Will wealth become more concentrated in Europe?

Evidence from a calibrated neo-Kaleckian model

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Will wealth become more concentrated in Europe? Evidence from a calibrated neo-Kaleckian model

Abstract: We develop and calibrate an analytical growth model in the neo-Kaleckian tradition with an endogenous wealth distribution and differential returns to wealth between workers and capitalists. We show that a long-run equilibrium allows for non-zero wealth owned by workers, even as the model contains the "triumph of the rentier" predicted by Piketty's r > g as a special case. The model's calibration to ten European countries shows that the distribution of wealth is likely to become more unequal in all cases, barring political countermeasures.

Keywords: inequality, wealth, income, neo-Kaleckian theory, model calibration

JEL classifications: D31, E12, E21

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1. Introduction

The accumulation of wealth and its distribution among persons and households are key to understanding economic inequality. Wealth defines classes, and as such, it is the basis of the functional distribution of income. Wealth conveys economic capabilities, and it is closely linked to political power. Empirically, it is distributed much more unequally than income.

For decades, Post-Keynesian models have reigned supreme in distributional analysis (Kaldor 1955, Kalecki 1971, Pasinetti 1962). The debate between wage-led and profit-led growth has further refined the Post-Keynesian theory of distribution (Bhaduri and Marglin 1990, Stockhammer and Ederer 2008, Stockhammer et al. 2009, Lavoie and Stockhammer 2013, Barbosa and Taylor 2006, Kiefer and Rada 2015). Yet, for reasons of data availability and, presumably, path dependency, Post-Keynesian modelling has focused mainly on the functional distribution of income. The distribution of wealth has remained a Cinderella issue, as has the personal distribution of income. Notable exceptions are Palley (2017a) and Taylor et al. (2015) for wealth, and Carvalho and Rezai (2016), Palley (2017b), and Taylor et al. (2017) for the personal income distribution.

On the other hand, the empirical literature has recently focused in detail on the distribution of wealth. Pioneered by authors often close to Post-Keynesian thought (Wolff 1983, Avery et al. 1988, Atkinson et al. 1989), the topic has gained traction with broad swathes of economists with the work of Piketty and his co-authors (Piketty 2014, Saez and Zucman 2016, Alvaredo et al. 2017). These same authors have also drawn attention to the increasing inequality in the size distribution of income. However, while this empirical literature excels in describing both history and the status quo, its theoretical underpinning have generated controversy. For instance, the conclusion of Piketty's famous "$r > g$" equation, i.e. that wealth will become ever more concentrated, has been met with criticism (Taylor 2014, Bofinger et al. 2015, Bernardo et al. 2016).

This paper aims to fill gaps of both these literatures. On the one hand, we extend Post-Keynesian models in the Bhaduri-Margin tradition by incorporating an endogenous distribution of wealth and differential rates of return, and by empirically estimating key model parameters from household data. On the other hand, we provide a theoretically well-founded model of wealth distribution that generates a stable long-run distribution of wealth, while permitting corner solutions of all (or zero) wealth held by capitalists. Finally, we compare the model solution with empirical data, which permits us to draw conclusions regarding a likely future development of our key variable, the share of wealth held by capitalists. In particular, we find that the distribution of wealth is likely to become more concentrated in the hands of capitalists in the future in all ten European countries covered by our data.

The paper is structured as follows: Section 2 reviews the literature, section 3 describes the model including an extension covering the personal income distribution and differential

returns, and section 4 provides the data definitions and contains the empirical results. Section 5 concludes.

2. Theory and empirics of the distribution of income and wealth

Theoretical analysis of distribution is a mainstay of Post-Keynesian theory (Kaldor 1955, Kalecki 1971, Pasinetti 1962). Its traditional focus on the functional distribution of income inspired a class of neo-Kaleckian and structuralist models, also known as the wage-led/profit-led debate (Bhaduri and Marglin 1990, Stockhammer and Ederer 2008, Stockhammer et al. 2009, Lavoie and Stockhammer 2013, Barbosa and Taylor 2006, Kiefer and Rada 2015). In wage-led regimes, increasing the real wage (i.e., the wage share) leads to higher growth, and the reverse is true in profit-led regimes. Apart from providing direct economic policy implications regarding redistribution and growth, these models helped explain the empirical observation that the wage share has experienced a secular decline in most high-income countries (mostly continental Europe): In a financialised production and regulation regime (Stockhammer 2004), the ability of capitalists to capture an ever-increasing share of national income feeds into declining growth rates and a further entrenchment of a weak bargaining position of workers.

While the functional distribution of income is still a perhaps surprisingly accurate approximation to the personal income distribution (Rehm et al. 2016), empirics of the personal income distribution has garnered increasing attention in economics in recent years (Piketty and Saez 2003, Atkinson et al. 2011, Piketty 2014). On the theoretical side, wage-/profit-led models have more recently been expanded by work disambiguating the personal distribution of income. In particular, Lavoie (2009) incorporated manager pay and overhead costs to explain the stagnation of wage shares in Anglo-Saxon countries – which had been a puzzle given the financialised production regime described above. Secondly, papers that are more recent have incorporated aspects of the personal income distribution in models in the Marglin-Bhaduri tradition by manipulating the savings function (Carvalho and Rezai 2016 Palley 2017b). Covering both theory and empirics, Carvalho and Rezai (2016) show that the increased wage inequality observed in the U.S. has a two-fold effect: a direct one, increasing saving out of wages and reducing the saving differential between workers and capitalists (which makes the economy more likely to be profit-led); and an indirect one through the demand regime, which is ambiguous. If the economy is wage-led, more inequality makes the economy less wage-led, and if it is profit-led, the economy becomes more profit-led. Empirically, they find the US-economy to be profit-led, and that "the increase in income inequality has turned demand more profit led in the USA" (Carvalho and Rezai 2016: 499).

Relative to the functional and personal distribution of income, the distribution of wealth has received limited attention in the literature. The empirics of the wealth distribution have

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recently started being investigated in detail (Wolff and Zacharias 2009, Piketty 2014, Saez and Zucman 2016, Alvaredo et al. 2017, Kennickell 2017). One important finding of the empirical literature is that there are differential returns to wealth that depend on the size of wealth owned (Piketty, 2014, 447f). Potential reasons are manifold: Large estates make professional wealth management possible and profitable; high wealth permits long-term investment strategies including high-risk, high yield assets; high wealth might be more conducive to providing contacts that might lead to advance or inside information on investment opportunities; and high wealth might confer the ability to influence policies that might reduce incomes of the very wealthy.

Regarding the theoretical literature, only a few papers have modelled the distribution of wealth in an analytical setting. In particular, recent contributions by Palley (2017a in a neat exposition of his 2012 work) and Taylor et al. (2015), building on work by Dutt (1990) and Pasinetti (1962) respectively, lay the ground for modelling the wealth distribution in a structuralist/Post-Keynesian framework. Taylor et al. (2015) develop a model in which both capitalists and workers save and thus receive profit income, but only workers work and thus get wages. They incorporate capital gains into capital income, which played an important empirical role in rising income inequality in the US. Taylor et al. (2015) simulate a wealth concentration ratio of about 60% - the top 1% owns roughly 60% of total wealth. Wealth is split between "the rich" and "middle class-workers", with the "bottom 60%" empirically not owning any wealth.

This paper follows Taylor et al. (2015) in measuring wealth inequality as the share of capitalists in total wealth. However, Taylor et al. (2015) explicitly assume a profit-led economy due to previous empirical work on the US (see e.g. Kiefer and Rada 2015), whereas most empirical research finds EU countries to be wage-led (see e.g. Onaran and Galanis 2014). We therefore do not impose any restrictions on our model. Secondly, in contrast to Taylor et al. (2015), this paper only covers two classes, capitalists and workers, and does not include a third, distinct "middle income" class. Still, since both models are in the demand driven, Post-Keynesian traditions, many conclusions transfer across model sub-groups: the wealth concentration depends positively (negatively) on the saving rate of capitalists (workers), and positively on the profit share.

Palley (2017a) revolves around the question whether the personal distribution of income is a direct causal factor in determining growth – which he answers in the negative. His paper permits blended income sources – both workers and capitalists receive both work and profit income in a neo-Kaleckian framework. The parameters influencing the personal income distribution (and growth) are the functional income distribution, the distribution of the wage bill between workers and capitalists, and the distribution of wealth between workers and capitalists. The latter, in turn, depends on the differential propensities to save. Palley's

(2017a) model serves as a valuable starting point for our investigation of the dynamics of the wealth distribution.

Our contribution to this literature is, first, incorporating differential rates of return into an analytical model of growth with blended income sources and an endogenous wealth distribution. Second, we integrate the empirical and the theoretical literature by calibrating the model to ten European countries. Third, the solid theoretical foundation of our empirical work permits us to investigate "counterfactual" long-run levels of wealth concentration.

3. The distribution of wealth in a neo-Kaleckian framework
a. A bare bones formulation

As described in section 2, the model is neo-Kaleckian in the tradition of Bhaduri and Marglin (1990) similar to those in Palley (2017a) and Taylor et al. (2015). As such, it contains the standard features of (1) the separation of the household sector into classes, namely workers and capitalists which differ with regard to their saving propensities, and (2) an investment function in which investment depends both on capacity utilisation and on profitability. We introduce two novel aspects compared to standard neo-Kaleckian models: (1) wealth accumulates through saving along the lines of Palley (2017a); (2) we include differential rates of return between workers and capitalists.

In our model, income Y is divided between wages W and profits R according to the (exogenous) functional income distribution π (the profit share).

$$W = (1 - \pi)Y$$

$$R = \pi Y$$

In the basic version of the model presented in this section, all wages accrue to workers. Workers (denoted by a subscript w) also receive a part of profits R proportional to their share of wealth ownership *(1 − z)*, which together with their wages make up total income of workers Y_w. Income of capitalists (subscript r) amounts to profits R on their share of wealth z.

$$Y_w = W + (1 - z)R$$

$$Y_r = zR$$

As mentioned, we assume differential savings rates between capitalists s_r and workers s_w, and the former to be higher than the latter. Consumption propensities of workers and capitalists multiply with their respective incomes to give total consumption C.

$$C = (1 - s_w)Y_w + (1 - s_r)Y_r$$

Investment follows a standard neo-Kaleckian functional form, in which the capital stock K grows depending on capacity utilization u and the profit share π. This formulation allows for both wage-led and profit-led demand growth regimes, depending on the values of the parameters β_1 and β_2.

$$I = (\beta_0 + \beta_1 u + \beta_2 \pi)K$$

The goods market is in equilibrium; output equals demand. Since we abstract from all sectors other than households and firms, total demand consists of consumption and investment.

$$Y = C + I$$

Following convention, we normalize income, profits, and investment to the capital stock to get stable solutions for capacity utilization u, the profit rate r and the growth rate of the capital stock g.

$$u = \frac{Y}{K}$$

$$r = \frac{R}{K} = \pi u$$

$$g = \frac{I}{K}$$

The only asset in the model is productive wealth, which is equal to the capital stock K. The ownership of (productive) capital entitles to the receipt of the corresponding share in profits. Both workers and capitalists accumulate wealth through savings. The level of savings is the difference between income and consumption.

In solving the model, we distinguish between the short and the long run. In the short run, wealth shares are constant, since wealth accumulates over a longer period. Capacity utilization, the profit rate and the growth rate then all depend on the wealth share of capitalists z (for formal results, see Appendix 7.a). In particular, a higher wealth share of capitalists z lowers capacity utilization, the profit rate and the growth rate of the capital stock. The reason is that a higher wealth share of capitalists transfers profit income to capitalists, which depresses total consumption due to capitalists' higher saving rate.

Over time, both capitalists and workers accumulate wealth until the wealth share adjusts to its equilibrium. In the long term, the distribution of wealth only depends on the (differential) saving rates and the profit share (for a formal deduction, see Appendix 7.b). Capitalists' long-run equilibrium wealth share z^* is higher: (1) the higher the profit share, (2) the higher the saving rate of capitalists, and (3) the lower the saving rate of workers.

$$z^* = \frac{s_r \pi - s_w}{(s_r - s_w)\pi}$$

The model is stock-flow consistent as shown in Table 1. As per convention, a plus sign notes a source of funds and a minus sign is a use of funds, rows and columns sum to zero. Firms pay wage income to workers (row 3), and distribute profits (row 4), which both workers and capitalists receive. Workers and capitalists consume their income (row 1), and firms invest (row 2). Both workers and capitalists save and thus accumulate wealth in the form of productive capital (row 5). Initially, firms are assumed to finance their expenditures through (endogenous) credit creation. After sales, firms' investment is directly financed by the savings of households (column 4). We thus abstract from a financial sector and assume that households hold their (productive) wealth directly in the form of shares.

Table 1: Flows and stocks in the neo-Kaleckian model with endogenous wealth distribution

| | Households | | Firms | | |
	Workers	Capitalists	Current	Capital	Total
Consumption	$-C_w$	$-C_r$	$+C$		0
Investment			$+I$	$-I$	0
Wages	$+W$		$-W$		0
Profits	$+R_w$	$+R_c$	$-R$		0
Wealth	$-\Delta V_w$	$-\Delta V_r$		$+\Delta K$	0
Total	0	0	0	0	0

Source: own elaboration.

b. Including personal income distribution and differential rates of return

In the basic version of the model, all wages accrued to workers. However, our empirical analysis (see section 4) shows that capitalists receive a share of 5 to 10 per cent of wages in most Euro-area countries. In the vein of Palley (2017a), we thus extend the model by allowing for blended income sources, i.e. a distribution also of wages between workers and capitalists. To simplify the exposition, the share of wage income going to capitalists is given by an exogenous parameter α. As a consequence, the personal income distribution is more skewed towards capitalists than in the simple case since workers now receive less (wage) income.

Furthermore, as noted above, the empirical literature has uncovered differential rates of returns – the higher the wealth owned, the higher the returns on this wealth (Piketty 2014:

447f). This can be due to more professional wealth management, the ability to take higher risk, a higher likelihood of insider knowledge, or other factors. Our empirical analysis confirms that the composition of wealth varies between workers and capitalists, with the former holding a larger share of their wealth in low-yield asset classes (in particular deposits). The implication for the distribution of profits is that capitalists receive higher capital income and thus benefit more from the compound interest effect. We thus extend the model by distinguishing two asset types within productive wealth: deposits, which we assume for simplicity to be non-interest bearing, and profit-generating assets, which yield profit income. Workers and capitalists hold different shares of their wealth in profit-generating assets (γ_w, γ_r). Since their respective shares of profits now depend both on their share in wealth and on the part of wealth which they hold in profit-generating assets, income of workers and capitalists then amount to

$$Y_w = (1 - \alpha)W + \frac{\gamma_w(1 - z)}{\gamma_w(1 - z) + \gamma_r z} R$$

$$Y_r = \alpha W + \frac{\gamma_r z}{\gamma_w(1 - z) + \gamma_r z} R$$

The analytical solution of the model becomes more complicated than in the basic version.[1] Capitalists' wealth share now depends not only on the saving rates of workers and capitalists and on the profit share, but furthermore on the distribution of wages between workers and capitalists and on their respective shares of wealth held as profit-generating assets. That is, the six parameters $s_w, s_r, \pi, \alpha, \gamma_w, \gamma_r$ define the distribution of wealth in the long run. In addition to savings rates and the distribution of profits discussed above, the higher capitalists' share of the wage bill, the higher is their wealth share in the long run. The higher the share of capitalists' wealth held in the form of profit-generating assets, the higher is their wealth share; the same holds for workers.

4. Results
a. Calibrating the model

In order to calibrate the model, we empirically estimate its key parameters from household data. Our primary source is the Household Finance and Consumption Survey (HFCS), which was conducted by the European System of Central Banks in 2010 and contains household information on wealth and socioeconomic characteristics for 15 countries. The data is ex-ante harmonized and multiply imputed. We take this into account in all calculations by using Rubin's rule.

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[1] Available on request.

The HFCS covers detailed wealth components. Since only productive wealth is relevant for the purpose of this paper, we define wealth as businesses (in which the owner may or may not be self-employed) and financial wealth (including shares and bonds), and deduct financial liabilities (i.e., non-mortgage debt). The HFCS also provides information on income from work and from capital ownership.

We complement the wealth information of the HFCS with data on saving rates from the European Household Budget Survey (EHBS) 2010. This partially harmonized data contains detailed information on consumption and income for individual households, which permits us to calculate saving rates at the household level. We merge these with the HFCS data across percentiles of the income distribution. The theoretical hypothesis that households with higher incomes have higher saving rates is empirically confirmed in all ten countries for which data is available (see Appendix 7.d). Our results thus cover Austria, Belgium, Cyprus, Spain, Finland, France, Greece, Malta, Portugal and Slovakia.

Table 2: Capitalists' share in the number of households and in incomes

	Households	Total income	Work income	Capital income
Austria	0.05	0.11	0.07	0.63
Belgium	0.02	0.04	0.02	0.38
Cyprus	0.12	0.23	0.18	0.69
Spain	0.05	0.13	0.10	0.54
Finland	0.01	0.05	0.02	0.54
France	0.02	0.09	0.05	0.50
Greece	0.02	0.05	0.05	0.30
Malta	0.02	0.05	0.03	0.27
Portugal	0.02	0.05	0.04	0.45
Slovakia	0.03	0.05	0.05	0.31

Source: HFCS 2010, own calculations.

We follow Rehm et al. (2016) in defining classes through both income and wealth. In particular, capitalists include households owning a business (with more than five employees),

rentiers (receiving capital income higher than the average work income), and the wealthiest 1%. Worker households are those whose main income earner is an employee. Households that do not fall into either category are excluded from the analysis.

Table 2 shows the distribution of classes and income in all countries. In most cases, capitalists represent between 1 and 5% of households. They receive an over-proportional share of work income and total income, and a particularly large share of capital income. Note that these income shares of capitalists in Table 2 are likely to be underestimated. The reason is that high-wealth households are under-represented in surveys such as the HFCS (Vermeulen, 2016), and capital income, which is concentrated at the top (Ertl et al., 2017), is particularly prone to under-reporting.

b. The distribution of wealth – empirics and model results

The six parameters for the model are the saving rates of workers s_w and capitalists s_r, the profit share π, capitalists' share of the wage bill α, and workers' and capitalists' share of wealth held in profit-generating assets, respectively (γ_w, γ_r). The first six columns of Table 3 give an overview of the empirical values for these six parameters for all ten countries covered by our data.

Our empirical results are consistent with the theoretical model. The saving rate of capitalists is markedly higher than that of workers in all countries. Whereas capitalists save between 7 and 39% of their income, workers' saving rates range between 0 and 18%.[2] Despite country-specific idiosyncrasies, saving rates of capitalists and workers exhibit a pattern of co-movement across countries: the marked difference between the two rates is observable in all countries.

The share of profits in total income lies between 37% and 46%. Capitalists' share in work income ranges mostly between 2 and 5% with the exception of Cyprus and Spain, where it amounts to 18 and 10%, respectively. The share of profit-generating assets as a percentage of workers' wealth varies from 20% to 81%, and it is markedly lower than that of capitalists in each country. The latter hold more than 80% and in most countries more than 90% of their wealth in profit-generating assets. As a consequence, we observe differential returns on (productive) wealth that are highly skewed towards capitalists.

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[2] In some countries, the saving rate of workers is negative. Since this is not possible in the long run, we set the saving rate to zero.

Table 3: Empirical values of the model parameters in ten Euro-area countries

	s_w	s_r	π	α	γ_w	γ_r
Austria	0.05	0.23	0.38	0.07	0.40	0.92
Belgium	0.10	0.29	0.34	0.02	0.59	0.85
Cyprus	0.00	0.10	0.37	0.18	0.81	0.96
Spain	0.00	0.07	0.41	0.10	0.53	0.90
Finland	0.12	0.39	0.37	0.02	0.55	0.93
France	0.01	0.29	0.37	0.05	0.57	0.97
Greece	0.05	0.13	0.34	0.05	0.25	0.90
Malta	0.00	0.26	0.46	0.03	0.59	0.98
Portugal	0.13	0.33	0.41	0.04	0.42	0.90
Slovakia	0.18	0.30	0.44	0.05	0.20	0.83

Note: Columns refer to: (1) s_w saving rate of workers, (2) s_r saving rate of capitalists, (3) π profit share, (4) α share of capitalists in the wage bill, (5) γ_w share of workers' wealth held in profit-generating assets, (6) γ_r share of capitalists' wealth held in profit-generating assets.

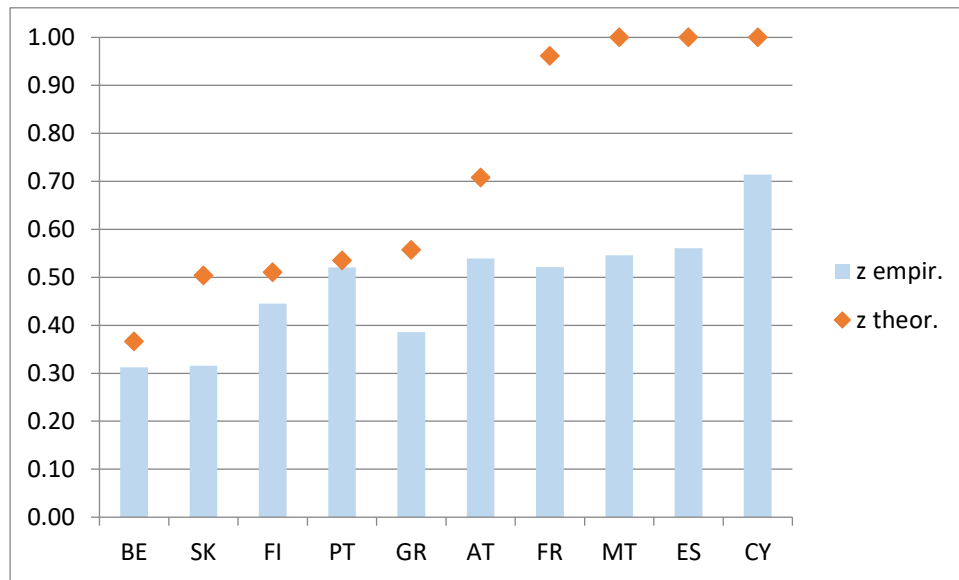Data: HFCS 2010, EHBS 2010; own calculations.

Figure 1 shows the empirical wealth distribution in each of the ten Euro-area countries, and contrasts it with the model results for the distribution of wealth using the parameters described in Table 3. Empirically, the bars indicate that the share of wealth owned by capitalists is high in all countries relative to their share in the population - between 31% and 71% of productive capital is owned by this group. (Recall that capitalists make up at most 5% of households in most countries.)

Nonetheless, the wealth share predicted by our calibrated theoretical model (rhombi) is even higher in every country. That is, the endogenous dynamics of wealth concentration, which are incorporated in the model, would lead to an even higher wealth concentration in the long run than is currently empirically observed.

In particular, in the four countries where the saving rate of workers is zero or very low, the predicted wealth share of capitalists rises to (near) 1. The model thus allows for the "triumph of the rentier", as described by Piketty (2014). In the majority of countries, however, there

exists a stable long-run wealth share of capitalists that is well below unity. In those cases, workers always hold a sizeable share of productive wealth, even if it is low relative to their population share.

Figure 1: Theoretical and empirical share of capitalists in total wealth

Data: HFCS 2010, EHBS 2010; own calculations.

Finally, the correlation between predicted and empirical values suggests that the model successfully captures key drivers of the endogenous wealth concentration despite its condensed form. The model thus predicts that the wealth concentration will increase further, absent forces that are not included in the model (such as a government sector).

5. Conclusion

This paper develops and calibrates an analytical growth model with an endogenous distribution of wealth and differential returns to wealth between workers and capitalists. The dynamics of the wealth distribution are key to understanding economic inequality since it has severe repercussions on the distribution of income, well-being, and political power in a society. While the model contains the "triumph of the rentier" predicted by Piketty's inequality $r > g$ as a special case, we show that a long-run equilibrium allows for non-zero wealth owned by workers.

The results show that our model captures the main mechanisms of wealth accumulation and distribution. Regarding parameter calibration, we find that the data does indeed show differential saving rates between workers and capitalists in all countries covered by our data, as required by our model assumptions. Furthermore, capitalists receive a significant share of work income; we therefore extend the standard post-Keynesian model by blending income sources (work income for capitalists and profit income for workers). Crucially, we find empirically that a much higher share of capitalists' productive wealth is held in profit-generating assets, while workers own a large share of their productive wealth in low-yield deposits. This justifies our novel introduction of differential returns between workers and capitalists into the analytical model.

These empirical stylized facts drive the distribution of wealth between classes in our model. We find that the long-run solution of the calibrated model predicts a wealth share of capitalists which is very high. In some countries, the model even suggests a near-extreme wealth concentration, if workers are barely able to save. However, in every country covered by our data the empirical concentration of wealth, albeit high, still lies below the model solution.

We interpret this as an indication that the wealth concentration is likely to increase further due to the endogenous mechanisms covered by our model. We are thus unable to dismiss Piketty's (2014) dire warnings of a rising concentration of wealth due to factors endogenous to the functioning of capitalist economies, even as we cannot confirm a universal corner solution of capitalists owning all wealth. On the other hand, we can also interpret our results to suggest that factors not included in our model – such as the government sector – might play a mitigating role for the concentration of wealth.

Of course, the analytical model presented in this paper is highly simplified and abstracts from many complicating aspects of reality. This opens several interesting future research questions. First, introducing household debt, while perhaps more relevant in a US context than in Europe, might still be a fruitful avenue for future research. The HFCS data show that households with negative net productive wealth make up a negligible share of total net wealth, but in some cases their shares in the household population is sizeable. Splitting workers into positive and negative net wealth owners would lead to a less tractable yet possibly insightful three-class model, in which debt of one class would add to the wealth of the other two classes.

Second, in our model deposit owners do not receive any interest rate. While this is certainly true in a situation where central bank interest rates are close to zero such as in the years after the financial crisis, it would not be a plausible assumption for periods of strong economic upswings. As long as yields on deposits are lower than on other productive assets, relaxing this assumption should not challenge our results qualitatively, but would provide a fuller picture.

Finally, we abstract from asset prices and capital gains, which would likely increase the gap in the differential returns of workers and capitalists. We thus expect that including an explicit financial market into the model would not only add to its relevance for wealth dynamics in the 21st century, but would strengthen our results.

6. Bibliography

Alvaredo, F.; Chancel, L.; Piketty, T.; Saez, E.; Zucman, G. 2017. Global Inequality Dynamics: New Findings from WID.world, American Economic Review: Papers & Proceedings vol. 107 no. 5, 404–409. https://doi.org/10.1257/aer.p20171095

Atkinson, A. B., Gordon, J., Harrison, A. 1989. Trends in the shares of top wealth-holders in Britain, 1923–1981, Oxford Bulletin of Economics and Statistics vol. 51, 315–332, doi:10.1111/j.1468-0084.1989.mp51003006.x

Atkinson, A.B., Piketty, T., Saez, E. 2011. Top incomes in the long run of history, Journal of Economic Literature vol. 49, no. 1, 3–71

Avery, R.B., Elliehausen, G. E., Kennickell, A. B. 1988. Measuring Wealth with Survey data: An Evaluation of the 1983 Survey of Consumer Finances," Review of Income and Wealth vol. 34, no. 4, 339–369

Barbosa-Filho, N. and Taylor, L. 2006. Distributive And Demand Cycles In The Us Economy-A Structuralist Goodwin Model, Metroeconomica vol. 57, no. 3, 389–411

López-Bernardo, J., López-Martínez, F., Stockhammer, E. 2016. A post-Keynesian response to Piketty's "Fundamental contradiction of capitalism", Review of Political Economy vol. 28, no. 2, 190–204

Bhaduri, A. and Marglin, S. 1990. Unemployment and the Real Wage: The Economic Basis for Contesting Political Ideologies, Cambridge Journal of Economics vol. 14, no.4, 375–93

Bofinger, P., Horn, G., Schmid, K., van Treeck, T. 2015. Thomas Piketty und die Verteilungsfrage. Analysen, Bewertungen und wirtschaftspolitische Implikationen für Deutschland, SE Publishing, https://www.boeckler.de/pdf/Piketty_Verteilungsfrage.pdf

Carvalho, L. and Rezai, A. 2016. Personal income inequality and aggregate demand, Cambridge Journal of Economics vol. 40, no. 2, 491–505

Dutt, A.K. 1990. Growth, distribution and capital ownership: Kalecki and Pasinetti revisited, in Dutta, B., Gangopadhayay, S., Mookherjee, D. and Ray D. (eds.): Economic Theory and Policy: Essays in Honor of Dipak Banerjee, Bombay: Oxford University Press, 132–145

Ertl, M., Humer, S., Moser, M., Schnetzer, M. 2017. The distribution of capital income, mimeo.

Kalecki, M. 1971. Selected Essays on the Dynamics of the Capital Economy, Cambridge, UK: Cambridge University Press

Kaldor, N. 1955. Alternative Theories of Distribution, The Review of Economic Studies vol. 23, no.2, 83–100. http://restud.oxfordjournals.org/lookup/doi/10.2307/2296292

Kennickell, A. B. 2017. Getting to the Top: Reaching Wealthy Respondents in the SCF, Statistical Journal of the IAOS vol. 33, no. 1, 113–123

Kiefer, D. and Rada, C. 2015. Profit maximising goes global: the race to the bottom, Cambridge Journal of Economics vol. 39, no. 5, 1333–1350, https://doi.org/10.1093/cje/beu040

Lavoie, M. 2009. Cadrisme within a Kaleckian model of growth and distribution, Review of Political Economy vol. 21, no. 3, 371–93

Lavoie, M. and Stockhammer, E. 2013. Wage- led growth: concepts, theories and policies, in Lavoie, M. and Stockhammer, E.: Wage- led Growth: An Equitable Strategy for Economic Recovery, Basingstoke: Palgrave Macmillan, 13–39

Mohun, S. 2005. Distributive Shares in the US Economy, 1964-2001, Cambridge Journal of Economics vol. 30, no.3, 347–70. https://academic.oup.com/cje/article-lookup/doi/10.1093/cje/bei065

Onaran, O. and Galanis, G. 2014. Income distribution and growth: a global model, Environment and Planning A vol. 46, no. 10, 2489–2513

Onaran, O. and Obst, T. 2016. "Wage-Led Growth in the EU15 Member-States: The Effects of Income Distribution on Growth, Investment, Trade Balance and Inflation." Cambridge Journal of Economics (January): bew009. http://cje.oxfordjournals.org/lookup/doi/10.1093/cje/bew009

Palley, T. 2012. Wealth and wealth distribution in the neo-Kaleckian growth model, Journal of Post Keynesian Economics vol. 34, no. 3, 453–474

Palley, T. 2017A. Inequality and growth in neo-Kaleckian and Cambridge growth theory, Review of Keynesian Economics vol.5, no. 2, 146–69

Palley, T. 2017B. Wage- vs. profit-led growth: the role of the distribution of wages in determining regime character, Cambridge Journal of Economics vol. 41, no. 1, 49–61

Pasinetti, L. 1962. Income Distribution and Rate of Profit in Relation to the Rate of Economic Growth, Review of Economic Studies vol. 29 no. 4, 267–279

Piketty, T. 2014. Capital in the Twenty-First Century. Cambridge Massachusetts: The Belknap Press of Harvard University Press

Piketty, T. and Saez, E. 2003. Income Inequality in the United States, 1913-1998, Quarterly Journal of Economics vol. 118, no. 1, 1–39

Rehm, M., Schnetzer, M. 2015. Property and Power: Lessons from Piketty and New Insights from the HFCS, European Journal of Economics and Economic Policies: Intervention vol. 12, no.2, 204–19. http://www.elgaronline.com/abstract/journals/ejeep/12-2/ejeep.2015.02.06.xml

Saez, E. and Zucman, G. 2014. Wealth inequality in the United States since 1913: Evidence from capitalized income tax data, Quarterly Journal of Economics vol. 131, no. 2, 519–578

Stockhammer, E. 2004. Financialisation and the slowdown of accumulation, Cambridge Journal of Economics vol. 28, no. 5, 719–741

Stockhammer, E. and Ederer, S. 2008. Demand Effects of the Falling Wage Share in Austria, Empirica vol. 35, no. 5, 481-502, http://www.springer.com/10663

Stockhammer, E. and Onaran, Ö. 2013. Wage-led growth: theory, evidence, policy, Review of Keynesian Economics vol. 1, no. 1, 61–78

Stockhammer, E., Onaran, Ö., Ederer, S. 2009. Functional income distribution and aggregate demand in the Euro area, Cambridge Journal of Economics vol. 33, no. 1, 139–159

Taylor, L. 2014. The Triumph of the Rentier? Thomas Piketty vs. Luigi Pasinetti and John Maynard Keynes, International Journal of Political Economy vol. 43, no. 3, 4–17

Taylor, L., Ömer, Ö., Rezai, A. 2015. Wealth Concentration, Income Distribution, and Alternatives for the USA, INET Working Paper No. 17, https://www.ineteconomics.org/uploads/papers/WP17-Lance-Taylor-Income-dist-wealth-concentration-0915.pdf

Taylor, L., Rezai, A., Kumar, R., Barbosa, N., Carvalho, L. 2017. Wage increases, transfers, and the socially determined income distribution in the USA, Review of Keynesian Economics, vol. 5, no. 2, 259–275

Vermeulen, P. 2016. Estimating the Top Tail of the Wealth Distribution, American Economic Review vol. 106, no. 5, 646–50

Wolff, E. 1983. The Size Distribution of Household Disposable Wealth in the United States, Review of Income and Wealth, vol. 29 no. 2, 125–146

Wolff, E. and Zacharias, A. 2009. Household wealth and the measurement of economic well-being in the United States, The Journal of Economic Inequality vol. 7, no. 2, 83–115

7. Appendix

a. Short-run solutions for the simple version of the model:

$$u^* = \frac{\beta_0 + \beta_2\pi}{s_w - (s_r - s_w)\pi z - \beta_1}$$

$$r^* = \frac{\beta_0\pi + \beta_2\pi^2}{s_w - (s_r - s_w)\pi z - \beta_1}$$

$$g^* = \frac{(\beta_0 + \beta_2\pi)[s_w + (s_r - s_w)\pi z\,]}{s_w - (s_r - s_w)\pi z - \beta_1}$$

b. Formal deduction of the long-run equilibrium

When we take the derivative of the wealth share with respect to time, we get

$$\dot{z} = \frac{\dot{V_r}V - V_r\dot{V}}{V^2}$$

With $\dot{V_r} = s_r Y_r$, $\dot{V_w} = s_w Y_w$ and $V = V_w + V_r = K$, the differential equation for z is

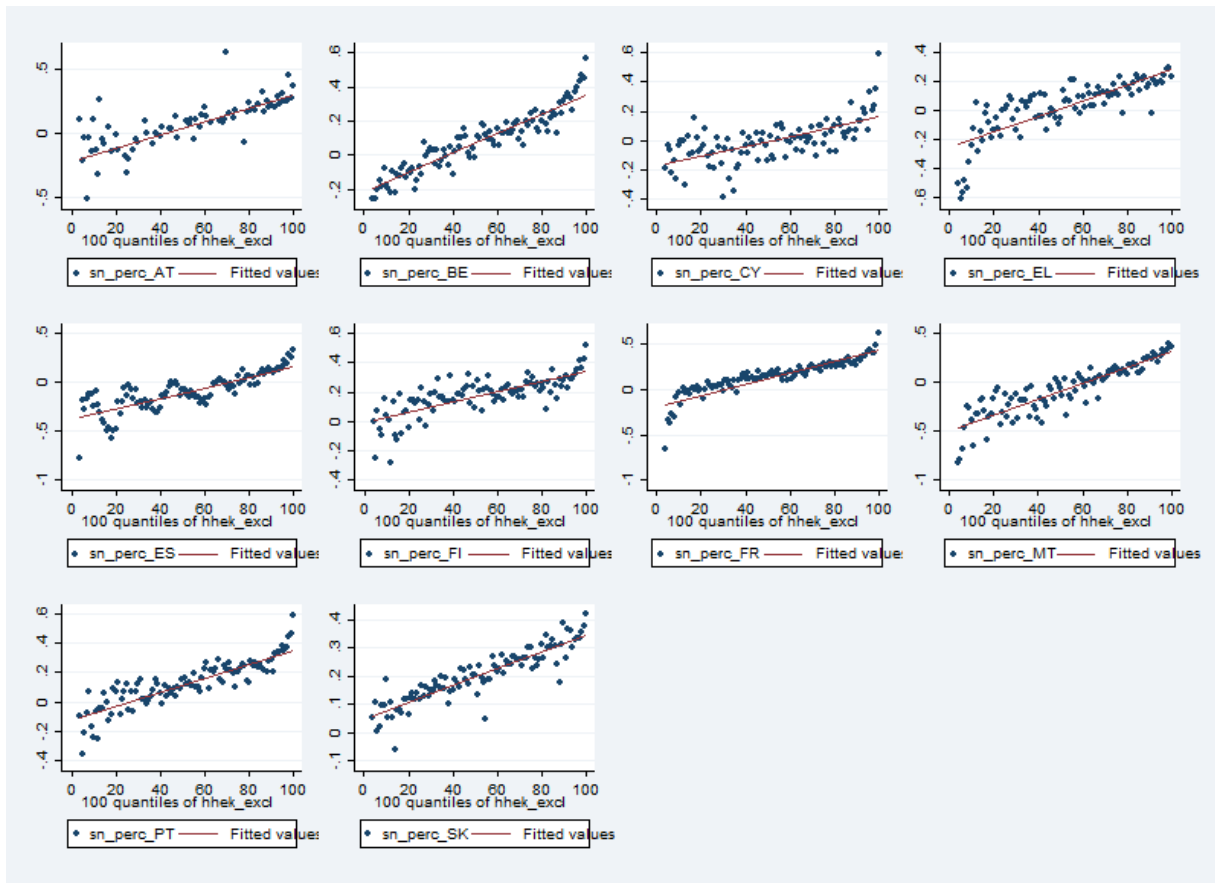$$\dot{z} = \frac{(\beta_0 + \beta_2\pi)[s_r\pi - s_w - (s_r - s_w)\pi z]z}{s_w - (s_r - s_w)\pi z - \beta_1}$$

c. Table 4: Transaction flow matrix of the extended model

| | Households | | Firms | | |
	Workers	Capitalists	Current	Capital	Total
Consumption	$-C_w$	$-C_r$	$+C$		0
Investment			$+I$	$-I$	0
Wages	$+W_w$	$+W_r$	$-W$		0
Profits	$+R_w$	$+R_r$	$-R$		0
Wealth	$-\Delta V_w$	$-\Delta V_r$		$+\Delta K$	0
Total	0	0	0	0	0

Source: own elaboration.

d. Figure 2: Saving rates across unconditional income percentiles in the European Household Budget Survey 2010

This figure shows the saving rate, calculated at the household level and averaged over percentiles, for all ten countries for which data is available in the EHBS: Austria, Belgium, Cyprus, Greece, Spain, Finland, France, Malta, Portugal, and Slovakia. This data is subsequently matched across percentiles of household income to the HFCS. Interestingly, as a side note, a linear fit (red line) matches the data reasonably well in all cases.

Data: EHBS 2010; own calculations.