



# **The Pattern of Home Ownership Across Cohorts and its Impact on the Net Wealth Distribution: Empirical Evidence from Germany and the US**

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# **Non technical summary**

## **Research Question**

Homeownership and the accumulation of wealth by households have been found to be closely linked. Renters are in general poorer than owners and countries with a high share of renters have lower median net wealth and a more unequal wealth distribution. We analyze the impact of homeownership on the net wealth distribution. In particular we are interested in the effect of the pattern of ownership across cohorts. Given that wealth accumulates over the life-cycle and that owners are wealthier than renters, past tenure choices, affecting today's share of owners for different cohorts, should have an impact on wealth levels and inequality currently observed.

## **Contribution**

We analyse empirically the relationship between the homeownership structure over cohorts and wealth inequality, an issue that has not received a lot of attention in the literature. We apply a relatively new reweighting decomposition technique. To illustrate the link between the ownership-cohort structure and the wealth distribution we impose on Germany the structure of the US, which exhibits a higher ownership rate and a structure more consistent with a life-cycle hypothesis where households become homeowners early and save over life in form of mortgage repayment. In doing so we provide insight into how the German wealth distribution would look like in the counterfactual case, i.e. with the US pattern of ownership by cohort.

## **Results**

We show that past tenure choices, affecting today's share of owners for different cohorts, are related to current wealth levels and inequality. Our results indicate that the ownership rate and its pattern within cohorts are closely linked with the wealth distribution. Imposing the full ownership-cohort structure of the US on Germany leads to a large increase in the German median net wealth and reduces wealth inequality. We show that some of these effects can be attributed to the difference in ownership shares between older cohorts in Germany and the US as often mentioned in the literature, but this effect appears to be less pronounced than expected. We also find that a comparable change in terms of wealth inequality can be achieved by proportionally increasing the ownership rates for each cohort, without changing the particular tenure pattern over cohorts.

# Nichttechnische Zusammenfassung

## Fragestellung

Viele Studien belegen, dass der Besitz von Wohneigentum und die Akkumulation von Vermögen von privaten Haushalten eng miteinander verbunden sind. So zeigt sich z.B. dass Mieterhaushalte im Allgemeinen über weniger Vermögen verfügen als Eigentümer und dass Länder mit einem hohen Mieteranteil durch ein geringes Mediannettovermögen sowie hohe Vermögensungleichheit gekennzeichnet sind. In dieser Arbeit untersuchen wir den Zusammenhang des Anteils von Wohneigentümer in einem Land mit der dort beobachteten Vermögensverteilung. Insbesondere steht die Frage im Raum, wie die Wohneigentümerquote je Kohorte sich auf die Vermögensverteilung auswirkt. Anbetracht der Tatsache, dass sich Vermögen über einen längeren Zeitraum aufbaut und Eigentümer vermögender sind als Mieter, sollte sich Entscheidungen über Kauf und Miete in der Vergangenheit auf die aktuell beobachtbare Vermögensverteilung auswirken.

## Beitrag

Die empirische Analyse des Zusammenhangs zwischen Wohneigentumsquote nach Kohorten und der Vermögensverteilung ist in der empirischen Literatur bisher nur wenig beachtet worden. Wir verwenden die sog. "reweighting decomposition" Methode, um die Eigentümerstruktur je Kohorte der USA auf Deutschland zu übertragen. Wir wählen die US als Vergleichsgruppe, da die Eigentümerstruktur über Kohorten dort eher mit der klassischen Lebenszyklus-Hypothese im Einklang steht und die Eigentümerrate auch insgesamt höher ist als in Deutschland. Wir untersuchen, wie die hypothetische deutsche Vermögensverteilung aussehen würde, wenn die Eigentümerquoten nach Kohorte der Struktur in den USA entsprächen.

## Ergebnisse

Im Ergebnis zeigt sich dass die Eigentümerstruktur nach Kohorten und die Vermögensverteilung in Deutschland stark zusammenhängen. Entscheidungen der Haushalte über Kauf und Miete in der Vergangenheit und die Vermögensverteilung heute stehen in einer engen Beziehung. Wird die Eigentümerstruktur der USA auf Deutschland übertragen, fällt die Vermögensungleichheit und der Median des Nettovermögens steigt. Ein Teil dieses Effekts ist den unterschiedlichen Eigentümerquoten bei älteren Haushalten (65 und älter) zwischen den USA und Deutschland geschuldet. Allerdings ist der Beitrag dieser Kohorte kleiner als erwartet. Einen vergleichbaren Effekt auf die Vermögensverteilung ergibt sich in einem Szenario, bei dem der Eigentümeranteil in jeder Kohorte proportional erhöht wird.

## **The Pattern of Home Ownership Across Cohorts and its Impact on the Net Wealth Distribution: Empirical Evidence from Germany and the US**

Arthur Alik-Lagrange (Toulouse School of Economics)

Tobias Schmidt (Deutsche Bundesbank)

### **Abstract**

In this empirical paper we analyze the link between homeownership across cohorts and the net wealth distribution. In particular we are interested in the effect of the pattern of ownership across cohorts. Given that wealth accumulates over the life-cycle and that owners are wealthier than renters, past tenure choices, affecting today's share of owners for different cohorts, should be related to current wealth levels and inequality. In order to gauge the effect of the ownership structure over cohorts on the distribution of net wealth we impose the homeownership pattern of the US on Germany and ask: What would the net wealth distribution in Germany look like if German households were distributed across tenure status along cohorts the same way as those in the US? Our results indicate that the ownership rate and pattern within cohorts is closely linked to the wealth distribution. Imposing the structure of the US on Germany leads to a large increase in the German median and reduces wealth inequality. We show that some of these effects can be attributed to the difference in ownership shares between old cohorts in Germany and the US as often mentioned in the literature, but this effect appears to be less pronounced than expected. Past tenure choice indeed affects today's net wealth distribution.

**JEL Codes:** D31, D30

**Keywords:** homeownership, decomposition, cohort effects, wealth

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# 1 Introduction

Homeownership and the accumulation of wealth have been found to be closely linked. Renters are in general poorer than owners and countries with a high share of renters have lower median net wealth and a more unequal wealth distribution. The goal of our analysis is to document the link between the structure of homeownership across cohorts and the distribution of net wealth. Given that wealth accumulates over the life-cycle and that owners are on average wealthier than renters regardless of cohort, the share of owners for different cohorts should be related to wealth levels and inequality.

In order to gauge the effect of the ownership structure on the distribution of net wealth we use a reweighting technique. The basic idea of this econometric procedure is to modify the ownership pattern of a given country through reweighting the data within cohorts and to assess the impact of this modification on the distribution of wealth. We follow the usual procedure using the observed structure of another country. This approach is in the spirit of Bover (2010) and relies mostly on the reweighting method developed in DiNardo *et al.* (1996). In this paper we impose the homeownership structure within US cohorts on Germany and ask: What would the net wealth distribution in Germany look like if German households were distributed across tenure status along cohorts the same way as those in the US? We chose those two countries to investigate the mechanisms because they exhibit very different homeownership patterns. While Germany's ownership share is one of the lowest for industrialized countries at 44%, the respective figure for the US is at 67%. The age-group specific ownership shares are different as well. The tenure status along age groups in the US seems to be driven by classical life-cycle savings patterns, making it a suitable target structure. US households buy property at a young age and repay the mortgage over their life-time. This means e.g. that the share of renter households decreases as we move from young to older households and more households transition to ownership. In Germany on the contrary, the share of renters increases again for the age group 65 and older. This is quite unusual and can hardly be explained by a reselling motive of the main residence among old German households. The structure may very well be an effect of the Second World War, when many households lost their property and wealth, or the particular housing conditions in East-Germany.

Our empirical analysis based on data from the "Household Finance and Consumption Survey" (HFCS) indicates that the ownership-cohort pattern has an effect on the wealth distribution. When imposing the US ownership structure on Germany we find a large change of the wealth distribution. After reweighting, the distribution of net wealth is more equal and the median for Germany jumps from 50,000 Euro to 105,000 Euro. Our results also indicate that (contrary to what might have been expected) the older cohorts contribute in a limited way to this increase. Although older cohorts in Germany differ markedly from those in the US, in terms of homeownership rates, they only represent a small fraction of the population. This potentially has implications for housing policy aiming at reducing inequality, suggesting that targeting younger cohorts would be more effective in achieving this goal. Insofar as the comparatively high share of renters among old German households could be a result of historical

events, the structure may converge to one more similar to the one observed in the US as cohorts age, potentially leading to a reduction in wealth inequality.

In the next section we will review the literature on housing and its impact on households' wealth. Section 3 presents the data we use and provides a description of our empirical approach we use to construct the counterfactual distribution. The presentation of results in Section 4 precedes the conclusions in Section 5.

## **2 Ownership, Wealth and Age - A Review of Related Literature**

The recently released data from the new European Central Bank (ECB) "Household Finance and Consumption Survey" show that homeownership and wealth are closely linked in the euro area as a whole as well as in each euro area country (ECB, 2013). In 2010, euro area renters hold on average 49,500 euro of net wealth with a median of 9,100 euro while outright-owners hold on average 391,300 euro, with a median of 241,200 euro. In the US the same structure is observed, owners hold more wealth than renters. For owners, median net wealth is estimated to be at 174,500 dollars compared to 5,100 dollars for renters in 2010 (Bricker et al., 2012). The mean net wealth of owners is 713,400 dollars, that of renters only 57,200 dollars.

That wealth distribution features and ownership are linked is not a novel finding. Sielos (2007) shows in a theoretical life-cycle model that the share of renters matters for an economy's wealth distribution. Adding renter households to his life-cycle model increases wealth inequality for all cohorts compared with a model which features homeowners only. It also leads to a better fit of the model to the wealth inequality patterns observed in the US in 2001. These findings should not be interpreted to imply that in countries with low ownership rates wealth inequality is always higher, but it can be seen as indicating that *ceteris paribus* higher ownership rates have a moderating impact on inequality.

Dietz and Haurin (2003) review over 200 studies dealing with the impact of ownership on households' behavior and wealth. They state that "nearly all discussions on homeownership point to changes in wealth as the most important consequence" (Dietz and Haurin, 2003: 405). Frequently cited reasons for this link between homeownership and wealth are house price appreciation, savings behavior of owners, renters, and prospective buyers, the ability to use a house as collateral, and inheritances. Additionally there is some evidence that wealth and ownership are "endogenous", i.e. only the wealthy households or the ones with high permanent income can afford to buy a house or flat (Boehm, 1993; see also the literature on borrowing constraints e.g. Haurin et al, 1997; Chiuri and Jappelli, 2013; Boehm). Di et al. (2007) document that owning a home is significantly positively linked to wealth accumulation over time. In an earlier study Di et al. (2003) found that US households owning their home in 1984 exhibit in 1999 net wealth more than twice that of renters. Boehm and Schlottmann (2004) conclude that homeownership and wealth accumulation are positively linked for low income households.

Our study is mainly concerned with analyzing statistically the impact of a specific ownership-cohort structure on the net wealth distribution. To our knowledge there are few empirical

studies dealing directly with the impact of the ownership-cohort structure on wealth inequality. Di *et al.* (2003) presents empirical evidence of this link using the Survey of Consumer Finance revealing a gap between the median net wealth of owners and renters and showing that this gap increases substantially with the age of the household's head. The gap for the oldest cohort (65 and over) is 238,450 dollars in 2001. For the younger cohorts (under 35) it is just 57,080 dollars in 2001.

Where this effect comes from is an open question. One possible explanation is that the composition of owners and renters is different for different age groups (see e.g. Silos, 2007). Among the younger renters there are also future buyers, who are already saving for their down-payment, whereas among the older cohorts the renters are mainly either low income households which could not afford to buy or high income ones which decided not to. Old owners are households that have profited from the positive effects of ownership on wealth for an extended period of time and they typically exhibit a more homogeneous wealth distribution with lower inequality.

Differential savings behavior has also been suggested as an explanation. Krumm and Kelly (1989) find that both, being homeowner as well as the value of the main residence, have a positive impact on household savings. They also observe that renters aspiring to become owners in the future save more than their peers. Grunert (2003) documents lower average saving for renters than homeowners in Germany. She argues that homeowners are subject to forced savings, because they have to pay back their mortgage redemption. Smith *et al.* (1988) also put forth that the setup of the housing finance markets requires households to "save for a down payment and [... to] accept the forced savings aspect of their mortgage" (Smith *et al.* 1988: 42). The differential savings and consumption patterns imply that homeowners will tend to accumulate more wealth than renters over the life-cycle and start accumulating wealth earlier in life.

Assuming that households in the older cohorts are not first time buyers, but have been owners for an extended period of time, Di *et al.* (2007) show that the duration of homeownership positively impacts on net wealth. If these effects accumulate, the difference between older owners and older renters should be larger than for the younger cohorts. Also, countries in which households buy their homes at younger ages should *ceteris paribus* be wealthier on average than countries with households that buy late. Germany and the US differ in that more US households bought homes at a younger age than German households, probably due to more favorable mortgage conditions in the US compared to Germany (see Chiuri and Jappelli, 2003; Haurin *et al.* 1997).

Long time owners, mainly found among the older owners, may also have profited from substantial house price increases in the years before the 2008 financial crisis. As house prices are volatile, the exact date when the household becomes an owner plays an important role<sup>1</sup>. Cohort effects can of course also be caused by other historical events like wealth losses or distortions of the ownership structure because of wars (Kesternich *et al.* 2013) or changes of political systems, e.g. the German separation and reunification (Gebhardt, 2013).

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<sup>1</sup> For Germany it also makes a difference in which region the main residence is located and what type it is (see e.g. Hoffmann and Lorenz, 2006).

We will return to this issue when we present the descriptive evidence on ownership in Germany and the US below.

According to the classic life-cycle model both renters and owners accumulate wealth as they age and their wealth should deplete as they reach retirement. Browning and Lusardi (1996) write “most standard models predict that old people should dissave” but cite empirical evidence that savings rates are positive for all age groups. There is also evidence that housing wealth is not de-cumulated and that older households keep their main residence until household members die or experience a health shock (see Scheiner et al. 2011 for Germany; Börsch-Supan, 1994, for West Germany; Venti and Wise, 2001 for the US; Chiuri and Jappelli, 2007 for OECD countries). If older households do not sell their mortgage free homes in order to finance consumption, their wealth levels should also remain high.

Linked to these life-cycle considerations, the purchasing process usually also has a “life-cycle pattern”. Typically households buy their first home with a mortgage when they are young (Bicakova and Sierminska, 2008) and then repay the mortgage as they age. With each repayment their net wealth increases. Therefore the share of owners with a mortgage and thus little net housing wealth is higher among the younger cohorts than among the older cohorts. Younger households recently switched to ownership should be very similar in terms of wealth to renter households about to buy a home. This again should lead to a larger gap in wealth between renters and owners in older cohorts than in younger cohorts. The life-cycle pattern of ownership also has another implication: it creates a cohort effect through the households’ history of credit constraints. In markets with high credit constraints, young households aspiring to become homeowners will remain renters for an extended period of time and potentially save more than their peers in markets with less restrictive credit constraints. If the credit constraints change over time, a cohort effect with respect to the wealth distribution can be expected.

The literature cited above supports the argument that cohort effects with respect to ownership and wealth exist and that older owner households are richer than younger owner households. Its specific ownership-cohort pattern should therefore impact the wealth levels and wealth distribution of a given country. Comparing Germany and the US seems to be particularly interesting in this respect, as the two countries do not only exhibit different ownership shares (Germany: 44%, US: 67%), but also different homeownership-cohort patterns.

### **3 Data, Key Variables and Methodology**

#### **3.1 Data and Key Variables**

For our analysis, we use two datasets, the German part of the Household Finance and Consumption Survey from ECB, called “Panel on Household Finance (PHF)”<sup>2</sup>, and the Survey of Consumer Finances (SCF) of the Federal Reserve<sup>3</sup>. Both surveys provide a representative picture of the respective population of non-institutionalized households. They were both undertaken in 2010 and use a comparable methodology. They are based on random

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<sup>2</sup> See von Kalckreuth et al (2010) for a detailed description of the survey and some results.

<sup>3</sup> See [http://www.federalreserve.gov/econresdata/scf/scf\\_workingpapers.htm](http://www.federalreserve.gov/econresdata/scf/scf_workingpapers.htm) for details on the survey’s methodology and Brickner et al. (2012) for results.

samples with oversampling of wealthy households<sup>4</sup>, interviews are conducted face-to-face (CAPI) and the datasets are multiply imputed. The SCF contains information on more than 6,000 households, while the PHF covers more than 3,500 households. In addition to using a similar methodology, both surveys collect data on assets and liabilities for households in the respective countries using the same concepts. This allows us to construct the same indicators for households' net wealth and home ownership status for Germany and the US. Our indicator of net wealth is the total sum of both real and financial<sup>5</sup> assets minus outstanding liabilities<sup>6</sup>. The homeownership status can take three values: homeowner with a mortgage, homeowner without a mortgage, and renters. Because we are in particular interested in the ownership structure for different cohorts, we need to group households by age. The "age of a household" is usually determined by assigning the age of a reference person to the household. We follow this approach and chose the SCF's mechanism to identify a reference person for households with two or more adults. This means that in a household with a couple, the male is the reference person.

The data show that the mean net wealth in the US is at about 369 500 euro<sup>7</sup> in 2010. The median net wealth stands at 57 800 euro<sup>8</sup>. For Germany the mean net wealth in 2010 is at 197 000 euro, with the median amounting to roughly 50 000 euro. Both the US and Germany exhibit a significant wealth inequality in 2010, the Gini coefficients for net wealth being respectively 80% and 71%.

The descriptive analysis reported in Table 1 also reveals the classic stylized facts that owners have higher levels of net wealth than renters, that owners without a mortgage are wealthier than households with a mortgage and that the net wealth is more unequally distributed among renters than among owners. As a result, the relative importance of owners and renters in a country should play a role in determining its wealth and inequality levels. We investigate this further below.

**Table 1 Mean, Median and Gini Coefficient for Net Wealth of German and US Households (in 2010 Euros), by Ownership Status**

		mean	median	sd	gini
DE	renters	42,270	10,500	135,949	0.80
	owners with a mortgage	249,635	161,550	323,990	0.54
	owners without	359,899	252,500	387,419	0.47
	Total	162,304	50,000	296,464	0.71
US	renters	36,934	4,004	211,124	1.03
	owners with a mortgage	365,537	107,781	824,097	0.74
	owners without	530,589	211,401	955,514	0.66
	Total	291,026	60,217	743,841	0.80

Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), SCF 2010, weighted

<sup>4</sup> The results we present below are all weighted to take the oversampling into account.

<sup>5</sup> The assets covered are: real estate (owner-occupied and other properties), private businesses, valuables and vehicles, deposits, bonds, shares, mutual funds, managed accounts, private lending, voluntary pensions and whole life insurance contracts, as well as other financial assets, e.g. gold or money owed to the household.

<sup>6</sup> Liabilities include mortgage debt as well as unsecured loans (e.g. credit card debts, overdrafts, consumer loans).

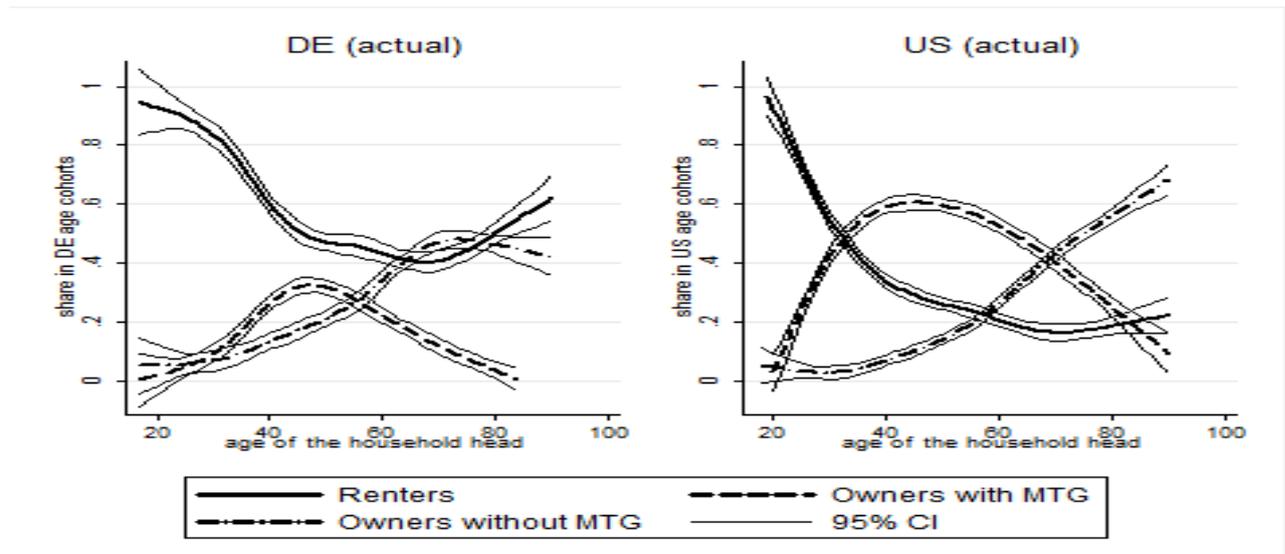
<sup>7</sup> The figures reported here slightly differ from the results published by the Federal Reserve Board, because we drop the top and bottom 0.5% of the distribution from the data.

<sup>8</sup> We use the IRS' yearly average exchange rate of 0.785 Euro/USD to convert USD into euro. IRS website <http://www.irs.gov/Individuals/International-Taxpayers/Yearly-Average-Currency-Exchange-Rates> accessed February 13<sup>th</sup> 2014.

### 3.2 Descriptive Evidence on Ownership by Age Group

As mentioned in the introduction we will reweight the German data to bring its homeownership patterns by cohorts in line with the one for the US, which follows the typical life-cycle pattern. Figure 1 illustrates the differences in actual homeownership patterns between the two countries before reweighting. It shows the share of households within each age group owning its main residence (with or without a mortgage) and the share of the population renting the main residence for the year 2010<sup>9</sup>.

Figure 1 Ownership Shares (in %) by Age of Household Head, Germany and US



Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), SCF 2010, weighted

In the US, the observed structure for cohorts is consistent with a life-cycle interpretation: households buy a house or apartment with a mortgage when they are young and pay of their mortgage as they age. For the older cohorts (65 and older) the share of renters is therefore low. In Germany, however, the share of renters is noticeably higher for the older cohorts than for the middle cohorts (between 40 and 65). This effect cannot be attributed to older households selling their property and moving into renting. Typically older households keep their main residence until they die (see Scheiner et al. 2011 for Germany; Börsch-Supan, 1994, for West Germany; Venti and Wise, 2001 for the US)<sup>10</sup>. One possible explanation for the increase in the renter share for households with a head 65 and older lies in Germany's history. Events like the Second World War, during which many households lost their property and wealth (Kesternich et al. 2013), or the German separation into an eastern and western part, have perhaps influenced not only the wealth holdings but also the wealth accumulation process (Fuchs-Schündeln, 2008) and ownership decisions of these older German cohort. They either could not recover from the consequences of the war on their own wealth or their par-

<sup>9</sup> We choose 2010 as the year of analysis, since the German survey was conducted in 2010 for the first time. US data is available for other years as well. To make sure that the pattern in 2010, in the middle of the financial crisis, is not particular, we compare the 2010 pattern with that in 2007 and 2013. As table A5 in the appendix shows, the ownership by cohort pattern for all three survey years (2007, 2010 and 2013) is very similar.

<sup>10</sup> If they transfer the main residence to their children during their life time, these former owners typically retains the right to free use of the property. These households would not consider themselves renters. This "other" group of households is not shown in the graph. Also, if the households dissolve and members move to a retirement home, they are no longer part of the survey population.

ents' wealth, or if they lived in East Germany did not have the time to accumulate enough assets to be able to buy property since the wall came down. The comparatively high share of renters for old cohorts (65 and older) is present in East and West Germany, but it is clearly more pronounced in the East (see Figure A1 in the appendix).

Differences between the two countries also exist for the younger cohorts: US households buy houses at a younger age than German households, probably due to more favorable mortgage conditions in the US and possibly reflecting lower inheritance levels related to previous argument. Germany is known for its rather restrictive mortgage system with comparatively high down-payment requirements and high transaction costs (European Central Bank, 2009; Chiuri and Jappelli, 2003; Earley, 2004), preventing or dissuading many young households from buying a property at the beginning of their careers. Furthermore, the rental market in Germany is very well developed which reduces the necessity to buy.<sup>11</sup>

The pattern of ownership is very relevant for wealth inequality because owners and renters do not own similar net wealth and the distribution of wealth within those two groups is different. Table 1 above and Table 2 below show that this is indeed the case in Germany and the US. The structure we find is consistent with the literature cited above. Renters are poorer than owners in both countries (see Table 2) independent of age and the gap between the two groups widens as we move from the younger to the older cohorts. Inequality is also higher for renters than for owners. The difference in inequality between owners and renters is particularly pronounced for young households (below 35). This can be attributed to heterogeneity in the composition of the renters. The young cohort (below 35) contains high income renters who are saving for buying real estate as well as renters who will remain renters throughout their life. The old and to a lesser degree the middle cohorts on the contrary contain households that were never able to buy and renters who decided not to buy.

The group of homeowners is also not homogeneous. The difference between owners with a mortgage and owners without a mortgage is less pronounced than between renters and owners, but still visible. As expected, inequality and the difference in the median wealth holdings is reduced when moving from young to old cohorts. We take these differences into account by treating the owners with a mortgage and those without as two distinct groups when applying the reweighting method.

The observed patterns imply that not only the ownership rate as such should influence the wealth distribution, but also the ownership-cohort structure. In particular, the gap in wealth levels between renters and owners should be higher in a country with a high share of homeowners in the older cohorts (65 and older) than in a country with a high share of young homeowners, even if the two countries have overall the same homeownership rate. In this vein, one may relate the relatively low ownership rates for these older cohorts in Germany with the country's comparatively low median net wealth and high wealth inequality.

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<sup>11</sup> For an overview of additional reasons why the ownership rate in Germany is low see Voigtländer (2009).

**Table 2 Mean, Median and Gini for Net Wealth of German and US Households (in 2010 Euros), by Cohort and Ownership Status**

		Age		
		<35	35-64	65+
<b>DE</b>				
renters	mean	19,550	58,098	41,028
	median	5,600	15,450	12,000
	sd	48,423	185,001	90,942
	gini	0.81	0.80	0.72
home owners with a mortgage	mean	150,764	241,494	360,980
	median	95,500	164,750	221,800
	sd	183,040	298,379	479,322
	gini	0.46	0.52	0.58
home owners without	mean	252,301	415,905	323,306
	median	145,900	272,600	251,100
	sd	221,557	468,529	310,317
	gini	0.39	0.49	0.44
<b>US</b>				
renters	mean	18,997	41,104	84,051
	median	3,360	4,671	3,705
	sd	113,431	219,957	372,267
	gini	1.19	1.00	0.92
home owners with a mortgage	mean	94,336	408,538	475,660
	median	35,796	126,385	174,427
	sd	286,393	878,357	912,593
	gini	0.77	0.73	0.68
home owners without	mean	164,307	598,322	503,659
	median	62,329	205,984	236,599
	sd	389,834	1,110,055	841,392
	gini	0.69	0.69	0.62

Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), SCF 2010, weighted

### 3.3 Methodology

We present here briefly the reweighting procedure for the main counterfactual analysis. We follow a reweighting procedure close to DiNardo *et al.*(1996), where the survey is re-weighted multiplying available weights by the following likelihood ratio<sup>12</sup>:

$$R(h, age) = \frac{f(h|age, US)}{f(h|age, DE)}$$

Where  $h \in \{renters, owners\ with\ a\ mortgage, owners\ without\}$  and  $age$  is the age of the reference person as defined above. Multiplying the expansion weights available in micro-data

<sup>12</sup> This is equivalent to a change in measure, see Bover 2010.

by an estimate of this ratio we end up with a German population characterized by a home-ownership structure at any given age similar to the US one. In particular, the counterfactual cumulative distribution function for Germany would it have the same tenure distribution conditional on age can be expressed as follows:

$$\begin{aligned}
F^{DE(US)}(y|age) &= E^{US}[\mathbb{1}(NW \leq y)|age] = E^{US}[E^{DE}[\mathbb{1}(NW \leq y)|H, age]] \\
&= \int_{\Omega_H} \left[ \int_{\Omega_{NW}} \mathbb{1}(nw \leq y) f(nw|h, age, DE) dnw \right] f(h|age, US) dh \\
&= \int_{\Omega_H} \left[ \int_{\Omega_{NW}} \mathbb{1}(nw \leq y) \frac{f(nw, h|age, DE)}{f(h|age, DE)} dnw \right] f(h|age, US) dh \\
&= \int_{\Omega_H} \int_{\Omega_{NW}} \mathbb{1}(nw \leq y) \frac{f(h|age, US)}{f(h|age, DE)} f(nw, h|age, DE) dnwdh \\
&= E^{DE}[\mathbb{1}(NW \leq y)R(H, age)|age]
\end{aligned}$$

Where  $nw$  is net wealth as defined above. One can estimate the ratio  $R(h, age)$  in many ways, based mostly on parametric assumptions, e.g. logit in DiNardo *et al.*, 1996, or by fixing some cell proportions, e.g. Bover, 2010 where cells are defined by households' structures<sup>13</sup>. However, considering the non-linearities observed in the housing structure over cohorts (see Figure 1, in particular the share of renters over cohorts), we use in our case a non-parametric estimate of the ratio based on a cubic-splines estimate of  $f(h|age, US)$  and  $f(h|age, DE)$ .

We want to check how well our reweighting procedure performs. To do so we compare the actual density for the US  $\hat{f}(h|age, US)$  and the counterfactual one for Germany  $\hat{f}_{US}(h|age, DE)$ . If the reweighting works well, then these two conditional densities should be similar, indeed:

$$f_{US}(h|age, DE) = R \times f(h|age, DE) = f(h|age, US)$$

We report  $\hat{f}_{US}(h|age, DE)$  and  $\hat{f}(h|age, US)$  in Figure A2 of the Appendix and we see that the patterns are very similar, indicating that the share for each homeownership status  $h$  at a given age is the same in the SCF and in the reweighted German PHF, i.e. the reweighting procedure applied performs well.

## 4 Results

In this section we present the results on how a change of the ownership-cohort structure is related to the net wealth distribution. We will reweight the German ownership pattern to bring it in line with the US pattern and analyze how much of the resulting change in wealth inequality can be contributed to an increase in the ownership rate versus a cohort effect. This

<sup>13</sup> In a previous version of this paper, we replicate Bover's (2010) analysis and we find very little impact of the difference between distribution across households' structures in Germany and in the US.

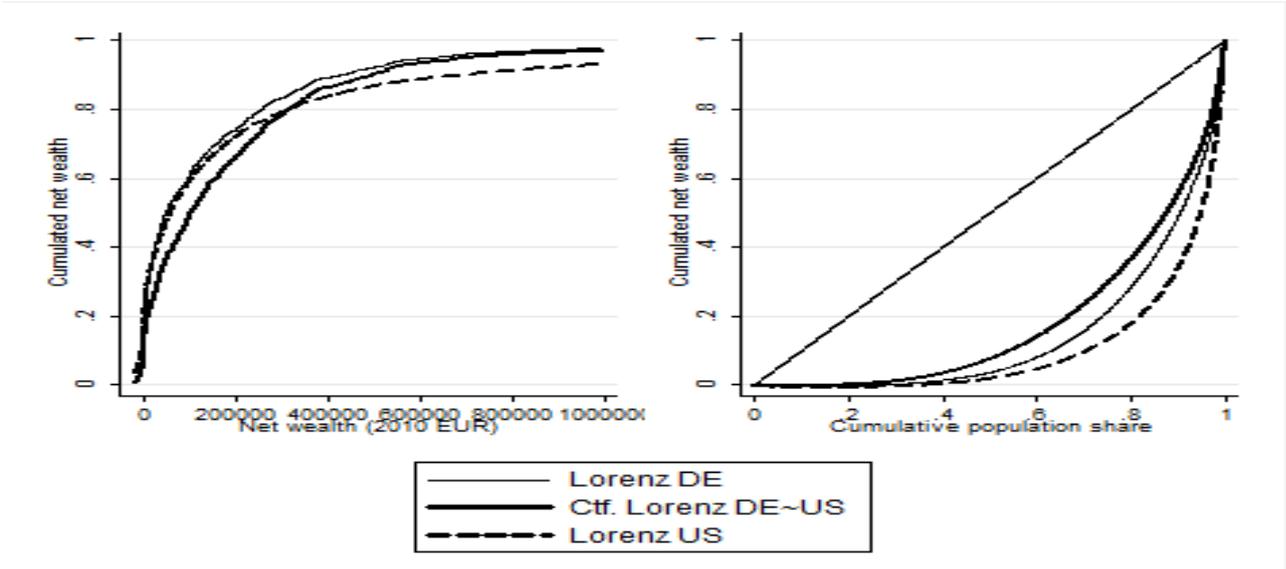
is complemented by an additional reweighting exercise in which we investigate to what extent older cohorts' (65 and older) structure are affecting wealth inequality.

### 4.1 Overall Results of the Reweighting of the Ownership Structure

To analyze the impact of the ownership-cohort structure on the wealth distribution, we first present the results for the reweighting exercise if the whole ownership by age structure of Germany is reweighted to look like the US structure (see Figure A2 in the appendix).

The impact of reweighting on the net wealth distribution is striking. We report results in Table 3. Inequality is significantly reduced. The Gini index drops from 71% to 63%. The impact of the reweighting is particularly strong in the middle quintiles of the distribution as can be seen in Figure 2 below (additionally we plot the difference in cumulative distribution functions in Figure A3 in the Appendix); the median more than doubles for Germany after reweighting. It rises from 50,000 euro before to 105,050 euro after reweighting. The pre-crisis median in the US was at a comparable level in 2007 with 90 000 euro (cf. Bricker et al., 2012). At the fringes of the distribution the impact is negligible; for households with net wealth of about 500 000 euro and more the counterfactual and actual distribution look very similar. The homeownership structure in Germany seems to affect the observed wealth inequality substantially in our set-up.

Figure 2: Actual and Counterfactual Cumulative distribution Functions and Lorenz Curves for Net Wealth of German Households (in 2010 Euros) - Reweighting Benchmark: US Cohorts



Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), weighted and reweighted, 2010 euros.

Our previous remarks on the particular role of the homeownership structure over cohorts and our descriptive statistics suggest a stronger impact of the reweighting among the older cohorts (Section 4.1). We check if this presumption holds in reporting in Table 3 results by cohorts. We find indeed a stronger impact of the reweighting on the within cohort net wealth distribution for the age group 65 years and older. For this age group the median almost dou-

bles and the Gini drops by 13% with 6 percentage points more than for the 35 years old and younger.

**Table 3: Actual and Counterfactual Mean, Median and Gini Coefficient for Net Wealth of German Households (in 2010 Euros) - Reweighting Benchmark: US all Cohorts**

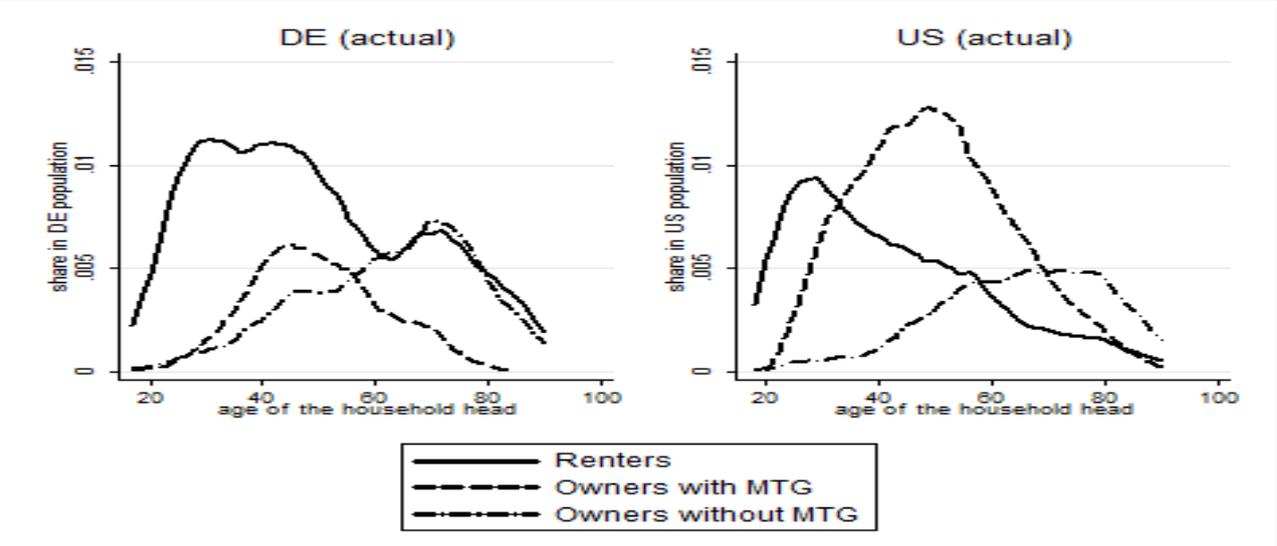
<i>net wealth in euro</i>	mean	median	sd	gini
BEFORE	162,304	50,000	296,464	0.71
AFTER	206,969	105,050	317,777	0.63
DIFF (in %)	28%	110%	7%	-11%
<i>by age categories</i>				
<i>BEFORE</i>				
<=35	46,158	10,300	111,471	0.81
35-65	189,299	76,300	334,232	0.69
>=65	193,884	92,200	293,640	0.65
<i>AFTER</i>				
<=35	65,855	16,000	132,460	0.76
35-65	219,489	116,400	328,993	0.61
>=65	278,237	182,000	353,297	0.56
<i>DIFF (in %)</i>				
<=35	43%	55%	19%	-7%
35-65	16%	53%	-2%	-11%
>=65	44%	97%	20%	-13%

Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), weighted and reweighted, 2010 euros.

At first glance this seems to imply that mainly the households from the cohorts 65 and older accentuate the wealth inequality in Germany. However, it is not *per se* clear what the impact of the reweighting of these cohorts on the overall wealth distribution should be. There are at least two things to consider: First, because the difference between the target ownership structure (US) and the actual one is most pronounced for the older cohorts, the reweighting of older households will lead to a big adjustment of their ownership distribution; but on the other hand they represent only a small fraction of the population possibly counterbalancing the first effect. Second, from Figure 3 below and Figure 1 above, one can see that the reweighting of the young and middle cohorts, i.e. households between 18 and 64, will mainly “convert” renters into owners with a mortgage. For the older cohorts the reweighting will mainly “convert” renters into owners without a mortgage. Given that the difference between owners with and without a mortgage is non-negligible this will moderate the effect of the adjustment for young and middle cohorts. What is more, the difference between renters and owners with a mortgage grows from one cohort to the next as reported in Table 2 above, because the cohorts will contain more and more households that have already repaid a fraction of their mortgage. Thus, “converting” a young renter into an owner with a mortgage will have less of an impact on its net wealth, than doing the same for an old renter. This has been motivating the view that the strong inequality observed in the German wealth distribution can be related to strong disturbances of housing choices after World War 2 and in East Germany

among old cohorts (65 and older). We want to give an order of magnitude of this effect and to further investigate the role of the old cohorts in determining the overall wealth inequality of Germany we reweight only this part of the homeownership-cohort distribution.

**Figure 3 Density Estimate of Age Distribution for Household Heads in Germany and the US, by Ownership Status**



Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), SCF 2010, weighted.

Reweighting the ownership structure of German households with a head 65 and older to bring it in line with the US structure for the 65 and older while leaving the rest of the ownership-cohort structure unchanged, overall leads to a significant but rather limited increase in the median net wealth for German households (see Figure 4 and A4 in the appendix) and a small reduction in the inequality as measured by the Gini coefficient (see Table 4). Recall that reweighting the whole distribution resulted in an increase of the median to 105 000 euro. Only reweighting the households with a head of 65 or older leads to a median of 69 700 euro, i.e. an increase in the median of about 20 000 euro<sup>14</sup>. The Gini index for all of Germany is 69%, if we reweight the homeownership structure of the old households so that old household in Germany and the US are the same, down from 71%.

This implies that even though the within cohort changes in terms of median net wealth and the Gini coefficient when reweighting the complete ownership-cohort structure are less pronounced for the younger cohorts (18 to 64), the fact that they represent a larger part of the household population makes them more important for the overall wealth distribution, even if the renters-owners wealth differential is less marked for them.

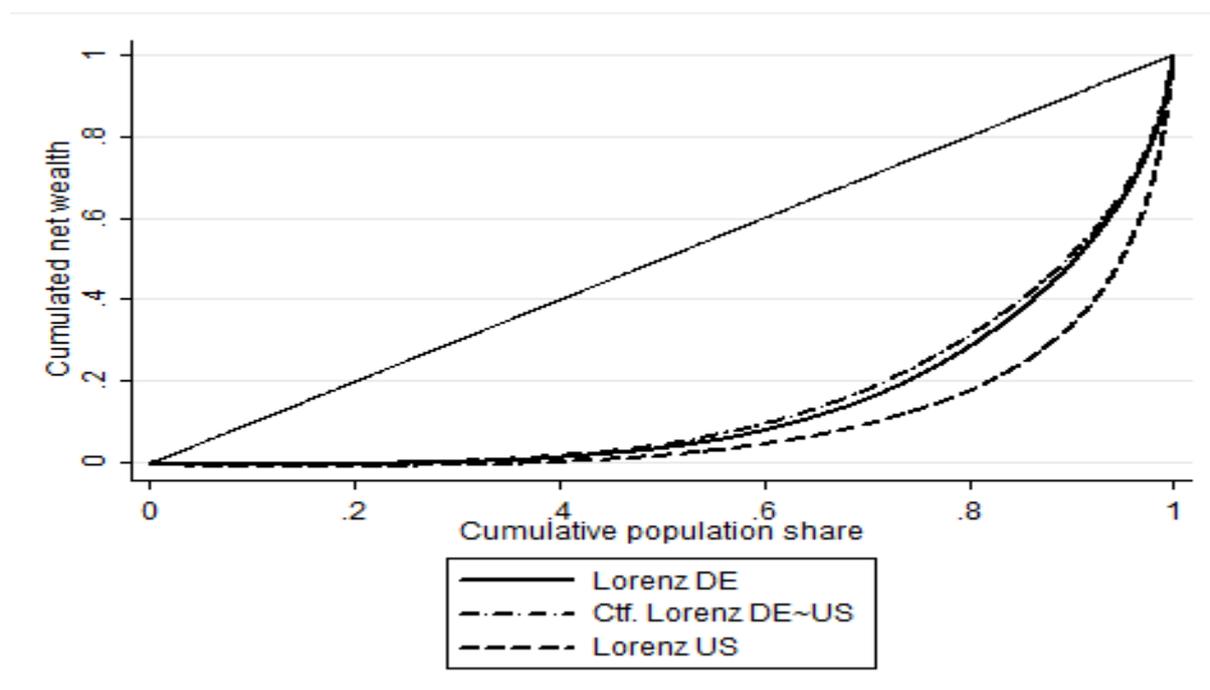
<sup>14</sup> The effect of reweighting specific parts of the ownership structure on the median is not linear, i.e. all the changes we can generate with reweighting certain parts of the distribution will not add up to the total change in median and Gini coefficient observed if we reweight the whole distribution.

**Table 4: Actual and Counterfactual Mean, Median and Gini coefficient for Net Wealth of German Households (in 2010 Euros) - Reweighting Benchmark: US only Cohorts 65 and older**

<i>net wealth in euro</i>	mean	p50	sd	gini
<i>BEFORE</i>	162,304	50,000	296,464	0.71
<i>AFTER</i>	185,607	69,700	318,964	0.69
<i>DIFF (in %)</i>	14%	39%	8%	-3%

Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), weighted and reweighted, 2010 euros.

**Figure 4 Actual and Counterfactual Lorenz Curves for Net Wealth of German Households (in 2010 Euros) - Reweighting Benchmark: US only Cohorts 65 and older**



Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), weighted and reweighted, 2010 euros.

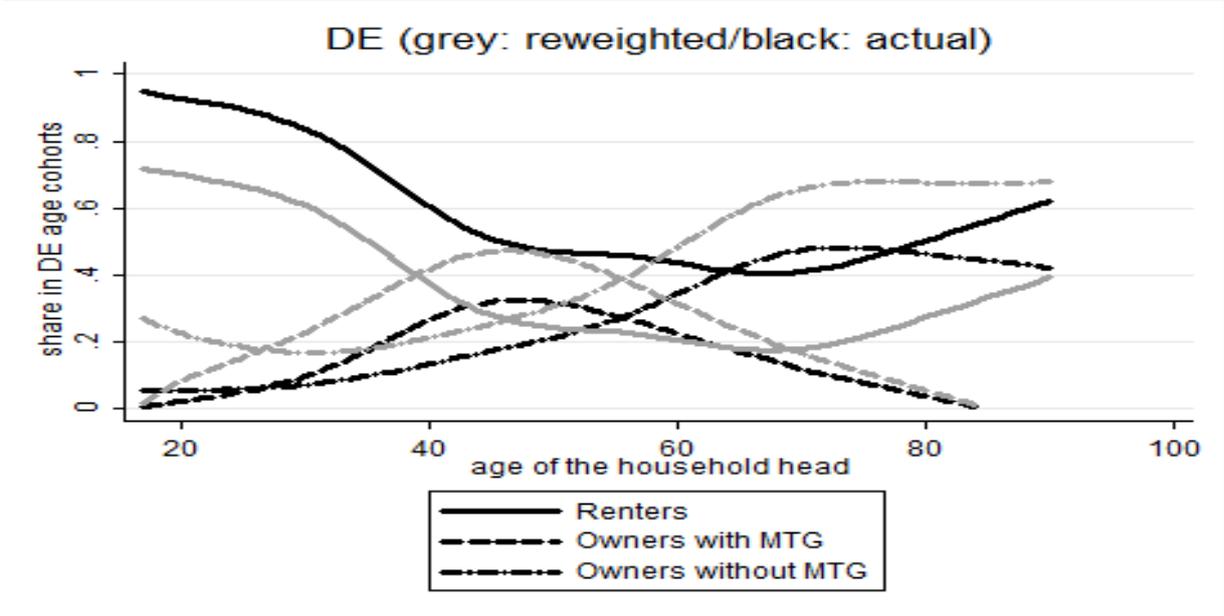
## 4.2 Ownership Share or Ownership-Cohort Structure?

In the previous section we mainly focused on the impact of the ownership-cohort structure. Analyzing the cohort structure explicitly has the benefit of being able to identify the relative contribution of different cohorts to the observed wealth inequality, and give insights as to whether it is historical reasons or more recent housing policy and credit conditions that are important. However, after reweighting not only the ownership-cohort pattern has changed, but also the ownership rates. Separating the impact of the increase in the ownership rate from the impact of adjusting the cohort structure on the wealth distribution is not an easy task. We run two counterfactual analyses to shed light on this issue: First, we increase the ownership rate to the US benchmark of 63%, i.e. we proportionally scale the ownership-cohort structure of Germany up<sup>15</sup>. The resulting ownership-cohort structure is depicted in Figure 5 below. Second, we keep the share of renter households constant at the German

<sup>15</sup> A detailed description of this rescaling exercise is available from the authors upon request.

level (36%) and only adjust the ownership-cohort structure to bring it in line with the one observed in the US.

Figure 5 Counterfactual Analysis when the Benchmark is US Ownership rate, German Structure



Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata)

The results of these two exercises are presented in Tables 5 and 6 below. They seem to indicate that the main effect comes from the increase in the ownership rate. If the ownership rate is kept constant and only the structure is adjusted, we see a small change after reweighting compared to the actual situation. On the contrary, increasing the ownership rate with a constant cohort structure results in a picture that is very similar to the one obtained if the whole ownership-cohort structure is adjusted. Here the median jumps from 50,000 euro to 118,000 euro, the full ownership-cohort structure adjustment had increased it to 105,050 euro. These results do not imply, however, that the ownership-cohort structure does not play a role in determining wealth inequality. The relative difference in ownership shares for specific cohorts between the actual and the counterfactual situation, which is not taken into account in our two experiments, can still influence the observed adjustments. Put differently, imposing the full US structure will - contrary to our first reweighting - not shift up the ownership share proportionally in each cohort, but lead to different adjustments within each cohort. The overall result with respect to the net wealth distribution seems to be rather similar, however.

**Table 5: Actual and Counterfactual Mean, Median and Gini Coefficient for Net Wealth of German Households (in 2010 Euros) - Reweighting Benchmark: US homeownership rate, German ownership-cohort structure**

net wealth	mean	p50	sd	gini
BEFORE	162,304	50,000	296,464	0.71
AFTER	220,851	118,000	329,606	0.62
DIFF (in %)	36%	136%	11%	-13%

Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), weighted, 2010 euros.

**Table 6: Actual and Counterfactual Mean, Median and Gini Coefficient for Net Wealth of German Households (in 2010 Euros) - Reweighting Benchmark: German homeownership rate, US ownership-cohort structure**

net wealth	mean	p50	sd	gini
BEFORE	162,304	50,000	296,464	0.71
AFTER	148,210	42,400	279,595	0.72
DIFF (in %)	-9%	-15%	-6%	1%

Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), weighted, 2010 euros.

## 5 Robustness, Limitations and Caveats

### 5.1 Robustness Checks

Tenure choices are strongly related with households' income, mostly because of credit constraints. Households with high current and expected future income face looser credit constraints and are in a better position if they want to buy house or apartments. Hence, reweighting the population to modify the housing structure over cohorts actually may impact the wealth distribution through a change in the income distribution. After reweighting we get a new set of weights and can calculate the "new" income distribution. If the income distribution after reweighting has changed significantly, we cannot rule out that the observed change in net wealth is the result of the new income distribution across cohorts rather than the effect of homeownership on net wealth. Or, to put it in another way, what we may have identified is the relationship between the income distribution over age groups and the wealth distribution, rather than differences between renters' and homeowners' wealth accumulation over cohorts. Notice that the income distribution may also be affected by the historical events mentioned above with old cohorts' income trajectories and careers disturbed in post war years and during the German separation.

We find, that the income distributions before and after the reweighting procedure presented above are quite similar. We nonetheless check if controlling explicitly for age *and* income<sup>16</sup>

<sup>16</sup> Ideally we would be able to analyse the past income trajectories of households and individuals in both countries. Past income trajectories are certainly closer linked to current wealth levels than current income, in particular for older households. Due to data limitations the use of past income is not possible. We therefore use current (gross) income here, which may not perfectly reflect past income trajectories, but should be related to them.

in the reweighting procedure does affect our main results. The densities' ratio used in this reweighting procedure is then<sup>17</sup>:

$$R(h, age, income) = \frac{f(h|age, income, US)}{f(h|age, income, DE)}$$

This ratio is again estimated non-parametrically using splines estimates. As reported in Table 7, we find less impact of the reweighting procedure. The increase in the mean is reduced by 25 percentage points and halved for the median. Contrary to the previous analysis, we see an increase in standard deviation. The impact on the Gini coefficient is still high with a 7% decrease. From this we can conclude that our results hold in direction but not in size when controlling for income, with however a robust conclusion on the impact on inequality which substantially decreases.

**Table 7: Actual and Counterfactual Mean, Median and Gini for Net Wealth of German Households (in 2010 Euros) - Reweighting Benchmark: US all Cohorts, controlling for age and income**

<i>net wealth</i>	mean	p50	sd	gini
BEFORE	162,304	50,000	296,464	0.71
AFTER	166,928	77,320	278,421	0.66
DIFF (in %)	3%	55%	-6%	-7%

Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata), weighted 2010 euros.

## 5.2 Limitations and Caveats

There are limitations to our approach. First, it is based on a “no general-equilibrium effects” assumption, like any other matching or reweighting approach. In modifying the housing structure, one would actually strongly impact the housing markets: changes in housing prices and on households' assets value would almost certainly occur. It is interesting to ask in which direction this potential bias goes. If a given housing policy turns a lot of renters into owners, this will probably push house prices up, leading to a bigger gap in net wealth between owners and renters, as the value of houses owned increasing.

Closely linked to these arguments, the housing stock availability may alter feasibility of such a policy. By turning renters into owners we simply assume that they would always find a suitable residence to buy. In particular, renters typically stay in smaller residences and such products may not be available for purchase right away.

A third caveat is that imposing the counterfactual US structure “creates” wealth out of nowhere. This is a direct result of owners being richer and more prevalent than renters in the counterfactual compared to the actual state. If the ownership share increases through the reweighting, then total net wealth in the economy will automatically go up, which is arguably not realistic.

<sup>17</sup> Some reweighting procedures are not invariant to the sequencing of the variables with respect to the reweighting variables. The reweighting we use allows us to simultaneously reweight for age and income, i.e. no sequencing of variables takes place. The impact of this reweighting procedure is not the sum of the impacts of two reweighting procedures controlling for age and income separately.

We also face the general problem to disentangle age from cohort effects with one cross-section. Any graph with age on the horizontal axis therefore shows a mixture of age and cohort effects. A more detailed analysis disentangling the two will only be possible once data from the second wave of the German PHF-survey becomes available.

Finally, we assume that the accumulation process of housing wealth would have been the same under the counterfactual regime as it has actually been. We “switch” renters that have accumulated wealth under the German mortgage system and market conditions to owners that have accumulated wealth in the same system. Put differently, we only impose the tenure over age group pattern of the US on Germany, but not the US institutions, credit conditions or housing market history. In this sense our exercise does not answer the question how the German wealth distribution would look like under US conditions.

Our analysis should however be considered to be a valid partial equilibrium scenario showing the potential impact of past housing decisions on net wealth distributions and motivating further research based on general equilibrium models.

## **6 Conclusions**

Modifying the homeownership by imposing the US homeownership by cohort structure has a big impact on the wealth distribution in Germany. Imposing the US structure, which is closer to a distribution consistent with life-cycle considerations and characterized by higher ownership rates, on Germany leads to a reduction of wealth inequality and a substantial increase in median net wealth for German households. The largest adjustments are observed within the older cohorts (65 and older), who incurred wealth losses in the past caused by historical events. However, because they are less populous than the younger cohorts their contribution to the overall inequality in net wealth is less than expected. We also show that a comparable change in terms of wealth inequality can be achieved by proportionally increasing the ownership rates for each cohort, without changing the particular tenure pattern over cohorts.

In a partial equilibrium approach, our results would imply that a change of the ownership structure could be a valid tool to reduce wealth inequality and that a housing policy that promotes ownership could therefore influence the wealth distribution in Germany. Younger cohorts (between 18 and 64) in Germany are less often homeowners than in the US. This can be the result of less favorable institutions for purchasing property through high down payment requirements and transaction costs, preferences for renting or the fact that fewer Germans have inherited their homes than in other countries. The latter has resulted in ownership rates being low among old cohorts in Germany for an extended period of time. Wealth inequality induced by the younger cohorts' structure will likely remain, unless preferences change or credit constraints are relaxed. In our analysis of the role of the overall ownership rates and the contribution of old cohorts' structure, we have shown how important the ownership rates of young cohorts are for wealth inequality. Inducing more households to buy property early on in their life could be a promising strategy and could contribute to a reduction in net wealth inequality in the long run. Insofar as the ownership structure for the old households in Germany may be the result of historical events, the inequality in net wealth distribu-

tion may also gradually decrease. Policies targeting older generations' tenure choice decisions may be hard to implement and would concern only a small share of the population. In all the considerations it has to be kept in mind, that we completely abstract from general equilibrium considerations in our analysis. Increasing the share of owners will certainly have an impact on house prices, which in turn may generate more inequality.

It is unclear whether the results would hold for other countries. The impact of changing the homeownership pattern across cohorts on the net wealth distribution will depend on many things, among them the difference in wealth levels between renters and owners or the distribution of renters and owners across cohorts. However, our empirical analysis does suggest that classical life-cycle driven tenure choices over cohorts tend to enrich households and lead to more evenly distributed net wealth. A fully structural analysis based on an overlapping generation model would make this feature explicit.

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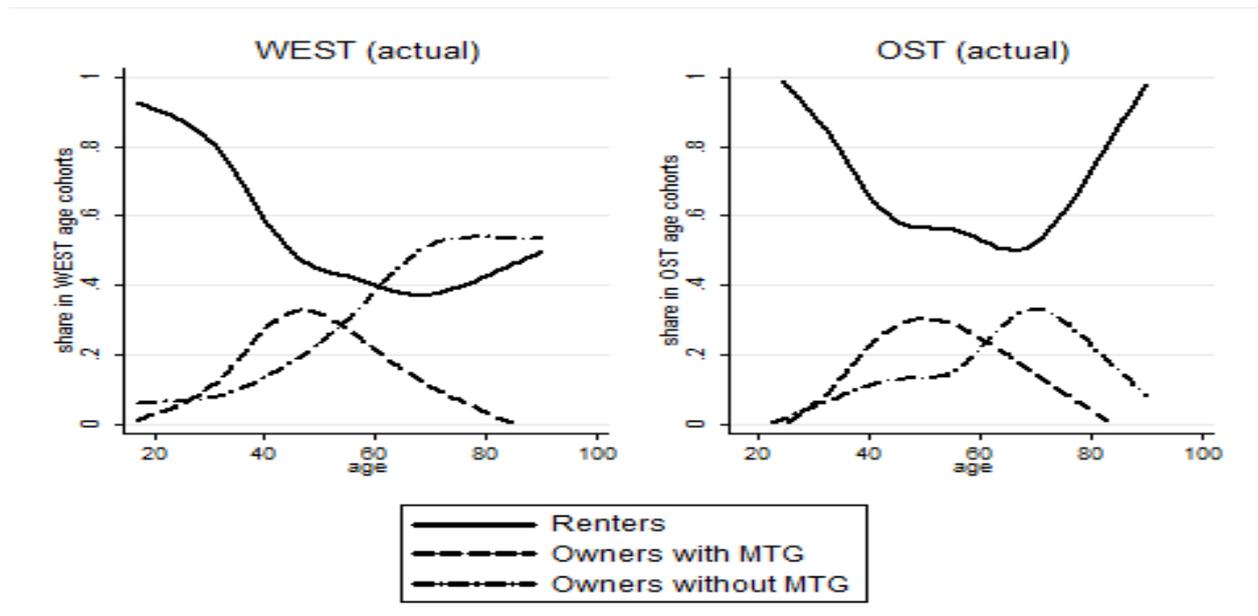
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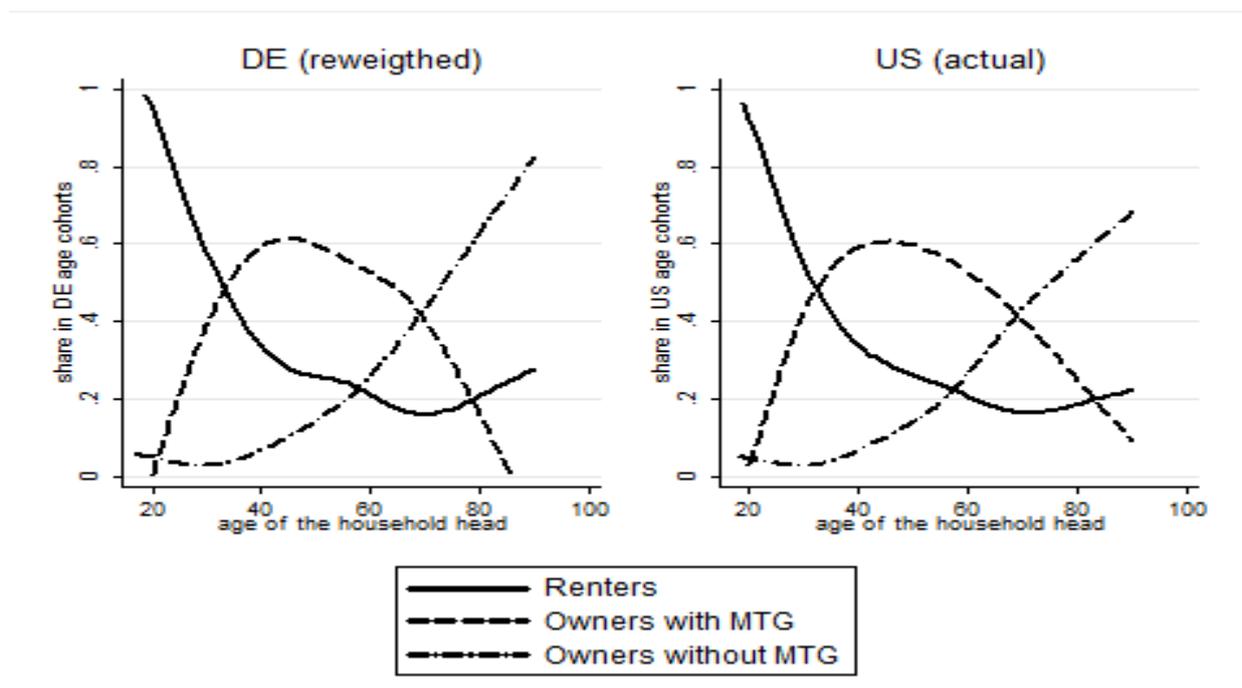
## 8 Appendix

Figure A1 Ownership by cohort, East and West Germany



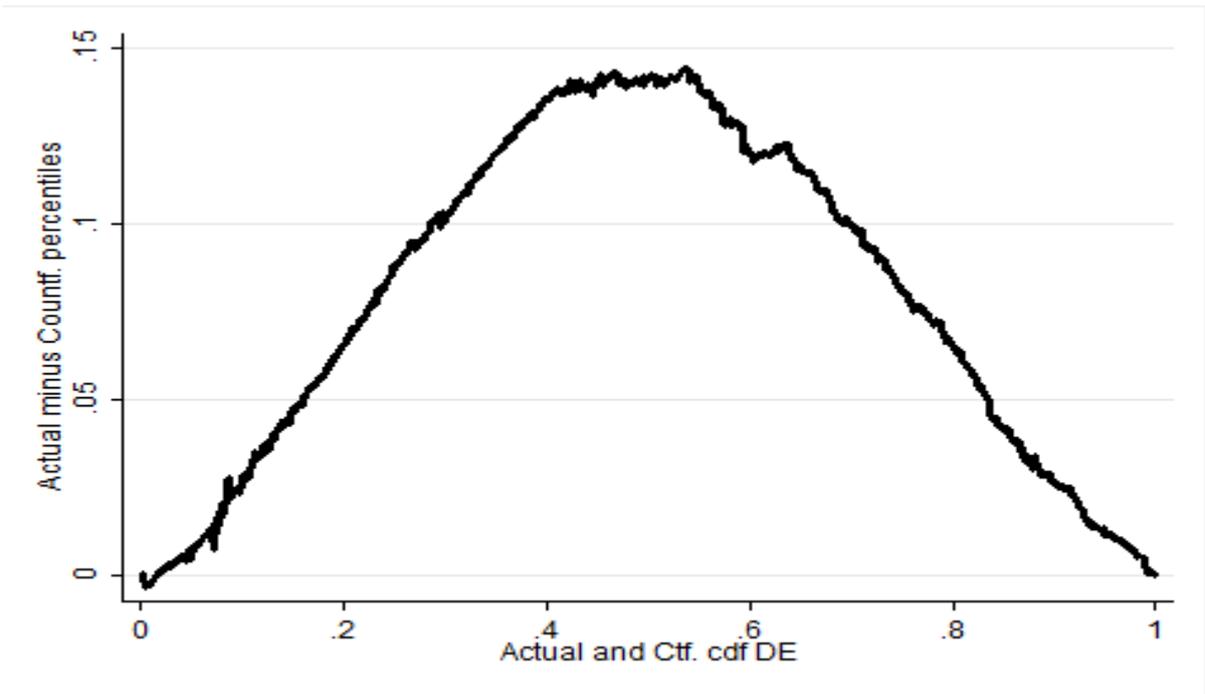
Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata)

Figure A2 COMPARING THE COUNTERFACTUAL GERMAN DISTRIBUTION WITH THE ACTUAL US, WHEN THE BENCHMARK FOR REWEIGHTING IS US ALL COHORTS



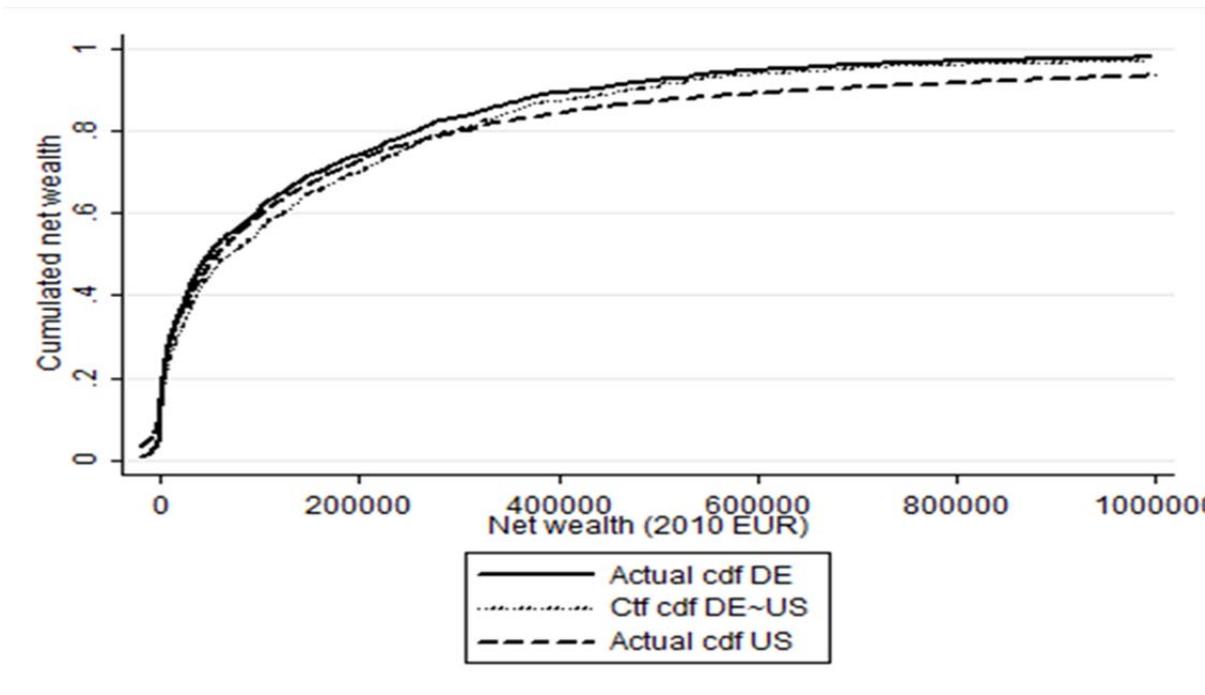
Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata)

Figure A3 COUNTERFACTUAL ANALYSIS WHEN THE BENCHMARK IS US ALL COHORTS: Actual minus Counterfactual CDF



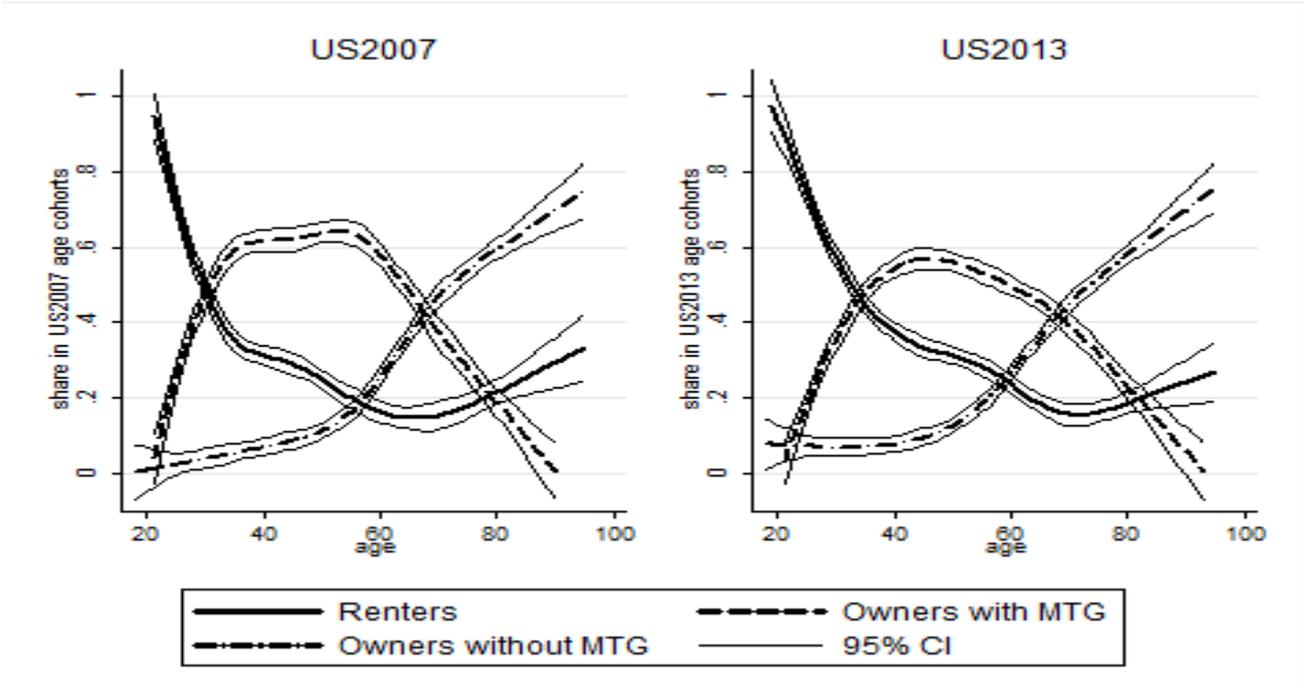
Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata)

Figure A4 COUNTERFACTUAL ANALYSIS WHEN THE BENCHMARK IS US OLD COHORTS: Actual and Counterfactual CDF



Source: Authors' own calculations - PHF 2010 (DOI: 10.12757/PHF.01.01.01.stata)

Figure A5 Ownership by cohort, US 2007 and US 2013



Source: Authors' own calculations SCF 2007 and 2013, weighted.





