Securitisation, wage stagnation and financial fragility: A stock-flow consistent perspective

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Abstract: Securitisation and wage stagnation have been viewed as two main root causes of the recent financial distress in the global economy. This paper develops a stock-flow consistent framework that allows the investigation of the macroeconomic channels through which securitisation and wage stagnation can jointly affect financial fragility. Particular attention is paid to their role in enhancing a borrowing-induced expansion, a housing boom and an appreciation in the prices of mortgage-backed securities that are of temporary nature. The results from simulation experiments provide support to the view that the combination of risky financial practices and higher inequality can increase the likelihood of instability in a macro system.

Key words: Securitisation; wage stagnation; financial fragility; stock-flow consistent modelling

JEL classifications: E12, E44, D33, G20

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1. Introduction

Securitisation has been at the core of various academic analyses for the causes of the recent financial crisis. Broadly speaking, securitisation is a technique that transforms illiquid assets into liquid tradable instruments. In its more widespread form, this technique allows banks to remove loans from the asset side of their balance sheets and distribute the associated risks to other financial units. Securitisation has, therefore, given rise to the so-called 'originate and distribute' model of banking in which the default risk on granted loans is disconnected from loan originators. By doing so it has played a prominent role in facilitating excessive lending and in supporting speculative financial activities in money manager capitalism, with adverse effects on macroeconomy's financial fragility (see Minsky, 2008; Kregel, 2008; Wray, 2009; Lavoie, 2012-3).

Wage stagnation has been viewed as another main root cause of the recent crisis (Palley, 2010; Lysandrou, 2011; Stockhammer, 2013; van Treeck and Sturn, 2012; Wisman, 2013). It has been argued that the decline in the wage income share of workers in the pre-crisis period was conducive to the excessive rise in household debt, the deterioration of workers' financial position, and the growing tendency of the economies toward financial speculation. Wage stagnation has also been regarded as a factor that put downward pressures on domestic demand, giving rise to unsustainable growth regimes.

In this paper, we employ the recently developed stock-flow consistent (SFC) approach to macroeconomics[1] to integrate into a coherent macro framework the complex mechanisms of securitisation and their interaction with functional income distribution. With the aid of simulations we study how a more widespread adoption of securitisation is likely to increase the financial fragility of an economy. We also examine the mechanisms through which wage stagnation can reinforce this tendency of securitisation to increase the financial fragility. The simulation results of the paper provide support to the view that the combination of risky financial practices and higher inequality can substantially increase the likelihood of financial instability in a macro system.

The paper is structured as follows. Section 2 briefly describes the potential adverse effects of securitisation and wage stagnation on financial fragility. Section 3 develops the stock-flow consistent model. Section 4 presents the simulation experiments. Section 5 concludes.

2. Securitisation and wage stagnation: Their interconnected role in the emergence of financial fragility

The securitisation process begins when commercial banks (the originators) decide to securitise a part of their loans. There are various motives that may induce banks to do so. Among them are the need for liquidity, the minimisation of credit risk and the

[1] See Godley and Lavoie (2007).

reduction of capital requirements (see e.g. Cardone-Riportella *et al*., 2010).[2] The loans decided to be securitised are pooled together and are sold off to administrators. The administrators set up the special purpose vehicles (SPVs) which purchase the pooled loans in exchange of fee income.[3] The SPVs issue asset-backed securities (ABSs) and distribute the cash inflows from loan repayment and interest to the holders of the ABSs. The ABSs are bought by institutional investors (typically with the aid of underwriters that receive fee income) and the proceeds are then used by the SPVs to purchase the loans from banks. Institutional investors finance their investment in ABSs either by repo transactions or shares that are bought by households. Remarkably, various credit enhancement techniques (e.g. excess spread, overcollateralisation, tranching etc.) are utilised to render ABSs attractive for institutional investors.[4] The attractiveness of ABSs can also be enhanced by high grades from credit-rating agencies.

The securitisation process can be a significant source of financial fragility. First, by allowing banks to remove loans from their balance sheets, securitisation disrupts the traditional loan assessment procedure: since banks do not bear the cost of a loan default, they are induced to provide loans without paying sufficient attention to the creditworthiness of their borrowers (see e.g. Kregel, 2008; Tymoigne, 2009A; Cardone-Riportella *et al*., 2010; Acharya and Schnabl, 2010; Lavoie, 2012-3). Excessive loan expansion is also enhanced by the reduction of capital requirements. The overall result can be the provision of loans to borrowers with weak economic status and prospects, rendering them financially fragile.

Second, of particular importance is the fact that mortgage loans are among the main assets that tend to be securitised. This can enhance excessive investment in housing market, generating a virtuous cycle in which easy access to credit increases housing prices, higher housing prices improve the net worth of borrowers, and higher net worth encourages new borrowing, further boosting housing prices. Such a virtuous cycle can be conducive to the development of Ponzi financing schemes since many borrowers may rely on housing price appreciation in order to acquire new loans that are necessary for meeting their debt commitments (see Kregel, 2008; Wray, 2009; Tymoigne, 2010).[5] Ponzi financing schemes can easily collapse as a result of small unexpected shocks. In such a case a virtuous cycle is transformed into a vicious one, which can lead to a widespread loan default, with adverse effects on the stability of the financial system.

[2] Lysandrou (2011) has pointed out that securitisation can also be significantly prompted by the need of institutional investors to find new securities to invest the accumulated wealth of rich households.

[3] This paper focuses on the modern, more widespread, form of securitisation in which securitised loans are removed from the balance sheet of banks. In other forms of securitisation the securitised loans remain within the bank that originates the loans (see Lavoie, 2012-3). Furthermore, there are cases in which the securitisation is utilised for banks' liabilities (Cardone-Riportella *et al*., 2010). For a detailed description of the securitisation process analysed in the current paper see Gorton and Souleles (2007), Stein (2010) and Noeth and Sengupta (2011). See also Tymoigne (2009B) for the various complex forms that the securitisation procedure can take in the real world economies.

[4] Credit enhancement is a mechanism through which the holders of ABSs are protected from default and prepayment risk. For a presentation of the various credit enhancement techniques see Fabozzi and Kothari (2008, ch. 5).

[5] See also Gorton (2009) for the role of housing price appreciation in the refinancing of subprime mortgages.

Third, with the aim to promote investment in ABSs, credit-rating agencies may have a tendency to underestimate in their public assessments the risks associated with the holding of ABSs (see Minsky, 2008; Wray, 2009). Hence, although there is no credible market maker for securities like ABSs,[6] the investors can be prompted by the credit-rating agencies to act as if this was the case. This implies that the ABSs market can easily collapse when there is a widespread liquidation the ramifications of which cannot be countered by the credit enhancement techniques. This possibility is also reinforced by the short-term nature of the funding on which the ABSs market is usually based. In such a case, a sudden stop to loan expansion can occur, endangering the stability of the macroeconomic system.

Under specific circumstances, wage stagnation can reinforce these destabilising forces created by the securitisation process. First, by reducing worker households' income, wage stagnation can contribute to the deterioration of the financial position of workers that have acquired securitised loans. Such a deterioration can have important adverse effects on the ABSs market, since it makes higher the possibility of loan default.

Second, in an economy in which there are changes in income distribution in favour of profit earners, workers may try to maintain their relative consumption standards by demanding more loans (see e.g. Cynamon and Fazzari, 2008; Barba and Pivetti, 2009; Wisman, 2013). Since securitisation tends to decrease banks' credit rationing, its coexistence with wage stagnation can lead to extensive credit expansion which, under certain conditions, can reduce the robustness of households' financial structure.

Third, the redistribution of income from workers to wealthy individuals may increase the propensity of the economy to speculate (Stockhammer, 2013). The rationale behind this argument is that wealthy individuals tend to use the income that is added to their wealth for speculation activities (see also Lysandrou, 2011). So long as the ABSs market is a market in which speculation activities are encouraged, wage stagnation is a factor that can contribute to the further development of this market; and, hence, of its destabilising forces.

Fourth, in wage-led economies wage stagnation can place downward pressures on economic activity, with negative effects on household income and, thus, on household financial fragility. Moreover, in wage-led economies macroeconomic performance can become more dependent on credit availability. Thus, the detrimental macroeconomic effects of a rise in securitisation, which is likely at a first stage to promote credit expansion, but gradually to create the conditions for a sharp credit restriction, may be much more important.

3. The macroeconomic model

The model developed in this section allows us to explore, within a coherent macro framework, the mechanisms through which securitisation and wage stagnation can jointly affect the financial fragility of the macroeconomy. To keep the analysis

[6] A credible market maker is an agent that has the capacity to buy a significant amount of securities whenever there is a cascade of sell orders, ensuring that the investors will invariably liquidate their assets without significant losses (see Davidson, 2008A). Remarkably, in the financial distress of 2007 the underwriters of ABSs tried without success to act as market makers, with significant negative effects on their solvency position (see Davidson, 2008B).

tractable and in line with the purposes of the paper, various simplifying assumptions in the formulation of the securitisation process have been adopted.

First, the securitisation procedure is confined to home mortgages provided to workers. Home mortgages constitute the most prominent securitised asset class in both the US and the European economy (see Loutskina, 2011; ECB, 2011). Furthermore, the link between securitisation and home mortgage provision to workers was particularly intense in the pre-crisis period, especially in the US, and has greatly contributed to the sub-prime crisis.

Second, commercial banks are both originators and administrators in the securitisation process. Thus, in the model they receive fee income from the SPVs when they sell off the securitised loans.

Third, the SPVs and the underwriters are grouped into one single sector. The sector of SPVs-underwriters pays fee income to commercial banks, transforms securitised loans into mortgage-backed securities (MBSs) and distributes coupon and principal payments to institutional investors. It also receives income by investing in treasury bills. Importantly, the SPVs-underwriters are postulated to issue only single class pass-through MBSs.[7] In particular, the principal and the interest payments are 'passed-through' to institutional investors with a part of interest being held to cover the fees provided to commercial banks and to create the excess spread, which is the only credit enhancement technique in the model (note that administration fees for the services of SPVs and underwriters have been assumed away). The excess spread is retained with the purpose to cover a predetermined rate of default on securitised loans. If the actual rate of default is higher than the guaranteed one, the excess losses are transferred to institutional investors.[8] Lastly, note that the complications arising from prepayments are not part of the analysis in the model of this paper.

Fourth, the investment in MBSs is exclusively financed in our model via shares which are purchased by investor households. Investor households in the model are basically wealthy agents that receive income from investment in various assets. They also receive the distributed profits of firms. Therefore, their income is positively affected, all other things being equal, by wage stagnation. This formulation allows us to concentrate on the link between wage stagnation and investment in MBSs.

Nine sectors comprise our macroeconomy: worker households of type I, worker households of type II, firms, commercial banks, SPVs-underwriters, institutional investors, investor households, government and the central bank. Table 1 displays the balance sheet matrix of the model. Table 2 depicts the transactions matrix. The number of households in each household type is constant and all households in the model are postulated to be of the same size and composition. In worker households there is one member that participates in the labour force.

Worker households of type I take out mortgages from commercial banks to partly finance the purchase of houses. A proportion of the housing loans are securitised and

[7] For an analysis of the features of mortgage pass-through securities see Fabozzi (2000, ch. 11).
[8] An alternative assumption would be to postulate that the SPVs-underwriters cover all loan losses so long as their capital is positive. However, this would complicate the model without changing the substance of the underlying mechanism.

become a component of the asset side of the balance sheet of SPVs-underwriters. The later transform these loans into MBSs, which are acquired by institutional investors, who issue shares bought by investor households.[9] Worker households of type II take out only consumer loans and dissave (as in Dutt, 2008). Except shares, investor households hold houses, firms' equities, deposits, treasury bills and money.[10] Firms build houses, invest in productive capital and produce goods. They pay wages to worker households and dividends to investor households. They issue equities and take out loans from commercial banks. Government finances its expenditures by issuing treasury bills, imposing income taxes and using the central bank's profits. Central bank holds treasury bills on the asset side of its balance sheet and high-powered money and advances on the liability side.

In what follows, we present the equations of the model for each sector of the economy. Note that inflation is assumed away and the price of output in the economy is set equal to unity. For simplicity, the expected values of endogenous variables are captured by their lagged values. Unless otherwise indicated, the parameters in the model are positive.

[9] The institutional investors in the model refer basically to mutual and hedge funds. For a description of the features of institutional investors see Davis (2003).

[10] To avoid unnecessary complications, no housing transactions between worker and investor households are considered. Furthermore, we have assumed away any rental transaction.

Table 1. *Balance sheet matrix*

	Worker households - type I	**Worker households - type II**	**Firms**	**Commercial banks**	**SPVs-underwriters**	**Institutional investors**	**Investor households**	**Government**	**Central bank**	**Total**
Houses	$+p_H H_{DW}$		$+p_H HU$				$+p_H H_{DI}$			$+p_H H$
Productive capital			$+K_F$							$+K_F$
High-powered money				$+HPM_B$			$+HPM_{IH}$		$-HPM$	
Consumer loans		$-LC$		$+LC$						
Housing loans	$-LH$			$+LH_{NS}$	$+LH_S$					
Firms' loans			$-LF$	$+LF$						
Treasury bills				$+TB_B$	$+TB_U$	$+TB_{II}$	$+TB_{IH}$	$-TB$	$+TB_{CB}$	
MBSs					$-p_M M$	$+p_M M$				
Deposits				$-D_{IH}$			$+D_{IH}$			
Instit. investors' shares						$-SH$	$+SH$			
Firms' equities			$-p_e e$				$+p_e e$			
Advances				$-A$					$+A$	
Total (net worth)	$+V_{W1}$	$-LC$	$+V_F$	$+K_B$	$+K_U$	$+K_{II}$	$+V_I$	$-TB$	*0*	$+K_F+p_H H$

Table 2. *Transactions matrix*

	Worker households - type I	Worker households - type II	Firms		Commercial banks		SPVs-underwriters		Institutional investors		Investor households	Government	Central bank	Total
			Current	Capital	Current	Capital	Current	Capital	Current	Capital				
Housing investment			$+\Delta H$	$-\Delta H$										0
Investment in prod. capital			$+\Delta K_F$	$-\Delta K_F$										0
Consumption	$-C_{W1}$	$-C_{W2}$	$+C_{W1}+C_{W2}+C_{IH}$								$-C_{IH}$			0
Government expenditures			$+GOV$									$-GOV$		0
Income taxes	$-T_{W1}$	$-T_{W2}$									$-T_{IH}$	$+T_{W1}+T_{W2}+T_{IH}$		0
Wages	$+W_{W1}$	$+W_{W2}$	$-W$											0
Interest on consumer loans		$-i_{LC}LC_{-1}$			$+i_{LC}LC_{-1}$									0
Interest on housing loans	$-i_{LH}LH_{-1}$				$+i_{LH}LH_{NS-1}$		$+i_{LH}LH_{S-1}$							0
Interest on firms' loans			$-i_{LF}LF_{-1}$		$+i_{LF}LF_{-1}$									0
Fees					$+FEE$		$-FEE$							0
Interest on treasury bills					$+i_T TB_{B-1}$		$+i_T TB_{U-1}$		$+i_T TB_{II-1}$		$+i_T TB_{IH-1}$	$-i_T TB_{-1}$	$+i_T TB_{CB-1}$	0
Interest on deposits					$-i_D D_{IH-1}$						$+i_D D_{IH-1}$			0
Interest on advances					$-i_A A_{-1}$								$+i_A A_{-1}$	0
SPVs-underwriters' profits							$-PU$	$+PU_U$	$+COUPON$					0
Instit. investors' profits									$-PI$	$+PI_U$	$+PI_D$			0
Firms' profits			$-PF$	$+PF_U$							$+PF_D$			0
Central bank's profits												$+PB_{CB}$	$-PB_{CB}$	0
Commercial banks' profits					$-PB_B$	$+PB_{BU}$					$+PB_{BD}$			0
Δdeposits						$+\Delta D_{IH}$					$-\Delta D_{IH}$			0
Δequities of firms				$+p_e\Delta e$							$-p_e\Delta e$			0
Δshares of instit. investors										$+\Delta SH$	$-\Delta SH$			0
Δadvances						$+\Delta A$							$-\Delta A$	0
Δhouses	$-p_H\Delta H_{DW}$			$+p_H\Delta H_{DW}+p_H\Delta H_{DI}$							$-p_H\Delta H_{DI}$			0
Δloans for housing	$+\Delta LH$					$-\Delta LH_{NS}$		$-\Delta LH_S$						0
Δloans for consumption		$+\Delta LC$				$-\Delta LC$								0
Δloans to firms				$+\Delta LF$		$-\Delta LF$								0
ΔMBSs								$+p_M\Delta M$		$-p_M\Delta M$				0
Δtreasury bills						$-\Delta TB_B$		$-\Delta TB_U$		$-\Delta TB_{II}$	$-\Delta TB_{IH}$	$+\Delta TB$	$-\Delta TB_{CB}$	0
Δhigh-powered money						$-\Delta HPM_B$					$-\Delta HPM_{IH}$		$+\Delta HPM$	0
Defaulted loans	$+DL$					$-DL_{NS}$		$-DL_{SU}$		$-DL_{SII}$				0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0

3.1 Worker households-type I

$$YD_{W1} = W_{W1} - i_{LH} LH_{-1} - T_{W1} \tag{1}$$

$$YD^{G}_{W1} = YD_{W1} + i_{LH} LH_{-1} \tag{2}$$

$$W_{W1} = \frac{n_1}{n_1 + n_2} W \tag{3}$$

$$C_{W1} = c_{11} YD_{W1-1} + c_{12} V_{W1-1} \tag{4}$$

$$CG_{HW} = H_{DW-1} \Delta p_H \tag{5}$$

$$NLH^{D} = \left(H^{D}_{DW} - H_{DW-1}\right) p_{H-1} + rep_L LH_{-1} + C_{W1} - YD_{W1} \tag{6}$$

$$LH = LH_{-1} + NLH - rep_L LH_{-1} - DL \tag{7}$$

$$DL = \varphi LH_{-1} \tag{8}$$

$$\varphi = \varphi_0 + \varphi_1 BUR_{W1-1} - \varphi_2 k_{H-1} \tag{9}$$

$$BUR_{W1} = \frac{\left(i_{LH} + rep_L\right) LH_{-1}}{YD^{G}_{W1}} \tag{10}$$

$$V_{W1} = V_{W1-1} + YD_{W1} - C_{W1} + CG_{HW} + DL \tag{11}$$

$$LEV_{W1} = \frac{LH}{p_H H_{DW}} \tag{12}$$

$$H^{D}_{DW} = H_{DW-1} + \left(h_{10} - h_{11} BUR_{W1-1} + h_{12} \left(\frac{\Delta p_H}{p_{H-1}} \right)_{-1} \right) H_{DW-1} \tag{13}$$

$$H_{DW} = H_{DW-1} + \frac{YD_{W1} + \Delta LH - C_{W1} + DL}{p_H} \tag{14}$$

Equation (1) defines the net disposable income of type I worker households $\left(YD_{W1}\right)$, which is given by the wages $\left(W_{W1}\right)$ minus the taxes $\left(T_{W1}\right)$ and the interest payments on housing loans; i_{LH} is the interest rate on housing loans and LH is the amount of loans that worker households take out to invest in the housing market. Equation (2) specifies the gross disposable income of type I worker households $\left(YD^{G}_{W1}\right)$. Equation (3) shows that the wage bill of type I worker households is a proportion $\left(n_1/\left(n_1 + n_2\right)\right)$ of the total wage bill $\left(W\right)$ paid by firms to worker households; n_1 and n_2 is the number of worker households of type I and of type II, respectively. It is assumed that the employment rate in the two types of households is the same. Equation (4) gives the consumption of type I worker households $\left(C_{W1}\right)$, which depends on their lagged net disposable income and wealth $\left(V_{W1}\right)$. The capital gains due to changes in the price of houses $\left(CG_{HW}\right)$ are defined in equation (5), where H_{DW} is the demand for houses from worker households of type I and p_H is the price of houses.

In the model there is a distinction between the desired amount of new loans and the actual amount of new loans. As will be explained below, the latter is a proportion of the former, since a part of the new loans demanded by worker households are not provided by banks due to credit rationing. The desired amount of new loans $\left(NLH^{D}\right)$ is given by equation (6) as the sum of worker households' desired investment in the

housing market and the repayment of outstanding loans, minus their saving; H_{DW}^{D} is the desired demand for houses and rep_L is the loan repayment ratio. Note that the lagged price of houses is used by households as a proxy for the current level of prices in the procedure of estimating the amount of money that they need to borrow from banks to acquire their desired houses.

The change in housing loans is depicted by equation (7) where NLH stands for the actual amount of new housing loans. The model explicitly introduces the possibility of default on the part of type I worker households. The amount of defaulted loans (DL) is defined in equation (8). The rate of default (φ) is a positive function of the lagged burden of debt (BUR_{W1}) of worker households and a negative function of the lagged degree of credit availability for housing loans (k_H) (see equation (9)). The burden of debt is defined, according to equation (10), as the ratio of the debt commitments of worker households to their gross disposable income.[11] It is assumed that, when the burden of debt of this sector increases, there is a higher likelihood that more worker households (at the unit level) will face liquidity problems. Thus, at the aggregate level, a higher burden of debt translates into a higher rate of default. Furthermore, the liquidity problems are reinforced when the degree of credit availability by banks declines, that is when there is a rise in the proportion of new housing loans that is credit rationed (for the exact definition of the degree of credit availability see equation (51) below). A lower credit availability implies that more households cannot attain their desired liquidity. This is important because the liquidity created by new loans can be partially used for the repayment of existing debt. Accordingly, the higher the unwillingness of banks to satisfy the demand for new loans the higher the rate of default.

Equation (11) shows worker households' wealth. Defaulted loans exert a positive impact on their wealth.[12] Equation (12) defines the leverage of worker households (LEV_{W1}), expressed as the ratio of housing loans to the value of houses. In our model this variable plays a crucial role in the credit availability from commercial banks. Equation (13) shows worker households' desired demand for houses. It is assumed that this demand relies negatively on the lagged households' burden of debt and positively on the lagged growth rate of housing prices.[13] Equation (14) defines the change in the demand for houses as the difference between the sum of the change of housing loans and the amount of defaulted loans minus saving, divided by the price of houses. The higher the housing loans the larger, *ceteris paribus*, the demand for houses.

3.2 Worker households-type II

$$YD_{W2} = W_{W2} - i_{LC} LC_{-1} - T_{W2} \tag{15}$$

$$YD_{W2}^{G} = YD_{W2} + i_{LC} LC_{-1} \tag{16}$$

[11] See also van Treeck (2009) and Dafermos (2012).

[12] For simplicity, we assume that there is no bankruptcy in the economy. See Charpe *et al*. (2011, ch. 9) for a SFC model in which both bankruptcy and default are explicitly considered.

[13] See Zezza (2008) for a similar formula and Andre (2010) for some empirical evidence regarding the main drivers of housing demand.

$$W_{W2} = \frac{n_2}{n_1 + n_2} W \tag{17}$$

$$C_{W2} = YD_{W2} + LC - LC_{-1} \tag{18}$$

$$CA^D_{W2} = \xi \frac{C_{IH-1}}{n_3} \tag{19}$$

$$C^D_{W2} = n_2 CA^D_{W2} \tag{20}$$

$$NLC^D = C^D_{W2} + rep_L LC_{-1} - YD_{W2} \tag{21}$$

$$LC = LC_{-1} + NLC - rep_L LC_{-1} \tag{22}$$

$$BUR_{W2} = \frac{(i_{LC} + rep_L) LC_{-1}}{YD^G_{W2}} \tag{23}$$

Equation (15) gives the net disposable income of type II worker households (YD_{W2}), which is equal to wages (W_{W2}) minus the sum of taxes (T_{W2}) and the interest payments on consumer loans; i_{LC} is the interest rate on consumer loans and LC is the amount of consumer loans. Equation (16) defines the gross disposable income of type II worker households (YD^G_{W2}). Their wages are a proportion $(n_2/(n_1 + n_2))$ of the total wage bill paid by firms.

Equation (18) gives the consumption of type II worker households (C_{W2}). These households consume all their net disposable income and take out consumer loans to finance part of their consumption expenditures. The amount of loans demanded by type II worker households for consumption purposes depends on their desired consumption. Following Cynamon and Fazzari (2008), Barba and Pivetti (2009) and Wisman (2013), it is assumed that these workers try to emulate the consumption of their reference group to maintain their relative social status. In our model, investor households constitute the reference group for type II worker households. Thus, according to equation (19), the average desired consumption of type II worker households (CA^D_{W2}) is a proportion $(\xi < 1)$ of the average consumption of investor households; (C_{IH}) is the aggregate consumption of investor households and n_3 is the number of investor households.[14] The aggregate desired consumption of type II worker households (C^D_{W2}) is defined in equation (20). Note that wage stagnation increases, *ceteris paribus*, the desired aggregate consumption of type II worker households, since it positively affects the income and the consumption of investor households.

The desired amount of new loans (NLC^D) is equal to the sum of the desired amount of consumption and the repayment of outstanding loans, minus the net disposable income of type II worker households (see equation (21)). The amount of consumer loans is given by equation (22), where NLC is the actual amount of consumer loans. As in housing loans, the presence of credit rationing implies that the actual amount of new consumer loans is a fraction of the desired amount of new consumer loans. Notice that when the amount of amortised loans is higher than the amount of new loans, the change in loans is negative. In this case, consumption expenditures are lower than the

[14] See Dutt (2008) for a similar formula.

net disposable income (see equation (18)). To avoid unnecessary complications, it is postulated that there is no default on consumer loans. The burden of debt of worker households-type II (BUR_{W2}) is equal to the ratio of households' debt commitments to their gross disposable income (see equation (23)).

3.3 Firms

$$Y = C_{W1} + C_{W2} + C_{IH} + INV + GOV + \Delta H \tag{24}$$

$$INV = (a_0 + a_1 u_{-1} + a_2 r_{F-1}) K_{F-1} \tag{25}$$

$$u = \frac{Y}{vK_F} \tag{26}$$

$$r_F = \frac{PF_U}{K_F} \tag{27}$$

$$K_F = K_{F-1} + INV \tag{28}$$

$$PF = Y - W - i_{LF} LF_{-1} \tag{29}$$

$$W = s_W Y_{-1} \tag{30}$$

$$PF_U = s_F PF_{-1} \tag{31}$$

$$PF_D = PF - PF_U \tag{32}$$

$$e = e_{-1} + \frac{xINV_{-1}}{p_e} \tag{33}$$

$$\Delta LF = INV + \Delta H - PF_U - p_H \Delta H_{DW} - p_H \Delta H_{DI} - p_e \Delta e \tag{34}$$

$$H = H_{-1} + \left(h_{21} \frac{H_{DW} + H_{DI}}{H} + h_{22} \frac{\Delta p_H}{p_{H-1}} \right) H_{-1} \tag{35}$$

$$\Delta HU = \Delta H - \Delta H_{DW} - \Delta H_{DI} \tag{36}$$

$$p_H = p_{H-1} + h_3 \left(\left(\frac{\Delta (H_{DW} + H_{DI})}{H_{DW-1} + H_{DI-1}} \right)_{-1} - \left(\frac{\Delta H}{H_{-1}} \right)_{-1} \right) p_{H-1} \tag{37}$$

Equation (24) shows that the output of the economy (Y) is equal to the sum of worker households' consumption, investor households' consumption, investment in productive capital (INV), investment in housing (ΔH) and government expenditures (GOV).[15] Equation (25) shows that investment in productive capital is affected by the lagged rate of capacity utilisation (u) and the lagged firms' rate of undistributed profits (r_F). Capacity utilisation, firms' rate of undistributed profits and productive capital (K_F) are given in equations (26), (27) and (28) respectively; v is the potential output to capital ratio. Equation (29) defines firms' profits (PF). It has been postulated that firms take out loans (LF) and, hence, they pay interest income; i_{LF} is the interest on firms' loans. Wages are determined as a fixed proportion of the lagged output produced (see equation (30)); s_W is income share of wages. Firms keep a part

[15] For simplicity, the price of new houses is assumed to be equal to the general price level (recall that the latter is equal to unity). However, the price of existing houses in the housing market is different and not associated with the general price level. See Zezza (2008) for a similar assumption.

(s_F) of their profits (PF_U) while the rest profits (PF_D) are distributed to investor households (see equations (31) and (32)). A proportion (x) of firms' investment expenditures are financed by issuing equities (see equation (33)); e is the number of firms' equities and p_e is their price. Equation (34) suggests that firms' loans act as a residual in the budget constraint of firms; H_{DI} is the demand for houses from investor households.

The housing investment is positively affected by the ratio of demanded to existing houses as well as by the growth rate of housing prices (see equation (35)).[16] Equation (36) defines the change in unsold houses (HU) as the difference between the change in existing and the change in demanded houses. The growth rate of the price of houses is positively linked with the difference between the growth rate of the demanded houses and the growth rate of the existing houses (see equation (37)).[17]

3.4 Commercial banks

$$s = s_0 - s_1\left(y_{M-1} - y_M^T\right) \tag{38}$$
$$LH_S = sLH \tag{39}$$
$$LH_{NS} = (1-s)LH \tag{40}$$
$$PB_B = i_{LH}LH_{NS-1} + i_{LC}LC_{-1} + i_{LF}LF_{-1} + i_T TB_{B-1} + FEE - i_D D_{IH-1} - i_A A_{-1} \tag{41}$$
$$i_{LH} = i_A + x_1 \tag{42}$$
$$i_{LC} = i_A + x_2 \tag{43}$$
$$i_{LF} = i_A + x_3 \tag{44}$$
$$i_D = i_A - x_4 \tag{45}$$
$$K_B = K_{B-1} + PB_{BU} - DL_{NS} \tag{46}$$
$$DL_{NS} = \varphi LH_{NS-1} \tag{47}$$
$$PB_{BU} = s_B PB_{B-1} \tag{48}$$
$$PB_{BD} = PB_B - PB_{BU} \tag{49}$$
$$NLH = k_H NLH^D \tag{50}$$
$$k_H = k_{H0} - k_{H1}LEV_{W1-1} + k_{H2}\left(CAR_{-1} - CAR^T\right) - k_{H3}BUR_{W1-1} - k_{H4}\phi \tag{51}$$
$$NLC = k_C NLC^D \tag{52}$$
$$k_C = k_{C0} + k_{C1}\left(CAR_{-1} - CAR^T\right) - k_{C2}BUR_{W2-1} \tag{53}$$
$$CAR = \frac{K_B}{LH_{NS} + LC + LF} \tag{54}$$
$$HPM_B = h_B D_{IH} \tag{55}$$
$$TB_{BN} = K_B + D_{IH} - LH_{NS} - LC - LF - HPM_B \tag{56}$$
$$A_N = LH_{NS} + LC + LF + HPM_B - K_B - D_{IH} \tag{57}$$
$$A = A_N, \text{ iff } A_N > 0; \text{ otherwise } A = 0 \tag{58}$$
$$TB_B = TB_{BN}, \text{ iff } TB_{BN} > 0; \text{ otherwise } TB_B = 0 \tag{59}$$

[16] For the role of housing price appreciation in the supply of houses see e.g. Andre (2010).
[17] This formulation relies on Eatwell *et al*. (2008).

Equation (38) defines the proportion (s) of loans that are securitised. The first term (s_0) captures some exogenous factors related with the institutional structure in the economy and the regulation with regard to the financial activities. The second term reflects the fact that there is a target yield on MBSs and that the supply of MBSs partially adjusts to their demand so as for the actual yield to remain close to the target one.[18] In particular, when the actual yield (y_M), which is inversely linked with the price of MBSs (see equation (79)), is lower (higher) than the target yield (y_M^T), the level of securitisation increases (decreases) and so does the supply of MBSs. This places downward (upward) pressures on the price of MBSs, increasing (decreasing) the actual yield. Equation (39) gives the amount of securitised loans, which are transferred to the balance sheet of SPVs-underwriters (LH_S). Equation (40) shows the amount of non securitised loans, which are retained in the balance sheet of commercial banks (LH_{NS}).

The profits of commercial banks (PB_B) are equal to the sum of the interest on non securitised loans, the interest on consumer loans, the interest on firms' loans, the interest on treasury bills (TB_B) and the administrative fees (FEE) due to securitised loans, minus the interest on deposits and the advances from the central bank (A) (see equation (41)); i_T is the interest on treasury bills, D_{IH} are the deposits of investor households and i_D is the interest on deposits. The interest rates on loans and deposits are set with reference to the interest rate of the central bank (i_A). Note that, for simplicity, x_1, x_2, x_3, x_4 are deemed exogenous. According to equation (46), the change in the capital of commercial banks (K_B) equals their undistributed profits minus the amount of defaulted loans (see also Godley and Lavoie, 2007, ch. 11; Charpe *et al*. 2011, ch. 9). The amount of defaulted loans (DL_{NS}) is a proportion (φ) of LH_{NS} (equation (47)). Equations (48) and (49) show that commercial banks retain a proportion (s_B) of their profits (PB_{BU}) while the rest profits are distributed (PB_{BD}) to the investor households who are the owners of the commercial banks (for a similar assumption see Godley and Lavoie, 2007, ch.11).

Commercial banks apply credit rationing when they grant loans to worker households-type I and to worker households-type II. This is captured in our model by making a distinction between the desired amount of new loans demanded by worker households and the effective amount of new loans; the latter represents the amount of new loans that are ultimately provided after imposing the credit rationing procedure. Equation (50) gives the effective amount of new housing loans as a proportion of the desired amount of new housing loans.[19] The variable k_H captures the degree of credit availability for housing loans $(0 \le k_H \le 1)$. According to equation (51), this depends negatively on the lagged leverage ratio of worker households-type I, positively on the lagged actual capital adequacy ratio (CAR) of commercial banks relative to the target capital adequacy ratio (CAR^T), and negatively on the burden of debt of worker

[18] This mechanism draws on Lysandrou (2014).
[19] See Le Heron and Mouakil (2008) and Dafermos (2012) for similar formulations.

households of type I and the default rate. The target capital adequacy ratio is determined by the regulatory authority and the actual capital adequacy ratio is defined as the ratio of banks' capital to the sum of non-securitised loans, consumer loans and firms' loans (equation (54)).[20]

Equation (52) defines the effective amount of consumer loans as a proportion (k_C) of the desired amount of consumer loans $(0 \le k_C \le 1)$. According to equation (53), the degree of credit availability for consumer loans is a positive function of the difference between the lagged capital adequacy ratio and the target capital adequacy ratio and negatively on the burden of debt of type II worker households. Importantly, our formulation implies that the higher the proportion of securitised loans the higher, *ceteris paribus*, the actual capital adequacy ratio and the lower, thereby, the credit rationing. In this way, securitisation can be conducive to higher investment in housing market and larger consumption expenditures by type II worker households.

Equation (55) shows that the commercial banks hold a proportion of deposits in the form of cash (HPM_B), based on the reserve requirement ratio (h_B) determined by the central bank. Banks hold treasury bills when the sum of capital and deposits is higher than the sum of loans and cash. Otherwise, the commercial banks take advances from the central bank and hold no treasury bills. This fact is captured by equations (56)-(59).

3.5 SPVs-underwriters

$$COUPON = coupM_{-1} \tag{60}$$
$$coup = i_{LH} - x_5 \tag{61}$$
$$FEE = feLH_{S-1} \tag{62}$$
$$ES = i_{LH} LH_{S-1} - COUPON - FEE \tag{63}$$
$$PU = i_{LH} LH_{S-1} + i_T TB_{U-1} - FEE \tag{64}$$
$$PU_U = i_T TB_{U-1} + ES \tag{65}$$
$$M = M_{-1} + \Delta LH_S + DL_{SU} \tag{66}$$
$$DL_S = \varphi LH_{S-1} \tag{67}$$
$$DL_{SU} = DL_S \text{, iff } \varphi < \varphi^g \text{; otherwise } DL_{SU} = \varphi^g LH_{S-1} \tag{68}$$
$$TB_U = TB_{U-1} + PU_U + p_M \Delta M - \Delta M \tag{69}$$
$$K_U = K_{U-1} + PU_U - DL_{SU} - CG_M \tag{70}$$
$$CG_M = M_{-1} \Delta p_M \tag{71}$$

Equation (60) defines the coupon payment $(COUPON)$ provided by SPVs-underwriters to institutional investors; M is the amount of MBSs. The coupon rate $(coup)$ is defined according to the interest rate on housing loans minus a specific spread (x_5), which is deemed to be high enough to cover the guaranteed loan losses and the administrative fees (equation (61)). Equation (62) determines the amount of

[20] Following Godley and Lavoie (2007, ch. 11), housing and consumption loans are assigned a 100% risky weight, while cash and treasury bills are assumed to carry a 0% weight.

administrative fees that the SPVs-underwriters provide to the commercial banks. Administrative fees are a proportion (fe) of the loans that are securitised. The excess spread (ES) is determined by subtracting administrative fees and coupon payments from interest payments (see equation (63)). Equation (64) gives the total profits of SPVs-underwriters (PU) and equation (65) defines the profits that are retained (PU_U); TB_U denotes the amount of treasury bills held by SPVs-underwriters.

Equation (66) indicates that the change in the amount of MBSs equals the change in securitised loans plus the amount of defaulted securitised loans (DL_{SU}) that are covered by SPVs-underwriters. Two points are in order. First, it is postulated that the commercial banks sell mortgage loans to the SPVs-underwriters at a price equal to \$1 while the face value of an MBS is also \$1. However, the SPVs-underwriters may sell the mortgages at price different than \$1 (this is the price of the MBSs, p_M, which can only accidentally be equal to 1). Second, equations (67)-(68) suggest that the principal repayments are distributed to institutional investors without being affected by defaults on securitised loans (DL_S) in so far as the latter are lower than those guaranteed by the SPVs-underwriters. If $DL_S > DL_{SU}$ the principal repayments to MBSs holders decline by $(\varphi - \varphi^g)LH_{S-1}$; φ^g is the guaranteed rate of default by SPVs-underwriters.[21] Note that in this case there is also a reduction in the coupon payments.

Equation (69) indicates that treasury bills act as a residual in the portfolio choice of SPVs-underwriters. The change in the capital of SPVs-underwriters (K_U) is defined in equation (70). Equation (71) specifies the capital gains on MBSs (CG_M).

3.6 Institutional investors

$$PI = COUPON + i_T TB_{II-1} \tag{72}$$

$$PI_U = s_I PI_{-1} \tag{73}$$

$$PI_D = PI - PI_U \tag{74}$$

$$K_{II} = K_{II-1} + PI_U + CG_M - DL_{SII} \tag{75}$$

$$DL_{SII} = (\varphi - \varphi^g)LH_{S-1}, \text{ iff } \varphi > \varphi^g; \text{ otherwise } DL_{SII} = 0 \tag{76}$$

$$p_M M = (\gamma_{10} + \gamma_{11} r_{M-1} + \gamma_{12} i_T)(K_{II-1} + SH_{-1}) \tag{77}$$

$$TB_{II} = (\gamma_{20} + \gamma_{21} r_{M-1} + \gamma_{22} i_T)(K_{II-1} + SH_{-1}) \tag{78a}$$

$$TB_{II} = K_{II} + SH - p_M M \tag{78}$$

$$y_M = \frac{COUPON}{p_{M-1} M_{-1}} \tag{79}$$

$$r_M = y_M + \frac{CG_M}{p_{M-1} M_{-1}} \tag{80}$$

[21] This can be shown by combining equations (7), (39), (66), (67) and (68), which yields: $\Delta M = sNLH - rep_L LH_{S-1} - (\varphi - \varphi^g)LH_{S-1}$.

The institutional investors get revenues from holding MBSs and treasury bills. Their profits (PI) are given by equation (72); TB_{II} is the amount of treasury bills held by institutional investors. A small part of their profits are retained (PI_U); s_I denotes the retention ratio (see equation (73)). The rest profits (PI_D) are distributed to investor households who hold the shares issued by institutional investors (equation (74)). The shares bought by investor households constitute the main source of fund of institutional investors' investments. For simplicity, it is assumed that the shares issued by institutional investors have a stable price equal to \$1 per share.[22]

Equation (75) defines the change in the capital of institutional investors (K_{II}); DL_{SII} denotes the amount of defaulted loans that are not guaranteed by SPVs-institutional investors (see equation (76)). The portfolio choice of institutional investors is captured by equations (77) and (78a). In our formulation, Godley's (1999) imperfect asset substitutability framework has been adopted. Therefore, the expected gross wealth of institutional investors (which is equal to $K_{II-1} + SH_{-1}$) is allocated between treasury bills and MBS according to the respective rates of return; SH are the shares of institutional investors.[23] Note that equation (78a) is replaced in the computer model by equation (78), with treasury bills acting as a buffer. The yield on MBSs is given by the ratio of the coupon payments to the lagged value of MBSs (equation (79)). The total rate of return on MBSs (r_M), defined in equation (80), consists of two components: the yield and the capital gain on MBSs.

3.7 Investor households

$$YT_I = i_T TB_{IH-1} + i_D D_{IH-1} + PI_D + PF_D + PB_{BD} \quad (81)$$

$$YD_I = YT_I - T_{IH} \quad (82)$$

$$V_I = V_{I-1} + YD_I - C_{IH} + CG_e + CG_{HI} \quad (83)$$

$$V_{IN} = V_I - HPM_{IH} \quad (84)$$

$$HPM_{IH} = h_I C_{IH} \quad (85)$$

$$C_{IH} = c_{31} YD_{I-1} + c_{32} V_{I-1} \quad (86)$$

$$CG_e = e_{-1} \Delta p_e \quad (87)$$

$$CG_{HI} = H_{DI-1} \Delta p_H \quad (88)$$

$$\frac{SH}{V_{IN-1}} = \lambda_{10} + \lambda_{11} r_{S-1} + \lambda_{12} i_T + \lambda_{13} r_{e-1} + \lambda_{14} r_{H-1} + \lambda_{15} i_D + \lambda_{16} \frac{YD_{I-1}}{V_{IN-1}} \quad (89)$$

$$\frac{TB_{IH}}{V_{IN-1}} = \lambda_{20} + \lambda_{21} r_{S-1} + \lambda_{22} i_T + \lambda_{23} r_{e-1} + \lambda_{24} r_{H-1} + \lambda_{25} i_D + \lambda_{26} \frac{YD_{I-1}}{V_{IN-1}} \quad (90)$$

$$\frac{p_e e}{V_{IN-1}} = \lambda_{30} + \lambda_{31} r_{S-1} + \lambda_{32} i_T + \lambda_{33} r_{e-1} + \lambda_{34} r_{H-1} + \lambda_{35} i_D + \lambda_{36} \frac{YD_{I-1}}{V_{IN-1}} \quad (91)$$

[22] Unlike our abstraction, in practice the price of institutional investors' shares can be different than unity due to significant changes in institutional investors' net asset value or due to adverse expectations on the part of borrowers regarding the safety of their investment (see e.g. Macey, 2011; Duygan-Bump *et al*., 2013). However, in normal times this price is close to unity.

[23] The parameters in the portfolio choice equations satisfy the horizontal, vertical and symmetry adding-up conditions. Thus, some of them are negative.

$$\frac{p_H H_{DI}}{V_{IN-1}} = \lambda_{40} + \lambda_{41} r_{S-1} + \lambda_{42} i_T + \lambda_{43} r_{e-1} + \lambda_{44} r_{H-1} + \lambda_{45} i_D + \lambda_{46} \frac{YD_{I-1}}{V_{IN-1}} \quad (92)$$

$$\frac{D_{IH}}{V_{IN-1}} = \lambda_{50} + \lambda_{51} r_{S-1} + \lambda_{52} i_T + \lambda_{53} r_{e-1} + \lambda_{54} r_{H-1} + \lambda_{55} i_D + \lambda_{56} \frac{YD_{I-1}}{V_{IN-1}} \quad (93a)$$

$$D_{IH} = V_{IN} - SH - TB_{IH} - p_e e - p_H H_{DI} \quad (93)$$

$$r_S = \frac{PI_D}{SH_{-1}} \quad (94)$$

$$r_e = \frac{PF_D + CG_e}{p_{e-1} e_{-1}} \quad (95)$$

$$r_H = \frac{CG_{HI}}{p_{H-1} H_{DI-1}} \quad (96)$$

Equation (81) defines the before taxes income of investor households (YT_I). The disposable income of investor households (YD_I) is given by equation (82). Note that TB_{IH} denotes the treasury bills held by investor households and T_{IH} stands for their income taxes. Equations (83) and (84) describe, respectively, the wealth of investor households (V_I) and their wealth net of cash (V_{IN}). The high-powered money (HPM_{IH}) is, according to equation (85) a proportion (h_I) of their consumption. Equation (86) gives the consumption of investor households, which depends on their expected disposable income and expected wealth. Equations (87) and (88) define, respectively, the capital gains on firms' equity (CG_e) and houses (CG_{HI}).

Investor households allocate their expected wealth (net of cash) between deposits, treasury bills, houses, firms' equities and institutional investors' equities. As in the portfolio choice of institutional investors, Godley's (1999) imperfect asset substitutability framework is adopted (see equations (89-93a)).[24] Note that equation (93a) is replaced in the computer model by equation (93), with deposits acting as a buffer. Equations (94), (95) and (96) define, respectively, the rate of return on institutional investors' equity (r_S), the rate of return on firms' equity (r_e) and the rate of return on houses (r_H).

For the purposes of our analysis, two points are worth highlighting. First, a decline in the distributed profits of institutional investors (e.g. due to excessive mortgage defaults) reduces investor households' willingness to invest in institutional investors' shares with adverse effects on the MBSs market. Second, a fall in the wage income share exerts, *ceteris paribus*, a positive impact on the income of investor households and thereby on their wealth. Hence, since a proportion of investor households' wealth is held in the form of institutional investors' equities, wage stagnation can enhance investment in MBSs, bolstering mortgage securitisation.

[24] Again the parameters in the portfolio choice equations satisfy the horizontal, vertical and symmetry adding-up constraints.

3.8 Government

$$TB = TB_{-1} + GOV - T_{W1} - T_{W2} - T_{IH} + i_T TB_{-1} - PB_{CB} \quad (97)$$

$$GOV = GOV_{-1}(1+g) \quad (98)$$

$$T_{W1} = \tau_W W_{W1-1} \quad (99)$$

$$T_{W2} = \tau_W W_{W2-1} \quad (100)$$

$$T_{IH} = \tau_{IH} YT_{I-1} \quad (101)$$

$$i_T = i_A \quad (102)$$

Equation (97) gives the amount of treasury bills issued by the government (TB). As equation (98) shows, the government expenditures grow at a constant rate (g). Equations (99)-(101) define income taxes. Equation (102) states that the interest rate on treasury bills equals the interest rate of the central bank. The latter is set exogenously.

3.9 Central bank

$$PB_{CB} = i_T TB_{CB-1} + i_A A_{-1} \quad (103)$$

$$HPM = HPM_{IH} + HPM_B \quad (104)$$

$$TB_{CB} = HPM - A \quad (105)$$

$$TB_{CB} = TB - TB_{IH} - TB_B - TB_{II} - TB_U \quad (106)$$

Equation (103) describes the profits of the central bank (PB_{CB}). The high-powered money provided by the central bank (HPM) is depicted by equation (104). Equation (105) gives the amount of treasury bills held by the central bank (TB_{CB}). The redundant equation of the model (equation (106)) indicates that the central bank is the residual purchaser of treasury bills.

4. Simulation experiments

The complexity of the model presented in section 3 precludes analytical solutions. Hence, the model was solved numerically using reasonable values for its parameters. Steady-state solutions were then found that served as a basis for our simulation experiments in which exogenous shocks were imposed on the model.[25]

The first experiment simulates the effects of some exogenous developments that increase the degree of securitisation in the economy. In particular, we consider a rise in the exogenous component that determines the proportion of mortgages securitised by banks (s_0). This rise is postulated to stem from changes in the institutional

[25] Note that the methodology used here (and is widely adopted in the related literature) has the drawback that it explores the behaviour of the model only close to specific plausible steady states. Therefore, the behaviour of the model around other possible steady states is not analysed. This is the cost of developing a model that is complex enough to capture the joint macroeconomic effects of securitisation and wage stagnation. It should, however, be pointed out that an advantage of the employed methodology is that it isolates the effects that stem from the exogenous changes under investigation.

structure of the banking sector that prompt banks to engage more intensively in securitisation activities. An additional development is the reallocation of investor households' wealth from bank deposits to institutional investors' shares (i.e. λ_{10} increases). This reallocation reflects investor households' willingness to increase the yield of their portfolio taking advantage of the higher return provided by institutional investors. It may also be prompted by a more favourable evaluation of the quality of MBSs by the credit rating agencies. Note that the reallocation enhances the demand for MBSs, putting downward pressures on their yield. This, in turn, increases the proportion of the mortgages that are securitised.

Figure 1 shows the main effects of these shocks.[26] The increase in the proportion of mortgages that are securitised brings about a rise in the capital adequacy ratio of commercial banks, inducing them to decrease their credit rationing (Figure 1a). Accordingly, the amount of new mortgages and consumer loans becomes higher. The rise in mortgages causes an increase in the demand for houses from worker households of type I that leads to: (i) a housing price appreciation (Figure 1b) that has feedback enhancing effects on credit availability since it tends to reduce the leverage of households;[27] and (ii) an increase in the supply of houses. The rise in consumer loans boosts consumer spending. These developments increase the output of the economy (Figure 1d). Remarkably, the output is also positively affected by the rise in the consumption of investor households, as a result of the income and wealth effects that stem from the expansion of the MBSs market: Figure 1b indicates that there is a rise in the price of MBSs after a passing initial decline.

Furthermore, credit expansion increases the debt commitments of worker households. The result is a gradual rise in the burden of debt of worker households, which is more important in the case of type I households. This increase tends to make higher the rate of default. However, the significant rise in credit availability overpowers the adverse effects of the higher burden of debt, leading to a lower rate of default in the first periods after the shocks (see Figure 1d).

Overall, in the first periods the economy experiences an economic, housing and financial boom that coexists with a rise in the burden of debt of households and a fall in the rate of default. It is also noteworthy that higher credit provision and increasing housing and MBSs prices reinforce the one the other. Following Tymoigne's (2010, 2011) conceptualisation of financial fragility, it can be argued that these developments correspond to an economy characterised by increasing financial fragility.

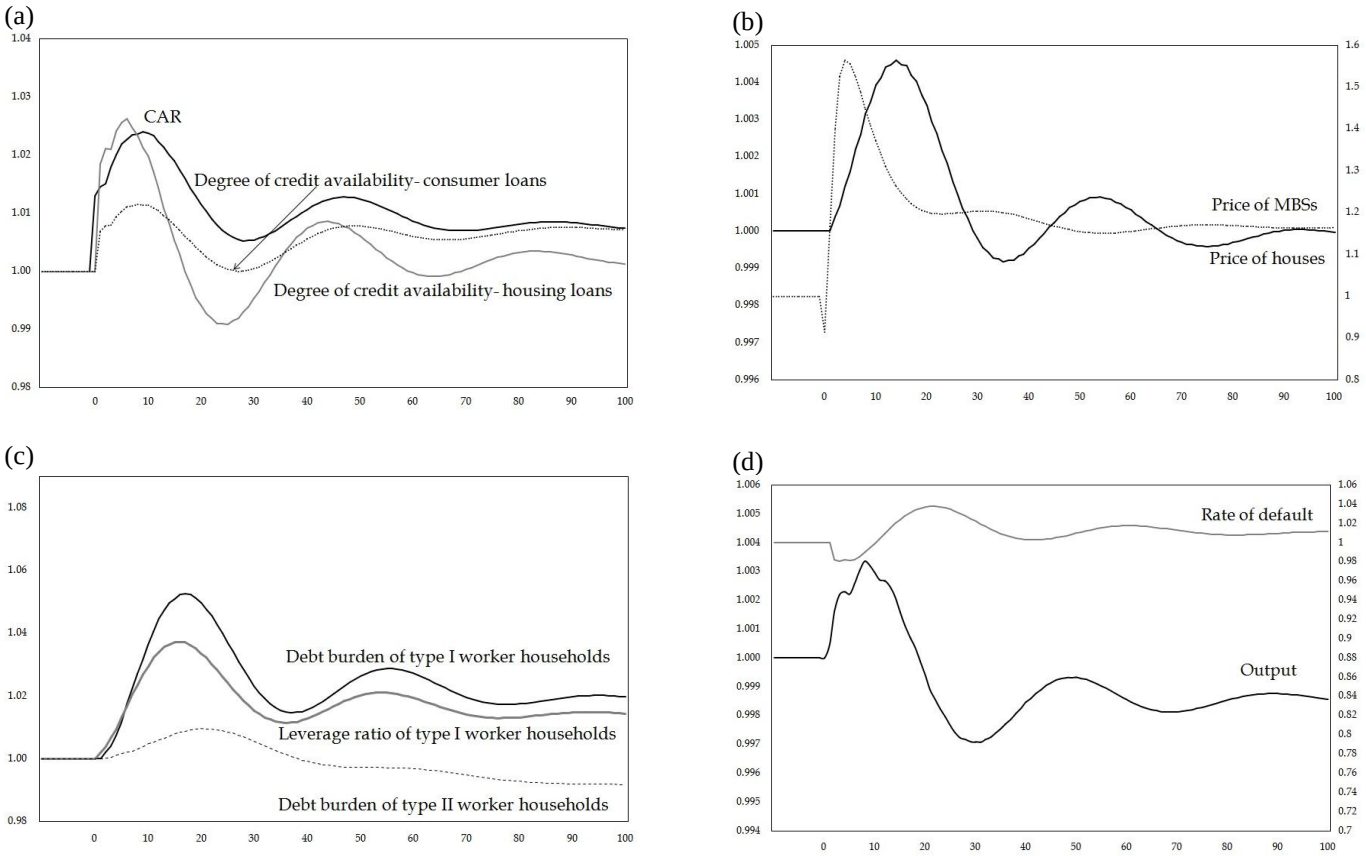
This growing financial fragility has long-run adverse effects. The gradual increase in the burden of debt of type I workers households, in conjunction with the loan expansion that places downward pressures on the capital adequacy ratio, reduces banks' credit availability and increases the rate of default on mortgages (see Figures 1a and 1d). Moreover, the higher burden of debt negatively affects worker households' demand for houses leading to a decline in the price of houses (Figure 1b). Hence,

[26] In Figure 1 (and in Figure 2 below) the series are expressed as a ratio of their values in the steady-state baseline solution.

[27] Note that, as indicated in Figure 1c, the leverage ratio of type I households increases relative to the baseline solution. The reason is that in our simulations the increase in loans outweighs the rise in the value of houses, making the leverage ratio higher. However, without the increase in the price of houses the leverage ratio would be higher.

housing investment and consumption start falling, reducing the level of output in the economy. Importantly, this reduction in the output has detrimental feedback effects on households' burden of debt, further reducing credit availability and further increasing the rate of default (see Figures 1a and 1d). The increasing rate of default has adverse effects on the MBSs market since the capital of institutional investors declines, putting downward pressures on the price of MBSs. This tends to increase the yield on MBSs and, therefore, the proportion of mortgages that are securitised declines, further slowing down credit expansion. As a result of these developments, output ends up lower than its baseline solution. Overall, after a period of economic and financial prosperity, the initial rise in the degree of securitisation brings eventually the economy into a period of financial instability, which is characterised by a lower output, a higher rate of loan defaults, a declining price of MBSs and a volatility in the price of houses.

Fig. 1. *Effects of an increase in the degree of securitisation*



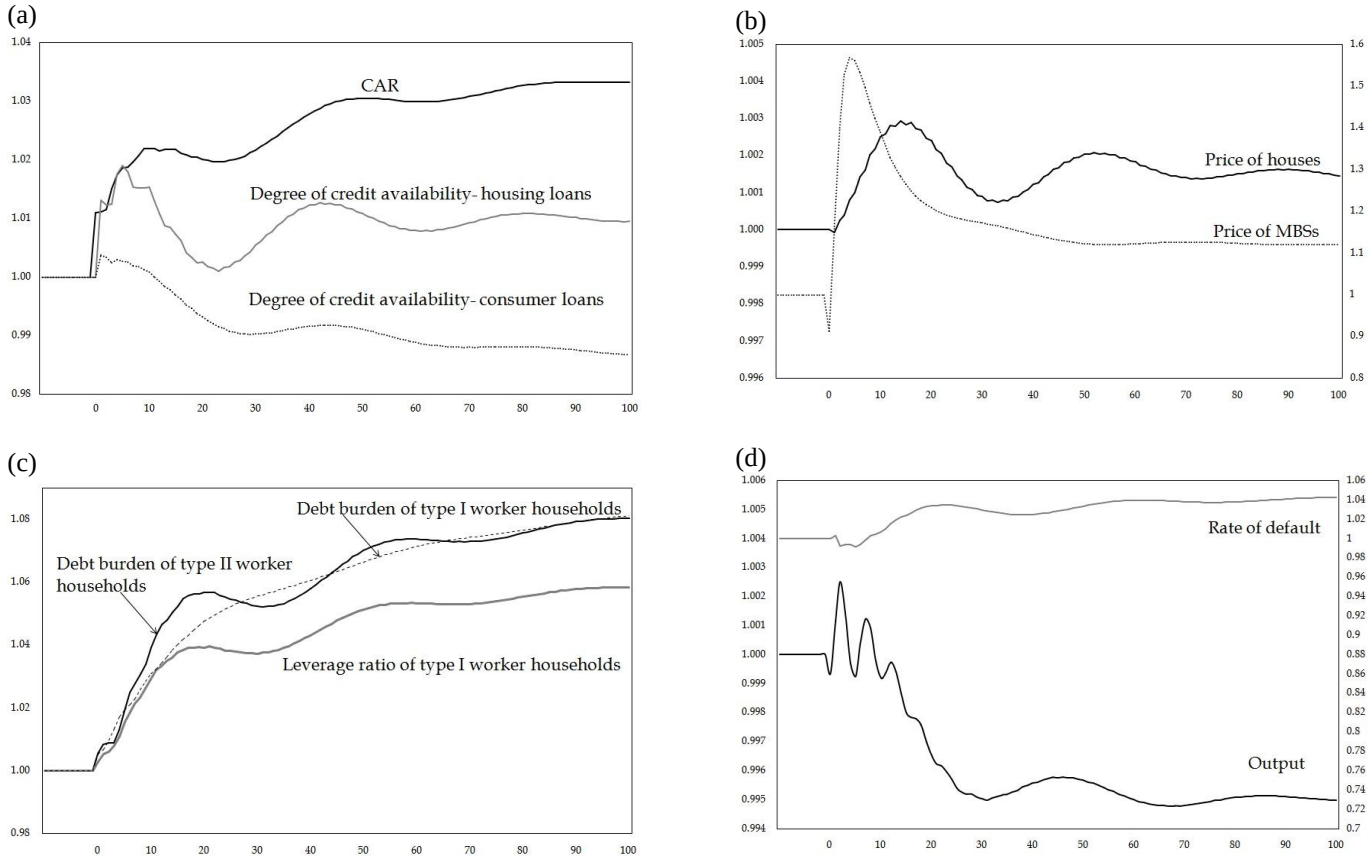
The second simulation experiment is identical to the first one with the only difference being that the rise in the degree of securitisation is accompanied by a decline in the wage income share (s_W). Figure 2 presents the results. Initially, the economy experiences a passing decline in the level of economic activity (Figure 2d). This decline is basically due to the adverse impact of the wage shock on consumption. In our simulations this adverse impact outweighs the favourable effects on the profits of firms that push upwards the investment in productive capital and the consumption of investor households. In other words, with our choice of parameters, aggregate demand is wage-led.

However, after the initial reduction the economy enters a borrowing-induced expansion as in the first simulation. There are, though, various noteworthy differences. To begin with, the decline in the wage income share induces type II worker households to demand more loans to attain their consumption norms. This produces a more vigorous rise in their debt commitments, compared with the first simulation. In conjunction with the direct negative effect of the wage shock on households' gross disposable income, this higher increase in debt commitments leads to a more rapid rise in their burden of debt (Figure 2c). At the same time, worker households of type I also experience a higher rise in their burden of debt, due to the adverse effect of the wage shock on their gross disposable income. This more rapid rise in the burden of debt of households is the main driving force behind the lower price increase in houses (see Figure 1b) and the lower duration of the economic boom in the second simulation, in comparison with the first simulation (see Figure 2d). The shorter economic boom is also explained by the lower initial rise in the proportion of mortgages that are securitised. Notice that wage stagnation affects favourably the income of investor households and, thus, their wealth. As a result, it provides an additional boost in the shares of institutional investors and, hence, in the demand for MBSs. This higher demand for MBSs ultimately leads to a higher degree of securitisation.

Another important implication of the wage shock is that the negative longer-run effects of the initial credit expansion on the macroeconomy are more intense. The higher debt expansion in the initial periods combined with the direct detrimental effects of wage stagnation on worker households' consumption leads eventually to a lower level of output and a higher rate of default compared to the first simulation (Figure 2d). Moreover, the leverage and the burden of debt of households of type II keep rising in the long run (in the first experiment there was a decline after the initial periods) and the degree of credit availability for consumer loans becomes lower than in the baseline solution.[28] Consequently, it can be overall argued that wage stagnation reinforces in our model the long-run adverse effects of securitisation on macroeconomic stability.

[28] Interestingly, the degree of credit availability for housing loans remains higher than in the baseline solution. The reason for this is that the wage shock reduces the loans of firms placing upward pressures on the capital adequacy ratio. The firm loans decline because the wage shock affects positively the internal funds of firms and negatively the desired investment (due to the wage-led structure of aggregate demand).

Fig. 2. *Effects of an increase in the degree of securitisation combined with a decline in the wage income share*



5. Conclusion

This paper explored the macroeconomic effects of securitisation and wage stagnation within a SFC model, paying particular attention to their role in the emergence of financial fragility. The simulation experiments indicated that a rise in securitisation practices is likely to bring about, at a first stage, a borrowing-induced expansion, a housing boom, an appreciation in MBSs prices and a decline in the rate of default. However, this prosperity is accompanied by a rise in the burdens of debt of households, indicating a situation of increasing financial fragility. The rising burdens of debt gradually set the stage for the reversal of the initial expansionary effects of securitisation. Ultimately, the economy experiences a lower level of output, a higher rate of default on mortgages, a declining price of MBSs and a volatility in the price of houses.

When the securitisation shock is accompanied by an exogenous decline in the wage income share the period of prosperity is shorter, basically because the burden of debt of households increases much more rapidly. Furthermore, the long-run adverse effects on macroeconomic performance are enhanced. Overall, these results provide support to the view that the combination of risky financial practices and higher inequality can increase the likelihood of instability in a macro system.

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