

U.S. Growth, the Housing Market and the Distribution of Income

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Abstract: Keynesian models of household behavior suggest that a shift in the distribution of income towards profits - or towards rentiers - should imply an increase in the propensity to save out of income for the population as a whole. However, the available empirical evidence for the U.S. shows that, starting in 1985, the propensity to save out of income for the household sector has decreased steadily. Meanwhile, starting in 1981, the share of income accruing to the richest 5% of the population has increased steadily, with wide fluctuations related to capital gains on equities and, more recently, in the housing market. The aim of this paper is to lay down a growth model, grounded in the post-keynesian stock-flow-consistent approach of Godley and Lavoie, to analyze the links between consumption and saving behavior of two classes of households, financial markets and the housing market. The model will be used from a theoretical perspective to analyze the dynamics of markets along a steady growth path.

JEL codes: E12, E21, E44

Keywords: growth, income distribution, saving propensity, capital gains, housing market

1. Introduction

The purpose of this paper is to lay down a model for a growing economy, with enough detail to address some puzzles in the characteristics of U.S. growth since 1990.

In our view¹, and irrespective of short-term fluctuations, a key driver of U.S. growth has been a steady increase in household consumption, obtained through a decrease in the propensity to save out of disposable income. Consumption theories usually imply that the propensity to save will decrease as the distribution of income shifts away from the top percentiles: it is therefore puzzling to note that the share of income accruing to the top 5% of the population has been increasing steadily. Alternative explanations of movements in the propensity to save - apart from

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¹ Our analysis is heavily based on Godley's work at the Levy Institute of Economics. See Godley (1999) and the Strategic Analyses published in the following years at <http://www.levy.org>

demographics - can be based on changes in the value of real and financial wealth, and can therefore be linked to the equity market boom of the last half of the 1990s, and the housing market behavior thereafter.

Our purpose here is to lay down a model capable of analyzing these phenomena from a theoretical point of view. We adopt the post-keynesian, stock-flow consistent approach of Godley², recently expanded in Godley - Lavoie (2007), which ensures a rich enough environment to capture the major interrelations between real and financial markets.

In Section 2 we will analyze in greater detail the stylized facts sketched above; in Section 3 we will develop a stock-flow consistent model of a growing economy, with integrated financial and real markets, and behavioral assumptions grounded in the post-Keynesian tradition. The model will be simulated, in Section 4, to analyze the behavior of our economy under different kind of shocks, similar to those experienced by the U.S. in the recent past.

2. Some stylized facts on U.S. recent economic growth

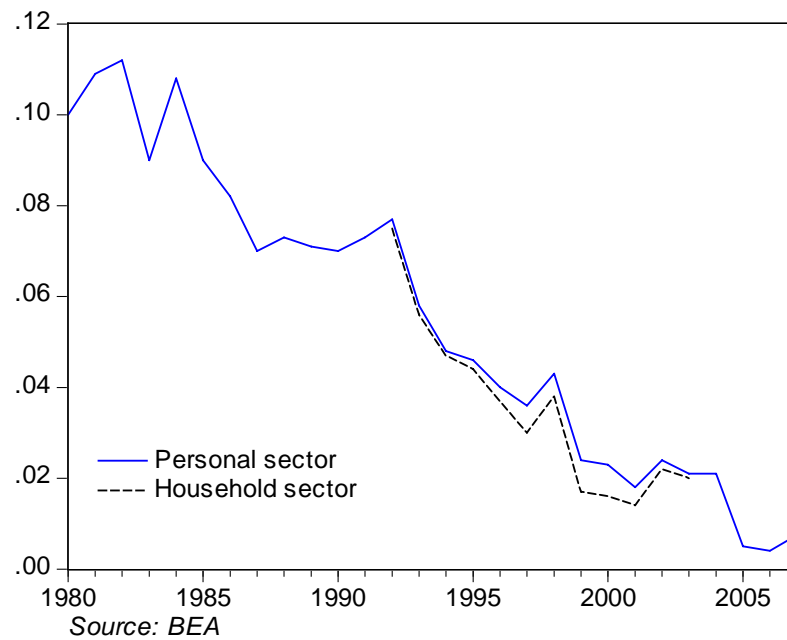
Keynesian models of household behavior *a la* Kaldor - Pasinetti³ suggest that a shift in the distribution of income towards profits - or towards rentiers - should imply an increase in the propensity to save out of income for the population as a whole. However, the available empirical evidence for the U.S. shows that, starting in 1985, the propensity to save out of income for the household sector has decreased steadily from a starting value of about 10% to a value close to zero in 2007⁴ (figure 1).

² The essential features of Godley's recent work are already present in his 1983 book with Cripps. See Dos Santos (2006). The model developed here extends in several ways the models presented in Zezza - Dos Santos (2004), (2005) which are based in turn on Lavoie - Godley (2001-2).

³ See Kaldor (1976) among others. These authors build on the work of Kalecki and on some passages from Keynes' (1935, ch.8) *General Theory* (I am grateful to C.H. Dos Santos for providing this reference).

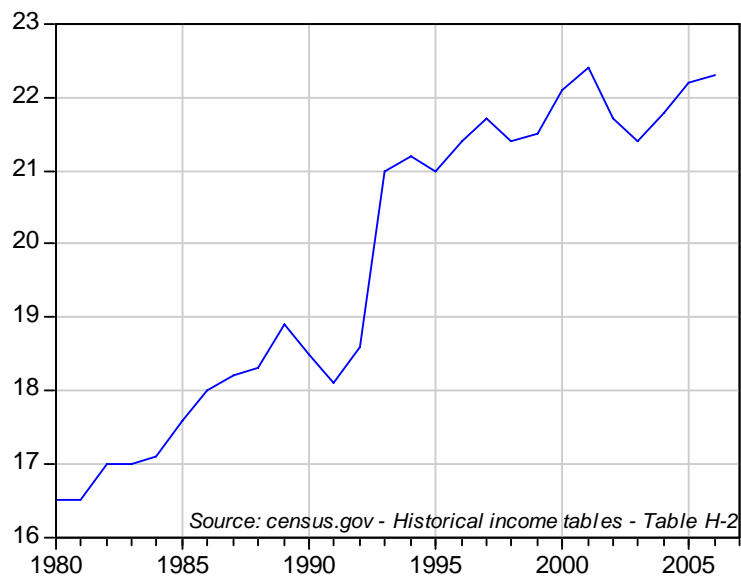
⁴ The recently revised GDP data from the Bureau of Economic Analysis still show negative saving for the third quarter of 2006. Saving have recovered somewhat since then. There is some debate on which is the correct measure of saving: in figure 1 we report the data for the household sector, net of non-profit institutions which are included in the

Figure 1. Propensity to save out of disposable income



Meanwhile, starting in 1981, the share of income accruing to the richest 5% of the population has increased steadily, rising from 16% in the 70s to about 22%, with wide fluctuations

Figure 2. Share of aggregate income received by top 5% of households



Personal sector. Although there may be disagreement on how to measure exactly saving and disposable income, the evidence of a decline in the propensity to save is very clear.

related to stock market movements (figure 2).

Consumption theories can hardly be reconciled with these two concurrent phenomena. A standard hypothesis, laid down in the Post-Keynesian theories of consumption, is that the propensity to consume out of wages is low, while the propensity to spend out of rentiers' income - dividends etc - is higher. This literature studies the effects of changes to the functional distribution of income between profits and wages, showing that, as the distribution shifts towards profits, aggregate consumption should decrease, with an effect on growth which may outbalance the effects on investment generated by the higher share of profits on income.

Recent results in the analysis of the distribution of income⁵ show that the top 5% of the population holds a very large share of financial and real assets. This result is consistent with the evidence cited above on the fluctuations in the distribution of income of the richest household group, connected to movements in the equity market. Therefore, the difference between the *functional* and the *personal* distribution of income should not be of great importance, in order to analyze the overall behavior in the propensity to save of the whole economy⁶.

Microeconomic evidence has recently become available to help shed light on this matter. A study by Maki and Palumbo at the Federal Reserve⁷ computes the propensity to save for all income quintiles in U.S. households, putting together micro data from the Survey of Consumer Finances and aggregate data from the Flow of Funds published by the Federal Reserve. Their results are striking, as they show that (a) the propensity to save of the two lowest quintiles is only marginally smaller (but increasing) than the propensity to save of the third and fourth quintiles; (b) the propensity to save of the top quintile has declined in the 1990s to become systematically negative

⁵ See A. Shaikh and A. Ragab (2007), and the references in this work on the econo-physics literature on the distribution of income.

⁶ In what follows, and in our model, we will thus make no distinction between “capitalists”, rentiers and “rich people”.

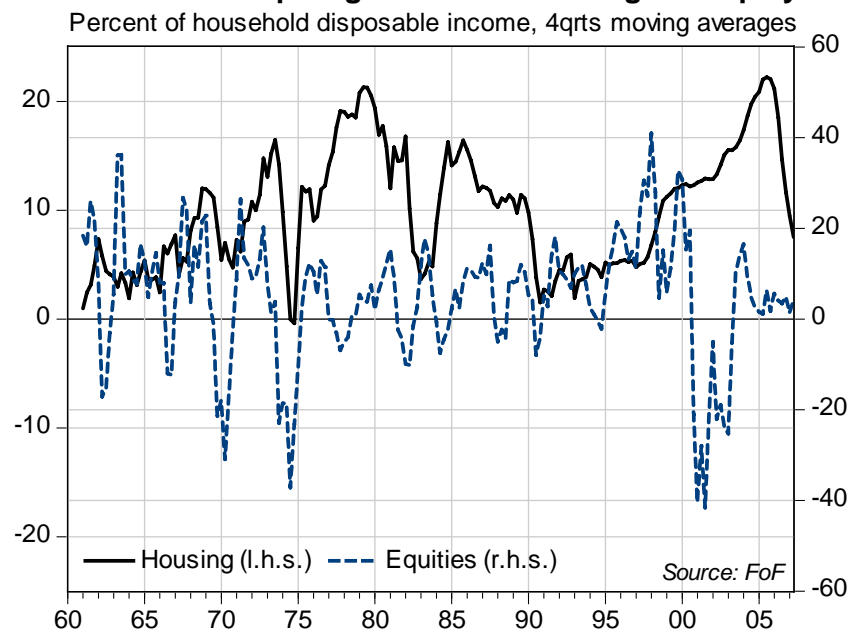
⁷ D.M. Maki and M.G. Palumbo (2001).

after 1998; (c) the propensity to save of the top quintile has a larger variance, which could be attributed, for the reasons stated above, to fluctuations in the equity market.

Their evidence thus suggests that the drop in the propensity to save in the whole economy is attributable to the richest quintile, which already had a negative level of saving at the end of the 1990s. If this evidence is correct, given the further fall in the overall propensity to save experienced in the last seven years, it should follow that these households managed to spend annually more than their income for a period of about ten years, due to prolonged capital gains arising from the equity and housing market.

According to theories of consumption based on inter-temporal choice, capital gains on the existing stock of wealth should increase expected income, and therefore generate an increase in current expenditure and a drop in the propensity to save. The chart in Figure 3 provides a simple measure of capital gains on the equity market and the housing market⁸: from 1995 to 2000 (the so-called “New Economy”), capital gains on equities were substantial relative to disposable income.

Figure 3. Household capital gains on the housing and equity markets



⁸ Capital gains in figure 3 are obtained as $CG_t = \Delta X_t - DX_t$, where ΔX_t measures the difference between the market value of equities (housing) from the beginning to the end of period t , and DX_t measures net acquisition of equities (or residential investment) in period t .

As the equity market began to fall, speculative funds were probably shifted from the equity market into the housing market, and the price of existing homes accelerated, again providing prolonged capital gains relative to income, with a peak in the second quarter of 2005⁹.

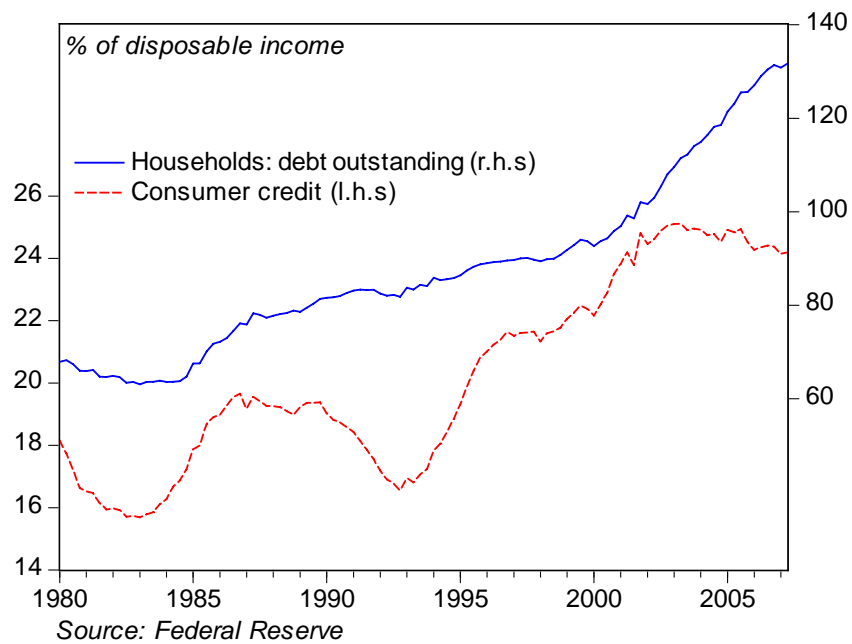
Capital gains may thus provide a simple explanation for the decline in the saving rate. On the other hand, capital gains provide additional funds for expenditure only when they are realized, as real or financial assets are sold¹⁰. From a microeconomic perspective, therefore, individuals experiencing capital gains should always increase their consumption. From a macroeconomic perspective, however, if these capital gains have to be realized, it must be the case that some different subject - who will buy the assets in the future - has to increase his/her saving in order to afford a more expensive asset in the future. Capital gains should always match capital loss, with no aggregate effect in a closed system, and the rise in spending from categories experiencing capital gains should be matched by an increase in saving from categories who will experience a capital loss. An aggregate effect is possible in the presence of imperfect information, or other forms of asymmetries, but it is difficult to believe that such asymmetries can last for such a prolonged period.

Alternative - or additional - explanations can rely on access to credit. With financial liberalization and the decline in interest rates, household debt has risen steadily as a share of income (figures 4 and 5), and if the percentage of consumption financed by borrowing has increased, this can help explain the drop in the propensity to save.

⁹ Our measure of capital gains in the housing market will be influenced by events such as the Katrina hurricane in 2005, which caused significant property losses.

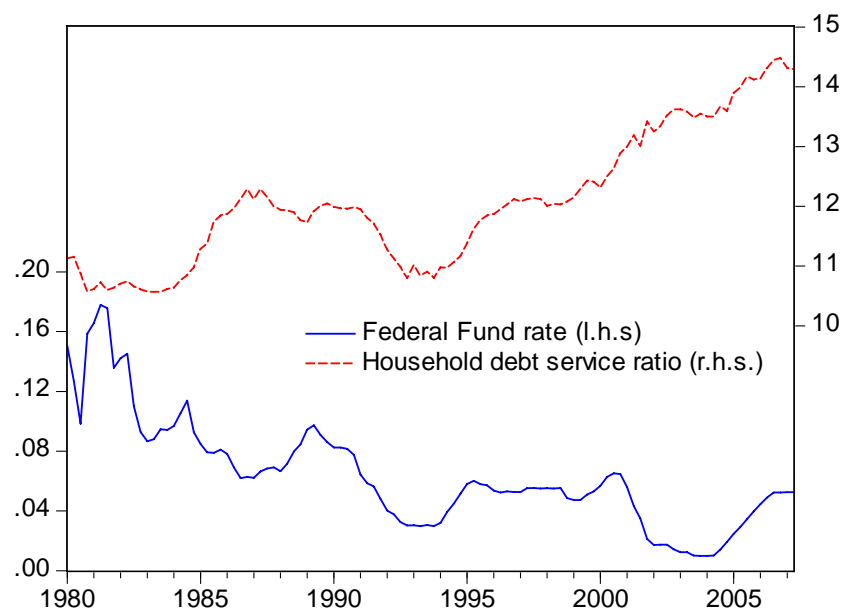
¹⁰ For housing, innovation on financial markets has provided other forms of transforming capital gains on housing into cash, as the increase in the value of the collateral makes it possible, say, to refinance an existing mortgage so that new mortgage monthly payments decrease, or to resort to mortgage equity withdrawal.

Figure 4. Household debt



It is interesting to note that the decline in interest rates was such to completely offset the rise in debt for a prolonged period, so that households debt service ratio remained relatively stable up to the second half of the 1990s. As interest rates stabilized, and debt kept rising relative to income, the

Figure 5. Fed interest rate and household debt service ratio



debt service ratio started to increase.

If the fall in the saving rate is due to an increase in the share of consumption financed out of credit, microeconomic evidence should show a smaller drop in the saving rate in the top quintiles, and therefore this explanation is at odds with the evidence produced by Maki - Palumbo. On the other hand, the recent collapse in the subprime mortgage market, i.e. financial institutions lending to households with a higher risk of default, supports the idea that the lowest quintiles in the income distribution were relying on debt to a greater extent than other quintiles. Maki - Palumbo results might be affected by some bias in estimating income by quintiles, and more microeconomic evidence - which we plan to develop in future research - is therefore needed.

Imitation effects on consumption may also be at work¹¹, to explain the drop in the aggregate saving rate. If households in the lower quintiles plan their consumption relative to the standard of living in upper quintiles, when relative wages of the quintiles shift in favor of the top quintile - has it happened in the U.S. in recent past - imitation effects should put additional pressure on the middle class to increase consumption out of debt¹². Again, this effect is at odds with the evidence in Maki - Palumbo.

In the next section we will investigate the dynamics of the processes sketched above through a simulation model, where parameters have been chosen to ensure stable growth in a baseline scenario, which will be used as a benchmark to analyze the effects of different shocks.

3. The model

Our model is grounded in the post-Keynesian, stock-flow consistent growth model presented in Zezza - Dos Santos (2005) (ZDS from now on), where we discussed the implications for growth of exogenous shocks to the distribution of income between workers and rentiers, where the latter were defined as the owners of banks and firms, and the former were assumed to consume all of their

¹¹ Morgan - Kristen (2003).

¹² We may rephrase this assumption in terms of Akerlof (2007) “norms”: if the socially desirable standard of living increases faster than real disposable income of workers, there is a rational incentive to increase real expenditure faster than real disposable income.

income. ZDS extended a simpler growth model which included a government and a Central bank - presented as Zezza - Dos Santos (2004) - and that model, in turn, was based on the path-breaking contribution of Lavoie - Godley (2001-2002), recently extended in chapter 11 of Godley - Lavoie (2007).

The current model extends our previous analysis by considering two classes of households with different behavior with respect to consumption decisions and portfolio management, and two classes of firms, to allow for separate modeling in the supply of homes with respect to other goods and services. Due to space limit considerations, we will focus here on the new extensions to our model: interested readers are referred to ZDS for further details on core model properties.

[Table 1 about here]

Our detailed flow accounting is laid down in Table 1, while Table 2 report the corresponding stock balances.

[Table 2 about here]

3.1 Capitalists (“rich households”)

As mentioned before, we split households in two categories, where the richest 5% may be labelled “capitalists” as they are assumed to receive distributed profits from both banks and non financial firms. Home owners who rent their property also fall into this category, as shown in Table 1. Equations defining disposable income, saving and expenditure for this group are given by¹³:

- 1) $Y_c = w_c \cdot N_c + \text{Rents} + \text{FD} + r_{m-1} * M_{c-1} + \text{FB} + r_{b-1} * B_{h-1} - T_{dc}$
- 2) $Sh_c = Y_c - C_c$
- 3) $C_c = cc * p$

¹³ See the Appendix for a complete legenda of model variables.

$$4) \quad cc = \alpha_{1c} \cdot yc^e + \alpha_{2c} \cdot vc_{-1} + \alpha_{3c} \cdot (cge^e + cghc^e - p^e \cdot vc_{-1} / (1 + p^e))$$

$$5) \quad Vc = Vc_{-1} + Shc + CGE + CGHc$$

$$6) \quad yc = Yc / p$$

$$7) \quad CGE = \Delta pe \cdot E_{-1}$$

$$8) \quad CGHc = \Delta ph \cdot Hc_{-1}$$

Disposable income is defined in equation (1) from Table 1 as the sum of wage income, distributed profits from non financial firms and banks, interest income from bank deposits and government bills, and rents, net of direct taxes paid to the government. We assume a single price level p for all non-durables, which is used to deflate disposable income (equation 6) and consumption (equation 3). Saving, defined in equation (2) augment the stock of wealth in equation (5), which includes capital gains. In turn, capital gains for this category of households are given from changes in the market price of equities (equation 7) and homes (equation 9).

Consumption decisions, in equation (4), depend on expected disposable income, the opening stock of wealth and expected capital gains, all measured in real terms.

Capitalist households are assumed to manage their portfolio of assets, excluding cash, according to a Tobinesque approach, where the share of wealth allocated to real and financial assets depend on expected rates of return¹⁴:

$$9) \quad HPc = \eta \cdot Cc$$

$$10) \quad Mc = Vc - HPc - Bc - E \cdot pe - ph \cdot Hc$$

$$11) \quad Bh/(Vc^e - HPc) = \lambda_{10} - \lambda_{11} \cdot rrm - \lambda_{12} \cdot rre^e - \lambda_{13} \cdot (Yc^e/Vc^e) + \lambda_{14} \cdot rrb - \lambda_{15} \cdot rrh^e$$

$$12) \quad pe \cdot E/(Vc^e - HPc) = \lambda_{20} - \lambda_{21} \cdot rrm + \lambda_{22} \cdot rre^e - \lambda_{23} \cdot (Yc^e/Vc^e) - \lambda_{24} \cdot rrb - \lambda_{25} \cdot rrh^e$$

$$13) \quad Hc \cdot ph/(Vc^e - HPc) = \lambda_{30} - \lambda_{31} \cdot rrm - \lambda_{32} \cdot rre^e - \lambda_{33} \cdot (Yc^e/Vc^e) - \lambda_{34} \cdot rrb + \lambda_{35} \cdot rrh^e$$

¹⁴ Parameters in asset demand functions obey the standard restrictions of simmetry (eg $\lambda_{12} = \lambda_{21}$) and guarantee that in equilibrium wealth is entirely allocated among assets (eg $\sum_j \lambda_{ij} = 0$ when $i \neq 0$, and $\sum \lambda_{i0} = 1$).

$$14) \quad re = (FD + CGE^e)/(pe_{-1} \cdot E_{-1})$$

$$15) \quad rh = (Rents + CGHc^e) / (ph_{-1} \cdot Hc_{-1})$$

Cash holdings are assumed to depend on current consumption, in equation (9). Wealth net of cash is allocated, in equations (10) to (13), among bank deposits, government bills, equities and housing, according to relative expected rates of return. We assume, following Godley - Lavoie (2007), that bank deposits act as a buffer, so that mistaken expectations will result in an ex-post amount of bank deposits different than expected.

Return on equities is given, in (14), by distributed profits and expected capital gains on equities, while return on housing is given, in (15), by rents and expected capital gains.

3.1 Workers (“other households”)

Equations and identities describing this households group are similar to those presented above. Behavior differs in that (1) we assume that this group may need to borrow from banks to finance their housing investment; (2) disposable income is given only by after-tax wages and interest income on deposits, net of interest payments on mortgages¹⁵; (3) demand for homes depends on the growth in population.

$$16) \quad Y_o = w_o \cdot N_o - Rents + rm_{-1} \cdot Mo_{-1} - rmo_{-1} \cdot MOo_{-1} - Tdo$$

$$17) \quad Sho = Y_o - Co$$

$$18) \quad Co = co \cdot p$$

$$19) \quad co = \alpha_{10} \cdot yo^e + \alpha_{20} \cdot vo_{-1} + \alpha_{30} \cdot (cgho^e - p^{^e} \cdot vo_{-1} / (1 + p^{^e})) + iec - \alpha_{40} \cdot morp \cdot MOo_{-1} / Yo_{-1}$$

$$20) \quad Vo = Vo_{-1} + Sho + CGHo$$

$$21) \quad yo = Y_o / p$$

$$22) \quad CGHo = \Delta ph \cdot Ho_{-1}$$

¹⁵ We assume that mortgages have a variable interest rate, while the principal is paid back according to a fixed rate (*morp*).

$$23) \quad iec = \alpha_{40} \cdot No \cdot (cc_{-1}/Nc - co_{-1}/No)$$

We allow for different parameters in the households consumption function (19), to study the effects of different propensities to consume out of income. We also allow for possible imitation effects in consumption of workers (*iec*), relative to the consumption of capitalists, and for liquidity constraints deriving from payments due on the existing stock of mortgages.

Workers have a demand for cash (equation 24), and hold bank deposits (equation 25), but are assumed not to demand any other financial assets. Their demand for homes does not depend on portfolio management: rather, we assume that it grows with population and expected real income, and falls with a (lagged) debt repayment ratio (equation 26). Demand for homes is financed by saving, with the difference between demand for homes and saving being financed by the net increase in bank mortgages (equation 27).

$$24) \quad HPo = \eta \cdot Co$$

$$25) \quad Mo = Vo - HPo - ph \cdot Ho$$

$$26) \quad \Delta Ho / Ho_{-1} = \Delta No / No_{-1} + \mu_1 \cdot \Delta yoe / yo_{-1} - \mu_2 \cdot \Delta [(rmo_{-1} + morp) \cdot Mo_{-1} / Yo]_{-1}$$

$$27) \quad \Delta MOo = ph \cdot \Delta Ho - Sho - morp \cdot MOo_{-1}$$

$$28) \quad Rents = rent \cdot Hcr_{-1}$$

$$29) \quad rent = rent_{-1} \cdot (1 + y^e)$$

Households either own their homes or rent them from capitalists households. The treatment of rents is still rather rudimentary in the model: there is no assumption on how households decide whether to rent or own their homes, the share of rented houses owned by capitalists is exogenous, and the rent is simply assumed to grow at the same rate as income (equation 29).

3.3 Non financial firms

Our treatment of non financial firms keeps the same assumptions of ZDS. Firms investment decision depend on actual profits, the cost of borrowing from banks, Tobin's *q* and the utilization

rate (equation 30). Prices are set with a mark-up on wages (equation 31), and this implies that total profits are determined relative to the wage bill (equation 32). A fixed share of profits, net of taxes and interest payments, is distributed to capitalists households (equation 33).

The mark-up is assumed to depend, following ZDS, on a conflict in the distribution of income: if firms are relatively stronger than workers they will appropriate a larger share of productivity growth (equation 34). As a first approximation, the utilization rate is given by the ratio of real sales to “normal sales”, which in turn are in a fixed ratio λ to the stock of real capital (equation 35).

$$30) \quad \Delta k/k_{-1} = \iota_0 + \iota_1 \cdot FU_{-1}/K_{-2} - \iota_2 \cdot r_{L-1} \cdot (L_{-1}/K_{-1}) + \iota_3 \cdot (pe_{-1} \cdot E_{-1}/K_{-1}) + \iota_4 \cdot u_{-1}$$

$$31) \quad p = (1 + \rho) \cdot \text{wage}/[\text{prod} \cdot (1 - \tau)]$$

$$32) \quad FT = \rho \cdot WB$$

$$33) \quad FD = (1 - \beta) \cdot (FT - r_{L-1} \cdot L_{-1} - TF)$$

$$34) \quad 1 + \rho = (\rho_1 \cdot (\text{prodg} - \text{wo}^\wedge) + 1)/(1 + \rho_{-1})$$

$$35) \quad u = s/(\lambda \cdot k_{-1})$$

Firms finance investment through retained profits (equation 36), issuing new equities (by an amount assumed to be equal to a fixed share of investment not financed by internal funds, equation 37) or borrowing from banks. Borrowing is assumed to increase only when internal funds are not sufficient (equation 38).

$$36) \quad FU = FT - r_{L-1} \cdot L_{-1} - FD - TF$$

$$37) \quad pe \cdot \Delta E = \xi \cdot (\Delta K - FU)$$

$$38) \quad \Delta L = + \Delta K - FU - pe \cdot \Delta E$$

3.4 Banks and the Central bank

Banks accommodate the demand for loans from firms, the demand for deposits from households, and the demand for mortgages. We assume for simplicity that banks demand for

government bills is a fixed share of deposits (equation 39). Banks have a reserve requirement (equation 40) and if internal funds are not sufficient to satisfy the demand for loans or mortgages, banks get advances from the Central Bank (equation 41).

$$39) \quad Bb = \chi_1 \cdot (Mc + Mo)$$

$$40) \quad HPb = \chi_2 \cdot (Mc + Mo)$$

$$41) \quad A = L + HPb + Bb + MOo - (Mc + Mo)$$

Interest rates on loans, mortgages and deposits are determined through a simple mark-up mechanism on the interest rate on Central bank advances

$$42) \quad r_l = r_a + \text{spread1}$$

$$43) \quad r_{mo} = r_a + \text{spread2}$$

$$43) \quad r_m = r_a + \text{spread3}$$

Finally, banks are assumed to distribute all of their profits, and therefore they don't accumulate net wealth as shown in Tables 1 and 2.

$$44) \quad FB = r_{l-1} \cdot L_{-1} + r_{b-1} \cdot Bb_{-1} + r_{mo-1} \cdot MOo_{-1} - [r_{m-1} \cdot (Mc_{-1} + Mo_{-1}) + r_{a-1} \cdot A_{-1}]$$

The Central bank accommodates the demand for advances from banks, and buys government bills not absorbed by households or the banking sector (equation 45). Central bank interest income (equation 46) is paid to the government, so that the Central bank has zero net saving as in Table 1. The (real) interest rate on Central bank advances is set exogenously.

$$45) \quad Bc = B - Bh - Bb$$

$$46) \quad FC = r_{a-1} \cdot A_{-1} + r_{b-1} \cdot Bc_{-1}$$

3.5 The government

The government collects taxes on production, wages and profits, and finances any deficit *GD* by issuing bonds. The (real) interest rate on government bills is set exogenously. We assume that real government expenditure grows with expected income (equation 55), so that the share of government expenditure on output in steady growth will be stable.

$$47) \quad GD = (G + rb_{-1} \cdot B_{-1}) - (IT + DT + TF + FC)$$

$$48) \quad IT = \tau \cdot S$$

$$49) \quad Tdc = \tau_d \cdot wc \cdot Nc$$

$$50) \quad Tdo = \tau_d \cdot wo \cdot No$$

$$51) \quad Td = Tdc + Tdo$$

$$52) \quad TF = \tau_f \cdot FT$$

$$53) \quad \Delta B = GD$$

$$54) \quad G = g \cdot p$$

$$55) \quad g = g_{-1} \cdot (1 + y^e)$$

3.5 The housing market¹⁶

We already laid down the demand for housing from capitalists (equation 13) and workers (equation 26). Our treatment of the supply of new homes relies on a buffer mechanism based on unsold houses available on the market. The stock of unsold houses increases when the number of newly built homes exceeds the desired demand from households.

$$56) \quad \Delta HU = HN - \Delta Hc - \Delta Ho$$

The supply of new houses is assumed to be a function of expected demand and past capital gains on houses.

$$57) \quad HN = v_1 \cdot (Hc_{-1} \cdot y^e + \Delta Ho) + v_2 \cdot \Delta ph_{-1}$$

and, finally, the market price of homes increases when the number of unsold homes drops

$$58) \quad \Delta ph/ph_{-1} = -v_3 \cdot \Delta HU$$

In this setting, if the expected market price of homes increase, the demand for homes from capitalists should increase faster than expected demand, the number of unsold homes will fall and

¹⁶ The literature on macroeconomic models of the housing market is quite scarce. See Arestis - Karakitsos (2007) for a recent analysis of the U.S. housing market.

the market price of homes will rise. In turn, capital gains on housing should stimulate supply, so that a bubble in the housing market can arise only if expectations on price increases are systematically higher than actual price increases.

3.6 Aggregate demand, employment, unemployment and wages

We can now move towards closing the model with the remaining accounting identities. Sales are given by aggregate demand in equation (59), where we make the strong simplifying assumption that the price of new homes is equal to the price level, and not related to the market price for existing homes¹⁷.

$$59) \quad s = cc + co + \Delta k \cdot p + HN \cdot p + g$$

$$60) \quad S = s \cdot p$$

Employment is given by demand, and the share of employment between the two classes of households is exogenously given.

$$61) \quad N = s/prod$$

$$62) \quad N_c = \omega_c \cdot N$$

$$63) \quad N_o = N - N_c$$

Rather than model the dynamics in the labour force we assume that the unemployment rate follows a simple sort of Okun's law

$$64) \quad y^{\wedge} = s/s_{-1} - 1$$

$$65) \quad \Delta ur = -\psi \cdot (y^{\wedge} - y^o)$$

Wages are set relative to expected inflation and the expected growth in productivity, through a parameter ω which depends on the unemployment rate, giving rise to a sort of Phillips curve (equation 70). Finally, productivity growth is assumed to decelerate when the utilization rate is above its “normal” level (equation 72).

¹⁷ We are aware of the limitations of this assumption, and we plan to expand the model, with future research, to analyze the relations between the housing industry and other industries through, say, an input-output matrix.

$$66) \quad WB = [wc \cdot \omega c + wo \cdot (1 - \omega c)] \cdot N$$

$$67) \quad wc = wc_{-1} \cdot (1 + wc^{\wedge})$$

$$68) \quad wo = wo_{-1} \cdot (1 + wo^{\wedge})$$

$$69) \quad wc^{\wedge} = p^{\wedge e} + \omega \cdot prodg^e$$

$$70) \quad wo^{\wedge} = p^{\wedge e} + \omega \cdot prodg^e$$

$$71) \quad \omega = f(ur); f' < 0$$

$$72) \quad prodg = \pi_0 - \pi_1 \cdot u$$

3.7 Expectations

Expectations are modeled in a simple, adaptive way for each variable expressed in growth rates, so to ensure steady growth under the hypothesis of correct expectations. For any variable X with expected value X^e , we have

$$X^e = X_{-1} + \sigma \cdot (X^e_{-1} - X_{-1})$$

As the number of equations for expectations in prices, income, asset prices and interest rates is rather long, we prefer to omit it¹⁸.

4. Model properties

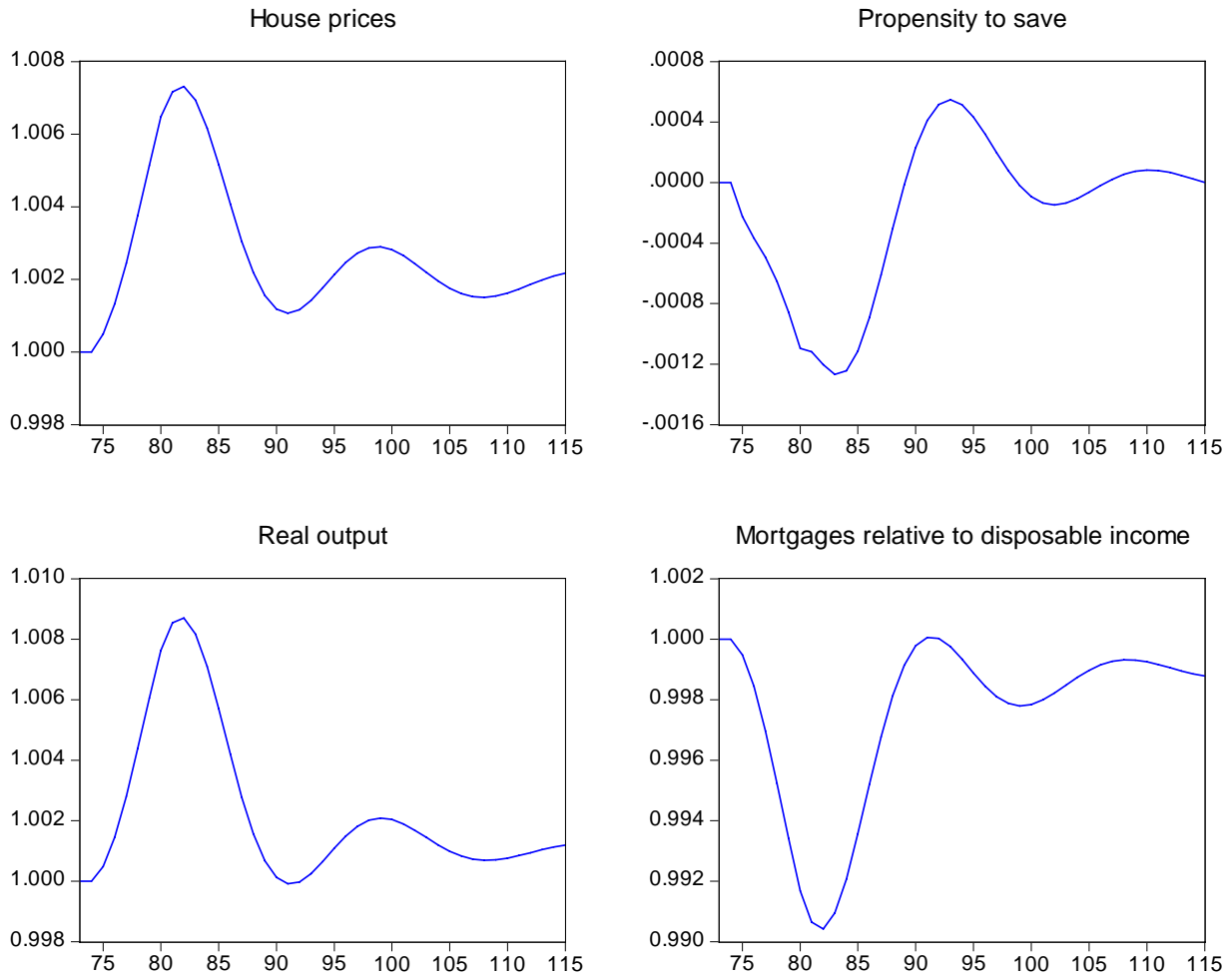
Given the complexity of our model, its properties can be analyzed only through numerical simulations. We start from a plausible set of parameters that ensure stable growth in our baseline simulation, with stock-flow norms, the utilization rate etc. all converging to stable values¹⁹.

In our model, an exogenous shock to expected house prices will raise the effective market price, with a short-run effect greater than the long-run effect, since the supply of new houses will

¹⁸ An Eviews program to replicate results in this paper is available from the author on request.

¹⁹ In the simulations that follow we assume that the economy is below the “normal” utilization rate, so that a demand shock has negligible effects on inflation. We plan to calibrate the model more carefully to U.S. data in future research, as the values for several variables and parameters for the two classes of households are not readily available.

Figure 6. A Shock to expected house prices



react with a lag to the increase in demand (see figure 6). As supply increases, house prices slow down. Short-run effects on output will be positive, because (a) capital gains on houses will increase consumption, and (b) residential investment stimulates growth. Capital gains will also lower the aggregate propensity to save in the economy. This simulation shows that our model does not capture the potential effect discussed in Section 1, namely that households willing to buy a house in the future should increase their saving on the face of a rise in house prices.

It is interesting to note that, with our choice of parameters, disposable income for “workers” - and therefore saving - increases more rapidly than their demand for housing, and therefore the stock of mortgages drops relative to disposable income.

In a second exercise we introduce an imitation effect on per-capita consumption of “workers” against per-capita consumption of “capitalists” (see figure 7). The increase in

Figure 7. A shock to the imitation effects on consumption



consumption of “workers”, relative to the baseline, implies a strong stimulus for demand-led growth. In this simulation, the lower level of saving relative to disposable income implies an increase in mortgages. The overall propensity to save in the economy obviously falls.

In our third exercise we investigate the effects of monetary policy, assuming a fall in the interest rate (figure 8). We first assume that the Central bank lowers the discount rate, but that the interest rate on government bills remains at its baseline value. We assume further, as discussed above, that banks will lower the interest rates on loans and mortgages. As a result, investment will rise because of the lower leverage, and disposable income of “workers” increase because of the reduction in interest payments on existing mortgages. Both effects stimulate aggregate demand, and demand for houses will increase following both the increase in real income and the reduction in the

Figure 8. A shock to the Central bank discount rate

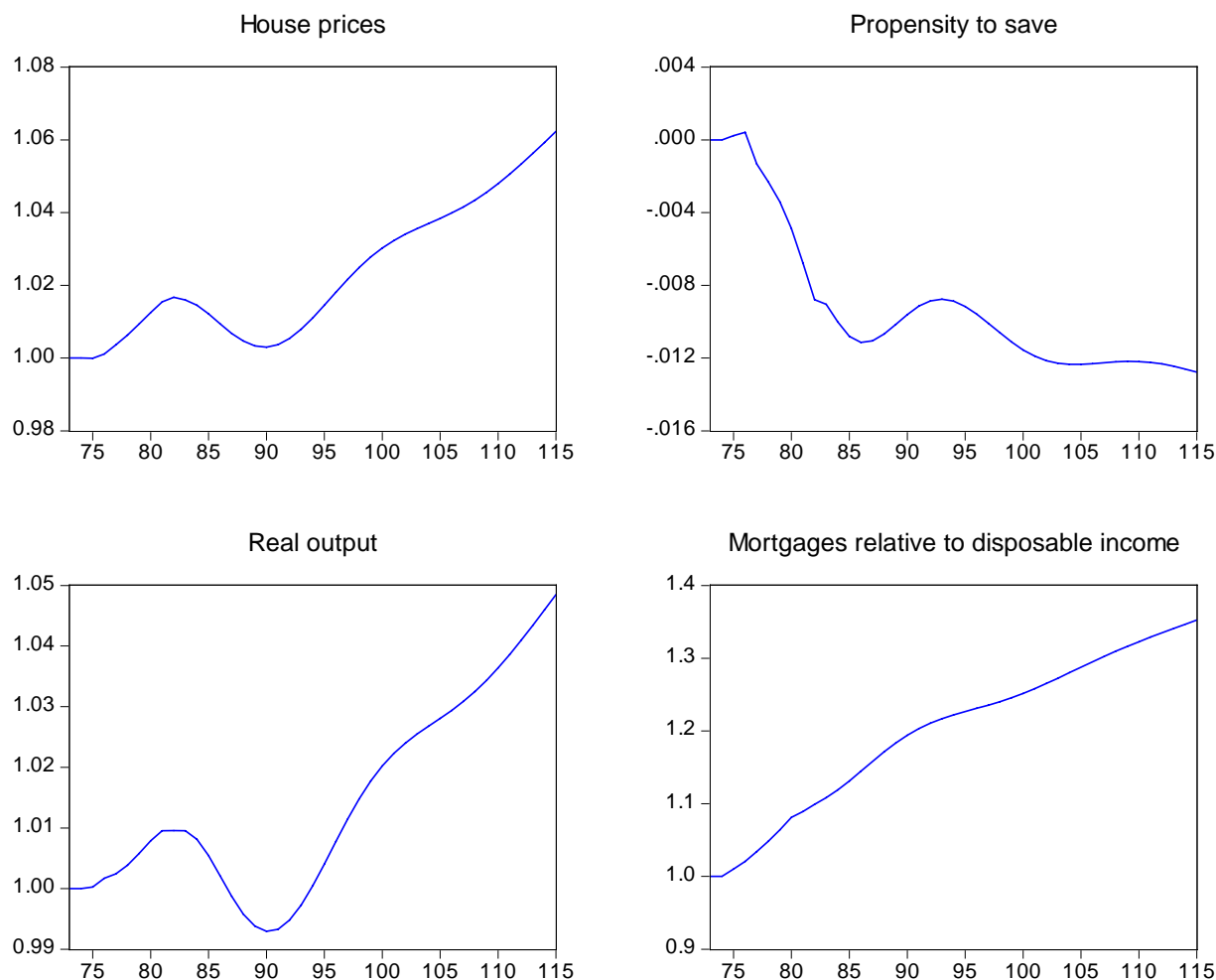


debt burden. With our choice of parameters, however, the increase in “workers” saving is large enough to more than finance the increase in their demand for housing, so that, paradoxically, the stock of mortgages will be lower, relative to disposable income, than in the baseline.

Results will change if the interest rate on government bonds is also lower. In this case, the decrease in interest payments from the government to rentiers generate a drop in aggregate demand which may be large enough to outbalance the increase in investment and workers consumption.

In our final exercise we give a shock which permanently increase the “wage” of capitalists relative to the wage of workers. Results in Figure 9 are completely consistent with the evidence on the U.S. economy: the increase in real income for capitalists is translated into higher house prices and higher consumption for this group, while workers consumption drops relative to the baseline solution. With our choice of parameters the aggregate effect ultimately makes real output increase,

Figure 9. A shock to relative wages



while the aggregate propensity to save drops. As income of workers is now (temporarily) rising more slowly, there is a need to increase borrowing to finance home purchases, so that the stock of mortgages rises relative to income.

5. Conclusions

In this paper we discussed a puzzle in the evolution of the U.S. economy in the last twenty years, namely the coexistence of a shift in the distribution of income towards the richest 5% of the population, and the decline in saving relative to disposable income. We discussed elsewhere²⁰ how

²⁰ See Godley, Papadimitriou and Zezza (2007) and previous Strategic Analysis published by the Levy Institute.

strong growth in the U.S. economy has been relying to a great extent on growth in private expenditure relative to income, which therefore implies a decline in the saving rate.

Consumption theories linking the distribution of income to the saving rate suggest, however, that the changes in the distribution experienced in the U.S. should imply a rise in the saving rate, rather than a fall. This puzzle can in our view be solved, up to a point, by the fact that capital gains on equities and in the housing market, which have been substantial in the recent past, justify a decline in saving relative to income, and may help explain how the distribution of income changes, provided that the top 5% of households own a very large share of real and financial wealth.

We have thus presented a model for a growing economy, with integrated real and financial markets, where we extend previous work²¹ by taking explicitly into account the housing market, and splitting the household sector into capitalists and workers, where capitalists manage their portfolio of real and financial assets according to expected rates of return, while workers save - and eventually borrow from banks - to finance home purchases.

Our model shows that an increase in the expected market price of houses will generate a price bubble if the supply of new homes lags behind the increase in speculative demand. Output will rise, driven both by capital gains on the existing stock of homes and by residential investment, and the saving rate will fall. The consequences for the distribution of income, with our choice of parameter and starting values for wealth distribution, do not necessarily imply a shift in the distribution of income towards capitalists, though. Again, if workers receive a large enough share of income growth, the demand for mortgages may actually *fall*, rather than rise.

In a second exercise we analyzed the effects of imitation effects in consumption: if workers increase their consumption to income ratio to catch-up with capitalists consumption, the model predicts an increase in mortgages, and a (temporary) fall in the saving rate.

²¹ Our model is based on the path-breaking contribution of Lavoie - Godley (2001-2), extended in Zezza - Dos Santos (2004), (2005) and Godley - Lavoie (2007).

Analysis of model performance shows some shortcomings, that we plan to address in future research based on model calibration to U.S. data: the most important is our that the shift in the distribution of income towards capitalists is only partially endogenized in the model, while some major aspects - such as the increase in the income of managers relative to workers - are still exogenous. However, the model shows that an exogenous shift to the distribution of income towards the richest is entirely consistent with the evidence about the U.S. economy: growth will be faster as the propensity to save drops, but the increase in the stock of mortgages relative to disposable income puts the economy into a potentially unstable growth path.

If our hypothesis that growth in the U.S. in the last twenty years has relied mainly on the decline in the saving rate - favored by capital gains - is correct, the recent fall in home prices and the credit crunch which is taking place will put a stop to the ability of households to finance their consumption plans out of borrowing, and growth will decline substantially, until household debt relative to income has turned back to more sustainable levels. An expansionary monetary policy, in this framework, will have limited effects, given that (real) interest rates are already low.

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Appendix 1. Model variables

Symbol	Variable
A	Advances from the Central bank to commercial banks
Bb	Government bills held by banks
Bh	Government bills held by households
c(i)	Real consumption
C(i)	Consumption
CGE	Capital gains on equities
CGE ^e	Expected capital gains on equities
cge ^e	Expected real capital gains on equities
CGH(i)	Capital gains on homes
cgh(i) ^e	Expected real capital gains on homes
E	Number of equities
FB	Profits distributed by banks
FD	Profits distributed by non financial firms
G	Government expenditure
GD	Government deficit
H(i)	Number of homes
HN	Newly built houses
HU	Unsold houses
HPb	Banks reserves
HP(i)	Cash held by households
I	Investment
i	Real investment
iec	Imitation effect on consumption of workers
K	Stock of capital
k	Stock of real capital
L	Loans to firms
M(i)	Bank deposits
MOo	Mortgages
morp	Mortgages repayment ratio
N(i)	Number of workers
Rents	Rents paid to capitalists households
p	Price level
p [^]	Inflation
p ^{^e}	Expected inflation
pe	Price of equities
ph	Price of homes
prod	Normal productivity
prodg	Growth rate in productivity
ra	Interest rate on Central bank advances
rb	Interest rate on government bills
re	Return on equities
rm	Interest rate on deposits
rmo	Interest rate on mortgages

rrb	Real interest rate on government bills
rre^e	Real expected return on equities
rrh^e	Real expected return on housing
rrm	Real interest rate on deposits
$Sh(i)$	Savings of households
$Td(i)$	Direct taxes
u	Utilization rate
ur	Unemployment rate
$v(i)$	Real wealth of households
$V(i)$	Wealth of households
$V(i)^e$	Expected wealth of households
$w(i)$	Unit wages
$w(i)^\wedge$	Percent increase in unit wages
$wage$	Average unit wages
$WB(i)$	Wage bill
$y(i)$	Real disposable income
$Y(i)$	Disposable income
$Y(i)^e$	Expected disposable income
$y(i)^e$	Expected real disposable income
y^\wedge	Growth in real income
y^\wedge^e	Expected growth in real income
y°	“Normal” growth in real income
β	Share of firms’ net profits distributed to households
ρ	Mark-up
τ	Indirect tax rate
ωc	Ratio of capitalists to the working population

(i) = *c* for capitalists households; (i) = *o* for other households

Table 1. Model Social Accounting Matrix									
	Prod.	Hous. Top 5%	Hous. B.95%	Firms	Banks	Central Bank	Govt	Capital Account	Total
1. Production		+p·Cc	+p·Co				p·G	p·ΔK + p·ΔH	p·Y
2. Households (top 5%)	+WBc		+Rents	+FD	+iMc +Fb		+iBh		+Yhc
2. Households (bottom 95%)	+WBo				+iMo				+Yho
3. Firms	+FT								+FT
4. Banks			+iMOo	+iL			+iBb		+Yb
5. Central Bank					+iA		+iBc		+Yc
6. Government	+Ti	+TDc	+TDo	+Tf		+Fc			+Yg
7. Capital Account		+Shc	+Sho	+FU	0	0	+Sg		+SAV
TOTAL	+p·Y	+Yhc	+Yho	+FT	+Yb	+Yc	+Yg	p·ΔK + p·ΔH	

Table 2. Model Stock Balances							
	Hous. Top 5%	Hous. B.95%	Firms	Banks	Central Bank	Govt	Total
1. Productive capital			$+p \cdot K$				$+p \cdot K$
2. Homes	$+ph \cdot H_c$	$+ph \cdot H_o$	$+ph \cdot H_U$				$+ph \cdot H$
3. Cash	$+HP_{hc}$	$+HP_{ho}$		$+HP_b$	$-HP$		0
4. Central bank advances				$-A$	$+A$		0
5. Banks deposits	$+M_c$	$+M_o$		$-M$			0
6. Loans to firms			$-L$	$+L$			0
7. Mortgages		$-MO$		$+MO$			0
8. Treasury bills	$+B_h$			$+B_b$	$+B_c$	$-B$	0
9. Equities	$+pe \cdot E$		$-pe \cdot E$				0
TOTAL	$+V_c$	$+V_o$	$+V_f$	0	0	$-B$	$+p \cdot K$ $+ph \cdot H$