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**Rethinking inequality in the 21<sup>st</sup> century – inequality and household balance sheet composition in financialized economies**

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## **Rethinking inequality in the 21<sup>st</sup> century – inequality and household balance sheet composition in financialized economies**

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*Abstract:* This paper analyses the impact of household wealth heterogeneity on inequality and macroeconomic stability in financialized economies. Based on the case of the USA since the 1980s it argues that transformation of financial sector operations has generated inequality by influencing gains from wealth ownership and leverage levels across the income distribution. Securitization and the subprime lending expansion have led to the emergence of a new class of leveraged homeowners, experiencing large increases in wealth prior to the Great Recession, followed by substantial losses after the crisis. Simultaneously, capitalists have diversified their asset portfolios while earning the highest and fastest growing wages in the economy when employed as financial sector executives. In this light, the paper proposes a new conceptualization of households in macroeconomic models, defined by balance sheet composition rather than income sources alone. To inform this taxonomy, inequality and leverage indicators are simulated in a stock-flow consistent model calibrated to US data with three classes of households distinguished by their wealth composition, and a securitized financial sector. The proposed framework is found to produce more empirically accurate levels of income inequality and greater macroeconomic instability than the two-class division, and establishes an equalizing effect of housing for wealth distribution.

*Keywords:* Household wealth, Inequality, Macroeconomic modelling, Financial system, USA

*JEL Classifications:* C63, D31, E44

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### **1. Introduction**

The aim of this paper is to analyze the role of household wealth heterogeneity on inequality and macroeconomic stability in the USA since the 1980s. It is argued that financial sector transformation has contributed to inequality by making household balance sheets more complex in the process of financial deregulation, financial innovation, securitization, and broader liberalization and privatization policies in the US economy over the past five decades. The main contribution of this paper is to demonstrate that heterogeneity of household wealth structures across the distribution of income is an independent distributional channel in financialized economies. The findings of this paper show that consideration of the increasing complexity of household wealth contributes to our understanding how income and wealth distribution influence economic stability in times of financialization. The paper also contributes to the stock-flow consistent modelling literature by proposing a new conceptualization of the household sector in this framework.

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The interplay between the micro-level structures of household wealth and macroeconomic institutions related to financial sector transformation has been manifest in the subprime homeownership bubble in the USA in the 2000s. The process of securitization has contributed to rising capital income flows among low- and middle-income families, while the expansion of subprime lending raised household indebtedness. Simultaneously, high-income individuals, typically identified in the Post Keynesian literature as capitalists, have benefited from high and rapidly growing earnings when employed as top managers in the financial sector, contributing to greater wage inequality. These processes have increased the complexity of household balance sheet composition across the distribution of income, pulling top managers, financial executives, and owners of diversified wealth portfolios towards the top of the income distribution, while simultaneously pushing low- and middle-income households into unsustainable indebtedness.

Greater household balance sheet complexity poses a challenge for the Post Keynesian macroeconomic modelling literature because it puts into question the suitability of the conventional dichotomous division of households into workers and capitalists in understanding the determinants of inequality and macroeconomic stability. Recent developments in the inequality literature have accounted for aggregate wealth disparities to explain the causes of inequality and its consequences for macroeconomic dynamics (Piketty, 2014). This paper attempts to integrate these insights into the Post Keynesian framework, arguing that the role of balance sheet heterogeneity across the distribution of income has not been explicitly explored by the existing Post Keynesian literature on inequality and macroeconomic stability.

To fill this gap in the literature, a stock-flow consistent model is developed incorporating three classes of households distinguished by their balance sheet composition and a complex financial sector. The model is calibrated to the US data. The model contributes to the Post Keynesian financialization literature by simultaneously considering the complexity of household wealth structures and the diversity of income flows among low- and middle-income households, as well as indebtedness and rising wage inequality at the top of the distribution. The analysis reveals that the proposed taxonomy of households according to wealth composition rather than income sources alone produces empirically accurate patterns of inequality, leading to higher income inequality and macroeconomic fragility. The findings of this paper highlight the importance of explicitly considering the disparities in household balance sheet structures in macroeconomic processes. The proposed model also formally

shows within the SFCM that homeownership has an equalizing influence on the distribution of household wealth.

The paper is structured as follows. Section 2 identifies key institutional mechanisms of the transformation of the US financial sector since the 1980s and documents their influence on household balance sheet disparities. Section 3 reviews how these disparities have been incorporated in the existing macroeconomic theories of inequality. Section 4 outlines the proposed three-class conceptualization of households based on wealth structures, emphasizing its importance for explaining rising inequality and macroeconomic stability in times of financial sector transformation. Sections 5 and 6 examines the ability of this framework to reproduce the observed patterns of wealth and income inequality in the USA and compares it to the dichotomous division of households into workers and capitalists using simulation analysis based on a stock-flow consistent model. Section 7 concludes.

## **2. The transformation of household wealth and rising inequality, 1989-2013**

The explicit focus on the composition of household wealth in this study is motivated by the increased ownership of wealth towards the bottom of the income distribution in the course of subprime lending expansion and securitization. Although the distributions of income and wealth are related, as those with high income tend to hold high wealth, income reflects current living conditions, while wealth provides an additional insight into their past levels (if savings are seen as excess income over consumption) and future possibilities (by determining capacity for investment in education and the quality of life; Cowell *et al.*, 2012, p.1). Recent literature emphasizes that wealth distribution is more important for the overall structure of inequality in the 21st century than it was in the post-war era, and that differences in saving and consumption propensities are not enough to predict inequality levels in advanced countries (Piketty and Zucman, 2014).

In the USA, wealth inequality has been persistently higher than income inequality, and these two measures followed divergent trends in the immediate aftermath of the Great Recession. Data from the U.S. Survey of Consumer Finances (U.S. SCF) indicates that the Gini index of pre-tax income<sup>1</sup> increased from 0.521 in the 1989 wave of the survey 0.598 in the 2016 wave,

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<sup>1</sup> The U.S. SCF measures household income before transfers and taxes for the calendar year prior to the survey wave, and accounts for wage income, business income, interest and dividend income, realized capital gains, social security and retirement income, and income from social transfers.

and that the Gini index for net wealth rose from 0.828 to 0.877 in this period (Wolff 2017)<sup>2,3</sup>. But while the Gini index for income fell from 0.574 to 0.549 between the 2007 and the 2010 waves of the survey, the Gini coefficient for net wealth continued to rise, increasing from 0.834 in 2007 to 0.866 in 2010.

Increasing wealth and income inequality in the USA since the 1980s have been underpinned by institutional changes in the US economy (Fitoussi and Stiglitz, 2009; Guttmann and Plihon, 2010; Karacimen, 2013). Since the 1980s, growth of real average earnings has been sluggish, which has been linked to the introduction of labor market liberalization policies, shareholder value maximization in corporations leading to greater preference for short term financial profits over long-term productive investment, as well as rising costs of healthcare, education, and housing following privatization of public services (see Dos Santos, 2009). Financial positions of low- and middle-income households have become increasingly unsustainable as debt has come to serve as a substitute for falling real incomes (Barba and Pivetti, 2009).

Moreover, rising inequality has been influenced by financial sector transformation. Specifically, securitization was a major part of this process, underpinned by gradual financial deregulation and motivation to identify alternative sources of revenue among financial intermediaries in a new “originate-to-distribute” banking model (Dymski, 2009; Dymski *et al.*, 2013). The 1999 Gramm- Leach-Bliley Act was instrumental in these developments: By allowing commercial banks’ involvement in investment banking activities, it facilitated the rise of unregulated shadow banks and led to the expansion of the mortgage-backed securities market, which was fueled in large part by subprime mortgages and payday loans (*ibid.*). By 2006, mortgage-backed securities accounted for nearly 60% of total mortgage debt outstanding (Rosen, 2007), while over 80% of subprime and Alt-A loans were securitized (Baily *et al.*, 2008). The rise of structured finance based on proliferation of subprime mortgages generated an unequal hierarchy of monetary claims, which boosted asset values and income flows for households at the top of the income distribution at the cost of increasing financial fragility for low- and middle-income families (Szymborska, 2019). According to

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<sup>2</sup> Note that estimates of income inequality using data from the U.S. SCF tend to be higher than other estimates as the dataset oversamples households at the top of the distribution. For instance, estimates based on data from Annual Social and Economic Supplement to the Current Population Survey yield the Gini index for pre-tax household at 0.431 in 1989, rising to 0.463 in 2007 and 0.476 in 2013 (U.S. Census Bureau 2019).

<sup>3</sup> Note that the estimates of the Gini index of net wealth in Wolff (2017) exclude the value of vehicles owned by a household on the grounds that the resale value of a vehicle does not accurately reflect its consumption value to the household (Wolff, 2017, p.6).

available evidence, the share of capital income going to the individuals in the top 10% and the top 1% of the income distribution began rising in the mid-1990s, reaching over 50% and 70% respectively in 2015 (Robbins, 2018).

The processes of financial sector transformation have influenced inequality by increasing the complexity of household balance sheets across the distribution of income and by generating stark disparities in the returns to assets and leverage across the households. Households at the top of the income distribution experienced systematically higher returns between 1983 and 2007 than low-income households, and they have also experienced smaller losses in their returns to wealth after the Great Recession (Wolff, 2014, p.34). Financial deregulation and innovation boosted capital incomes of the rich through access to profitable wealth management services, financial securities markets, purchases of corporate shares, and accumulation of secured debt, all of which require large initial downpayments (Foster and Holleman, 2010; Galbraith, 2012). Simultaneously, low-to-middle-income households became locked into leveraged homeownership or had insufficient income to accumulate assets at all, while their demand for credit to finance expenditure increased. Rising demand for securitized products among financial investors incentivized predatory lending practices to subprime borrowers, as financial innovation and deregulation measures eased credit constraints for lower income groups, women, and people of color (Goda and Lysandrou, 2013; Young, 2010).

Figure 1 compares the composition of asset and debt holdings<sup>4</sup> between households in the bottom quintile, the 20<sup>th</sup> to the 90<sup>th</sup> percentile, and the top decile of the income distribution between 1989 and 2013. Around 80% of the asset portfolio of households in the bottom income quintile was accounted for by low-yielding assets, including vehicles<sup>5</sup> and other non-financial assets, primary residence, and transaction accounts. Debt holdings of these

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<sup>4</sup> In the U.S. SCF assets are defined as follows: Primary residence is measured as the reported market value. Business equity is measured in net terms. Transaction accounts include call, checking, and saving accounts, money market deposit accounts, and money market mutual funds. Financial investment assets include certificates of deposits, savings bonds, bonds, stocks, other managed assets, pooled investment funds, i.e. non-money market mutual funds, and other financial assets. Retirement and insurance assets include the Individual Retirement Accounts, Keogh accounts, 401(k), and other retirement accounts, as well as the cash value of life insurance plans. Liabilities are measured as follows: Secured debt is measured as the amount outstanding on mortgages and home equity lines of credit secured by primary residence and other property. Unsecured debt is defined as credit card balances and instalment loans (which include vehicle, student, and consumer loans). Other debt is defined as other unsecured lines of credit and other miscellaneous forms of debt (e.g. debt to family members, borrowing against insurance policies or pension accounts, margin debt, etc.).

<sup>5</sup> As the objective of Figure 1 is to examine the breakdown of household asset and debt holdings at different points of the income distribution, vehicles are included in this figure as they constitute a substantial portion of the value of net wealth for households in the bottom income quintile.

households consisted primarily of unsecured instalment and credit card debt, although the contribution of mortgages secured by principal residence to total debt holdings of this group increased over time.

Moreover, asset portfolios of households in the 20<sup>th</sup> to the 90<sup>th</sup> percentile of the income distribution relied heavily on primary residence, which contributed over 40% to total assets of these households between 1989 and 2013, with the share peaking before the 2007 crisis. Retirement and insurance assets accounted for the largest part of financial asset holdings of this group, rising over time. Debt accumulated by households in the 20<sup>th</sup>-90<sup>th</sup> percentile comprised mainly debt secured by primary residence, and the contribution of this type of debt rose over time, even throughout the crisis (that is, between 2007 and 2010).

In contrast, asset holdings of households in the top income decile were more diversified, with financial assets, particularly retirement and insurance assets and high-yielding financial investment assets, contributing 44% to the overall asset holdings of the top income decile in 2013, up from 34% in 1989. The contribution of business equity and other residence to total assets was substantial compared to the other income groups, accounting for around a fifth of the total portfolio of households in the top income decile. In addition, debt holdings of these households were dominated by debt secured by primary residence and other real estate.

[Figure 1 here]

The uneven accumulation of household debt constitutes another channel through which financial sector transformation has contributed to increasing inequality. Household debt to GDP ratio nearly doubled from 49% in the first quarter of 1980 to 98% in the first quarter of 2008, stabilizing at 80% in the second quarter of 2016 (Federal Reserve Economic Data St. Louis Fed, 2017). Households in the bottom two income quintiles experienced the most rapid increases in indebtedness. Between 1989 and 2013, debt ownership rates increased from 47% to 52% for households in the bottom 20% of income distribution and from 60% to 67% for those in the 20<sup>th</sup> to 40<sup>th</sup> income percentile (U.S. SCF 2016). Simultaneously, the conditional median value of debt held by households in the bottom 20% of the income distribution nearly quadrupled in this period, rising in real terms from \$3,172 in 1989 to \$11,134 in 2013 (figures in 2016 prices; *ibid.*). The increase was also substantial for households in the second income quintile, for whom the conditional median value of debt rose from \$9,329 in 1989 to \$21,653 in 2013. Nevertheless, it was households in the top income decile who recorded the highest debt levels, with debt ownership rate at 85% in 2013 (falling from 88% in 1989) and

the conditional median value of \$278,398 in 2013 (rising in real terms from \$138,074 in 1989; *ibid.*).

The composition of debt holdings presented in Figure 1 above matters for the conditions of loan repayment and household relative indebtedness. Between 1998 and the second quarter of 2017, 30-year fixed mortgage rate averaged 5% compared to the average of 7% for the interest rate for a 48-month new car loan and 13% for the rate for credit card debt (Federal Reserve Data, G.19 release, 2017; Federal Reserve Economic Data St. Louis Fed, 2017). Relatively high contribution of unsecured debt to debt holdings of low- and middle-income households has contributed to these households' financial fragility before and in the aftermath of the 2007 crisis. According to Figure 2 below, households in the 20<sup>th</sup>-90<sup>th</sup> percentile had the highest debt-to-asset and debt-service-to-income ratios between 1989 and 2013. Households in the bottom 20% of the income distribution experienced rapid growth in their debt-to-income ratio and the debt-to-asset ratio, particularly in the run up to and immediately after the Great Recession (compared to a decline in the debt-to-asset ratio between 2010 and 2013 for the other income groups). By comparison, the increase in leverage was substantially lower for households in the top 10% of the income distribution, although these households experienced the highest levels of the debt-to-income ratio. This is expected given the higher value of assets held at the top of the distribution, which serve as collateral and allow for accumulation of greater debt levels relative to income.

[Figure 2 here]

In sum, the period of financial sector transformation since the 1980s has led to a greater balance sheet complexity and indebtedness of households across the income distribution. Divergent trends in capital income and earnings have contributed to unequal capacities to accumulate wealth for different households. Owing partly to the large share of primary residence, low-yielding assets, and unsecured debt, balance sheets of middle-income and low-income households have become increasingly leveraged and volatile to property price movements and financial shocks. Conversely, greater contribution of profitable business equity, financial assets, and secured debt to wealth holdings of the richest households has been associated with higher annual rates of return. These dynamics have been directly related to the political economy of securitization and household indebtedness outlined above. Consequently, a powerful case for the impact of financial sector transformation on inequality emerges from the disparities of wealth holdings and leverage across households.



### 3. Revisiting the economic theories of inequality

Despite its profound impact on the patterns of income and wealth inequality in the USA since the 1980s, heterogeneity of wealth structures across the income distribution has received insufficient attention in modern approaches explaining inequality<sup>6</sup>. Economic theory which puts the largest emphasis on the importance of wealth for inequality is found in Piketty (2014). In this view, inequality is driven by an interconnectedness between the aggregate levels of income and wealth. Accumulation of higher returns to wealth relative to the growth of income raises the capital share of income and increases inequality. However, while Piketty's insight regarding the distributional impact of the interplay between income and wealth is pertinent in times of financial sector transformation, the theory does not explicitly discuss the role of these institutional changes (Szyborska, 2017). Several institutional causes behind rising income concentration have been identified elsewhere in the literature, focusing on financial liberalization (Galbraith, 2012), globalization and decreasing unionization (Rodrick, 1997; Kristal, 2010; Bengtsson, 2014; Stockhammer, 2017), and rent seeking behavior (Stiglitz, 2012).

The link between household heterogeneity and financial sector transformation has been explicitly examined by the Post Keynesian functional income distribution literature. This theory distinguishes between profit-earning capitalists and wage-dependent workers<sup>7</sup>.

Financialization<sup>8</sup> is seen to increase the capitalist share of income through maximization of

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<sup>6</sup> Neoclassical theory states that income inequality is a natural outcome of market processes as it reflects the marginal contributions to production, rewarding those with high or scarce skills (Stiglitz, 2012, p.37). Skill-biased technological change, differences in human capital, and trade openness are seen as the key determinants of inequality (Galbraith, 2016, p.74). This approach has been criticized for ignoring structural and institutional factors generating inequality in modern advanced economies, which are outlined in the previous section.

<sup>7</sup> A distinction can be made between capitalists as entrepreneurs, who realize variable profit income dependent on the difference between expected and actual investment, and more passive rentiers, who receive fixed income in the form of unproductive rents based on their ownership of companies and financial institutions (Hayes, 2006; Toporowski, 2015). In the context of financial sector transformation and the existence of derivative trading, the capitalist class can be analyzed as including both entrepreneurs and rentiers, who pursue capital returns through investing in financial markets and ownership of financial assets (Toporowski, 2001).

<sup>8</sup> In this paper, we focus exclusively on changes in financial sector operations (primarily the development of structured finance and subprime lending) and their impact on the economy occurring since the 20th century, and avoid the term financialization to avoid its ambiguity (see definition by Epstein, 2005). This is because the processes of financialization related to the development of credit, money, financial instruments, and interest rates have been argued to take place for as many as 5,000 years (Graeber, 2011; Sawyer, 2013). Consequently, *financialization* is not limited to any particular time or place, can take a variety of forms, and at times may also go in reverse (Sawyer, 2017). For this reason, the preferred term used in this paper is *financial sector transformation*, which refers to the processes of financial liberalization and deepening in the USA since the second half of the 20th century. Financial deepening refers to increasing provision of financial services, diversity of financial instruments, and a greater number of financial institutions (Shaw, 1973).

shareholder value (see Hein, 2012; Palley, 2012, 2013). The distributive consequences of financialization have been analyzed in this literature using the stock-flow consistent modelling (SFCM) framework. Most SFCM studies are based on the dichotomous division of the household sector into workers and capitalists/rentiers, and focus on simulating the determinants of the functional distribution of income, particularly the wage share.

While the functional income distribution literature often assumes that workers don't accumulate wealth (Kalecki, 1954, 1971), several recent contributions in the SFCM literature include elements of household wealth in analyzing growth and macroeconomic stability (Zezza, 2008; Setterfield and Kim, 2013; Caverzasi and Godin, 2015; Nikolaidi, 2015; Dafermos and Papatheodorou, 2015; Sawyer and Passarella Veronese, 2017; Detzer 2018). Most commonly, aspects of wealth distribution are included by allowing for borrowing by workers. Based on the endogenous money theory (Palley, 2002; Michell, 2016; Fontana and Sawyer 2016, 2017), these loans and the corresponding debt repayments are transferred from "debtor" workers to "creditor" capitalists in the form of financial assets. Wealth of rentiers is usually divided into firm equities and bank deposits. In addition, in Zezza (2008) capitalists receive income from homeownership through renting houses to some of the workers. Furthermore, Nikolaidi (2015) and Sawyer and Passarella Veronese (2017) incorporate securitization into the SFCM framework, assuming that the shadow banking sector increases the capital income inflows of rentiers. Moreover, Caverzasi and Godin (2015), Setterfield and Kim (2013), Kapeller and Schuetz (2014, 2015) and Detzer (2018) account for emulation of rentier consumption by workers.

However, these SFCM analyses have not explicitly captured the role of differences in household balance sheet structures owing to financial sector transformation in explaining inequality. With the exception of Dafermos and Papatheodorou (2015), most of the studies reviewed above do not endogenously model the indices of personal income and wealth distribution. Moreover, few of these studies account for wage earnings among the top income group, or consider differences in household portfolio decisions in macroeconomic dynamics. This arises because of the dominance of the dichotomous division of households in these models, which does not sufficiently encompass the rising heterogeneity of wealth structures along the distribution. Furthermore, apart from Sawyer and Passarella Veronese (2017) borrowing is restricted to workers. However, as in the previous section, in the USA it is the rich who hold the largest amounts of debt, which calls for a distinction of various debt accumulation motives across the distribution.

In sum, greater complexity of household balance sheets resulting from financial sector transformation poses a series of challenges for the macroeconomic analyses of inequality. Existing theories tend to focus on aggregate categories and neglect the heterogeneity of income flows and wealth holdings among different households. Income heterogeneity is to a certain extent considered by the Post Keynesian functional distribution literature, but what this approach has not yet done is to examine how financial sector transformation has made the dichotomous division of households into workers and capitalists more complex. Given this gap in the literature, the paper proposes a framework complementing the functional distribution approach with Piketty's emphasis on the interplay between income and wealth. This framework analyses endogenous determination of personal income and wealth inequality, accounting for household wealth heterogeneity and financial sector complexity. This is achieved by introducing a three-class view of households, including the middle class defined by its balance sheet structure dependent on leveraged housing. The household sector is thus redefined according to the differences in asset ownership, debt accumulation motives, and leverage levels rather than the type of income received.

#### **4. New conceptualization of households**

To incorporate the increased wealth heterogeneity of workers and capitalists in the macro-modelling literature the household sector is defined based on differences in the balance sheet composition rather than their wage/profit shares. These differences are related to the securitization processes and various wealth accumulation motives. The paper models three classes of households, introducing a new group identified with the new class of leveraged homeowners formed in the subprime lending boom<sup>9</sup>. Based on the earlier analysis of household balance sheet structures, the three household groups are identified with the working class, the middle class, and the rentier class<sup>10</sup>. This approach links insights of Piketty (2014) and the functional distribution approach, highlighting the interplay between wealth ownership and income flows for overall inequality. The usefulness of the three-class distinction is the ability to identify different motives for asset and debt accumulation across households and to present a more intricate analysis of the points of financial fragility in the

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<sup>9</sup> At this stage it is not endogenously explained why households in each group chose to rent or own their house.

<sup>10</sup> As shown in Table A2, it is assumed that working class households account for 40% of all households in the model, while the middle class and rentier households account for 50% and 10% of the modelled population respectively. This assumption implies that the homeownership rate in the model is 60% (corresponding to the sum of the population size of the middle class and rentiers), which is consistent with the empirically estimated value of 63.7% in 2016 based on the U.S. Survey of Consumer Finances.

economy. It is assumed that the population in each household group expands at the same exogenously given population growth rate of 0.7% (see Table A1 in the Appendix).

#### **4.1. Working class: “the working poor”**

The working class is identified with households whose balance sheets are dominated by low-yielding assets and high leverage levels. It is assumed that these households do not carry enough wealth or income that would allow them to take out mortgages. Hence, all working class households rent houses from rentiers. Consequently, credit to the working class is assumed to consist of unsecured short-term consumer credit and payday loans. This is particularly relevant in the recent years as unsecured debt and payday borrowing have been on the rise after the 2007 crisis (The Pew Charitable Trust, 2012). This household group can thereby be classified as the “working poor”.

Real disposable income of the working class consists of wage income ( $\omega_w w_l DL_{wm}$ ) and interest earned on deposits ( $r_{cb} M_{w,-1}$ ), less interest paid on loans ( $r_{w,-1} L_{w,-1}$ ) and house rental payments ( $R$ ) to rentiers (equation 1). Gross income of the working class is defined as wages and interest on deposits without considering loan repayments and housing rent payments (equation 2). Wage income of this group depends on the demand for labor performed by the working poor and the middle class ( $DL_{wm}$  in equation 1) and the wage rate  $w_l$ . It is also determined by an exogenously determined parameter  $\omega_w$ , which corresponds to the share of the wage bill paid by firms to the working class and the middle class ( $w_l DL_{wm}$ ) going to either group. It is assumed that the working poor earn 40% of this wage bill, with the rest accruing to the middle class.

Rental payments on housing are defined in equation 4. They are determined by the value of houses owned by rentiers ( $H_r$ ), adjusted by parameter  $\gamma$  and the debt-service-to-income ratio of rentiers ( $DSY_r$ ). The rationale for including the latter variable stems from the assumption that rentiers would attempt to compensate for any increases in their debt repayments relative to income by raising the amount charged on rent to the working class. Parameter  $\gamma$  depends on how fast the rentiers’ demand for housing expands compared to the growth of the housing stock supplied by firms ( $H$ ), adjusted by an exogenously determined parameter  $h_0$  (equation 5). It implies that if rentiers’ demand for houses grows at a faster rate than the available

supply of houses, rent payments charged to the working class will increase to compensate for the upward pressures on the price of housing<sup>11</sup>.

Working class households consume an exogenously determined proportion  $c_1$  of their gross income less rent payments and an exogenously determined share  $c_2$  of their net wealth (equation 3)<sup>12</sup>. It is assumed that working class households honor rent payments before making other consumption decisions to ensure that they have sufficient means to afford rent and minimize the risk of eviction<sup>13</sup>. The propensity to consume out of wealth is assumed to be the highest for this group compared to other households. Income remaining after consumption, rent payments, and loan repayments is saved as bank deposits (equation 6)

We assume that the working class takes on debt to finance consumption (which is why the consumption function includes income before debt repayments). Assuming simple adaptive expectations<sup>14</sup>, borrowing by the working class is determined by their past consumption level, adjusted by parameter  $\beta_w$ , and depends on the repayment rate of loans in the previous period (equation 7).  $\beta_w$  captures household borrowing norms as well as lending norms in the financial sector (Setterfield and Kim, 2013, p.10). It is assumed that  $\beta_w$  for the working class is lower compared to the other households. In this way, we are able to indirectly account for the borrowing constraints of workers, reflecting commercial banks' attitude towards the creditworthiness of borrowers<sup>15</sup>. Net wealth of the working class is accumulated entirely in deposits less loans (equation 8).

Three measures of leverage are included to account for different aspects of households' financial fragility. Firstly, the debt-to-asset ratio is provided (equation 9), capturing the value of loans relative to the value of gross wealth. Secondly, the debt-to-income ratio (equation 10) constitutes a measure of the stock of loans to the flow of disposable income in each

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<sup>11</sup> Unlike in Zezza (2008), rent payments in this model are not directly dependent on the growth of income. This corresponds to the observation that income growth in the USA has lagged behind the growth of rent prices and total housing stock between 2005 and 2016 (Federal Reserve Economic Data St Louis Fed, 2017).

<sup>12</sup> This corresponds to the assumption of the "pecking order" in Setterfield and Kim (2013) stating that households treat savings as a "luxury that is foregone first" in the presence of debt repayments.

<sup>13</sup> Exclusion of rent payments from household consumption decisions is consistent with Zezza (2008). If rent payments are excluded from the consumption function (so that working class consumption depends on the entire value of gross income), consumption and loans of this group becomes so large that net wealth is persistently negative.

<sup>14</sup> While a weakness of this backward-looking approach to the formation of expectations is the possibility of systematically erroneous predictions if the economic variable is unstable, such adaptive expectations are preferred to the rational expectations hypothesis due to the presence of fundamental uncertainty in the economy.

<sup>15</sup>  $\beta_w$  is assumed to be high during a boom, as in the early 2000s when lending norms were lax due to the perceived minimization of credit risk through securitization. In times of recessions,  $\beta_w$  can be thought of as low as lenders are more concerned about creditworthiness, leading to stricter lending norms.

period. Finally, the debt-service-to-income ratio (equation 11) shows how much of gross income is directed towards debt repayments in each period.

*Worker households' income and consumption*

$$YD_w = \omega_w w_1 DL_{wm} + r_{cb} M_{w,-1} - r_{w,-1} L_{w,-1} - R \quad (1)$$

$$YG_w = YD_w + r_{w,-1} L_{w,-1} + R \quad (2)$$

$$C_w = c_1 (YG_{w,-1} - R) + c_2 V_{w,-1} \quad (3)$$

$$R = \gamma_{-1} H_{r,-1} DSY_{r,-1} \quad (4)$$

$$\gamma = \gamma_{-1} + \gamma_{-1} * h_0 * \left( \frac{\Delta H_r}{H_{r,-1}} - \frac{\Delta H}{H_{-1}} \right) \quad (5)$$

*Worker households' wealth*

$$M_w = V_w + L_w \quad (6)$$

$$\Delta L_w = \beta_w C_{w,-1} - DSY_w L_{w,-1}, \beta_w > 0 \quad (7)$$

$$\Delta V_w = YD_w - C_w + \Delta L_w \quad (8)$$

*Worker households' leverage indicators*

$$DA_w = \frac{L_w}{M_w} \quad (9)$$

$$levY_w = \frac{L_w}{YD_w} \quad (10)$$

$$DSY_w = \frac{r_{w,-1} L_{w,-1}}{YG_w} \quad (11)$$

**4.2. Middle class: “leveraged homeowners”**

In defining the middle class, it has to be acknowledged that this group can be considered along a variety of dimensions. In economic analysis, the middle class is often defined in relative terms as the middle 60% of income earners, with incomes typically ranging from 75% to 125% of the median income<sup>16</sup>. But characterization of the middle class is also linked to wealth ownership. Atkinson and Brandolini (2011) develop a wealth criterion to qualify the income definition of the middle class, classified as holding enough assets to be safe from the risk of falling into poverty for a certain period of time, e.g. 6 months, if income suddenly falls. They argue that asset-poor individuals may need to be excluded from the middle class

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<sup>16</sup> Some studies extend the upper limit to as much as 300% of the median income because the 125% cut-off places a disproportionately large portion of the population in certain countries into the top category (Pressman, 2007).

even if their income exceeds the poverty threshold. Furthermore, the middle class can be described according to social criteria such as class consciousness, social status, lifestyle, and type of employment, which influence the individual economic security and prospects (Savage, 2013).

In the macro-modelling literature, Palley (2015) constitutes one of the first attempts at formalizing the middle class. He models a Goodwinian economy with three classes of households based on the type of employment. The upper class is identified with the richest 1% of the population, corresponding to the top managers. The middle class is defined as the next 19%, consisting of middle managers. The working class corresponds to the bottom 80% and includes non-supervisory production workers. Palley's model introduces a complex class struggle, where the middle managerial class has conflicts with both the upper and the working class. Since middle managers are assumed to own part of the capital stock, they benefit from increases in either the profit share or the wage share (Palley, 2015, p.240). Similar proposition regarding the simultaneous capitalist and non-capitalist nature of the middle class has been put forward by Wright (1997, 2009).

While Palley's model constitutes an important contribution to the literature, its conclusions concern the functional distribution of income rather than wealth. The middle class is seen to have contradicting interests and be in conflict with both the upper- and the lower-income groups. However, as argued before, the processes of financial sector transformation harmed wealth accumulation of the middle-income households, making their fate more similar to the working class in terms of their high leverage levels. Thus, the middle class is defined according to their balance sheet composition based on the stylized facts established in the earlier analysis of household wealth composition in the USA.

In the present model, the middle class is classified as "leveraged homeowners", as it is distinguished as a group whose balance sheets depend on housing purchased through mortgages. Wealth of leveraged homeowners increased in the 1990s and the 2000s due to the rising house prices, allowing for mortgage refinancing and home equity withdrawal, which was only feasible in the house price bubble. When the growth of house prices reversed in July 2006, these households saw their wealth gains largely eroded. For these reasons, the middle class is assumed to have high leverage ratios. As argued before, the expansion of credit wasn't accidental as mortgages underpinned the proliferation of asset-backed securities. Consequently, the existence of the middle class is strongly linked to the financial sector

transformation due to incentives of financial institutions to generate as many mortgages as possible to satisfy the growing demands of financial investors for securitized instruments. In the present model, securitization is related to the provision of credit to the middle class.

Separation of the middle class from the working class is important to account for the impact of homeownership on inequality. As shown earlier, unlike asset-poor households (classified here as the working class), middle class households experienced large wealth losses in the past decades due to the reliance of their balance sheets on leveraged housing and the falling house prices around the time of the Great Recession (see U.S. SCF). Moreover, the middle class is distinct from the rentier household group because of disparate returns to wealth and lower capital income flows owing to less diversified asset composition (which relies on housing) and higher relative indebtedness.

Real disposable income of the middle class (equation 12) consists of wage income ( $\omega_m w_1 DL_{wm}$ ), interest earned on bank deposits ( $r_{cb} M_{m,-1}$ ), and the imputed rent on housing ( $r h_{m,-1} h_{m,-1}$ ), less interest payments on loans ( $r_{m,-1} L_{m,-1}$ ). The imputed rent corresponds to the return on the real value of housing owned by this group. Gross income is defined as income before debt payments<sup>17</sup> (equation 13). Middle class households earn an exogenously determined portion  $\omega_m$  of the wage bill paid by firms to the working and middle class ( $w_1 DL_{wm}$ ), assumed to be at 60%. This group consumes a fraction  $c_4$  of net wealth and a portion  $c_3$  of gross income (equation 14). The marginal consumption propensities of the middle class are assumed to be lower than those of the working class and higher than those of the rentier class. Residual income after consumption and repayment of loans is saved as deposits (equation 16).

We assume that the middle class accumulates mortgage debt to finance home purchases as well as part of their consumption (through home equity withdrawal). For simplicity, loans to the middle class are assumed to consist exclusively of mortgages. Loans demanded by middle-class households depends indirectly on the demand for housing via the consumption function. Borrowing of the middle class (equation 17) depends on their target consumption adjusted by parameter  $\beta$  and their repayment capacity, measured by the debt-service-to-income ratio multiplied by the amount of credit granted in the previous period. Parameter  $\beta$  is analogous to the parameter  $\beta_w$  in the workers loan demand function and reflects household

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<sup>17</sup> This resembles the Haig-Simon income specification, where capital gains enter into the disposable income equation (Godley and Lavoie, 2007, p.392).



lending norms. It is assumed that  $\beta$  is the same across the middle class and rentiers. Target consumption of the middle class is set based on regular consumption level in the previous period (due to the simple adaptive expectations), and relative to the consumption of rentiers adjusted by an emulation parameter  $\eta$  (equation 15).  $\eta$  corresponds to an exogenously set Ravina emulation parameter (Ravina, 2007).

Net wealth of the middle class comprises the value of bank deposits, housing, and capital gains on houses, less loans (equation 18). All middle class households are assumed to be owner-occupiers of their property and not to rent out their houses. Demand for houses by the middle class (equation 19) depends positively on the growth rate of mortgages that commercial banks are willing to lend to this household group, adjusted by an exogenous parameter  $h_l$ . Equation 20 shows the real value of houses held by the middle class, and equation 21 defines capital gains on housing for this group. Return on housing is defined as the value of capital gains on houses relative to the value of housing times its price in the previous period (equation 22). As in the case of the working class, different measures of financial fragility for the middle class are presented, including the debt-to-asset ratio (equation 23), the debt-to-income ratio (equation 24) and the debt-service-to-income ratio (equation 25).

#### *Middle class households' income and consumption*

$$YD_m = \omega_m w_1 DL_{wm} + r_{cb} M_{m,-1} - r_{lm,-1} L_{m,-1} + r h_{m,-1} h_{m,-1} \quad (12)$$

$$YG_m = YD_m + r_{lm,-1} L_{m,-1} \quad (13)$$

$$C_m = c_3 YG_{m,-1} + c_4 V_{m,-1} \quad (14)$$

$$C_m^T = C_{m,-1} + \eta C_{r,-1} \quad (15)$$

#### *Middle class households' wealth*

$$M_m = V_m + L_m - H_m \quad (16)$$

$$\Delta L_m = \beta C_{m,-1}^T - DS Y_m L_{m,-1}, \beta > 0 \quad (17)$$

$$\Delta V_m = YD_m - C_m + \Delta L_m + CG_{Hm} \quad (18)$$

$$\Delta H_m = H_{m,-1} * h_1 * \frac{\Delta L_m}{L_{m,-1}} \quad (19)$$

$$h_m = \frac{H_m}{p_h} \quad (20)$$

$$CG_{Hm} = H_{m,-1} \Delta p_h \quad (21)$$

$$rh_m = \frac{CGH_m}{H_{m,-1}Ph_{,-1}} \quad (22)$$

*Middle class households' leverage indicators*

$$DA_m = \frac{L_m}{M_m + H_m} \quad (23)$$

$$levY_m = \frac{L_m}{YD_m} \quad (24)$$

$$DSY_m = \frac{r_{lm,-1}L_{m,-1}}{YG_m} \quad (25)$$

### **4.3. Rentier class: “the working rich”**

The rentier class is defined as owners of diversified wealth portfolios, with low relative indebtedness. In contrast to the other household groups, they saw rapid increases in their income and wealth since the 1980s and the smallest wealth losses in the aftermath of the 2007 crisis. Their balance sheets are assumed to be composed of high-yielding financial assets and business equity alongside various forms of real estate, which differentiates this group from the middle class. Because we do not analyze the dynamics of investment expectations and realization among entrepreneurs, the definition of the capitalist class is narrowed down to rentiers. This corresponds to analysis by Wolff and Zacharias (2013), who apply a wealth threshold in addition to occupational categories to define capitalist households as those whose assets consist primarily of financial and business assets.

The existing functional distribution studies often treat the rich as pure rentiers, who derive their income solely from capital ownership. This is also envisaged by Piketty – as wealth becomes inherited and compounding returns to wealth gradually exceed income growth over time, the rich abandon work and live from their returns to wealth. While this was true in the pre-Fordist era and is a plausible scenario for the future, it doesn't describe the realities observed since the post-war period. Keister and Lee (2014) show that inheritance in the USA accounts for a small portion of the existing wealth of the rich. Moreover, households in the top 10% of the income distribution have captured an increasing share of wages since the 1980s, which stems from the extremely high salaries paid to financial sector executives (Kaplan and Rauh, 2010; Philippon and Reshef, 2012).

To account for the growing wage inequality, wages are included in the income of rentiers, so that the top group corresponds to the “working rich”. This complements the traditional view of the capitalist class. Rentiers are assumed to engage in work not because of necessity (as is in the case of the working and the middle class) but because institutional conditions turn

employment into an “investment strategy” for the rich, as they are able to use economic power associated with their high wealth to influence their earnings. Consequently, unlike the working and the middle class, they do not rely on their wages to maintain living standards.

Furthermore, in contrast to most of the SFCM studies including household debt, the present model allows for indebtedness of the rich. The analysis of household balance sheet composition above revealed that the top income decile accumulated sizeable debt between 1989-2013, constituting the most indebted income group in terms of the ownership rates and the amount of debt. What is different about the indebtedness of the rich is their debt accumulation motives. Rentiers are assumed to take on debt as an investment strategy to accumulate more assets (and potentially also to take advantage of various tax breaks; however, taxes are not included in the present version of the model). Because of lower interest rates on loans and higher returns to the diversified asset portfolio, the debt-service-to-income ratio and the debt-to-asset ratio of the top income decile are assumed to be the lowest among all households. Conversely, based on the earlier analysis a high debt-to-income ratio is assumed for this group, reflecting their large asset holdings, which allow for high debt accumulation relative to their income flows.

Real disposable income of rentiers (equation 26) consists of wage income ( $w_2 DL_r$ ), interest income from bank deposits ( $r_{cb} M_{r,-1}$ ), distributed profits of firms ( $DP$ ), profits of commercial banks ( $BP$ ), profits of institutional investors ( $FI$ ), housing rent payments from the working class ( $R$ ), as well as returns on housing ( $r_{hr,-1} h_{r,-1}$ ), returns on business equity ( $r_{e,-1} e_{-1}$ ), and returns on shares of institutional investors ( $r_{s,-1} sh_{-1}$ ), less interest paid on loans ( $r_{l,-1} L_{r,-1}$ ).

Gross income is defined as income before debt repayments (equation 27). The working rich households’ wage income is part of the overall wage bill of firms and is given by the rentier wage rate  $w_2$  (defined in the next section in equation 64) and firms’ demand for labor performed by rentiers ( $DL_r$  in equation 26). Rentiers consume a fraction  $c_5$  of their gross income and  $c_6$  of their net wealth, and their marginal consumption propensities are assumed to be the lowest among all households (equation 28). Residual savings after debt repayments are stored in the form of deposits (equation 29).

Borrowing of rentiers (equation 30) depends on their past consumption, adjusted by parameter  $\beta$ , and loans repaid from the previous period. Net wealth of rentiers is given by the value of bank deposits, housing, firm equity, and institutional investors’ shares as well as capital gains on the latter three types of assets, less loans (equation 31). These capital gains

are defined in equations 41 to 43. Rentiers are assumed to be the sole buyers of firm equity and institutional investors' shares. The allocation of rentiers' wealth between houses, equities, and institutional investors' shares is assumed to follow the Tobinesque portfolio principle, i.e. it depends on the relative rates of return offered on these assets (equations 32-34), with bank deposits treated as residual. Real values of rentier housing, equity, and institutional investors' shares holdings are given in equations 35 to 37.

The rate of return on equity depends on the sum of distributed profits of firms and capital gains on equity relative to the nominal value of equity and its price in the previous period (equation 39). Price of firm equity is defined as the nominal value of equity  $E$  less a fraction  $x$  of firm investment spending  $I$ , adjusted by the real value of equity  $e$  (equation 38). The rate of return on rentier housing is determined by the sum of rent payments from the working class and rentiers' capital gains on housing relative to the rentier housing stock and the price of housing in the previous period (equation 40). The price of housing as well as the price and the rate of return on institutional investors' shares are described in the following section, in equations 55, 83, and 84 respectively. Equations 44 to 46 provide the leverage measures of the rentier households, i.e. the debt- to-asset ratio, the debt-to-income ratio, and the debt-service-to-income ratio.

#### *Rentier households' income and consumption*

$$YD_r = w_2 DL_r + r_{cb} M_{r,-1} - r_{l,-1} L_{r,-1} + DP + BP + FI + R + \dots \\ \dots + rh_{r,-1} h_{r,-1} + r_{e,-1} e_{-1} + r_{s,-1} sh_{-1} \quad (26)$$

$$YG_r = YD_r + r_{l,-1} L_{r,-1} \quad (27)$$

$$C_r = c_5 YG_{r,-1} + c_6 V_{r,-1} \quad (28)$$

#### *Rentier households' wealth*

$$M_r = V_r + L_r - H_r - E - SH \quad (29)$$

$$\Delta L_r = \beta C_{r,-1} - DS Y_r L_{r,-1}, \quad \beta > 0 \quad (30)$$

$$\Delta V_r = YD_r - C_r + \Delta L_r + CG_{Hr} + CG_E + CG_{SH} \quad (31)$$

$$E = (\lambda_{1,0} + \lambda_{1,1} r_{e,-1} + \lambda_{1,2} r_{cb} + \lambda_{1,3} \frac{YD_{r,-1}}{V_{r,-1}} + \lambda_{1,4} r_{hr,-1} + \lambda_{1,5} r_{s,-1}) V_{r,-1} / p_{e,-1} \quad (32)$$

$$H_r = (\lambda_{2,0} + \lambda_{2,1} r_{e,-1} + \lambda_{2,2} r_{cb} + \lambda_{2,3} \frac{YD_{r,-1}}{V_{r,-1}} + \lambda_{2,4} r_{hr,-1} + \lambda_{2,5} r_{s,-1}) V_{r,-1} / p_h \quad (33)$$

$$SH = (\lambda_{3,0} + \lambda_{3,1} r_{e,-1} + \lambda_{3,2} r_{cb} + \lambda_{3,3} \frac{YD_{r,-1}}{V_{r,-1}} + \lambda_{3,4} r_{hr,-1} + \lambda_{3,5} r_{s,-1}) V_{r,-1} / p_s \quad (34)$$

$$h_r = \frac{H_r}{p_h} \quad (35)$$

$$e = \frac{E}{p_e} \quad (36)$$

$$sh = \frac{SH}{p_s} \quad (37)$$

$$p_e = \frac{E - \chi I_{-1}}{e_{-1}} \quad (38)$$

$$r_e = \frac{DP + CG_E}{E_{-1} p_{e,-1}} \quad (39)$$

$$r h_r = \frac{(R + CG_{Hr})}{H_{r,-1} p_{h,-1}} \quad (40)$$

$$CG_E = E_{-1} \Delta p_e \quad (41)$$

$$CG_{Hr} = H_{r,-1} \Delta p_h \quad (42)$$

$$CG_{SH} = SH_{-1} \Delta p_s \quad (43)$$

*Rentier households' leverage indicators*

$$DA_r = \frac{L_r}{M_r + L_r + H_r + E + SH} \quad (44)$$

$$levY_r = \frac{L_r}{YD_r} \quad (45)$$

$$DSY_r = \frac{r_{l,-1} L_{r,-1}}{YG_r} \quad (46)$$

#### **4.4. Motives for debt accumulation**

Underpinning the distinction of different types of debt in the present model are differences in motives for debt accumulation across household groups. Contemporary analyses of household portfolio decisions are dominated by the life-cycle theory (Modigliani and Brumberg, 1954) and the permanent income hypothesis (Friedman, 1957) approach (LCT/PIH). This framework is rooted in quantitative general equilibrium models and assumes that households endowed with perfect information about the distribution of their lifetime income smooth consumption over their life-cycle to maximize their utility subject to an intertemporal budget constraint, based on behavioral assumptions of the standard microeconomic theory (Debelle, 2004, p.2; Gravelle and Reese, 2012, pp.12-19). Consequently, consumer preferences are stable and exogenously determined by these consumption rankings.

In LTC/PIH models, indebtedness is explained by households optimizing their consumption spending. Debt can never be excessive as it implies future income increases, i.e. it is assumed to generate a matching future flow of funds, and default is only possible due to unexpected external shocks to income (Bertola *et al.*, 2006, p.33). This argument lacks understanding of the institutional changes in financial markets outlined in Section 2 and downplays the

massive expansion of credit via predatory lending practices induced by the high demand for securitized assets among financial investors and stagnant incomes. View of households as rational optimizing agents carefully planning their consumption patterns obscures the complexity of household portfolio decisions in the age of active financial markets and thus renders this approach unsuitable to explain the mechanisms of wealth distribution in the 21st century<sup>18</sup>.

These weaknesses of the LTC/PIH approach are addressed by the heterodox insights into household consumption behavior (Lavoie, 2014, pp.95-96,98-99), which draw from the relative income hypothesis (Veblen, 1899; Duesenberry, 1949). They highlight the socio-institutional determinants of household portfolio choices (Nell, 1992), which undermine the utility-maximizing view of wealth accumulation (Robinson, 1956; Pasinetti, 1981; Eichner, 1986; Arestis, 1992) and allow for a more realistic examination of the mechanisms of inequality (Szymborska, 2017, p.145).

As indicated in Section 3, consumption emulation has recently emerged as a potentially important driver of borrowing (see Cynamon and Fazzari, 2008; Pressman and Scott, 2009). However, while in the existing SFCM studies emulation is applied to low-income workers, the present model restricts relative consumption to the middle class. This approach is more appropriate as emulation motives are more likely to be relevant among more affluent households belonging to the middle class, who can afford necessities such as owning their house. In contrast, the working class is more concerned with maintaining their living standards in light of the rising living costs (e.g. rent payments). Their demand for loans is thus more likely to be driven by necessitous borrowing concerns (see Pollin, 1988) rather than their desire to follow lifestyles of the rich. It would be possible to introduce emulation of the middle class consumption by the working class, which would be in line with the expenditure cascades hypothesis where each distributional group emulates consumption of the one just above it (Frank *et al.*, 2014). However, the present model it is assumed that due to sluggishly growing incomes and increases in house prices, rising credit demand among

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<sup>18</sup> Due to empirical problems, the LTC/PIH framework has seen numerous extensions aiming to improve its explanatory power. These incorporate factors which impede accurate formation of future income expectations, namely liquidity constraints in credit markets (Gross and Souleles 2002), precautionary saving (Carroll 1997), bequest motives (Cagetti and DiNardi, 2008), and wealth effects of asset price increases (Mehra, 2001; Duca *et al.*, 2012). Despite these various extensions of the standard LTC/PIH framework, its basic premise of rational optimizing agents carefully planning their consumption patterns over the lifecycle remains. Another problematic feature of this literature is its assumption that financial innovation and subprime credit expansion should act as a relief to credit-constrained households, allowing for a more optimal distribution of economic resources (Barba and Pivetti, 2009, p.119; Elul, 1995).

low-income households is motivated by sustaining a constant standard of living rather than achievement of a particular social status.

We also do not include relative consumption concerns in the rentiers' credit demand function. It should be mentioned, however, that relative consumption motives are bound to be especially strong among the richest 10%, who engage in luxury goods consumption and aim to elevate their social status and pursue "celebrity lifestyles". Much of the increase in the top 10% share of income is driven by the rising share of the top 1% (Piketty 2014). However, high aggregation of the SFCM and the elaborate character of the current model prevent us from modelling such precise consumption behavior of the different income groups within the top income decile.

In sum, distinguishing between differences in wealth accumulation and leverage levels across the three household groups allows for a more precise identification of the distributional channels in financialized economies and of the points of financial fragility defining macroeconomic stability. This is particularly important considering the changing features of the financialized economies in the post-crisis era, such as the increasing accumulation of unsecured debt among low-wealth households and restructuring of the housing market, which has created a deep divide in wealth accumulation opportunities and the resulting income flows between homeowners and renters. In this context, wealth ownership emerges as a powerful channel of distribution, which contributes to macroeconomic instability in new ways than before the Great Recession.

## 5. Simulation analysis

To formally validate usefulness of the proposed conceptualization of households based on balance sheet composition, we construct a stock-flow consistent model of inequality determination<sup>19</sup>. Choice of SFCM is motivated by its integrated analysis of balance sheet composition across the real and the financial sector (Godley and Lavoie, 2007). This feature yields itself to the examination of the role of household wealth heterogeneity in generating inequality. Moreover, this method has been widely used in the macro-modelling literature on the distributive consequences of financialization (see Section 3). However, unlike the current literature which focuses on the macroeconomic dynamics resulting from unequal distribution, the aim of the simulation analysis is to examine how the introduced balance sheet complexity

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<sup>19</sup> Simulation was conducted using R and the code is available upon request.

influences the predicted levels of inequality. For this reason, we compare trends in inequality and leverage in the proposed three-class framework and the traditional two-class approach. The hypothesis is that the above definition of households based on balance sheet structures leads to higher income inequality levels and financial fragility than the dichotomous division between workers and capitalists.

### **5.1. Model setup**

The model is calibrated using the US data. The analysis focuses on the personal distribution of wealth and income and analyzes the evolution of the Gini index for income and wealth. The model considers a closed economy with no government and consists of five sectors: a three-class household sector (outlined in the previous section), a simple firm sector, and a three-tier financial sector comprising of commercial banks, special purpose vehicles (SPVs)/underwriters, and institutional investors. This definition of the financial sector aims to capture the increased complexity of modern financial institutions by introducing securitization into the model dynamics (Nikolaïdi, 2015). A limitation of this model setup is that several important factors which played a relevant role in the concentration of income and wealth are excluded, including globalization, privatization of pensions, the structure of taxation (Yunker, 2010; Stiglitz, 2014), and inheritance (Yunker, 1998; Isaac, 2007). Table 1 shows the balance sheet matrix, while Table 2 presents the transaction flow matrix. The legend of model variables and details of parameter calibration and initial values can be found in the Appendix.

[Table 1 here]

[Table 2 here]

### **5.2 Firms**

We assume no inflation and a price of output equal to unity, so that nominal and real values coincide. Firm profits are residual (equation 47) and the profit share is determined exogenously (through a mark-up over unit labor costs). It is assumed that firms produce housing as well as a single capital good on demand so that capital inventories are not taken into account. Firms retain an exogenously determined share  $s_f$  of their profits (equation 48) and distribute the rest to rentiers (equation 49). Output is given by the consumption spending of households and investment in productive capital and housing (equation 50). The potential output of the economy is set in proportion to an exogenously given full-capacity capital-output ratio  $\varphi$  (equation 51).



Firm investment is defined as the growth rate of capital stock (equations 52-53). Firms' production of housing depends on the ratio of the demand for housing from the middle class and rentiers to the supply of housing by firms in the previous period as well as on the growth rate of the price of housing, adjusted by exogenous parameters  $h_2$  and  $h_3$  respectively (equation 54). It is assumed that a part of the housing stock may be unsold in a given period, depending on whether the demand for mortgages from the middle class (and so, indirectly, their demand for housing) is met by commercial banks (note that the Tobinesque portfolio equation implies that all houses demanded by rentiers are sold). The price of housing is determined by the ratio of the growth rate of the demand for housing from the household sector relative to the growth rate of the supply of housing by firms (both given for the previous period), adjusted by an exogenous parameter  $h_4$  (equation 55).

To maintain the focus on household wealth structures, the wage bargaining process is simplified. Firms are assumed to demand labor from either the working class and the middle class ( $DL_{wm}$ ) or from rentiers ( $DL_r$ ). Firms' wage bill (equation 56) is assumed to be divided into wages paid to the working class and the middle class ( $w_1 DL_{wm}$ ) and wages paid to rentiers ( $w_2 DL_r$ ). A homogenous wage rate  $w_1$  is negotiated by the working class and the middle class as a fraction  $s_w$  of their labor productivity  $\lambda_{wm}$  (equation 57). Because the price of output is assumed to be unity,  $s_w$  corresponds to the wage share of these workers in total income (Dafermos and Papatheodorou, 2015, p.12). It depends on an exogenous labor market parameter  $w_0$  less the unemployment rate for workers from the working class and the middle class, adjusted by an exogenous parameter  $w_1$  (equation 58)<sup>20</sup>. This unemployment rate is determined by the change in firms' demand for labor performed by workers from the working class and the middle class relative to the number of these workers in the population (equation 59).

Demand for labor performed by the working class and the middle class depends on the ratio of actual output to labor productivity of these households in the previous period (equation 60). Following Dafermos and Papatheodorou (2015), demand for rentier labor is given by the ratio of potential output to rentier labor productivity in the previous period (equation 61). For simplicity, labor productivity for all types of workers is assumed to grow at an exogenously set labor productivity growth rate  $g_\lambda$  (equations 62-

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<sup>20</sup> As noted by Dafermos and Papatheodorou (2015) the negative impact of the unemployment rate on the wage share reflects the reserve army effect.

63).

The rentier wage rate (equation 64) is linked to a variable remuneration dependent on firm profits and is given by an exogenous premium  $m_w > 1$  over the other workers' wage rate, as well as the profit sharing element  $ph$  adjusted by the number of rentiers  $N_r$  and an exogenous parameter  $\rho \in (0,1)$  reflecting the relative importance of profit remuneration in the rentier wage rate determination (*ibid.*, p.13).

#### *Firm output and profits*

$$TP = Y - W \quad (47)$$

$$RP = s_f TP \quad (48)$$

$$DP = TP - RP \quad (49)$$

$$Y = C_w + C_m + C_r + I + \Delta H \quad (50)$$

$$Y^* = \varphi K \quad (51)$$

#### *Firm investment and housing production*

$$I = g_k K_{-1} \quad (52)$$

$$\Delta K = I \quad (53)$$

$$\Delta H = H_{-1} * \left( h_2 \frac{(H_{m,-1} + H_{r,-1})}{H_{-1}} + h_3 \frac{(p_h - p_{h,-1})}{p_{h,-1}} \right) \quad (54)$$

$$\Delta p_h = p_{h,-1} * h_4 \left( \left( \frac{(H_m + H_r) - (H_{m,-1} + H_{r,-1})}{(H_{m,-1} + H_{r,-1})} \right)_{-1} / \left( \frac{(H - H_{-1})}{H_{-1}} \right)_{-1} \right) \quad (55)$$

#### *Firm wage bill*

$$W = w_1 DL_{wm} + w_2 DL_r \quad (56)$$

$$w_1 = s_w \lambda_{wm} \quad (57)$$

$$s_w = w_0 - w_1 UR_{wm} \quad (58)$$

$$\Delta UR_{wm} = UR_{wm,-1} * \frac{\Delta DL_{wm}}{(N_w + N_m)} \quad (59)$$

$$DL_{wm} = \frac{Y_{-1}}{\lambda_{wm,-1}} \quad (60)$$

$$DL_r = \frac{Y_{-1}^*}{\lambda_{r,-1}} \quad (61)$$

$$\Delta \lambda_{wm} = \lambda_{wm,-1} * g_\lambda \quad (62)$$

$$\Delta \lambda_r = \lambda_{r,-1} * g_\lambda \quad (63)$$

$$w_2 = (1 - \rho) * m_w * w_1 + \rho * h * \left( \frac{Y - w_1 * DL_{wm} - (1 - \rho) * m_w * w_1 * DL_r}{N_r} \right) \quad (64)$$

### **5.3. Financial sector**

We assume a three-tier financial sector, composed of commercial banks and two types of non-bank financial institutions: underwriters (and their SPVs) and institutional investors.

Commercial banks accept household deposits and create money through lending to households. A part of mortgages to the middle class is securitized and transformed into mortgage-backed securities (MBS) by the sector of SPVs and underwriters. MBS are subsequently bought by institutional investors in the form of coupon payments. Shares issued by institutional investors based on the value of their MBS holdings are then purchased by rentiers.

### *Commercial banks*

Commercial bank profits (equation 65) are defined as the sum of interest payments on consumer loans of the working class, non-securitized mortgages of the middle class, and loans to rentiers, less interest payments on deposits to households<sup>21</sup>. A constant interest rate on deposits is assumed for all households, equal to the exogenously set central bank base rate. The interest rate on loans is set by charging an exogenous premium  $\alpha$  over the deposit rate (equation 66).

Each household group faces a different rate of interest on loans, depending on the perception of their creditworthiness by commercial banks. The interest on loans to the working class is higher than the general interest rate on household loans by a premium  $\pi$  (equation 67). This risk premium depends on exogenous parameters  $\pi_0$  and  $\pi_1$ , which capture institutional conditions in the financial markets, as well as the debt-to-income ratio and the debt-service-to-income ratio of the working class (equation 68). Loans to the middle class are subject to a mortgage rate (equation 69), defined as a spread over the commercial bank lending rate (equation 70). The mortgage spread depends positively on the parameter  $\pi_0$ , the debt-service-to-income ratio, and the debt-to-income ratio of the middle class, adjusted by an exogenous parameter  $\pi_2$ , and negatively on the rate of return on mortgage-backed securities (MBS), adjusted by an exogenous parameter  $\pi_3$ .

All bank profits are transferred to rentiers, who are assumed to own commercial banks and the remaining financial institutions. This, together with the assumption that assets of rentiers outweigh their debt holdings, leads to the assumption that rentiers in the present model remain creditors in net terms. This is because their debt payments are ultimately returned to them in the form of bank profits.

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<sup>21</sup> The simulated steady-state value of the interest rates on mortgages to the middle class is 6.8%, while the interest rate on loans to the working class is 8.8%.

A part of mortgages to the middle class is securitized and sold to underwriters and their SPVs (equation 71), and the rest is kept on the commercial banks' balance sheets (equation 72). The share of securitized loans (equation 73) depends on an exogenous parameter  $s_0$  (capturing institutional conditions such as the degree of financial regulation) and the target yield on MBS (given by the past yield under the assumption of simple adaptive expectations), adjusted by an exogenous parameter  $s_1$ . The redundant equation of the model is derived in equations 74-78.

$$BP = r_{w,-1}L_{w,-1} + r_{lm,-1}L_{mNS,-1} + r_{l,-1}L_{r,-1} - r_{CB}(M_{w,-1} + M_{m,-1} + M_{r,-1}) \quad (65)$$

$$r_l = r_{CB} + \alpha \quad (66)$$

$$r_w = r_l + \pi \quad (67)$$

$$\pi = \pi_0 + \pi_1 levY_{w,-1} DSY_{w,-1} \quad (68)$$

$$r_{lm} = r_l + spreadm \quad (69)$$

$$spreadm = \pi_0 + \pi_2 levY_{m,-1} DSY_m - \pi_3 r_{MBS,-1} \quad (70)$$

$$L_{mS} = sL_m \quad (71)$$

$$L_{mNS} = (1 - s)L_m \quad (72)$$

$$s = s_0 + s_1 yield_{MBS,-1} \quad (73)$$

$$L_s = L_{s,-1} + \Delta L_d \quad (74)$$

$$L_d = L_w + L_m + L_r \quad (75)$$

$$M_s = M_{s,-1} + \Delta L_s \quad (76)$$

$$M_d = M_w + M_m + M_r \quad (77)$$

$$M_s = M_d \quad (78)$$

### *SPVs/underwriters*

The sector of underwriters and their SPVs purchases securitized loans to the middle class from commercial banks and transforms them into MBS (equation 79). MBS are assumed to be of the single “pass-through” type rather than consisting of various pooled MBS (Nikolaïdi, 2015, p.4). All MBS are sold to institutional investors in the form of coupon payments without any fee (equation 80), at a coupon rate determined by an exogenous spread over the mortgage rate (equations 81). Consequently, the sector of underwriters and SPVs accumulates no profits.

$$MBS = MBS_{-1} + \Delta L_{mS} \quad (79)$$

$$COUPAY = coupMBS_{-1} \quad (80)$$

$$coup = r_{lm} - spread_{MBS} \quad (81)$$

### *Institutional investors*

The sector of institutional investors is assumed to comprise entities such as pension funds, mutual funds, hedge funds, insurance companies, and investment banks (see Davis, 2003). They purchase MBS from underwriters and their SPVs as coupon payments, which are distributed to rentiers in the form of institutional investors' profits  $FI$  (equation 82).

Institutional investors' demand for MBS follows the portfolio principle (equation 83), where the return on MBS (equation 84) depends on the MBS yield (equation 85) and capital gains on MBS holdings (equation 86).

Institutional investors are assumed to finance their operations by issuing shares ( $SH$ ), which are purchased by rentier households at a price  $p_s$ , set in reference to the price of MBS adjusted by an exogenous parameter  $\theta_0$  (equation 87). The rate of return on the institutional investors' shares ( $rs$ ) is given by the ratio of coupon payments to the amount demanded by rentiers in the form of institutional investors' shares in the previous period (equation 88).

$$FI = COUPAY \quad (82)$$

$$p_{MBS} = \frac{(\theta_{10} + \theta_{11} r_{MBS,-1}) SH_{-1}}{MBS_{-1}} \quad (83)$$

$$r_{MBS} = yield_{MBS} + \frac{CG_{MBS}}{p_{MBS,-1} MBS_{-1}} \quad (84)$$

$$yield_{MBS} = \frac{COUPAY}{p_{MBS,-1} MBS_{-1}} \quad (85)$$

$$CG_{MBS} = MBS_{-1} \Delta p_{MBS} \quad (86)$$

$$\Delta p_s = p_{s,-1} * \theta_0 p_{MBS} \quad (87)$$

$$rs = \frac{FI}{SH_{-1}} \quad (88)$$

#### 5.4. Outcome variables

The proposed model focuses on personal income and wealth inequality, and analyzes how the increased complexity of household balance sheet composition affects the Gini index of income (equation 89) and wealth (equation 90), expecting the proposed balance sheet heterogeneity to produce more acute long-run polarization of income and wealth than simulated otherwise. It also examines the impact of household balance sheet complexity on macroeconomic stability, measured by the debt-to-income ratio of the entire economy (equation 91).

Wealth inequality levels as measured by the Gini index are expected to be higher than for income. This is because the inclusion of wealth heterogeneity in the model creates forces which pull the upper class even further away from the rest of the distribution, drowning the middle and working class in debt. In this model, these forces are identified with unequal

returns to assets accumulated across different household groups and disparities in borrowing conditions and leverage. Apart from income transfers through repayments of loans from commercial banks, inequality is influenced by securitization, which transfers wealth of the middle-income group to the upper class through differences in asset ownership. Furthermore, inclusion of relative consumption concerns allows for a distinction between different motives for debt accumulation across households and their implications for macroeconomic stability.

The model is simulated for 100 periods. Simulation results of the full model outlined above are compared with four reduced form specifications without features introduced in this baseline model: (1) a pure capitalist class specification, in which rentiers derive income solely from capital ownership and profits and thus receive no wages (an additional reduced specification is run that excludes rentier debt from the pure capitalist scenario); (2) a scenario without relative consumption determining the demand for loans among the middle class; (3) a specification without securitization (restricting the financial sector to include only commercial banks); and (4) a specification without the middle class (which corresponds to the traditional dichotomous division between workers and capitalists and excludes relative consumption effects). The latter scenario without the middle class accounts for securitization of loans to the working class instead<sup>22</sup>. This allows us to gauge the impact of household wealth heterogeneity proposed in this model on personal distribution of income and wealth, and on macroeconomic stability.

$$GINI = \frac{1}{2N^2\mu} \sum_{i,j} |YH_i - YH_j| N_i N_j \quad \text{where } i,j = w, m, r^{23} \quad (89)$$

$$GINI_V = \frac{1}{2N^2\mu V} \sum_{i,j} |VH_i - VH_j| N_i N_j \quad \text{where } i,j = w, m, r \quad (90)$$

$$levY = \frac{L_w + L_m + L_r}{Y} \quad (91)$$

$$YH_i = \frac{YD_i}{N_i} \quad \text{where } i,j = w, m, r \quad (92)$$

$$VH_i = \frac{V_i}{N_i} \quad \text{where } i,j = w, m, r \quad (93)$$

$$\mu = \frac{YD_w + YD_m + YD_r}{N_w + N_m + N_r} \quad (94)$$

$$\mu V = \frac{V_w + V_m + V_r}{N_w + N_m + N_r} \quad (95)$$

<sup>22</sup> A different version of that latter scenario was run, where securitization was excluded entirely from the reduced specification without the middle class; the results obtained are similar to the scenario presented here.

<sup>23</sup> Note that  $N$  is the total number of households:  $N = N_w + N_m + N_r$ .

## 6. Results and discussion

Table 3 presents results of the simulation analysis. In the full model, higher levels of wealth inequality are observed than of income inequality, which corresponds to inequality patterns observed in the data. The simulated steady-state value of the Gini index is 0.83 for net wealth and 0.59 for income<sup>24</sup>. The values are consistent with the recent estimates based on data from the U.S. SCF. In contrast to other surveys of household income and wealth (namely the Panel Study of Income Dynamics), the U.S. SCF oversamples rich households to account for the impact of systematic non-response of wealthy households that is common in household survey data. Using data from the U.S. SCF, Wolff (2017) estimates a value of 0.87 for the Gini index of net wealth and 0.57 for pre-tax income in 2013.

It needs to be noted that the U.S. SCF collects data on pre-tax income and net wealth, which leads to higher estimated values of the Gini coefficients compared to other sources of data. For instance, the Congressional Budget Office (CBO) estimates that the Gini index of income was 0.42 in 2016 for income after taxes and transfers, compared to a value of 0.59 for market income and 0.51 for income before taxes and transfers (CBO 2019)<sup>25</sup>. In comparison, the U.S. Census Bureau's Current Population Survey (CPS) estimates a value of 0.481 for the Gini index of income in 2016, rising to 0.486 in 2018 (U.S. Census Bureau 2019).

The present model excludes taxes and transfers, which explains the proximity of the simulated Gini index values to the U.S. SCF estimates (although the simulated Gini index for income is close to the CBO's estimate of market income inequality of 0.59). The simulated value of the Gini index for income is slightly higher than in the U.S. SCF as the model excludes transfer income (which tends to make the income distribution more egalitarian). The value of the Gini coefficient for net wealth simulated in the model is lower than the U.S. SCF values estimated for the recent years. This can be explained by the fact that the present model does not account for retirement wealth, which has been characterized by high levels of inequality (the author estimated a 0.86 Gini coefficient for this component of wealth using the 2013 U.S. SCF).

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<sup>24</sup> The simulated value of the income Gini index is more empirically accurate than the simulated value of 0.22 in Dafermos and Papatheodorou (2015).

<sup>25</sup> The CBO defines market income as income earned from non-governmental sources, including labor, business, capital, and retirement income (CBO 2019). Income before taxes and transfers additionally accounts for social insurance benefits.

In addition, different measures of leverage are simulated for each household group to analyze the impact of the model features on financial fragility. The simulated values of leverage measures are consistent with the empirical observations in Section 2. The middle class emerges as the most leveraged in terms of the debt-service-to-income ratio, which is simulated to reach 6.9% for this group, 5.3% for the working class, and 4.3% for rentiers. This ordering is consistent with Figure 3, although the simulated magnitudes are lower. This occurs as the model only considers one type of debt payments for each household group (either consumer debt or mortgages).

Moreover, the steady-state values of the debt-to-asset ratio are simulated to be the highest for the working class at 63.4%, compared to 33.8% for the middle class and 17.9% for rentiers. These values are higher than observed in the data, in which middle-income households were found to have the highest debt-to-asset ratios. The greater value simulated by the model for working class households may be explained by the lack of housing on the asset side of their balance sheets in the model.

Lastly, as was expected, rentiers are simulated to have the highest value of the steady-state debt-to-income ratio, at 142.9%. The simulated steady-state values of the ratio for the middle and the working class are 112.8% and 66.4% respectively. Table 3 also reports the steady-state value of the debt-to-income ratio of the whole simulated economy, which settles at 108.2%. This is slightly higher than the observed value of approximately 100% of the household debt-to-GDP ratio in the USA around the time of the Great Recession (Federal Reserve Economic Data St. Louis, 2017).

[Table 3 here]

The results of the baseline scenario are generally robust to different parameter values<sup>26</sup>. In a univariate sensitivity analysis (where parameters are changed one at a time), the simulated values of the inequality are the most sensitive to parameters influencing the wage rate for the middle class and the working class (namely the labor market parameters  $w_0$  and  $w_1$  and productivity growth rate  $g_\lambda$ ), the firm profit retention rate  $s_f$ , parameters affecting the demand and the repayment of loans for the working class and the middle class ( $\beta_w$  and  $\pi_0$ ), parameter influencing the price of the institutional investors' shares  $\theta_0$ , the marginal consumption propensities out of income for all households ( $c_1$ ,  $c_3$ , and  $c_5$ ), and the marginal propensity to

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<sup>26</sup> Details of the sensitivity analysis are available upon request.



consume out of wealth for the middle class and rentiers ( $c_4$  and  $c_6$ )<sup>27</sup>. In addition to these parameters, the simulated values of the leverage measures are also sensitive to the values of the central bank interest rate  $r_{cb}$  and parameters influencing the demand and repayment of loans for the middle class and the household sector in general ( $\alpha$ ,  $\beta$ ,  $\eta$ , and  $\pi_2$ )<sup>28</sup>. These results suggest that both wealth and income channels are important in influencing the levels of inequality and leverage in this model, particularly those pertaining to wage determination, consumption, and the demand for and repayment of loans.

An additional robustness check has also been performed, using a multivariate sensitivity analysis in which all parameter values are altered simultaneously, in order to replicate a crisis scenario<sup>29</sup>. This multivariate analysis shows that inequality measures increase in result of the shock to the parameters, reaching higher steady-state values compared to the baseline scenario (0.88 for wealth and 0.64 for income). Moreover, the simulated values of households' debt-to-income ratios and the debt-service-to-income ratios initially rise and then fall below their baseline values, while the debt-to-asset ratios increase to a higher level than in the baseline, particularly for the working class and the middle class households.

Comparison of the reduced specification results with the full model shows that the modelled heterogeneity of balance sheets among different household groups matters for inequality and macroeconomic stability. Firstly, exclusion of the rentier wage results in lower simulated steady-state values of the Gini index for income and wealth (of 0.54 and 0.81 respectively), as well as the debt-to-asset and the debt-to-income ratios. This suggests that accounting for diverse income sources is important in understanding the rise of income and wealth inequality.

Moreover, removing relative consumption effects from the model leads to lower steady-state values of the three leverage measures for the middle class, as well as the debt-to-income ratio for the economy as a whole. Additionally, excluding securitization from the model yields

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<sup>27</sup> The simulated values of the Gini index for income and wealth inequality are higher in response to: a fall in  $w_0$  and  $w_1$ , a decrease in the profit retention rate  $s_f$ , a lower marginal propensity to consume out of income for rentiers  $c_5$ , a higher  $\beta_w$ . Income inequality also increases following a reduction in the rate of productivity growth  $g_\lambda$ . In addition, the Gini index for wealth rises when: the marginal propensity to consume out of income for the working class and the middle class increases ( $c_1$  and  $c_3$ ), the marginal propensity to consume out of wealth for the middle class ( $c_4$ ) increases and falls for rentiers ( $c_6$ ), and when  $\theta_0$  or  $\pi_0$  increase.

<sup>28</sup> Leverage measures increase in response to: an increase in  $w_0$  and  $w_1$ , a higher marginal propensity to consume out of income for rentiers  $c_5$ , a higher  $\beta$  and  $\beta_w$ , and a fall in  $\theta_0$ . In addition, the debt-to-income ratio for the economy increases following: a lower  $\alpha$ , an increase in  $\eta$ , a higher  $r_{cb}$ , and a fall in  $\pi_0$  or  $\pi_2$ . The debt-service-to-income ratio for households additionally rises when  $\alpha$  and  $\pi_0$  increase.

<sup>29</sup> Detailed results are available on request.

higher simulated steady-state values of the debt-service-to-income ratio for the middle class, the debt-to-asset ratio for rentiers, and the debt-to-income ratio for workers. Nevertheless, the latter scenario also results in a lower steady-state value of the debt-to-income ratio for the middle class, rentiers, and the economy as a whole. These results replicate the empirical finding that the period of securitization was associated with increased financial fragility for the economy.

Furthermore, comparing the baseline model results with the reduced specification in which the middle class is excluded leads to *lower* simulated steady-state values of the Gini index for income at 0.54, but *higher* values for the Gini coefficient for wealth at 0.86. Additionally, the reduced specification without the middle class yields a higher simulated value of the steady-state debt-to-income ratio for the economy. The middle class in the baseline model is distinguished by the presence of housing on their balance sheets. Consequently, the finding of higher wealth inequality in the reduced specification without the middle class indicates that homeownership has an equalizing effect on wealth distribution among households. However, it simultaneously contributes to greater macroeconomic instability and higher income inequality in the context of financial sector transformation, as evidenced by the lower simulated values of the steady-state Gini index for income and the debt-to-income ratio for the economy in the reduced model. These results suggest that the dichotomous classification of households typically encountered in stock-flow consistent models obscures some channels of macroeconomic instability and personal income distribution.

Moreover, the model results reveal that due to disparities in debt accumulation motives across households, household leverage needs to be analyzed holistically. Each measure of financial fragility captures a different aspect of indebtedness and does not represent the true capacity of households to handle financial distress when analyzed by itself. Importantly, the analysis finds that inclusion of the socially determined component in the loan demand function of the middle class raises their leverage, which increases macroeconomic instability<sup>30</sup>.

Consequently, the present analysis considering the different motives for debt holdings, together with the structural conditions of asset accumulation, is instrumental in understanding the implications of rising indebtedness for financial fragility for individual households and at

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<sup>30</sup> This is consistent with Zezza (2008) and Caverzasi and Godin (2015) where an increase in consumption emulation is simulated to raise the aggregate debt-to-income ratio. While in this model we do not observe changes to the results following the shock to the emulation parameter, comparison of results of the full model with the reduced specification without emulation shows that the presence of relative consumption concerns leads to higher macroeconomic volatility measured by the debt-to-income ratio.

macroeconomic level. The three-class household specification presented in this paper is conducive to capturing this diversity of debt accumulation motives.

Note that the middle class constitutes the largest household group in this analysis, as it is assumed to account for 50% of households. Thus, issues associated with heterogeneity of this group need to be acknowledged. We argue that heterogeneity issues cannot be avoided in analyzing the household sector. The three-class division adopted here is superior to the two-class conceptualization of households in the macro-modelling literature because it shows a more intricate channels of inequality determination in times of financial sector transformation arising from household balance sheet heterogeneity, which altered the traditionally envisaged economic relationships underpinning inequality and macroeconomic stability.

It is possible to extend the division of households even further, which has been done by Dafermos and Papatheodorou (2015), who distinguish between five groups of households depending on their employment status, skill level, and the type of income earned. Such detailed division is not necessary in the present framework for two reasons. Firstly, it would introduce a considerable degree of complexity to an already elaborate model of heterogeneous households. Secondly, in the aggregate framework of SFCM, it would be difficult to meaningfully break down social classes into upper/lower groups and introduce a drastically different picture of balance sheets than that already provided in the three-class model. This is because at the aggregate level the most important distinctions in wealth accumulation possibilities are already made.

On the whole, modelling of household wealth heterogeneity in the manner developed in this paper provides new insights into the channels of income and wealth transfers to the top of the income distribution compared to the conceptualization of households based on income sources alone. Securitization of mortgages to the middle class constitutes an indirect transfer of income and wealth from the middle to the rentier class, together with payments of housing rents by the working class. Moreover, holdings and payments of debt provide an indirect transfer of income from the working and the middle class to the rentiers, while homeownership among the middle class acts to reduce wealth inequality. These distributional channels are summarized in Figure 3.

[Figure 3 here]

## 7. Concluding remarks

This paper analyzed the relationship between household balance sheet complexity and inequality in the context of financial sector transformation in the USA since the 1980s. The paper argued that by expanding wealth accumulation among low-to-middle-income households and deepening wage disparities, changes in financial intermediation, financial deregulation, and securitization have highlighted the limitations of the dichotomous division of households in the Post Keynesian literature in explaining inequality. The paper proposed a new approach to inequality determination in the Post Keynesian literature, focused on disparities in household wealth structures. The present analysis is one of the first attempts in the Post Keynesian literature to formalize the channels of personal income and wealth distribution in financialized economies through disparities in household wealth ownership (in addition to differences in income sources that are typically analyzed in SFCM). The key contributions of the paper are: (1) to provide a narrative of how institutional changes in the economy and the financial sector have led to greater complexity of household balance sheet structures across the personal distribution of income and wealth; (2) to incorporate conceptualization of a three-class household sector based on wealth structures, rather than income sources alone, into the SFCM framework; (3) to show that the three-class taxonomy of households including the middle class of leveraged homeowners produces higher levels of personal income inequality and macroeconomic instability compared to the conventional dichotomous view of the household sector in the Post Keynesian SFCM literature; and (4) to demonstrate that homeownership has an equalizing effect on the personal distribution of wealth using the SFCM approach. The findings of this paper are important for analyzing inequality in the context of financial sector transformation because they show that explicit consideration of wealth composition and the diversity of leverage and debt accumulation motives is essential in understanding the rising levels of inequality and macroeconomic fragility in financialized economies like the USA.

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## **Appendix**

### ***A.1. Calibration***

Calibration is performed based on three criteria. Firstly, the latest available record common to the largest number of variables is identified with 2014. Secondly, if no data is available, parameter values are taken from previous studies or are assumed by the author based on economic intuition. Thirdly, for securitization parameters, a pre-2007 average is taken to simulate the securitization boom scenario.

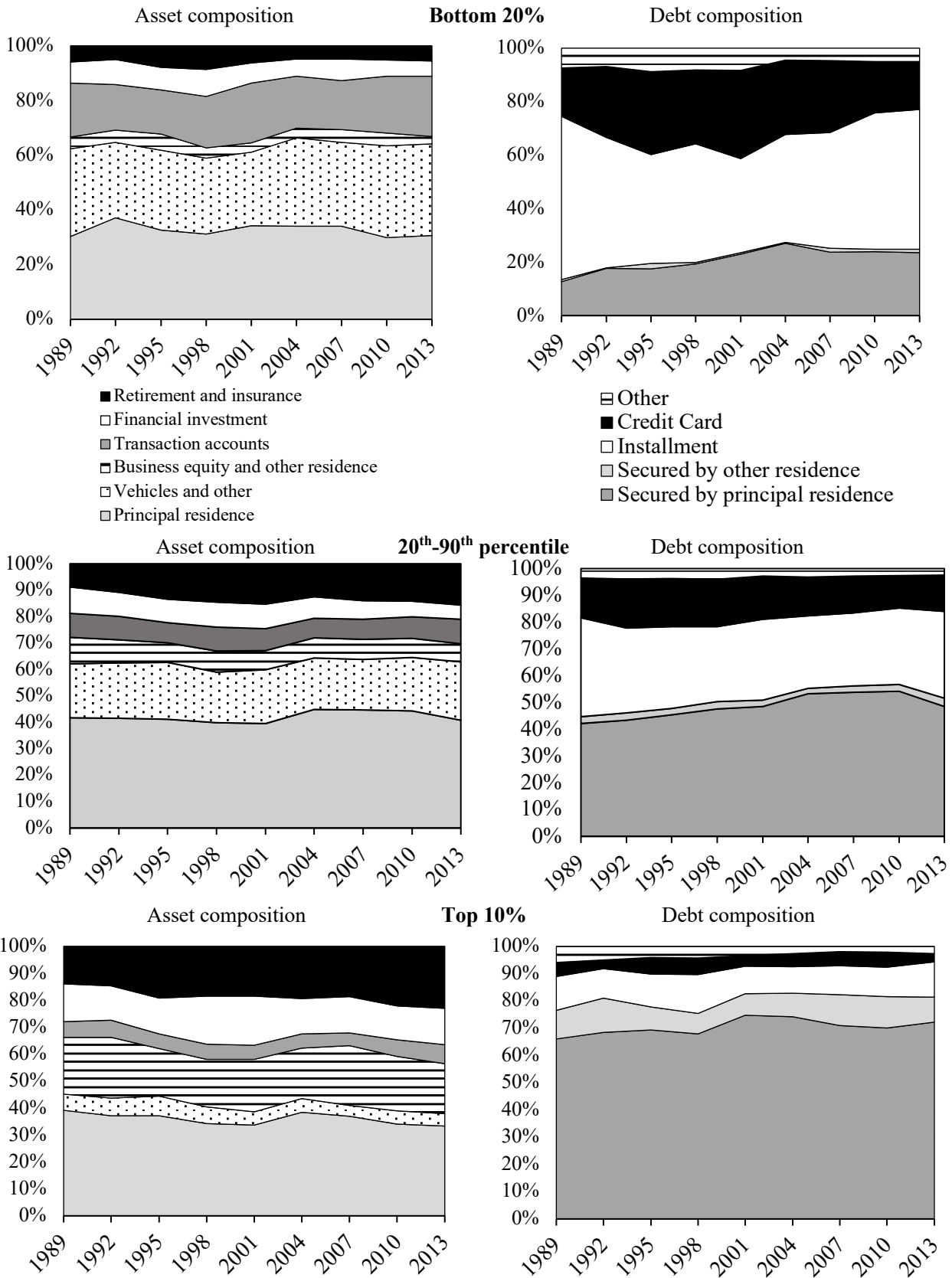
[Table A1 here]

### ***A.2. Initial values for endogenous variables***

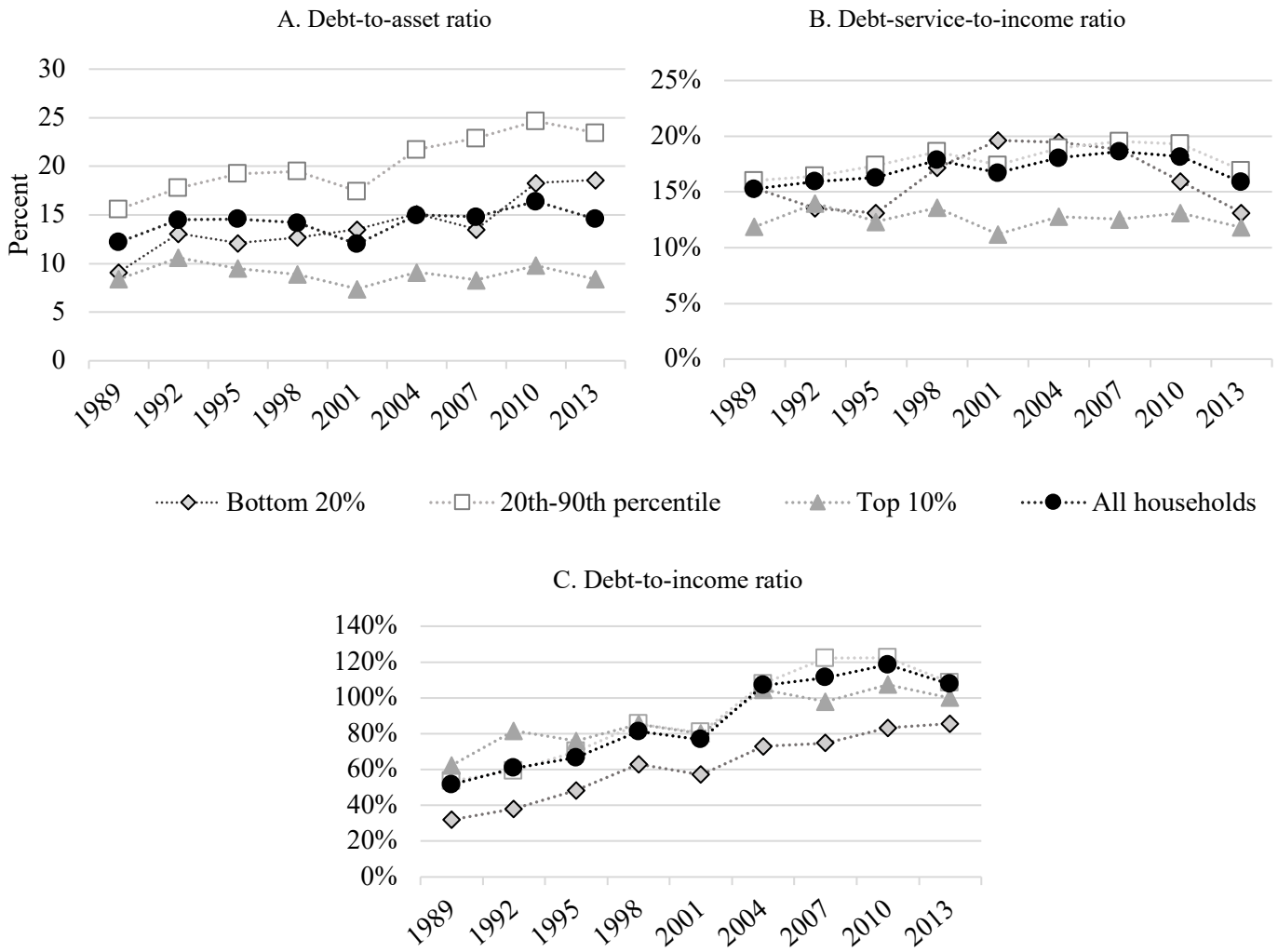
[Table A2 here]



Figure 1. Balance sheet composition by income group, USA 1989-2013 (source: author's calculations based on the U.S. S.C.F.)



**Figure 2.** Leverage by income group, USA 1989-2013 (source: author's calculations based on the U.S. S.C.F.)



**Figure 3.** Distributional channels in the three-class SFC model (source: author's elaboration)

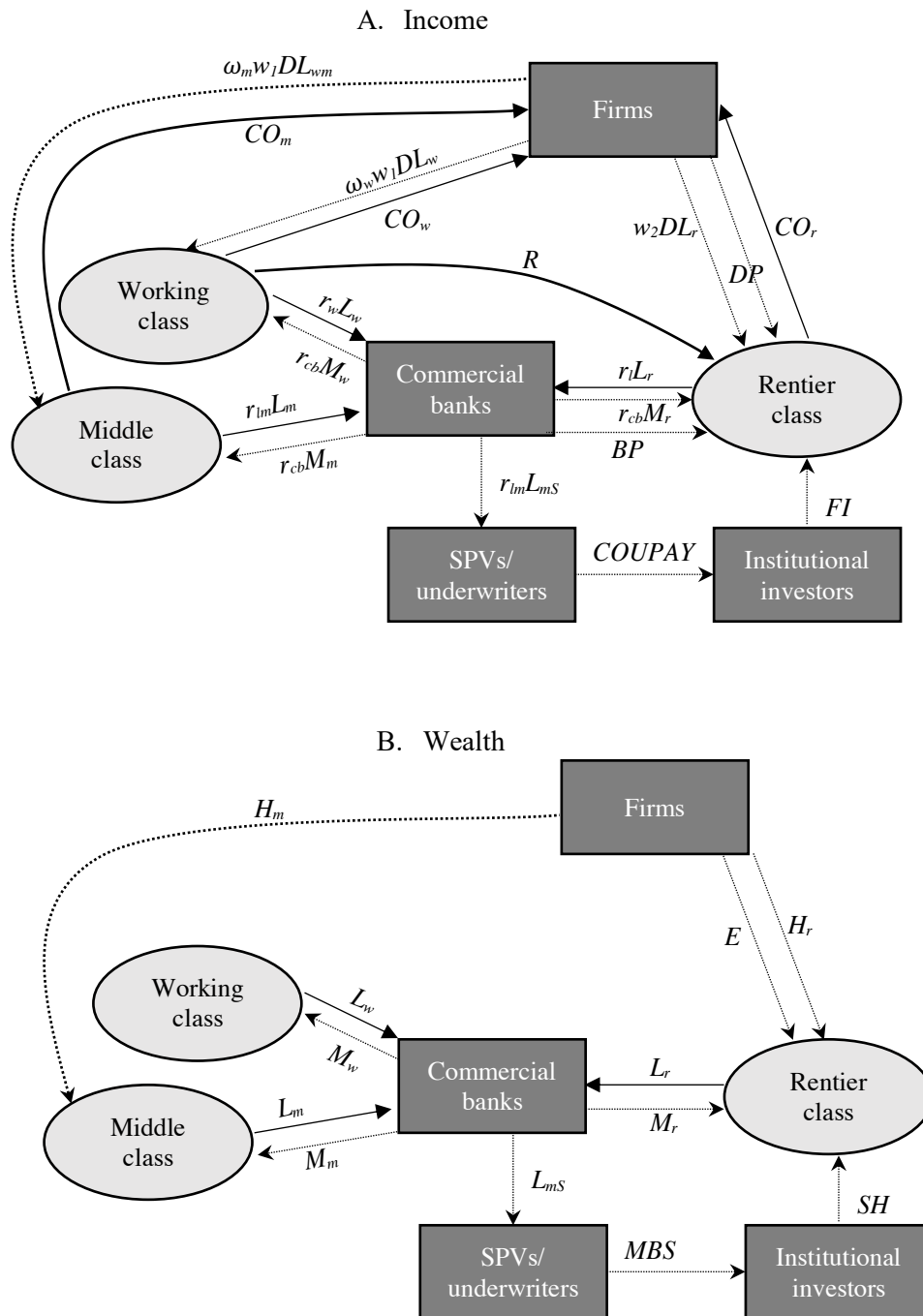


Table 1 Balance sheet matrix (source: author's elaboration)

	Households			Firms	Commercial banks	Underwriters and SPVs	Institutional investors	Sum
	Working class	Middle class	Rentier class					
Deposits	$+M_w$	$+M_m$	$+M_r$		$-M_w - M_m - M_r$			0
Loans	$-L_w$	$-L_m$	$-L_r$		$+L_w + L_m + L_r$	$+L_{ms}$		0
Capital				$+K$				$+K$
Houses		$+H_m$	$+H_r$	$+H$				$+H$
Equity			$+E$	$-E$				0
MBS						$-MBS$	$+MBS$	0
Institutional investors shares			$+SH$				$-SH$	0
Net worth	$V_w$	$V_m$	$V_r$	$V_f$	$V_b$	$V_s$	$V_I$	$V$

Table 2 Transaction flow matrix (source: author's elaboration)

	Households			Firms		Commercial banks		SPVs/underwriters		Institutional investors		Sum
	Working class	Middle class	Rentier class	Current	Capital	Current	Capital	Current	Capital	Current	Capital	
Consumption	$-C_w$	$-C_m$	$-C_r$	$+C_w+C_m+C_r$								0
Investment				$+I$	$-I$							0
Wages	$+\omega_w w_1 DL_{wm}$	$+\omega_m w_1 DL_{wm}$	$+w_2 DL_r$	$-W$								0
Firm profits			$+DP$	$-TP$	$+RP$							0
Bank profits			$+BP$			$-BP$						0
Inst. invest. profits			$+FI$							$-FI$		0
Coupon payments								$-COUPAY$		$+COUPAY$		0
Interest on deposits	$+r_{cb} * M_w$	$+r_{cb} * M_m$	$+r_{cb} * M_r$			$-r_{cb} * M$						0
Interest on loans	$-r_w * L_w$	$-r_{lm} * L_m$	$-r_l * L_r$			$+r_w * L_w + r_l * L_r$ $+r_{lm} * L_{mNS}$		$+r_{lm} * L_{mS}$				0
Rent on housing	$-R$		$+R$									0
$\Delta$ Deposits	$-\Delta M_w$	$-\Delta M_m$	$-\Delta M_r$				$+\Delta M$					0
$\Delta$ Loans	$+\Delta L_w$	$+\Delta L_m$	$+\Delta L_r$				$-\Delta L_w - \Delta L_r$ $-\Delta L_{mNS}$		$-\Delta L_{mS}$			0
$\Delta$ Capital				$+\Delta K$	$-\Delta K$							0
$\Delta$ Houses		$-\Delta H_m$	$-\Delta H_r$		$+\Delta H_m$ $+\Delta H_r$							0
$\Delta$ Equities			$-\Delta E$		$+\Delta E$							0
$\Delta$ MBS								$+\Delta MBS$		$-\Delta MBS$		0
$\Delta$ Inst. inv. shares			$-\Delta SH$							$+\Delta SH$		0
$\Delta$ Net worth	$\Delta V_w$	$\Delta V_m$	$\Delta V_r$	0	$\Delta V_f$	0	$\Delta V_b$	0	$\Delta V_s$	0	$\Delta V_I$	$\Delta V$

Table 3. Simulation analysis results – long-run steady state values (source: author's elaboration)

	Full model	Pure capitalist		No relative consumption	No securitization	No middle class
		<i>With debt</i>	<i>No debt</i>			
<b>Gini index</b>						
Income	0.56	0.54	0.54	0.56	0.56	0.54
Wealth	0.82	0.81	0.81	0.82	0.82	0.86
<b>Debt-service-to-income ratio</b>						
The working class	5.3%	5.3%	5.3%	5.3%	5.2%	5.3%
The middle class	6.9%	6.8%	6.8%	6.8%	7.1%	<i>(omitted)</i>
Rentiers	4.3%	4.3%	<i>(omitted)</i>	4.3%	4.3%	4.4%
<b>Debt-to-asset ratio</b>						
The working class	63.4%	62.7%	62.4%	63.4%	63.4%	63.4%
The middle class	33.8%	33.4%	33.0%	33.4%	33.7%	<i>(omitted)</i>
Rentiers	17.9%	17.9%	<i>(omitted)</i>	17.9%	18.2%	18.1%
<b>Debt-to-income ratio</b>						
The working class	66.4%	65.9%	65.5%	66.4%	66.9%	67.1%
The middle class	112.8%	111.8%	111.6%	110.8%	110.6%	<i>(omitted)</i>
Rentiers	142.9%	141.1%	<i>(omitted)</i>	142.9%	141.5%	143.4%
Whole economy	108.2%	101.6%	29.3%	107.8%	106.6%	100.1%

**Note:** The pure capitalist specification excludes rentier wage; the “no debt” specification additionally excludes rentier debt. Specification with no relative consumption excludes rentier consumption from the target consumption of the middle class. Specification with no securitization excludes the sector of SPVs/underwriters and institutional investors. Specification with no middle class also excludes relative consumption effects and accounts for securitization of loans to the working class.

Table A1 Exogenous parameter values in the stock-flow consistent model

<b>Parameter</b>		<b>Value</b>	<b>Source</b>
$r_{cb}$	Federal funds rate	0.0025	Federal Reserve, USA Dec 2008–Dec 2015
$\alpha$	Premium on the central bank interest rate	0.03	World Bank, USA 2014
$w_0$	Parameters in the working class and the middle class wage rate function	0.34	Dafermos/Papatheodorou 2015
$w_1$		0.24	
$\omega_w$	Share of non-rentier wage bill paid to working class workers	0.4	
$\omega_m$	Share of non-rentier wage bill paid to middle class workers	0.6	
$\varphi$	Full capacity capital-output ratio	0.125	Dafermos/Papatheodorou 2015
$c_1$	Propensity to consume out of income of the working class	0.9	
$c_2$	Propensity to consume out of wealth of the working class	0.2	
$c_3$	Propensity to consume out of income of the middle class	0.75	
$c_4$	Propensity to consume out of wealth of the middle class	0.1	
$c_5$	Propensity to consume out of income of the rentier class	0.6	
$c_6$	Propensity to consume out of wealth of the rentier class	0.05	
$g_{pop}$	Population growth rate	0.007	U.S. Census, 2014
$g_k$	Growth rate of capital	0.025	
$g_\lambda$	Growth rate of labor productivity	0.02	
$s_f$	Profit retention rate of firms	0.32	Dividend payout ratio for S&P500 companies, 2014 (Factset)
$\beta$	Parameter in the loan function of the middle class and rentiers	0.1	Setterfield/Kim 2013
$\beta_w$	Parameter in the loan function of the working class	0.05	

x	Proportion of investment financed by equity issuance	0.045	Dafermos/Papatheodorou 2015
$\lambda_{10} = \lambda_{20} = \lambda_{30}$		0.3333	
$\lambda_{13} = \lambda_{23} = \lambda_{33}$		0.2222	
$\lambda_{11} = \lambda_{21} = \lambda_{31}$	Parameters in the rentier portfolio choice equation	0.1111	Own calculations based on Godley/Lavoie 2005
$\lambda_{12} = \lambda_{22} = \lambda_{32}$		0.1111	
$\lambda_{14} = \lambda_{24} = \lambda_{34}$		0.1111	
$\lambda_{15} = \lambda_{25} = \lambda_{35}$		0.1111	
$\eta$		Emulation parameter	
$\pi_0$	Parameters in the risk premium function	0.03	Sawyer/Passarella 2015
$\pi_1$		0.8	
$\pi_2$	Parameters in the mortgage spread equation	0.1	
$\pi_3$		0.005	
$s_0$	Parameter in the securitization function	0.6	FRB and SIFMA, USA 2006
$\text{spread}_{\text{MBS}}$	MBS spread	0.0121	Bloomberg, USA 2005-2006
$h_0$	Parameter in the house rent payments function	0.01	
$h_1$	Parameter in the middle class housing demand function	1.3	
$h_2$	Parameters in the house supply function	0.05	
$h_3$		0.1	
$h_4$	Parameter in the house price function	0.01	
$h_0$	Parameter in the house rent payments function	0.01	
$\theta_0$	Parameters in the price of inst. inv. shares function	0.01	
$\theta_{10}$	Parameters in the price of MBS function	0.3	
$\theta_{11}$		0.01	
$m_w$	Parameter in the wage premium function	1.6	
$\rho$	Parameter in the wage premium function	0.3	Dafermos/Papatheodorou 2015
h	Parameter in the wage premium function	$0.2/\rho + 0.3$	



Table A2 Initial values for endogenous variables

<b>Variable</b>		<b>Value</b>	<b>Additional information</b>
$N_w$	Number of working class households	128	US Census Bureau, millions, USA 2014
$N_m$	Number of middle class households	160	
$N_r$	Number of rentier households	32	
$Y$	Output	17,000	BEA NIPA Data, bn USD, USA 2014
	Capital-output ratio	3	BEA NIPA Data, USA 2014
$UR_{wm}$	Unemployment rate for working class and middle class workers	0.1	
$M_w$	Value of working class deposits	500	
$M_m$	Value of middle class deposits	1,000	
$M_r$	Value of rentier households' deposits	2,000	
$L_w$	Value of loans to the working class	500	
$L_m$	Value of loans to the middle class	1,000	
$L_r$	Value of loans to rentier households	2,000	
$E$	Value of equities outstanding	14,000	Fed Z.1 Tables, bn USD, USA 2014
$H_m$	Housing demand by the middle class	500	
$H_r$	Housing demand by the rentier class	1,000	
$H$	Housing supply by firms	1,500	
$SH$	Shares of institutional investors	6,600	Fed Z.1 Tables, bn USD, USA 2014
$p_e$	Price of equity	1	
$p_h$	Price of housing	1	
$p_{MBS}$	Price of MBS	1	
$p_s$	Price of institutional investor shares	1	
	Growth rate of the price of equity	0.02	
	Growth rate of the price of housing	0.02	
$r_{im}$	Interest rate on mortgages	0.06	Freddie Mac Data, 30-year fixed-rate mortgage annual average 2000-2008
$\gamma$	Parameter in the housing rent function	0.3	<i>Zeza</i> 2008
$s$	Share of securitized loans	0.6	FRB and SIFMA, USA 2006
$spreadm$	Spread on mortgage rate	0.03	
$\pi$	Risk premium	0.03	