance levels.

[Table 4 around here]

The Ng and Perron (2001) unit root test for each linear variable is shown in Table 5 and the Kapetanios *et al.* (2003) unit root test for each non-linear variable is in Table 6.<sup>2</sup> Note that the degree of personal income inequality and households' labour income are non-stationary in levels and stationary in first differences according to the Ng and Perron (2001) unit root test, i.e. they are integrated of order one. The level of interest rates only become stationary in second differences according to the Ng and Perron (2001) unit root test, i.e. it is integrated of order two.<sup>3</sup> Households' indebtedness, the housing prices, financial asset prices and the importance of welfare state expenditures are non-stationary in levels and stationary in first differences according to the Kapetanios *et al.* (2003) unit root test, i.e. they are integrated of order one. The

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<sup>2</sup> The Kapetanios *et al.* (2003) unit root test was performed in the Stata software (version 17) following the 'kssur' command.

<sup>3</sup> Results of the the Ng and Perron (2001) unit root test for the level of interest rates in second differences are available upon request.

fraction of the working-age population is stationary in levels according to the Kapetanios *et al.* (2003) unit root test, i.e. it is integrated of order zero.

[Table 5 around here]

[Table 6 around here]

We also perform the Clemente *et al.* (1998) unit root test due to the possible existence of (unknown) structural breaks in our sample, which could invalidate the conclusions provided by the previous unit root tests.<sup>4</sup> Results are shown in Table 7. Despite the structural breaks identified for each variable, we cannot reject the null hypothesis of a unit root at the conventional significance levels for the majority of our variables. The only exception is the variable of financial asset prices in the case of innovative outliers for which the null hypothesis of a unit root is rejected.

[Table 7 around here]

All in all, these unit root tests provided mixed results, but all of them point to the existence of variables that are stationary in levels and variables that are stationary in first differences.

#### 4. ECONOMETRIC STRATEGY

Our econometric strategy involves the implementation of the NARDL estimator developed by Shin *et al.* (2014), which represents an extension of the ARDL estimator proposed by Pesaran (1997), Pesaran and Shin (1999) and Pesaran *et al.* (2001). The NARDL estimator allows the assessment of the potential asymmetric effects of the housing prices on households' indebtedness and to work with a data set composed of a mixture of variables that are integrated of order zero and variables that are integrated of order one. This estimator allows us to work with variables in levels, i.e. without

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<sup>4</sup> The Clemente *et al.* (1998) unit root test was performed in the Stata software (version 17) following the 'clemao2' and 'clemio2' commands.

differentiating them, which facilitates the economic interpretation of the obtained coefficients. The EViews software (version 12) is used to obtain our estimates.

This econometric strategy has five steps. The first step corresponds to the determination of the number of lags that should be included in the NARDL to produce our estimates. In fact, and according to the NARDL estimator, the characteristics of households' indebtedness will be modelled using its lagged values and the contemporaneous and lagged values of the independent variables, i.e.:

$$\begin{aligned}
\Delta HI_t = & \beta_1 HI_{t-1} + \beta_2 HP_{t-1} + \beta_3 FAP_{t-1} + \beta_4 IN_{t-1} + \beta_5 LI_{t-1} + \beta_6 WS_{t-1} \\
& + \beta_7 WP_{t-1} + \beta_8 IR_{t-1} + \gamma_0 + \sum_{i=0}^{\rho} \gamma_1 \Delta HI_{t-i} \\
& + \sum_{i=0}^{\rho} \gamma_2 \Delta HP_{t-i} + \sum_{i=0}^{\rho} \gamma_3 \Delta FAP_{t-i} + \sum_{i=0}^{\rho} \gamma_4 \Delta IN_{t-i} \\
& + \sum_{i=0}^{\rho} \gamma_5 \Delta LI_{t-i} + \sum_{i=0}^{\rho} \gamma_6 \Delta WS_{t-i} + \sum_{i=0}^{\rho} \gamma_7 \Delta WP_{t-i} + \sum_{i=0}^{\rho} \gamma_8 \Delta IR_{t-i} + \alpha_t
\end{aligned} \tag{2}$$

where  $\Delta$  is the operator of the first differences,  $\beta_k$  are the long-term coefficients,  $\gamma_k$  are the short-term coefficients and  $\alpha$  is an independent and identically distributed (white noise) disturbance term with null average and constant variance (homoscedastic).

In order to detect the asymmetric effects of housing prices on households' indebtedness, the variable of housing prices is decomposed into positive and negative shocks both in the long and the short term, i.e.:

$$\begin{aligned}
\Delta HI_t = & \beta_1 HI_{t-1} + \beta_2^+ HP_{t-1} + \beta_2^- HP_{t-1} + \beta_3 FAP_{t-1} + \beta_4 IN_{t-1} + \beta_5 LI_{t-1} + \beta_6 WS_{t-1} \\
& + \beta_7 WP_{t-1} + \beta_8 IR_{t-1} + \gamma_0 + \sum_{i=0}^{\rho} \gamma_1 \Delta HI_{t-i} \\
& + \sum_{i=0}^{\rho} \gamma_2^+ \Delta HP_{t-i} + \sum_{i=0}^{\rho} \gamma_2^- \Delta HP_{t-i} + \sum_{i=0}^{\rho} \gamma_3 \Delta FAP_{t-i} + \sum_{i=0}^{\rho} \gamma_4 \Delta IN_{t-i} \\
& + \sum_{i=0}^{\rho} \gamma_5 \Delta LI_{t-i} + \sum_{i=0}^{\rho} \gamma_6 \Delta WS_{t-i} + \sum_{i=0}^{\rho} \gamma_7 \Delta WP_{t-i} + \sum_{i=0}^{\rho} \gamma_8 \Delta IR_{t-i} + \alpha_t
\end{aligned} \tag{3}$$

According to Shin *et al.* (2014), a positive shock reflects the impact of the housing price booms on households' indebtedness and a negative shock reflects the impact of the housing price busts on households' indebtedness.



The second step is the assessment of the existence of a cointegrating relationship between all the variables by the bounds test procedure developed by Pesaran *et al.* (2001).

The third step is the analysis of several diagnostic tests in order to confirm that our estimates are reliable, namely to confirm that residuals are not serially correlated, are normal and are homoscedastic, that our model is correctly specified in its functional form and that our estimates are stable and do not present any structural breaks.

The fourth step is the presentation of our long-term and short-term estimates, which allows us to identify the determinants of households' indebtedness in Portugal. To produce our estimates, we will take into account case number three, i.e. an unrestricted constant and no trend, and the inclusion of a dummy as an exogenous variable (taking the value 1 for the specific year of 2009 and the value 0 for the remaining years). Note that 2009 corresponds to the year where there was a change in the evolution of the Portuguese households' indebtedness. In fact, it exhibited an increasing trend until 2009 and a decreasing trend after that (Figure A1 in the Appendix).

The fifth step corresponds to the analysis of the economic effects of our estimates (McCloskey and Ziliak, 1996; Ziliak and McCloskey, 2004). This will allow us to identify the contribution of each statistically significant variable to Portuguese households' indebtedness from 1988 to 2016.

## 5. RESULTS AND DISCUSSION

We start by defining the number of lags that should be included in the NARDL to produce our estimates. We use only one lag because this is the traditional rule of thumb for annual data in order to not lose so many degrees of freedom (Wooldridge, 2003), which is particularly relevant in the case of small samples. Moreover, the use of more lags will imply that the unrestricted VAR would not satisfy the stability condition with more than one characteristic polynomial root outside the unit circle (Lütkepohl, 1991).<sup>5</sup>

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<sup>5</sup> Results of the stability condition are available upon request.

Table 8 provides the bounds test procedure in order to assess the existence of a cointegrating relationship between our variables. Note that the estimated F-Statistic is higher than the upper-bound critical values at the traditional significance levels, which means that our variables are strongly cointegrated.

[Table 8 around here]

Table 9 provides the results of the diagnostic tests. Five conclusions deserve our attention. Firstly, the Breusch–Godfrey test indicates that residuals are not serially correlated. Secondly, the Jarque–Bera test reveals that residuals are normal. Thirdly, the Breusch–Pagan–Godfrey test confirms that residuals are homoscedastic. Fourthly, Ramsey’s RESET test highlights that our model is well specified in its functional form. Fifthly, the CUSUM test (Figure A2 in the Appendix) and the CUSUMSQ test (Figure A3 in the Appendix) strongly support the inexistence of structural breaks and the concomitant stability of our estimates in all periods of our sample. These diagnostic tests tell us that our estimates are quite reliable because our model does not suffer from any econometric problem.

[Table 9 around here]

Table 10 exhibits the long-term estimates for Portuguese households’ indebtedness. At the conventional significance levels, all variables are statistically significant with the exception of the positive shock in housing prices (housing price booms), welfare state expenditures and interest rates.<sup>6</sup> These results seem to suggest that the hypotheses on welfare state retrenchment and the low level of interest rates do not explain Portuguese households’ indebtedness. On the one hand, the rise in the welfare state expenditures in Portugal in the few decades due to its late consolidation (Lagoa and Barradas, 2020) seems to suggest a rise in the corresponding social protection, which tends to dissuade households from more precautionary saving and to encourage them to consume more by incurring debt because they feel fully protected by the State. This is the ‘free-rider problem’, which is more common in more generous welfare states (Homburg, 2000, Comelli, 2021). On the other hand, the insignificance of public

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<sup>6</sup> Please note that these results do not change if we use nominal short-term interest rates instead of the real short-term interest rates. Results available upon request.

housing, the malfunctioning of the rental market for housing purposes and the existence of mortgages subsidized by the Portuguese government until at least the end of 2002 have favoured households buying homes through housing credit despite the cost of the respective borrowing or even despite their prices (Barradas *et al.*, 2018). The statistical insignificance of the welfare state expenditures and of the interest rates was also found by Moore and Stockhammer (2018). The remaining variables are statistically significant, albeit the negative shock in housing prices (housing price busts) and households' labour income exhibit counterintuitive impacts on Portuguese households' indebtedness. The negative shock in housing prices (housing price busts) exerts a positive influence on Portuguese households' indebtedness, which is not in line with the majority of empirical works on this subject that find a symmetric and a positive effect of housing prices on households' indebtedness (Kohn and Dynan, 2007; Oikarinen, 2009; Gimeno and Martinez-Carrascal, 2010; Valverde and Fernandez, 2010; Meng *et al.*, 2013; Anundsen and Jansen, 2013; Rubaszek and Serwa, 2014; Stockhammer and Wildauer, 2018; Moore and Stockhammer; Samad *et al.*, 2020; Dumitrescu *et al.*, 2022) and do not corroborate the theoretical predictions of the post-Keynesian literature linked to the collateral effects (Godley and Lavoie, 2007) and of the consumption wealth effects literature related to the wealth effects (Ryoo, 2016).<sup>7</sup> The negative impact of housing prices on Portuguese households' indebtedness during housing prices busts could be attributed to the decision to anticipate home buying when there is a decline in the respective prices. This household behaviour is very relevant in Portugal, considering that wages are low, the savings rate is too small and the majority of a household's debt is due to buying a permanent home. Thus, a decline in housing prices accelerates the decision for house purchase, despite the aggravation of households' credit constraints during that time related to lower value of collateral, because now the entry price (10%) is lower. Effectively, after the Great Recession, the Portuguese commercial banks were prohibited by the Bank of Portugal from granting housing credits in the total amount corresponding to the home price. Now they just grant housing credit up to 90% of the minimum value between the value of the appraisal and that of the acquisition. The positive impact of households' labour income on Portuguese households' indebtedness was also reported by Valverde and Fernandez (2010) for the Spanish economy. This

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<sup>7</sup> Please note that these asymmetric results on the effect of housing prices on Portuguese households' indebtedness do not change if we use the natural logarithm of the nominal housing price index instead of the natural logarithm of the real housing price index (2005=100). Results available upon request.

result could be associated with the higher conservative stance of the Portuguese banks, according to which the level of households' wages is still the best means of assessing their risk when they want credit. Financial asset prices exert a positive effect on Portuguese households' indebtedness, which is in accordance with the theoretical claims that upward movements in financial asset prices lead households to incur debt in order to buy more financial assets as a way of leveraging. In Portugal, this households' behaviour was very common in the past, particularly after the 1990s, due to the privatisation of several banks and other public corporations through public offerings in order to promote 'popular capitalism' (Barradas *et al.*, 2018). Households incur debt in order to participate in those operations and the respective stocks were used as collateral. As found by Klein (2015), the personal income inequality positively influences Portuguese households' indebtedness, which seems to confirm 'expenditure cascades' behaviour or a 'keeping up with the Joneses' behaviour in Portugal. Finally, the fraction of the working-age population is also a positive influencer of Portuguese households' indebtedness. This result confirms the theoretical predictions that households' indebtedness would be determined by the growing importance of the working-age population, as found by Stockhammer and Wildauer (2018).

[Table 10 around here]

Table 11 contains the short-term estimates for Portuguese households' indebtedness. At the traditional significance levels, the error correction term is statistically significant and exhibits a negative coefficient that lies between -2 and 0. This confirms the convergence of our model to the long-term equilibrium even when there is a shock in the short term. The speed of adjustment of any disturbance in the short term is corrected within a year by approximately 14%. As in the case of the long-term estimates, the degree of personal income inequality and the fraction of the working-age population are also positive determinants of Portuguese households' indebtedness in the short term. The high values for the R-squared and the adjusted R-squared indicate that our estimates explain reasonably well the dynamics of Portuguese households' indebtedness. In fact, our estimates explain more than 96% of the variation in Portuguese households' indebtedness.

[Table 11 around here]

Table 12 provides the economic effects of the long-term estimates that proved to be statistically significant in order to assess the contribution of each one to the evolution of Portuguese households' indebtedness in the period 1988 to 2016. During that time, Portuguese households' indebtedness had a dissimilar evolution because it exhibited an increasing trend until 2009 and a decreasing trend after that (Figure A1 in the Appendix). Against this backdrop, the analysis of the economic effects is carried out for these two particular periods and for the full period. For these three periods, we use the same long-term coefficients because we have already concluded that our estimates remain stable over time (Figure A2 and Figure A3 in the Appendix).

[Table 12 around here]

In the period 1988 to 2009, we conclude that the rise in financial asset prices and the decline in housing prices were the main drivers of the increase in the Portuguese households' indebtedness. Effectively, the rise in financial asset prices and the decline in housing prices favoured an increase in Portuguese households' indebtedness by about 44.0 and 2.0 per cent, respectively, during that time. Additionally, Portuguese households' indebtedness during that time would have been even higher by about 103.7 per cent if there had not been a fall in personal income inequality, 22.7 per cent if households' labour income had not declined and 10.1 per cent if there had not been a drop in the working-age population.

In the period 2010 to 2016, the decrease in Portuguese households' indebtedness is explained by the reductions in households' labour income, the working-age population and the personal income inequality. They favoured a decrease in Portuguese households' indebtedness by about 43.6, 42.4 and 6.7 per cent, respectively. They also compensated for the prejudicial effects of the decline in housing prices and the rise in financial asset prices. Note that Portuguese households' indebtedness during that time would have even been lower by around 12.3 per cent if there had not been a decline in the housing prices and 3.3 per cent if there had not been a rise in financial asset prices, respectively.

Taking into account the full period, we conclude that the increase in financial asset prices and the decline in housing prices were the main drivers of the Portuguese households' indebtedness, contributing to its increase of about 41.5 and 16.4 per cent, respectively. The reductions in personal income inequality, of the working-age

population and households' labour income were not enough to prevent an increase in Portuguese households' indebtedness in the period between 1988 and 2016. In fact, Portuguese households' indebtedness during that time would have been even higher by around 317.7 per cent if there had not been a reduction in personal income inequality, 53.4 per cent if there had not been a decrease in the working-age population, and 30.2 per cent if households' labour income had not declined.

## 6. CONCLUSIONS AND POLICY IMPLICATIONS

The existing literature suggests at least eight macroeconomic determinants of households' indebtedness (Moore and Stockhammer, 2018), namely the rise in housing prices, the upward movements in financial asset prices, the increase in personal income inequality, the decline in households' labour income, welfare state retrenchment, the increase in the working-age population, the low level of interest rates and the greater availability of credit.

From an empirical point of view, there are several empirical and econometric works about households' indebtedness (Kohn and Dynan, 2007; Oikarinen, 2009; Gimeno and Martinez-Carrascal, 2010; Valverde and Fernandez, 2010; Meng *et al.*, 2013; Anundsen and Jansen, 2013; Rubaszek and Serwa, 2014; Klein, 2015; Malinen, 2016; Stockhammer and Wildauer, 2018; Moore and Stockhammer, 2018; Samad *et al.*, 2020; Dumitrescu *et al.*, 2022), but they do not take into account all these eight macroeconomic determinants of households' indebtedness.

This paper developed a time series econometric analysis in order to identify the macroeconomic determinants and the corresponding drivers of Portuguese households' indebtedness in the period 1988 to 2016. We estimated an equation according to which the Portuguese households' indebtedness depends on the seven macroeconomic determinants identified in the existing literature (housing prices, financial asset prices, the degree of personal income inequality, households' labour income, the importance of welfare state expenditures, the fraction of the working-age population and the level of interest rates). As in Moore and Stockhammer (2018), the availability of credit was the only macroeconomic determinant that was not included in our equation due to the absence of a proxy to measure it.

Our estimates were produced through the NARDL estimator due to the existence of variables that are stationary in levels and variables that are stationary in first differences and in order to test for the existence of asymmetric effects of the housing prices on households' indebtedness. Our results show that the housing prices busts, financial asset prices, the degree of personal income inequality, households' labour income and the fraction of the working-age population exert positive influences on Portuguese households' indebtedness. Our findings also confirm that these macroeconomic determinants drove the evolution of Portuguese households' indebtedness in recent years. In the period 1988 to 2009, we conclude that the increase in financial asset prices and the decline in housing prices were the main drivers of the increase in Portuguese households' indebtedness during that time. In the period 2010 to 2016, we conclude that the reductions in households' labour income, the working-age population and personal income inequality were the main drivers of the decrease in Portuguese households' indebtedness during that time. Over the full period, the increase in financial asset prices and the decline in housing prices were the main drivers of Portuguese households' indebtedness.

Against this backdrop, the Portuguese policymakers should concentrate their efforts on limiting financial asset prices, avoiding the formation of speculative bubbles in the stock markets, and continuing to promote a decrease in personal income inequality in the coming years. Otherwise, households' indebtedness will continue in an upward trend, making the Portuguese economy more vulnerable to any downside risks. In order to fulfil that purpose, the Portuguese government should introduce a new tax on financial transactions and/or a rise on taxes on capital gains, which should mitigate speculation on financial markets for short-term gains and contain financial asset price booms. These public receipts should be directed to more redistributive policies and social transfers to poorer people in order to reduce personal income inequality in Portugal. An increase in taxes related to inheritances and large fortunes could also be welcomed. A refocus on full employment goals and on higher labour protection (e.g. at the level of unemployment benefits, employment protection, employment rights and minimum wage) and the promotion of more collective bargaining (e.g. among public servants) and higher unionisation levels should also contribute to narrow personal income inequality in Portugal.

This paper has at least two important shortcomings that should be considered in future research about Portuguese households' indebtedness. Firstly, the macroeconomic

determinant related to the availability of credit was not taken into consideration due to the inexistence of a convenient proxy to assess it. However, the higher availability of credit is particularly relevant in Portugal for explaining the evolution of households' indebtedness due to the arrival of foreign banks and the easier access of banks to European financial markets via euro interbank, or even to the liquidity mechanisms provided by the European Central Bank (Barradas *et al.*, 2018). Secondly, this paper followed a macroeconomic perspective in order to identify the macroeconomic determinants and the respective drivers of Portuguese households' indebtedness as a whole. As such, we cannot be certain our results are common among the majority of households, or they would be quite different depending on the characteristics of households, such as wealth, income, qualifications, occupation, size, age, among others. The use of micro data at the household level could be promising in this respect.

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<sup>8</sup> The data that support the findings of this study are available from the corresponding author upon reasonable request.



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## 8. APPENDIX

[Figure A1 around here]

[Figure A2 around here]

[Figure A3 around here]

**Figure 1 – Macroeconomic Determinants of Households' Indebtedness**

|                                     |                                                                                                            |                                                                                                                                               |
|-------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Households'<br/>Indebtedness</b> | <b>Asset-Transaction Explanations</b><br>(Post Keynesians and Consumption Wealth Effects)                  | Rising Housing Prices<br>Upward Movements in Financial Asset Prices                                                                           |
|                                     | <b>Consumption-Oriented Explanations</b><br>(Behavioural Economics, Post Keynesians and Life Cycle Models) | Rising Personal Income Inequality<br>Decline in Households' Labour Income<br>Welfare State Retrenchment<br>Increase in Working-Age Population |
|                                     | <b>Monetary Policy and Credit Supply Explanations</b>                                                      | Low Interest Rates<br>Greater Availability of Credit                                                                                          |

Source: Authors' representation based on Moore and Stockhammer (2018)

**Table 1** – The details of the main empirical works on macroeconomic determinants of households' indebtedness

| Author(s)                                   | Data and Methodology                                                                                                       | Dependent Variable               | Independent Variables                                                                                                                                                                                                                | Main Results                                                                                                                                                      |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Kohn and Dynan (2007)</b>                | Time series<br>US (Survey of Consumer Finances, 1983, 1989, 1992, 1995, 1998 and 2001)<br>Ordinary least squares           | Household debt (% of income)     | House prices, demographic variables and income                                                                                                                                                                                       | House prices exert a positive impact on households' indebtedness                                                                                                  |
| <b>Oikarinen (2009)</b>                     | Time series<br>Finland (1975Q1 to 2006Q4)<br>Vector error correction model and Granger causality                           | Household liabilities (% of GDP) | Real house prices, real GDP, real interest rate and real stock prices                                                                                                                                                                | Real house prices exert a positive impact on households' indebtedness                                                                                             |
| <b>Gimeno and Martinez-Carrascal (2010)</b> | Time series<br>Spain (1984Q1 to 2009Q1)<br>Vector error correction model                                                   | Mortgage loans                   | House prices, households' labour income, nominal interest rate and real interest rate                                                                                                                                                | House prices exert a positive impact on households' indebtedness                                                                                                  |
| <b>Valverde and Fernandez (2010)</b>        | Time series<br>Spain (1988Q4 to 2008 Q4)<br>Vector error correction model                                                  | Real mortgage credit             | House prices, house prices (% of rental income), nominal mortgage credit interest rate, real wage per worker, real interest rate, GDP per capita, mortgage credit default rate and stock prices                                      | House prices exert a positive impact on households' indebtedness                                                                                                  |
| <b>Anundsen and Jansen (2013)</b>           | Time series<br>Norway (1986Q2 to 2008Q4)<br>Vector error correction model                                                  | Real household liabilities       | House prices, household disposable income, housing stock, housing turnover, nominal interest rate, real after-tax interest rate, housing starts, investment in housing, construction costs and rate of depreciation of housing stock | House prices exert a positive impact on households' indebtedness                                                                                                  |
| <b>Meng <i>et al.</i> (2013)</b>            | Time series<br>Australia (1988Q2 to 2011Q2)<br>Vector error correction model                                               | Nominal household liabilities    | Number of new dwellings approved, house prices, interest rate, unemployment rate, GDP, population and inflation                                                                                                                      | House prices exert a positive impact on households' indebtedness                                                                                                  |
| <b>Rubaszek and Serwa (2014)</b>            | Panel data<br>Thirty-six countries (1995-2009)<br>Panel cointegration                                                      | Household debt (% of GDP)        | Interest rate spread, disposable income per capita, real interest rate, unemployment rate, house prices                                                                                                                              | House prices exert a positive impact on households' indebtedness                                                                                                  |
| <b>Klein (2015)</b>                         | Panel data<br>Nine OECD countries (1953-2008)<br>Panel cointegration                                                       | Real credit                      | Top 1% income share, inverted Pareto-Lorenz coefficient, households' labour income and the Gini coefficient                                                                                                                          | Personal income inequality exerts a positive impact on households' indebtedness and households' labour income exert a negative impact on households' indebtedness |
| <b>Malinen (2016)</b>                       | Panel data<br>Eight OECD countries (1960 to 2008)<br>Panel cointegration, first-difference estimator and Granger causality | Household loans (% of GDP)       | Top 1% income share, investment (% of GDP), real GDP per capita, M2 (% of GDP) and short-term interest rate                                                                                                                          | Personal income inequality exerts a positive impact on households' indebtedness                                                                                   |
| <b>Stockhammer and Wildauer (2018)</b>      | Panel data<br>Eleven OECD countries (1980-2011)<br>Error correction model                                                  | Total credit                     | Household disposable real gross income, real long-term interest rate, fraction of population aged 65 or older, top 1% income share, Gini coefficient, real house prices and Fraser credit regulation index                           | House prices and credit supply exert a positive impact on households' indebtedness, whilst ageing population exert a negative impact on households' indebtedness  |
| <b>Moore and Stockhammer (2018)</b>         | Panel data<br>Thirteen OECD countries (1993-2011)<br>Error correction model                                                | Household debt (% of GDP)        | Real house prices, real stock prices, top 1% income share, real average wages, welfare state spending (housing, health and education), the ratio of dependents to the working-age population and the real short-term interest rate   | House prices exert a positive (and asymmetric) impact on households' indebtedness                                                                                 |

|                                        |                                                                                                 |                           |                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                      |
|----------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Samad <i>et al.</i> (2020)</b>      | Panel data<br>19 emerging countries (1995-2018)<br>Least-Squares Dummy Variable Bias-Corrected  | Household debt (% of GDP) | GDP per capita, unemployment, working population, inflation rate, lending interest rate, household consumption, house prices, house prices and financial development                                                                                             | Financial development, house prices and lending interest rate exert a positive impact on households' indebtedness, whilst unemployment rate and inflation rate exert a negative impact on households' indebtedness                                   |
| <b>Dumitrescu <i>et al.</i> (2022)</b> | Panel data<br>Twenty-six OECD countries (2002Q1 to 2020Q4)<br>Unconditional quantile regression | Household debt (% of GDP) | Lagged household debt (% of GDP), economic growth, inflation, investment (% of GDP), government expenditures, house prices, the mortgage credit interest rate, unemployment rate, global economic crises (dummy variable) and covid-19 pandemic (dummy variable) | House prices, investment and mortgage credit interest rate exert a positive impact on households' indebtedness, whilst economic growth, inflation, unemployment rate and government expenditures exert a negative impact on households' indebtedness |

Source: Authors' representation based on Moore and Stockhammer (2018)



**Table 2 – The descriptive statistics**

| Variable                   | Mean  | Median | Maximum | Minimum | Standard Deviation | Skewness | Kurtosis |
|----------------------------|-------|--------|---------|---------|--------------------|----------|----------|
| Households' Indebtedness   | 0.582 | 0.679  | 0.914   | 0.152   | 0.284              | -0.357   | 1.533    |
| House Prices               | 4.789 | 4.812  | 4.938   | 4.545   | 0.113              | -0.754   | 2.529    |
| Financial Asset Prices     | 4.268 | 4.537  | 5.067   | 3.174   | 0.549              | -0.764   | 2.144    |
| Personal Income Inequality | 0.086 | 0.088  | 0.098   | 0.071   | 0.008              | -0.457   | 2.107    |
| Households' Labour Income  | 0.573 | 0.581  | 0.606   | 0.510   | 0.028              | -0.709   | 2.455    |
| Welfare State Expenditures | 0.134 | 0.134  | 0.175   | 0.079   | 0.030              | -0.440   | 2.008    |
| Working-Age Population     | 0.605 | 0.610  | 0.638   | 0.576   | 0.018              | -0.210   | 1.793    |
| Interest Rates             | 0.014 | 0.005  | 0.075   | -0.020  | 0.027              | 0.774    | 2.580    |

**Table 3 – The correlation matrix**

|     | HI        | HP        | FAP       | IN        | LI       | WS        | WP     | IR    |
|-----|-----------|-----------|-----------|-----------|----------|-----------|--------|-------|
| HI  | 1.000     |           |           |           |          |           |        |       |
| HP  | -0.454**  | 1.000     |           |           |          |           |        |       |
| FAP | 0.871***  | -0.349*   | 1.000     |           |          |           |        |       |
| IN  | -0.531*** | 0.882***  | -0.348*   | 1.000     |          |           |        |       |
| LI  | -0.340*   | 0.845***  | -0.195    | 0.863***  | 1.000    |           |        |       |
| WS  | 0.953***  | -0.556*** | 0.856***  | -0.572*** | -0.372** | 1.000     |        |       |
| WP  | 0.128     | 0.317*    | -0.047    | 0.036     | 0.052    | -0.118    | 1.000  |       |
| IR  | -0.683*** | 0.378**   | -0.740*** | 0.447**   | 0.416**  | -0.652*** | -0.127 | 1.000 |

Note: \*\*\* indicates statistical significance at 1% level, \*\* indicates statistical significance at 5% level and \* indicates statistical significance at 10% level

**Table 4 – The Harvey and Leybourne (2007) test**

| Variable                   | RSS <sub>0</sub> | RSS <sub>1</sub> | W <sub>T</sub> | W <sub>T</sub> * (1%) | W <sub>T</sub> * (5%) | W <sub>T</sub> * (10%) |
|----------------------------|------------------|------------------|----------------|-----------------------|-----------------------|------------------------|
| Households' Indebtedness   | 0.005            | 0.007            | 11.600         | 10.527                | 10.585                | 10.687                 |
| House Prices               | 0.019            | 0.032            | 19.842         | 17.282                | 17.416                | 17.655                 |
| Financial Asset Prices     | 0.719            | 0.957            | 9.599          | 8.034                 | 8.114                 | 8.258                  |
| Personal Income Inequality | 0.0003           | 0.0004           | 9.667          | 3.107                 | 3.310                 | 3.703                  |
| Households' Labour Income  | 0.002            | 0.003            | 14.500         | 0.002                 | 0.003                 | 0.008                  |
| Welfare State Expenditures | 0.001            | 0.002            | 29.000         | 25.177                | 25.376                | 25.733                 |
| Working-Age Population     | 0.001            | 0.003            | 58.000         | 44.841                | 45.488                | 46.661                 |
| Interest Rates             | 0.005            | 0.006            | 5.800          | 4.938                 | 4.982                 | 5.062                  |

Note: Critical values for the Harvey and Leybourne (2007) test are 13.3, 9.49, and 7.78 at the level of 1%, 5%, and 10%, respectively

Source: Authors' calculations based on Harvey and Leybourne (2007)

**Table 5 – The Ng and Perron (2001) unit root test**

| Variable                   | Level (Intercept)           |                 |       |                 | First Difference (Intercept)           |                 |          |                 |
|----------------------------|-----------------------------|-----------------|-------|-----------------|----------------------------------------|-----------------|----------|-----------------|
|                            | MZ <sub>α</sub>             | MZ <sub>t</sub> | MSB   | MP <sub>T</sub> | MZ <sub>α</sub>                        | MZ <sub>t</sub> | MSB      | MP <sub>T</sub> |
| Personal Income Inequality | -0.973                      | -0.517          | 0.531 | 16.870          | -12.246**                              | -2.472**        | 0.202**  | 2.008**         |
| Households' Labour Income  | -0.447                      | -0.224          | 0.502 | 17.570          | -11.679**                              | -2.399**        | 0.205*** | 2.164**         |
| Interest Rates             | -4.240                      | -1.383          | 0.326 | 5.875           | -1.503                                 | -0.846          | 0.562    | 16.832          |
| Variable                   | Level (Trend and Intercept) |                 |       |                 | First Difference (Trend and Intercept) |                 |          |                 |
|                            | MZ <sub>α</sub>             | MZ <sub>t</sub> | MSB   | MP <sub>T</sub> | MZ <sub>α</sub>                        | MZ <sub>t</sub> | MSB      | MP <sub>T</sub> |
| Personal Income Inequality | -2.933                      | -1.162          | 0.396 | 29.725          | -10.320                                | -2.257          | 0.219    | 8.896           |
| Households' Labour Income  | -1.640                      | -0.676          | 0.412 | 37.160          | -35.196***                             | -4.184***       | 0.119*** | 2.648***        |
| Interest Rates             | -6.954                      | -1.853          | 0.266 | 13.115          | -12.818                                | -2.519          | 0.197    | 7.175           |

Note: \*\*\* indicates statistical significance at 1% level, \*\* indicates statistical significance at 5% level and \* indicates statistical significance at 10% level

**Table 6 – P-values of the the Kapetanios *et al.* (2003) unit root test**

| Variable                   | Level | First Difference |
|----------------------------|-------|------------------|
| Households' Indebtedness   | 0.171 | 0.094            |
| House Prices               | 0.422 | 0.028            |
| Financial Asset Prices     | 0.358 | 0.057            |
| Welfare State Expenditures | 0.792 | 0.003            |
| Working-Age Population     | 0.053 | 0.781            |

Note: The number of lags was defined according to the AIC criteria

**Table 7** – The Clemente *et al.* (1998) unit root test with two structural breaks

| Variable                   | Level                    |                          | First Difference      |                          |
|----------------------------|--------------------------|--------------------------|-----------------------|--------------------------|
|                            | Additive outliers        | Innovative outliers      | Additive outliers     | Innovative outliers      |
|                            | Breaks, t-statistic      | Breaks, t-statistic      | Breaks, t-statistic   | Breaks, t-statistic      |
| Households' Indebtedness   | 1996***, 2002***, -2.884 | 1996***, 2011***, -3.884 | 1997, 2010***, -4.537 | 2008**, 2011, -3.620     |
| House Prices               | 2007***, 2013, -4.756    | 2007, 2009***, -5.151    | 1997, 2003, -3.073    | 1990, 2009, -2.787       |
| Financial Asset Prices     | 1994***, 2004***, -4.645 | 1994***, 2001*, -5.473   | 1997, 2003, -4.219    | 1994**, 1999***, -5.131  |
| Personal Income Inequality | 2003*, 2009**, -0.206    | 2000**, 2007***, -4.285  | 1993, 1997, -9.828    | 1994*, 1998, -9.580      |
| Households' Labour Income  | 2005***, 2011***, -3.182 | 2004**, 2010**, -3.436   | 1998**, 2011, -4.694  | 1993***, 2002***, -7.129 |
| Welfare State Expenditures | 1994***, 2001***, -3.723 | 1991***, 2000***, -3.901 | 1994, 2013, -7.687    | 2006, 2014, -6.017       |
| Working-Age Population     | 1989*, 1997*, -2.111     | 1990, 1996, -3.230       | 1995, 2002, -1.812    | 1991, 1997*, -3.845      |
| Interest Rates             | 1996***, 2014*, -3.971   | 1995, 2011***, -4.595    | 1991**, 2007, -7.396  | 1992***, 1998**, -6.907  |

Note: Critical values for the Clemente *et al.* (1998) unit root test with two structural breaks are -5.96, -5.49, and -5.24 at the level of 1%, 5%, and 10%, respectively, \*\*\* indicates statistical significance at 1% level, \*\* indicates statistical significance at 5% level and \* indicates statistical significance at 10% level

**Table 8** – Bounds test

| F-Statistic | Critical Value | Lower Bound Value | Upper Bound Value |
|-------------|----------------|-------------------|-------------------|
| 41.277      | 1%             | 2.79              | 4.10              |
|             | 5%             | 2.22              | 3.39              |
|             | 10%            | 1.95              | 3.06              |

**Table 9** – Diagnostic tests

| Diagnostic Test       | F-Statistic | P-value |
|-----------------------|-------------|---------|
| Breusch-Godfrey       | 0.548       | 0.472   |
| Jarque-Bera           | 2.284       | 0.319   |
| Breusch-Pagan-Godfrey | 0.634       | 0.791   |
| Ramsey's RESET        | 0.174       | 0.684   |

Note: Breusch-Godfrey test was conducted with 1 lag and Ramsey's RESET test was performed with 1 fitted term, albeit results do not change if we had used more lags and more fitted terms, respectively

**Table 10** – The long-term estimates

| Variable                                | Coefficient | Standard Error | T-Statistic |
|-----------------------------------------|-------------|----------------|-------------|
| House Prices <sub>t</sub>               | -0.537      | 0.483          | -1.111      |
| House Prices <sub>t</sub>               | -1.860**    | 0.646          | -2.881      |
| Financial Asset Prices <sub>t</sub>     | 0.368***    | 0.118          | 3.121       |
| Personal Income Inequality <sub>t</sub> | 33.443**    | 13.963         | 2.395       |
| Households' Labour Income <sub>t</sub>  | 4.453*      | 2.115          | 2.105       |
| Welfare State Expenditures <sub>t</sub> | -0.859      | 3.046          | -0.282      |
| Working-Age Population <sub>t</sub>     | 9.219***    | 1.828          | 5.042       |
| Interest Rates <sub>t</sub>             | 0.917       | 0.939          | 0.977       |

Note: \*\*\* indicates statistical significance at 1% level, \*\* indicates statistical significance at 5% level and \* indicates statistical significance at 10% level

**Table 11** – The short-term estimates

| Variable                                         | Coefficient | Standard Error | T-Statistic |
|--------------------------------------------------|-------------|----------------|-------------|
| $\beta_0$                                        | -1.729***   | 0.073          | -23.850     |
| $\Delta$ Personal Income Inequality <sub>t</sub> | 2.663***    | 0.343          | 7.768       |
| $\Delta$ Households' Labour Income <sub>t</sub>  | -0.070      | 0.135          | -0.523      |
| $\Delta$ Working-Age Population <sub>t</sub>     | 0.379***    | 0.124          | 3.060       |
| Dummy <sub>2009</sub>                            | 0.023***    | 0.007          | 3.024       |
| $\Delta$ ECT <sub>t</sub>                        | -0.143***   | 0.006          | -24.161     |

*R-squared* = 0.967

*Adjusted R-squared* = 0.960

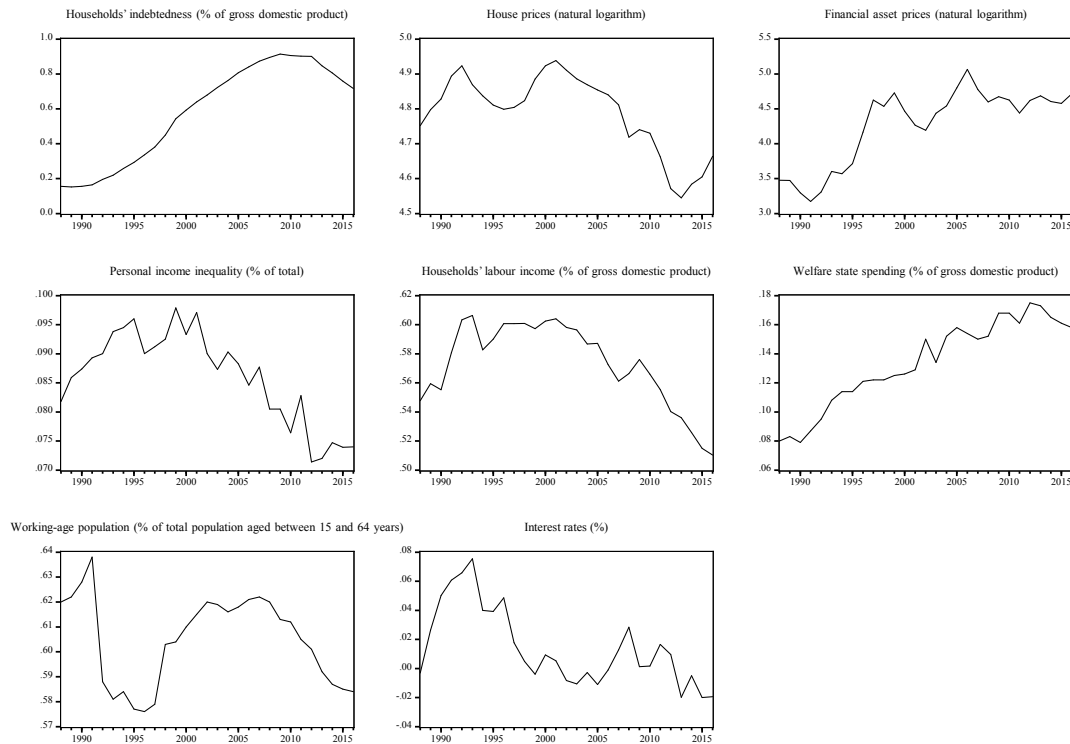
Note:  $\Delta$  is the operator of the first differences, \*\*\* indicates statistical significance at 1% level, \*\* indicates statistical significance at 5% level and \* indicates statistical significance at 10% level

**Table 12** – The economic effects of long-term estimates

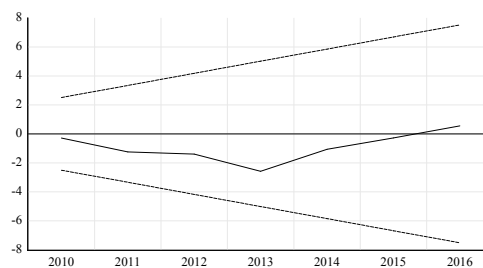
| Period                                                  | Variable                                | Long-term Coefficient | Actual Cumulative Change | Economic Effect |
|---------------------------------------------------------|-----------------------------------------|-----------------------|--------------------------|-----------------|
| <b>Increase of Households' Indebtedness (1988-2009)</b> | House Prices <sub>t</sub>               | -1.860                | -0.011                   | 0.020           |
|                                                         | Financial Asset Prices <sub>t</sub>     | 0.368                 | 1.195                    | 0.440           |
|                                                         | Personal Income Inequality <sub>t</sub> | 33.443                | -0.031                   | -1.037          |
|                                                         | Households' Labour Income <sub>t</sub>  | 4.453                 | -0.051                   | -0.227          |
|                                                         | Working-Age Population <sub>t</sub>     | 9.219                 | -0.011                   | -0.101          |
| <b>Decrease of Households' Indebtedness (2010-2016)</b> | House Prices <sub>t</sub>               | -1.860                | -0.066                   | 0.123           |
|                                                         | Financial Asset Prices <sub>t</sub>     | 0.368                 | 0.090                    | 0.033           |
|                                                         | Personal Income Inequality <sub>t</sub> | 33.443                | -0.002                   | -0.067          |
|                                                         | Households' Labour Income <sub>t</sub>  | 4.453                 | -0.098                   | -0.436          |
|                                                         | Working-Age Population <sub>t</sub>     | 9.219                 | -0.046                   | -0.424          |
| <b>Full Period (1988-2016)</b>                          | House Prices <sub>t</sub>               | -1.860                | -0.088                   | 0.164           |
|                                                         | Financial Asset Prices <sub>t</sub>     | 0.368                 | 1.129                    | 0.415           |
|                                                         | Personal Income Inequality <sub>t</sub> | 33.443                | -0.095                   | -3.177          |
|                                                         | Households' Labour Income <sub>t</sub>  | 4.453                 | -0.068                   | -0.302          |
|                                                         | Working-Age Population <sub>t</sub>     | 9.219                 | -0.058                   | -0.534          |

Note: The actual cumulative change corresponds to the growth rate of the correspondent variable during the respective period. The economic effect is the multiplication of the long-term coefficient by the actual cumulative change

**Figure A1** – Plots of the variables



**Figure A2** – The CUSUM test



**Figure A3 – The CUSUMSQ test**

