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# Macroeconomic effects of personal and functional income inequality – theory and empirical evidence for the US and Germany

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**Abstract**
This paper presents a simple illustrative post-Kaleckian model of distribution and growth that incorporates personal income inequality and interdependent social norms. The model shows in an easily accessible manner how personal and functional income inequality can potentially have contrary effects on aggregate demand and growth. It can illustrate some of the major domestic developments that took place in different countries in the decades prior to the Great Recession and which were connected to inequality and country specific consumption and saving behaviour. Furthermore, aggregate consumption functions are estimated for the United States and Germany. The finding of previous studies regarding a higher elasticity of aggregate consumption with respect to wage income than with respect to profit income is confirmed. We find positive long-run effects of personal income inequality on consumption in the US. The effect is strongest for the top 10% income share and the Gini index and less strong for the top 5% and 1% income shares. While this is evidence for relative consumption patterns, it also supports the view that the 'super rich' are a somewhat distant strata for most people – questioning the notion of expenditure cascades from the very top to the very bottom of the distribution. For Germany, we fail to find compelling evidence for substantial effects of personal income distribution.

**Keywords:** Income inequality, Personal and functional income distribution, Demand and growth regimes, Relative income hypothesis, Kaleckian model

**JEL Classification:** C22, D31, D33, E11, E12, E25

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# 1 Introduction

By now, there is a large and growing body of research that investigates the link between personal income inequality and the Great Recession. With respect to the US, one basic line of argument is shared by many authors in different versions (cf. Van Treeck and Sturn 2012, Van Treeck 2014): rising personal income inequality in the US intensified pressure on low and middle income households, which in turn went increasingly into debt to maintain or increase expenditures. While the regulation of the financial system became increasingly inefficient after 1980, this behaviour on the consumption and credit demand side was coupled with fearless lending behaviour on the credit supply side and a financial crisis became hard to avoid. The fall of the US saving rate and the strong increase of aggregate consumption as a share of GDP is therefore connected to the rise of personal income inequality. Such a connection is hardly compatible with the Keynesian absolute income hypothesis or the neoclassical permanent income or life-cycle hypothesis. Even when these theories are extended by adding habit persistence, it seems rather implausible that such effects can solely account for the rise of consumption as a share of GDP. The debate on inequality and falling saving rates has therefore also led to the revival of theories of interdependent social norms in the spirit of Veblen (1899) and Duesenberry (1949) (see Van Treeck 2014), in which consumption desires or needs relative to higher income earning reference groups can lead to increasing consumption demand despite stagnating or falling absolute incomes. If such emulation patterns exist and connect the consumption of the very top and the very bottom households of the income distribution, expenditure cascades triggered by redistribution to the very top can have the strongest effect on aggregate consumption (Frank et al. 2014).

However, while such explanations might fit well to the US case, falling saving rates are by no means a necessary outcome of increasing inequality and it seems implausible to serve as a general explanation of the link between inequality and the global crisis. Indeed, the fall of aggregate consumption as a share of GDP and rising aggregate saving rates, despite rising income inequality, in countries like Germany or China corresponded to growing global and regional imbalances, which are often seen as another major cause of the Great Recession and the subsequent crisis in the Euro area.[1]

Furthermore, there are strong theoretical and empirical arguments for the importance of changes in the functional income distribution for aggregate consumption,

[1] See for example Rogoff and Obstfeld (2009), Wade (2009) and Hein (2013) and the references therein for different perspectives on the connection of the crises and global imbalances.

due to a positive differential between the propensity to consume from wage and profit income, and also for other components of aggregate demand (Hein 2014, Chapter 7, Lavoie 2014, Chapter 6). In addition, the diverging strength of changes in both distributional dimensions compared between different countries like the US, Germany and China has corresponded to diverging macroeconomic developments (Belabed et al. 2013). This suggests that both, functional and personal income distribution need to be taken into account for a rigorous analysis between inequality and macroeconomic variables.

While distributional conflict was at the heart of post-Keynesian macroeconomics, the focus was on the functional distribution of income. More recently, there have been several attempts to incorporate personal income distribution and interdependent social norms into Kaleckian models of distribution and growth. However, these extensions have been usually applied to already quite complex stock-flow consistent models, often solved by numerical simulation. This paper contributes to the literature by overcoming the often corresponding lack of accessibility and traceability of these models. It provides a simple and illustrative Kaleckian macroeconomic model that is open to different relationships between personal income inequality and aggregate demand and growth, thereby adding further theoretical flexibility to the basic post-Kaleckian model. Potential effects of changes in personal and functional income distribution on aggregate demand and growth can be discussed within this framework. The model fits well to the general Kaleckian models presented in recent textbooks (e.g. Hein 2014; Lavoie 2014) and is therefore especially relevant for graduate students and teachers who want to stress the importance of personal income distribution within a post-Keynesian framework.

The second contribution of this paper is empirical: It provides a brief summary of the econometric literature on consumption (or saving) and income distribution, focussing on the macroeconomic effects of personal income distribution since the effects of functional income distribution on consumption have been found to be quite robust throughout the literature. Furthermore, aggregate consumption functions are estimated for the US and Germany, two countries which have been very different when it comes to the development of aggregate consumption and the saving rate, but which both experienced distributional changes in the same direction in the medium to long run before the crisis. The estimations extend commonly used single equation specifications of aggregate consumption which distinguish between profit and wage income by adding different measures of personal income inequality and controlling for wealth and debt effects.

Since the relationship between inequality, consumption and the macroeconomy

is very complex this paper has some obvious limitations. For example, it is not discussing how personal and functional income inequality influence each other. Also, broader issues of financialisation or the emergence of financial fragility are not discussed. A more comprehensive investigation would need to take these and other aspects of inequality into account.

The paper is structured as follows: Section 2 develops a pedagogical post-Kaleckian model that includes personal income distribution and interdepend social norms. Section 3 provides a brief review of the related empirical literature and estimates aggregate consumption functions for the United States and Germany to investigate the effects of personal and functional income distribution. The last section concludes.

# 2 Interdependent social norms and personal income inequality in a simple post-Kaleckian model

The combination of the principle of effective demand with issues of growth and the distribution of income between profits and wages has been a major part of the post-Keynesian research program at least since the publications of Nicholas Kaldor (1955/56) and Joan Robinson (1956) (cf. Hein 2014). Modern post-Keynesians have increasingly used the Kaleckian framework to investigate questions of functional income distribution. Yet, personal income inequality and interdependent preferences did not figure prominently in the corresponding models. However, recently there have been some attempts to incorporate the combination of personal income distribution and interdependent social norms into neo- and post-Kaleckian models of distribution and growth (Belabed et al. 2013; Detzer 2016; Kapeller and Schütz 2014; Kapeller and Schütz 2015; Setterfield and Kim 2016; Zezza 2008).

Personal inequality is often introduced into these models by splitting the wage income earning class into high and low wage income groups often corresponding to workers vs. managers, non-supervisory vs. supervisory workers, etc. Some authors instead assume that entrepreneurs or rentiers earn part of the wage share. By incorporating a relative income term with an emulation parameter into the consumption functions of lower income groups it is then commonly assumed that the lower income groups try to emulate the consumption expenditures of the higher income earners to some extent. In some models the richest income class, mostly corresponding to rentiers or entrepreneurs, is emulated by high wage earners or, in

other models, regarded as a somewhat distant class without being an emulation target for another income group.[2] Depending on the specific model at hand such emulation effects have been combined with debt accumulation, financial norms and constraints and Minskyian dynamics.[3]

These extensions usually have been applied to already quite complex models, which are often solved by numerical simulation. We try to overcome the often-associated lack of accessibility and traceability by providing a simple analytical model that retains the key points of the more complex models related to potentially diverging effects of changes in functional and personal income distribution due to interdependent social norms. This is achieved by introducing a simple variation inspired by Carvalho and Rezai (2016), who implement effects of personal inequality by making the propensity to save from wages depend directly on a measure of wage inequality. However, based on their discussion of US saving rates per income quintile, they assume that rising wage inequality always leads to a rising propensity to save out of wage income. Contrasting with this assumption, the literature on socially interdependent behavioural norms going back to Veblen (1899), Duesenberry (1949) and more recently Frank et al. (2014) presents theoretical arguments that the opposite effect is also possible. And indeed, developments in countries like the US suggest that such effects may have been relevant prior to the Great Recession (Cynamon and Fazzari 2008). Yet, Carvalho and Rezai (2016) use the cross-sectional observation of an increasing propensity to save over income quintiles in the United States (Figure 1) as an argument that the propensity to save is positively correlated to income and that, therefore, it is justified to assume that the saving rate is also positively correlated with inequality. However, this argument seems unconvincing for the following reason: theories of interdependent social norms clearly state a theoretical argument why there should be an increasing saving rate in the cross-sectional dimension with respect to income. The compatible empirical observation would be that the saving rate increases with increasing relative income,

[2]This distinction is connected to the question whether the strongest expenditure cascades can be triggered by redistribution to the very top.

[3]Note that there have also been other attempts in the literature to include either emulation effects or personal income inequality into Keynesian macroeconomic models. For personal income distribution: see for example Dutt (1992), Lavoie (1996), Tavani and Vasudevan (2014). On other explicit or implicit attempts to include interdependent social norms see for example Dutt (2008), Hein (2012). There have also been attempts to implement relative income effects into neoclassical models of consumption based on utility-maximization (e.g. Alvarez-Cuadrado and Van Long (2011)). However, there is usually no role for the functional distribution of income in these models. Grüning et al. (2015) is a notable exception. Using the neoclassical notion of the 'corporate veil', they incorporate functional income inequality into a heterogeneous-agent dynamic stochastic general equilibrium model building on the framework of Kumhof et al. (2012).

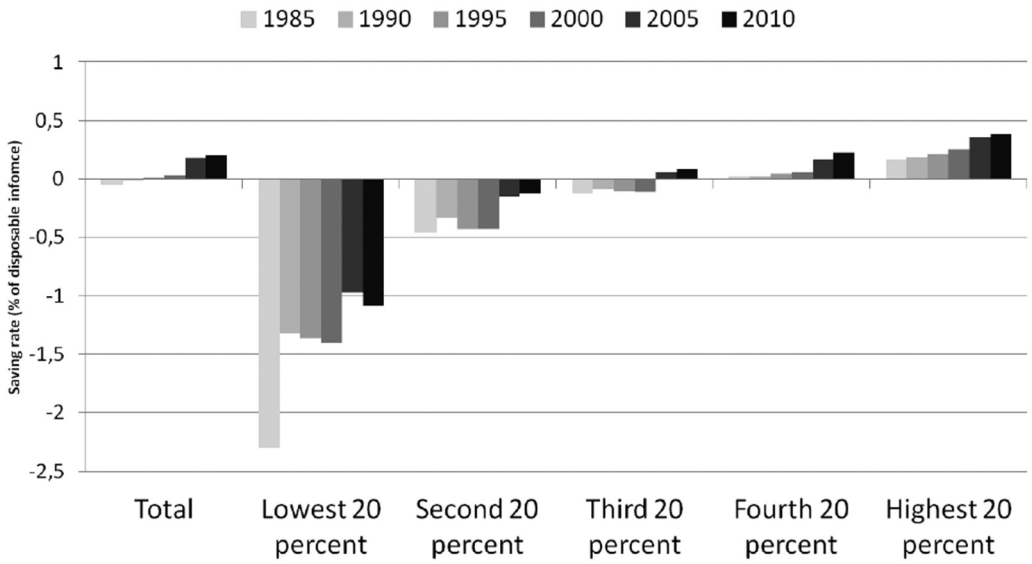


Figure 1: *Saving rate per income quintile in the USA (1985-2010) (Source: Carvalho and Rezai (2016, p. 494, Figure 1))*

and, therefore, from low income to high income quintiles. However, in addition, these theories state that the saving relative to disposable income in a times series context, in which income changes for a specific quintile, can either be increasing or decreasing, depending on the strength and direction of relative income effects and, hence, on interdependent behavioural norms. One compatible empirical observation would be that for a specific quintile the saving rate decreases over time if relative income with respect to other quintiles decreases. Exactly this is observable in the data of Carvalho and Rezai for the lowest three income quintiles in the period from 1990 to 2000, a period of strongly increasing personal income inequality.[4]

We will therefore not follow the restrictive assumption by Carvalho and Rezai (2016). Instead, by building on Carvalho and Rezai's basic idea this section provides a post-Kaleckian model of distribution and growth in which different relationships between personal income inequality and the saving rate can lead to various macroeconomic outcomes. The main purpose of this exercise is to illustrate in a very simple and pedagogical way that the effects of redistribution between profits and wages, on the one hand, and redistribution between households, on the other hand, can potentially be different depending on prevailing consumption and financial norms. This has also been shown in the much more complex post-Keynesian models mentioned above, yet, our model is easy to solve analytically and fits well to the basic Kaleckian model frameworks presented in recent textbooks

[4]Furthermore, it is surprising that their dataset shows an increasing total saving rate for the USA in the period before the Great Recession.

like Hein (2014) and Lavoie (2014).

In the following, we assume that personal income inequality can be approximated by wage inequality, which we take as given exogenously. We also abstract from interdependencies between functional and personal income distribution. We model a closed economy without a government sector in the tradition of the basic post-Kaleckian model (Bhaduri and Marglin 1990) with saving out of wages, using the notation of Hein (2014, Chapter 7). We assume that our economy produces a homogeneous real output ($Y$), which can be used for consumption and investment. We abstract from overhead labour and depreciation of the capital stock ($K$). Moreover, we exclude technological change and, therefore, imply a constant labour-output ratio ($a = L/Y$) and a constant capital-potential output ratio ($v = K/Y^p$). Capacity utilisation ($u = Y/Y^p$) is endogenous and usually below 1, meaning that output is usually below the potential output given by the capital stock ($Y < Y^p$). Labour supply is assumed to be usually in excess, which means that it usually does not constrain output. Following Kalecki's price theory and abstracting from raw material costs, we assume that prices ($p$) are determined by mark-up pricing on unit labour costs in oligopolistic markets, which gives us the following equation for the general price level:

$$p = (1 + m)\frac{W}{Y}, \tag{1}$$

where $m$ is the mark-up and $W$ depicts the sum of nominal wages. The mark-up is determined by the degree of market concentration or the importance of price competition in the goods market and the relative bargaining power of capital and labour (cf. Hein 2014, p. 191). The profit-share ($h$) in our closed economy is determined by the mark-up:[5]

$$h = \frac{\Pi}{pY} = \frac{pY - W}{pY} = 1 - \frac{W}{pY} = 1 - \frac{1}{1 + m} = \frac{m}{1 + m}, \tag{2}$$

with $\Pi$ being the sum of nominal profits. The endogenous profit rate is given by the following equation:

$$r = \frac{\Pi}{pK} = \frac{\Pi}{pY}\frac{Y}{Y^p}\frac{Y^p}{K} = \frac{hu}{v}. \tag{3}$$

The post-Kaleckian investment rate ($g$) in our model depends on animal spirits ($\alpha$),

[5] See Hein (2014, section 5.2) for a richer discussion of the determinants of the mark-up and the profit share.

capacity utilization and functional income distribution:

$$g = \frac{I}{K} = \alpha + \beta u + \tau h, \tag{4}$$

where $I$ is investment and $\beta$ and $\tau$ denote the responsiveness of investment to changes in capacity utilization and the profit share, respectively.

Two types of functional income exist in our model economy: wage income ($W$) earned by working households and profits ($\Pi$) earned by firm owning households. We assume that only parts of both income types are spent for consumption purposes and the rest is saved, as described by the following equation:

$$S = S(\Pi, W) = S_\pi(\Pi) + S_w(W) = s_\pi \Pi + s_w W, \tag{5}$$

with $S$ as total saving, $S_\pi$, $S_w$ denoting saving out of profits and saving out of wages, respectively, and $s_\pi$, $s_w$ depicting the respective propensities to save from profit and wage income. Saving out of profits and wages is achieved by either buying assets issued by the firm sector or by building up deposits with the financial sector, which is not explicitly modelled here. Note that the different propensities to save are strictly related to the two functional income categories and not to specific persons, households or classes.[6] We do, however, make the reasonable assumption that the propensity to save from profits is higher than the propensity to save from wages ($0 \leq s_w < s_\pi \leq 1$). Hein (2014, p. 273) recalls two important reasons for this. For one thing, firms do not distribute all their profits, but build up retained earnings, which count as savings by definition. Moreover, it is reasonable to assume that most working households only receive a very small part of the distributed profits and that the main part goes to a minority of the households which own extremely large parts of the corporate sector. The latter group is assumed to have a much higher per head income than the households who predominantly rely on wages as a source of income. The Keynesian absolute income hypothesis and theories with interdependent preferences, as well as more sophisticated versions of the neoclassical permanent income and/or life-cycle hypotheses, suggest increasing saving rates in the cross-sectional dimension of the income distribution.

By dividing equation 5 by the nominal capital stock, we obtain the saving rate

[6] This is necessary, since working households built up financial assets through saving, which means that they will earn part of the profits in the form of interest or dividends (Hein 2014, p. 273).

in our model economy:

$$\sigma = \frac{S}{pK} = \frac{S_\pi + S_w}{pK} = \frac{s_\pi \Pi + s_w (Y - \Pi)}{pK} = [s_w + (s_\pi - s_w) h] \frac{u}{v}, \quad 0 \leq s_w < s_\pi \leq 1. \tag{6}$$

Equation 6 corresponds to the saving rate of the basic post-Kaleckian model with saving from wages, as in Hein (2014, section 7.2.2). It is determined by the profit share, capacity utilization, the constant capital-potential output ratio, and the exogenously given propensities to save from profits and wages. However, we now introduce a crucial variation to the basic post-Kaleckian model. We endogenize the propensity to save from wages by making it depend on wage income inequality in the following simple manner:

$$s_w = s_0 - \eta \Gamma, \quad \Gamma \geq 0, \quad 0 \leq s_0 \leq 1. \tag{7}$$

In equation 7, $s_0$ is a constant that represents the propensity to save if there is no effect of wage inequality on the propensity to save from wage income. Alternatively, it can be interpreted as the propensity to save from wages if wages are equally distributed. Wage income inequality is represented by $\Gamma$, where an increase in $\Gamma$ is associated with an increase in wage inequality. Finally, $\eta$ is the social norms parameter and denotes the responsiveness of the propensity to save from wages to increasing wage inequality. The sign and absolute value of $\eta$ are determined by the specific consumption and financial norms prevailing in the economy. These norms determine the *willingness* of households to lower or increase their savings in the face of a relative income decline and the *ability* to go into debt for consumption purposes. Factors influencing the *willingness* are related to different consumption theories which stress different influences on consumption decisions. These encompass socially interdependent consumption norms and habit persistence (Veblen 1899, Duesenberry 1949), interdependent financial norms of households (Thaler and Shefrin 1981, Cynamon and Fazzari 2008) and absolute income effects (Keynes 1936). The *ability* to go into debt to increase or maintain consumption expenditures is determined by the financial norms of the credit system and can be related to financialisation, deregulation, originate and distribute business models of banks, new financial instruments, etc. (Barba and Pivetti 2009; Cynamon and Fazzari 2008).

In a situation in which $\eta$ is positive the social norms are such that, at the aggregate, increasing wage inequality encourages working households as a whole to increase their propensity to consume from total wage income. For example,

the consumption norms must be such that a sufficiently large number of working households that lost wage income relative to others are *willing* and *able* to maintain or even increase their relative consumption expenditures, and, thus, cause a fall of the aggregate propensity to save from wages. This can be achieved by lowering their individual propensity to save from wages. While we are not modelling a credit system explicitly here, this can be associated with increasing debt of these households if the financial norms of the economy allow for it. A positive $\eta$ can be seen as equivalent to the assumption that any possible negative absolute income effects on consumption, stemming from increasing personal income inequality, would be overcompensated by relative income effects or habit persistence (including subsistence consumption) at the aggregate level. In the opposite case, a negative $\eta$ would imply that the consumption and financial norms of the model economy would be such that, in case of increasing personal income inequality households who lost relative income are not *willing* and/or not *able* to maintain or increase their consumption expenditures to such an extent that it overcompensates the savings of households who gained relative income. Hence, the aggregate propensity to save from wages would increase. In this case, any positive relative income or habit effects on consumption would be overcompensated by negative absolute income effects. Of course, we could also think of a situation in which relative and absolute income effects exactly compensate each other at the aggregate. In this case, $\eta$ would be zero and there would be no aggregate effect of personal income distribution on the propensity to save from wages.

With our new formulation of the propensity to save from wages the saving rate of the economy becomes:

$$\sigma = \left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right] \frac{u}{v}. \tag{8}$$

This new saving rate enables us to calculate the respective partial effects of functional and personal income redistribution on the equilibrium values in our model. The equilibrium condition for the goods market is that saving equals investment and hence:

$$g = \sigma. \tag{9}$$

The adjustment to the post-Kaleckian goods market equilibrium takes place via capacity utilization. For the goods market equilibrium to be stable in the short-run, the following condition needs to be fulfilled:

$$\frac{\partial \sigma}{\partial u} - \frac{\partial g}{\partial u} > 0 \Rightarrow \left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right] \frac{1}{v} - \beta > 0. \tag{10}$$

Equation 10 implies that the marginal response of the saving rate to changes in capacity utilization needs to be stronger than the response of the investment rate. In the following, we always assume this to be the case. Furthermore, we assume the following without modelling it explicitly: If firms have some view on target or 'normal' rates of capacity utilization, this is a relatively wide range rather than a unique rate. Moreover, the range itself may be endogenous to the actual rates of past periods, as firms may adapt their target to past actual states of the economy. These assumptions are necessary to provide a relatively wide corridor in which the model will not suffer from 'Harrodian instability'.[7]

By substituting equations 4 and 8 into equation 9, and solving for $u$, we obtain the equilibrium capacity utilization:

$$u^* = \frac{\alpha + \tau h}{\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right] \frac{1}{v} - \beta}. \tag{11}$$

Substituting equation 11 into equation 4 (or 8) and equation 3 yields the equilibrium values for capital accumulation and the profit rate, respectively:

$$g^* = \sigma^* = \frac{(\alpha + \tau h)\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right] \frac{1}{v}}{\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right] \frac{1}{v} - \beta}, \tag{12}$$

$$r^* = \frac{(\alpha + \tau h)\frac{h}{v}}{\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right] \frac{1}{v} - \beta}. \tag{13}$$

Calculating the partial derivatives of these equilibrium values, with respect to the profit share, yields the usual results for the post-Kaleckian model with the slight variation, however, that the partial effects now include our new distribution dependent propensity to save from wages:

$$\frac{\partial u^*}{\partial h} = \frac{\tau - (s_\pi - (s_0 - \eta\Gamma))\frac{u}{v}}{\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right] \frac{1}{v} - \beta}, \tag{14}$$

$$\frac{\partial g^*}{\partial h} = \frac{\frac{1}{v}\left[\tau(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))(\tau h - \beta u)\right]}{\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right] \frac{1}{v} - \beta}, \tag{15}$$

[7] See Hein (2014, chapter 11) and Lavoie (2014, section 6.4 and 6.5) for discussions of instability issues in Kaleckian models.

$$\frac{\partial r^*}{\partial h} = \frac{\frac{1}{v}\left[\alpha + 2\tau h - (s_\pi - (s_0 - \eta\Gamma))h\frac{u}{v}\right]}{\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right]\frac{1}{v} - \beta}. \tag{16}$$

The well-known possibility of different demand and growth regimes with respect to functional income distribution is obviously maintained in our model, because we cannot know the signs of the partial effects before we specify relations between our model parameters. Demand and growth can either be wage-led, implying $\frac{\partial u^*}{\partial h} < 0$ for demand and $\frac{\partial g^*}{\partial h} < 0$ for growth, or profit-led, implying $\frac{\partial u^*}{\partial h} > 0$ for demand and $\frac{\partial g^*}{\partial h} > 0$ for growth. The overall demand and growth regime might be wage-led, conflictive or profit-led. Which regime prevails in the economy depends on the specific parameters in the functions for the saving and investment rate (equation 8 and 4, respectively).[8] Note, that the equations for the partial effects with respect to the profit share now contain the exogenously given variable for personal income inequality $\Gamma$. Therefore, if we hold all other parameters of the model constant, but change personal income distribution, this will change the partial effects with respect to functional income distribution. If the change in $\Gamma$ is sufficiently large, this can potentially change the sign of the respective partial effect. This means that endogenizing the propensity to save from wages also makes the demand and growth regimes with respect to functional income distribution dependent on the size distribution of income.

Let us now consider the partial effects of our equilibrium values with respect to personal income distribution:

$$\frac{\partial u^*}{\partial \Gamma} = \frac{(\alpha + \tau h)(1-h)\frac{\eta}{v}}{\left(\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right]\frac{1}{v} - \beta\right)^2}, \tag{17}$$

$$\frac{\partial g^*}{\partial \Gamma} = \frac{(\alpha + \tau h)(1-h)\beta\frac{\eta}{v}}{\left(\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right]\frac{1}{v} - \beta\right)^2}, \tag{18}$$

$$\frac{\partial r^*}{\partial \Gamma} = \frac{(\alpha + \tau h)(1-h)\frac{\eta h}{v^2}}{\left(\left[(s_0 - \eta\Gamma) + (s_\pi - (s_0 - \eta\Gamma))\, h\right]\frac{1}{v} - \beta\right)^2}. \tag{19}$$

[8] See Hein (2014, pp. 284–285) for a discussion of different parameter constellations in the basic post-Kaleckian model with saving from wages.

If $\eta > 0$, we have $\frac{\partial u^*}{\partial \Gamma} > 0, \frac{\partial g^*}{\partial \Gamma} > 0, \frac{\partial r^*}{\partial \Gamma} > 0$, meaning that the economy specific consumption and financial norms would be such that increasing wage inequality would lead to a fall in the propensity to save from wage income. On the other hand, if $\eta < 0$, the increase in inequality is contractionary, because the consumption and financial norms would lead to an increase in the propensity to save from wages and $\frac{\partial u^*}{\partial \Gamma} < 0, \frac{\partial g^*}{\partial \Gamma} < 0, \frac{\partial r^*}{\partial \Gamma} < 0$.[9] Obviously, if $\eta = 0$, there is no effect of increasing wage inequality, and we find ourselves in the world of the basic post-Kaleckian model, in which only functional income redistribution leads to changes in $u^*, g^*$ and $r^*$. In a setting in which $\eta > 0$, the increase in wage income inequality would be expansionary, regardless of other parameters – assuming the stability condition to hold and the usual relations between saving from profits and wages of course. At the same time, however, the effect of redistribution between wages and profits could either be wage-led, conflictive or profit-led, depending on the model parameters. This result illustrates in a simple way how the effects of functional and personal redistribution can potentially differ quite strongly, depending in particular on the consumption and financing behaviour of households in response to personal income redistribution and also on the financial norms on the credit supply side. These factors determine the value and the sign of the parameter $\eta$, which have an influence on the partial effects in of our model.

Table 1 summarises the theoretically possible effects of a simultaneous marginal increase in personal and functional income inequality in a wage-led or profit-led demand or growth regime. For both regimes, there are four different conceivable scenarios depending on the absolute size of the respective partial effects and the sign of $\eta$. In a wage-led demand or growth regime in which $\eta$ is positive and the absolute size of the partial effect of personal income redistribution is bigger than the absolute size of the partial effect of functional income redistribution the overall effect of rising personal and functional income inequality on demand or growth will be expansionary.[10] If one would ignore the effect of personal inequality in an empirical investigation, as would be the case in the most basic Kaleckian framework, the demand or growth regime would appear to be profit-led, even though it is actually wage-led. The opposite case would prevail if $\eta$ is positive, but the negative partial effect of functional income redistribution outweighs the positive partial effect of rising personal income inequality. In this case simultaneously rising personal and functional income inequality have a contractionary effect, though the

[9] Note, that the signs of the partial effects, with respect to $\Gamma$ for either $\eta > 0$ or $\eta < 0$, are due to the validity of the paradox of thrift, as $\frac{\partial u^*}{\partial s_w} < 0$, $\frac{\partial g^*}{\partial s_w} < 0$ and $\frac{\partial r^*}{\partial s_w} < 0$.

[10] This case is similar to the *consumption-driven profit-led regime* as elaborated in Kapeller and Schütz (2015).

Table 1: Possible effects of marginally rising personal and functional income inequality in wage-led or profit-led demand or growth regimes

| Demand/growth regime | $\eta > 0$ | $\eta < 0$ |
|---|---|---|
| Wage-led | Expansionary (seemingly proftit-led) *or* Seemingly no effect *or* Contractionary (decelerated wage-led) | Contractionary (accelerated wage-led) |
| Profit-led | Expansionary (accelerated profit-led) | Expansionary (decelerated profit-led) *or* Seemingly no effect *or* Contractionary (seemingly wage-led) |

positive effect due to rising personal inequality dampens the negative effect of rising functional income inequality, hence this case can be called 'decelerated wage-led'. The intermediary case would be that the positive effect of rising personal income inequality exactly compensates the negative effect of functional redistribution in favour of profit income and hence the simultaneous increase of both types of inequality appears as if there is no effect at all. For the cases of a profit-led demand or growth regime the four different scenarios can be described in an analogous fashion. If demand or growth are profit-led and $\eta$ is positive, the overall effect will be positive, and rising personal inequality will accelerate the effect from redistribution to profits. On the other hand, when $\eta$ is negative, the overall effect is expansionary when the size of the effect of a rising profit share is higher than the absolute value of the partial effect of rising personal inequality. Yet, the rise in personal inequality will dampen the expansionary effect, hence it can be called a 'decelerated profit-led' case. The intermediary regime would again prevail if both effects exactly compensate each other, which would appear as if there is no effect at all. And we would have the 'seemingly wage-led' case, if the effect of the rising profit share is overcompensated by the negative effect from rising personal income inequality and the overall effect is contractionary, even though demand or

growth are actually profit-led. In an empirical investigation that is solely based on the basic post- or neo-Kaleckian framework, and that would hence not control for effects of rising personal income inequality, from the eight different scenarios in Table 1 the seemingly profit-led, the seemingly wage-led and the two intermediary scenarios must appear as empirical puzzles.

Table 1 highlights the flexibility of theoretical outcomes of the post-Kaleckian model that is gained by the simple variation that was introduced by equation 7. It must be noted, however, that the above model is of very limited use for long-run analyses when $\eta$ is positive, since it does not consider any credit and debt dynamics. The model assumes that in a scenario where $\eta > 0$ households, which wish to increase their consumption expenditures relative to their (wage) income due to emulation and habits, are always able to finance this desired increase, even if their consumption at some point exceeds their income. While this is grounded in the assumption of facilitative financial norms, it is highly unrealistic that ever increasing personal inequality would lead to ever increasing consumption and, therefore, infinite credit supply even to (over-)indebted households. At some point, the credit system might question the creditworthiness of highly indebted households, which could lead to decreasing credit supply and/or rising financial fragility and finally a financial crisis, and thus an end of the expansionary effect of increasing personal inequality and indeed might reverse it. Also, the increasing cost of interest and principal payments will be a burden on households. Such contradictory effects of household indebtedness have been modelled in various ways by several authors (see Dutt 2005; Dutt 2006; Hein 2012; Belabed et al. 2013; Kapeller and Schütz 2014; Kapeller and Schütz 2015; Detzer 2016; Setterfield and Kim 2016).

# 3 Empirical evidence

The model presented above gives an illustrative theoretical account on the potentially differing effects of changes in personal and functional income distribution associated with rising inequality. It remains an empirical question which specific effects prevailed in different countries. Accordingly, this section provides a brief review on related empirical literature as well as an empirical investigation on aggregate consumption for the United States and Germany.

## 3.1 Related empirical literature

Based on the Bhaduri-Marglin model, a rich empirical literature on the connection between functional income distribution and aggregate demand and growth has

grown in the last decades, the results of which are mixed, however. Recent surveys of the literature can be found in Hein (2014, section 7.4) or Stockhammer and Wildauer (2016, pp. 1616–1618). Different econometric methods have been employed to investigate the question on wage- vs. profit-led demand and growth regimes. As Stockhammer and Wildauer (2016) point out, the findings of the strand in the literature that makes use of VAR-models or panel methods are mixed. Authors who rely on single equation procedures, in contrast, find wage-led domestic demand in most countries, yet, the results on external trade are mixed too (ibid.). This section will only briefly describe the main and rather robust findings on the connection between consumption or saving behaviour and functional income distribution. The main focus then lies on the empirical studies which directly or indirectly estimate the relationship between personal income distribution and aggregate consumption or saving behaviour.

The effect of functional income distribution on aggregate consumption or saving is usually estimated in a single equation approach and the findings are relatively robust across different studies (Hein 2014, section 7.4). The consumption or saving function is often estimated as a function of the profit share or, alternatively, as a function of both, the sum of wages and the sum of profits.[11] These studies find statistically significant differences between the marginal propensity to consume (or save) out of profit and wage income (Hein 2014, p. 300). Therefore, one of the most robust findings on the empirical connection between aggregate demand and functional income distribution is that aggregate consumption is inversely related to redistribution in favour of profits.

There are only a few empirical studies which investigate the relationship between personal income distribution and aggregate consumption or saving.[12] The results of Brown (2004) and Carvalho and Rezai (2016) for the USA suggest negative (positive) aggregate effects of increasing personal income inequality on consumption (saving) behaviour. Brown (2004) is estimating a single equation time series model for US consumption expenditures over the period 1978-2000. Besides disposable income and a consumer sentiment variable, he includes the Theil-Index as an explanatory variable that measures private sector (non-supervisory worker) wage inequality between industries. He finds a statistically significant negative effect of rising inequality on consumption expenditure. Carvalho and Rezai (2016) estimate a

[11] See Hein and Vogel (2008, Table 1) for an overview of specifications used in different studies.

[12] There is, however, a number of empirical studies which report microeconometric evidence for Veblen effects, the relative income hypothesis and the importance of interdependent preferences at the individual level (see for example Neumark and Postlewaite (1998), Alpizar et al. (2005), Bowles and Park (2005), Luttmer (2005), Ravina (2007), Gasana (2009)).

two-dimensional threshold vector autoregressive model including capacity utilisation and the labour income share for the USA from 1967 to 2010. While they are not directly controlling for personal income inequality, their threshold variable is the Gini index, which allows them to estimate different coefficients for regimes of low and high personal income inequality respectively. Their threshold for the two regimes corresponds to the value of the Gini in 1981. With this methodology, they can investigate whether the level of personal income inequality had an influence on the responsiveness of capacity utilization to functional income distribution. They find that the US is in an overall profit-led demand regime, but that the increase in inequality after 1981 has made US aggregate demand more profit-led, which would correspond to an increase of the propensity to save out of wages due to increasing wage inequality. The empirical studies of Brown (2004) and Carvalho and Rezai (2016) are in line with the absolute income hypothesis and more sophisticated versions of the permanent income or life-cycle hypothesis with bequest, precautionary savings, etc. They would therefore reject an explanation of the falling saving rate in the USA based on relative consumption concerns and rising personal income inequality. Given these findings, the fall of the aggregate US saving rate would remain a puzzle.

In contrast, the results of Darku (2014) for Canada, and Behringer and Van Treeck (2015), for a panel of twenty countries including the US, find strong empirical evidence for negative effects of rising personal income inequality on household saving rates through relative consumption concerns. Darku (2014) is using a panel including all ten Canadian provinces to estimate the relationship between personal saving rates and personal income inequality (1981–2010), which is represented by the Gini coefficient. Controlling for standard determinants of saving rates, he finds a statistically significant negative effect of increasing inequality for Canada as a whole, as well as for seven out of ten provinces. His results are robust to using the Kuznets ratio as a variable for personal income inequality. Behringer and Van Treeck (2015) use a panel of twenty countries to estimate the effects of personal and functional income distribution on household and corporate financial balances as well as on the current account for the years 1972-2007. They control for standard explanatory variables and use the Gini index, and different top income shares, as measures of personal inequality. They find that rising personal income inequality leads to a statistically significant decrease of the private household financial balance and the current account. In addition, they find that a fall in the wage share leads to a statistically significant increase in the current account. The results of Darku (2014), and Behringer and Van Treeck (2015) confirm a relative income hypothesis

explanation of falling saving rates and increasing personal income inequality in Canada and the USA, as well as in other countries.

In contrast to these four studies, Stockhammer and Wildauer (2016) present evidence for another panel of eighteen countries that there are neither negative nor positive effects of personal income distribution on aggregate consumption. They estimate aggregate demand and its components in a panel of eighteen OECD countries in the period from 1980 to 2013. In their specifications of the consumption function, they include GDP as a measure for income, the wage share as a measure for functional income inequality and different variables for personal income inequality: two different measures of the Gini index and the top 1% income share. In addition, they include variables for household debt, as well as property and stock prices, as a measure for household wealth. They find that redistribution in favour of wage income has a modest but robust positive statistically significant effect on consumption. They also find that household debt has significant positive effects on aggregate consumption. Their estimation provides only weak evidence for wealth effects, since the estimated coefficients on property prices are often statistically insignificant and small, and stock prices have no statistically significant effects at all. With respect to personal inequality, Stockhammer and Wildauer (2016) fail to find any statistically significant effects on aggregate consumption, which they interpret as evidence against the existence of relative income or consumption effects at the aggregate. However, it can be argued that their findings are in line with theories of interdependent social norms, although, in contrast to the findings of Darku (2014) and Behringer and Van Treeck (2015), they suggest that potentially negative absolute income effects and potentially positive relative income effects of increasing personal income inequality have compensated each other, such that no aggregate effect on consumption emerged. They also include the personal inequality variables into estimations of investment. While they find no statistically significant effects of the top income share, they find a statistically significant negative effect on investment for the Gini index, which they interpret as evidence that any relative status effects on housing do not influence aggregate investment.

What emerges from this literature is that the econometric evidence on the relationship between personal income inequality and aggregate consumption or saving and aggregate demand is rather mixed. One reason for the mixed results of empirical investigations of personal income inequality and aggregate consumption and saving might be that the data on consumption and saving are not complements. In theory, household saving and consumption would move 'in step', though with opposite signs. This is not the case for the data on saving and consumption. There

are a number of private household expenditures which do not count as consumption in the national accounts, but which nevertheless draw down their savings. This is especially true for some 'positional goods' (Frank 2005) which are defined as being especially relevant for social status comparison. While the empirical studies which investigate aggregate consumption (Brown 2004, Stockhammer and Wildauer 2016) do not find evidence for relative income effects, the studies which investigate household financial balances or saving rates (Darku 2014, Behringer and Van Treeck 2015) do find such evidence.

Nevertheless, two aspects of the findings in the empirical literature seem particularly puzzling. With respect to the findings of Brown (2004), Darku (2014) and Carvalho and Rezai (2016) it seems questionable if it is really true that two countries, with such a similar development in personal income inequality and consumption as a share of GDP or saving rates, as Canada and the USA, are so different when it comes to the connection between these variables? Second, with respect to the findings of Behringer and Van Treeck (2015) and Stockhammer and Wildauer (2016), one can ask if general relationships between personal income inequality and saving or consumption behaviour within a set of several countries can really be assumed, since consumer and financial norms are probably strongly heterogeneous across different countries such as the USA, Germany and China, for example, which would also lead to different relationships between personal income inequality and consumption. While panel estimation techniques can control for country heterogeneity to some extent the results of Behringer and Van Treeck (2015) and Stockhammer and Wildauer (2016) are hardly compatible with each other. In the next subsections, we will therefore investigate the question on the relationship between the size distribution of income and aggregate consumption for Germany and the US separately in different single equation estimations.

## 3.2 Data and estimation strategy

We apply our econometric analyses to two countries, which experienced quite different developments in the decades prior to the Great Recession: the USA and Germany. For the USA and other countries with strongly increasing personal income inequality and falling saving rates, we would expect that we can find some empirical evidence for a positive connection between personal inequality and aggregate consumption. This would fit well to a positive $\eta$ in the theoretical model presented above. In contrast to the US, we would rather expect not to find evidence for a positive relationship between personal inequality and consumption for Germany. As we are also interested in the effects of functional income inequality,

we also investigate the empirical relationship between functional income inequality and aggregate consumption in both countries. We would expect to find an inverse relationship in both countries, since the empirical literature is rather clear on that account.

We make use of the commonly used empirical specification of the consumption function in single-equation form as applied in Hein and Vogel (2008), Onaran and Galanis (2014) and Onaran and Obst (2016), for example.[13] The annual data we are using for the estimation are retrieved from different sources:

- The variables that can be represented by national accounts data (i.e. real private consumption ($C$), total gross profit income ($P$) and total wage income ($W$)) were obtained from the annual macro-economic database (AMECO) of the European Commission (EC 2016).

- We use different variables for personal income inequality:
  - The estimated Gini index ($GINI$) from the Standardized World Income Inequality Database (SWIID) (Solt 2014).
  - The top (10%, 5% and 1%) income shares ($TIS$) of the World Wealth and Income Database (WID 2016).
  - Note that the data on the top income shares for Germany are only available at four-year frequency in the period from 1960 to 2000. Also, the series of the Gini index for Germany has gaps in 1961, 1963, 1965 and 1966. Therefore, the missing data points for the inequality variables were constructed by linear interpolation for Germany.

- In addition to including inequality variables, we control for wealth effects by including data on private net wealth (non-financial assets + financial assets - liabilities) retrieved from the WID (2016).

- For the US we also control for debt effects by including data on total credit of households and non-profit-institutions serving housholds (NPISH) taken from the Bank for International Settlements (BIS 2017). For Germany, we cannot control for debt effects due to data availability.

Due to data availability the sample for the US is 1960–2012. For Germany the sample is 1960–2008 for the estimations including the top income shares and 1960–2012 for those including the Gini. Table 7 in the appendix provides specific

[13] See Onaran and Galanis (2014) and Onaran and Obst (2016) for a discussion on the advantages of this approach compared to VAR models in the context of estimating aggregate demand.

definitions, time periods and sources for each of the variables we are using in the estimations.

We apply a single equation approach to the data for varying time periods. To avoid spurious regressions, all variables are tested for stationarity. Results of augmented Dickey-Fuller tests (ADF) are reported in section B of the appendix. Most of the variables in log-transformed levels were found to be integrated of order one. Furthermore, the two-step Engle-Granger approach, as outlined in Hassler (2004), was applied to test for cointegration (see section B in the appendix).[14] For the US, the tests find cointegration relationships between aggregate consumption and total wage income and between consumption and all inequality variables, which induces us to estimate error correction models (ECM) for aggregate consumption in logarithmic form. For Germany, the tests failed to find long-term relationships between consumption and the explanatory variables which matches other findings in the literature (Hein and Vogel 2008; Onaran, Stockhammer et al. 2011; Onaran and Galanis 2014; Onaran and Obst 2016). Therefore, a logarithmic first differences specification is used in the estimations for Germany.

For the US, we first estimate the long-term relationship between the cointegrated variables in logarithmic levels of the following form:

$$c_t = \alpha_0 + \alpha_1 w_t + \alpha_2 q_t + z_t, \tag{20}$$

where $c_t$ stands for the log of real private final consumption expenditure, $\alpha_0$ is a constant, $w_t$ is the log of real compensation of employees of the total economy, $q_t$ is the log of the respective inequality variable and $z_t$ is the error term for which the usual assumptions are applied. For the different inequality variables $gini_t$ depicts the log of the Gini index and $\ldots tis_t$ depicts the log of the respective top income share (10%, 5% or 1%). Secondly, we estimate a general error correction model including profit income ($\Pi$), wage income ($W$), private net wealth ($NW$), houshold borrowing ($HB$) and the respective inequality variable ($Q$) as regressors. We include lagged endogenous variables and use the lagged estimated residuals of equation 20 as the error correction term ($ECT_{t-1}$). Again lower case letters indicate logarithmic transformation, $\Delta$ denotes the first difference operator and $\varepsilon_t$

[14] Due to the relatively small number of observations in the sample it was not possible to apply the Johansen test for cointegration.

is the error term applying usual assumptions:

$$\Delta c_t = const + \sum_{i=1}^{n} \beta_{AR,i} \Delta c_{t-i} + \sum_{i=0}^{n} \beta_{\pi,i} \Delta \pi_{t-i} + \sum_{i=0}^{n} \beta_{w,i} \Delta w_{t-i} + \sum_{i=0}^{n} \beta_{nw,i} \Delta nw_{t-i} + \sum_{i=0}^{n} \beta_{hb,i} \Delta hb_{t-i} + \sum_{i=0}^{n} \beta_{q,i} \Delta q_{t-i} + \gamma ECT_{t-1} + \varepsilon_t. \quad (21)$$

Starting with one lag for each explanatory variable and following the general-to-specific approach, insignificant lags are successively eliminated from the equation and different post-estimation tests are employed.

For Germany, we extend the usual single equation specification to directly take the potential effects of personal income inequality into account, while we also control for wealth effects. The general estimation equation is of the following form:

$$\Delta c_t = const + \sum_{i=1}^{n} \alpha_{ARi} \Delta c_{t-i} + \sum_{i=0}^{n} \alpha_{\pi,i} \Delta \pi_{t-i} + \sum_{i=0}^{n} \alpha_{w,i} \Delta w_{t-i} + \sum_{i=0}^{n} \alpha_{nw,i} \Delta nw_{t-i} + \sum_{i=0}^{n} \alpha_{q,i} \Delta q_{t-i} + \varepsilon_t. \quad (22)$$

Starting from this general equation, again insignificant lags are successively eliminated to obtain a parsimonious model.

Estimation of all the above regression equations was done by applying the method of ordinary least squares. The next section presents the estimated coefficients of the parsimonious models found in our estimation procedure and a discussion of the implications we can draw from them.

## 3.3 Results

Table 2 presents the estimated long-run coefficients of the cointegration relationship (equation 20) for different measures of inequality and Table 3 shows the estimated coefficients of the parsimonious version of the error correction models (equation 21) for the United States in the period from 1960 to 2012. The parsimonious models only include the lag of net wealth as a lagged exogenous variable in first differences. Lagged endogenous variables, even if statistically insignificant, were included whenever there was a potential problem of serial correlation in the estimated residuals. There are no contemporaneous variables of inequality in the parsimonious models, since they always turned out to be statistically insignificant at the commonly used significance levels. Note that all estimated coefficients on

Table 2: Estimations of the cointegration relationship between consumption ($c_t$), wages ($w_t$) and different inequality variables as in equation 20. USA 1960–2012.

| | | | | |
|---|---|---|---|---|
| $w_t$ | 1.067 | 0.965 | 0.987 | 1.00 |
| $gini_t$ | 0.402 | | | |
| $10\%tis_t$ | | 0.503 | | |
| $5\%tis_t$ | | | 0.319 | |
| $1\%tis_t$ | | | | 0.166 |
| Observations | 51 | 51 | 51 | 51 |

*Notes: Data corrected for outliers in 1983 and 2009.*

the error correction terms ($ECT_{t-1}$) in Table 3 are negative and highly significant. This verifies our cointregration tests because negativity and high significance of the error correction term are necessary for cointegration relationships.

As can be seen from Table 2 the estimated long-term wage income elasticity of consumption is about 1 in all three estimated long-term equations depending on the variable representing personal inequality. Is this a meaningful result for the US? This would mean that any saving from wages of higher wage earning households has been compensated by consumption from wages of lower wage earning households in the long run. Given the developments of aggregated consumption and the personal saving rate in the US this seems not unrealistic. The high long-run elasticity of consumption to wage income therefore seems to be a reasonable result.

Regarding inequality, we found positive long-run relationships between aggregate consumption and personal income inequality. The estimated long-run personal inequality elasticity of US consumption is highest with respect to the top 10% income share, followed by the Gini index, the 5% share and substantially lower for the 1% share. This result might indicate that expenditure cascades where indeed triggered by redistribution from the very top (1% and 5%) but that the effects on consumption where much stronger when redistribution happened in favour of the top 10% and at the middle of the income distribution (as reflected by *gini*). This would be in line with the argument that the richest income groups in terms of emulation behaviour are a somewhat 'distant' strata to the majority of society. This finding casts some doubt on the theoretical argument related to expenditure cascades which maintains that redistribution at the very top can have the strongest

impact on aggregate consumption.

This result is a bit difficult to explain within the more complex macroeconomic models that have been proposed to include emulation and personal income inequality, which usually either assume that there is emulation of the 'super rich' and therefore, strong cascades from the top to the bottom, or that there is no emulation of the richest strata, but only emulation between low- and high-wage earning households. Perhaps, we can make sense of it in the following way: while there is an effect of redistribution towards the top 1% and 5% on aggregate consumption, this effect might be triggered by emulation within the richer classes. It seems reasonable to assume that the types of goods purchased are different from the ones that are important for emulation behaviour at the middle of the income distribution. Therefore, the emulation of the 1% and 5% does not cascade down from the very top to the very bottom of the distribution, but rather, there are several disconnected emulation patterns in the economy. Of course, the positive long-term effects of the different inequality variables can also be connected, at least in part, to habit persistence including minimum levels of consumption, which essentially also is a form of relative consumption behaviour, since perceived minimum levels of consumption are determined by social norms once the standard of living exceeds a certain threshold (Kapeller and Schütz 2015, p. 65).

The estimated short-term coefficients on the contemporaneous variables of profit and wage income in first differences in Table 3 confirm the standard finding of a higher elasticity of aggregate consumption to an increase in wage income than to an increase in profit income. This result is robust across all the estimations further using different inequality variables in the regressions, since the size of the estimated coefficients does not vary strongly and the coefficients on $d(\pi_t)$ and $d(w_t)$, are all significantly different from zero at the 1% significance level. We also tested for issues related to misspecification, heteroscedasticity and serial correlation in the residuals, as can be seen from the lower part of Table 3. We cannot reject the null hypothesis of no general misspecification, tested by the Ramsey RESET test, for any of the usual significance levels in any of the regressions. The same holds true for the null hypothesis of homoscedasticity of the White-Test and there was also no evidence for autocorrelated residuals, as the Breusch-Godfrey test did not allow for a rejection of the null hypothesis of no autocorrelation. We also cannot reject the null hypothesis of normally distributed residuals.

The coefficients of net wealth are significant in all regressions. However, they imply (small) negative effects of increasing wealth after one year (since $\beta_{nw,0} +$

Table 3: ECM estimations of consumption ($\Delta c_t$) as in equation 21) (parsimonious models) with different variables for personal income inequality. USA 1960–2012.

| Inequality variable in $ECT_{t-1}$: | $gini_t$ | $10\%tis_t$ | $5\%tis_t$ | $1\%tis_t$ |
|---|---|---|---|---|
| *const* | 0.011*** | 0.010*** | 0.010*** | 0.011*** |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| $\Delta\pi_t$ | 0.118*** | 0.121*** | 0.123*** | 0.126*** |
| | (0.028) | (0.028) | (0.028) | (0.029) |
| $\Delta w_t$ | 0.524*** | 0.516*** | 0.517*** | 0.523*** |
| | (0.051) | (0.051) | (0.051) | (0.051) |
| $ECT_{t-1}$ | -0.119*** | -0.137*** | -0.122*** | -0.114*** |
| | (0.039) | (0.042) | (0.039) | (0.036) |
| $\Delta nw_t$ | 0.0499** | 0.046** | 0.047** | 0.047** |
| | (0.023) | (0.023) | (0.023) | (0.023) |
| $\Delta nw_{t-1}$ | -0.085*** | -0.082*** | -0.082*** | -0.084*** |
| | (0.025) | (0.025) | (0.025) | (0.025) |
| $\Delta hb_t$ | 0.068** | 0.088*** | 0.084*** | 0.078*** |
| | (0.026) | (0.026) | (0.026) | (0.026) |
| Adj. $R^2$ | 0.900 | 0.902 | 0.901 | 0.901 |
| Breusch-Godfrey ($P$) | 0.759 | 0.789 | 0.780 | 0.798 |
| Ramsey RESET Test ($P$) | 0.285 | 0.427 | 0.395 | 0.361 |
| White-Test ($P$) | 0.608 | 0.231 | 0.286 | 0.360 |
| NORM ($P$) | 0.642 | 0.587 | 0.593 | 0.675 |
| Observations | 48 | 48 | 48 | 48 |

*Notes: Standard errors in parentheses. ***/**/* indicates significance at the 1%/5%/10% level respectively. Data corrected for outliers in 1983 and 2009.*

$\beta_{nw,1} < 0$).[15] This seems implausible. Kim et al. (2015, pp. 99–101) find also somewhat inconclusive evidence on short-run wealth effects, since the coefficients of their wealth variables are rather small and not robust across different specifications. Stockhammer and Wildauer (2016) find no robust wealth effects as well. They argue that the wealth effects may not be captured by direct measures of wealth, but are reflected by their debt variable, because wealth is a prerequisite to obtain credit, especially housing wealth for equity withdrawals. Indeed, our debt variables are statistically significant at the 10% level, positive and of a similar size as the

[15]F-tests of joint significance of $\Delta nw_t$ and $\Delta nw_{t-1}$ retained this implication for each of the regressions (results available upon request).

Table 4: Partial effects of a change in the profit share on the GDP growth contribution of consumption. USA 1960–2012.

| Inequality variable used in estimation: | $gini$ | $10\%tis$ | $5\%tis$ | $1\%tis$ |
|---|---|---|---|---|
| $(\partial C/Y)/\partial h$ | -0.400 | -0.329 | -0.326 | -0.389 |

*Notes: Calculated according to* $(\partial C/Y)/\partial h = e_{c,\pi}\frac{C}{\Pi} - e_{c,w}\frac{C}{W}$ *with* $e_{c,x}$ *denoting the respective estimated elasticity and using average values for* $\frac{C}{\Pi}$ *and* $\frac{C}{W}$ *over the sample period.*

ones found in Kim et al. (2015) for the period 1980–2011.

Our results on the short-run income elasticities for the US resemble the ones in the literature (Hein and Vogel 2008; Onaran and Galanis 2014). Table 4 presents the partial effect of a change in the profit share on the GDP growth contribution of consumption based on the estimated elasticities in Table 3 and average values over the sample period. The calculated partial effects confirm the contractionary effect of redistribution in favour of profit income on aggregate consumption. Since we did not find significant short-run coefficients on the inequality variables, we fail to find short-run effects of personal income distribution. On the one hand, this can be interpreted such that there were no positive short-run aggregate effects of increasing inequality on aggregate private final consumption expenditure in the United States for the estimated period (except for the error adjustment whenever there was a divergence from the cointegration relationship). However, it is also possible that the frequency of the available data on inequality is not sufficient to reveal an existing positive short-run relationship between personal income inequality and aggregate consumption. In the light of the estimated positive long-run relationships we therefore remain reluctant to reject the existence of a positive dynamic between inequality and consumption in the short run in the sample period.

In any case, our findings deliver evidence that the increase in personal income inequality had no negative, but a positive long-term effect on aggregate consumption in the US. This result contrasts with the traditional Keynesian view based on the absolute income hypothesis, and with various versions of the permanent income hypothesis that include precautionary savings or other assumptions that lead to an inverse relationship between the two, which means that there is no evidence that $\eta$ in the macroeconomic model discussed above was negative in the US within our sample period. Therefore, our result for the estimation of equation 20 and 21 stand in contrast to the findings of Brown (2004) and Carvalho and Rezai (2016), who find negative effects of personal income inequality for the US. The implication

of our findings in terms of the macroeconomic model of section 2 would be that for the US $\eta$ had a positive sign over most of the sample period and that the assumption of a positive differential between the propensity to save from profits and the propensity to save from wages is justified. Therefore, changes in personal and functional income inequality had diverging effects on US aggregate consumption.

Table 5 shows the results of the parsimonious short-run estimations for Germany (equation 22). The results for the short-run coefficients on profits and wages are similar to the ones for the US and also resemble the coefficients found for Germany in the literature (e.g. Hein and Vogel 2008; Onaran and Galanis 2014; Onaran and Obst 2016). There is again a substantial difference between the profit and the wage income elasticity of real private final consumption expenditures. The responsiveness of consumption with respect to wage income is substantially higher than the responsiveness with respect to profits. This is in line with the standard results on functional distribution and consumption. The coefficients on $d(\pi)$ and $d(w)$ are highly significant across our different estimation equations. Again, we cannot reject the null hypothesis of no general misspecification tested by the Ramsey RESET test for any of the usual significance levels in any of the regressions.

The same holds true for the null hypothesis of homoscedasticity of the White-Test and there was no evidence for autocorrelated residuals from the Breusch-Godfrey test-statistic. Table 6 presents the partial effects of a change in the profit share on the GDP growth contribution of consumption. Again, the calculated partial effects confirm the contractionary effect of redistribution in favour of profit income on aggregate consumption. Our control variable for wealth effects is statistically significant at the 5% level in all estimations and implies positive wealth effects on German aggregate consumption.

With regard to the estimated short-run coefficients on the personal inequality variables, there is a difference to our findings for the US. While we fail to find effects of the top income shares that are statistically different from zero at one of the commonly used significance levels, we find a relatively small negative effect of an increase in the Gini index that is significant at the ten percent level. In any case, as the coefficient for the summarised Gini is only significant at the ten percent level and there are no statistically significant effects of the top income shares, this would only be a very weak indication for the existence of aggregate negative effects of personal income inequality on aggregate consumption in Germany for the sample period.

The results for Germany do not indicate any aggregate positive effects of personal income inequality on consumption. The $\eta$ in the theoretical model would not

Table 5: Short-term estimations of consumption ($\Delta c_t$) as in equation 22 (parsimonious models) with different variables for personal income inequality. Germany 1960–2008/12.

| | | | | |
|---|---|---|---|---|
| *const* | 0.002 | 0.002 | 0.002 | 0.002 |
| | (0.002) | (0.003) | (0.003) | (0.003) |
| $\Delta\pi_t$ | 0.105*** | 0.091** | 0.092** | 0.091** |
| | (0.037) | (0.0397) | (0.0396) | (0.0396) |
| $\Delta w_t$ | 0.502*** | 0.509*** | 0.508*** | 0.509*** |
| | (0.035) | (0.036) | (0.037) | (0.036) |
| $\Delta nw_t$ | 0.136** | 0.145** | 0.142** | 0.143** |
| | (0.053) | (0.057) | (0.056) | (0.057) |
| $\Delta gini_t$ | -0.067* | | | |
| | (0.038) | | | |
| $\Delta 10\%tis_t$ | | 0.019 | | |
| | | (0.074) | | |
| $\Delta 5\%tis_t$ | | | -0.012 | |
| | | | (0.055) | |
| $\Delta 1\%tis_t$ | | | | -0.002 |
| | | | | (0.030) |
| Sample | 1960–2012 | 1960–2008 | 1960–2008 | 1960–2008 |
| Adj. $R^2$ | 0.881 | 0.871 | 0.871 | 0.871 |
| Breusch-Godfrey ($P$) | 0.773 | 0.745 | 0.667 | 0.689 |
| Ramsey RESET Test ($P$) | 0.888 | 0.874 | 0.907 | 0.898 |
| White-Test ($P$) | 0.612 | 0.112 | 0.108 | 0.223 |
| NORM ($P$) | 0.382 | 0.821 | 0.798 | 0.809 |
| Observations | 46 | 44 | 44 | 44 |

*Notes: Standard errors in parentheses. ***/**/* indicates significance at the 1%/5%/10% level respectively. Data corrected for outliers in 1975, 1991 and 2009.*

have a positive sign for Germany. This is not surprising given the development of aggregate consumption and inequality in the country. However, the results also do not provide any persuasive evidence for an inverse relationship between aggregate consumption and personal inequality. Therefore, the $\eta$ in our macro model would not be negative either but would be zero instead. This more or less corresponds to the findings of Stockhammer and Wildauer (2016) and, therefore, is in line with theories of interdpendent social norms in which relative and absolute income effects of rising personal income inequality cancel each other out.

Table 6: Partial effects of a change in the profit share on the GDP growth contribution of consumption. Germany 1960–2008/12.

| Inequality variable used in estimation: | *gini* | 10%*tis* | 5%*tis* | 1%*tis* |
|---|---|---|---|---|
| $(\partial C/Y)/\partial h$ | -0.393 | -0.424 | -0.421 | -0.424 |

*Notes: Calculated according to* $(\partial C/Y)/\partial h = e_{c,\pi}\frac{C}{\Pi} - e_{c,w}\frac{C}{W}$ *with* $e_{c,x}$ *denoting the respective estimated elasticity and using average values for* $\frac{C}{\Pi}$ *and* $\frac{C}{W}$ *over the sample period. Sample period for Gini 1960–2012. Sample period for* 10%*tis*, 5%*tis*, 1%*tis: 1960–2008.*

# 4 Conclusion

A simple post-Kaleckian model of distribution and growth was presented that incorporates personal income inequality and interdependent social norms. This was achieved by making the propensity to save out of wage income endogenous with respect to personal income inequality. Whether the actual aggregate effect of increasing personal inequality on saving and consumption behaviour is contractionary, expansionary or zero depends on the specific consumption and financial norms prevailing in the model economy. The model shows in an easily accessible manner how personal and functional income inequality can potentially have contrary effects on aggregate demand and growth. It can illustrate some of the major domestic developments in the decades prior to the Great Recession that are connected to inequality, consumption and saving behaviour for different countries.

In an empirical investigation, aggregate consumption functions have been estimated for the United States and Germany to explore whether effects of functional and personal income distribution can be found. The findings of previous studies regarding a substantial differential between the elasticities of aggregate consumption with respect to wage and profit income was confirmed, underlining the negative relationship between functional income inequality and aggregate consumption. For the US, we also found significant positive long-run effects of personal income inequality on consumption, and thus for the relative income hypothesis, with the effects being strongest for the top 10% income share and the Gini index and substantially less strong effects for the top 5% and 1% income shares. In the econometric analyses for Germany we found only very weak evidence for negative effects of personal income distribution on aggregate consumption. Generally, these empirical results show that it is important to distinguish between macroeconomic effects of functional and personal income distribution.

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# Appendix

# A Data sources and graphs of time series

Table 7: Description and sources of the data used for the estimations in section 4.

| Variable | Description | Source |
|---|---|---|
| $C$ | Private final consumption expenditure at 2010 prices.<br>1960–2012. | AMECO<br>(OCPH) |
| $\Pi$ | Gross operating surplus: total economy.<br>Adjusted for imputed compensation of self-employed.<br>Deflated by the price deflator private consumption (2010 = 100).<br>1960–2012. | AMECO<br>(UQGD) |
| $W$ | Compensation of employees: total economy.<br>Deflated by the price deflator private consumption (2010 = 100).<br>1960–2012. | AMECO<br>(UWCD) |
| $GINI$ | Summarised estimations of the Gini index of inequality in household disposable (post-tax, post-transfer) income.<br>1960–2012. | SWIID<br>(gini_net) |
| 10% | Top 10% income share.<br>US: 1960–2012. Germany: 1960–2008. | WID |
| 5% | Top 5% income share.<br>US: 1960–2012. Germany: 1960–2008. | WID |
| 1% | Top 1% income share.<br>US: 1960–2012. Germany: 1960–2008. | WID |
| $NW$ | Real private net wealth: non-financial wealth (including housing wealth) plus financial wealth minus liabilities (WID).<br>Deflated by the price deflator GDP (2010 = 100) (AMECO).<br>1960–2012. | WID and<br>AMECO |
| $HB$ | Real total credit of households and NPISH (BIS).<br>Deflated by the price deflator GDP (2010 = 100) (AMECO).<br>US: 1960–2012. | BIS and<br>AMECO |

*Notes:* For Germany prior to 1991 the data is equal to the values for West Germany due to data availability.

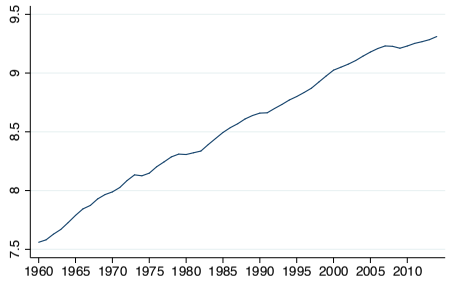


Figure A1: Log. Private final consumption expenditure at 2010 prices. USA 1960-2012.

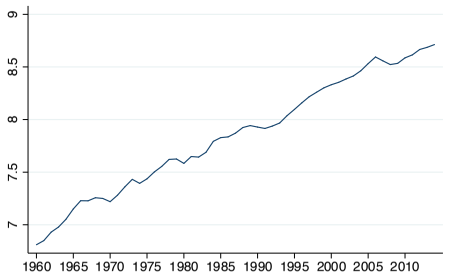


Figure A2: Real gross operating surplus. USA 1960-2012.

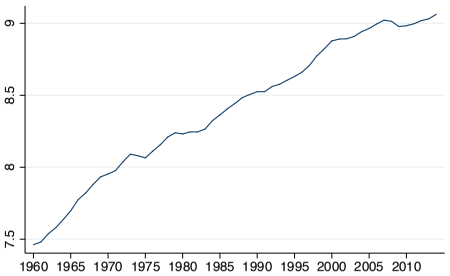


Figure A3: Log of real compensation of employees at 2010 prices. USA 1960-2012.

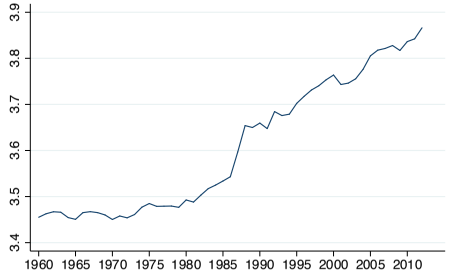


Figure A4: Log of the top 10% income share. USA 1960-2012.

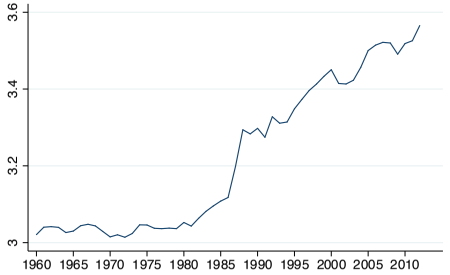


Figure A5: Log of Top 5% income share. USA 1960-2012.

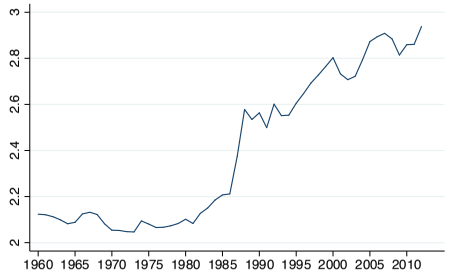


Figure A6: Log of top 1% income share. USA 1960-2012.

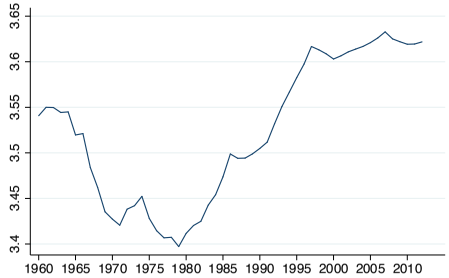


Figure A7: Log of estimated Gini index. USA 1960-2012

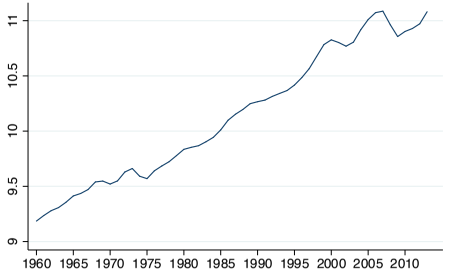


Figure A8: Log of real private net wealth. USA 1960-2012

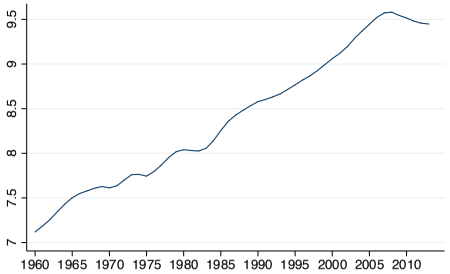


Figure A9: Log of real total credit of households and NPISH. USA 1960-2012

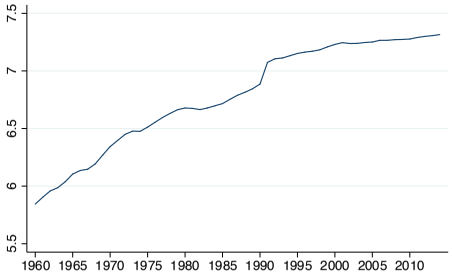


Figure A10:Log Private final consumption expenditure at 2010 prices. Germany 1960-2012.

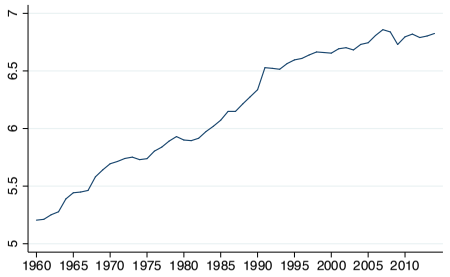


Figure A11: Real gross operating surplus. Germany 1960-2012.

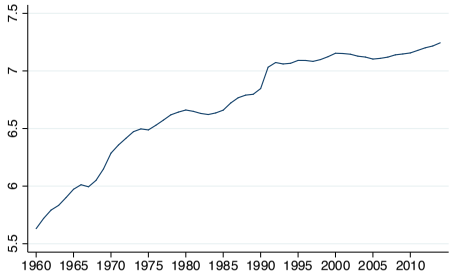


Figure A12: Log of real compensation of employees at 2010 prices. Germany 1960-2012.

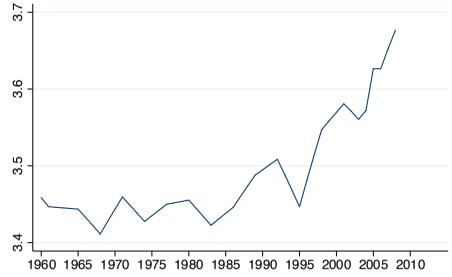


Figure A13: Log of the top 10% income share. Germany 1960-2008.

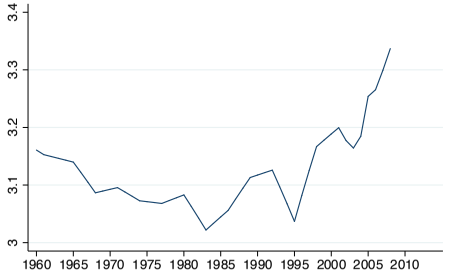


Figure A14: Log of Top 5% income share. Germany 1960-2008.

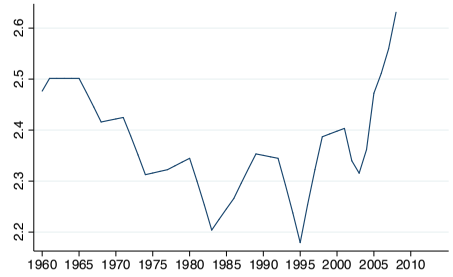


Figure A15: Log of top 1% income share. Germany 1960-2008.

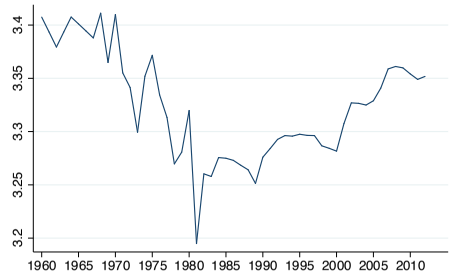


Figure A16: Log of estimated Gini index. Germany 1960-2012.

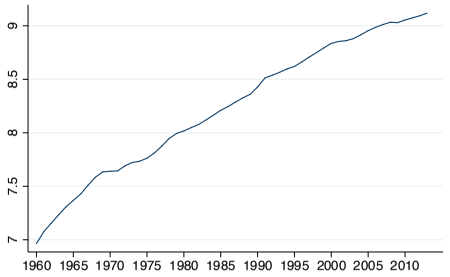


Figure A17: Log of real private net wealth. Germany 1960-2012.

# B Augmented Dickey-Fuller- and Cointegration-tests

Table 8: ADF-Tests USA. H0: Series contains a unit-root.

| | Log-level | | Log-diff | |
|---|---|---|---|---|
| | Specification | t-statistic | Specification | t-statistic |
| $c$ | c, t, l | -2.250 | c, l | -4.256*** |
| $\pi$ | c, t, l | -4.412*** | c, l | -5.555*** |
| $w$ | c, t, l | -2.751 | c, l | -4.111*** |
| $gini$ | c, ll | -1.184 | c, ll | -2.816* |
| $10\%tis$ | c, t, l | -2.331 | c, l | -4.291*** |
| $5\%tis$ | c, t, l | -2.300 | c, l | -4.283*** |
| $1\%tis$ | c, t, l | -2.380 | c, l | -4.439*** |
| $nw$ | c, t, lllll | -2.009 | c, l | -6.067*** |
| $hb$ | c, t, lll | -2.620 | c, l | -4.373*** |

*Notes:* c: constant; t: time trend; l: first lag; ll: first and second lag, etc.
***/**/* indicates significance at the 1%/5%/10% level respectively.

Table 9: ADF-Tests Germany. H0: Series contains a unit-root.

| | Log-level | | Log-diff | |
|---|---|---|---|---|
| | Specification | t-statistic | Specification | t-statistic |
| $c$ | c, t, l | -1.108 | c, l | -4.016*** |
| $\pi$ | c, t, l | -1.155 | c, l | -5.328*** |
| $w$ | c, t, ll | -1.725 | c, l | -4.451*** |
| $gini$ | c, l | -1.768 | c, l | -6.456*** |
| $10\%tis$ | c, t, l | -0.151 | c, ll | -4.057*** |
| $5\%tis$ | c, t, l | -0.817 | c, l | -3.480** |
| $1\%tis$ | c, t, l | -1.198 | c, llll | -3.221** |
| $nw$ | c, t, ll | -1.803 | c, ll | -3.266** |

*Notes: c: constant; t: time trend; l: first lag.*
****/**/* indicates significance at the 1%/5%/10% level respectively.*

Table 10: Cointegration-Tests USA. Consumption and different explanatory variables. H0: Residuals contain a unit-root (no cointegration).

| Log-level | | |
|---|---|---|
| Explanatory Variable(s) | ADF-Specification | t-statistic |
| $w$ | c, l | -3.227** |
| $gini$ | c, ll | -3.364** |
| $10\%tis$ | c, l | -3.050** |
| $5\%tis$ | c, l | -3.034** |
| $1\%tis$ | c, l | -2.998** |
| $nw$ | c, ll | -2.012 |
| $hb$ | c, l | -1.690 |
| $w, gini$ | c, l | -3.428* |
| $w, 10\%tis$ | c, l | -4.581*** |
| $w, 5\%$tis | c, l | -4.473*** |
| $w, 1\%tis$ | c, l | -4.431*** |

*Notes:* c: constant; t: time trend; l: first lag
Corrected for outliers in 1983 and 2009.
***/**/* indicates significance at the 1%/5%/10% level respectively (MacKinnon (1991) t-ratios were used).

Table 11: Cointegration-Tests Germany. Consumption and different explanatory variables. H0: Residuals contain a unit-root (no cointegration).

| Log-level | | |
|---|---|---|
| Explanatory Variable | ADF-Specification | t-statistic |
| $\pi$ | c, l | -2.011 |
| $w$ | c, l | -1.048 |
| $gini$ | c, t, l | -1.450 |
| $10\%tis$ | c, l | -2.110 |
| $5\%tis$ | c, t, l | -0.126 |
| $1\%tis$ | c, t, l | -3.088 |
| $nw$ | c, ll | -1.685 |

*Notes:* c: constant; t: time trend; l: first lag
Corrected for outliers in 1975, 1991 and 2009.
***/**/* indicates significance at the 1%/5%/10% level respectively (MacKinnon (1991) t-ratios were used).

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