

## **Financialisation, Debt and Inequality: Export-led Mercantilist and Debt-led Private Demand Boom Economies in a Stock-flow consistent Model**

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Abstract: In the era of financialisation, increasing income inequality could be observed in most developed and many developing countries. Despite these similar developments in inequality, the growth performance and drivers for growth differed markedly among countries, allowing clusters of different growth regimes to be identified. Among them two extreme types: the debt-led private-demand boom type and the export-led mercantilist type. Whereas the former relies mainly on credit-financed household consumption in order to compensate for the potential lack of demand (associated with the depressing effect of financialisation), the latter relies on net exports as the main driver of aggregate demand. Using a stock-flow consistent model it will be demonstrated how increasing inequality, depending on a countries institutional structure and regulatory framework, affects growth differently, explaining the occurrence of both regime types.

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## **1) Introduction**

The era of financialisation has been associated with rising income inequality. Increases in personal as well as functional income inequality could be observed in most developed and many developing countries before the financial and economic crisis (Dodig et al. 2015, Hein 2012). Despite these similar developments in inequality, the growth performance and drivers for growth differed markedly among countries, allowing clusters of different growth regimes to be identified. In Dodig et al. (2015) two extreme types of development under financialisation are distinguished: the debt-led private-demand boom type and the export-led mercantilist type (as well as an intermediate type, the domestic-demand led type). Whereas the debt-led private-demand boom type relies mainly on credit-financed household consumption in order to compensate for the potential lack of demand (associated with the depressing effect of financialisation on investment in capital stock and on income-financed consumption), the export-led mercantilist type relies on net exports as the main driver of aggregate demand. Using a stock-flow consistent (SFC) model it will be demonstrated how increasing inequality, depending on a country's institutional structure and regulatory framework, affects growth differently, explaining the occurrence of both regime types.

In the second section of the following paper, we will first shortly discuss the main theoretical channels through which financialisation and in particular increasing inequality is assumed to affect macroeconomic developments. In particular, the focus will be to explore the different circumstances under which increasing inequality tends to contribute to the export-led mercantilist type of development or to the debt-led private-demand boom type. After a short literature review, we will present the structure of our own stylised SFC-model, built to show how inequality has contributed to each of the regimes. We will create two model economies only differing in some institutional features to demonstrate how identical changes in personal income inequality supported the emergence of differing regimes. The final section will summarise the results and draw some conclusions.

## **2) Financialisation, inequality, debt and economic growth**

The era of financialisation has been associated with increasing inequality, lower investment demand, a higher potential for debt-financed and wealth based consumption, as well as the deregulation of international financial markets and capital accounts (Hein & Dodig 2015). Financialisation has contributed to a rising profit share and higher personal income inequality, mainly via reduced bargaining power of trade unions, rising profit claims by more influential shareholders, and a change in the sectoral composition of the economy at the expense of the government and the non-financial corporate sector in some countries. The investment activity of firms has been depressed through the 'preference channel' – due to a variety of measures managers are incentivised to prefer short-term financial investment over long-term real investment – and the 'internal means of finance channel' – a drain of internal sources of finance due to higher dividend demands and share buybacks reducing overall investment in the capital stock. The effect of lower investment on aggregate demand is directly comprehensible. For functional income inequality, a higher share of GDP going to profits in a world where the vast majority of countries are wage-led can be expected to add to stagnationary

tendencies.<sup>1</sup> For higher personal income inequality, redistribution from low income households to high income households is expected to lead to overall lower consumption demand due to the lower propensity to consume of the latter group.<sup>2</sup> Hence, in a country where financialisation has strongly affected investment and where inequality has increased substantially, domestic demand should be growing relatively slowly and a tendency towards net-exports as the driver for growth should be apparent. However, sustaining this 'strategy' of export-led growth required that these countries accumulate large current account surpluses and positive international investment positions. The financing of the counterpart deficits and debts was enabled by another feature linked to the era of financialisation: liberalised and deregulated international capital markets and open capital accounts. Finally, financialisation has provided alternative ways to generate growth for some countries. The liberalisation and deregulation of national financial systems in the era of financialisation allowed some countries to generate demand via debt-financed consumption by households (and partly by debt-financed investment of firms). In the literature a range of explanations are put forward, why in some countries debt driven expansions occurred but not in others. In principle two preconditions must be met for the occurrence of this debt-led private-demand boom type of development. On the one hand, households must have reason to increase their consumption to such a level that they need to borrow. On the other hand, credit supply must be sufficient. If either of these two factors is absent a debt-led expansion driven by private demand will not occur. In line with this, the arguments brought forward in the literature can be analytically divided into two groups; those focusing on the increasing availability of credit, assuming that this was the limiting factor holding back existing consumption demand by households, and those stressing the reasons why households increased their consumption demand, assuming that credit was sufficiently available.

One of the main supply side explanations for whether a country will tend towards debt-led expansion or a slowdown of activity in the face of increasing inequality is found in the degree of development, regulation, and liberalisation of the financial system, which determine the availability of credit for households (Belabed et al. 2013, Kumhof et al. 2012, Cardaci & Saraceno 2015). Here, the argument is that in some countries access to consumer credit (in particular, access of low income households) is restricted while in others access to credit is relatively easy. Differences in credit access among countries or within one country over time are related to different levels of development of the financial system (Kumhof et al. 2012) or the degree of deregulation and liberalisation (Dutt 2005, Belabed et al. 2013). Others relate the credit expansion to deliberate government policies to alleviate the effects of increasing inequality (Rajan 2010) or see it as the outcome of a bad incentive structure in the financial system or regulatory failure (Stiglitz 2010). Another supply side argument is related to asset price increases observed in many of the debt-led private-demand boom countries. The argument here is twofold. Firstly, increasing asset prices increase the collateral households can offer banks to secure loans and so lift credit constraints. And secondly, when prices for assets held by banks increase, this increases banks' regulatory capital and so allows them to extend additional loans

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<sup>1</sup> A country is described as wage-led when an increase in the wage share increases aggregate demand, or profit-led when an increase in the profit share increases aggregate demand (Bhaduri & Marglin 1990). A range of empirical studies have shown that based on their domestic demand aggregates most countries are wage-led, even though for some countries the results can differ when net-exports are also considered (Bowles & Boyer 1995, Stockhammer & Ederer 2008, Stockhammer et al. 2009, 2011, Onaran & Galanis 2012).

<sup>2</sup> For research on different savings rates by different income groups see Dynan et al. (2004) or more recently Alvarez-Cuadrado & Vilalta (2012). See also Brown (2004) for discussion and simulations on the effect of income inequality on aggregate consumption in the USA.

(Bhaduri et al. 2006). Finally, Cynamon & Fazzari (2008) argue that the debt norms of households have changed. While in the past it was common to take out a loan to buy a house or some consumer durables (e.g. a car), it has become much more acceptable to debt-finance far less needed commodities and services (e.g. a holiday). The social stigma associated with debt has decreased over time.

While these factors can explain why credit was more easily accessible in some countries than in others and why credit supply may change over time, the reasons why households increased their consumption demand relative to income (forcing them to rely on debt) are not explained. Explanations provided by the recent literature are often based on relative consumption concerns, emulation effects, and conspicuous consumption. It is argued that households' own consumption aspirations are partially oriented towards the consumption of a reference group, often the group just above theirs in the income distribution. The strength of these emulations or 'keeping up with the Joneses' effects depend on the institutional setting within a country (labour market structure, access to public services, schooling, etc.). Depending on whether those effects are strong (as in the US) or weak (as in Germany) an increase in personal income inequality will either have expansionary effects – because the increased savings of the higher-income households are overcompensated by a decrease in the savings of the lower-income households – or lead to a slow-down in demand growth (Duesenberry 1949, Frank 2007, Frank et al. 2014). An alternative argument is brought forward by Pollin (1988), who argues that there was, what he terms, a 'necessitous demand for credit'. It is assumed that households seek to maintain a certain level of consumption, thus, if their income declines they would rather lower their savings or go into debt than decrease consumption. For low income households and generally for low income countries this level can be assumed to be determined by a subsistence level of consumption, which can be socioeconomic or existential. More generally, and also relevant for households further up the income distribution, it can be determined by habit persistence. Meaning that households are reluctant to consume less than a previously experienced level of consumption. According to Barba & Pivetti (2009), the existence of such an acquired standard of living was already recognised by classical economist as 'customary necessities'. Only declines in real wages persisting over longer periods of time will slowly reduce those 'customary necessities'. Again, the effects of increases in income inequality depend on the country specific strength of these effects, which in turn may be influenced by national institutions (e.g. welfare state provisions) (Duesenberry 1949, Frank 2007, Frank et al. 2014). Finally, some authors relate the increases in consumption in some countries to asset price increases. Here the argument follows that increased asset prices have increased households' notional wealth compared to income, households feel richer and so consumption out of wealth increases (Bhaduri et al. 2006, Dutt 2006).

### **3) Literature review on models dealing with financialisation, inequality and debt**

While there are many formal models looking at the relations between increasing inequality and debt and its macroeconomic implications, as for example; Palley (1994), Dutt (2006), Zezza (2008), Lavoie (2008), Kumhof & Ranciere (2010), Hein (2012a), Kapeller & Schütz (2012), Kim et al. (2014) or the stock-flow consistent agent based model of Cardaci & Saraceno (2015), only few models have dealt with these topics while simultaneously considering open economy issues – to our knowledge only those by Kumhof et al. (2012) and Belabed et al. (2013). Therefore, we will focus our review on these

last two, as they include an international dimension, and also on the model by Cardaci & Saraceno (2015) because of their very similar methodology, research question, and results.

Belabed et al. (2013) construct a three-country SFC-model, calibrated for China, Germany, and the USA, examining the effect of increasing inequality on current account balances. Their focus is on consumption emulation, where its relative strength in each country depends on the respective institutional structure. In addition, they consider credit supply side constraints as related to regulation and financial system development, represented by a maximum leverage ratio for households. They find that a large part of the observed debt increases and current account deficits in the USA can be explained by increasing personal income inequality (in particular top end inequality) interacting with institutions which incentivise upward looking consumption emulation and allow for relatively easy access to credit. In contrast, they find that the weak domestic demand and increasing current account surpluses of China and Germany can be explained by a shift in functional income distribution away from the household sector with no compensation by credit-financed consumption.

Kumhof et al. (2012) build an open economy DSGE model in which they address the issue of inequality. In their model, higher inequality in countries with developed financial systems leads to stronger growth in the short run, but also to rising debt balances for workers. These debts are financed by domestic high income households and foreign investors and lead to a deterioration of the current account balance. The effects are stronger with more liberalised financial markets. In an emerging markets scenario, where workers cannot borrow due to a lack of financial intermediation, increasing inequality leads to current account surpluses instead.

Cardaci & Saraceno (2015) build a SFC-model with an agent based household sector. In their household sector, households consume according to their own income and emulate the consumption of the households just above them in the income distribution. They have access to credit, which banks however ration according to the overall debt-to-GDP ratio and households' individual financial soundness. They look at two different scenarios; one where access to credit is easy and the other where access is restricted to a low level. If they increase personal income inequality in both, they find for the scenario with little access to credit that the economy enters a recession. In contrast, in the scenario with high access to credit, the redistribution of income leads to an initial expansion. However, when debt becomes too high, banks restrict access to credit and GDP declines slowly and even falls below the baseline level.

Regarding the chosen methodology and the theoretical background, the model we will present in this paper is closest to the models of Belabed et al. (2013) and Cardaci & Saraceno (2015). Both use the SFC framework for their models. While Belabed et al. (2013) model every decile of the household sector for each country, the other sectors of their economies are lumped together into one sector. Cardaci & Saraceno (2015) have a more detailed domestic economy and an agent based households sector but neglect the international dimension. The model presented here will add to the literature by taking into account the international dimension – by adding an additional sector representing the rest of the world. This is less detailed than in Belabed et al. (2013) but allows us to give more emphasis on the national sectoral relations. This enables us to look at different effects of financialisation in more detail and also examine policy changes in a single coherent framework.

## 4) Model Structure<sup>3</sup>

In this section we will introduce our basic model set-up. We will employ the method of stock-flow consistent accounting advanced by Lavoie & Godley (2002) and Godley & Lavoie (2007). The model will display personal and functional income distribution in a stylised way. Following on from the previous discussion, our model will focus on a number of the aspects thought to prevent or support the occurrence of either regime type. On the demand side we will focus on relative consumption concerns and model household consumption behaviour along these lines. We will also consider the effects of credit supply side constraints, which in principle can be interpreted as a constraint imposed by prudence considerations of the banking sector, by regulation, or by the household sector as a self-imposed conventional constraint. While asset price bubbles play an important role, in particular as an explanation for the US-crisis, their role will not be explored within this paper.

### Balance sheet and transaction flow matrices

Our model economy contains a firm sector, a banking sector, the government, a household sector, and an external sector. Similar to Kapeller & Schütz (2014), the household sector is split into three parts to explicitly allow us to model the effects of changes in the income distribution: a rentier sector, where we have the main wealth holders and profit recipients, and two worker household sectors. Worker 1 households are assumed to be lower-wage workers, while worker 2 households receive relatively higher wages. This allows us to model separately wage distribution and functional income distribution. To show the effects of domestic developments on the current account we add a simple external sector which represents the rest of the world (RoW). We abstained from introducing a central bank. Therefore, there is only private bank money in the form of deposits. The balance sheet relations of our model economy are shown in table 1 and in table 2 the transaction flow matrix is displayed.

<<Insert Table 1 around here>>

<<Insert Table 2 around here>>

### Behavioural equations

#### Distribution, employment and production

The proposed model is demand constrained and firms produce and sell on demand so that there are no inventories. Total production is therefore given as the sum of total consumption demand, investment demand, government demand, and export demand minus import demand. With fixed labour productivity, the production level determines total employment. Firms hire labour power from type 1 and type 2 worker households. We assume for simplicity that the production process necessitates equal amounts of both workers and that there is no constraint on the supply of labour (Equations 1 – 4).

We assume a constant capital potential output ratio, fixed labour productivity, and fixed prices. Functional income distribution is set exogenously and assumed to be determined by institutional factors such as the power of labour unions, competition in the goods market, power and dividend/interest aspirations of rentiers, etc. – variables exogenous to the model. The total wage bill is determined by the wage share and total production. Dividing the wage bill by total employment

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<sup>3</sup> The entire set of model equations and a full list of all variables can be found in the Appendix.

provides the average wage. The distribution of the total wage bill within the working class is set exogenously. The better earning worker 2 households receive a multiple of the average wage, the wage of worker 1 households is then determined as residual (Equations 5 – 9).

### **The firm sector**

Firms' capital stock in the current period is given by the previous period's capital stock plus gross investment minus the depreciation of the capital stock, which equals the depreciation allowances of firms. The rate at which firms want to let the capital stock grow (the accumulation rate) is oriented along the lines of the post-Kaleckian investment function introduced by Bhaduri & Marglin (1990) or Kurz (1990). This means we assume that the utilisation rate is adjusting endogenously.

$$gr_k = \beta_1 + \beta_2 * u(-1) + \beta_3 * PS(-1) - \beta_4 * r_l(-1) + \beta_5 * (PU_f(-1) + DA(-1))/K(-1)$$

Accumulation is positively affected by firms' animal spirits. Additionally, the previous period's utilisation rate (which can be seen as a proxy for future expected utilisation and sales) and the profit share (which gives the profits per unit of production) affect investment positively, because both increase the expected profit rate. In addition, we assume that the cash flow rate positively affects the ability of firms to finance investment internally. This is important for the overall ability of firms to invest, when acting in incomplete credit markets with asymmetric information (Kalecki 1937) and can be seen as the internal means of finance channel (Hein 2010, Hein & van Treeck 2010). Therefore, higher dividend payments, e.g. a lower retention rate, have a negative impact on investment through this channel. The interest rate has a dual negative impact, directly and indirectly. The indirect effect is, as with dividend payments, via the cash flow variable which will be lower when interest payments increase. The direct effect is that higher interest payment commitments, when the interest rate rises, lower firms' credit worthiness and increases the risk of insolvency, so that entrepreneurs may be more reluctant to start new investment projects. Also banks are more reluctant to grant additional credit (Lavoie & Godley 2001, 2002, Minsky 1986) (Equations 10 – 16).

Firms' gross profits are determined as total production times the profit share. Firms pay a fraction of their positive profits after depreciation and interest payments as taxes. An exogenously determined fraction of net profits is retained and the rest is distributed to rentiers (Equations 17 – 23).

Firms need to finance their investment. For the share that is not covered by retained profits and depreciation allowances they need to raise external finance. A fraction of this external finance demand is covered by selling new shares to the public and the residual demand is covered by bank loans or by drawing on existing deposits (Equations 24 – 32).

### **The household sector**

For the consumption function of high-wage workers (type 2) and rentiers we follow the standard formulation in Godley & Lavoie (2007) so that consumption is determined by households' previous period's income (and therefore increases with accumulated wealth).

$$C_{W2} = p_{C_{Yd,W2}} * Y_{dW2}(-1) + p_{C_{V,W2}} * V_{W2}(-1)$$

$$C_R = p_{C_{Yd,R}} * Y_{dR}(-1) + p_{C_{V,R}} * V_R(-1)$$

For worker 1 households' consumption we deviate from this standard formulation and add an emulation term. Inspired by Veblen's (1899) concept of conspicuous consumption and Duesenberry's (1949) relative income hypothesis, low income workers' consumption is positively influenced by the

consumption of high-wage workers. As do Kapeller & Schütz (2014), we also assume that relative consumption concerns are more relevant among worker households (that share a common social identity), while the rentier class (representing a distant group) has no influence.<sup>4,5</sup> The desired consumption of worker 1 households is then determined by their income, their wealth, and the consumption of worker 2 households, which they try to emulate. The relative importance of the emulation among workers is determined by different factors and given exogenously.<sup>6</sup>

If their consumption aspirations are below their income, workers' actual consumption will be equal to their desired consumption. If workers' income is lower than their consumption aspirations, they can take out loans. In the baseline cases banks grant all loans demanded, so that actual consumption will always equal desired consumption.

However, in line with the argument that a restriction of credit supply can prevent the occurrence of a debt-led private-demand regime, we impose in the financial constraint scenario a limit to credit supply. The amount of consumption workers can finance by debt will be restricted based on households' debt-to-income ratio and an exogenously given prudential ratio. The lower this prudential ratio the lower the acceptable debt-to-income ratio. In line with the arguments presented above, it can be interpreted either as a self-imposed convention by workers, as a constraint imposed by banks own prudence or financial regulation, or as a measure of financial sector development.

$$C_{d,W1} = (1-imit) * pc_{Yd,W1} * Yd_{W1}(-1) + imit * C_{W2} + pC_{V,W1} * D_{W1}$$

Consumption function for the baseline scenarios:

$$C_{W1} = C_{d,W1}$$

Consumption function for the financial constraint scenario:

$$C_{W1} = z_{99} * C_{d,W1} + z_{100} * (C_{d,W1} - (C_{d,W1} - Yd_{W1}(-1)) * L_{W1}(-1)/Yd_{W1}(-1)/PrudRat)$$

$$z_{99} = 1, \text{ if } C_{d,W1} < Yd_{W1}; \text{ else } 0$$

$$z_{100} = 1, \text{ if } C_{d,W1} > Yd_{W1}; \text{ else } 0$$

If consumption is below income, households accumulate wealth. Both worker households will only hold deposits as savings. Rentiers make a portfolio choice between holding firms' equity and deposits. The portfolio composition of expected wealth is determined by the relative rate of returns along the principles proposed in Godley & Lavoie (2007).<sup>7</sup> In addition rentiers want to hold a certain

<sup>4</sup> Empirical evidence for this type of consumption function is provided by Kim et al. (2015) for US-households.

<sup>5</sup> This assumption is in line with the argument by Frank (2007) that consumption behaviour is most heavily influence by reference groups close to one in rank, time, and space.

<sup>6</sup> Our consumption function is oriented along the same lines as the consumption function found in Belabed et al. 2013. For the discussion of this consumption emulation effect in the literature see for example Duesenberry (1949), Frank (2007), and Frank et al. (2014).

<sup>7</sup> These imply a range of adding up constraints, which ensure consistency of the chosen parameters for the portfolio decision of households. For an overview of those see Godley & Lavoie (2007, 141 - 146).

amount of deposits for transaction purposes. Since it is the only sector holding equities they have to hold all shares issued by the firm sector. Given this constraint, the price of equity is the adjusting variable. Deposits form the buffer stock if rentiers' expectations are not met (Equations 33 – 67).

### **The government sector**

Government income consists of tax income received from households and firms. Government consumption expenditure is growing at a rate that follows the overall growth of the economy, but is adjusted to reach a deficit target (we assume for the baseline case a 3% deficit in line with the EU stability and growth pact). The deficit is defined as government consumption minus tax receipts minus net interest payments (Equations 68 – 76). Therefore, the government sector is largely passive and does not play a stabilising role but focuses on reaching its deficit target.

### **The banking sector**

Banks are the counterparts for all loans and deposits in the economy. They are also the financial link to the RoW. Banks supply loans on demand and are willing to accept any amount of deposits. Interest rates on loans and deposits both equal the policy rate, so that there will be no profits in the banking sector (Equations 77 – 80).

### **The rest of the world**

While many open economy SFC models are developed as multiple country models (e.g. Belabed et al. 2013, Godley & Lavoie 2007), we use a simpler framework and the RoW is added as another sector to our model economy, as for example done by Godley & Lavoie (2012) or Meijers et al. (2013). We assume that this external sector grows at an exogenously given rate and that our domestic economy's exports grow at the same rate. Imports from the RoW are determined as a share of domestic production. As Godley & Lavoie (2012) or Meijers et al. (2013) we do not discuss terms of trade and exchange rate issues. This can partially be justified by the fact that we assume our economy to be part of the Euro area. Additionally, even though countries will still be affected by the external exchange rate of the euro, the effects on the exchange rate from actions of our economy are assumed to be negligible, making this factor also exogenous to our model. In addition, with fixed prices we have also abstained, somewhat unrealistically, from allowing for internal devaluation via differential inflation rates. The banking sector intermediates the external financial relations by taking deposits from and granting loans to the RoW. The growth of the economy in the steady state is driven by the exogenously given growth of exports, which we set at 3.5% (Equations 81 – 89).<sup>8</sup>

## **5) Modelling strategy and the baseline scenarios**

As mentioned earlier, while in many countries there has been an increase in personal income inequality and a shift towards profits, the outcome on a macroeconomic level has differed markedly among countries. Some ended up with meagre growth and substantial current account surpluses (export-led mercantilist economies in our classification), while others have experienced higher growth, increasing debt levels, and current account deficits (debt-led private-demand economies). While there are many factors influencing the macroeconomic performance of countries, we attempt to show that increasing inequality can have different effects depending on the specific institutional setting of a country and the form which inequality takes. Although country studies on financialisation

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<sup>8</sup> This roughly equals the average world growth rate in the 2000s before the financial and economic crisis.

and the macroeconomic regime<sup>9</sup> have found a range of important features and phenomena influencing the respective macroeconomic developments, we chose to focus on the emulation effect, a phenomenon directly related to inequality. Other important findings which could be modelled and examined in further research are, for example, the existence of a socio-economic minimum consumption level which persisted despite lower incomes and which led to increasing household debt levels (see for example Kattel & Juuse (2014) on Estonia), or the role of asset price bubbles (as in Ferreiro et al. (2014) on Spain). Both could add in particular to the understanding of the mechanisms behind the debt-led private-demand boom type of development.

As a modelling strategy we created two scenarios of two very similar stylised economies with the same set of parameters except for the emulation term: we will start with *Low Emulation Country (LEC)*, which represents an economy with an institutional structure that minimises the emulation effect. Using the same starting values to minimise effects of path dependency, we created our *High Emulation Country (HEC)* scenario representing a country with an institutional structure conducive to strong emulation effects. There are various factors proposed which determine the relative importance of emulation for consumption in a country. Belabed et al. (2013) for example argue that the strength of the emulation effect is influenced by country specific institutional factors such as flexibility of labour markets, availability and quality of public infrastructure, etc. The more universal, good quality services a state offers, the lower the influence of the emulation effect on consumption should be. For example, if high quality public schools can be found throughout a country, the necessity to pay high fees for private schools or to move to certain areas where the public schools are regarded as of higher quality is less relevant. According to Frank (2007), certain regulations and also how public services (e.g. kindergarten vouchers or free public kindergartens) are provided encourages or discourages emulative behaviour and the focus on positional goods. Belabed et al. (2013) calculate the effects of differences in labour market arrangements and public infrastructure (health care, schooling, transfers, etc.). According to their calculation the difference of 0.5, which is the difference in emulation between our *LEC* and *HEC* cases, would approximately reflect the difference in emulation between the USA and Germany. After having found a steady state for both economies, we expose them to the same shocks and compare the results to the respective baselines. For the interpretation of the results in the following scenario analyses it is important to distinguish between the 'short to medium' run transition effects (being predominantly described and displayed in the figures) where growth rates differ, and the steady-state results in which the economies return to the exogenously given growth rate determined by the growth of exports. However, the level of the steady-state growth path, the composition of demand components, and also the financial positions may change substantially due to the shocks.

## Starting values and parameters

The chosen parameters can be found in the Appendix. We chose the parameters to produce plausible values<sup>10</sup> for our baseline scenario in terms of shares in GDP, utilisation rates, and saving/lending

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<sup>9</sup> See FESSUD studies 18 – 34 available at <http://fessud.eu/studies-in-financial-systems/>.

<sup>10</sup> The values do not correspond to the values found in any particular country, but are close to what can be found in a typical western industrialised country. The shares in GDP would roughly fit the values found for the Euro area in the year 2000. However, the share of consumption is slightly too low and investment and government expenditure are too high. Also, with the very low degree of inequality, both baseline cases do not clearly exhibit features of the export-led mercantilist or the debt-led private-demand types of development. The developments will only show if we allow inequality to increase.

relationships. In addition, we oriented the values along typical stylised facts (e.g. higher propensities to save for high income earners) and of values chosen in other SFC-models of a similar structure. Furthermore, we wanted our model economies to recreate some well-known features established in the Post-Keynesian literature, such as the paradox of thrift. Regarding the distribution of the wage bill we start with a very low degree of inequality, while for functional income distribution on the firm level 60% goes to wages and 40% to profits.

### **The baseline scenario with and without emulation**

For the *LEC* we set the effect of the emulation term to zero, so that there is no emulation affecting the consumption decision of low-wage worker households (here consumption is only influenced by their own income and wealth). In table 3, we present the steady-state values for the *LEC* in columns 1 – 4 and for the *HEC* in columns 5 – 9. In the long run, for all scenarios, the steady-state growth rates of GDP and its demand components and of the capital stock all converge to 3.5%, in line with the exogenously given growth of exports. In our *LEC* baseline scenario (column 1) the utilisation rate converges to 68.39%. The economy has a low trade surplus of 0.7%. Regarding the financial balances, the household sector and also its three subsectors are in surplus. The firms, the government sector, and the RoW are net financial debtors.

To create the *HEC* baseline scenario we increased the emulation factor to 0.5, while all other parameters remained unchanged. Generally, when comparing the figures the focus should be on the qualitative change and less on the quantitative size of the effect. Compared to the *LEC* the steady-state GDP level is higher in the *HEC*. This is due to the increased consumption of worker 1 households, which now try to mimic the higher consumption level of worker 2 households. The new steady state is characterised by a higher share of consumption in GDP, while exports and the trade balance have deteriorated. Regarding the wealth position, worker 1 households have run down parts of their wealth, while the net international investment position of the domestic economy has deteriorated (column 5).

<<Insert Table 3 around here>>

## **6) Experiments**

We used the models to conduct a range of experiments: First, we increased the propensity to save of worker 2 households, to demonstrate the paradox of thrift. Then, we focused on income inequality. We first changed functional income distribution by redistributing towards profits. Then we simulated an increase in wage inequality. To mention an important result in advance, we found that increasing wage inequality in the *LEC* showed the features of an export-led mercantilist growth model, while in the *HEC* the debt-led private-demand boom scenario was established. To show the importance of credit supply we repeated the experiment in the *HEC*, however, in this case we imposed a financial constraint that limits access to credit as discussed earlier. Here, it became clear that only with the help of easy credit policies are debt-led private-demand types of growth feasible, outlining the central role of financial deregulation for this type of regime. While we present the steady-state

results for all experiments in table 3, we focus our discussion on the shocks to personal income inequality, while only shortly discussing the other scenarios.<sup>11</sup>

### **Scenario 1: Increased propensity to save**

We shocked both baselines by reducing the propensity to consume of worker 2 households from 0.7 to 0.6. Here in both the *LEC* and the *HEC*, we find the paradox of thrift to be valid. The initial decrease in worker 2 consumption leads to an overall slowdown of growth of domestic expenditure. While in the long-run utilisation reaches its previous level again, GDP and capital stock are below the baseline. Overall, worker 2 households' consumption has decreased its relative share in GDP. Furthermore, the lower relative growth rate compared to the RoW in the transition phase has led to an increase in the trade balance. This is reflected in the financial balances: while worker 2 households accumulated more financial wealth due to their higher savings rate, the improving trade balance has led to increased indebtedness of the RoW (table 3, column 2).

The results of the increased propensity to save of worker 2 households are qualitatively the same in the *HEC*. However, the effects are stronger due to the fact that the reduced consumption of worker 2 households lowers also the consumption of worker 1 households, so that GDP sees a greater drop relative to baseline. Both worker households increase their financial wealth and the increase in the trade balance and in the debt level of the RoW is stronger (table 3, column 6).

### **Scenario 2: Changes in the functional distribution of income**

Next we assumed a decline in the wage share by 10 percentage points of GDP. This decline is modelled in a way that it affects all worker households equally – this means the wage distribution remains unaltered. This could be interpreted as a general decline of workers bargaining power, due to weaker unions, global wage competition, or a decline in product market competition, e.g. due to an increase in the degree of monopoly. Here for the *LEC* and the *HEC* we find that a higher profit share, while able to increase total profits leads to a temporary slowdown of growth. While higher profits initially lead firms to increase their investment expenditure, consumption falls and utilisation rates decline. With the lower utilisation firms reduce investment and in the new steady state both model economies have an overall lower level of activity and a lower capital stock (which is to be expected for a wage-led economy). However, the capital stock has grown stronger than output so that utilisation in the new steady state is lower. Investment as a share of GDP has increased. Overall consumption has gone down. Due to the overall contractionary effect the trade balance of the domestic economy has improved. The changes in distribution are reflected in the financial positions of the sectors. Workers have reduced their financial wealth, while the financial position of rentiers has improved. Also, the firm sector could reduce its debt level, while the domestic economy as a whole increased its financial claims on the RoW. While the results are qualitatively the same for both

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<sup>11</sup> To investigate the effects of the different experiments we simulated both model economies until they converged to a steady state. We introduced the shock in period 100 and ran the model for another 400 periods to obtain the new steady states. Each period should be considered as one year. With 500 periods our simulations cover a very long period of 500 years. This is due to the fact that after a shock the model is adjusting for a relatively long time towards the new steady state. However, as one can see in the figures, the most relevant deviations take place within a 10 – 20 year period after a shock, while the changes thereafter are of relatively small magnitude.

baselines, in the economy with the higher emulation effect, the effects are slightly stronger again. This is due to the fact that the emulation behaviour has led to an overall higher propensity to consume of worker households, and so redistribution away from worker households to rentiers will have a stronger effect than in the economy without emulation effects (table 3, columns 3 and 7).

### **Scenario 3: Changes in the wage dispersion**

Next we focus on personal income distribution and change in the wage dispersion. In the baseline cases we assumed relatively mild wage inequality with the worker 1 households earning 10% below the average wage and the worker 2 households earning 10% above the average wage. In this scenario we increased the wage dispersion by increasing this differential to 30% each, so that the average wage in the economy and the functional income distribution are not affected.

In the case of the *LEC* we find typically expected effects (figure 1, table 3 column 4). Consumption growth substantially goes down. Worker 1 households see their income decline and lower their consumption correspondingly. At the same time worker 2 households increase their consumption because of their higher income. However, due to their lower propensity to consume this does not compensate fully for the decline in low-wage workers' consumption. With the slow-down of the economy the government sees its deficit increase and reduces its growth of expenditures as well. The firms, confronted with lower capacity utilisation and lower cash flows, also reduce investment. In the long run, the economy reaches a new steady state with a GDP level and a capital stock below the baseline. The share of worker 1 household consumption in GDP has dropped and worker 2 households consume relatively more. The slow-down of the economy relative to the RoW has improved the trade balance. This is reflected in the financial positions. Worker 1 households have lowered their financial wealth in line with the lower income and worker 2 households have increased their financial wealth. The improved trade balance has led to an improvement of the domestic economy's net international investment position and correspondingly to an increase in the indebtedness of the RoW.

<<insert Figure 1 around here>>

Conducting the same experiment in the *HEC*, the obtained results are quite different (figure 2, table 3 column 8). While worker 2 households increase their consumption in line with their increased income, a difference is noted from the *LEC*, as worker 1 households do not decrease their consumption correspondingly. Rather, worker 1 households' consumption is initially negatively affected by their lower income, but this is subsequently compensated by their emulation behaviour. Observing the higher consumption level of worker 2 households, worker 1 households try to keep up and increase their consumption again. However, with consumption being higher than disposable income, worker 1 households first run down their financial wealth and then get increasingly indebted. The overall higher consumption stimulates the economy and lowers the government deficit, so that the government increases its expenditure. Firms' utilisation rates and cash flows rise so that they start increasing investment. In the new steady state, the level of GDP and the capital stock are both at a higher level. However, strong domestic growth compared to the RoW has led to a deterioration of the trade balance. This led to higher indebtedness of the domestic economy against the RoW, leaving it in a potentially vulnerable position to capital outflows. In their attempt to keep up with their better earning peers, worker 1 households have increased their debt-to-income ratio substantially, which makes the economy financially more fragile.

<<insert Figure 2 around here>>

### **Scenario 4: Increased wage dispersion with strong financial regulation**

In the previous analyses we have assumed that banks supply credit on demand without limits, which was of key importance in enabling the strong increase in the worker 1 households' debt levels. While this is clearly an extreme assumption it is inspired by the observation that the era of financialisation is associated with a weakening of financial regulation and easier access of households to credit.<sup>12</sup>

However, while a lowering of financial standards could be observed in many countries, in some countries substantial regulations remained in place. Also, it should be noted that these changing attitudes of households towards credit did not occur in all countries to the same degree – previous experiences of debt bubbles or a lack of optimism about the future economic developments may have induced households to restrict themselves in their use of debt. Also, in some countries high debt levels did not allow for a further extension of credit. Regulatory and norm-based restrictions may have become more binding with the financial crisis. Countries have introduced new regulations to address the problems observed during the crisis. In addition, consumer attitudes towards borrowing for consumption purposes may have changed due to their experience of the financial crisis or may be restricted due to incurred debt in the credit boom. Therefore, in the following scenario we investigated how increases in inequality affect the macroeconomic developments under binding financial constraints. For this, we modified the consumption function as described above. Desired consumption of worker 1 households is determined as before but a financial constraint is imposed based on their prevailing debt-to-income ratio and the exogenously given prudential ratio. We repeat scenario 3, the increase of wage dispersion, in the *HEC*, but with the modified consumption function and use a parameter of 1 for the prudential ratio which substantially limits households' access to credit compared to the original *HEC* case.

The initial effects after the shock are similar to the ones observed in scenario 3 (see figure 3). Worker 2 households increase their consumption in line with their higher income. Worker 1 households first react to the reduction of their own income and limit consumption accordingly. However, with the observation of the higher consumption of worker 2 households, they increase consumption as well. Consumption increases above income and so they run down their wealth and eventually have to resort to credit. While in the beginning, the financial constraint is only weak, it increases with a higher debt-to-income ratio so that the gap between desired consumption and actual consumption grows. This drags overall consumption and GDP growth down. Initial positive impacts on government consumption and capital accumulation are reversed. In the long run, we achieve a steady state with a slightly lower capital stock and GDP level. Due to the introduced financial regulation, the expansionary effect of debt-financed consumption that previously countered the contractionary effect of higher inequality only occurred for a short period. Hence, countries face a dilemma – in the face of further increasing inequality they seem to be able to choose between higher growth, coupled

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<sup>12</sup> See Cynamon & Fazzari (2008) / FESSUD studies on financial systems 1 -17 for detailed studies on the spread of financial innovations that facilitated easier access to credit (<http://fessud.eu/studies-in-financial-systems/>).

with an increasingly financially fragile household sector, or lower growth, while maintaining a financially sounder household sector.<sup>13</sup>

<<insert Figure 3 around here>>

## **7) Some qualification of the obtained results**

When looking at the results, some caveats should be raised. The results depend on the specific parameter constellation chosen for the simulation. Plus, a key assumption made in order to obtain the two regimes was the difference in relative consumption concerns. Regarding the parameter choice, we have not calibrated the model to any specific country. Instead, we chose them to deliver plausible results and oriented our choice along empirically found parameters and parameters used in the literature. The wage-led character of the economy also depends on the parameter choice we made, but given the econometric research on this topic it can be seen as plausible for most countries. Relative consumption concerns are a culturally and institutionally determined factor and their relative strength depends on a variety of institutional settings and may change over time. A clearer investigation into their determinants should be conducted. Also it is only one of the explanations found in the literature that can explain the occurrence of the macroeconomic features of the debt-led private-demand boom type of development and its relevance is mostly documented for the USA. While in country studies summarised by Dodig et al. (2015) and within other research (for example conducted by Hein (2012)) many countries showed features of the debt-led private-demand type of development in the macroeconomic data, the underlying explanation may be different. For example, in Spain, the increase in housing prices seemed to be of high relevance for its development (Ferreiro et al. 2014), and for many of the Eastern European countries, the case for a minimum consumption that is upheld relatively independent of developments in income may be a more appropriate explanation (Gabor 2014, Kattel & Juuse 2014). The dynamics of the model should be examined under such alternative assumptions. Finally, changes in the financial sector and in credit supply have played a central role for the developments before the crisis. While we are examining the role of a financial constraint in the scenario conducted last, this clearly is an overly simplified representation of the complex processes and changes in the financial sector in many countries. The specific developments in the financial sector in the era of financialisation have been country specific and taken different forms. An advantage of the abstract nature of the financial constraint we adopted is that it can be interpreted in a variety of ways and so applies to many countries.

## **8) Conclusions**

We started from the observation that in the era of financialisation increasing functional and personal income inequality could be observed in most developed countries. At the same time at the international level growing current account imbalances have occurred, with a set of countries growing relatively strongly – often based on consumption growth, but realising current account deficits (debt-led private-demand boom countries), and another set of countries growing weakly – with exports as growth drivers and realising current account surpluses (export-led mercantilist countries). The link between the increasing inequality and the occurrence of the export-led mercantilist countries is established easily in a Post-Keynesian theoretical framework. Increasing

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<sup>13</sup> Here we equate higher financial fragility with higher debt-to-income ratios.

functional and personal income inequality redistributes income to groups with higher savings propensities and therefore undermines consumption growth. Lower growth compared to the rest of the world then improves the current account balance. The strong growth of the first set of countries in the face of increasing inequality is puzzling at first. However, coupled with the observation that in those countries low-income households have (despite lower incomes) not decreased their consumption, but rather chosen to reduce their savings or even become indebted, it appears less of a puzzle. It remains, however, to determine what factors were responsible for this decline in savings rates and allowed for the increasing indebtedness of households. Reviewing the literature, it becomes clear that two factors have to interact to create the debt-led private-demand boom type regime. On the one hand, a reason for households to reduce their savings rates is required. Potential explanations for this reduction provided by the literature are relative consumption concerns, habit persistence, a minimum level of consumption, or wealth based consumption in the face of asset price bubbles. On the other hand, a sufficient credit supply to those households that want to consume in excess of their income needs to be available. Here, the literature argues that credit became increasingly available in some countries due to deregulation of the financial sector, due to increasing collateral and bank equity because of booming asset prices, and because of changed attitudes towards debt-financed consumption and reduced stigmas associated with debt.

We have explored the interaction and importance of these factors within a stock-flow consistent model. We created two identical baseline economies, with the only difference being the importance of relative consumption concerns in households' consumption. Initially, for both model economies we assumed relatively low inequality and free access to credit. We exposed both to the same types of shocks. Related to functional inequality we found that in both economies an increasing profit share reduces growth and improves the trade balance. Increasing personal income inequality in an economy where relative consumption concerns are of little relevance leads to the expected result of a lower growth path and a tendency towards the export-led mercantilist type of development. Alternatively, in the economy where relative consumption concerns play an important role, an increase in inequality shifts the growth path upwards. This is due to the aspiration of low-wage workers to keep up with high-wage workers' consumption. For this, however, the debt-to-income ratio of those households has to increase substantially, making the economy more vulnerable to financial instability. At the same time, the higher growth path compared to the rest of the world led to a deteriorating trade balance. In this case, increasing inequality has contributed to the debt-led private-demand type of development. Finally, we gave up the assumption of free access to credit and introduced a financial constraint. Depending on how restrictive the financial constraint, the expansive effect of increasing inequality is smaller, or the regime even follows the trajectory of the export-led mercantilist type of development.

## 9) References

- Alvarez-Cuadrado, F. and M. E.-A. Vilalta (2012): Income inequality and saving, IZA Discussion Paper 7083, Institute for the Study of Labor, Bonn.
- Barba, A. and M. Pivetti (2009): Rising household debt: Its causes and macroeconomic implications—a long-period analysis, *Cambridge Journal of Economics*, 33, 113-137.
- Belabed, C.A., T. Theobald and T. van Treeck (2013): Income Distribution and Current Account Imbalances, IMK Working Paper No. 126, Macroeconomic Policy Institute (IMK) at the Hans Boeckler Foundation, Düsseldorf.
- Bhaduri, A. and S. Marglin (1990): Unemployment and the Real Wage: The Economic Basis for Contesting Political Ideologies, *Cambridge Journal of Economics*, 14(4), 375-393.
- Bhaduri, A. K. Laski and M. Riese (2006): A Model of Interaction between the Virtual and the Real Economy, *Metroeconomica*, 57(3), 412-427.
- Bowles, S. and R. Boyer (1995): Wages, aggregate demand and unemployment in an open economy: an empirical investigation, in: G. Epstein and H. Gintis (eds), *Macroeconomic Policy After the Conservative Era. Studies in Investment, Saving and Finance*, Cambridge: Cambridge University Press.
- Brown C. (2004): Does Income Distribution Matter for Effective Demand? Evidence from the United States, *Review of Political Economy*, 16(3), 291-307.
- Cardaci, A. and F. Saraceno (2015): Inequality, Financialisation and Economic Crises: an Agent-Based Macro Model, paper presented at the conference The Spectre of Stagnation? Europe in the World Economy, Berlin
- Cynamon, B. Z. and S.M. Fazzari (2008): Household debt in the consumer age: Source of growth - risk of collapse, *Capitalism and Society*, 3(2), 1-30.
- Dodig N., E. Hein and D. Detzer (2015): Financialisation and the financial and economic crises: Theoretical framework and empirical analysis for 15 countries, FESSUD Working Paper Series No. 110, University of Leeds.
- Duesenberry, J. S. (1949): *Income, Saving and the Theory of Consumer Behavior*, Harvard University Press.
- Dutt A.K. (2006): Maturity, stagnation and consumer debt: a Steindlian approach, *Metroeconomica*, 57, 339-364.
- Dynan, K. E., J. Skinner and S.P. Zeldes (2004): Do the rich save more?, *Journal of Political Economy*, 112(2), 397-444.
- Ferreiro, J., C. Gálvez, and A. González (2015): Financialisation and the Financial and Economic Crises: The Case of Spain, FESSUD Studies in Financial Systems No 19, University of Leeds.
- Frank, R. H. (2007): *Falling Behind: How Rising Inequality Harms the Middle Class*, University of California Press.

Frank, R. H., A.S. Levine and O. Dijk (2014): Expenditure cascades, *Review of Behavioral Economics*, 1, 55–73.

Gabor, D. (2013): The Romanian Financial System: from central bank-led to dependent financialization, FESSUD Studies in Financial Systems No. 5, University of Leeds.

Godley W. and M. Lavoie (2007): *Monetary Economics. An Integrated Approach to Credit, Money, Income, Production and Wealth*, Palgrave Macmillan, New York.

Godley W. and M. Lavoie (2012): Fiscal Policy in a Stock-Flow Consistent (SFC) Model, in: M. Lavoie and G. Zezza (eds), *The Stock-Flow Consistent Approach. Selected Writings of Wynne Godley*, Palgrave Macmillan, Basingstoke, UK.

Hein, E. (2010): A Keynesian perspective on financialisation, in: P. Arestis and M. Sawyer (eds), *21st Century Keynesian Economics, International Papers in Political Economy*, Palgrave Macmillan, Basingstoke, UK.

Hein E. (2012): *The Macroeconomics of Finance-dominated Capitalism – and its Crisis*, Edward Elgar, Cheltenham, UK.

Hein, E. (2012a): Finance-dominated capitalism, re-distribution, household debt and financial fragility in a Kaleckian distribution and growth model, *PSL Quarterly Review*, 65(260), 11-51.

Hein E. and N. Dodig (2015): Finance-dominated capitalism, distribution, growth and crisis – long-run tendencies, in: E. Hein, D. Detzer and N. Dodig (eds), *The Demise of Finance-dominated Capitalism. Explaining the Financial and Economic Crisis*, Edward Elgar, Cheltenham.

Hein, E. and T. van Treeck (2010): Financialisation in Post-Keynesian models of distribution and growth – a systematic review, in: M. Setterfield (ed), *Handbook of Alternative Theories of Economic Growth*, Edward Elgar, Cheltenham.

Juuse, E. and R. Kattel (2014): Financialisation and the Financial and Economic Crises: The Case of Estonia, FESSUD Studies in Financial Systems No 20, University of Leeds.

Kalecki, M. (1937): The Principle of increasing risk, *Economica*, 4, 440-447.

Kim, Y.K., M. Setterfield and Y. Mei (2014): A theory of aggregate consumption, *European Journal of Economics and Economic Policies: Intervention*, 11(1) 31–49.

Kim, Y.K., M. Setterfield and Y. Mei (2015): Aggregate consumption and debt accumulation: an empirical examination of US household behaviour, *Cambridge Journal of Economics*, 39(1), 93-112.

Kumhof, M. and R. Ranciere (2010): Inequality, Leverage and Crises, IMF Working Papers 268, International Monetary Fund.

Kumhof, M., C. Lebarz, R. Ranciere, A.W. Richter and N.A. Throckmorton (2012): Income Inequality and Current Account Imbalances, IMF Working Papers 12/08, International Monetary Fund.

Kurz, H.D. (1990): Technical change, growth and distribution: a steady-state approach to unsteady growth, in H.D. Kurz (ed), *Capital, Distribution and Effective Demand*, Polity Press, Cambridge, UK.

Lavoie, M. (2008): Financialisation Issues in a Post-Keynesian Stock-flow Consistent Model, *Intervention*, 5(2), 331-356.

Lavoie M. and W. Godley (2002): Kaleckian models of growth in a coherent stock-flow monetary framework: a Kaldorian view, *Journal of Post Keynesian Economics*, 24(2), 277-311.

Meijers, H., J. Muysken and O. Sleijpen (2015): The Deposit Financing Gap: Another Dutch disease, *European Journal of Economics and Economic Policies: Intervention*, 12(1), 32-50.

Minsky, H.P. (1986): *Stabilizing an Unstable Economy*, Yale University Press, New Haven.

Onaran, O. and G. Galanis (2012): Is aggregate demand wage-led or profit-led? National and global effects, ILO Conditions of Work and Employment Series No. 40, International Labor Office.

Palley T.I. (1994): Debt, Aggregate Demand, and the Business Cycle: An Analysis in the Spirit of Kaldor and Minsky, *Journal of Post Keynesian Economics*, 16(3), 371-390.

Pollin, R. (1988): The growth of US household debt: demand-side influences, *Journal of Macroeconomics*, 10(2), 231-248.

Rajan, R. G. (2010): *Fault Lines: How Hidden Fractures Still Threaten the World Economy*, Princeton University Press, New Jersey.

Stiglitz, J. E. (2010): *Freefall America, free markets, and the sinking of the world economy*, W. Norton and Company, New York.

Stockhammer, E., and S. Ederer (2008): Demand effects of a falling wage share in Austria, *Empirica*, 35(5), 481-502.

Stockhammer, E., O. Onaran and S. Ederer (2009): Functional income distribution and aggregate demand in the Euro area, *Cambridge Journal of Economics*, 33, 139-159.

Stockhammer, E., E. Hein and L. Grafl (2011): Globalization and the effects of changes in functional income distribution on aggregate demand in Germany, *International Review of Applied Economics*, 25(1), 1-23.

Veblen, T. (1899): *The Theory of the Leisure Class*, Dover Publications, 1994.

Zeza, G. (2008): U.S. growth, the housing market, and the distribution of income, *Journal of Post Keynesian Economics*, 30(3), 375-401

## Appendix 1: The complete Model

- (1)  $Y = C + I + G + Ex - Im$
- (2)  $N = Y / pr$
- (3)  $N_{W1} = N * n_{W1}$
- (4)  $N_{W2} = N * (1 - n_{W1})$

### Distribution

- (5)  $WS = 1 - PS$
- (6)  $WB = WS * Y$
- (7)  $w_a = WB / N$
- (8)  $w_{W2} = w_a * w_{m_{W2}}$
- (9)  $w_{W1} = (WB - N_{W2} * w_{W2}) / N_{W1}$

### Capital Stock

- (10)  $K = K(-1) + I(-1) - DA(-1)$
- (11)  $DA = \delta * K(-1)$
- (12)  $Y_{fc} = K / COR$
- (13)  $u = Y / Y_{fc}$
- (14)  $I = I_{net} + DA$
- (15)  $I_{net} = gr_K * K(-1)$
- (16)  $gr_K = \beta_1 + \beta_2 * u(-1) + \beta_3 * PS(-1) - \beta_4 * r_L(-1) + \beta_5 * (PU_F(-1) + DA(-1)) / K(-1)$

### Profit distribution

- (17)  $Pg_F = PS * Y$
- (18)  $INT_{net,F} = r_L(-1) * L_F(-1) - r_D(-1) * D_F(-1)$
- (19)  $T_F = \max(t_F * (Pg_F - INT_{net,F} - DA), 0)$
- (20)  $P_F = Pg_F - INT_{net,F} - DA - T_F$
- (21)  $PD_F = \max(P_F * (1 - RR), 0)$
- (22)  $DpS = PD_F / E_{s,F}(-1)$
- (23)  $PU_F = P_F - PD_F$

### Financing by Firms

- (24)  $exFD_F = I - PU_F - DA$
- (25)  $E_{issued} = exFD_F / p_E(-1) * EFR$
- (26)  $E_{s,F} = E_{s,F}(-1) + E_{issued}$
- (27)  $Bankbalance_F = Bankbalance_F(-1) - exFD_F + E_{issued} * p_E$
- (28)  $D_F = Bankbalance_F * z_9$
- (29)  $L_F = - Bankbalance_F * z_{10}$
- (30)  $z_9 = 1$ , if  $Bankbalance_F > 0$ ; else 0
- (31)  $z_{10} = 1$ , if  $Bankbalance_F < 0$ ; else 0
- (32)  $V_F = V_F(-1) + I(-1) - DA(-1) + (D_F - D_F(-1)) - (L_F - L_F(-1)) - CG_E - E_{issued} * p_E$

### Household Worker 1

- (33)  $Yg_{W1} = w_{W1} * N_{W1} + D_{W1}(-1) * r_D(-1)$   
(34)  $T_{W1} = \max( t * ( Yg_{W1} ) , 0 )$   
(35)  $Yd_{W1} = Yg_{W1} - T_{W1} - L_{W1}(-1) * r_L(-1)$   
(36)  $C_{d,W1} = (1-imit) * pc_{Yd,W1} * Yd_{W1}(-1) + imit * C_{W2} + pc_{V,W1} * D_{W1}$   
(37)  $C_{W1} = C_{d,W1}$   
(38)  $V_{W1} = V_{W1}(-1) + Yd_{W1} - C_{W1}$   
(39)  $D_{W1} = V_{W1} * z_3$   
(40)  $L_{W1} = -V_{W1} * z_4$   
(41)  $z_3 = 1, \text{ if } V_{W1} > 0; \text{ else } 0$   
(42)  $z_4 = 1, \text{ if } V_{W1} < 0; \text{ else } 0$

*Modified Consumption W1 for financial regulation scenario*

- (43)  $C_{d,W1} = (1-imit) * pc_{Yd,W1} * Yd_{W1}(-1) + imit * C_{W2} + pc_{V,W1} * D_{W1}$   
(44)  $C_{W1} = z_{99} * C_{d,W1} + z_{100} * (C_{d,W1} - (C_{d,W1} - Yd_{W1}(-1)) * L_{W1}(-1)/Yd_{W1}(-1)/PrudRat)$   
(45)  $z_{99} = 1, \text{ if } C_{d,W1} < Yd_{W1}; \text{ else } 0$   
(46)  $z_{100} = 1, \text{ if } C_{d,W1} > Yd_{W1}; \text{ else } 0$

**Households Worker 2**

- (47)  $Yg_{W2} = w_{W2} * N_{W2} + D_{W2}(-1) * r_D(-1)$   
(48)  $T_{W2} = \max( t * ( Yg_{W2} ) , 0 )$   
(49)  $Yd_{W2} = Yg_{W2} - T_{W2} - L_{W2}(-1) * r_L(-1)$   
(50)  $C_{W2} = pc_{Yd,W2} * Yd_{W2}(-1) + pc_{V,W2} * V_{W2}(-1)$   
(51)  $V_{W2} = V_{W2}(-1) + Yd_{W2} - C_{W2}$   
(52)  $D_{W2} = V_{W2} * z_5$   
(53)  $L_{W2} = -V_{W2} * z_6$   
(54)  $z_5 = 1, \text{ if } V_{W2} > 0; \text{ else } 0$   
(55)  $z_6 = 1, \text{ if } V_{W2} < 0; \text{ else } 0$

**Households Rentiers**

- (56)  $Yg_R = D_R(-1) * r_D(-1) + E_{h,R}(-1) * DpS$   
(57)  $T_R = \max( t * ( Yg_R ) , 0 )$   
(58)  $Yd_R = Yg_R - T_R$   
(59)  $C_R = pc_{Yd,R} * Yd_R(-1) + pc_{V,R} * V_R(-1)$   
(60)  $V_R = V_R(-1) + Yd_R - C_R + CG_E$   
(61)  $V_R^e = V_R(-1) * (1+gr_V(-1))$

**Portfolio decision**

*Tobin Equations (not in the model):*

- (62)  $D_R/V_R = \theta_0 + \theta_1 * r_D - \theta_2 * DpS/p_E(-1) + \theta_3 * Yd_R/V_R$   
(63)  $p_E * E_{h,R} / V_R = (1 - \theta_0) - \theta_1 * r_D + \theta_2 * DpS/p_E(-1) - \theta_3 * Yd_R/V_R$

*Model equations:*

- (64)  $E_{h,R} = E_{s,F}$

$$(65)p_E = (((1 - \theta_0) - \theta_1 * r_D + \theta_2 * DpS/p_E(-1)) * V_R^e - \theta_3 * Yd_R) / E_{h,R}$$

$$(66)D_R = V_R - p_E * E_{h,R}$$

$$(67)CG_E = (p_E - p_E(-1)) * E_{h,R}(-1)$$

### Government

$$(68)G = G(-1) * (1 + gr_G)$$

$$(69)gr_G = gr_Y(-1) + (defT_{Gov} - (def_{Gov}(-1) / Y(-1)))$$

$$(70)T = T_{W1} + T_{W2} + T_R + T_F$$

$$(71)def_{Gov} = G - T + L_{Gov}(-1) * r_L(-1) - D_{Gov}(-1) * r_D(-1)$$

$$(72)V_{Gov} = V_{Gov}(-1) - def_{Gov}$$

$$(73)D_{Gov} = V_{Gov} * z_7$$

$$(74)L_{Gov} = -V_{Gov} * z_8$$

$$(75)z_7 = 1, \text{ if } V_{Gov} > 0; \text{ else } 0$$

$$(76)z_8 = 1, \text{ if } V_{Gov} < 0; \text{ else } 0$$

### Banks

$$(77)r_D = r$$

$$(78)r_L = r$$

$$(79)L = L_F + L_{W1} + L_{W2} + L_{Gov} + L_{RoW}$$

$$(80)D = D_F + D_{W1} + D_{W2} + D_R + D_{Gov} + D_{RoW}$$

### RoW

$$(81)Y_{RoW} = Y_{RoW}(-1) * (1 + g_{RoW})$$

$$(82)Im = plm * Y$$

$$(83)Ex = Ex(-1) * (1 + g_{RoW})$$

$$(84)CA = Ex - Im - r_D(-1) * D_{RoW}(-1) + r_L(-1) * L_{RoW}(-1)$$

$$(85)V_{RoW} = V_{RoW}(-1) - CA$$

$$(86)D_{RoW} = V_{RoW} * z_1$$

$$(87)L_{RoW} = -V_{RoW} * z_2$$

$$(88)z_1 = 1, \text{ if } V_{RoW} > 0; \text{ else } 0$$

$$(89)z_2 = 1, \text{ if } V_{RoW} < 0; \text{ else } 0$$

<<insert Appendix 2 here>>