Inequality, Consumption Emulation and Economic Growth

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Abstract

We develop a short-run neo-Kaleckian model to investigate the interplay of functional and personal distribution of income, and their impact on growth. Referring to the institutionalist hypothesis of consumption emulation, we assume that the propensity to save out of individual wages or profits is a function of one's position in the income distribution. We thus obtain instutionalist microfoundations of the model whereby the aggregate saving function depends on the concentration of the two income sources. We derive the conditions for an economy to be wage-led or profit-led, finding that the more an increase in the profit share leads to a more equal distribution of wages and profits the more the growth regime of the economy is profit-led. We empirically test the model's predictions using data from the Bank of Italy's Survey on Household Income and Wealth, finding support for the assumption that the saving ratio depends on the individual's position in the income distribution and on the source of income, and that the model overall exhibits good - though not perfect - predictive capacity over the period 1980s-2010s.

1 Literature

In the last decade, the issue of inequality has become increasingly central to the economic debate. Although the focus is only recent, inequality has shaped and driven every period of history as Piketty's work stresses. [Piketty (2014); Piketty (2020)].

Over the last 30 years, in particular, inequality has increased, both in terms of the distribution of personal income and wealth [OECD (2011); Piketty (2014)], and in terms of functional distribution, Karanassou and Sala (2010). Economists, historically always interested in growth, have begun to question whether rising economic inequality in the developed world is weighing on growth.

Barro (2000), for example, distinguishes between rich countries where inequality encourages growth and poor countries where it slows growth. The positive effects of a more equal income distribution on growth duration, e.g. by looking at the Gini index, are highlighted by Berg et al. (2012). The results are confirmed in Berg et al. (2018), where IMF scholars conclude that redistributive policies do not harm growth. Milanovic (2017) explores the relationship between the income share of capital and inequality. He argues that the growth of the capital's income share generates an increase in income inequality only under certain conditions. When the rate of return on capital is higher than the rate of income growth,

when capital income is concentrated among the richest households and finally if there is a correlation between overall income and the income source that is less equally distributed.
Kumhof et al. (2015) highlight another feature of inequality, its ability to lead to economic crises. In a 2012 paper, Stockhammer (2012) argues that the current inequality in income distribution is one of the main factors, combined with financial deregulation, of the 2008 economic crisis. In his view, the reasons are to be found in the savings function. Indeed, poorer income groups have a lower marginal propensity to save causing a lack of stimulus to aggregate demand. Brown (2004) had already shown through simulation results that income inequality has a substantial negative impact on consumption and can therefore exert a significant brake on effective demand.
Indeed, saving represents a link between macroeconomic analysis and income distribution that has been historically neglected.

From the 1940s several economists challenged the conventional economic theory of saving and consumption.
Kaldor (1940), for example, argued that the marginal propensity to consume is non-linear because households, in addition to a certain amount of self-consumption, save much less when income is low. Many authors suggested that it was relative rather than absolute levels of income that often determined patterns of consumption demand. Among these were Brady and Friedman (1947) who first investigated the effect of relative income on the savings rate. The authors showed how consumption patterns seemed to depend on an individual's position in the income distribution in a given community. It was at this time that Duesenberry's research was conducted and he wrote the famous book *Income, Saving and the Theory of Consumer Behavior*. In this work the author challenges two fundamental assumptions of aggregate demand theory. Namely, "(I) that every individual's consumption behaviour is independent of that of every other individual, and (II) that consumption relations are reversible in time."
Duesenberry (1949) argues that the consumption of one individual depends on the consumption of others with different weights. There will be different weights because *neighbouring* individuals will have more influence on the individual's consumption choices. His conclusion is that "when the Lorenz curve is given, the savings ratio depends on position in the income distribution rather than upon absolute income." In particular, "the propensity to save of an individual can be regarded as a rising function of his percentile position in the income distribution. The parameters of that function will change with changes in the shape of the income distribution."

Mason (2000) recalls that after 1920 economists tried to promote the idea that their discipline was an exact science, i.e. able, through precise mathematical models, to best describe reality. When in 1957 Friedman (1957) formulated the "permanent income" hypothesis, economists were able to distance themselves from Duesenberry by having an alternative diagnosis that lent itself easily to mathematical analysis. Friedman's theory, like Modigliani's, stripped consumption theory of social interdependency and restored an individualistic approach based on utility maximisation.
"The suspicion remains, however, that Duesenberry was abandoned by mainstream economists not because his theories had been tested and found wanting, but because an alternative hypothesis was now available that, in essence, recognized no sociology of consumption. Duesenberry's emphasis on interdependent

preferences had, in fact, always posed a threat to conventional consumer theory-a theory that held that preferences were independent and that aggregate demand could therefore be derived from the simple summation of individual demand schedules" [Mason (2000)].
Frank (1985) echoes Duesenberry's work by supporting the evidence of a positive correlation between the savings rate and relative income. The author points out how the recent empirical evidence and the extent to which life-cycle and permanent income theories of consumption have supplanted Duesenberry's work in textbooks "seems yet another testament to the power of a priori beliefs held by most economists". Starr (2008), in fact, following Veblen's theory states that "a conformity-based view of lifecycle saving has considerable advantages over the standard lifecycle view". This is because it is not necessary to show that people engage in forward-looking planning and indeed little evidence exists to support this view. Rather, household behaviour seems to adhere to "lifestyles that conform to what is considered natural and expected in their social context". This issue can be linked to the current one of financialisation. In his work Starr (2010) shows the phenomenon of overborrowing and the need for a coherent theory of consumption. Weiss (2019) combines the theme of financialisation with that of modern instability, which undermines the standard life-cycle view in the analysis of savings.
The relationship between absolute, relative income, savings and consumption rates was the focus of experimental analysis by Alpizar et al. (2005) and Dynan et al. (2004). Here it is shown that the average propensity to save has a strong positive correlation with income levels. This work is used by Caiani et al. (2019) to assess the impact of income inequality on consumption and demand patterns. In particular, Palley (2008) distinguishes the case where the marginal propensity to consume is concave from the one where it is convex. The increase in inequality thus decreases aggregate consumption in the first instance and increases it in the second.

Standard neo-Kaleckian models, as noted above, incorporate the functional distribution of income but fail to explain the effects of personal inequality. As Behringer and van Treeck (2019) point out, this is largely due to the lack of an explicit theory of household consumption. However, as we have seen, there is a wide literature on the link between consumption, saving and personal income distribution that would lead to the conclusion, from a neo-Kaleckian perspective, that inequality has an effect on the growth regime of the economy.
An attempt in this direction has been proposed by Lavoie (1996) and Palley (2014a) by introducing an unproductive managerial class. Palley (2014b) also formalises a model consisting of three classes: workers, a middle-management middle class and a 'top' management capitalist class. This allows him, starting from the labour market conflict between these classes, to study their potential macroeconomic outcomes in terms of growth and distribution. In particular, in the model he assumes that only the middle-management class and the 'top' management capitalist class save and that the saving rate of the former is lower than that of the latter.
Carvalho and Rezai (2016), after showing that the propensity to save increases significantly from the lowest to the highest quantile of wage earners, introduce the inequality measure in their theoretical model. In particular, the propensity to save out of wages depends on the size distribution of income among workers. These assumptions determine that, if the economy is wage-led, a more equal

distribution always pushes the economy towards wage-ledness, if on the other hand the economy is "strongly profit led" personal income inequality lead to less profit-ledness. In any case, a more equal personal income distribution increases capacity utilisation.
Palley arrives at the same conclusion [Palley (2016); Palley (2017)]. The author assumes that capitalists receive some labour income in their role as managers and workers have a positive propensity to save in order to own part of the capital stock and thus receive part of the profits. In this case, as Dutt (1984) did, Palley creates an index of inequality defined as the ratio of capitalists' income to workers' income. Since the assumptions of the model of Bhaduri and Marglin (1990) are relaxed, this index will not depend exclusively on the functional distribution but also on the personal income one.
Also Góes (2020) shows empirically how the propensity to save increases with income and exploiting the quantile division concludes that a more equal distribution of income has positive effects on aggregate demand, utilisation and growth.

2 Model

2.1 Description

The one presented here is a neo-Kalecki model of growth. To the well-known version of Bhaduri and Marglin (1990) some assumptions on the savings rate have been added that incorporate the consumption emulation theory discussed in the previous section. In formalizing this approach the paper by Ranaldi (2021) has been very supportive.

We start by distinguishing two sources of total income Y: capital income Π and labour income W. Considering no capital depreciation we write:

$$Y = \Pi + W \tag{1}$$

Using the share of profits π and wages w in the income, from equation (1) we get:

$$\frac{\Pi}{Y} + \frac{W}{Y} = \pi + w = 1 \tag{2}$$

Suppose now a population where each individual i receives an individual income Y_i. We sort the individuals in non-decreasing order with respect to their income, i.e. such that $Y_i \leq Y_{i+1}\ \forall i$.
Setting N as the total number of individuals we can write:

$$\sum_{i=1}^{N} Y_i = Y \tag{3}$$

Let us define Π_i and W_i as the individual profits and wages respectively. Recall that, given the order just established, it is not necessary that $W_i \leq W_{i+1}$ or $\Pi_i \leq \Pi_{i+1}\ \forall i$.
At this point, using the terminology of Ranaldi (2021), we define $\alpha_i = \Pi_i/\Pi$ as the share of individual profits in total profits and $\beta_i = W_i/W$ as the share of

individual wages in total wages.
The income of each individual i can be written as:

$$Y_i = \Pi_i + W_i = \frac{\Pi_i}{\Pi}\Pi + \frac{W_i}{W}W = \alpha_i \Pi + \beta_i W \tag{4}$$

with:

$$\sum_{i=1}^{N} \alpha_i = \sum_{i=1}^{N} \beta_i = 1 \tag{5}$$

In the original model of Kalecki (1968) and Steindl (1976), as well as in the standard neo-kaleckian models, it is assumed that the only ones saving are the capitalists. Post-Keynesian theory [Robinson (1956), Kaldor (1955), Pasinetti (1981)], on the other hand, assuming that workers also save, considers two different propensities to save. It also assumes a higher propensity to save on profits than on wages. As recalled by Sylos Labini (1992) "l'impostazione dei risparmi che dipendono esclusivamente dal reddito individuale non è accettabile, le diverse classi, per svariati motivi, avranno infatti propensioni al risparmio differenti. Ad esempio, la quota del reddito risparmiato dai lavoratori autonomi é significativamente maggiore della quota relativa ai lavoratori dipendenti: un importante motivo sta in ciò, che il lavoratore autonomo deve compiere investimenti per migliorare la competitività della sua piccola azienda o per far fronte alla concorrenza dei suoi rivali, mentre questa esigenza non c'è nel caso dei lavoratori dipendenti; questi poi, di norma, godono di forme sociali di assistenza e di previdenza più ampie di quelle dei lavoratori autonomi." [Sylos Labini (1992), p. 34-35].
In the following subsections we will consider the cases where the saving rate out of profits is equal to the saving rate out of wages (2.2) and the case where they are different (2.3).

2.2 A special case: $s = s_\pi = s_w$

Standard macroeconomic models assume a constant marginal propensity to save. This underestimates the effects of income distribution because it requires individuals to save the same share of their income whatever it is.
Instead we define s_i as the saving rate of each individual i:

$$S_i = s_i Y_i \tag{6}$$

Let us now assume that the individual saving rate increases as individual relative income increases. The underlying idea is that as one's income increases relative to the community, individuals are inclined to save a greater share of it. As we have seen, a large literature emphasises the interdependence of individuals in their choice of consumption and savings. Indeed, many authors have suggested that the saving rate is closely related to the position within the income distribution: Veblen (1953), Brady and Friedman (1947), Duesenberry (1949), Frank (1985), Alpizar et al. (2005) and Palley (2008).
Formally we can write:

$$S_i = \kappa_y \frac{i}{N} Y_i \tag{7}$$

with $\kappa_y > 0$ constant and $i \in [0,1]$ indicating the position the individual has in the personal distribution of total income.
We define total saving as the sum of individual saving, i.e:

$$S = \sum_{i=1}^{N} S_i = \kappa_y \left(\sum_{i=1}^{N} \frac{iY_i}{N} \right) = \kappa_y \left(\sum_{i=1}^{N} \frac{iy_i}{N} \right) Y \tag{8}$$

Where y_i denotes the share of individual income in total income.
At this point, using the terminology of Ranaldi (2021), we call $\tilde{\mu}_y$ the area of the Lorenz curve, i.e. the area of the income concentration curve. By construction $\tilde{\mu}_y$ assumes values between 0 and 1. As it increases (decreases), there will be a greater (lesser) equidistribution of income.
Through a brief algebraic step we can write:

$$\tilde{\mu}_y = \frac{2N+1}{2N} - \frac{1}{N} \sum_{i=1}^{N} iy_i \tag{9}$$

Therefore, by substituting equation (9) into (8) we obtain:

$$S = \kappa_y \left[\frac{2N+1}{2N} - \tilde{\mu}_y \right] Y \tag{10}$$

Now, given the population size, we decide to approximate $\frac{2N+1}{2N} \approx 1$ and then rewrite the total savings as:

$$S = \kappa_y (1 - \tilde{\mu}_y) Y \tag{11}$$

So we are proposing a new formulation of the saving rate, s. Looking at equation (11) it is indeed possible to write it as:

$$s = \kappa_y (1 - \tilde{\mu}_y) \tag{12}$$

We have constructed a model where the marginal propensity to save is increasing with respect to the individual's position in the income distribution. This assumption led us to write the saving rate as the product of a constant and the complement to one of the area of the Lorenz curve.
The overall saving rate of the economy is low when income is more evenly distributed, i.e. when $\tilde{\mu}_y$ is close to 1. In the opposite case a high saving rate will be observed.

We introduce the capacity utilisation rate, z given by the ratio of income to potential income determined by the available capital stock Y^*. The latter is for the sake of simplicity normalised to 1. Equation (11) can be rewritten as:

$$S = \kappa_y (1 - \tilde{\mu}_y) Y = \kappa_y (1 - \tilde{\mu}_y) \frac{Y}{Y^*} Y^* = \kappa_y (1 - \tilde{\mu}_y) z \tag{13}$$

Suppose, as in Bhaduri and Marglin (1990), that the investment function depends on the profit share in income π and the capacity utilisation rate z. Let us choose a linear function with the partial derivatives I_z and I_π constant in the domain as in Bhaduri (2020), Pariboni (2016), Hein and Vogel (2007).

$$I = I_0 + I_z z + I_\pi \pi \tag{14}$$

The constant term I_0 can be thought of either as the Keynesian "animal spirit" or, if government intervention is considered, as social investment.
Suppose for the sake of simplicity an economy without significant trade and economic activity by the government. Setting saving equal to investment we can write:

$$I_0 + I_z z + I_\pi \pi = z\kappa_y(1 - \tilde{\mu}_y) = zs \tag{15}$$

We then obtain the capacity utilisation rate guaranteeing equilibrium z^* as:

$$z^* = \frac{I_0 + I_\pi \pi}{\kappa_y(1 - \tilde{\mu}_y) - I_z} = \frac{I_0 + I_\pi \pi}{s - I_z} \tag{16}$$

A high saving rate depresses aggregate demand. In this case, by construction, this can be explained by either a large k_y or a small $\tilde{\mu}_y$.When incomes are more equally distributed then the capacity utilisation rate increases.

We define as in Blecker and Setterfield (2019) the excess demand for goods, $EDG = I - S$, as a function of the capacity utilisation rate:

$$EDG = I_0 + I_\pi \pi + z[I_z - \kappa_y(1 - \tilde{\mu}_y)] \tag{17}$$

In neo-Kaleckian models an increase in z is necessary to eliminate excess demand which is equivalent to imposing $\partial EDG/\partial z < 0$:

$$\frac{\partial EDG}{\partial z} = I_z - \kappa_y(1 - \tilde{\mu}_y) = I_z - s < 0 \tag{18}$$

Following the neo-Kaleckian theory we now calculate the variation of z with respect to the profit share on income that guarantees the equilibrium of equation (3.15). Using logarithmic differentiation we write:

$$I_z \frac{dz}{d\pi} + I_\pi = \frac{dz}{d\pi}\kappa_y(1 - \tilde{\mu}_y) - z\kappa_y \frac{d\tilde{\mu}_y}{d\pi} \tag{19}$$

$$\Rightarrow \frac{dz}{d\pi} = \frac{I_\pi + z\kappa_y \frac{d\tilde{\mu}_y}{d\pi}}{\kappa_y(1 - \tilde{\mu}_y) - I_z} \tag{20}$$

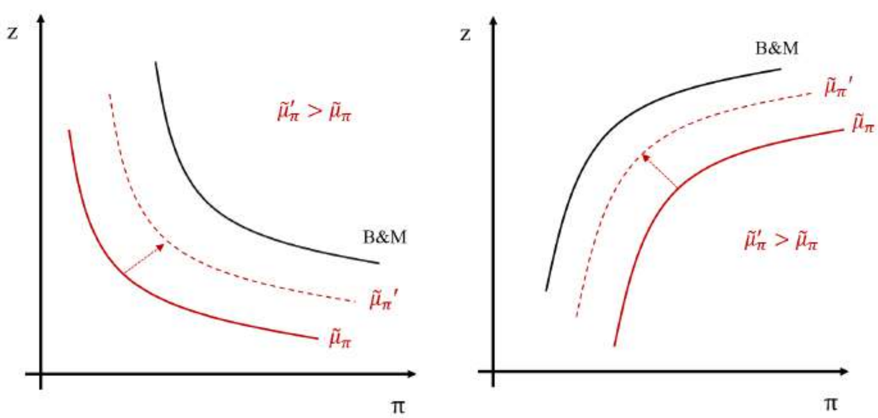
Assuming inequality (18) to be verified and thus Keynesian stability means assuming the denominator of equations (16,20) to be positive.
We now define $\eta_y = \frac{d\tilde{\mu}_y}{d\pi}$ in order to rewrite (20) as:

$$\frac{dz}{d\pi} = \frac{I_\pi + z\kappa_y \eta_y}{\kappa_y(1 - \tilde{\mu}_y) - I_z} = \frac{I_\pi + z\kappa_y \eta_y}{s - I_z} \tag{21}$$

We assume the equilibrium in the goods market to be stable. As seen above, this means studying the sign of $\frac{dz}{d\pi}$ considering only the numerator.

Following the work of Bhaduri and Marglin (1990) we can distinguish two growth regimes in an economy. In the first one, called *wage-led*, the response to the change in the profit share π on investment is smaller than the opposite effect on consumption, and hence smaller than the effect on individuals' savings ($I_\pi - S_\pi < 0$). When, on the other hand, the numerator in equation (20,21) is positive, the investment response to profitability is such that it exceeds the individuals' propensity to save. This type of regime is called *profit-led*.
There are two main points to be made when looking at equation (21). The first is that, holding other variables constant, the area of income concentration is positively correlated with the derivative $dz/d\pi$. In fact, if incomes are more evenly distributed, aggregate demand is more stimulated through consumption which leads the economy to be more *wage-led*.
The second point is that if the increase in the profit share is distributed in such a way as to decrease income inequality ($\eta_y > 0$), the value of the numerator in equation (21) is positive, so the economy cannot but be *profit-led*. The increase in the profit share would generate a negative effect on the saving rate and therefore a positive effect on the utilisation rate.
Figure 1 compares the model above (by the red line) and the model of Bhaduri and Marglin (1990). The two curves coincide when the saving rate is constant for each individual and only capitalists save. Moreover, as we have already seen, a more equal distribution of income generates an increase in the rate of capacity utilisation whatever the growth regime.

Figure 1: B&M: Bhaduri and Marglin (1990)



(a) *Wage-led* (b) *Profit-led*

We impose a positive numerator in equation (21) to study under which conditions the growth regime is *profit-led*. We then write:

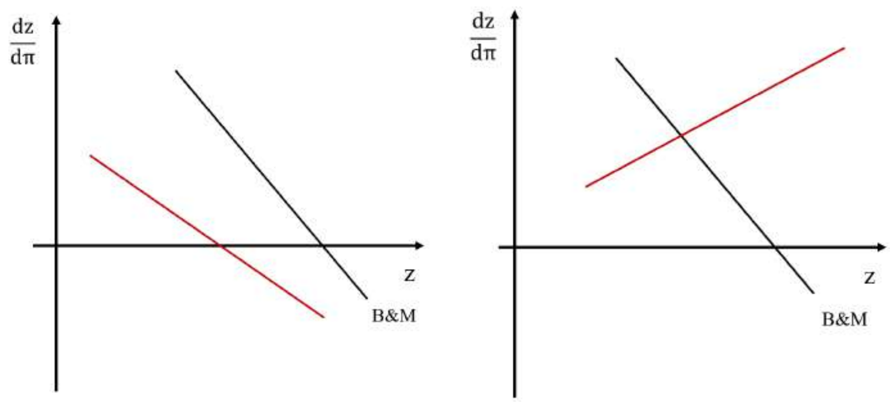
$$I_\pi > -z\kappa_y\eta_y \tag{22}$$

In Bhaduri and Marglin (1990) the inequality was instead expressed as:

$$I_\pi > zs \tag{23}$$

In the model presented above, in fact, the derivative of the saving rate with respect to the profit share will not be zero since the propensity to save depends on the income distribution.
The comparison between the two models in Figure 2 shows what we had argued by looking at equation (21): if the increase in the profit share generates a decrease in inequality ($\eta_y > 0$) the growth regime must be *profit-led*.

Figure 2: B&M: Bhaduri and Marglin (1990)



(a) $\eta_y < 0$ or $d\mathcal{G}/d\pi > 0$

(b) $\eta_y > 0$ or $d\mathcal{G}/d\pi < 0$

We can also show the results by replacing the area of income concentration $\tilde{\mu}_y$ with the Gini coefficient $\mathcal{G}$. Remarking that:

$$\mathcal{G} = 1 - 2\tilde{\mu}_y \Rightarrow \frac{d\mathcal{G}}{d\pi} = -2\eta_y \tag{24}$$

(22) becomes:

$$I_\pi > \frac{z\kappa_y}{2}\frac{d\mathcal{G}}{d\pi} \tag{25}$$

2.3 The general case: $s_\pi \neq s_w$

Let us define $s_{\pi,i}$ and $s_{w,i}$ as the individual marginal propensities to save out of profits and wages respectively, we then write:

$$\begin{aligned} S_i &= s_i Y_i = s_{\pi,i}\Pi_i + s_{w,i}W_i \\ &= s_{\pi,i}\alpha_i\Pi + s_{w,i}\beta_i W \\ &= [(s_{\pi,i}\alpha_i - s_{w,i}\beta_i)\pi + s_{w,i}\beta_i]Y \\ &= (s_{\pi,i}\alpha_i\pi + s_{w,i}\beta_i w)Y \end{aligned} \tag{26}$$

In the previous section we assumed that each individual's saving rate increases as his relative income increases. In addition to this assumption we now assume that the increasing share saved will depend on the source of income i.e:

$$s_{\pi,i} = \kappa_\pi \frac{i}{N} \tag{27}$$

$$s_{w,i} = \kappa_w \frac{i}{N} \tag{28}$$

with $\kappa_\pi > 0$ and $\kappa_w > 0$ constants.
Equation (26) then becomes:

$$S_i = \frac{1}{N}(\kappa_\pi \pi i \alpha_i + \kappa_w w i \beta_i)Y \tag{29}$$

While the total saving will be:

$$S = \sum_{i=1}^{N} S_i = \left(\kappa_\pi \pi \sum_{i=1}^{N} \frac{i\alpha_i}{N} + \kappa_w w \sum_{i=1}^{N} \frac{i\beta_i}{N}\right) Y \tag{30}$$

We introduce, as in Ranaldi (2021), the variables $\tilde{\mu}_\pi$ and $\tilde{\mu}_w$. These have values between 0 and 1 and represent the areas of the capital and labour income concentration curves respectively. $\tilde{\mu}_\pi$ increases (decreases) when profits move towards the lower (upper) part of the distribution. The same behaviour will obviously occur in the case of wages.
As we did for $\tilde{\mu}_y$ we can write:

$$\tilde{\mu}_\pi = \frac{2N+1}{2N} - \frac{1}{N}\sum_{i=1}^{N} i\alpha_i \tag{31}$$

$$\tilde{\mu}_w = \frac{2N+1}{2N} - \frac{1}{N}\sum_{i=1}^{N} i\beta_i \tag{32}$$

Then rewrite equation (30) as:

$$S = \left[\kappa_\pi \left(\frac{2N+1}{2N} - \tilde{\mu}_\pi\right)\pi + \kappa_w \left(\frac{2N+1}{2N} - \tilde{\mu}_w\right) w\right] Y \tag{33}$$

With $\frac{2N+1}{2N} \approx 1$, the saving equation will finally be:

$$S = \left[\kappa_\pi \left(1 - \tilde{\mu}_\pi\right)\pi + \kappa_w \left(1 - \tilde{\mu}_w\right) w\right] Y \tag{34}$$

It can be observed that the saving rate, s, here is:

$$s = \kappa_\pi \left(1 - \tilde{\mu}_\pi\right)\pi + \kappa_w \left(1 - \tilde{\mu}_w\right) w \tag{35}$$

It is then possible to define the saving rate out of profits, s_π, and the saving rate out of wages, s_w, by means of the equations:

$$s_\pi = \kappa_\pi \left(1 - \tilde{\mu}_\pi\right) \tag{36}$$

$$s_w = \kappa_w \left(1 - \tilde{\mu}_w\right) \tag{37}$$

and rewrite (35) as:

$$S = (s_\pi \pi + s_w w)\, Y = s_\pi \Pi + s_w W \tag{38}$$

This is the well-known saving equation written in relation to wages and profits. In our case, the saving rate out of wages and profits are a function of the area of concentration of the two income sources.
Finally using the utilisation rate z and normalising to 1 the potential income Y^* as before:

$$S = (s_\pi \pi + s_w w)\, Y = (s_\pi \pi + s_w w)\, \frac{Y}{Y^*} Y^* = (s_\pi \pi + s_w w)\, z \tag{39}$$

Again we assume an economy without significant trade and economic activity by the government. Equation (15) becomes:

$$I_0 + I_z z + I_\pi \pi = z \left[\kappa_\pi \left(1 - \tilde{\mu}_\pi\right) \pi + \kappa_w \left(1 - \tilde{\mu}_w\right) w\right] = z(s_\pi \pi + s_w w) \tag{40}$$

And we observe the z guaranteeing equality between investments and savings:

$$z^* = \frac{I_0 + I_\pi \pi}{\left(\kappa_\pi \left(1 - \tilde{\mu}_\pi\right) \pi + \kappa_w \left(1 - \tilde{\mu}_w\right) w\right) - I_z} = \frac{I_0 + I_\pi \pi}{(s_\pi \pi + s_w w) - I_z} = \frac{I_0 + I_\pi \pi}{s - I_z} \tag{41}$$

Equation (41), as we expected, is very similar to equation (16). The difference is that the saving rate does not depend on the income distribution, but on the distribution of the two sources of income considered separately. This result follows from the assumption that individuals do not save wages and profits indifferently.
We can also see that $\tilde{\mu}_\pi$ and $\tilde{\mu}_w$ are positively correlated with z. In fact, a more equal distribution of wages and profits leads to a decrease in the saving rate, thus generating a stimulus to aggregate demand through an increase in consumption. In this case, Keynesian stability is guaranteed for:

$$\frac{\partial EDG}{\partial z} = I_z - (s_\pi \pi + s_w w) < 0 \tag{42}$$

Again, stability implies a positive denominator in equation (41) which expresses the equilibrium utilisation rate.

As before, we use logarithmic differentiation with respect to the profit share in equation (41) obtaining:

$$I_z \frac{dz}{d\pi} + I_\pi = \frac{dz}{d\pi}(s_\pi \pi + s_w w) + z(s_\pi - s_w) + z\left(\pi \frac{ds_\pi}{d\pi} + w \frac{ds_w}{d\pi}\right) \tag{43}$$

$$\Rightarrow \frac{dz}{d\pi} = \frac{I_\pi + z\left[(s_w - s_\pi) - \left(\pi \frac{ds_\pi}{d\pi} + w \frac{ds_w}{d\pi}\right)\right]}{(s_\pi \pi + s_w w) - I_z} \tag{44}$$

Recalling that, by construction, $w = 1 - \pi$:

$$\frac{dz}{d\pi} = \frac{I_\pi + z\left[(s_w - s_\pi) - \left(\pi \frac{ds_\pi}{d\pi} - w \frac{ds_w}{dw}\right)\right]}{(s_\pi \pi + s_w w) - I_z} \tag{45}$$

Let us define $\eta_\pi = \dfrac{d\tilde{\mu}_\pi}{d\pi}$ and $\eta_w = \dfrac{d\tilde{\mu}_w}{dw}$ in order to rewrite:

$$\frac{ds_\pi}{d\pi} = \frac{d[\kappa_\pi (1-\tilde{\mu}_\pi)]}{d\pi} = -\kappa_\pi \eta_\pi \tag{46}$$

$$\frac{ds_w}{dw} = -\frac{d[\kappa_w (1-\tilde{\mu}_w)]}{dw} = -\kappa_w \eta_w \tag{47}$$

(45) then becomes:

$$\frac{dz}{d\pi} = \frac{I_\pi + z\left[(s_w - s_\pi) + (\pi\kappa_\pi\eta_\pi - w\kappa_w\eta_w)\right]}{(s_\pi \pi + s_w w) - I_z} \tag{48}$$

We can therefore conclude that if the increase in the profit share occurs through a more equal distribution of profits the growth regime will tend to be more profit-led. If, on the other hand, the increase in the wage share is distributed more evenly, the regime of an economy will tend to be more wage-led. In order to know under which conditions the regime of an economy can be considered *profit-led* we set $\frac{dz}{d\pi} > 0$.Taking the process as stable, thus the denominator in equation (48) as positive, we write:

$$I_\pi > z\left[(s_\pi - s_w) + \left(\pi\frac{ds_\pi}{d\pi} - w\frac{ds_w}{dw}\right)\right] \tag{49}$$

Or alternatively:

$$I_\pi > z[(s_\pi - s_w) + (w\kappa_w\eta_w - \pi\kappa_\pi\eta_\pi)] \tag{50}$$

$$I_\pi > z\{[\kappa_\pi(1-\tilde{\mu}_\pi) - \kappa_w(1-\tilde{\mu}_w)] + (w\kappa_w\eta_w - \pi\kappa_\pi\eta_\pi)\} \tag{51}$$

Starting from the comparison with the model of Bhaduri and Marglin (1990) we note basically two new elements. The first is that, as we expected, the saving rate out of wages has been introduced with a positive sign. In this model. In addition, however, a second term is introduced that emphasises how the increase in the profit/wage share is distributed in the population (η_π and η_w). Specifically, the former enters with a positive sign while the latter enters with a negative sign. Therefore, if in the model of Bhaduri and Marglin (1990) the value of $\frac{dz}{d\pi}$ decreased as the utilisation rate increased, in this case the result is less obvious. The relationship could also be increasing as already observed in Figure 2.
We will observe in the next section that the empirical evidence confirms the post-Keynesian assumptions of $s_\pi - s_w > 0$ even if with small values, the inequality $(s_\pi - s_w) < (\pi\kappa_\pi\eta_\pi - w\kappa_w\eta_w)$ will be easily verified if η_π is greater than zero and η_w smaller. Namely, when the increase in the profit share generates a more equal distribution of wages and profits. In this specific case $\frac{dz}{d\pi}$ is always positive. This means that if the increase in the profit share leads to a decrease in personal income inequality, the economy must be *profit-led*.

3 Empirical analysis

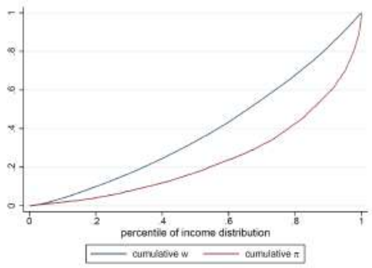
The data we will use in the analysis are taken from the Bank of Italy's *Survey on Household Income and Wealth* (SHIW) that was conducted by collecting information from (officially) Italian households resident in Italy since 1960. Since 1987, the frequency of the survey has been every two years (except in 1998).
The Bank of Italy provides the net disposable income of each household. This restricts our analysis, since the distribution of income sources will be computed net of taxes in force.
Although the survey has been carried out since the 1960s, data on returns on financial assets such as interest and dividends have only been available on a consistent basis since 1989. This, as in the work of Brandolini et al. (2018) and Iacono and Ranaldi (2020), forces us to restrict the period of analysis from 1989 to 2016 to a total of 14 available years.
In our analysis, households with pensions and arrears greater than zero are excluded.
This decision stems from the fact that, by its nature, the attitude of a part of the population, that of pensioners, does not respond to a similar behaviour with respect to that of workers or capitalists. Excluding them from the analysis means analysing the composition of income and its evolution with respect to savings by observing only one section of the population.
Our aim is to obtain the decomposition between capital income (Π) and labour income (W) shown in the proposed model. Therefore, we decide to split the net income from self-employment and entrepreneurial income (YM) into a capital and a labour component, using the strategy suggested by Glyn (2012).
Estimated values of saving are only available for households and not for individuals. This is consistent with Sylos Labini (1992) observation that it is the heads of households who divide their disposable income between consumption and saving. We must therefore impose that the i, which in our neo-Kaleckian model defined the individual, represents in the empirical analysis the Italian family, appropriately weighted.
Available data may show negative values of saving, these are to be interpreted as debts accumulated in that year by the household.

Figure 3 shows the pattern of concentration curves for labour income (in blue) and capital income (in red) in different years. These graphs clearly show the blue line always above the red curve. This means that the share of wages held by the bottom of the distribution is larger than that of profits, or equivalently, that wages are always more evenly distributed than profits.

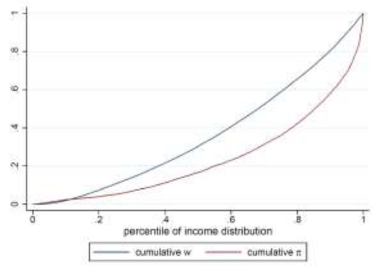
As can be noted, profits are increasingly less equally distributed than wages, but their concentration at the top of the income distribution has increased over the last 30 years. This is even more evident from Figures 4 and 5, which represent the distribution of total income, labour and capital. Like in the previous figure, the cumulative values of the variables have been used, ordered with respect to total income. As can be seen, the concentration curve of income and wages tends to move away from the bisector over the years. The Lorenz curve of profits shows a less clear trend.

We can now compute the areas of the profit and capital concentration curves, denoted earlier as in Ranaldi (2021) $\tilde{\mu}_\pi$ and $\tilde{\mu}_w$. Figure 6a shows the trend of the areas over the years while Figure 6b displays their difference. We observe first of all that, as we expected from the previous figures, the area of the wage

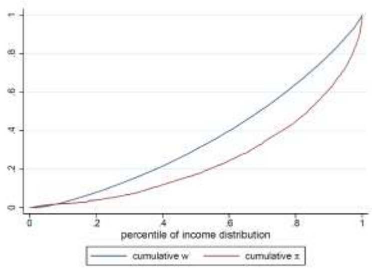
Figure 3: Cumulative w vs Cumulative π



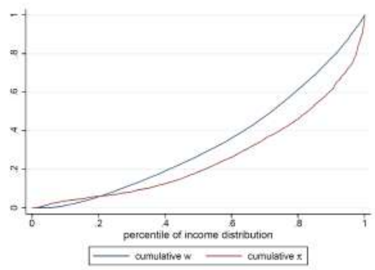
(a) 1989



(b) 2000

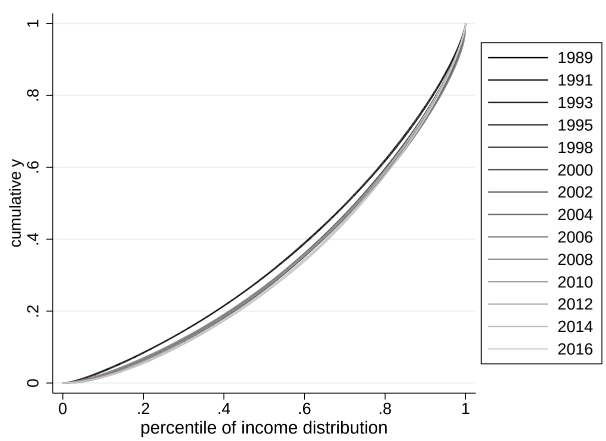


(c) 2008



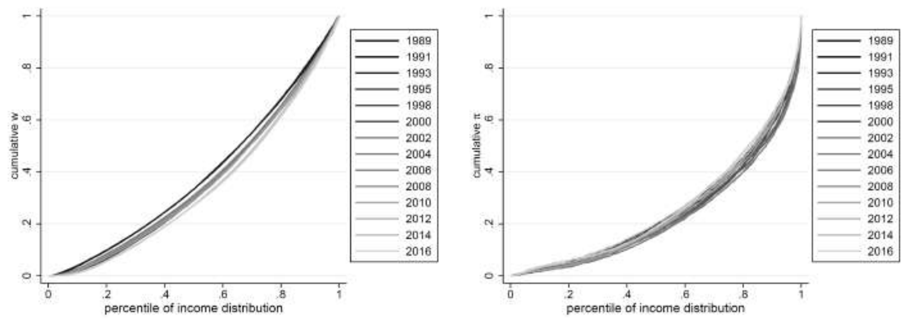
(d) 2016

Figure 4



concentration curve is always larger than the area of the profit concentration curve. Another remarkable point is the positive trend of $\tilde{\mu}_\pi$ and the negative trend of $\tilde{\mu}_w$ since 2004. Indeed, in the last decade, wage inequality has increased and in 2016 $\tilde{\mu}_w$ reached its lowest value in the last 30 years.

Figure 5



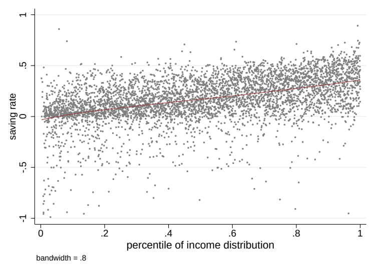
(a) cumulative w (b) cumulative π

Figure 6

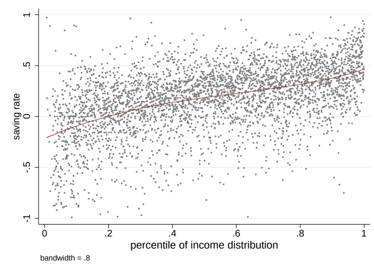
(a) $\tilde{\mu}_\pi$ vs $\tilde{\mu}_w$ (b) $\tilde{\mu}_w - \tilde{\mu}_\pi$

The model hypothesis is that the savings rate increases as the relative income of the individual (household) increases. Specifically, the position of the individual (household) in the income distribution. Figure 7 shows a positive relationship between the saving rate (S/Y) and the percentile of the income distribution in four different years. It is useful to remember that the available data do not allow us to distinguish between saving from wages and saving from profits.

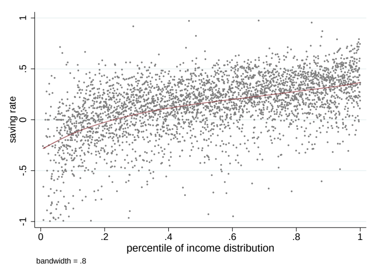
Figure 7: Lowess smoother



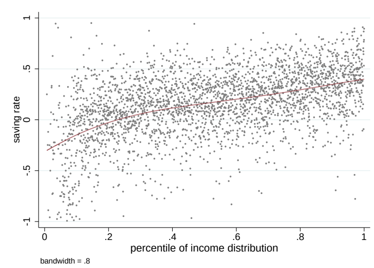
(a) 1989



(b) 2000



(c) 2010



(d) 2016

Empirically, we verified the model's hypothesis. We obtain significant results on the positive relationship between the saving rate and the individual's position in the income distribution. Initially, we used the OLS estimator for each available year using the income sources as explanatory variables. In addition, we converted the dataset provided by the Bank of Italy as panel and pseudo-panel data and applied the fixed effect model. Further details and results tables can be found in Appendix A.

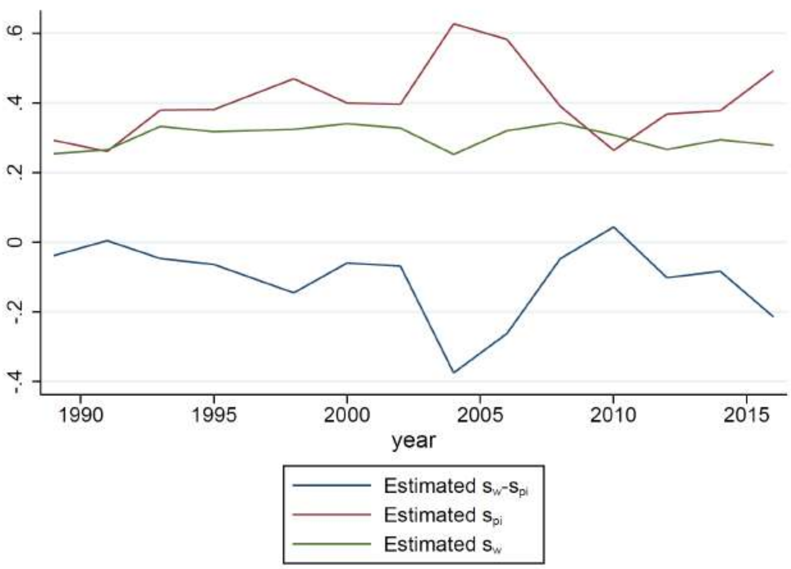
Figure 8 allows us to study the trend of the estimated coefficients and their confidence intervals. Both variables change over the years but there does not seem to be a clear trend for both. The saving rates in the model are defined as: $s_\pi = \kappa_\pi(1 - \tilde{\mu}_\pi)$ and $s_w = \kappa_w(1 - \tilde{\mu}_w)$. Using the previously obtained values of $\tilde{\mu}_p i$ and $\tilde{\mu}_w$ we can derive $\hat{s}_\pi$ and $\hat{s}_w$. Through Figure 9 we observe a constant trend of $\hat{s}_w$ and more fluctuating and higher values of $\hat{s}_\pi$. Overall, the difference $\hat{s}_w - \hat{s}_\pi$ seems to be always negative. This economically means that the propensity to save of wages is on average lower than that of profits. The former can be considered almost constant, while the latter ranges from 30 to 60% and is probably influenced by economic conditions.

Figure 8

(a) $\hat{\kappa}_\pi$

(b) $\hat{\kappa}_w$

Figure 9: $\hat{s}_\pi$ vs $\hat{s}_w$

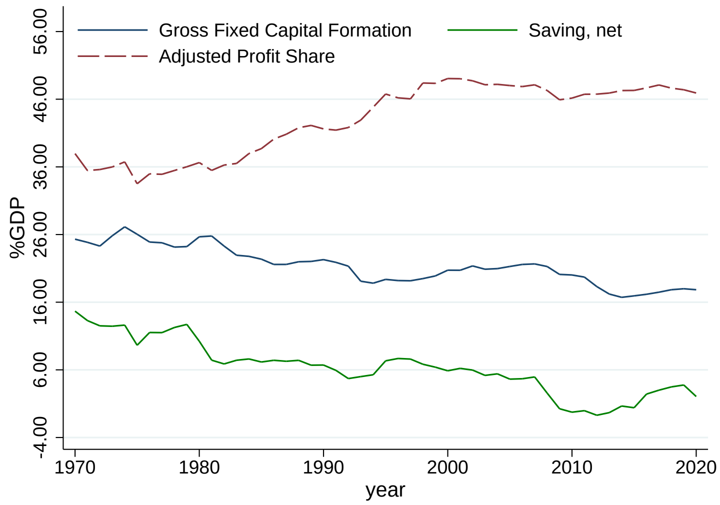


There is a wide literature of authors who have empirically investigated whether a regime is wage or profit led in different countries.
Naastepad and Storm (2006), for example, perform the analysis for eight major OECD countries in the 1960-2000 period. They first observe how Italy has the lowest wage share and this is a reason for its limited impact on growth. However, its effect is positive and allows the conclusion that Italy is wage-led.
Stockhammer et al. (2009) estimate the Euro area regime as a whole. The positive effect of an increase in the wage share by one percentage point on private consumption is larger than the negative effect on investment and net exports. The total effect of a 1 percentage point increase in the wage share on private excess demand ranges between 0.17% and 0.19% of GDP. Even in these estimates, therefore, the effect of an increase in the wage share is so large to define the Euro Area economy wage led.
The ILO report of Onaran and Galanis (2012) confirms these results. The authors observe a clear secular decline in the wage share in all countries starting from late 1970s or early 1980s onwards and in the Euro area the negative trend is particularly strong. The regime of the Italian economy, as well as that of the Euro area, is estimated to be wage-led.
The work of Onaran and Obst (2016) shows that among the 15EU member-states only Austria, Ireland, Belgium and Denmark are profit-led. However, in the case of a simultaneous fall in the wage share, only Belgium and Denmark remain profit-led.
All the works just mentioned use what Blecker (2016) calls the *structural* approach. This consists in estimating the individual components of aggregate demand and inferring the growth regime by summing the partial derivatives. The alternative is called the *aggregative* approach which estimates the derivative directly by regressing output Y on (various lags of) the profit share.

In section 2 we have built, by revisiting the saving function, a neo-Kaleckian model that incorporates the personal income distribution. The hypothesis is that the propensity to save depends on the areas of the wage and profit concentration curves ($\tilde{\mu}_\pi$ and $\tilde{\mu}_w$). The model then explores the link between macroeconomic and microeconomic variables in order to estimate the regime of an economy. As mentioned above, the Bank of Italy sample provides data for 14 years only. It would therefore be impossible to adopt the "structural" approach and estimate the derivatives of the components of aggregate demand. We therefore try to get some preliminary results by estimating all the variables involved in the model. Figure 10 shows the Italian macroeconomic variables from 1970 to 2021. The values of the profit share π are between 0.42 and 0.5 and therefore $\pi < w$ each year. We also observe a decreasing trend for investments I and savings S. The latter, defined by the OECD as the difference between net national disposable income and final consumption expenditures takes negative values from 2010 to 2013.

The problem of estimating z is left. We have defined the capacity utilisation rate $z = Y/Y^*$. It is not possible to know a priori the value of the potential (full capacity) output Y^*.
Some, such as Hein and Vogel (2007), have used the real gross domestic product (GDP) as a proxy for capacity utilisation and hence economic activity. Barrales and von Arnim (2017) also suggest using the Y/K ratio. It is in fact proportional to the utilisation rate under the assumption that the full capacity output to capital ratio is constant. In the *aggregative* approach of Barbosa-Filho and Taylor (2006) z is estimated as the ratio of actual to Hodrick-Prescott (HP)

Figure 10



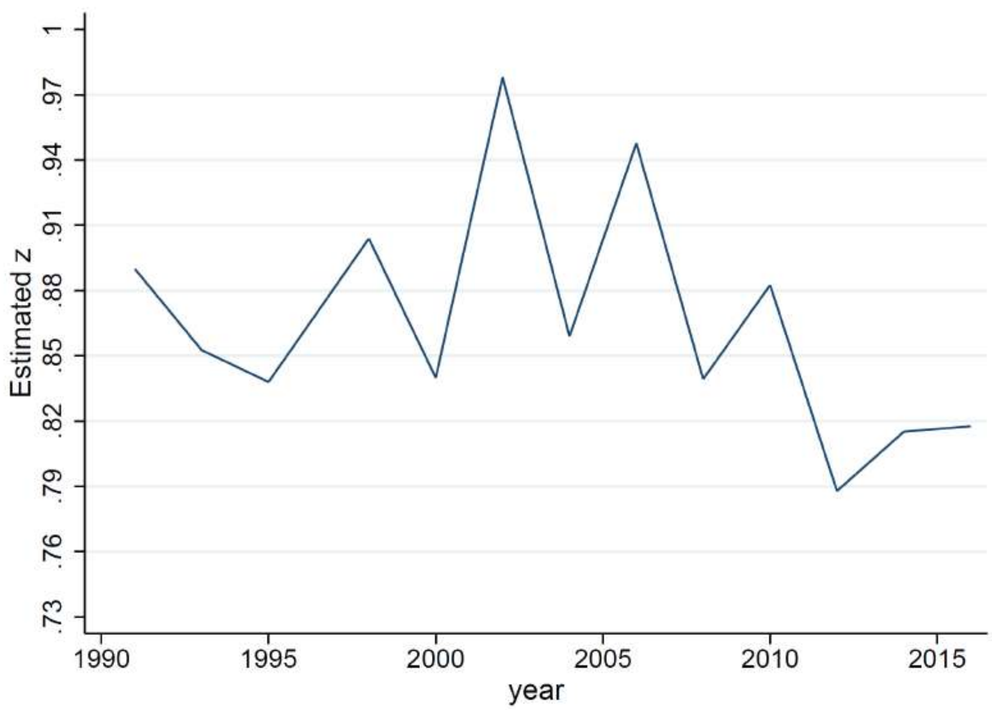
trend output.
We begin by estimating the effect of the change in the utilisation rate on the profit share in order to get an estimate of the growth regime. It is useful to keep in mind here that this type of variation represents an estimate of the incremental ratio during the period under consideration (2 years). This means that it often cannot summarise the regime of an economy as a whole, for which a longer period needs to be taken into account. We used the three proxies above for the change in the utilisation rate.
Assuming the Keynesian stability hypothesis is satisfied, we estimate the growth regime by calculating the sign of the numerator of the right-hand side of equation (48). For each year, we have used the values of $\hat{s}_\pi$, $\hat{s}_w$, $\hat{\kappa}_\pi$ and $\hat{\kappa}_w$ previously estimated by regression and $\tilde{\mu}_\pi$ and $\tilde{\mu}_w$. The results are presented in Figure (11).
With the two-year estimation, the growth regime seems to alternate. Six times a profit-led regime and six wage-led ones are observed. Overall, compared to the proxies of z, the model appears to have good prediction capabilities. We have indicated with a $*$ where the model prediction coincides with the estimates.
The total case deserves a separate mention, here the growth regime over the last 25 years appears to be profit-led whatever the estimator used. The results are confirmed by the model. In general the result over a longer period appears by construction more reliable.

We have already discussed the complexity of estimating the utilisation rate z, so we decided to exploit the model constructed to obtain an estimate of its values. We use, for 1991, the value of 0.89, that is the ratio between employment and labour force of that year according to OECD data. Graphically, from figure (10) we note a very oscillating trend. The overall trend appears negative, especially as from 2002, reaching a final value slightly higher than 0.8.

Figure 11: Wage- and profit-led growth regimes

	Growth regime ($dz/d\pi$)			
year	Different estimations of z			Implied by the model
	Y/K	H-P filter	Y	
1991	wage-led*	wage-led*	profit-led	wage-led
1993	profit-led	wage-led*	profit-led	wage-led
1995	profit-led	profit-led	profit-led	wage-led
1998	profit-led*	profit-led*	profit-led*	profit-led
2000	profit-led*	profit-led*	profit-led*	profit-led
2002	wage-led*	wage-led*	wage-led*	wage-led
2004	profit-led	wage-led*	wage-led*	wage-led
2006	profit-led*	wage-led	wage-led	profit-led
2008	profit-led*	profit-led*	profit-led*	profit-led
2010	profit-led*	profit-led*	profit-led*	profit-led
2012		wage-led*	wage-led*	wage-led
2014		profit-led*	profit-led*	profit-led
Tot	profit-led*	profit-led*	profit-led*	profit-led

Figure 12: z reconstructed



4 Conclusion

The last 30 years have seen a general increase in inequality. This issue, forgotten for years by economists, is coming back to the centre of the debate. Especially we have shown that the distribution of wages is increasingly unequal, reaching levels never achieved in the last 30 years.
Since it is impossible to talk about growth without talking about distribution, starting from the neo-Kaleckian model, this work has tried to deal with inequality in the most complete way possible by considering both personal and functional income distribution.
Veblen and Duesenberry's study was a fundamental inspiration to introduce the income distribution into the saving function. The authors in fact state that the propensity to save or consume depends more on relative income than on absolute one. Unfortunately, as we have seen, there are several reasons why the work of these authors has been forgotten. These are more of an ideological rather than empirical nature.
We have therefore decided to assume the non-linearity of the saving function. In particular, a different saving rate for profits and wages and increasing with respect to the position of each individual in the income distribution. Both hypotheses were empirically confirmed in the Italian case, and specifically the saving rate out of profits proved to be higher than the saving rate out of wages. We estimated that the latter can be considered almost constant while the former ranges between 30% and 60%. This is perfectly consistent with Post-Keynesian growth models. This allowed us once again to note how important is both the personal distribution of income and the composition of income itself.
It is necessary to recall some critical aspects of the neo-Kaleckian model and the one seen in section 2. By construction these neglect raw materials and overhead costs. Furthermore, in our model we have assumed, for the sake of simplicity, an economy without significant trade and economic activity by the government. Neglecting these components of aggregate demand, which are often crucial for some countries, can be a serious weakness. The exclusion of government expenditures, social investments, transfers and pensions also generates a limit to the possibility of any analysis on possible policies to be undertaken. All these extensions are possible, as well as the introduction of an autonomous component of aggregate demand Pariboni (2016) or adjustments to the investment function taking into account its non-linearity or income distribution.
The model constructed predicts that a more equal distribution of wages and profits generates a decrease in the saving rate, thus generating a stimulus to aggregate demand through an increase in consumption. Furthermore, it is possible to draw conclusions about how the increase in the profit share is distributed, a topic little covered in the literature on neo-Kaleckian models. If, for instance, this increase generates a more equal distribution of profits and wages we have a *profit led* growth regime.
Due to the limited availability of the sample at our disposal we have made a first estimation on the regimes of the observed economy in the single periods and in the total 30 years. Furthermore, as we did not have a reliable data for the assessment of the utilisation rate we decided to estimate it through our model obtaining a clear oscillating pattern and a negative trend.
We can conclude by saying that studying the effect on the rate of capacity utilisation of an increase in the profit share without asking how it is distributed within society can generate biased results. We need to make as complete an

analysis as possible, without forgetting that we are interdependent social beings and that 'different' inequalities exist. Choosing to do this is necessary for academic ends, but also for deciding the society of the future.

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Appendix A

The equation that expresses our hypothesis is (29) written in section 2. We can rewrite it here as:

$$S_i = \kappa_\pi \frac{i}{N}\Pi_i + \kappa_w \frac{i}{N} W_i \tag{52}$$

In the first case we run a linear regression using the ordinary least squares (OLS) estimator. The control variables come directly from the Bank of Italy (SHIW) data set. Among the household member characteristics we have chosen:

- *male*: 1 = male, 0 = female
- *age*: age-min(age), years
- age^2
- *south*: 1 = South and Island, 0 = otherwise
- *tertiary education*: 1 = bachelor's degree or higher, 0 = otherwise
- *north*: 1 = North, 0 = otherwise
- *household size*: Number of household members

The choice of regressors was made by means of a stepwise estimation, specifically a backward-selection estimation. The equation to be assessed thus becomes:

$$\begin{aligned} S_i &= \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + \beta_3 x_{3,i} + \beta_4 male_i + \beta_4 age_i + \beta_5 south_i + \beta_6 north_i \\ &+ \beta_7 tertiaryeducation_i + \beta_8 householdsize_i \end{aligned} \tag{53}$$

where:

$$x_1 = \frac{i}{N}\Pi_i \tag{54}$$

$$x_2 = \frac{i}{N} W_i \tag{55}$$

$$x_3 = \frac{i}{N} Y_{3,i} \tag{56}$$

Y_3 represents the part of income not included in wages and profits $(Y - \Pi - W)$ and therefore excluded from the model (e.g. pensions). Defining x_1 and x_2 as in equations (54, 55) allows us to consider $\hat{\beta}_1 = \hat{\kappa}_\pi$ and $\hat{\beta}_2 = \hat{\kappa}_w$.
Here the dataset we constructed was divided into 14 cross-sectional data, each for each year. The regression then investigates the relationship between the variables for each Italian household in the sample in a specific year. The results are shown in tables 4.1 and 4.2. From the tables we observe the non-significance of variable *north* and the constant term, the standard error is in fact quite high. The variables *male* and *age* are significant only in some years.
We find that the negative effect on saving is due to whether the head of the household has a bachelor's degree. Households living in the south save more on average than those in the north. Moreover, as we expected, the number of members is negatively correlated with household savings.
Finally, as far as the most relevant variables are concerned, we observe the high significance of $\hat{\kappa}_\pi$ and $\hat{\kappa}_w$ with values always positive and between 0 and 1.

Table 4.1: OLS results (a)

	1989	1991	1993	1995	1998	2000	2002
π	0.381***	0.346***	0.499***	0.514***	0.626***	0.535***	0.528***
	(0.031)	(0.059)	(0.056)	(0.071)	(0.070)	(0.052)	(0.060)
w	0.406***	0.429***	0.514***	0.494***	0.519***	0.550***	0.525***
	(0.019)	(0.049)	(0.030)	(0.029)	(0.030)	(0.034)	(0.036)
other income source	0.351**	0.322	0.404	1.350***	1.135***	1.139***	1.469***
	(0.139)	(0.585)	(0.460)	(0.218)	(0.240)	(0.068)	(0.231)
male	-549.201**	-363.240	9.025	633.031	11.518	-446.995	-911.989*
	(246.677)	(437.655)	(466.229)	(491.720)	(545.038)	(435.010)	(474.271)
age	7.418	-12.885	-27.059	9.962	-21.837	-38.574	-55.817**
	(10.721)	(16.655)	(19.740)	(17.954)	(24.664)	(24.351)	(24.300)
south	458.237**	1315.432***	2236.052***	2332.486***	2758.648***	2601.306***	2402.438***
	(209.074)	(414.914)	(437.514)	(470.870)	(625.272)	(523.300)	(704.273)
tertiary education	-977.498**	-1255.462**	-1756.261**	-1884.226***	-2575.601***	-2829.322***	-2756.049***
	(388.772)	(574.566)	(799.712)	(651.006)	(950.811)	(897.370)	(994.527)
north	216.649	336.254	649.956	808.576*	306.379	-480.923	-88.148
	(242.817)	(349.962)	(472.133)	(434.085)	(610.284)	(471.123)	(818.948)
household size	-452.073***	-275.793**	-684.274***	-536.880***	-966.941***	-1088.248***	-519.207***
	(75.466)	(131.340)	(149.554)	(133.370)	(242.332)	(182.935)	(198.503)
constant	931.799**	40.509	-280.145	-3317.213***	-2.307	1364.989	111.374
	(401.735)	(516.948)	(877.867)	(796.140)	(950.889)	(911.104)	(1064.347)
N Obs.	4660.000	4262.000	3709.000	3667.000	3535.000	3775.000	3586.000
R^2	0.575	0.447	0.547	0.612	0.616	0.643	0.595
adjusted R^2	0.574	0.446	0.546	0.611	0.616	0.642	0.594

Note: *** p<0.01, ** p<0.05, * p<0.10.

Table 4.2: OLS results (b)

	2004	2006	2008	2010	2012	2014	2016
π	0.816***	0.761***	0.530***	0.357***	0.510***	0.527***	0.663***
	(0.046)	(0.076)	(0.032)	(0.043)	(0.048)	(0.046)	(0.086)
w	0.406***	0.515***	0.552***	0.492***	0.424***	0.459***	0.416***
	(0.032)	(0.054)	(0.053)	(0.024)	(0.026)	(0.019)	(0.049)
other income source	0.607**	1.639***	0.944***	0.864***	0.795***	1.576***	1.322***
	(0.269)	(0.373)	(0.175)	(0.187)	(0.186)	(0.407)	(0.191)
male	-382.049	-873.713*	-632.559	-869.006**	-571.303	375.030	-723.083
	(436.834)	(481.829)	(397.931)	(443.084)	(348.981)	(344.995)	(494.384)
age	-76.575***	-83.460**	8.538	-44.315*	-33.845*	-51.150***	-52.062*
	(26.076)	(34.652)	(25.917)	(24.591)	(19.023)	(17.536)	(27.200)
south	3357.707***	4552.412***	3181.418***	1003.371	2140.448***	1761.560***	2890.232***
	(728.621)	(783.185)	(691.720)	(659.674)	(491.015)	(458.640)	(822.998)
tertiary education	-3255.622***	-3241.183***	-1298.650*	-2597.569***	-1749.640***	-2427.763***	-2437.142***
	(995.978)	(1054.826)	(753.662)	(841.054)	(616.489)	(609.739)	(892.783)
north	975.824	473.000	685.444	-408.439	589.533	958.162**	1456.427*
	(659.059)	(796.480)	(529.709)	(674.388)	(482.404)	(462.632)	(798.063)
household size	-719.562***	-1288.203***	-1260.636***	-833.489***	-1016.561***	-845.772***	-734.827***
	(193.801)	(352.811)	(227.469)	(167.330)	(151.314)	(128.315)	(206.123)
constant	-567.292	320.080	-1563.443**	1253.563	-603.744	1000.138	-443.685
	(1007.677)	(1336.597)	(794.446)	(952.900)	(706.082)	(765.117)	(933.291)
N Obs.	3592.000	3440.000	3445.000	3508.000	3542.000	3332.000	2999.000
R^2	0.803	0.805	0.703	0.534	0.614	0.634	0.626
adjusted R^2	0.802	0.805	0.702	0.533	0.613	0.633	0.625

Note: *** p<0.01, ** p<0.05, * p<0.10.

Let us now consider the available data as panel data. We will look at three different estimators: within regression estimator, between regression estimator and GLS estimator. The starting equation is as follows:

$$S_{i,t} = \beta_0 + x'_{i,t}\beta + \alpha_i + u_{i,t} \tag{57}$$

Where $x_{i,t}$ denotes the regressors used above. Depending on the assumptions on α_i, different estimators can be obtained.
We now observe the results via Table 4.3. The coefficients are all very significant. Depending on the model used, the estimators of *age* show contrasting signs. The GLS estimator and the between estimator of the variable *south* show here an opposite sign with respect to what we saw before. On the other hand, having a high educational qualification always seems to be negatively correlated with savings. Finally, sex, unlike in the previous models, is here a significantly non-zero variable. The empirical evidence shows (if the models are valid) that households where the head of household is a man save less than those headed by women.
As far as $\hat{\kappa}_\pi$ and $\hat{\kappa}_w$ are concerned, they are confirmed to be positive and between 0 and 1, and the inequality $\hat{\kappa}_\pi > \hat{\kappa}_w$ is also verified.

After dropping households present in more than one year from the sample, what we have is a sample of different households for each year called a pseudo panel.
We create cohorts in order to calculate the within estimator. Following the work of Deaton (1985), the households within the same cohort must have the same characteristics. From the dataset *comp* of the Bank of Italy we take the variable *ireg* containing the ISTAT regional code of residence for each household in the sample. We also use *studio*, a categorical variable representing educational qualification. Finally, we take the variable *male* introduced previously.
120 cohorts were created, the results of Table 4.4 confirm what we have seen before. In particular, now the coefficients expressing age are both significant. The negative sign of the coefficient of *age*2 can be read as a confirmation of the parabolic trend of savings and therefore of Modigliani's life cycle theory. $\hat{\kappa}_\pi$ and $\hat{\kappa}_w$ are both positive, between 0 and 1 and again $\hat{\kappa}_\pi > \hat{\kappa}_w$.

Table 4.3: FE: Fixed Effects RE: Random Effects BE: Between Estimator

	(1)	(2)	(3)
π	0.634***	0.506***	0.453***
	(0.045)	(0.033)	(0.003)
w	0.448***	0.347***	0.331***
	(0.018)	(0.011)	(0.004)
other income source	1.006***	0.796***	0.588***
	(0.080)	(0.058)	(0.040)
age	-121.901*	60.175***	86.211***
	(63.133)	(21.807)	(23.228)
age2	3.603***	-1.282***	-1.737***
	(1.126)	(0.409)	(0.392)
South	-7631.439***	1950.895***	1501.243***
	(1400.757)	(154.354)	(118.604)
ncomp	-898.030***	-835.054***	-698.726***
	(160.174)	(51.618)	(45.107)
male		-1087.993***	-1075.151***
		(105.013)	(125.458)
degree		-2457.813***	-1942.210***
		(276.426)	(168.434)
N Obs.	51052.000	51052.000	51052.000
R2 within	0.620	0.618	0.618
R2 between	0.574	0.617	0.617
R2 overall	0.579	0.623	0.622
rho	0.639	0.206	

Note: *** p<0.01, ** p<0.05, * p<0.10.

Table 4.4: Fixed Effects with Cohorts

	FE
π	0.550***
	(0.069)
w	0.255***
	(0.031)
other income source	0.226
	(0.418)
age	833.615***
	(105.919)
age^2	-10.486***
	(1.527)
household size	-1661.162***
	(285.821)
N Obs.	31059
R^2 within	0.579
R^2 between	0.828
R^2 overall	0.697
ρ	0.372

Note: *** p<0.01, ** p<0.05, * p<0.10.