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Interactive influence of house prices and the repo rate on household debt in South Africa

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ABSTRACT

The recent interest rate policy decisions of the South African Reserve Bank have been criticized significantly by left-leaning political parties and civic society organisations for being anti-poor, anti-labour, and pro-capital because of their implications for household debt. Existing literature has established that interest rates and house prices are insignificant determinants of household debt dynamics in South Africa. Taking advantage of additional data for the period 2013-2022, and contrary to the previous studies, the paper maintains that house prices and the central bank policy rate play a crucial role in household debt dynamics. Applying a Markov Switching regression to quarterly data for the period 1981Q1 to 2022Q1, the paper finds that house prices and the policy rate have a significant influence on household debt dynamics. It establishes the existence of a 'house price boom, low policy rate burden' regime and a 'high policy rate burden, low house price' regime. The coexistence of the 'house price boom' and the 'low policy rate' explains the debt euphoria characterised by significant household leveraging.

KEYWORDS

House prices; repo rate; household debt; Markov Switching; interactive effect

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1. Introduction

Although in the recent past, South African literature has found the central bank policy rate and the house price index (hereafter house prices) to have no effect on household indebtedness, the paper argues that the two variables, probably, are the strongest drivers of household debt dynamics. To uncover the operative mechanism, the paper considers the role of the interaction of the policy rate and house prices on the evolution of household debt. To date, the role of the interactive effect of the policy rate and house prices has not received any attention in the South African discourse and even globally. To fill the gap, a modelling approach that explicitly accounts for non-linearities and interaction effect in the relationship is employed. Thus, this section demonstrates the strong correlation between the repo rate and house prices and justifies why these variables require a special modelling technique to uncover the underlying regularities.

The general reaction one ordinarily comes across in media and pressers of trade unions and many other leftist-leaning organizations every time the South Africa Reserve Bank (SARB) raises the policy (repo) rate to deal with inflation is that the rate decision is pro-capital, anti-poor, and anti-working class. In its May 2023 decision, the SARB increased the repo rate to a 14-year high of 8.5%, but this came after a prolonged period of repo rate cuts between 2009 and 2020, reaching a low of 3.5%. As Hickel (2021, 57) argued, to leftist movements, the “central bank policy ... ultimately benefits the rich at the expense of the poor”. Boyce, Delaney, Ferguson, and Wood (2018) have shown that central bank policy rate hikes have wide-reaching psychiatric morbidity effects on many individuals through the debt repayment channel, explaining why there is always an outcry after a policy rate hike. The outcry in South Africa gained momentum between 2014 and 2016 to the extent that the Public Protector of South Africa issued a remedial action to expand the mandate of the central bank to include ‘inclusive growth’ because she perceived the bank to follow a pro-capital and anti-poor interest rate policy. The High Court of South Africa commented, in an obiter dictum, that the remedial action of the Public Protector

“to amend the constitutionally mandated primary object of the Reserve Bank was received with dismay and consternation, and as might reasonably have been predicted, had immediate negative consequences for the economy and investor confidence...” (South African Reserve Bank v Public Protector & Others, Case No. 43769/17, 2017: 3).

The constitutional mandate of the SARB is to protect the value of the currency, maintain price stability, and financial stability (Hickel, 2021). For this reason, the SARB adopted an inflation-targeting framework in February 2000, managing inflation within the 3-6% target band. The interest rate policy plays a crucial role in this quest. The SARB monthly reviews the repo rate. Upward repo rate reviews have been in the spotlight in most recent years because of the indebtedness of households. Using microdata, Merrino (2022) has shown that as policy rates rise, they alter the wage distribution unfavourably and induce higher household indebtedness in South Africa.

Figure 1 shows that while the household debt to disposable income ratio (hereafter debt ratio) and the repo rate rose and fell together until the 1990s, the relationship switched between the 1990s and the 2000s, with the debt ratio growing by nearly 20% and the repo rate falling by nearly 37%. The repo rate continued to decrease by between 36% and 37% since the global financial crisis, while the debt ratio continued to grow at a slower rate of just over 10% than in the past decade. Household savings fell significantly from the 2000s to the 2020s (Marire, 2023). The trend in Figure 1 seems to fit the ‘low-interest rate hypothesis’ (Stockhammer & Wildauer, 2018), which postulates that a falling policy rate tends to cause households to accumulate more debt.

Figure 2 shows that between the mid-1980s and the late-1990s, the real residential property price index fell by 30%, while the debt ratio grew by 16%. From the late-1990s to the close of the 2000s, house prices experienced unprecedented growth of 91%, while the debt ratio grew further by nearly 20%. This period coincides with the Dotcom bubble of the mid-1990s and the commodity super-cycle of the 2000s (Marire, 2023). Household incomes were rising, and financial liberalisation made access to credit easy, while borrowing played an essential role in

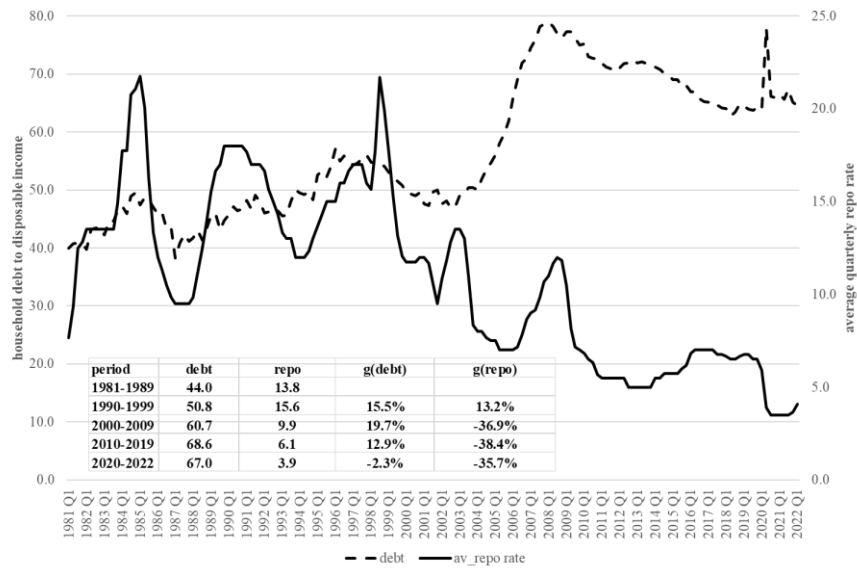


Figure 1. Household debt ratio and the South African Reserve Bank policy rate.

Source: South African Reserve Bank (debt) and Bank of International Settlements (repo rate). Note: $g(\text{debt})$ and $g(\text{repo})$ are growth rates of debt and the policy rate; av_repo rate is the quarterly average repo rate.

smoothing household consumption (Aron & Muellbauer, 2000; Marire, 2023; Prinsloo, 2002). The trends in Figure 2 seem to fit the ‘housing boom hypothesis’ (Stockhammer & Wildauer, 2018), which postulates that a housing price boom, through wealth effects and anticipated capital gains, causes households to accumulate debt further. The strong association between the debt ratio and house prices in the 2002-2008 period suggests that house prices might be a major contributor to the debt dynamics, as Stockhammer and Wildauer (2018) found for the Organisation for Economic Cooperation and Development (OECD) economies. The sharp increase in the debt ratio fits into what Keen (1995, 607) describes as ‘debt-financed euphoria’. However, the household debt ratio has not breached the threshold band of between 50% and 85%, according to some estimates for the South Korean economy made by Kwon and Park (2023). Nonetheless, the structures of the South African and the South Korean economies are different such that the threshold band might be different for South Africa.

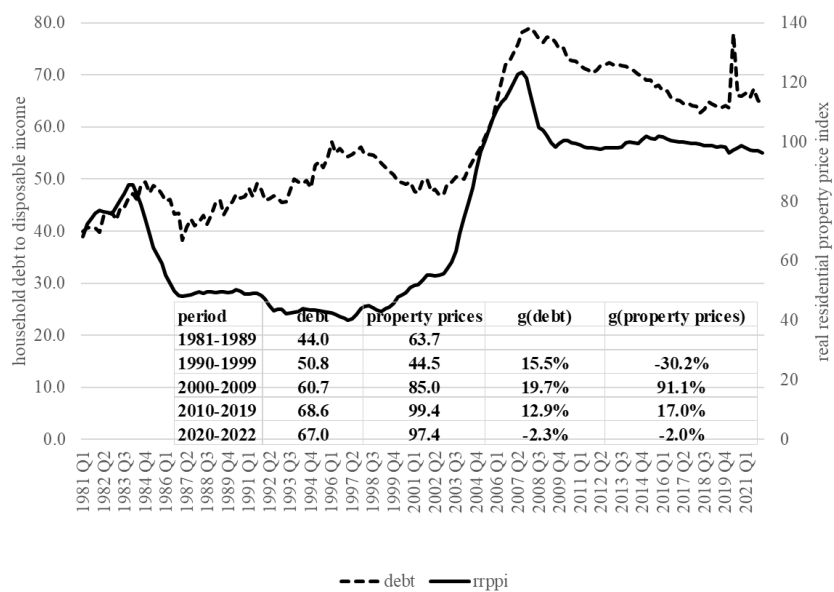


Figure 2. Household debt ratio and the real residential property price index.

Source: South African Reserve Bank (household debt) and Federal Reserve Bank of St. Louis (real residential property prices index, *rrppi*). Note: *g(property prices)* is the growth rate of the real residential property price index.

Taken together, Figures 1 and 2 lead the paper to pose three key questions and an incidental one worth exploring in the context of South Africa. First, has the repo rate been influencing household indebtedness? Second, have house prices been influencing household indebtedness? Thirdly, is there an interaction effect of the repo rate and the real residential property price index on household indebtedness? Fourth, the relationship between the repo rate and the debt ratio on the one hand and the house prices and the debt ratio on the other seems to have undergone a regime switch. To what extent does the regime switching model help explain the change in the relationships observed in Figures 1 and 2.

Existing work on household debt in South Africa has focused on the determinants of household debt (Meniago, Mukuddem-Petersen, Petersen, & Mongale, 2013) and the effects of household debt on growth and/or consumption (Mutezo, 2014). Both studies controlled for the prime lending rate, but in the present paper, we focus on the policy rate since it underpins all types of interest rates in the market, and policy rate decisions have been a contested policy issue in South Africa recently. Further, the policy rate captures the SARB's inflation expectations and policy attitude towards inflation.

Despite trend regularities suggesting regime-switching behaviour for debt, house prices and the repo rate post-2001/2002, Mutezo (2014) and Meniago et al. (2013) used methods that assume away the possibility of non-linearity. Mutezo (2014) employed an autoregressive distributed lag model and Meniago et al. (2013) used a Vector Autoregressive Error Correction modelling framework. The studies found both the prime lending rate and house prices to be insignificant causes of household debt. The studies were done a decade ago, and additional data (2013-2022) might bring further insights into the relationships. Although the studies found house prices and interest rates to have no effect on household debt, the paper, alongside Prinsloo (2002), Moore and Stockhammer (2018) and Stockhammer and Wildauer (2018), strongly maintain that house prices and the policy rate, probably, play a much stronger role in household debt dynamics than Mutezo (2014) and Meniago et al. (2013) found. A change in the modelling framework might uncover the basic pattern.

The paper is organised as follows. Section 2 surveys the empirical literature, Section 3 presents the methods and data, while section 4 presents analysis of results, and section 5 provides discussion and conclusions.

2. Literature

The section explores the literature on the three hunches proposed based on trends in Figures 1 and 2. The first hunch is that low policy rates promote household indebtedness. The second hunch is that a housing price boom induces household indebtedness. The third hunch is that the interaction of house prices and policy rates produces a powerful logic that explains sharp changes in household indebtedness.

Household debt has received considerable attention since the global financial crisis because of its ability to breed systemic financial instability and trigger economic recessions (Scatigna, Szemere, & Tsatsaronis, 2014; Valderrama, Gorse, Marinkov, & Topalova, 2023). Literature has focused on determinants of household debt (Hays, 2018; Stefani, 2020; Stockhammer & Wildauer, 2018), the effect of household debt on growth (Abd Samad, Mohd Daud, & Mohd Dali, Nuradli Ridzwan Shah, 2020; Lombardi, Mohanty, & Shim, 2017), the effect of household debt on consumption (Dyanan, Mian, & Pence, 2012; Mutezo, 2014), the effect of household debt on monetary policy pass through (Alpanda & Zubairy, 2019), and the link between household debt and business cycles (Mian & Sufi, 2016; Mian, Sufi, & Verner, 2017). The lines of inquiry are numerous, but the study focuses on the two crucial variables that seem to have gained attention in policy and legal debates in South Africa. The focus of the review is on the drivers of household debt with a specific attention to the central bank policy rate and residential property price

index since Figures 1 and 2 suggest strong relationships.

2.1. Central bank policy rate and household debt

Falling central bank policy rates tend to reduce various market interest rates and thus, reduce the cost of borrowing. Consequently, literature establishes an inverse link between policy rates and household debt (Debelle, 2004). In the early 2000s, scholars, such as Jacobsen and Naug (2004), had identified falling policy rates as major causes of household indebtedness. The European Central Bank's negative interest rate policy after the global economic recession, as Hamdar, Skheita, and Hamdar (2022) argue, triggered house price inflation and, consequently household debt. Meng, Hoang, and Siriwardana (2013), likewise empirically established that interest rates had a negative effect on household debt in Australia.

Although the bulk of the empirical literature suggests that interest rates negatively influence household debt, some studies establish a positive influence. In the period leading up to the sub-prime mortgage crisis, Montgomerie (2006) found that interest rates positively influenced household indebtedness in the United States, the United Kingdom and Canada. Similarly, using a century long historical data for the United States and vector autoregressive analysis, Berisha, Meszaros, and Olson (2018) found interest rates to have a positive effect on household debt. Recently, Flodén, Kilström, Sigurdsson, and Vestman (2021) have shown that for every 1%-point increase in the central bank policy rate, indebted households, whose debt contracts are linked to short-term interest rates, reduce their consumption spending, on average, by between 0.2 and 0.6%-points more than debt-free households. The need to create budgetary space to service the debt, reduces household spending. This can easily lead to a recession if indebtedness is a widespread phenomenon. Much earlier, Debelle (2004) had also established this point showing that mortgages with variable rates as opposed to fixed rates heightened the effect of central bank policy rate increases on household debt and consumption. Therefore, the first hypothesis (H1) is that the policy rate negatively influences household indebtedness.

2.2. House prices and household debt

Housing is an essential asset in the wealth portfolio of households. Rising house prices have a positive wealth effect that tends to cause households to consume more today in anticipation of capital gains. The consumption often is immediately met by further borrowing against anticipated capital gains and increased rental income. Jacobsen and Naug (2004) established that the major driver of household debt in the late 1990s and early 2000s was the housing market, especially the pricing aspect. Jacobsen and Naug (2004), Meng et al. (2013) and Mian et al. (2017) produced evidence that rising house prices influenced households to borrow for consumption, resulting in debt build-up and ultimately worsening business cycles. Meng et al. (2013) also showed that a sharp increase in domestic demand through population growth and overseas demand for Australian houses pushed house prices up and, consequently household indebtedness. Focusing on the OECD, Stockhammer and Wildauer (2018) and Moore and Stockhammer (2018) confirmed that house prices were the single most important driver of household debt because of speculative dynamics of the housing market.

Cloyne, Huber, Ilzetzki, and Kleven (2019) and Coletta, De Bonis, and Piermattei (2019) adduced empirical evidence showing that as house prices increase, the collateral value of the houses increases, and this makes loans cheaper. The collateral effect is a crucial mechanism linking house prices and household debt. Further, the collateral effect might be misleading because of the possibility of what Coskun, Seven, Ertugrul, and Alp (2020) and Valderrama et al. (2023) found to be an overvaluation of properties in emerging market economies such as Turkey and other parts of Europe. In such cases, the household debt bubble driven by a house price bubble leads to

unsustainable household debt dynamics. Therefore, the second hypothesis (H2) is that house prices positively influence household indebtedness.

2.3. Interactive effect of house prices and policy rates on household debt

Literature does not provide evidence of the interaction of house prices and policy rates on household debt, but there is very little on the interaction effect on consumption. The work of Cumming and Hubert (2022) provides some insight because they show that central bank policy rates have no effect on household consumption during a period of house price booms. Essentially, they are looking at the interaction effect of central bank policy rate and house prices on household consumption. Put differently, their argument is that for as long as the added interest cost on debt is less than the additional wealth and income effect of rising house prices, households do not feel disincentivised from borrowing. This interaction effect can be extended to household debt dynamics.

Therefore, the third hypothesis (H3) is that the effect of the policy rate on household debt conditional upon house prices is negative. Alternatively, the effect of the house prices on household debt conditional upon the policy rate is negative.

Figure 3 shows that the interaction variable is correlated with the debt ratio. The height of the interaction plot is governed by four possibilities namely, [1] high house prices and a high policy rate, [2] high house prices and a low policy rate, [3] low house prices and a high policy rate, and [4] low house prices and a low policy rate. Figure 3 shows that only in the 1980s did the first possibility hold. In the 1990s, the third possibility held. In the 2000s, 2010s and 2020s, the second scenario obtained. The three decades should dominate the relationship such that a relatively small to moderate negative relationship exist.

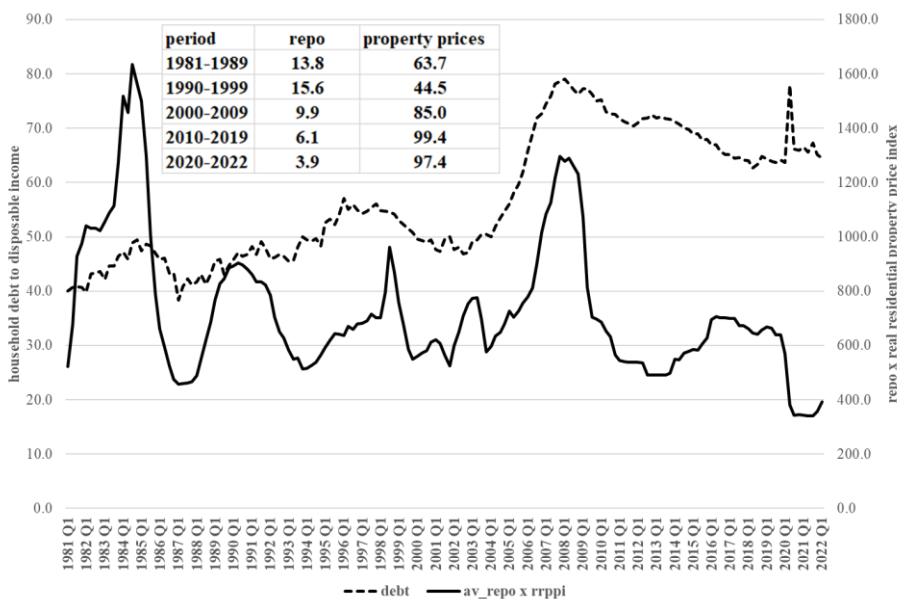


Figure 3. Real residential property price index and the repo rate.

Source: Federal Reserve Bank of St. Louis (property price index) and Bank of International Settlements (repo rate). Note: *av_repo x rrpqi* is the interaction variable.

2.4. Household debt and other economic factors

A growing economy increases the capacity of households to borrow against higher current and future incomes (Alter, Feng, & Valckx, 2018; Mian et al., 2017). Younger people borrow more today, while the elderly are most likely

to finance consumption through dissaving and capital gains (Daud, Podivinsky, & Abd Samad, 2021). However, Chantararat, Lamsam, Samphantharak, and Tangsawasdirat (2020) established that indebtedness had increased across all age groups so that even in the post-retirement phase of life the elderly still struggled with debt. Yet, using microdata, Goldstein (2013) showed that indebtedness increased significantly among the degreed and upper class, suggesting that psychological factors such as an increased appetite for financial risk and structural factors such as financialisation provide better explanations. Costantini and Seccareccia (2020) provide evidence through an institutional evolutionary analysis to the effect that a combination of financialisation of the economy and the increased role of household consumption despite weakening wages coexist with rising household debt. Thus, a debt-driven growth strategy explains rising household indebtedness.

Worsening income and wealth inequality tend to increase household indebtedness. The Veblenian emulative consumption effect tends to be prevalent in the lower end of the income and wealth distributions as the lower classes seek to emulate consumption patterns of the upper class (Stockhammer & Wildauer, 2018). Piao, Li, Sun, and Yang (2023) and De Stefani (2020), for the United States, found that rising income inequality positively influenced household indebtedness. Further, De Stefani (2020) showed that homeowners tended to accumulate more mortgage debt as wealth and income inequality increased, perhaps to increase the future stream of rental income and capital gains. Chatterjee, Czajka, and Gethin (2022) found wealth inequality to be worsening in South Africa with the top 10% controlling 86% of the wealth, the top 0.1% controlled 67% of the wealth, and the top 0.01% controlling over 15% of the wealth, which is higher than what the bottom 90% control. Merrino (2022) also showed that monetary policy shocks tended to adversely worsen income inequality resulting in increased dependence on debt to finance consumption by South African households.

Examining the drivers of household debt in South Africa, Meniago et al. (2013) and Mutezo (2014) found that several factors positively affect household debt, not least inflation, national income, and household consumption, but they found house prices, the prime lending rate and household savings to have no statistically significant effect on household debt. However, Nomatye and Phiri (2017) found, using quantile regression techniques, that inflation and consumption had no effect on household debt, while GDP growth and house prices had a moderately significant effect, and interest rates and investment very strong effects for South Africa. Meng et al. (2013) concurred using Australian evidence that showed that GDP and population size positively influence household debt. In the Australian context, Lowe (2017) concluded that the sharp increase in household indebtedness was driven by population growth, and sluggish growth in household incomes. Montgomerie (2006) found that as wages declined in the United States, the United Kingdom and Canada, households resorted to credit to finance consumption, thus leading to a debt build-up. The paper now turns to the methods and data. The three hypotheses stated above are tested.

3. Methods and data

3.1. Data, variable measurement, and sample

Table 1 provides information on the sources of the variables and the way they are measured. The data is quarterly for the period 1981Q1 to 2022Q1.

3.2. Empirical model

The data plotted in Figures 1 and 2 suggest that the time series might have experienced a regime switch at the beginning of the 2000s. According to Hamilton (1994) and Hamilton and Raj (2002), such sharp changes can only be adequately modelled as regime switching processes. Although deterministic modelling using dummy variables could be used, Hamilton (1994) argued that the regime is a stochastic process, making deterministic approaches

Table 1. Variable description and sources.

Variable label	Variable description	Data Source
debt (d_t)	Household debt to disposable income, measured in percentage units	South African Reserve Bank
av_repo	Average repo rate calculated as a quarterly average, measured in percentage units	Bank of International Settlements
lngdp	Natural log of real gross domestic product	South African Reserve Bank
lnrrppi	Natural log of the real residential property price index	Federal reserve of St. Louis
lnrrppi x av_repo	Interaction term	Own computation
sav	Household savings to disposable income, measured in percentage units	South African Reserve Bank
wir	Wealth to disposable income ratio, measured in percentage units	Reserve Bank of South Africa

Source: Author's compilation.

inappropriate. The Markov Switching process assumes that the variable being analysed depends on a discrete unobservable state (regime) variable. This means that there is a linear regression for each regime. Stated simply, a two-state Markov process for the household debt ratio, d_t , can be thought of as a set of two regime-specific regressions. The change in the regime could be due to a change in the intercept or the error variance, or both, being induced by factors such as the global economic recession, commodity super-cycles, wars, and speculative bubbles in the real estate, among others. The basic set up is:

$$d_t = \begin{cases} \mu_1 + \phi(d_{t-1} - \mu_1) + \varepsilon_t \\ \mu_2 + \phi(d_{t-1} - \mu_2) + \varepsilon_t \end{cases} \quad (1)$$

Equation (1) states that the level of household debt ratio depends on its mean and the deviation from its mean in the previous period for each regime. μ_1 is the mean of the debt ratio in regime 1 and μ_2 is its mean in regime 2. Equation (1) can be generalised to

$$d_t = \mu_{s_t} + \phi(d_{t-1} - \mu_{s_t}) + \varepsilon_t \quad (2a)$$

$$d_t = \mu_{s_t} + \phi d_{t-1} - \phi \mu_{s_t} + \varepsilon_t \quad (2b)$$

s_t is the regime or state. When $s_t = 1$ regime 1 is realised and when $s_t = 2$ regime 2 is realised. Rewriting the composite intercept, $\mu_{s_t} - \phi \mu_{s_t}$, as ψ_{0,s_t} , and for consistency the slope parameters are renamed with the same symbolism. Model (2b) can now be restated as (2c).

$$d_t = \psi_{0,s_t} + \psi_{1,t-1} d_{t-1} + \varepsilon_t \quad (2c)$$

Model (2c) can be extended to include exogenous variables that are also regime dependent ($x_{k,t-i}$) and other non-regime specific variables ($z_{h,t-j}$) to yield equation (3).

The Markov Switching regression is stated as:

$$d_t = \psi_{0,s_t} + \psi_{1,t-1} d_{t-1} + \psi_{k,s-i} x_{k,t-i} + \omega_{h,t-j} z_{h,t-j} + \varepsilon_t \quad (3)$$

Defining: d_t as the household debt ratio, while $x_{k,t-i}$ is a vector of regime dependent explanatory variables k at lag $t - i$. $z_{h,t-j}$ is the non-switching explanatory variable(s) h at lag $t - j$. The presence of two regimes is captured by the term $s_t = 1, 2$. ψ_{0,s_t} is the regime-dependent intercept. $\psi_{1,t-1}$ is the linear coefficient of the AR(1) term. Further, $\psi_{k,s-i}$ are regime-specific coefficients of switching explanatory variables. $\omega_{h,t-j}$ are linear coefficients of non-switching regressors. The error term ε_t is assumed to be normally distributed with a constant variance, that may/may not be regime dependent. According to Hamilton and Raj (2002), in a Markov Switching

process, the current state s_t is dependent on the previous state s_{t-1} , thus implying the transition probabilities of the following structure:

$$p(s_t = 1 | s_{t-1} = 1) = p_{11} \tag{4a}$$

$$p(s_t = 2 | s_{t-1} = 1) = p_{12} \tag{4b}$$

$$p(s_t = 1 | s_{t-1} = 2) = p_{21} \tag{4c}$$

$$p(s_t = 2 | s_{t-1} = 2) = p_{22} \tag{4d}$$

The conditional probabilities $p_{11}, p_{12}, p_{21}, p_{22}$ must be positive and the sum of probabilities of realising and not realising a specific state must sum to unity. Thus, $p_{11} + p_{12} = 1$ and $p_{21} + p_{22} = 1$. The evolution of state (regime) probabilities can be set to depend on the intercept term, lagged dependent variable, or even lagged explanatory variable. When the evolution of state probabilities depends on the lagged dependent variable the errors become serially correlated.

The coefficients in model (3) have to be divided by $1 - \psi_{1,t-1}$ before interpretation such that (3) can be rewritten as

$$d_t = \frac{\psi_{0,s_t}}{1 - \psi_{1,t-1}} + \frac{\psi_{k,s-i}}{1 - \psi_{1,t-1}} x_{k,t-i} + \frac{\omega_{h,t-j}}{1 - \psi_{1,t-1}} z_{h,t-j} + \frac{1}{1 - \psi_{1,t-1}} \mu_t \tag{5}$$

4. Results

4.1. Summary statistics

Table 2 shows that household debt in South Africa has been high, averaging 57% of disposable income, with a maximum of 79% of disposable income. The maximum levels were reached just before the global financial crisis. The high levels of household debt starkly contrast with low levels of household savings largely below 3% of GDP, becoming negative after democratic transition (Marire, 2023). The wealth to income ratio has been consistently high in the sample period, which in a country with over 90% of the population not holding any wealth implies that both wealth and income inequality have been worsening (Merrino, 2022).

Table 2. Summary statistics.

Variable	Mean	Median	Maximum	Minimum	Std. Dev	Obs
Debt	56.9	54.0	79.0	38.3	11.6	165
Repo	10.9	11.0	21.8	3.5	4.6	165
Log(GDP)	27.4	27.3	27.8	26.9	0.3	165
Log(RRPPI)	4.2	4.3	4.8	3.7	0.4	165
Saving	1.0	0.6	8.2	-3.2	2.5	165
WIR	327.5	330.5	438.1	253.7	42.9	165

Source: Author's calculations.

4.2. Correlation analysis

Table 3 reports zero-order correlations. For the entire sample period, the repo rate was negatively correlated to the debt ratio. However, in the 1981Q1-2001Q4 sub-sample, the correlation was significantly positive, but statistically zero in the 2002Q1-2008Q4 and the 2009Q1-2022Q1 sub-samples. The real residential property price index in the 1981-2001 period was inversely correlated to household debt, suggesting that as house prices fell, people contracted mortgage debt to buy homes. However, in the period 2002-2008, when the debt ratio and house

Table 3. Correlation analysis.

Sample	debt	av_repo	lngdp	lnrrppi	Lnrrppi x repo	sav	wir
1981Q1-2022Q1							
debt	1.000						
av_repo	-0.637***	1.000					
lngdp	0.878***	-0.796***	1.000				
lnrrppi	0.760***	-0.713***	0.769***	1.000			
lnrrppi x repo	-0.577***	0.983***	-0.756***	-0.582***	1.000		
sav	-0.746***	0.597***	-0.717***	-0.688***	0.532***	1.000	
wir	0.384***	-0.527***	0.372***	0.748***	-0.415***	-0.409***	1.000
1981Q1-2001Q4							
debt	1.000						
av_repo	0.456***	1.000					
lngdp	0.670***	0.048	1.000				
lnrrppi	-0.526***	0.013	-0.576***	1.000			
lnrrppi x repo	0.306***	0.967***	-0.103	0.263**	1.000		
sav	-0.277**	0.112	-0.286***	-0.094	0.097	1.000	
wir	-0.553***	-0.264**	-0.663***	0.854***	-0.043	-0.174	1.000
2002Q1-2008Q4							
debt	1.000						
av_repo	-0.099	1.000					
lngdp	0.969***	-0.143	1.000				
lnrrppi	0.889***	-0.517***	0.896***	1.000			
lnrrppi x repo	0.215	0.949***	0.171	-0.224	1.000		
sav	-0.892***	0.151	-0.813***	-0.818***	-0.117	1.000	
wir	0.905***	-0.342*	0.834***	0.911***	-0.063	-0.901***	1.000
2009Q1-2022Q1							
debt	1.000						
av_repo	0.107	1.000					
lngdp	-0.903***	-0.220	1.000				
lnrrppi	0.134	0.623***	-0.115	1.000			
lnrrppi x repo	0.113	1.000***	-0.226	0.630***	1.000		
sav	-0.501***	-0.284**	0.321**	-0.223	-0.285**	1.000	
wir	-0.341**	-0.404***	0.420***	-0.011	-0.404***	0.555***	1.000

Source: Author's analysis.

prices rose very sharply, the correlation was positive and strong (0.89), suggesting that households further contracted debt on the back of rising prices to increase consumption. This picture remains true in the full sample with a high and significant positive correlation of 0.76. The interaction variable (repo x house prices) was only significant in the 1981-2001 sub-sample (0.31) and the entire sample (-0.58). In the 1980s, it was a period of high repo rates and high house prices.

In conformance to economic theory, savings were negatively correlated to household debt in all sub-samples and the full sample (Table 3). As households accumulate savings, they tend to smooth consumption by the savings rather than by contracting debt. However, as capital dynamics outweighed labour incomes – the wealth to income ratio – before 2001 and after 2008, the wealth to income ratio was inversely related to the debt ratio. One last observation is that for all the sub-samples before 2009, economic growth was positively correlated to the debt ratio, but after the global financial crisis, the relationship became negative. Perhaps, households were using the growth dividend to deleverage.

4.3. Unit root test

The variables in Table 4 are cointegrated of order one. Thus, it is statistically safe to proceed to estimate the

regime switching model.

Table 4. Unit root tests.

Variable	Levels		First difference		Order of integration	
	Drift	Drift & Trend	Drift	Drift & Trend	Drift	Drift & trend
Debt to disposable income	-1.323	-1.258	-16.177***	-16.173***	One	One
Average repo rate	-2.339	-4.438***	-6.956***	-6.903***	One	Zero
Log(GDP)	-0.775	-1.439	-3.600***	-3.586**	One	One
Log(real residential property price index)	-1.284	-2.623	-4.460***	-4.550***	One	One
Wealth to disposable income	-2.036	-2.533	-16.904***	-17.017***	One	One
Household savings	-2.413	-3.748**	-12.318***	-12.279***	One	Zero

Note: *** means $p < 0.01$; ** means $p < 0.05$ and * means $p < 0.10$.

4.4. Regression results and analysis

Three time-varying Markov Switching regressions were estimated as reported in Table 5. In Model 1, the evolution of the probabilities is tied to the lagged central bank policy rate. Model 2 ties the evolution of the probabilities to the lagged natural log of real residential property price index and Model 3 ties them to lagged debt level. The interpretation of the estimated coefficients begins with the linear component estimates.

4.4.1. Regimes, classification, and probabilities

The regressions in Table 5 are reaction functions of the debt ratio to house prices and the policy rate. It can be seen that the debt ratio reacts positively more to house prices in Regime 1 than in Regime 2. It reacts positively more to the repo rate in Regime 2 than Regime 1. The classification suggests two regimes namely, a 'house price boom, low policy rate burden' regime (Regime 1) and 'high policy rate burden, low house price' regime (Regime 2). Regime 1 characterises a rising debt ratio, a debt euphoria type of scenario. The AR(1) coefficient suggests a strong hysteresis effect of household debt.

The regime classifications predicted by the three models are close despite differences in the evolutionary mechanisms for the state probabilities (see Appendices A1 – A3). Models 2 and 3 show periods of sharply rising household debt coinciding with periods of economic recessions or significant currency crisis, for example the rand crisis of the 1996-1998 and 2001/2 periods, the global financial crisis and the COVID-19 pandemic.

4.4.2. Linear component

Table 5 shows that a 1%-point increases in the household savings to disposable income ratio (savings), holding other things constant, reduces debt, on average, by between 2.6%-points and 5.6% points. Models 1's estimate is nearly double the estimates of Models 2 and 3. Economic theory shows that households that accumulate savings tend to borrow less because they can consume out of their savings. The converse also holds because households that dissave, rely on debt to finance consumption, a point Marire (2023) established for South Africa. The finding differs from the results of Meniago et al. (2013) and Mutezo (2014) who established that savings had an insignificant positive effect on household indebtedness in South Africa.

Except in Model 3, the wealth to income ratio has no effect the debt ratio. In Model 3, a 1%-point increase in the wealth to income ratio, on average, reduces household debt by 0.1%-points, other things equal. Although the effect seems quite small, it suggests that as households accumulate more wealth relative to income, they might

Table 5. Markov Switching regression results.

Variables	Model 1		Model 2		Model 3	
Switching:	<i>Regime 1</i>	<i>Regime 2</i>	<i>Regime 1</i>	<i>Regime 2</i>	<i>Regime 1</i>	<i>Regime 2</i>
	Debt _t	Debt _t	Debt _t	Debt _t	Debt _t	Debt _t
av_repo _t	2.559** (1.094)	3.150*** (1.175)	6.471*** (1.985)	7.436*** (2.113)	3.595*** (0.805)	4.382*** (0.827)
log(rrppi) _t	13.503*** (3.804)	10.642*** (3.614)	25.078*** (7.656)	21.853*** (7.404)	17.092*** (2.952)	14.215*** (2.874)
Non-switching:						
Debt _{t-1}	0.914*** (0.021)		0.784*** (0.027)		0.775*** (0.025)	
lngdp _t	-7.611*** (0.662)		-1.077 (1.325)		-1.432 (1.041)	
Saving _t	-0.480*** (0.079)		-0.617*** (0.091)		-0.594*** (0.079)	
Wealth-income _t	0.005 (0.007)		-0.014 (0.009)		-0.014** (0.006)	
(lnrrppi x av_repo) _t	-0.676** (0.282)		-1.682*** (0.502)		-0.992*** (0.198)	
Inflation targeting	6.552*** (2.005)		2.226 (3.490)		3.651* (1.895)	
Inflation targeting x repo	-0.227 (0.149)		-0.220 (0.222)		-0.345** (0.146)	
Constant	159.599*** (19.562)		-51.071 (48.268)		-6.699 (28.701)	
Log[sigma]	0.311*** (0.059)		0.282*** (0.061)		0.293*** (0.061)	
SE of regression	2.239		2.370		2.296	
<i>Transition probability:</i>	Repo _{t-1}		Ln(rrppi) _{t-1}		Debt _{t-1}	
	Regime 1, t	Regime 2, t	Regime 1, t	Regime 2, t	Regime 1, t	Regime 2, t
Regime 1, t+1	0.914 (0.076)	0.086 (0.076)	0.910 (0.016)	0.090 (0.016)	0.805 (0.044)	0.195 (0.044)
Regime 2, t+1	0.017 (0.028)	0.983 (0.028)	0.042 (0.011)	0.958 (0.011)	0.051 (0.026)	0.949 (0.026)
<i>Regime classification</i>	Quarters	Mean prob.	Quarters	Mean prob.	Quarters	Mean prob.
<i>Regime 1</i>						
1986Q4-1992Q4			25	0.948		
1987Q2					1	0.901
1989Q1-1993Q2					18	0.867
1987Q2-1999Q4	51	0.997				
1998Q2-1999Q2					5	0.853
1996Q2-1999Q3			14	0.973		
2007Q3-2009Q1			7	0.997	7	0.998
2020Q2	1	1.000	1	1.000	1	1.000
<i>Regime 2</i>						
1981Q2-1986Q3			22	0.971		
1981Q2-1987Q1	24	0.999			24	0.983
1987Q3-1988Q4					6	0.796
1993Q1-1996Q1			13	0.722		
1993Q3-1998Q1					19	0.830
1999Q4-2007Q2			31	0.947	32 [†]	0.975
2000Q1-2020Q1	81	1.000				
2009Q2-2020Q1			44	1.000	44	0.999
2020Q3-2022Q1	7	1.000	7	1.000	7	1.000

Note: * means $p < 0.10$; ** means $p < 0.05$; *** means $p < 0.01$; (...) means standard errors. † from 1999Q3.

reduce debt dependence for some of their expenditures, especially durable ones.

Economic growth does not have any significant effect on the debt ratio except in Model 1 in which a 1% increase in real GDP, on average, results in 0.09% points decrease in the debt ratio, other things equal. This suggests that households use the growth dividend to deleverage rather than to accumulate more debt. Models 1 and 3 indicate that household debt has been between 16.2%-points and 76.2%-points higher under the inflation targeting regime than in periods without inflation targeting. However, in Model 3, the differential slope effect of inflation targeting is negative suggesting that household debt rose by 1.5%-points slower than in periods without inflation targeting following a repo rate increase.

4.4.3. Hypotheses (dis)confirmed

It is observed that the policy rate positively affects the household debt ratio, and the effect is statistically significant (Table 5), which results in the rejection of first hypothesis (H1). Thus, the finding agrees with studies, such as Berisha et al. (2018) and Montgomerie (2006), that find that interest rates have a positive effect on household debt. The paper's findings contradict Mutezo (2014) and Meniago et al. (2013) who found that the interest rate was a statistically insignificant determinant of household debt in South Africa. Further, the hypothesis that house prices positively influence the household debt ratio (H2) is statistically confirmed (Table 5), which finds support in the work of Stockhammer and Wildauer (2018).

The paper also hypothesised (H3) that the interaction of the policy rate and house prices had a negative effect on household debt. Table 5 shows a consistent negative sign on the coefficient of the interaction term regardless of model specification. In section 1, the argument was advanced that the size and direction of the interaction effect depended on the realisation of one of the four scenarios namely, [1] high house prices and a high policy rate, [2] high house prices and a low policy rate, [3] low house prices and a high policy rate, and [4] low house prices and a low policy rate. Scenario [2] has been a prevalent scenario since the 2000s implying that the 'house price boom' and the 'low interest rate' hypotheses combined to produce pro-debt dynamics that escalated housed debt levels reaching a maximum of 79% of disposable income by 2007/8.

To make the interpretation of the interaction model intuitive, the first derivative of debt with respect to (a) the repo rate and (b) the log of the real residential property price index is evaluated using sample data values. This allows us to observe the changes in the rate of change of the debt ratio in response to a change in the repo rate given the level of house prices over time. Alternatively, it allows us to observe the changes in the rate of change of the debt ratio in response to changes in house prices given the level of the repo rate over time. Further, the paper plots the in-sample evaluations of the various partial derivatives of regime specific regressions. Figures 4 and 5 depict the evaluated partial derivatives. Figure 4 depicts the change in the debt ratio with respect to the repo rate, while Figure 5 depicts the change in the debt ratio with respect to house prices. The third hypothesis of the study is now examined in detail.

4.4.4. Marginal effect of the repo rate

Figure 4 presents the marginal effect of the repo rate on the debt ratio, given the level of house prices. Looking at Regime 1 estimates evaluated at different levels of the log of real house price index, show that $\frac{\partial debt_t}{\partial repo_t} | \ln rrrppi_t < 0$ for the entire period for all three models. Models 1 and 2 show a small positive rate of change for some years. The four plots of marginal effects are below the zero-line suggesting a negative rate of change in the debt ratio. In general, therefore, Regime 1 suggest that the debt ratio decreased by between 1%-point and 6%-points. Figure 4 shows that between 1987 and 1999, the debt ratio decreased at a fairly stable rate, ranging between 0 and 4%-points depending on model. This period coincides with high repo rates and low house prices. The combination of low

house prices (negative wealth effect) and high policy rates (high cost of borrowing) meant that households were deleveraging.

Figure 4 also provides a significant insight into the post-2000 period, which coincides with the adoption of the inflation targeting framework. The rate of decrease of the household indebtedness ratio is much larger ranging between 4%-points and 6%-points, depending on model. Notably, model three shows that the rate of decrease was high (6%-point) after the adoption of inflation targeting compared to the pre-inflation targeting period (4%). However, Model 1 shows that household debt increased marginally in the post 2008 period at a stable rate of 0.6% points. This means that the post-2000 period, especially since the global economic recession, the accommodationist interest rate policy stance in the midst of a house price boom encouraged household debt build-up but only marginally so. However, it is important to note that these effects are for the full sample that include periods in which Regime 1 did not hold. Thus, in the post-2000 period, instead of the 'debt euphoria' because of the low policy rates and the house price boom, frugal households would have used the capital gains, positive wealth effects of rising house prices, and the low interest rate environment to deleverage and pay off their debt.

The marginal effect of the repo rate on the debt ratio, given the level of house prices is entirely different for Regime 2, which is a 'high policy rate burden, low house price' regime. In the 1981-2004 period, the rate of change of the debt ratio, given the level of house prices, was positive ranging between 1% point and 8% points, depending on model. Even though the repo rate was high and house prices low, household debt continued, in this period, to increase at a stable rate. The evidence seems to indicate that the 'own a house' psychology might have caused people to contract mortgage debt to take advantage of the low house prices. Over the entire sample the mortgage debt to disposable income ratio has been stable at about half the size of the overall household debt to disposable income ratio. This seems to be a reasonable explanation of why the overall household debt ratio grew by as much as 8% points in a period of high repo rates. Post-global economic recession, with the exception of the marginal effects for Model 1, the rate of change of the household debt ratio became negative and declined at a stable rate of between -1% point and -2% points. The negative changes in the debt ratio following a change in the repo rate after 2009 suggests that households were deleveraging, taking advantage of the accommodative interest rate policy stance. Also, debt servicing costs stabilised because of falling policy rates since 2009. Speculatively, the paper argues that household debt in South Africa seems to be sustainable because in the post-2000 period, both the house price boom and high policy rate burden regimes converge to a deleveraging scenario. Kwon and Park (2023), for the South Korean economy, suggested that a household debt ratio in the range of 50% to 85% is sustainable. As a speculative guideline, the paper cannot agree more.

4.4.5. Marginal effect of the house prices

The general pattern from Figure 5, is that regardless of regime, the marginal effects of house prices on the debt ratio tend to increase over time, given the level of the central bank policy rate: $\frac{\partial (debt)}{\partial house_price} | repo_t$. The increase in the ratio of household debt ratio becomes more pronounced when the repo rate is falling or very low. Regime 2 (high policy rate burden, low house price) in-sample marginal effects are smaller than Regime 1 (house price boom, low policy rate burden), but they are much closer for models 2 and 3. It is evident that since the 2000/2001 in an environment of a largely accommodative interest rate policy, rising house price had the effect of increasing the rate of change of the household debt ratio ($g_{debt} > g_{income}$) by between 0.1% points to 1.3% points. This implies that the wealth and income effects of rising house prices and the falling interest burden on debt had a positive interactive effect on household debt growth.

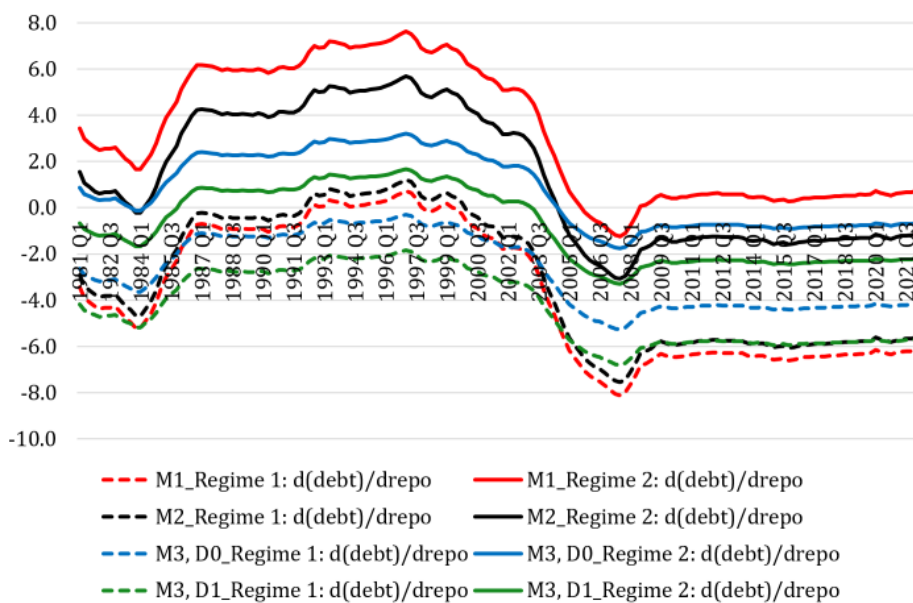


Figure 4. Effect of repo rate on household debt at different levels of the log of real residential property price index over the sample period.

Note: Note: M1, M2 and M3 are models 1, 2, and 3. D0 means inflation targeting dummy is zero and D1 means inflation targeting dummy is 1.

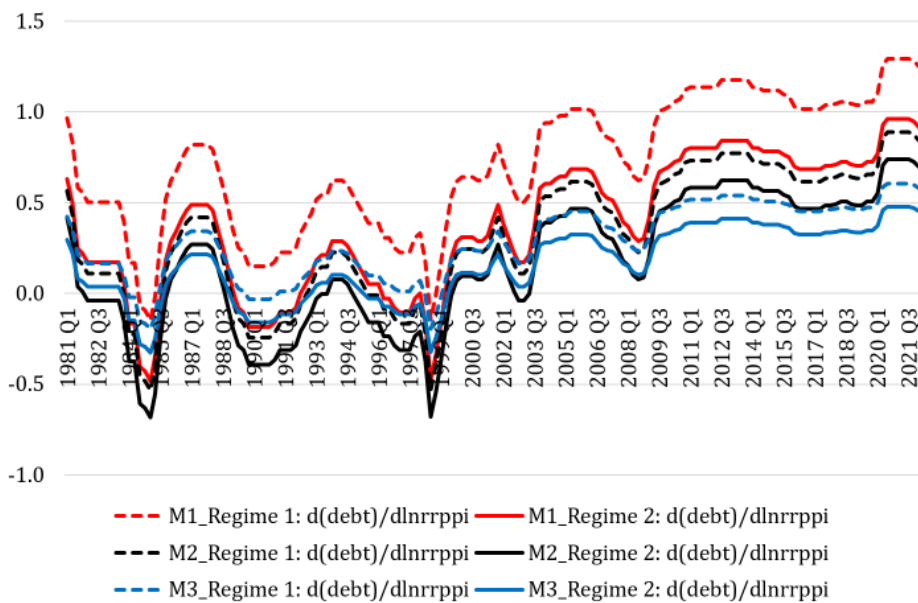


Figure 5. Effect of the log of real residential property price index on household debt at different levels of the repo rate in the sample period.

Note: M1, M2 and M3 are models 1, 2, and 3.

5. Discussion and conclusion

Financial regulators and policymakers are concerned with the rising household debt which, for some countries, has reached unsustainable levels. Understanding the major drivers of household debt is crucial for designing effective interventions. The paper sought to examine three important questions and a fourth incidental one. First, does the central bank policy rate influence household debt dynamics? Second, do house prices influence household

debt dynamics? Third, does the interaction of the policy rate and house prices influence household debt dynamics? Incidentally, does the Markov Switching regression help uncover the household debt dynamics. The motivation for raising these questions was that South African scholarship, for example Meniago et al. (2013) and Mutezo (2014), has found that both the interest rate (the prime rate which mimics the policy rate) and house prices have insignificant effects on household debt. As the contextual review in section 1 showed, it can hardly go unchallenged to claim that these two variables have no effect on household debt dynamics. It all depends on the modelling strategy used. The models employed so far assumed linearity despite the data revealing significant regime switches. Even though the studies were done a decade ago, the sample period they covered included the period of a significant shift in the household debt regime. Associated with three main questions were three hypotheses namely, the policy rate negatively influences household debt, house prices positively influence household debt, and the interaction effect of the policy rate and house prices negatively influences household debt.

After modelling household dynamics using a Markov Switching regression, the paper discovered two regimes – house price boom and high policy rate burden – and arrived at two broad conclusions. First, the marginal effect of the policy rate on household debt is positive and is moderated by the level of real house prices. On the one hand, the income and wealth effects of rising house prices strengthen the debt appetite when policy rates are low, producing a powerful dynamic of debt euphoria. On the other hand, the income and wealth effects of rising house prices strengthen the debt appetite when policy rates are high for as long as they outweigh the increase in debt servicing costs triggered by an increasing policy rate. Further, low policy rates coexisting with low house prices stimulate debt appetite for households because of two mechanisms, namely the psychology of owning a house and speculative property buying. This latter part leads to the financialisation of housing, a problem that will tend to cause household debt to increase by pushing the cost of housing up.

Second, the marginal effect of real house prices on household debt is positive and is moderated by the policy rate. In general, a low policy rate environment compounds the effect of house prices on household debt leading to debt euphoria. Rising real house prices signal current and future capital gains, increases in wealth and the capacity to consume. The tendency is for households to become illusioned by these effects, realised or not, such that a high policy rate environment is not explicitly factored into financial decision making. Reality only dawns that interest rates are high when the economy enters a recessionary period, at which point the debt euphoria ends.

Taken together, the implications of our findings are twofold. First, from a modelling point of view, it is important to follow a data driven model choice rather than theoretical intuition only. This is particularly clear in the present case because previous studies failed to uncover the influence of house prices and interest rates on household debt. Yet, the effects were hidden in non-linearities. Second, the financial regulators and policymakers in South Africa have an explicit framework for controlling inflation impulses from wages and materials but have not directly factored asset price inflation in their inflation targeting framework. In particular, the role of the policy rate in asset price inflation and ultimately household debt has not been carefully considered. This can be a potential source financial instability, especially in an environment of falling wage shares and rising capital incomes. Falling wage shares push households into debt to finance consumption and other necessities of life. Forslund (2013) and Merrino (2022) have argued that the South African labour market is segmented and characterised by skill and capital intensification, profit-led growth, and repressed wages for the larger portion of the labour market. At the same time, financial liberalisation since the 1990s has made access to credit easy (Marire, 2023). In the midst of repressed wages, the economy has followed finance-led growth characterised by household demand that is debt-financed. This broad observation has been established by other scholars such as Costantini and Seccareccia (2020), Lowe (2017), and Montgomerie (2006). An accommodative interest rate policy stimulates debt appetite, while high interest rates also push households further into debt through high debt servicing costs. The interest rate policy is a double-edged sword. The interaction of policy rates and house prices have the potential to breed an unsustainable

debt euphoria.

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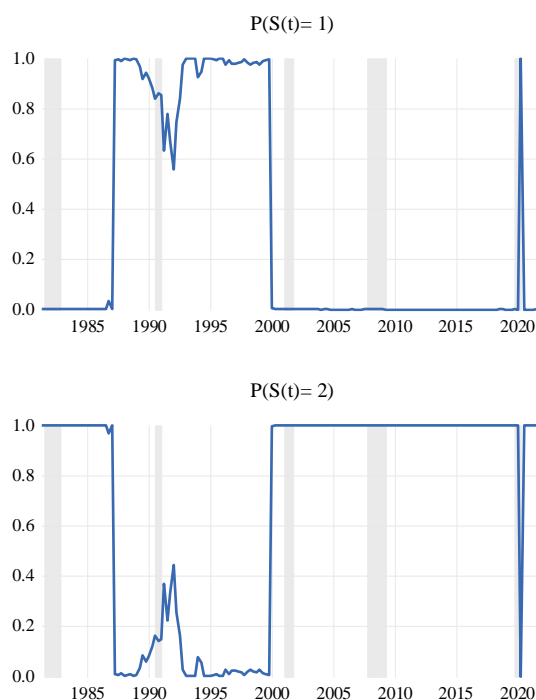
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Declaration of Competing Interest

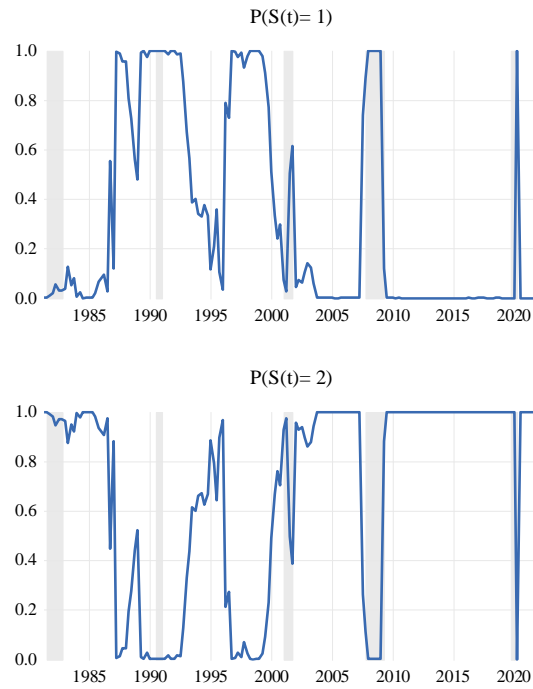
The author claims that the manuscript is completely original. The author also declares no conflict of interest.

Appendix



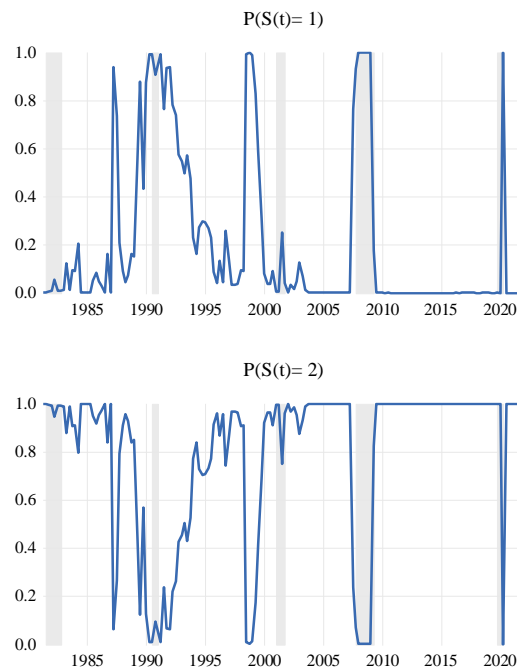
Appendix 1. Filtered probabilities for Model 1.

Source: Author's analysis. Note: $p(s(t) = 1)$ is the probability that regime1 ($s(t) = st = 1$, in the text of the manuscript) is realised. $P(s(t)=2)$ is the probability that regime 2 ($s(t) = st = 2$, in the text of the manuscript) is realised.



Appendix 2. Filtered probabilities for Model 2.

Source: Author's analysis. Note: $p(s(t) = 1)$ is the probability that regime1 ($s(t) = st = 1$, in the text of the manuscript) is realised. $P(s(t)=2)$ is the probability that regime 2 ($s(t) = st = 2$, in the text of the manuscript) is realised.



Appendix 3. Filtered probabilities for Model 3.

Source: Author's analysis. Note: $p(s(t) = 1)$ is the probability that regime1 ($s(t) = st = 1$, in the text of the manuscript) is realised. $P(s(t)=2)$ is the probability that regime 2 ($s(t) = st = 2$, in the text of the manuscript) is realised.

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