Wealth distribution with and without real estate assets and mortgage debt in ten European countries – a post-Kaleckian approach

Eckhard Hein, Moritz Marpe and Karolina Schütt

POST-KEYNESIAN ECONOMICS SOCIETY

Wealth distribution with and without real estate assets and mortgage debt in ten European countries – a post-Kaleckian approach

Eckhard Hein*, Moritz Marpe[§], Karolina Schütt[§]
*Institute for International Political Economy (IPE), Berlin School of Economics and Law
ORCID: https://orcid.org/0000-0002-6542-6630
[§]Berlin School of Economics and Law

Abstract

Ederer/Rehm (2020b) empirically calibrated long-run equilibrium wealth distribution for ten European countries, mainly using 2010 Household Finance and Consumption Survey (HFCS) data. Measuring wealth inequality through the capitalists' share of wealth, they find that seven out of ten countries deviate from Piketty's (2014) prediction that under the condition of r > g wealth distribution will become ever more unequal. With the actual capitalists' share in 2010 below the calibrated equilibrium, however, they forecast increasing wealth inequality. Our research extends this analysis in two ways. Firstly, using the 2010, 2014, 2017, and 2021 HFCS data, we recalibrate the equilibrium based on 2010 data and track the capitalists' share of wealth over the decade. We observe convergence tendencies towards the stable long-run equilibrium in some but not in all countries. Secondly, we expand the Ederer/Rehm (2020b) model to include real estate assets and mortgage debt. Recalibrating the long-run equilibrium for this extended model using 2010 values produces a similar pattern: For three countries, Piketty's prediction holds, while for the remaining seven the equilibrium capitalists' wealth share is lower than 100 per cent. The extended model shows a much lower actual capitalists' share of wealth, supporting the idea that real estate assets, adjusted for mortgage debt, are more equally distributed than other types of wealth. Wealth inequality for the extended model is also predicted to rise. Based on 2014, 2017 and 2021 HFCS data, we indeed find a convergence of actual wealth distribution towards the stable long-run equilibrium for some, but not for all countries. In several countries, the stable long-run equilibrium distribution itself varies over time, partly in line with actual distribution which points to potential endogeneity of the former towards the latter. The channels remain to be explored.

Contact

Prof. Dr. Eckhard Hein
Berlin School of Economics and Law
Badensche Str. 52
10825 Berlin
Germany
e-mail: eckhard.hein@hwr-berlin.de

1. Introduction

Thomas Piketty's (2014) *Capital in the 21st Century* put income and wealth inequality back on the research agenda, also in orthodox economics. The theoretical foundations of his core claim that a rate of profit exceeding the rate of growth (r > g) will lead to ever rising wealth inequality, however, were scrutinised, both from orthodox and heterodox perspectives, and were found to be seriously lacking (King 2017, Lopez-Bernado et al. 2016, Rowthorn 2014, Sawyer 2015, Taylor 2014, van Treeck 2015, Zamparelli 2017). Ederer/Rehm (2020a, 2020b, 2021) tried to overcome these deficiencies, re-examining the dynamics of wealth distribution in a post-Kaleckian distribution and growth model with two classes, capitalists and workers, who each hold wealth and earn both capital and labour incomes. They thus continued a long-standing research tradition in post-Keynesian economics starting with Pasinetti (1962) and Kaldor (1966), with more recent contributions by Dutt (1990), Lavoie (1996) and Palley (2012, 2017a, 2017b). Ederer/Rehm (2020b) calibrated their model for ten European countries, mainly based on data from the 2010 Household Finance and Consumption Survey (HFCS) by the European Central Bank (ECB) (ECB, 2010). The calibrated long-run equilibria of their model, in terms of the capitalists' share of wealth, are not in line with Piketty's prediction of ever rising wealth shares of the capitalists for all the countries in their dataset. However, the calibrated long-run equilibrium values are well above the actual 2010 values for several countries, from which Ederer/Rehm (2020b) predicted a further increase of wealth inequality for the investigated countries.

Our paper builds on the research by Ederer/Rehm (2020b) and provides contributions in two main respects. First, we make use of later HFCS vintages – 2014, 2017, 2021– in order to check whether there is a tendency towards the long-run equilibrium wealth distribution calibrated with the respective 2010 values. For this purpose, we recalculate the equilibrium wealth distribution based on 2010 data because of data revisions, which provides results only slightly different from those by Ederer/Rehm (20020b), vindicating their critique of Piketty (2014). Going beyond their analysis, we find that for some, but not all countries, there is a tendency of actual wealth distribution towards the long-run equilibrium values calibrated with 2010 values. Furthermore, the long-run equilibrium wealth distribution seems to be varying over time for some countries, with no clear relationship with actual distribution.

Second, we extend the Ederer/Rehm (2020b) theoretical and empirical analysis by including the distribution of real estate ownership and the related household mortgage debt. The focus of Ederer/Rehm (2020b) was on the distribution of what they call 'productive wealth', defined as business ownership plus net financial wealth, excluding real estate ownership and household mortgage debt. However, this disregards an important component of the debt and wealth dynamics, in finance-dominated capitalism in particular (Hein 2012, Moore/Stockhammer 2018, Stockhammer/Wildauer 2016, 2018). It has also had important implications for the dynamics of the demand and growth regimes, as well as their respective changes after the Global Financial Crisis and the Great Recession 2007-09 (Kohler/Stockhammer 2022, Kohler et al 2023). This broader notion of wealth distribution and its dynamics, including real estate assets and mortgage debt, are thus highly relevant for

macroeconomic analysis in general. Regarding the Piketty hypothesis, we show that the Ederer/Rehm (2020b) results also hold with the inclusion of real estate wealth and mortgage debt. Based on 2010 data, for several countries the equilibrium share of capitalists' wealth in total wealth is well below unity. Furthermore, actual wealth shares are further below their equilibrium values than in the Ederer/Rehm (2020b) calculations, vindicating that real estate wealth was more equally distributed than other types of wealth in 2010. Making use of 2014, 2017 and 2021 HFCS data, we find again that for some countries, but not for all, actual wealth shares move towards their long-run equilibria calculated with 2010 data. Finally, underlying parameters and thus the long-run equilibrium wealth distribution are varying over time for some countries, however, with no clear relationship with actual distribution.

We proceed as follows. In Section 2, we present the Ederer/Rehm (2020b) model, which will be the starting point for our extensions. In Section 3, we follow Ederer/Rehm (2020b) and calibrate the long-run equilibrium wealth distribution, measured by the capitalists' share in total wealth, based on (revised) 2010 HFCS data, and, going beyond Ederer/Rehm (2020b), we check whether the actual shares from the 2014, 2017 and 2021 HFCS vintages converge towards these equilibria. In Section 4, we extend the Ederer/Rehm (2020b) model by including real estate assets and mortgage debt, we calculate the modified long-run equilibrium values for the capitalists' share in total wealth based on the 2010 HFCS data, and we check whether the actual shares from the 2014, 2017 and 2021 HFCS vintages converge towards these equilibria. Here, we also compare the results for wealth distribution without and with real estate assets and mortgage debt and we touch upon the time variation of parameters determining the long-run equilibrium distribution of wealth and potential endogeneity channels. Section 5 summarises and concludes.

2. The Basic Theoretical Model

The Ederer/Rehm (2020b) post-Kaleckian one-good distribution and growth model is for a closed private economy with four sectors: workers' households, capitalists' households, firms and banks. It has four types of assets: deposits, loans from banks, external capital from households (equity, corporate bonds, self-owned business) and the real capital stock, as can be seen in Table 1. Our modifications in Section 4 are based on the same analytical model. We are presenting the model here in detail, in order to overcome some ambiguities in the presentation by Ederer/Rehm (2020b). Furthermore, we want to provide the grounds for our modifications of the definition and calculation of the parameters, in particular the shares of capital income generating assets in total wealth of both capitalists and workers, and the respective empirical applications in Section 4.

Table 1: Balance sheet matrix of the Ederer/Rehm (2020b) model

	Workers' households	Capitalists' households	Firms	Banks	Σ
Deposits	$+D_W$	$+D_R$		$-(D_R + D_W)$	0
Loans			$-L_F$	$+L_F$	0
Equity, corporate bonds, self-owned business	$+E_W$	$+E_R$	$-(E_W + E_R)$		0
Capital			K		K
Net worth	$-V_W$	$-V_R$	0	0	$-V$
Σ	0	0	0	0	0

Notes: D_W: deposits held by workers, D_R: deposits held by capitalists, L_F: loans to firms, E_W: equity and corporate bonds held by workers, E_R: equity, corporate bonds and own business held by rentiers, K: firms' capital stock, V: net worth, V_W: workers' net worth, V_R: capitalists' net worth.
Source: Based on Ederer/Rehm (2020b), own elaboration.

For the economy as a whole, net wealth (V) consists of the capital stock of the firms (K):

(1) $\quad V = K = V_R + V_W$.

Net wealth in the model economy is held by households only, while net wealth of the firms is zero, as is net wealth of the banking sector. Workers' households' net wealth (V_W) is composed of equity and corporate bonds (E_W) plus non-interest bearing deposits (D_W):

(2) $\quad V_W = D_W + E_W$.

Similarly, capitalists' households' net wealth (V_R) contains equity and corporate bonds (E_R) plus non-interest bearing deposits (D_R):

(3) $\quad V_R = D_R + E_R$.

The capitalists' share (z) and workers (1-z) shares in net wealth are defined as:

(4) $\quad z = \dfrac{V_R}{V}$,

(5) $\quad 1 - z = \dfrac{V_W}{V}$.

The ratio z is the indicator of wealth inequality. It is treated as exogenous in the short run and is then endogenously determined in the long run of the model.

It is assumed that capitalists have better access to high capital income generating assets, which in the model means that they hold a higher share of capital income generating assets in their net wealth. The respective shares for workers (γ_W) and capitalists (γ_R) are defined as:

(6) $\quad \gamma_W = \dfrac{E_W}{V_W} = \dfrac{V_W - D_W}{V_W}$,

$$(7) \qquad \gamma_R = \frac{E_R}{V_R} = \frac{V_R - D_R}{V_R}.$$

and it is assumed that $\gamma_R > \gamma_W$. Each share is treated as exogenously given and constant in the short and in the long run of the model.

In their empirical analysis, Ederer/Rehm (2020b) include interest on loans (Z) into the capital income, and it should thus be part of profits in the transaction flow matrix in Table 2. Firms pay interest to banks, and the banks then pay their profits based on the interest differential between loans and deposits out to capitalists and workers. Profits in Table 2 thus do not only include dividends on equity, interest on corporate bonds and profits of self-employed, but also interest payments on loans from firms to banks, assuming that the interest rate on deposits is zero.

Table 2: Transaction flow matrix of the Ederer/Rehm (2020b) model

	Workers' households	Capitalists' households	Firms' current	Firms' capital	Banks	Σ
Consumption	$-C_W$	$-C_R$	$+C_W + C_R$			0
Investment			$+I_F$	$-I_F$		0
Wages	$+W_W$	$+W_R$	$-(W_W + W_R)$			0
Profits (dividends, interest, profits of self-employed)	$+\Pi_{FW} + \Pi_{BW}$	$+\Pi_{FR} + \Pi_{BR}$	$-(\Pi_{FW} + \Pi_{FR})$		$-(\Pi_{BW} + \Pi_{BR})$	0
Interest on loans			$-Z_F$		$+Z_F$	0
Change in equity, corporate bonds, self-owned business	$-dE_W$	$-dE_R$		$+dE_W + dE_R$		0
Change in deposits	$-dD_W$	$-dD_R$			$+dD_W + dD_R$	0
Change in loans				$+dL_F$	$-dL_F$	0
Σ	0	0	0	0	0	0

Notes: C_W: consumption of workers, C_R: consumption of capitalists, I_F: firms' investment in the capital stock, W_W: wages received by workers, W_R: wages received by capitalists, Π_{FW}: profits from firms to workers, Π_{FR}: profits from firms to capitalists, Π_{BW}: profits from banks to workers, Π_{BR}: profits from banks to capitalists, Z_F: interest payments to banks by firms, dE_W: change in equity and corporate bonds held by workers, dE_R: change in equity, corporate bonds and own business held by rentiers, dD_W: change in deposits held by workers, dD_R: change in deposits held by capitalists, dL_F: change in loans to firms. Source: Based on Ederer/Rehm (2020b), own elaboration.

Different from other post-Keynesian distribution and growth models with financial variables (Hein 2014, Chapters 9-10), Ederer/Rehm (2020b, p. 62) do not consider retained profits, assuming that 'wealth surveys … do include (at least ideally), the full value of wealth, since the retained profits of firms should be reflected in the valuation of firms and should thus lead to higher net wealth'. Although there are some doubts regarding perfect capital asset valuation, we keep this assumption for simplicity and comparability.

As can be seen in Table 2, Ederer/Rehm (2020b) assume that firms pay wages (W) not only to workers' households (W_W), but also to capitalists' households (W_R), which are more broadly defined, as will be explained in the next section. The shares of capitalists' wages (α) and workers' wages (1-α) in total wages are exogenously given:

(8) $\quad W_R = \alpha W$,

(9) $\quad W_W = (1-\alpha) W$.

As usual in Kaleckian distribution and growth models, the profit and wage shares (h, 1-h) in the income generated in production are exogenous as well, mainly determined by mark-up pricing of firms in incompletely competitive goods markets, such that profits (Π) and wages (W) are given as:

(10) $\quad \Pi = hY$,

(11) $\quad W = (1-h) Y$.

Since all the profits are distributed to households and workers' households save and accumulate financial wealth, too, they also receive a part of profits. Workers' profits (Π_W) are determined by their share of wealth held as capital income generating asset:

(12) $\quad \Pi_W = \dfrac{\gamma_W (1-z)}{\gamma_W (1-z) + \gamma_R z} \Pi = \dfrac{\gamma_W (1-z) h}{\gamma_W (1-z) + \gamma_R z} Y$.

Similarly, capitalists' profits (Π_W) are determined as:

(13) $\quad \Pi_R = \dfrac{\gamma_R z}{\gamma_W (1-z) + \gamma_R z} \Pi = \dfrac{\gamma_R z h}{\gamma_W (1-z) + \gamma_R z} Y$.

With these assumptions, workers' income (Y_W) and capitalists' incomes (Y_R) are given as:

(14) $\quad Y_W = W_W + \Pi_W = (1-\alpha) W + \dfrac{\gamma_W (1-z)}{\gamma_W (1-z) + \gamma_R z} \Pi = \left[(1-\alpha)(1-h) + \dfrac{\gamma_W (1-z) h}{\gamma_W (1-z) + \gamma_R z} \right] Y$,

(15) $\quad Y_R = W_R + \Pi_R = \alpha W + \dfrac{\gamma_R z}{\gamma_W (1-z) + \gamma_R z} \Pi = \left[\alpha (1-h) + \dfrac{\gamma_R z h}{\gamma_W (1-z) + \gamma_R z} \right] Y$.

As can be seen in Table 2, workers' and capitalists' households spend their income on consumption and on wealth accumulation, determined by their respective propensities to consume and to save (s_W, s_Π), which are treated as exogenous parameters for which the usual condition is assumed: $s_W < s_\Pi$. The wealth portfolio compositions are given by the exogenous

parameters γ_R, γ_W, which then also apply to wealth accumulation. Firms do not retain any profits and finance their net investment by issuing further equity or debt, and by loans granted by banks. Banks also offer deposits to households. Bank profits determined by the interest differential for loans and deposits are distributed as profit to households.

For the saving rate (σ), relating saving (S) to the capital stock (K) and making use of equations (14) and (15), we get:

(16)
$$\begin{aligned}
\sigma = \frac{S}{K} &= \frac{s_W Y_W + s_R Y_R}{K} \\
&= \left\{ s_W \left[(1-\alpha)(1-h) + \frac{\gamma_W (1-z)h}{\gamma_W (1-z) + \gamma_R z} \right] + s_R \left[\alpha(1-h) + \frac{\gamma_R z h}{\gamma_W (1-z) + \gamma_R z} \right] \right\} u \\
&= \left\{ (1-h) \left[s_W (1-\alpha) + s_R \alpha \right] + \frac{h \left[s_W \gamma_W (1-z) + s_R \gamma_R z \right]}{\gamma_W (1-z) + \gamma_R z} \right\} u \\
&= (A+B) u, \quad 0 \le s_W < s_R \le 1
\end{aligned}$$

with the rate of capacity utilisation as $u = \frac{Y}{K}$, and with $A = (1-h)\left[s_W (1-\alpha) + s_R \alpha \right]$ and

$$B = \frac{h \left[s_W \gamma_W (1-z) + s_R \gamma_R z \right]}{\gamma_W (1-z) + \gamma_R z}.$$

For firms' accumulation rate (g), relating net investment (I) to the capital stock (K), Ederer/Rehm (2020b) follow the post-Kaleckian investment function from Bhaduri/Marglin (1990) and Kurz (1990), such that:

(17) $\quad g = \frac{I}{K} = \beta_0 + \beta_1 u + \beta_2 h, \qquad \beta_1, \beta_2 \ge 0.$

The goods market equilibrium and stability conditions are:

(18) $\quad g = \sigma$,

(19) $\quad \dfrac{\partial \sigma}{\partial u} - \dfrac{\partial g}{\partial u} > 0 \quad \Rightarrow \quad A + B - \beta_1 > 0.$

From equations (16), (17), and (18), the short-run equilibrium values for the rate of capacity utilisation and the accumulation rate are:

(20) $\quad u^* = \dfrac{\beta_0 + \beta_2 h}{A + B - \beta_1},$

(21) $\quad g^* = \sigma^* = (A+B) u^* = \dfrac{(A+B)(\beta_0 + \beta_2 h)}{A + B - \beta_1}.$

In the long run, the capitalists' and the workers' shares of wealth, and hence wealth distribution, turn endogenous. From equation (4), we get for the time rates of change, indicated by a dot on the variables:

(22) $\quad \dot{z} = \dfrac{\dot{V}_R V - V_R \dot{V}}{V^2} = \dfrac{\dot{V}_R - z\dot{V}}{V} = \dfrac{\dot{V}_R - zgK}{K} = \dfrac{S_R - zgK}{K}$

Making use of equations (15), (20) and (21), this turns to:

(23)

$$\dot{z} = s_R \left[\alpha(1-h) + \frac{\gamma_R zh}{\gamma_W(1-z) + \gamma_R z} \right] u - zg$$

$$= \left\langle \frac{s_R \{ \alpha(1-h)[\gamma_W(1-z) + \gamma_R z] + \gamma_R zh \}}{\gamma_W(1-z) + \gamma_R z} - (A+B)z \right\rangle u$$

$$= \left\langle \frac{s_R \{ \alpha(1-h)[\gamma_W(1-z) + \gamma_R z] + \gamma_R zh \}}{\gamma_W(1-z) + \gamma_R z} - (A+B)z \right\rangle \frac{\beta_0 + \beta_2 h}{A + B - \beta_1}$$

For the long-run equilibrium, we need $\dot{z} = 0$. This yields the quadratic equation:

(24) $\quad Cz^2 + Dz + E = 0$

with the following two solutions:

(25) $\quad z^{**} = \dfrac{-D \pm \sqrt{D^2 - 4CE}}{2C}$,

with:

$C = -\left[s_W(1-\alpha) + s_R \alpha \right](1-h)(\gamma_R - \gamma_W) - (s_R \gamma_R - s_W \gamma_W)h$,

$D = s_R \alpha(1-h)(\gamma_R - \gamma_W) + s_R \gamma_R h - \left[s_W(1-\alpha) + s_R \alpha \right](1-h)\gamma_W - s_W \gamma_W h$,

$E = s_R \alpha(1-h)\gamma_W$.

Equation (25) was used by Ederer/Rehm (2020b) in their empirical analysis to calibrate the long-run equilibrium values for the capitalists' and the workers' wealth shares, and hence for wealth distribution in that long-run equilibrium. For this, they took the following model parameters from the statistics: h, α, s_W, s_R, γ_W, γ_R. Applying the empirical values in their analysis for ten European countries, only the upper equilibrium value for z is stable, i.e. we have that $\dfrac{\partial \dot{z}}{\partial z} < 0$ in equation (23). This is then the value reported in their empirical calibration of the long-run equilibrium values.

3. Capitalists' Share of Wealth in the Ederer/Rehm (2020b) Approach: Convergence towards Calibrated Equilibrium?

In this section, we re-calibrate the long-run equilibrium wealth distribution indicated by the capitalists' share of wealth, based on the HFCS survey data of 2010 for ten European countries, following Ederer/Rehm (2020b). Furthermore, going beyond Ederer/Rehm (2020b), we compare the calibrated equilibrium values not only with the actual values for 2010 but also with the actual values from the 2014, 2017 and 2021 vintages of the HFCS, in order to check

whether there is a tendency of actual values moving towards the calibrated equilibrium values over time. The HFCS encompasses data on household wealth and socio-economic characteristics for fifteen European countries. It is a survey-based data collection on the household level, provided by the ECB, which started in 2010 and has been repeated in 2014, 2017 and 2021.[1]

Ederer/Rehm (2020b, p. 61) defined wealth as 'businesses (in which the owner may or may not be self-employed) plus financial wealth (including shares and bonds), and deduct financial liabilities (i.e. non-mortgage debt)'. Following Rehm et al. (2016), they divided households into capitalists and workers. The capitalist class contains households which either own a business (with more than five employees), are rentiers (receiving more capital income than average work income), or are part of the wealthiest 1%. Workers are defined as those households who earn most of their income from wages. All other households (i.e., pensioners and unemployed) are not included in the analysis. With this classification, the survey data allow for the calculation of the capitalists' share in wages (α), as well as the shares of capital income generating assets in respective total assets of capitalists (γ_R) and workers (γ_W). Capital income generating assets are defined as total financial assets plus self-employed business assets minus deposits. The class specific propensities to save (s_R, s_W) were derived by Ederer/Rehm (2020b) from the 2010 European Household Budget Survey (HBS) (Eurostat, 2010), because this contains more detailed information on households' expenditures and thus saving.[2] With Austria, Belgium, Cyprus, Spain, Finland, France, Greece, Malta, Portugal, and Slovakia, they have ten countries covered by the HBS, which are also included in HFCS. These are thus the ten countries included in their analysis. Finally, Ederer/Rehm (2020b) use the profit share (h) as the share of operating surplus in gross domestic product (GDP) at factor cost from the European Commission's AMECO database (European Commission, 2024). With these data, Ederer/Rehm (2020b) could directly calculate the capitalists' share of wealth (z) for 2010 and calibrate its long-run equilibrium values (z^{**}) based on the parameters for 2010, applying equation (25).

For our calibration of the long-run equilibrium values of the capitalists' share of wealth for the ten countries (z^{**}), we make use of the propensities to save (s_R, s_W), which Ederer/Rehm (2020b) calculated from the 2010 HBS. Furthermore, we use the values derived from the updated and revised HFCS and AMECO data bases for 2010 for the capitalists' share of wages (α), the share of capital income generating assets in total assets for each group (γ_R, γ_W), and the profit share (h). The long-run equilibrium capitalists' shares of wealth together with the parameters generating these equilibria can be seen in Table 3.

---

[1] The HFCS is conducted at a national level and provides household-level data. It contains households' information on (the financing of) assets, liabilities, consumption, and saving, as well as demographics, employment, future pension entitlements, and income (ECB, 2024). As any survey data, it suffers from a lack of coverage of very high wealth and capital income receiving households (Vermeulen 2016). Also, certain aspects of the HFCS data quality are challenging accurate empirical calculations, such as interest payments (particularly in the case of Finland) and the small number of observations (particularly in the case of Malta and Cyprus).

[2] Ederer/Rehm (2020b, 60) specify saving as the (level) 'difference between income and consumption'.

Table 3: Parameters, long-run equilibrium capitalists' shares of wealth for 2010 values, and actual values based on Ederer/Rehm (2020b)

| Country	s_R	s_W	h	γ_R	γ_W	α	z_1^{**} (stable)	z_2^{**} (unstable)	z
Austria	0.23	0.05	0.38	0.64	0.33	0.06	0.73	-0.07	0.47
Belgium	0.29	0.10	0.33	0.86	0.37	0.02	0.37	-0.11	0.23
Cyprus	0.10	0.00	0.37	0.83	0.54	0.22	1.00	-0.32	0.75
Spain	0.07	0.00	0.38	0.89	0.62	0.29	1.00	-0.41	0.79
Finland	0.39	0.12	0.38	0.80	0.40	0.02	0.52	-0.00	0.51
France	0.29	0.01	0.34	0.88	0.53	0.06	0.94	-0.1	0.55
Greece	0.13	0.05	0.39	0.75	0.36	0.05	0.54	-0.07	0.48
Malta	0.26	0.00	0.45	0.87	0.37	0.03	1.00	-0.02	0.43
Portugal	0.33	0.13	0.36	0.86	0.36	0.04	0.54	-0.09	0.61
Slovakia	0.30	0.18	0.52	0.60	0.14	0.06	0.51	-0.04	0.38

Notes: Parameters are calculated for the year 2010, s_W: workers' propensity to save, s_R: capitalists' propensity to save, h: profit share, γ_R: share of capital income generating assets in capitalists' net wealth, γ_W: share of capital income generating assets in workers' net wealth, α: capitalists' share in wages, z: capitalists' wealth share, z^{**}: long-run equilibrium capitalists' wealth share.
Source: ECB (2010), European Commission (2024), Eurostat (2010), own calculations.

As can be seen in the Figure 1(a) in the appendix, our results slightly deviate from those of Ederer/Rehm (2020b) due to data revisions and updates,[3] but the general pattern remains the same. As is also visible in Figure 1 below, only a few countries, Malta, Spain and Cyprus, show a stable long-run equilibrium capitalists' share in total wealth of 100 per cent, and hence a workers' share of zero per cent, which Piketty's (2014) model would imply. For the other seven countries, however, we obtain calibrated stable long-run equilibria based on 2010 data, in which the capitalists' share of wealth is between 37 and 94 per cent, and the workers' share hence between 63 and 6 per cent. This is in line with the theoretical predictions of the post-Keynesian distribution and growth models including wealth distribution, as briefly reviewed in the introduction. Furthermore, the actual values for the capitalists' share of wealth for 2010 are usually below the calibrated stable long-run equilibrium values, with Portugal as only exception in our calculations, while in Ederer/Rehm (2020b) the value for Portugal is close to the equilibrium value. From this general pattern, Ederer/Rehm (2020b, p.64) concluded that this 'would lead to an even higher wealth concentration in the long-run than is currently empirically observed'.

---

[3] Another reason for the deviation of our results from Ederer/Rehm (2020b) may be slight deviations in the application of the Ederer/Rehm (2020b) methodology. For example, while we apply the same class categorisation as Ederer/Rehm (2020b), households' classes might be slightly different due to the ambiguity in the criteria of business ownership (5+ employees) for capitalists.

Figure 1: Calibrated stable long-run equilibrium values for the capitalists' share of wealth for 2010 and actual values for 2010, 2014, 2017 and 2021 for the Ederer/Rehm (2020b) model
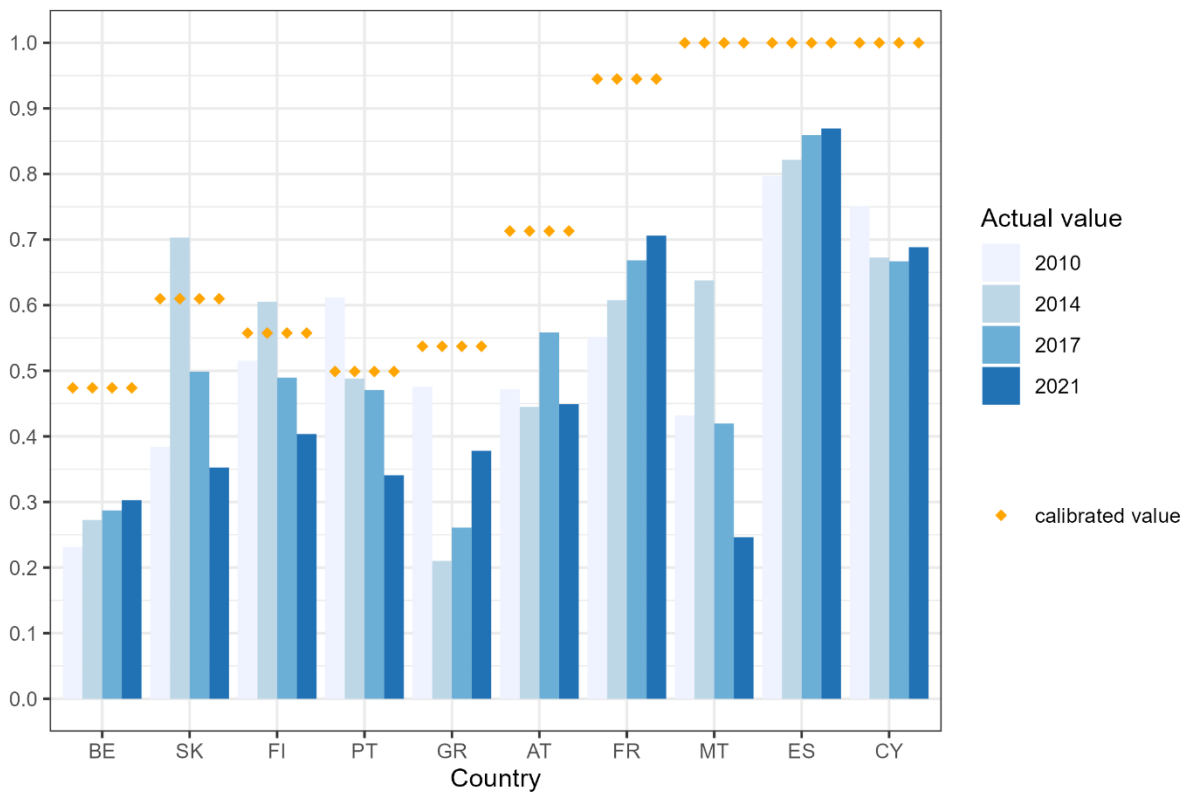
Notes: From left to right: Belgium (BE), Slovakia (SK), Finland (FI), Portugal (PT), Greece (GR), Austria (AT), France (FR), Malta (MT), Spain (ES) and Cyprus (CY).
Source: ECB (2010, 2014, 2017, 2021), European Commission (2024), Ederer/Rehm (2020b) and Eurostat (2010) for saving propensities, own calculations.

In order to check whether such an increasing trend towards calibrated stable long-run equilibrium values for the capitalists' share of wealth based on 2010 data has indeed materialised in the following decade, we calculate the actual data for the capitalists' share of wealth based on the 2014, 2017 and 2021 HFCS vintages, as can be seen in Figure 1. For three countries, Belgium, France and Spain, we indeed see such a trend throughout, while Greece shows such a trend since 2014 and Cyprus since 2017. For the other five countries, Austria, Finland, Malta, Portugal and Slovakia, however, no converging trends are visible, although the actual values are not below the unstable lower equilibrium, and are thus in the range of stability (Table 3). One of the reasons may be that the calibrated long-run equilibrium values themselves are not constant over time, but may vary due to changes in the underlying parameters. Based on the respective HFCS vintages and annual AMECO data in order to calculate the parameters h, α, γ_W and γ_R, but keeping the propensities to save s_W and s_R, derived by Ederer/Rehm (2020b) from the 2010 HBS, for simplicity, we find indeed that z_1^{**} is varying over time for some countries, as shown in Figure 2(a) in the appendix. However, while for some countries, like Finland and Austria, and partly Belgium, Greece, France and Portugal, we see a parallel development of z_1^{**} and the actual share of wealth owned by capitalists,

which would indicate some endogeneity of the equilibrium wealth share with regard to the actual share, for others the relationship remains rather unclear. We will come back to these time variations and potential endogeneities of the equilibrium capitalists' share of wealth when discussing the empirics of an extended model with real estate assets and mortgage debt, to which we turn next.

4. Extending the Ederer/Rehm (2020b) Analysis with Real Estate Assets and Mortgage Debt

Different from Ederer/Rehm (2020b), we include real estate wealth and the related mortgage debt into our extension for two main reasons. First, real estate wealth is a considerable share in total net wealth, varying between 60 per cent and 85 per cent in all countries but Spain (Figure 2). Second, rental income constitutes a non-negligible part of total income, across most examined economies, particularly for capitalists (Figure 3). At least part of housing wealth can thus be seen as capital income generating wealth. Another part, however, the home main residence, is not, and, as will be seen below, we have to refrain from making it part of income generating wealth via imputed rents, deviating from the conventions in the national accounts.[4].

---

[4] Of course, there may be good reasons to include the home main residence as capital income generating asset via imputed rents. However, the HFCS data set does not include imputed rents and there is no straightforward way to derive these from the available data.

Figure 2: Types of real estate as a share of total wealth per country in 2010
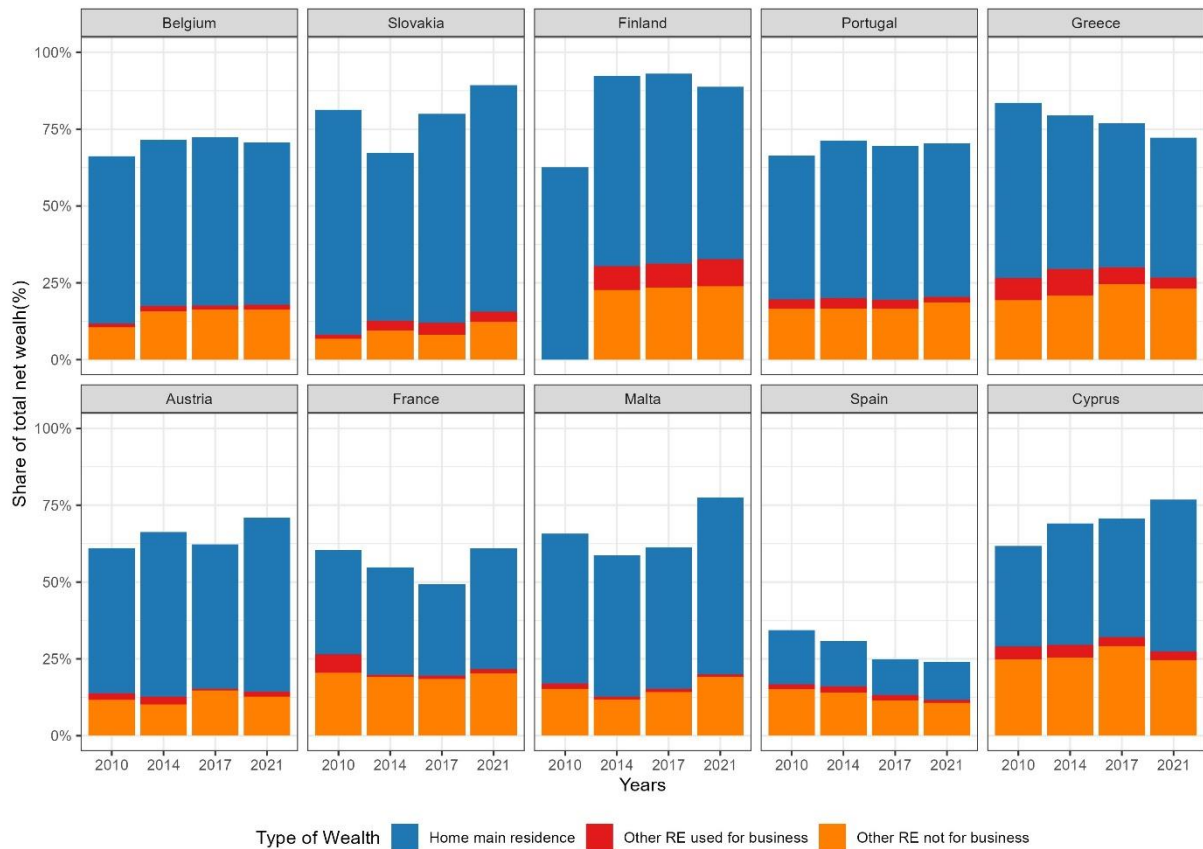
Notes: Blue bars illustrate the home-owned residences by survey participants, red illustrates the real estate (RE) assets used for business while orange bars indicated any other real estate assets owned by survey participants.
Source: ECB (2010, 2014, 2017, 2021), own calculations.

Figure 3: Share of rental income in capital income by class
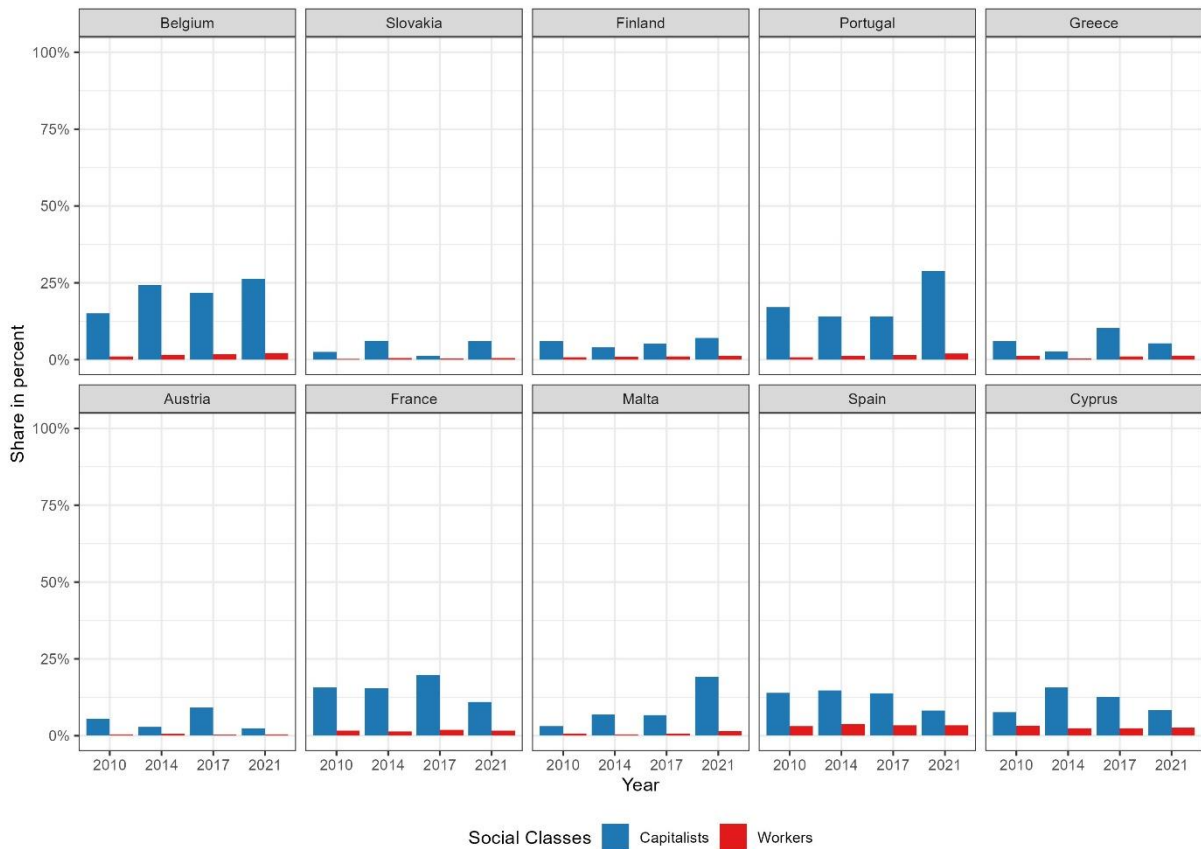
Notes: Blue bars illustrate the share of rental income in capital income received by capitalists, while
red bars indicate the share of rental income in capital income received by workers.
Source: ECB (2010, 2014, 2017, 2021), own calculations.

4.1 The Theoretical Model with Real Estate Assets and Mortgage Debt

With the introduction of real estate assets and mortgage debt, the balance sheet matrix for
our model economy from Table 1 turns to the one in Table 4.

For the economy as a whole, net wealth (V) now consists of the capital stock of the firms (K)
plus the stock of housing/real estate (K_H) directly owned by capitalists' (K_{HR}) and by workers'
(K_{HW}) households – real estate owned by firms is part of their capital stock:

$$(26) \quad V = K + K_H = K + K_{HR} + K_{HW} = V_R + V_W \,.$$

Net wealth is again held by households only. Workers' households' net wealth (V_W) is
composed of equity and bonds (E_W), plus non-interest bearing deposits (D_W), plus the value of
their real estate (K_{HW}), minus their total loans (L_W):

$$(27) \quad V_W = D_W + E_W + K_{HW} - L_W \,.$$

Table 4: Balance sheet matrix including real estate assets and mortgage debt

	Workers' households	Capitalists' households	Firms	Banks	Σ
Deposits	$+D_W$	$+D_R$		$-(D_R + D_W)$	0
Loans	$-L_W$	$-L_R$	$-L_F$	$+L_W + L_R + L_F$	0
Equity, corporate bonds, self-owned business	$+E_W$	$+E_R$	$-(E_W + E_R)$		0
Capital	$+K_{HW}$	$+K_{HR}$	$+K$		$+K_H + K$
Net worth	$-V_W$	$-V_R$	0	0	$-V$
Σ	0	0	0	0	0

Notes: D_W: deposits held by workers, D_R: deposits held by capitalists, L_W: loans to workers, L_R: loans to capitalists, L_F: loans to firms, E_W: equity and corporate bonds held by workers, E_R: equity, corporate bonds and own business held by rentiers, K_{HW}: stock of real estate held by workers, K_{HR}: stock of real estate held by capitalists, K: firms' capital stock, V: net worth, V_W: workers' net worth, V_R: capitalists' net worth.
Source: own elaboration.

For capitalists' households, we have accordingly that their net wealth (V_R) is composed of equity, bonds and self-owned business (E_R), plus non-interest bearing deposits (D_R), plus the value of their real estate (K_{HR}), minus their total loans (L_R):

$$(28) \quad V_R = D_R + E_R + K_{HR} - L_R .$$

The capitalists' share in net wealth (z) and the workers' share (1-z), as in equations (4) and (5), now includes real estate assets and mortgage debt.

The share of capital income generating assets in total net wealth of workers' households (γ_W) is defined as:

$$(29) \quad \gamma_W = \frac{E_W + K_{HW} - K_{HWMR} - L_W}{V_W} = \frac{V_W - K_{HWMR} - D_W}{V_W} .$$

Capital income generating assets thus include equity and bonds held by workers plus their real estate assets minus the value of their home main residence (K_{HWMR}), which does not generate rent revenues, minus their total debt. The capital income generated by real estate is thus not containing imputed rents on self-used housing.[5] For the capitalists, the share of their capital income generating assets in total net wealth (γ_R) is hence:

$$(30) \quad \gamma_R = \frac{E_R + K_{HR} - K_{HRMR} - L_R}{V_R} = \frac{V_R - K_{HRMR} - D_R}{V_R} .$$

---

[5] Rents in the transaction flow matrix in Table 5 are gross rents. Rents paid are part of households' consumption expenditures. This means that we are treating non-corporate rental housing as self-owned business in our theoretical model.

For our model extension, the transaction flow matrix from Table 2 turns into the one in Table 5. In our extended model, investment also includes workers' and capitalists' households' real estate investment (I_{HW}, I_{HR}). Profits include dividends, interest, rents, and profits of self-employed. Profits are completely distributed by firms and by banks to workers' households (Π_{FW}, Π_{BW}) and to capitalists' households (Π_{FR}, Π_{BR}). We also make explicit the interest on loans, which are paid by workers' households, capitalists' households and firms to banks, which add to banks' profits, then paid out to both types of households.[6]

Table 5: Transaction flow matrix for an economy with real estate assets and mortgage debt

	Workers' households	Capitalists' households	Firms' current	Firms' capital	Banks	Σ
Consumption, including rent	$-C_W$	$-C_R$	$+C_W +C_R$			0
Investment, including real estate investment	$-I_{HW}$	$-I_{HR}$	$+I_F +I_{HW} +I_{HR}$	$-I_F$		0
Wages	$+W_W$	$+W_R$	$-(W_W +W_R)$			0
Profits (dividends, interest on corporate bonds, profits of self-employed, rents)	$+\Pi_{FW} +\Pi_{BW}$	$+\Pi_{FR} +\Pi_{BR}$	$-(\Pi_{FW} +\Pi_{FR})$		$-(\Pi_{BW} +\Pi_{BW})$	0
Interest on loans	$-Z_W$	$-Z_R$	$-Z_F$		$+Z_W +Z_R +Z_F$	0
Change in equity, corporate bonds, self-owned business	$-dE_W$	$-dE_R$		$+dE_W +dE_R$		0
Change in deposits	$-dD_W$	$-dD_R$			$+dD_W +dD_R$	0
Change in loans	$+dL_W$	$+dL_R$		$+dL_F$	$-(dL_W +dL_R +dL_F)$	0
Σ	0	0	0	0	0	0

Notes: C_W: consumption of workers, C_R: consumption of capitalists, I_{HW}: real estate investment of workers, I_{HR}: real estate investment of capitalists, I_F: firms' investment in the capital stock, W_W: wages received by workers, W_R: wages received by capitalists, Π_{FW}: profits from firms to workers, Π_{FR}: profits from firms to capitalists, Π_{BW}: profits from banks to workers., Π_{BR}: profits from banks to capitalists, Z_W: interest payments to banks by workers, Z_R: interest payments to banks by capitalists, Z_F: interest payments to banks by firms, dE_W: change in equity and corporate bonds held by workers, dE_R: change in equity, corporate bonds and own business held by rentiers, dD_W: change in deposits held by workers, dD_R: change in deposits held by capitalists, dL_W: change in loans to workers, dL_R: change in loans to capitalists, dL_F: change in loans to firms.
Source: own elaboration.

---

[6] Interest payments of households were absent in the basic Ederer/Rehm (2020b) model and its empirical application. When extending the model by incorporating real estate assets and mortgage debt, we include total interest payments of households, affecting their net financial income.

With these qualifications, we can now make use of equations (14) and (15) from the Ederer/Rehm (2020b) model, with profits defined as the sum of dividends, interest, profits of self-employed and rents received minus interest payments for each class. Based on this, we can then use the saving equation (16). For the accumulation rate (17), for the sake of simplicity, we assume that capital accumulation includes the accumulation of real estate/housing, such that in equilibrium, the capital stock of the firm sector and the stock of real estate grow at the same rate, as determined in equation (20). For the long-run endogenous share of wealth owned by capitalists, Ederer/Rehm's (2020b) determination from equation (25) can hence be applied as well, and we can use the same set of parameters, h, α, s_W, s_R, γ_W, γ_R. However, γ_W, γ_R are defined as in the adjusted theoretical model and the empirical application is explained in the following section.

4.2 Long-run Equilibrium Wealth Distribution with Real Estate Assets and Mortgage Debt

For our calibration of the long-run equilibrium capitalists' share of wealth based on 2010 data, we use our interpretation of the Ederer/Rehm (2020b) classification of workers' and capitalists' households, already applied in Section 3. We make use of the updated 2010 HFCS data for calculating the capitalists' share in wages (α) and the shares of capital income generating assets in total assets for both workers and capitalists (γ_W, γ_R), as defined in the previous section. For the sake of clarity, Table 6 provides an overview over the respective empirical definitions of wealth, capital income, as well as capital income generating wealth, in the two versions of the model. Finally, we use the Ederer/Rehm (2020b) propensities to save (s_W, s_R) based on the 2010 HBS data, and updated AMECO data for the 2010 profit share (h). The respective values together with the calibrated equilibrium capitalists' shares of wealth (z^{**}) can be found in Table 7.

Table 6: Empirical definitions of net wealth, capital income and capital income generating wealth for the basic Ederer/Rehm (2020b) model and the extended version with real estate assets and mortgage debt

	Ederer/Rehm (2020b) model	Extended model
Net wealth	+ Total financial assets (DA2100) + Value of self-employment businesses (DA1140) – Outstanding balance of non-mortgage debt (DL1200)	+ Total financial assets (DA2100) + Value of self-employment businesses (DA1140) + Real estate wealth (DA1400) – Outstanding balance of total debt (DL1100 + DL1200)
Capital income	+ Income from financial assets (DI1400) + Gross income from other sources (HG06010)	+ Income from financial assets (DI1400) + Gross income from other sources (HG0610) + Rental income from real estate property (DI1300) – Interest payments (DI1412)
Capital income generating assets	+ Total financial assets (DA2100) – Deposits (DA2101) + Value of self-employment businesses (DA1140)	+ Total financial assets (DA2100) – Deposits (DA2101) + Value of self-employment businesses (DA1140) + Value of other real estate property (DA1120) – Outstanding balance of total debt (DL1100 + DL1200)

Notes: Classification in parenthesis is based on HFCS (2021).
Source: Ederer/Rehm (2020b), ECB (2021), own elaboration.

Comparing Table 7 for the extended model with real estate assets and mortgage debt with Table 3 for the model following the basic Ederer/Rehm (2020b) approach makes clear that some differences arise with respect to the shares of capital income generating assets in total assets for both workers and capitalists. The ratio γ_W increases in all countries for the extended model, while the ratio γ_R increases in all countries but Austria and Portugal. Also, the capitalists' share in wages (α) increases in four countries and decreases in one, but remains constant in five countries. The changes in the first two parameters arise due to the incorporation of additional asset classes in the extended model, which may ultimately result also in a reclassification of households and may thus cause a change in the capitalists' share in wages (α). Some differences hence also arise with respect to the long-run equilibrium capitalists' share in total wealth (z^{**}) from these changes in parameters. We see slight increases in all but three countries. However, the long-run equilibrium capitalists' shares of wealth based on 2010 data do not differ much between the two model variants. The inclusion of real estate assets and mortgage debt thus does not make much of a difference when it comes to the stable long-run equilibrium wealth distribution. For three countries, Malta, Spain and Cyprus, we find again that the stable long-run equilibrium capitalists' share of wealth is 100 per cent, the Piketty (2014) solution. However, for the other countries, the stable equilibrium capitalists' share of wealth is between 51 and 95 per cent.

Table 7: Parameters, long-run equilibrium capitalists' shares of wealth based on 2010 values, and actual capitalists' wealth share – including real estate assets and mortgage debt

Country	s_R	s_W	h	γ_R	γ_W	α	z_1^{**} (stable)	z_2^{**} (unstable)	z
Austria	0.23	0.05	0.38	0.66	0.22	0.06	0.73	-0.04	0.34
Belgium	0.29	0.10	0.33	0.81	0.27	0.03	0.51	-0.03	0.15
Cyprus	0.10	0.00	0.37	0.81	0.44	0.22	1.00	-0.18	0.52
Spain	0.07	0.00	0.38	0.86	0.55	0.29	1.00	-0.27	0.71
Finland	0.39	0.12	0.38	0.75	0.17	0.02	0.63	-0.01	0.15
France	0.29	0.01	0.34	0.86	0.43	0.07	0.95	-0.07	0.39
Greece	0.13	0.05	0.39	0.71	0.25	0.06	0.59	-0.04	0.17
Malta	0.26	0.00	0.45	0.86	0.32	0.02	1.00	-0.01	0.19
Portugal	0.33	0.13	0.36	0.86	0.20	0.04	0.56	-0.02	0.33
Slovakia	0.30	0.18	0.52	0.53	0.06	0.06	0.64	-0.07	0.15

Notes: Parameters are calculated for the year 2010, h: profit share, s_W: workers' propensity to save, s_R: capitalists' propensity to save, γ_W: share of capital income generating assets in workers' net wealth: γ_R: share of capital income generating assets in capitalists' net wealth, α: capitalists' share in wages, z: capitalists' wealth share, z^{**}: long-run equilibrium capitalists' wealth share.
Source: ECB (2010), European Commission (2024), Eurostat (2010), own calculations.

Comparing the calibrated stable long-run equilibrium values based on 2010 values with the actual values for the same year in Figure 4, we find that the gap between actual and equilibrium values is much larger for the extended model with real estate assets and mortgage debt than for the basic Ederer/Rehm (2020b) model in Section 3. Since calibrated equilibrium values for both model variants are rather similar, this difference is due to the fact that the inclusion of real estate assets and mortgage debt generates lower actual capitalists' shares of wealth. Real estate assets, corrected for the related mortgage debt, were thus more equally distributed in 2010 (and also in the following HFCS vintages) than the other types of wealth. We thus can confirm what Ederer/Rehm (2020b, p.65) had assumed:

> '(R)eal estate wealth is distributed more equally than financial wealth. Workers' wealth would therefore rise compared to capitalists' wealth, and thus the empirical wealth inequality [...] would be lower. As a consequence, the gap between the theoretical and empirical wealth distribution would increase.'

However, for given parameters, the wealth distribution including real estate wealth should converge towards an even somewhat higher degree of inequality than the one in the model without real estate assets and mortgage debt. Looking at the actual values for the capitalists' share of wealth from the further HFCS vintages, such a tendency is indeed visible for France and Spain for all the vintages, and for Belgium until 2017, as well as for Greece since 2014. For the other six countries, Cyprus, Austria, Finland, Malta, Portugal, and Slovakia, however, no

such tendency is visible, although actual values for the capitalists' share of wealth are in the range of stability between upper stable and lower unstable equilibrium values, similar to our finding in Section 3 on the basic Ederer/Rehm (2020b) model.

Figure 4: Calibrated stable long-run equilibrium values for the capitalists' share of wealth for 2010 and actual values for 2010, 2014, 2017 and 2021 for the extended model with real estate assets and mortgage debt
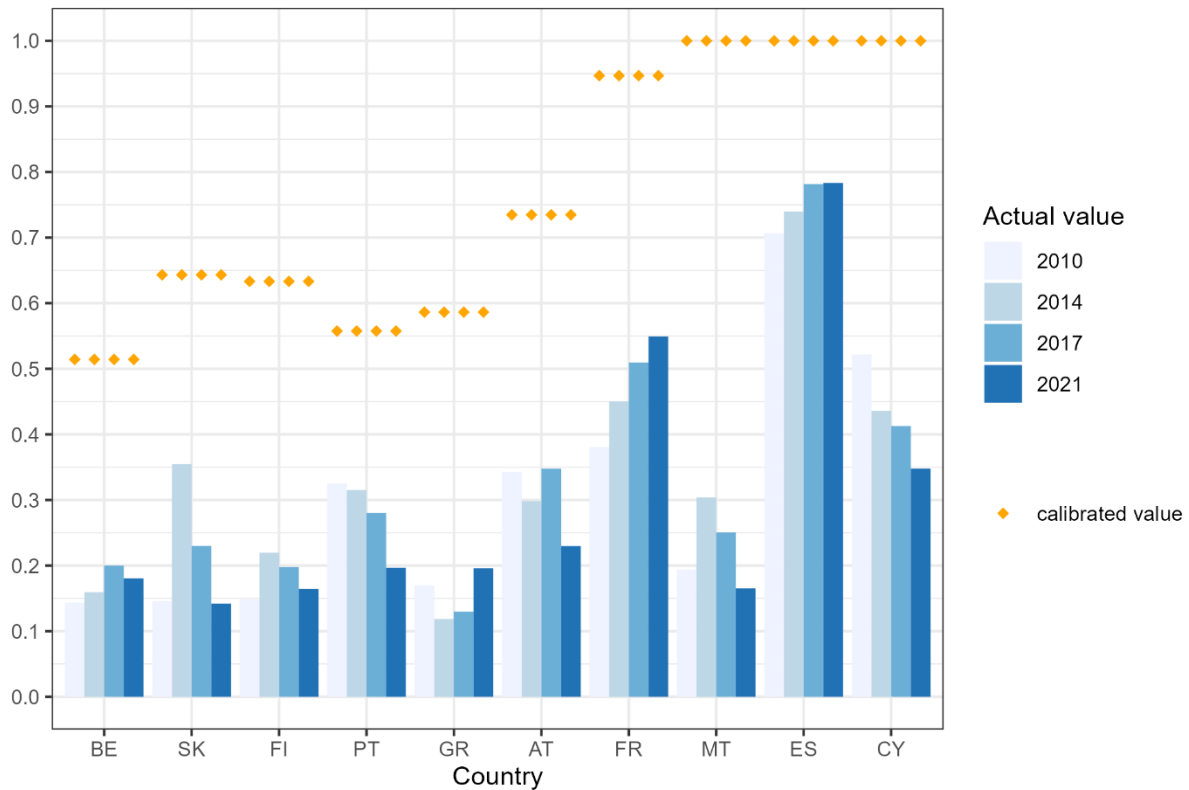
Notes: From left to right: Belgium (BE), Slovakia (SK), Finland (FI), Portugal (PT), Greece (GR), Austria (AT), France (FR), Malta (MT), Spain (ES) and Cyprus (CY).
Source: ECB (2010, 2014, 2017, 2021), European Commission (2024), Ederer/Rehm (2020b) and Eurostat (2010) for saving propensities, own calculations.

Again, we find that the parameters determining the long-run equilibrium, and thus the long-run equilibrium wealth distribution, itself are not necessarily constant over time (Table 8). We have used the respective HFCS vintages and annual AMECO data in order to calculate the parameters h, α, $γ_W$ and $γ_R$, but for simplicity kept the propensities to save s_W and s_R, derived by Ederer/Rehm (2020b) from the 2010 HBS. The stable equilibrium at z_1^{**} is thus varying over time for some countries also for our extended model, as also shown in Figure 5. No such variations are observed for Malta, Cyprus and Spain with the calibrated long-run equilibrium capitalists' share of wealth being 100 per cent. Also for France there is little variation. But for the other countries, even with assumed constancy of the propensities to save, the equilibrium capitalists' share of wealth does vary over time. For Austria, Belgium, Greece, Portugal, and Slovakia, these variations are partly in line with the changes in the actual capitalists' shares of wealth, while for Finland no such correspondence is obvious.

Table 8: Parameters and long-run equilibrium capitalists' shares of wealth for all HFCS vintages and actual values of capitalists' shares of wealth – including real estate assets and mortgage debt

Country	Year	s_R	s_W	h	γ_R	γ_W	α	z_1^{**} (stable)	z_2^{**} (unstable)	z
Austria	2010	0.23	0.05	0.38	0.66	0.22	0.06	0.73	-0.04	0.34
	2014	0.23	0..05	0.37	0.75	0.14	0.05	0.74	-0.02	0.3
	2017	0.23	0.05	0.38	0.8	0.15	0.08	0.76	-0.02	0.35
	2021	0.23	0.05	0.37	0.72	0.14	0.06	0.73	-0.04	0.23
Belgium	2010	0.29	0.1	0.33	0.78	0.27	0.03	0.51	-0.03	0.15
	2014	0.29	0.1	0.32	0.74	0.25	0.02	0.5	-0.03	0.16
	2017	0.29	0.1	0.34	0.76	0.22	0.02	0.54	-0.01	0.2
	2021	0.29	0.1	0.34	0.75	0.26	0.03	0.52	-0.02	0.18
Cyprus	2010	0.1	0	0.37	0.81	0.44	0.23	1	-0.18	0.52
	2014	0.1	0	0.4	0.81	0.35	0.16	1	-0.09	0.44
	2017	0.1	0	0.43	0.77	0.42	0.15	1	-0.1	0.42
	2021	0.1	0	0.42	0.71	0.32	0.22	1	-0.15	0.35
Spain	2010	0.07	0	0.38	0.86	0.55	0.29	1	-0.27	0.71
	2014	0.07	0	0.4	0.91	0.57	0.25	1	-0.21	0.74
	2017	0.07	0	0.41	0.93	0.58	0.25	1	-0.2	0.78
	2021	0.07	0	0.36	0.92	0.52	0.29	1	-0.29	0.78
Finland	2010	0.39	0.12	0.38	0.75	0.17	0.02	0.63	-0.01	0.15
	2014	0.39	0.12	0.36	0.69	0.14	0.07	0.66	-0.02	0.22
	2017	0.39	0.12	0.4	0.66	0.17	0.07	0.69	-0.03	0.2
	2021	0.39	0.12	0.41	0.78	0.22	0.02	0.66	-0.01	0.16

Table 8: continued

Country	Year	s_R	s_W	h	γ_R	γ_W	α	z_1^{**} (stable)	z_2^{**} (unstable)	z
France	2010	0.29	0.01	0.34	0.86	0.43	0.07	0.95	-0.07	0.39
	2014	0.29	0.01	0.33	0.86	0.35	0.07	0.94	-0.06	0.45
	2017	0.29	0.01	0.33	0.89	0.34	0.07	0.94	-0.05	0.51
	2021	0.29	0.01	0.33	0.74	0.23	0.07	0.94	-0.07	0.55
Greece	2010	0.13	0.05	0.39	0.71	0.25	0.06	0.59	-0.04	0.17
	2014	0.13	0.05	0.4	0.74	0.36	0.02	0.51	-0.03	0.12
	2017	0.13	0.05	0.4	0.68	0.38	0.04	0.5	-0.06	0.13
	2021	0.13	0.05	0.38	0.58	0.35	0.06	0.57	-0.05	0.2
Malta	2010	0.26	0	0.45	0.86	0.32	0.02	1	-0.01	0.19
	2014	0.26	0	0.45	0.89	0.26	0.02	1	-0.01	0.3
	2017	0.26	0	0.47	0.93	0.3	0.03	1	-0.01	0.25
	2021	0.26	0	0.43	0.76	0.26	0.02	1	-0.01	0.17
Portugal	2010	0.33	0.13	0.36	0.86	0.2	0.04	0.56	-0.02	0.33
	2014	0.33	0.13	0.4	0.86	0.14	0.03	0.6	-0.01	0.32
	2017	0.33	0.13	0.4	0.82	0.2	0.04	0.59	-0.02	0.28
	2021	0.33	0.13	0.36	0.79	0.27	0.04	0.56	-0.02	0.2
Slovakia	2010	0.3	0.18	0.52	0.53	0.06	0.06	0.64	-0.01	0.15
	2014	0.3	0.18	0.51	0.83	0.11	0.07	0.64	-0.01	0.36
	2017	0.3	0.18	0.48	0.64	0.08	0.07	0.6	-0.01	0.23
	2021	0.3	0.18	0.44	0.6	0.07	0.06	0.56	-0.00	0.14

Notes: Parameters are calculated for all HFCS vintages, h: profit share, s_W: workers' propensity to save, s_R: capitalists' propensity to save, γ_W: share of capital income generating assets in workers' net wealth: γ_R: share of capital income generating assets in capitalists' net wealth, α: capitalists' share in wages, z: capitalists' wealth share, z^{**}: long-run equilibrium values of capitalists' wealth share.
Source: ECB (2010, 2014, 2017, 2021), European Commission (2024), Eurostat (2010), own calculations.

Figure 5: Calibrated stable long-run equilibrium values for the capitalists' share of wealth and actual values for 2010, 2014, 2017 and 2021 for the extended model with real estate assets and mortgage debt
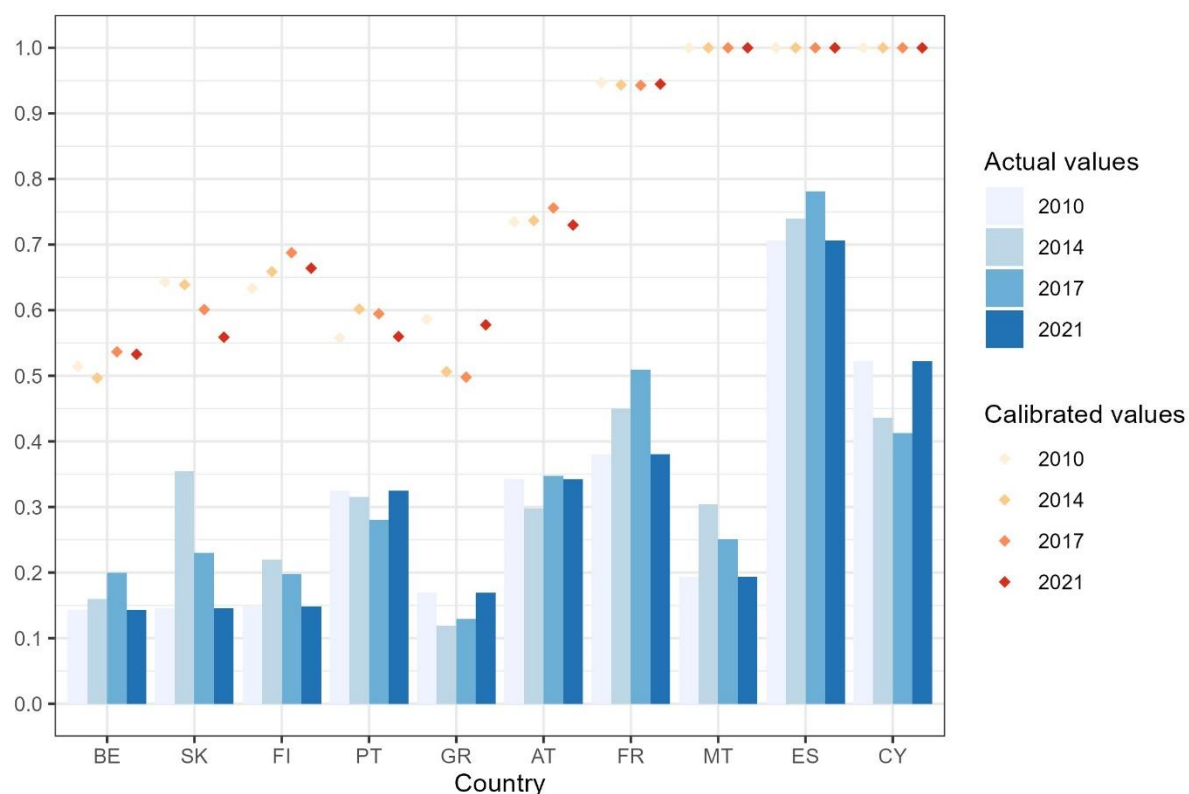
Notes: From left to right: Belgium (BE), Slovakia (SK), Finland (FI), Portugal (PT), Greece (GR), Austria (AT), France (FR), Malta (MT), Spain (ES) and Cyprus (CY).
Source: ECB (2010, 2014, 2017, 2021), European Commission (2024), Ederer/Rehm (2020b) and Eurostat (2010) for saving propensities, own calculations.

This observation raises again the issue of endogeneity of the equilibrium wealth share of capitalists with regard to their actual wealth share dynamics. Exploring such channels of endogeneity could include potential positive effects of the capitalists' wealth share on the profit share (h) in production, through associated changes in the power relationships between capital and labour. Also positive effects of the actual wealth share and thus wealth concentration on the share of capital income generating wealth in capitalists' total wealth (γ_R) could be considered, indicating a positive relationship between wealth concentration and wealth profitability. No obvious general pattern can be derived from our data in Table 8. This is no surprise, since the examination of each of these channels for our country set would have to control for other influences on profit shares or on the share of capital income generating wealth in capitalists' total wealth. This, of course, also applies to other potential endogeneity channels via the propensities to save, the share of capital income generating wealth in workers' total wealth or the capitalists' share in labour income. An in depth exploration is thus beyond the scope of the current paper and has to be left for future research.

5. Conclusions

While Piketty (2014) had argued that under the condition that the rate of profits exceeds the rate of growth (r > g) modern capitalism should see an ever increasing inequality of wealth distribution, post-Keynesian demand-led distribution and growth models including wealth distribution came up with more nuanced implications. Several models, including the one by Ederer/Rehm (2020b) used in this paper, imply that long-run equilibrium wealth distribution may deviate from Piketty's (2014) corner solution. Wealth distribution may thus converge towards some stable shares of capitalists and workers in a two-class model, and wealth inequality may hence not show ever increasing features, even if r > g, a condition which usually applies in post-Keynesian distribution and growth models. Ederer/Rehm (2020b) were the first to empirically calibrate long-run equilibrium wealth distribution for ten European countries, mainly making use of 2010 HFCS data and using the capitalists' share of wealth as a measure of inequality. They found that for seven out of ten countries, the long-run equilibrium solution deviates from Piketty's corner solution. Since the actual capitalists' share of wealth in 2010 was below the calibrated stable long-run equilibrium, they predicted further increases of wealth inequality.

We have extended this research in two directions. First, making use of the 2010, 2014, 2017 and 2021 vintages of the HFCS, we have re-calibrated the stable long-run equilibrium capitalists' share of wealth based on 2010 data and have checked whether in the following decade the actual share has moved towards this equilibrium. Indeed, for a few countries such a convergence is visible, while for others it is not. We have argued that this may be so, because the parameters determining the long-run equilibrium capitalists' share of wealth are not necessarily constant over time, and the stable long-run equilibrium may hence be (partly) endogenous with respect to the actual wealth distribution.

Second, we have extended the Ederer/Rehm (2020b) model by including real estate assets and mortgage debt, since the dynamics of these were found to be of major importance for recent macroeconomic regimes and their respective changes. Calibrating the long-run equilibrium capitalists' share of wealth for this extended model with 2010 values, we have found slightly higher values than the ones based on the Ederer/Rehm (2020b) model but no deviation from their pattern. For three countries, the Piketty (2014) solution seems to apply, while for the other seven a stable long-run equilibrium capitalists' wealth share partly well below 100 per cent has been found. However, the actual capitalists' share of wealth in the extended model is much lower than in the application of the basic Ederer/Rehm (2020b) model, for the 2010 and also the following HFCS vintages. This vindicates the Ederer/Rehm (2020b) suggestion that real estate assets, corrected for mortgage debt, are distributed more equally than the other types of wealth. However, the model predicts that inequality will converge towards a slightly higher level than in the basic Ederer/Rehm (2020b) model. We have found such a converging tendency applying the 2014, 2017 and 2021 vintages of the HFCS for some countries, but not for all countries in our data set. Furthermore, we have shown that the parameters determining the long-run equilibrium are indeed not constant over time. The long-run equilibrium may hence be endogenous with respect to the actual wealth distribution, via potential effects of

actual wealth distribution on those parameters determining the long-run equilibrium distribution, like the profit share in production or the share of capital income generating wealth in capitalists' total wealth, or via the other parameters. However, no obvious pattern could be derived from our data. An in-depth examination of these channels for our country set would require controlling for further influences on the behaviour over time of these parameters, and is thus left for future research.

References

Bhaduri, A., Marglin, S. 1990. 'Unemployment and the real wage: the economic basis for contesting political ideologies.' *Cambridge Journal of Economics* 14: 375-393.

Dutt, A.K. 1990. 'Growth, distribution and capital ownership: Kalecki and Pasinetti revisited.' In *Economic Theory and Policy. Essays in honour of Dipak Banerjee,* edited by B. Dutta, S. Gangopadhyay, D. Mookherjee and D. Ray. Bombay: Oxford University Press.

ECB. 2010. Household Finance and Consumption Survey (HFCS). Frankfurt am Main: ECB. https://www.ecb.europa.eu/home/pdf/research/hfcn/HFCS_Statistical_Tables_Wave 2010.pdf?90d1e5ab4ace3e15e90ed59950d21ca1.

ECB. 2014. Household Finance and Consumption Survey (HFCS). Frankfurt am Main: ECB. https://www.ecb.europa.eu/home/pdf/research/hfcn/HFCS_Statistical_Tables_Wave _2014.pdf?bf06c66b9f89bd01e30e9ead7d836dad.

ECB. 2017. Household Finance and Consumption Survey (HFCS). Frankfurt am Main: ECB. https://www.ecb.europa.eu/home/pdf/research/hfcn/HFCS_Statistical_Tables_Wave _2017_July2023.pdf?eb559c621d38c0da59eea9f6c86e84f0.

ECB. 2021. Household Finance and Consumption Survey (HFCS). Frankfurt am Main: ECB. https://www.ecb.europa.eu/home/pdf/research/hfcn/HFCS_Statistical_Tables_Wave _2021_July2023.pdf?0515e108613e1e4d0e839e816e9f07b8.

ECB. 2024. Household Finance and Consumption Survey (HFCS). Frankfurt am Main: ECB. https://www.ecb.europa.eu/stats/ecb_surveys/hfcs/html/index.en.html.

European Commission. 2024. AMECO Database. https://ec.europa.eu/economy_finance/ameco_dashboard.

Eurostat. 2010. Household Budget Survey (HBS). Luxembourg: European Commission. https://ec.europa.eu/eurostat/web/microdata/household-budget-survey.

Ederer, S., Rehm, M. 2020a. 'Making sense of Piketty's 'fundamental laws' in a post-Keynesian framework.' *Review of Keynesian Economics* 8(2): 195-219.

Ederer, S., Rehm, M. 2020b. 'Will wealth become more concentrated in Europe? Evidence from a calibrated post-Keynesian model.' *Cambridge Journal of Economics* 44(1): 55-72.

Ederer, S., Rehm, M. 2021. 'Wealth inequality and aggregate demand.' *Metroeconomica* 72(2): 405-424.

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

Hein, E. 2014. *Distribution and Growth after Keynes: A Post-Keynesian Guide*. Cheltenham: Edward Elgar.

Kaldor, N. 1966. 'Marginal productivity and the macroeconomic theories of distribution.' *Review of Economic Studies* 33: 309-319.

King, J.E. 2017. 'The literature on Piketty.' *Review of Political Economy* 29(1): 1-17.

Kohler, K., Stockhammer, E. 2022. 'Growing differently? Financial cycles, austerity, and competitiveness in growth models since the Global Financial Crisis.' *Review of International Political Economy* 29(4): 1314-1341.

Kohler, K., Tippet, B., Stockhammer, E. 2023. 'House price cycles, housing systems, and growth models.' *European Journal of Economics and Economic Policies: Intervention* 20(3): 461-490.

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

Lavoie, M. 1996. 'The neo-Pasinetti theorem in Cambridge and Kaleckian models of growth and distribution.' *Eastern Economic Journal* 24: 417-434.

Lopez-Bernado, J., Lopez-Martinez, F., Stockhammer, E. 2016. 'A post-Keynesian response to Piketty's 'Fundamental Contradiction of Capitalism'.' *Review of Political Economy* 28(2): 190-204.

Moore, G.L., Stockhammer, E. 2018. 'The drivers of household indebtedness reconsidered: An empirical evaluation of competing arguments on the macroeconomic determinants of household indebtedness in OECD countries.' *Journal of Post Keynesian Economics* 41(4): 547-577.

Palley, T.I. 2012. 'Wealth and wealth distribution in the neo-Kaleckian growth model.' *Journal of Post Keynesian Economics* 34(3): 453-474.

Palley, T.I. 2017a. 'Wage- vs. profit-led growth: the role of the distribution of wages in determining regime character.' *Cambridge Journal of Economics* 41: 49-61.

Palley, T.I. 2017b. 'Inequality and growth in neo-Kaleckian and Cambridge growth theory.' *Review of Keynesian Economics* 5(2): 146-169.

Pasinetti, L.L. 1962. 'Rate of profit and income distribution in relation to the rate of economic growth.' *Review of Economic Studies* 29: 267-279.

Piketty, T. 2014. *Capital in the Twenty-First Century.* Cambridge, MA, London: Cambridge University Press.

Rehm, M., Naqvi, S.A., Hofmann, J. 2016. 'Different but equal? Classes, wealth, and perceptions in Europe.' *Kammer für Arbeiter und Angestellte für Wien* Working Paper 16.

Rowthorn, R.E. 2014. 'A note on Piketty's Capital in the Twenty-First Century.' *Cambridge Journal of Economics* 38: 1275-1284.

Sawyer, M. 2015. 'Confronting inequality: review article on Thomas Piketty on Capital in the 21st Century.' *International Review of Applied Economics* 29(6): 878-889.

Stockhammer, E., Wildauer, R. 2016. 'Debt-driven growth? Wealth, distribution and demand in OECD countries.' *Cambridge Journal of Economics* 40(6): 1609-1634.

Stockhammer, E., Wildauer, R. 2018. 'Expenditure cascades, low interest rates or property booms? Determinants of household debt in OECD countries.' *Review of Behavioural Economics* 5(2): 85-121.

Taylor, L. 2014. 'The Triumph of the Rentier? Thomas Piketty vs. Luigi Pasinetti and John Maynard Keynes.' *International Journal of Political Economy* 43(3): 4-17. 10.1080/08911916.2014.1002296.

Van Treeck, T. 2015. 'r>g: Why the 'Piketty Debate' Unsettles Germany's Economic Experts.' *CESifo Forum ifo Institut Leibniz-Institut für Wirtschaftsforschung an der Universität München* 16(1): 26-34.

Vermeulen, P. 2016. 'Estimating the Top Tail of the Wealth Distribution.' *The American Economic Review* 106(5): 646-650.

Zamparelli, L. 2017. 'Wealth Distribution, Elasticity of Substitution and Piketty: An 'Anti-Dual' Pasinetti Economy.' *Metroeconomica* 68(4): 927-946
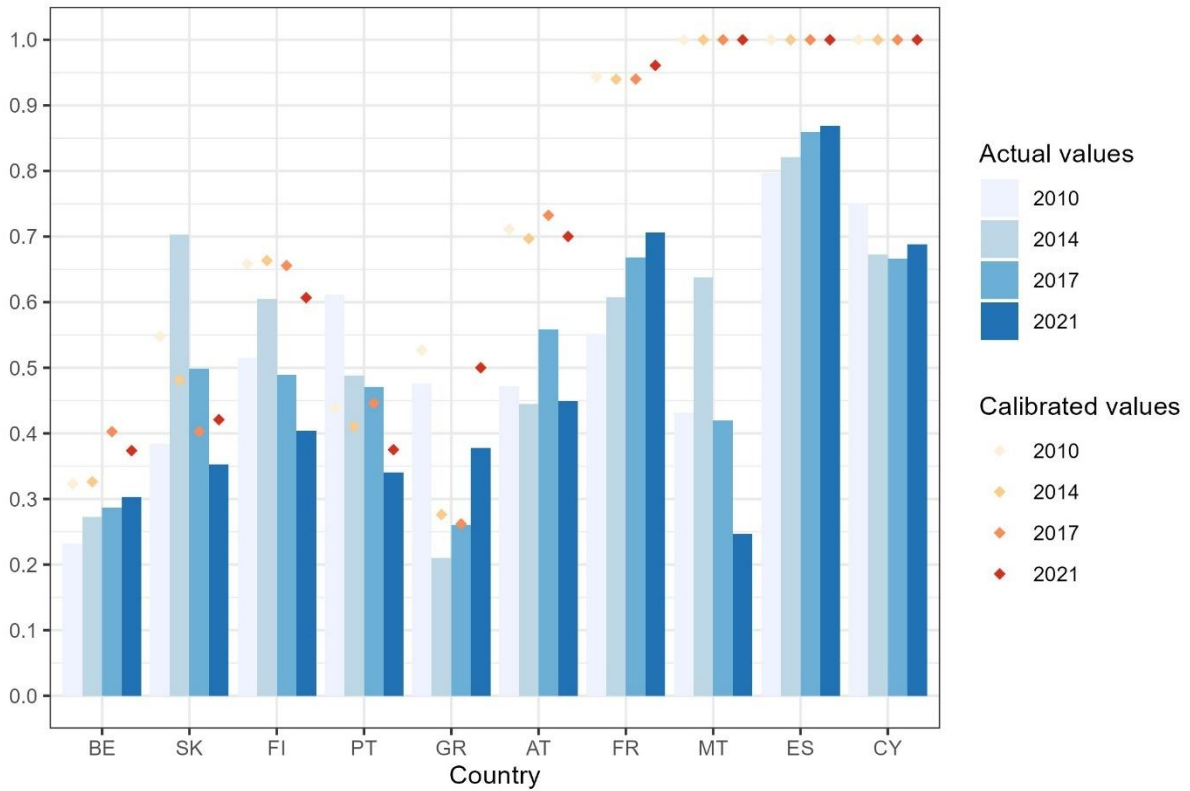
Appendix

Figure 1(a): The Ederer/Rehm (2020b) actual and calibrated stable long-run equilibrium values for the capitalists' share of wealth for 2010 data and our values

Panel (a)

Panel (b)

Share of wealth held by capitalists ◆ calibrated value
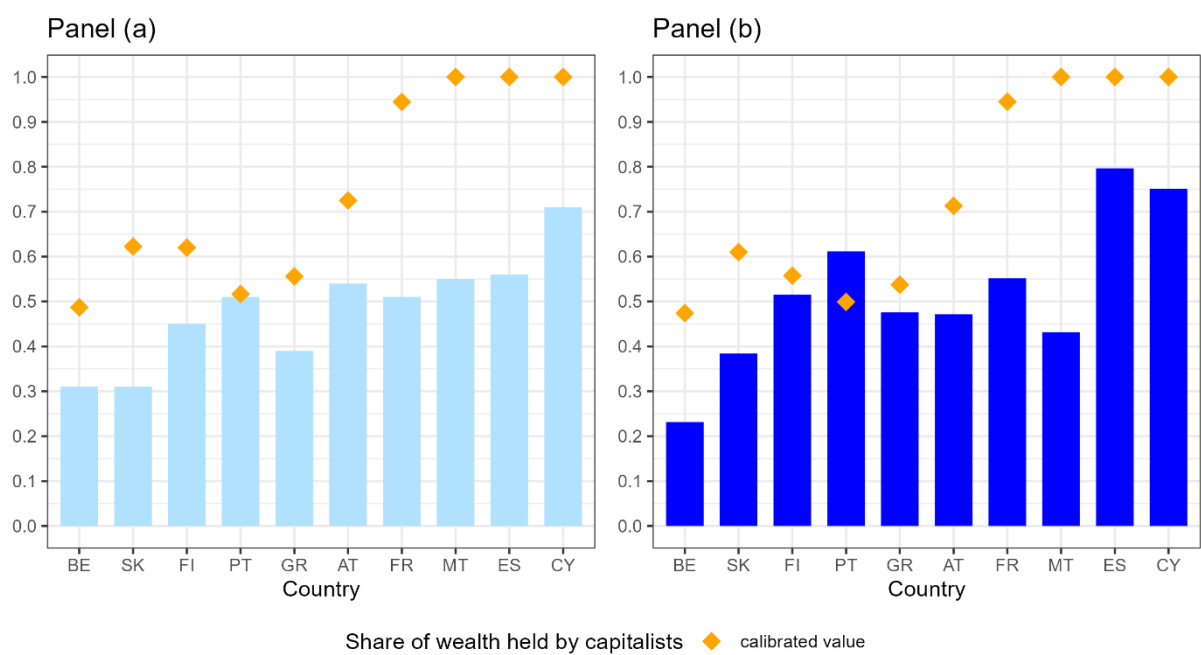
Notes: Panel (a) shows the Ederer/Rehm (2020b) actual values (bars) and calibrated stable lon-run equilibrium values for the capitalists' share of wealth for 2010. Panel (b) shows our values based on revised and updated HFCS and AMECO data for (from left to right) Belgium (BE), Slovakia (SK), Finland (FI), Portugal (PT), Greece (GR), Austria (AT), France (FR), Malta (MT), Spain (ES) and Cyprus (CY) for 2010.

Source: ECB (2010), European Commission (2024), Ederer/Rehm (2020b) and Eurostat (2010) for saving propensities, own calculations.

Figure 2(a): Calibrated equilibrium values for the capitalists' share of wealth and actual values for 2010, 2014, 2017 and 2021 for the Ederer/Rehm (2020b) model

Notes: From left to right: Belgium (BE), Slovakia (SK), Finland (FI), Portugal (PT), Greece (GR), Austria (AT), France (FR), Malta (MT), Spain (ES) and Cyprus (CY).
Source: ECB (2010, 2014, 2017, 2021), European Commission (2024), Ederer/Rehm (2020b) and Eurostat (2010) for saving propensities, own calculations.