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Nils Grevenbrock, Alexander Ludwig, Nawid Siassi

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Nils Grevenbrock†
Alexander Ludwig‡
Nawid Siassi§

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Abstract

Homeownership rates differ widely across European countries. We document that part of this variation is driven by differences in the fraction of adults co-residing with their parents. Comparing Germany and Italy, we show that in contrast to homeownership rates per household, homeownership rates per individual are very similar during the first part of the life cycle. To understand these patterns, we build an overlapping-generations model where individuals face uninsurable income risk and make consumption-saving and housing tenure decisions. We embed an explicit intergenerational link between children and parents to capture the three-way trade-off between owning, renting, and co-residing. Calibrating the model to Germany we explore the role of income profiles, housing policies, and the taste for independence and show that a combination of these factors goes a long way in explaining the differential life-cycle patterns of living arrangements between the two countries.

JEL Classification Codes: D15, E21, H31, R21
Keywords: Homeownership, Co-residence, Overlapping generations

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†Grevenbrock: Private Sector. E-mail: nils.grevenbrock@gmail.com.

‡Ludwig: Goethe University Frankfurt, ICIR, CEPR, Netspar, SAFE, ZEW. E-mail: mail@alexander-ludwig.com.

§Siassi: TU Wien. E-mail: nawid.siassi@tuwien.ac.at.

1 Introduction

Homeownership rates differ widely across developed countries. Within the Euro Area, Germany has the lowest homeownership rate with only 43% of households owning their main residence, whereas in Italy the fraction of homeowners is much higher at 68%, and in Spain even exceeds 83%. These persistent cross-country differences have sparked a large body of research exploring the determinants of the choice between owning and renting. In this paper, we present evidence that co-residence, i.e. living in the parental household, is an important decision to explain this gap—a mechanism, which most of the previous literature has largely overlooked.

We argue that accounting for co-residence is key for understanding homeownership rates for three reasons. Throughout, we mostly focus attention on a comparison of two countries that exhibit particularly striking differences in living arrangements, which put them at the center of the public debate on low versus high homeownership rates—Germany (low) and Italiy (high). First, we show that the fraction of people co-residing with their parents differs significantly across countries. In Germany, roughly 27% of young adults aged 17-40 co-reside with their parents, while Italy has one of the highest co-residence rates among European countries with a value that is more than twice as high at 61%.[1] Second, we argue that these differences manifest themselves in differences in the homeownership rate, the reason being that the latter is conventionally measured on the household level, not the individual level.[2] Comparing again Germany and Italy, we show that for young adults the gap in homeownership rates disappears entirely once co-residing individuals who do not form their own household are correctly accounted for. Third, and most importantly, we argue that the choice between owning, renting and co-residing is intrinsically intertwined and should be studied jointly. In light of this three-way trade-off we ask two main research questions: What are the determinants of the preferred living arrangement along the life cycle? And to what extent do economic factors, housing policies and preferences explain cross-country differences in co-residence patterns and housing choices?

To answer these questions, we build a novel incomplete markets overlapping-generations equilibrium model. At the heart of our model is an intergenerational link between children and their parents, which allows us to embed co-residence as a third form of living arrangement next to owning and renting. Individuals who choose to live with their parents do not have to pay rent, at the expense of incurring a utility loss from the lack of independence. Housing services are provided by the parents and shared among all household members. Importantly, parents take

[1] These estimates are based on the Household Finance and Consumption Survey (HFCS) for the year 2014.

[2] To understand this mechanism, consider a simple two-country example with 50 parents and 50 adult children living in each country. Suppose that in country A the homeownership rate among parents is 100% and the 50 children live in the houses of their parents, thus not forming own households. The homeownership rate per household in country A is thus 100%. Suppose that in country B the homeownership rate among parents is also 100%, but the 50 adult children have moved out of the parental household, formed an own household and live for rent (assuming that they cannot—yet—afford to live in owned houses). Then, the homeownership rate per household in country B is 50%. Per individual, however, the homeownership rate in both countries is 50%.

the economic circumstances and decisions of their children—i.e. their income position, financial assets, housing wealth and their co-residence decision—into account, and vice versa. This gives rise to a rich set of dynamics between family members and is a key contribution of our model. On the aggregate, house prices and rents are determined in equilibrium and depend on a supply technology with diminishing returns in the construction sector.

We calibrate the model to the German economy, taking as inputs the age-dependent individual income process as estimated from the German Socio-Economic Panel (SOEP) as well as housing policy parameters describing the institutional features of the German housing market. The calibrated model matches well key features of the data, such as the pattern of homeownership and co-residence over the life cycle. We then use the model to explore the determinants of these patterns in a series of counterfactual experiments, focusing on Germany and Italy.

Our main results are as follows. First, when replacing the German income process by its Italian counterpart, we find that more individuals choose to co-reside, especially among the young. The intuition is that Italian wages tend to be lower and increase later in life. This induces more people to postpone moving out of the parental household and renting their own apartment. Second, we explore the role of housing policy: Germany is known to have relatively well-functioning rental markets, an extensive social housing sector, and other policies and institutions favoring renters. Against this backdrop, we conduct a stylized experiment where we lower the price-rent ratio, i.e. the relative price of owning versus renting, to match the Italian homeownership rate. Our simulations indicate a substantial drop in the share of renters, bringing the model much closer to the Italian data. Finally, we show that differential preferences for living in a multigenerational household can explain the remaining gap in co-residence patterns. With a weaker taste for independence, the model generates life-cycle profiles for homeownership, rented housing and co-residence that closely resemble the observed patterns in Italy.

Our paper contributes to the burgeoning literature on housing in macroeconomics, surveyed in Davis and Nieuwerburgh (2015) and Piazzesi and Schneider (2016). To our knowledge, our paper is the first to include co-residence as a living arrangement, next to owning and renting, into a quantitative macroeconomic model, which we show to be a very important margin. A large strand of research has focused on understanding the age profile of homeownership. Some of these papers emphasize the importance of collateral and borrowing constraints for explaining the steep initial increase and the flattening out towards retirement (Yang, 2009; Fernández-Villaverde and Krueger, 2011; Ortalo-Magne and Rady, 2006; Goodman and Mayer, 2018). Our paper contributes to this line of research by introducing a novel link between housing tenure choices and co-residence decisions, and by illustrating the difference between homeownership rates measured at the individual and at the household level. Yao and Zhang (2005) argue that the possibility to rent is particularly important for young and poor households who cannot afford the downpayment on a house. Our paper adds to this notion by embedding the co-residence

channel as an informal substitute for renting.

The structural model in our paper builds on the framework developed by Kaas et al. (2021). Exploring potential reasons behind Germany's low homeownership rate, these authors find that taxes and social housing can account for roughly two thirds of the gap in homeownership to the United States. Our framework simplifies their model along some dimensions –e.g. we abstract from house price and rental rate risk–, but explicitly adds an intergenerational link between parents and children, and an endogenous household formation decision. In terms of modeling distortions in the market for rental housing, our paper is closely related to Kindermann and Kohls (2018). These authors develop a general equilibrium life-cycle model to study the negative relation between homeownership and wealth inequality across European countries, and they show that differences in rental market inefficiencies can explain about half of this variation.

Our paper further relates to a strand of literature that tries to quantify the effects of tax policy on homeownership. Many papers focus on the effects of mortgage interest deductibility, e.g., Gervais (2002), Chambers et al. (2009), Sommer and Sullivan (2018) and Floetotto et al. (2016). Yang (2009) highlights the importance of transaction costs for matching the slow downsizing of housing wealth towards the end of the life cycle. On the institutional side, Andrews et al. (2011) shed light on the regulatory differences in the housing market in OECD and Euro Area countries.

Finally, our paper relates to a growing literature that moves beyond the stand-in household assumption and integrates families explicitly into macroeconomic models (Doepke and Tertilt (2016) and Greenwood et al. (2017) provide recent surveys). An important theme in this literature is insurance within the family, e.g. between young and old family members. For instance, Kaplan (2012) studies a model where children have the option to co-reside with their parents as a device to smooth out income shocks. Compared to our model, in his setting parents are not allowed to save, and he does not consider the choice between renting and owning. Barczyk and Kredler (2018) use an overlapping-generations model with imperfectly altruistic generations to model long-term care decisions of families highlighting the importance of informal care. Informal care provision may be an important reason for co-residence potentially adding to the channels we look at in our work.

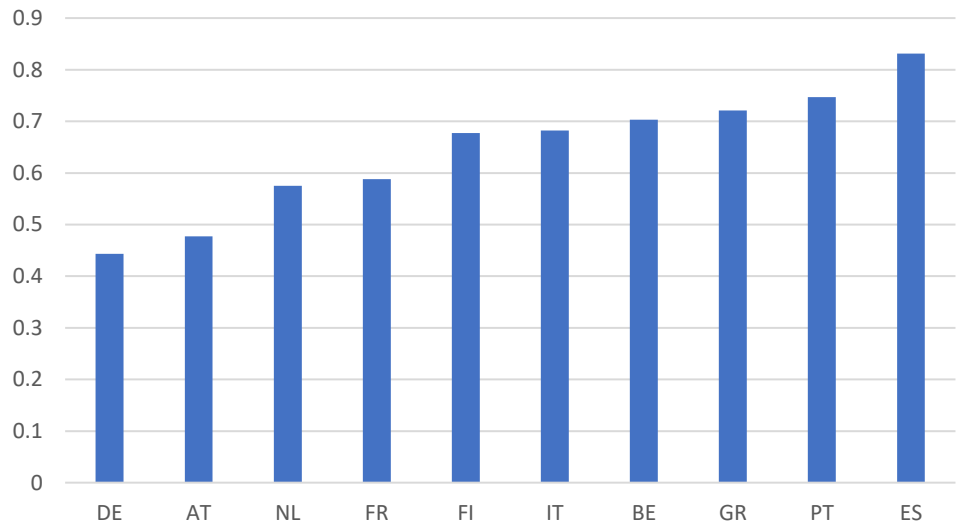
The remainder of the paper is organized as follows. Section 2 presents empirical facts on homeownership rates and co-residence patterns, with a special focus on Germany and Italy. Section 3 describes the structural model. After calibrating the model to Germany and evaluating its fit to the data in Section 4, we conduct our counterfactual experiments in Section 5. Some concluding remarks are contained in Section 6.

2 Empirical Facts

In this section, we document some stylized facts on homeownership and co-residence patterns across European countries. Our main data source is the Household Finance and Consumption Survey (HFCS). This is a well-known harmonized micro data survey that is administered by the European Central Bank. Our analysis is based on the second wave of the HFCS which was collected in 2014, and we restrict our sample to the ten largest Euro Area countries. Even though our presentation can be interpreted in general terms, much of our presentation will be focused on Germany and Italy.

Figure 1 presents homeownership rates across the countries in our sample. As is standard practice in the literature, we define homeowning households to be households that own at least part of their main residence. Figure 1 shows that there are massive cross-country differences in the homeownership rate: In Germany, only about 43% of households are homeowners, almost 25 percentage points lower that in Italy where the homeownership rate is roughly 68%. We will show next that part of this difference can be traced back to the fact that homeownership is conventionally measured at the household level, and not the individual level. It will become clear that this distinction becomes relevant when some individuals decide not to form their own households (and become owners or renters), but instead choose to co-reside with their parents or grandparents.

Figure 1: Homeownership Rates across Euro Area Countries



NOTES: Homeownership rates at the household level.
SOURCE: Own calculations based on HFCS (second wave, 2014).

Figure 2 provides a visual description of the life-cycle patterns of owning, renting and co-residing in Germany and Italy. At this point, it is useful to clarify what we mean by co-residence: We define an individual to be co-residing if her/his (grand-)parents are living in the same household and one of them is classified as the head of household. If the household is not headed by

a (grand-)parent, then the individual is either classified as an owner or a renter.[3] Figure 2 shows that co-residence constitutes an empirically relevant choice of living arrangement in both countries, in particular among young adults. In Germany, roughly 60% of individuals between 17 and 24 co-reside with their parents or grandparents. Among those aged 25 to 32, the share is already considerably lower at 18%, and it then quickly drops to negligible values for older ages. In Italy, co-residence also exhibits a monotonically declining life-cycle pattern, albeit at much higher values. For instance, the share of 17-24 year olds living in their parents' household is close to 95%. Among those aged 25-32, where most of them have completed their education and started their professional career, the share of those co-residing still exceeds 60%. Even in higher age groups, there is a significant share of people who choose to co-reside with their parents. Regarding the other two forms of living arrangement, a well-known pattern appears: young individuals are more likely to be renters, and the homeownership rate then increases over the life cycle.

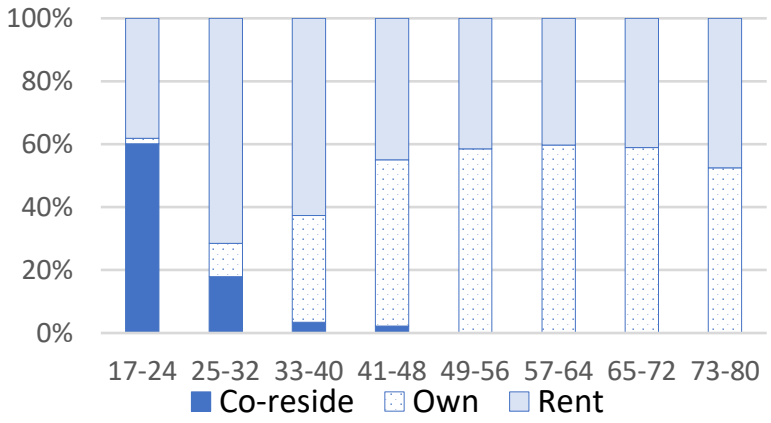
Next, we illustrate why this disparity in homeownership is partially related to the fact that some people choose to co-reside in their parental household. Figure 3 plots the homeownership rates over the life cycle in Germany and Italy. The left panel employs the conventional approach of basing the homeownership rate on the age of the *household* head. By contrast, the right panel measures homeownership rates based on the age of *individuals*, i.e. it shows the actual fraction of people owning their main residence for each age group. Assuming the perspective of the household as the relevant unit of observation (left panel) suggests a significantly higher homeownership rate across all age groups in Italy than in Germany. Does this mean that Italians are much more likely to be owner-occupiers than Germans, at any point of the life cycle? The answer is no. During the first part of the adult life cycle, many of them co-reside with their (grand-)parents and thus do not constitute a household. In fact, the individual ownership profiles in Germany and Italy are barely distinguishable until the age of 48 and only then start to spread out.

An important conclusion is that to understand cross-country differences in homeownership rates it is necessary to account for differences in co-residence patterns. This is particularly true for young individuals, leading us to the question: What determines their choice to live with their parents or grandparents? Next to preferences and cultural factors, income and affordability of rental, respectively owned, housing are prime economic factors that can be relevant when individuals make the decision to co-reside. Figure 4 suggests that the choice of living arrangement may indeed be related to income levels. In this figure, we plot average income by age and living arrangement from the data for Germany. Conditional on age, income-poor individuals are much more likely to be living in the parental household. This is particularly true among the first

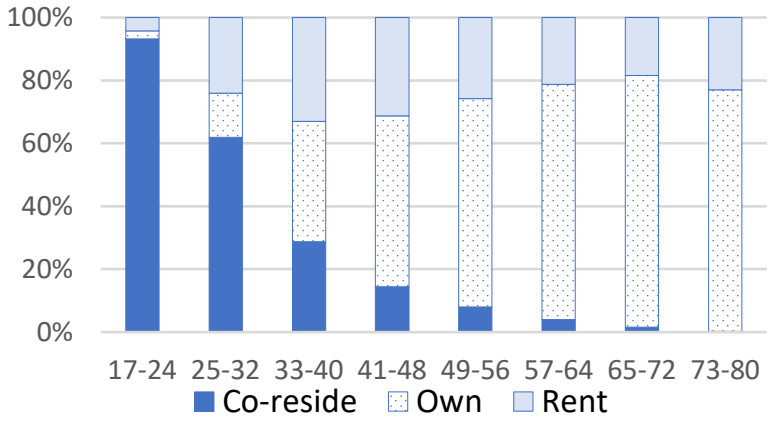
[3]Note that one can also think about co-residing with people of the same age group; however, our focus in this paper is on inter-age group co-residence choices. Also, co-residence should be distinguished from *cohabitation*, which refers to the state of living with another person and having a sexual relationship, without being married.

Figure 2: Split of living arrangements over the life cycle: Germany and Italy

(a) Germany



(b) Italy

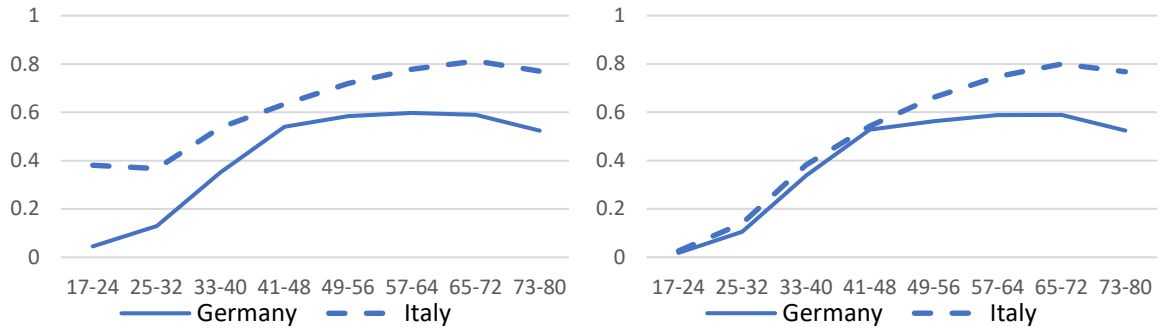


SOURCE: Own calculations based on HFCS (second wave, 2014).

Figure 3: Homeownership over the life cycle: Germany and Italy

(a) Based on age of household head (standard)

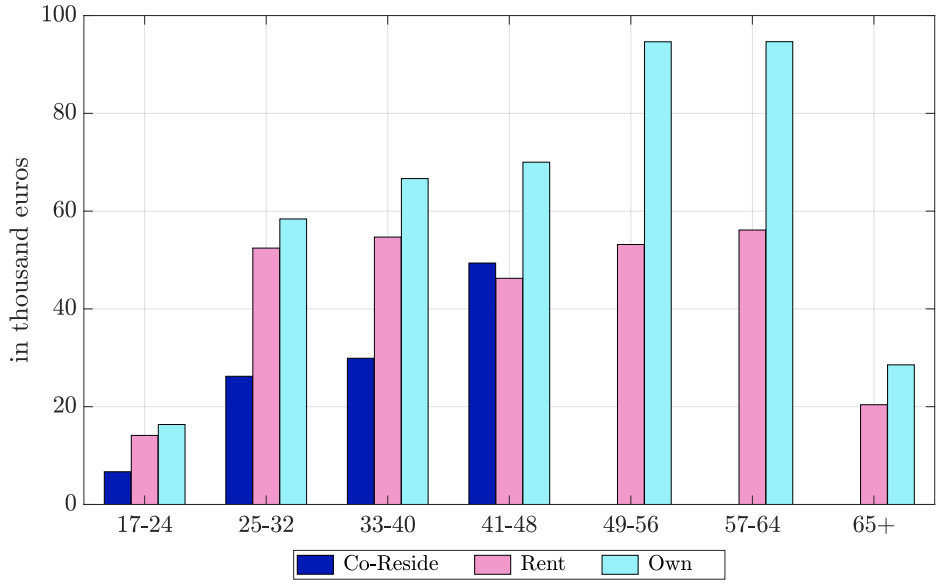
(b) Based on age of individual



NOTES: The figure shows the share of homeowners in Germany (continuous line) and Italy (dashed line). The left panel takes as measurement unit the age of the household head. The right panel takes the age of the individual.
SOURCE: Own calculations based on HFCS (second wave, 2014).

two age groups, which is when co-residence is more prevalent than later in life. This points to co-residence as an informal substitute for formal rental housing when income is low. In a similar vein, the affordability of rental housing might play an important role as well: In well-functioning rental markets, a lower relative price of rental housing versus owner-occupied housing might induce more individuals to become renters. The efficiency of rental housing markets is itself determined by government-mandated housing policies (subsidized social housing, taxation, etc.) as well as the legal regulatory framework. However, it is difficult to identify empirically the contribution of well-functioning rental markets in shaping co-residence and homeownership patterns. Therefore, we now turn to laying out our structural model.

Figure 4: Average income by living arrangement in (Germany)



SOURCE: Own calculations based on HFCS (second wave, 2014).

3 A Life-Cycle Model of Co-Residing, Renting and Owning

We consider an overlapping-generations economy that is populated by households, firms and the government. The model features a housing market where house prices and rental rates are determined endogenously, while wage processes and the safe real interest rate are taken as exogenous. Time is discrete and a period in the model corresponds to one year. We consider a stationary equilibrium where prices and distribution measures are constant over time.

3.1 Households

Demographics. The household model is cast at an annual frequency. Accordingly, denote by $j = \{1, \ldots, J = 65\}$ an individual's age. Individuals enter the economy at model age $j = 1$, which corresponds to the biological age of 17 years, and survive with certainty in each model

period until they die with certainty at the end of age J.[4] Each individual is part of a family where successive generations of parents and children are born 30 years apart. Individuals live through three life-cycle stages. During the first 30 years of their lives (first stage), each period, an individual has the option to co-reside with her/his parents, in which case multiple members of the family live in the same dwelling. If an individual chooses to own or rent a housing unit instead, s/he forms her own household. At model age 31 (second stage), the individual becomes part of the parent generation and is now linked to her/his own children, which are born into the economy at age 31. Since the measure of newborns is the same as the measure of parents, the population size is constant and normalized to unity. At model age 61, the individual becomes part of the grandparent generation (third stage). Overlaying these life-cycle stages are two life-cycle phases, a working phase spanning the model ages $j \in \{1, \ldots, j_r = 48\}$ and a retirement phase for all model ages $j \in \{j_r + 1 = 49, \ldots, J = 65\}$. Note that in this economy the number and the composition of households will be determined endogenously as the result of co-residence decisions made by agents in the model. Figure 5 gives a stylized representation of the time-line of the overlapping generations model by showing the life-cycles of three overlapping generations, labelled as "parents", "children", and "grandchildren".

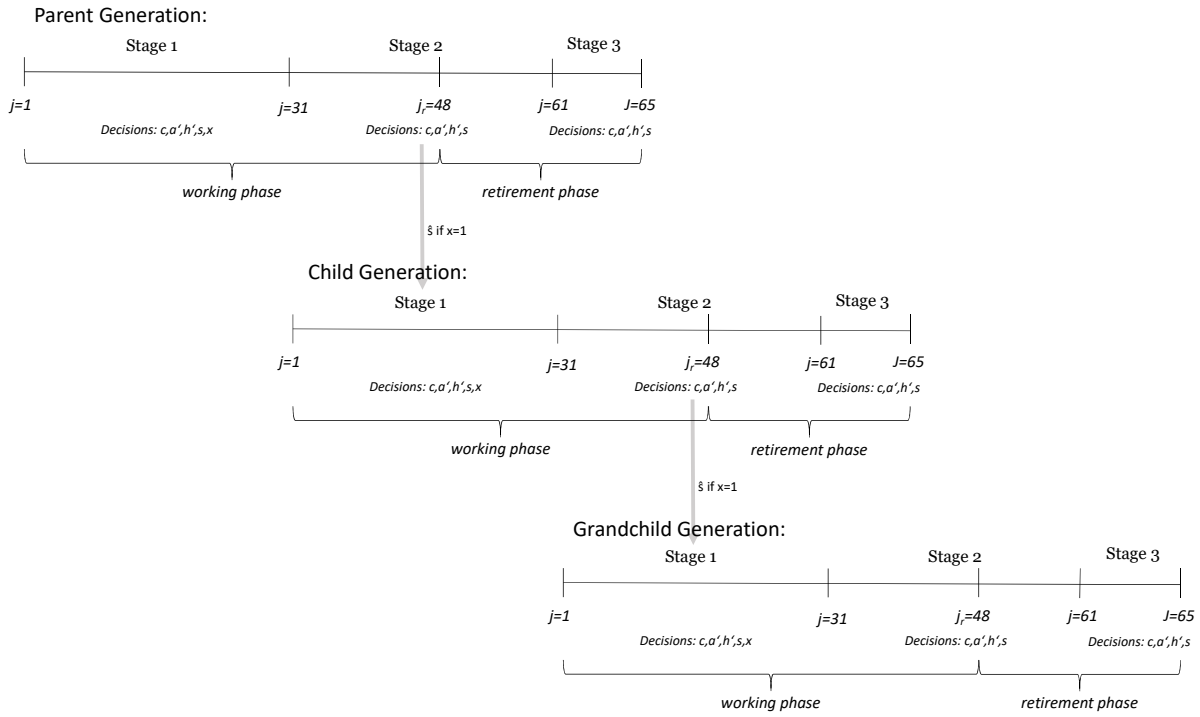
Preferences and Co-Residence. Individuals maximize expected lifetime utility with time discount factor β and period utility $U\big(c, \hat{s}, x; j, \mathbb{1}_{h>0}\big)$, where c denotes consumption of non-housing goods, $\hat{s}$ is consumption of housing services, and $x \in \{0, 1\}$ is an indicator variable for co-residence. We assume that housing services are provided by the parents and shared by all co-residing members of the family. Co-residence affects individuals in two ways. First, due to the sharing of resources, individual consumption of housing services $\hat{s}$ differs from overall housing services purchased by the household, s. Specifically, we will use household equivalence scales that depend on co-residence choices. Second, for children we will embed an age-dependent utility cost from co-residing with one's parents, capturing the desire for independence. Following Kaas et al. (2021), we further include an additional utility gain for retired homeowners, reflecting the notion that retirees may enjoy own housing more than rented housing. When parameterizing our utility function, this utility shifter will only apply to retired individuals ($j > j_r$) and who own $h > 0$ housing units.[5]

Labor and pension income. Gross labor income during working age consists of an age-dependent, deterministic component $\varepsilon(j)$, and a residual random component $\eta(j) \in E(j) =$

[4]Throughout the paper, we will use the term "individual" to refer to the main decision unit in our model. Later on, in the calibration section, we will introduce equivalence scales in order to capture variations in the size of this decision unit, beyond co-residence with one's parents. Therefore, the decision unit can be thought of as representing a generation of a family, where age-specific variations in its size (e.g. getting married and/or having kids) will not be explicitly modeled and taken as exogenous.

[5]This feature allows us to match homeownership rates at old age. We have experimented with an alternative specification where individuals have a bequest motive that distinguishes between housing and financial estates. We have found our results to be relatively similar. Also see Ludwig et al. (2023) for related modeling approaches.

Figure 5: Life-Cycle of Parents, Children and Grandchildren



NOTES: Stylized representation of three overlapping generations (parents, children and grandchildren).

$\left[\underline{\eta}_j, \ldots, \overline{\eta}_j\right]'$,

$$\ln y(\eta, j) = \varepsilon(j) + \eta(j). \tag{1}$$

The residual income component $\eta(j)$ evolves according to a Markov chain with age-dependent transition matrix $\pi\left(\eta(j+1) \mid \eta(j); j\right)$ and age j specific stationary invariant distribution $\Pi(\eta; j)$. Retired individuals receive non-stochastic and constant pension benefits. We assume that retirement benefits are a function of the last realization the income shock prior to retirement, $\eta(j_r)$, partially reflecting the fact that higher earnings lead to higher pension income.[6]

3.2 Assets

Housing. Housing units h can be owned by individuals and rental firms. Houses are restricted to the ordered set of discrete sizes $\mathcal{H} \in \{\underline{h}, ..., \bar{h}\}$, and they are traded at unit price p at the end of the period. One unit of housing provides one unit of shelter. A homeowning individual ($h > 0$) obtains $s = h$ units of housing services. Renting individuals ($h = 0$) buy housing services s at price ρ on the rental market. In every period, the housing stock depreciates at rate δ. As in İmrohoroğlu et al. (2018) and outlined in Piazzesi and Schneider (2016), we assume that homeowners have to pay this fraction of their home value which make it conceptually similar

[6]This is a simplification of Germany's pension system where retirement benefits are linked to an individual's entire earnings history throughout working age. For tractability reasons we do not model a pension stock as an additional state variable that explicitly keeps track of a worker's earnings history.

to maintenance costs. When an individual buys or sells housing units, s/he incurs transaction costs, which are fractions t^b (buyer) and t^s (seller) of the house price:

$$\gamma(h, h') = \begin{cases} t^s p h + t^b p h', & \text{if } h \neq h', \\ 0 & \text{else.} \end{cases} \tag{2}$$

Financial assets. Individuals can save in a risk-free bond at interest rate r, and they can borrow against their houses at mortgage rate $r+\iota$, $\iota > 0$. The mortgage premium ι is exogenous, potentially reflecting monitoring and administrative costs of mortgage lenders. Let a denote an individual's net financial assets. Newborn individuals hold zero assets. Mortgage borrowing is subject to a downpayment constraint,

$$a' \geq -p(1-\theta_j)h', \tag{3}$$

where θ_j is an age-specific downpayment parameter, and a' and h' denote the individual's choice for next period's net financial assets and housing assets.

3.3 Recursive Formulation of the Decision Problems

Our model features intergenerational links between parents and their children, which implies that both groups have to take into account the respective state variables of the other age group. The state vector of an individual is $(a, h, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j)$, where the first three components (a, h, η) summarize her/his own net financial assets, housing assets and labor income. If $j \leq 30$, the next three components $(\tilde{a}, \tilde{h}, \tilde{\eta})$ reflect the state variables of the parents; if $j > 30$, they denote the state variables of the children. Note that due to the fixed age difference between subsequent generations, j determines the age of the other group $\tilde{j}$ as well: $\tilde{j} = j + 30$ if $j \leq 30$, and $\tilde{j} = j - 30$ if $j > 30$.

Let $V(a, h, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j)$ denote an individual's value function. Individuals choose consumption of non-housing goods c, housing services s (unless they are co-residing in which case this will be chosen by their parents), financial assets a', and housing assets h' for next period. During the first 30 years, they also choose whether to co-reside with their parents x. We denote the policy functions by $C(\cdot)$ for consumption, by $S(\cdot)$ for housing services, by $A(\cdot)$ and $H(\cdot)$ for financial and housing assets, and by $X(\cdot)$ for co-residence. Thus, for example, $X(a, h, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j) = 1$ means that an individual of age j with own state variables a, h, η chooses to co-reside with its parents of age $j + 30$ with state variables $\tilde{a}, \tilde{h}, \tilde{\eta}$, and $X(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}) = 1$ means that an individual of age $\tilde{j} + 30$ with own state variables a, h, η has co-residing children of age $\tilde{j}$ and stage variables $\tilde{a}, \tilde{h}, \tilde{\eta}$.

Housing Decision. The discrete choice problem between owning and not owning—respectively the size of the house conditional on owning—is described by

$$V(a, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j) \;=\; \max_{h \in \{0, \mathcal{H}\}} \Big\{ V(a, h, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j) \Big\}. \tag{4}$$

Homeowners. Let $V(a, h > 0, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j)$ denote the value function of an individual who currently *owns* a house of some size $h \in \mathcal{H}$. This individual solves the recursive problem

$$V(a, h > 0, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j) = \max_{c,a',h'} U\big(c, \hat{s}, 0; j, 1\big) + \beta \mathbb{E}_{\eta', \tilde{\eta}' | \eta, \tilde{\eta}, j} \Big[V(a', \eta', \tilde{a}', \tilde{h}', \tilde{\eta}', j+1) \Big] \tag{5}$$

subject to

$$c + a' + ph' + \delta ph + \gamma(h, h') = y(\eta, j) - T_j(\bar{y}) + ph + \big[1 + r\mathbb{1}_{a>0} + (r+\iota)\mathbb{1}_{a<0}\big]a, \tag{6}$$

$$\bar{y} = y(\eta, j) + r \max(a, 0), \tag{7}$$

$$a' \geq -p(1-\theta_j)h', \text{ and } h' \in \mathcal{H} \cup \{0\}, \tag{8}$$

$$\hat{s} = h/n(X(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}), j) \tag{9}$$

$$\tilde{a}' = A(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}), \tag{10}$$

$$\tilde{h}' = H(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}). \tag{11}$$

Equation (6) is the budget constraint, which states that expenditures on consumption, financial and housing assets, maintenance costs, and transaction costs for buying/selling must be equal to the sum of labor (or pension) income net of taxes, and financial and housing assets. Taxes are a function $T_j(\bar{y})$ of the tax base $\bar{y}$, which is defined in equation (7) as the sum of labor and asset income. For simplicity, we assume that during retirement income is not taxed. Equation (8) is the borrowing constraint. Equation (9) maps overall housing services into individual consumption of housing services by using equivalence weights, denoted by $n(x, j)$, for households that have co-residents ($n(x = 1, j)$) and those that do not ($n(x = 0, j)$). Equations (10) and (11) define the laws of motion for financial and housing assets by the parents/children, respectively, as described by their policy functions.

None-Homeowners. Next, denote by $V(a, h = 0, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j)$ the value function of an individual who currently *does not own* a house. This individual can choose housing services s on the rental market. If the individual is of age $j \leq 30$, s/he also has the alternative option of co-residing with its parents. The recursive problem reads as follows:

$$V(a, h = 0, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j) = \max_{c,s,x,a',h'} U\big(c, \hat{s}, x; j, 0\big) + \beta \mathbb{E}_{\eta', \tilde{\eta}' | \eta, \tilde{\eta}, j} \Big[V(a', \eta', \tilde{a}', \tilde{h}', \tilde{\eta}', j+1) \Big] \tag{12}$$

subject to

$$c + a' + ph' + \gamma(0, h') = y(\eta, j) - T_j(\bar{y}) - \mathbb{1}_{x=0}\rho s + \left[1 + r\mathbb{1}_{a>0} + (r+\iota)\mathbb{1}_{a<0}\right]a, \tag{13}$$

$$\bar{y} = y(\eta, j) + r\max(a, 0), \tag{14}$$

$$a' \geq -p(1-\theta_j)h', \text{ and } h' \in \mathcal{H} \cup \{0\}, \tag{15}$$

$$\hat{s} = \begin{cases} S(\tilde{a}, \tilde{h}, \tilde{\eta}, a, 0, \eta, \tilde{j})/n(x=1, j) & \text{if } x = 1, \\ s/n(X(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}), j) & \text{otherwise,} \end{cases} \tag{16}$$

$$x \in \{0, 1\} \text{ if } j \leq 30, \text{ and } x = 0 \text{ otherwise,} \tag{17}$$

$$\tilde{a}' = A(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}), \tag{18}$$

$$\tilde{h}' = H(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}). \tag{19}$$

The distinction between renting and co-residing is reflected in equation (16), where $S(\cdot)$ denotes the policy function for housing services. Note that $S(\tilde{a}, \tilde{h}, \tilde{\eta}, a, 0, \eta, \tilde{j})$ describes the housing services that are chosen by the parents. Thus, if $j \leq 30$ and $x = 1$, then $S(\tilde{a}, \tilde{h}, \tilde{\eta}, a, 0, \eta, \tilde{j})/n(x = 1, j)$ is the housing service flow utility that a child of age j experiences from co-residing with its parents. The second line in equation (16) reflects the case where the individual is a renter and co-resides with her/his children, i.e. if children choose $X(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}) = 1$ or not, i.e. if children choose $X(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}) = 1$.[7] If the individual chooses to rent ($x = 0$), s/he can choose s freely, but has to pay expenditures on rent as reflected in the budget constraint (13). Equation (17) imposes an age restriction on the option of co-residing, and equations (18) and (19) mirror those from an owner's problem above.

3.4 Rental Firms and Construction Sector

We follow Kaas et al. (2021) in their modeling of the real-estate market and assume that rental firms need to pay monitoring costs μ per unit of rented housing. These costs reflect the information asymmetry between a real-estate firm and its renters, and they create a wedge between prices and rents that imply a motive for homeownership. The market of real-estate firms is competitive. As a result, the zero-profit condition implies that house prices and rental rates are related as

$$(r + \delta)p = \rho - \mu. \tag{20}$$

There is a construction sector producing housing units. Production entails costs which are convex and increasing in housing units, $K(I)$ with $K'(I) > 0$, and $K''(I) > 0$. The maximization problem of the construction sector implies

$$p = K'(I). \tag{21}$$

Denote by $\bar{H}$ the total housing stock. In steady state,

$$\delta\bar{H} = I, \tag{22}$$

[7] Recall that for $j > 61$, i.e. for grandparents, $X(\tilde{a}, \tilde{h}, \tilde{\eta}, a, h, \eta, \tilde{j}) = 0$ always.

i.e., investment in new housing equals depreciation.

3.5 Government

The government levies taxes on income for working-age individuals, and it pays out pension benefits to retirees. The tax base $\bar{y}$ is composed of labor and asset income, and is taxed according to the nonlinear function

$$T_j(\bar{y}) \;=\; \begin{cases} \bar{y} - (1-\tau)(\bar{y})^{1-\lambda} & \text{if } \; j \leq 48, \\ 0 & \text{else,} \end{cases} \tag{23}$$

where $\tau \in [0,1)$ and $\lambda \in [0,1]$ are two parameters characterizing the level and progressivity of the tax-transfer system (see Benabou (2002) and Heathcote et al. (2017)), with higher values of τ reflecting higher average tax levels and higher values of λ reflecting a higher degree of progressivity of the tax code. We assume a balanced budget and assume that any excess tax revenue is spent on public goods G, which do not affect individuals' decisions.

3.6 Equilibrium

A stationary equilibrium in this economy is a set of value functions $\{V\}$, a set of policy functions $\{C, S, A, H, X\}$, a stationary distribution Φ of individuals over states $(a, h, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j)$, a house price p, a rental rate ρ, construction I, a housing stock $\bar{H}$, such that:[8]

1. Value and policy functions solve the problems specified in equations (5)–(19).
2. Real-estate firms maximize profits which implies (20).
3. Construction firms maximize profits which implies (21).
4. All housing units are occupied
$$\bar{H} \;=\; \int S(a, h, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j)\; d\Phi(a, h, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j).$$
5. The housing stock is stationary and satisfies $\delta \bar{H} = I$.
6. The government budget constraint clears:
$$G = \int T_j(\bar{y}(a, \eta, j))\; d\Phi(a, h, \eta, \tilde{a}, \tilde{h}, \tilde{\eta}, j).$$
7. $\Phi(\cdot)$ is a stationary distribution induced by the exogenous processes and the policy functions.

We note that the last condition of this definition also entails a constraint on the distribution of newborns. In a stationary equilibrium, the distribution of newborns over parents' states has to be identical to the actual distribution of parents at age 31. Since this distribution of parents is itself a function of the initial distribution, this implies a fixed-point equilibrium constraint.

[8] In our model parents and children make simultaneous decisions that have to be mutually consistent. In principle, this could lead to multiple equilibria. However, in our quantitative exercises, we have never encountered such a case.

4 Functional Forms and Calibration

We calibrate the model to Germany. Unless otherwise noted, we use data from the German Socio-Economic Panel (SOEP) for the time period 1992-2015. The SOEP is a representative household survey covering a wide range of socio-economic variables, and is comparable to the Panel Study of Income Dynamics (PSID) in the United States.

4.1 Calibration

Our calibration strategy proceeds in two steps. First, we set some parameter values outside of the model using external estimates from our data or other studies. Second, we calibrate the remaining subset of parameters internally in order to match selected data targets.

4.1.1 Equivalence scales

We apply household equivalence weights to capture variations in household size over the life cycle. In our model, there are two components affecting the size of the household. The first component is the endogenous co-residence decision, which can result in multiple generations living in the same household. The second component is age-dependent and deterministic, reflecting other variations in family size over the life cycle that we do not explicitly consider in our model (singles vs. married/cohabiting couples, children, etc.). Equivalence weights are real number representations of these two components. To derive these equivalence weights, we proceed as follows. First, we compute the average number of adults and children for each age group.[9] Second, we weight the average number of adults and kids in accordance with the modified OECD equivalence weights (Hagenaars et al. (1994)). Table 1 reports our parameter values.

Table 1: Equivalence weights

Age	17-24	25-32	33-40	41-48	49-56	57-64	65-72	73-81
No co-residence ($n(x=0,j)$)	1.4017	1.3741	1.7682	1.8112	1.4326	1.3881	1.3058	1.2119
Co-residence ($n(x=1,j)$)	2.3343	2.2623	2.2081	2.1448	2.3343	2.2623	2.2081	2.1448

4.1.2 Preferences

The utility function for an individual is specified as

$$U\big(c,\hat{s},x;j,\mathbb{1}_{h>0}\big) \;=\; \frac{n(x=0,j)}{1-\sigma}\left[\left(\frac{c}{n(x=0,j)}\right)^{\zeta}\left((1+\xi\cdot\mathbb{1}_{h>0}\mathbb{1}_{j>j_r})\cdot\hat{s}\right)^{1-\zeta}\right]^{1-\sigma} - \mathbb{1}_{x=1}\alpha(j),$$

[9] To obtain the average number of children for an age group, we multiply the fertility rate per head. According to OECD data, the average fertility rate (birth per woman) in Germany between 1992-2014 was 1.352 which implies 0.676 kids per head.

where σ is the coefficient of relative risk aversion[10], and ζ is the expenditure share for non-housing consumption goods. Per-capita consumption of non-housing goods is obtained by dividing by the equivalence scale $n(x = 0, j)$. For housing services, per-capita consumption $\hat{s}$ depends on whether the individual is co-residing with her/his parents or children, $\hat{s} = s/n(x = 1, j)$, or not, $\hat{s} = s/n(x = 0, j)$. The shift parameter $\xi \geq 0$ reflects additional utility benefits for retired homeowners ($h > 0 \wedge j > j_r$). We set this parameter to match the homeownership rate among retired individuals, reflecting the idea that retirees may enjoy own housing more than rented housing. Finally, we include an age-dependent utility cost from co-residing with one's parents, capturing the desire for independence. We model the disutility as a simple linear function of age, $\alpha(j) = \alpha_0 \cdot j$, where α_0 is a parameter.

4.1.3 Income process and pensions

For our model, we cannot take household labor income for the estimation of the exogenous income process, because household sizes are partly an endogenous outcome. Therefore, we proceed in two steps. First, we estimate gross labor income profiles at the individual person level for non-retired male individuals. Second, we multiply this value with the average number of working individuals in an age group. We pool all waves in our sample and posit the following specification,

$$\ln y_{i,t} = \sum_{j=1}^{j_r} \nu_j d_j + \sum_{t=1993}^{2015} D_t + \epsilon_{i,t}, \tag{24}$$

where D_t are dummy variables for all years in our sample, and d_j is a set of age dummies translated into model age. We estimate (24) via ordinary least squares (OLS) and use the estimated coefficients $\{\nu_j\}_{j=1}^{j_r}$ to construct the age-dependent deterministic labor income component in our model. The estimation of the stochastic component follows a strategy similar to De Nardi et al. (2020) and Kaas et al. (2021). We use the residuals from the previous regression to construct age-dependent discrete Markov processes for residual income dynamics. To this end, we define five bins $\eta_{j,pc} \in \{\eta_{j,1}, ..., \eta_{j,5}\}$ representing the quintiles of the residual income distribution at age j (with $\eta_{j,1} < \eta_{j,2} < ... < \eta_{j,5}$). For each $\eta_{j,pc}$, we assign its mean value. The elements of the Markov transition matrices are calculated as the proportions of individuals that are in bin pc at age j and move to bin pc' at age $j + 1$. In order to make the transition matrices uniformly stationary, we translate the transition matrices into doubly stochastic matrices following a Sinkhorn-Knopp algorithm (Sinkhorn (1964)) as in Kaas et al. (2021).[11] Finally, retirement income is calculated as follows. We assume that pension benefits are a function of the last

[10] Of the total consumption bundle $\left(\frac{c}{n(x=0,j)}\right)^{\zeta} \left((1 + \xi \cdot \mathbb{1}_{h>0}\mathbb{1}_{j>j_r}) \cdot \hat{s}\right)^{1-\zeta}$.

[11] In practice, since we will present most of our results over the life cycle in eight-year intervals, we group individuals in eight-year bins and base our estimates of labor income on these age bins. Moreover, we observe a large number of workers dropping out of the labor force in the years prior to the mandatory retirement age of 65. Since our focus in this paper is not on endogenous retirement decisions, we assign the labor income of the second-to-last working-age bin also to the last working-age bin.

realization of η prior to retirement. Following Kaas et al. (2021), we set pension income at 42% of average earnings in the respective quintile across all ages, and we apply caps at 7,200 euros and 38,400 euros. The upper cap is based on a maximum contribution threshold for the public retirement system, while the lower cap is based on old-age security.

4.1.4 Externally calibrated parameters

Table 2: Externally calibrated parameters

Description	**Parameter**	**Value**	**Source**
Risk aversion	σ	2	Standard value
Expenditure share	ζ	0.717	Consumption shares
Depreciation rate	δ	0.01	100-year housing lifespan
Downpayment req.	θ_j	0.2 (for $j \leq j_r$)	Chiuri and Jappelli (2003)
Transaction costs	(t^b, t^s)	$(0.108, 0.029)$	Kaas et al. (2021)
Real interest rate	r	0.0249	External estimate
Real mortgage premium	ι	0.0182	External estimate
House sizes	$h \in \mathcal{H}$	$\{80, \ldots, 400\}$	See text
Supply elasticity	φ	2.34	Caldera and Johansson (2013)
Progressivity	τ	44.3%	SOEP
Level of taxation	λ	37.5%	SOEP

Table 2 summarizes the externally calibrated parameters. The coefficient of relative risk aversion σ is set to a standard value of 2. The share of expenditures on non-housing consumption ζ is set to 0.717 as in Kaas et al. (2021). We also adopt the housing transaction costs from their study and set $t^b = 0.108$ and $t^s = 0.029$. The depreciation rate is set to 0.01, in accordance with a housing lifespan of 100 years. Downpayment requirements are based on estimates from Chiuri and Jappelli (2003) and set to 20% of the house value during working age ($j \leq j_r$). We disallow mortgages during retirement by setting the downpayment requirement for $j > j_r$ to 1. The real interest rate and the real mortgage rate are based on estimates for the yield on 10-year government bonds and 10-year fixed rate mortgage rates giving $r = 0.0249$ and $\iota = 0.0182$. As for the set of house sizes, we specify an equidistant 10-node grid between 80k euros and 400k euros. The minimum house size corresponds to a value just below the 10th percentile of the housing wealth distribution in the SOEP sample as estimated by Kaas et al. (2021). The maximum house size is chosen large enough such that the fraction of individuals who would buy an even larger house is negligible (we verify this in our numerical solution). Turning to the construction technology, we follow Kaas et al. (2021) and assume $K(I) = \kappa_0 I^{1+\varphi}/(1+\varphi)$, where κ_0 is a construction cost parameter. Caldera and Johansson (2013) estimate the long-run price elasticity of new housing supply in Germany at 0.428, which leads to $\varphi = 2.34$. The parameters of the income tax function are again based on Kaas et al. (2021)'s estimates. Using SOEP data, these authors estimate τ and λ for different age groups by relating taxable income with net income.

We compute an average value of their estimates for working-age periods and set $\tau = 44.3\%$ and $\lambda = 37.5\%$ accordingly. The value for λ indicates that the German tax-transfer system exhibits a strong degree of tax progressivity.

4.1.5 Internally calibrated parameters

Table 3: Internally calibrated parameters

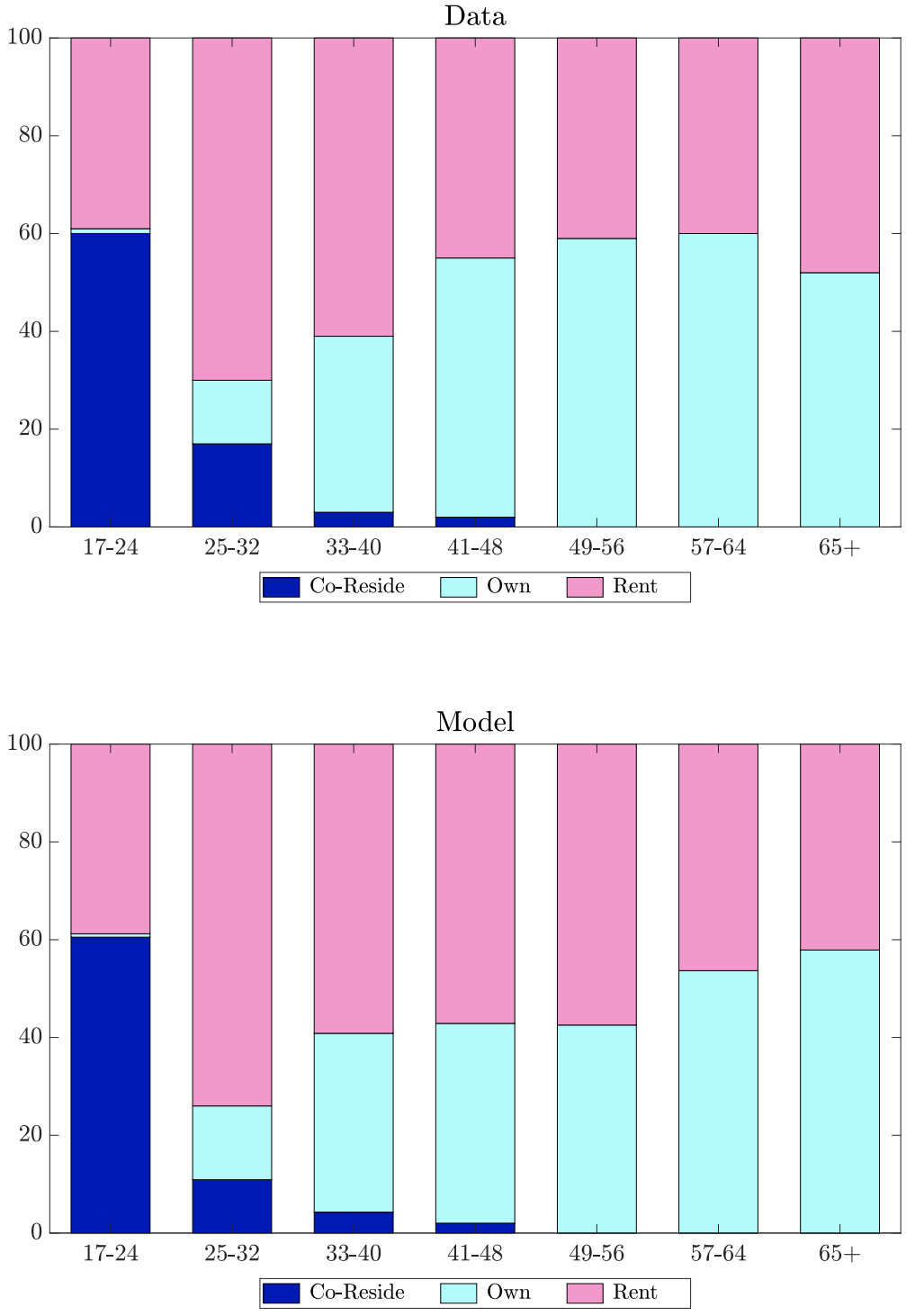
Description	**Param.**	**Value**	**Moment**	**Target**	**Model**
Discount factor	β	0.942	Average wealth	147.0	146.9
Monitoring cost (%)	μ	1.661	Homeownership (%)	42.8	42.7
Utility weight owner 65+	ξ	1.556	Homeownership 65+ (%)	58.0	57.6
Taste for independence	α_0	0.00084	Co-residence (%)	20.5	20.7
Construction cost	κ_0	0.1682	Normalization $p = 1$	–	–

The remaining parameters, summarized in Table 3, are calibrated jointly within the model to match the following data moments, where we report in parenthesis the most closely associated parameter and its calibrated value: (1) average wealth across households is 147k euros ($\beta = 0.942$); (2) the overall homeownership rate is 42.8% ($\mu = 1.661$); (3) the homeownership rate among retired households is 58% ($\xi = 1.556$); (4) the overall co-residence rate is 20.5% ($\alpha_0 = 0.00084$); (5) the construction cost parameter κ_0 is set using conditions (21) and (22), whereby we normalize the price per housing unit to $p = 1$ ($\kappa_0 = 0.1682$).

4.2 Model Fit

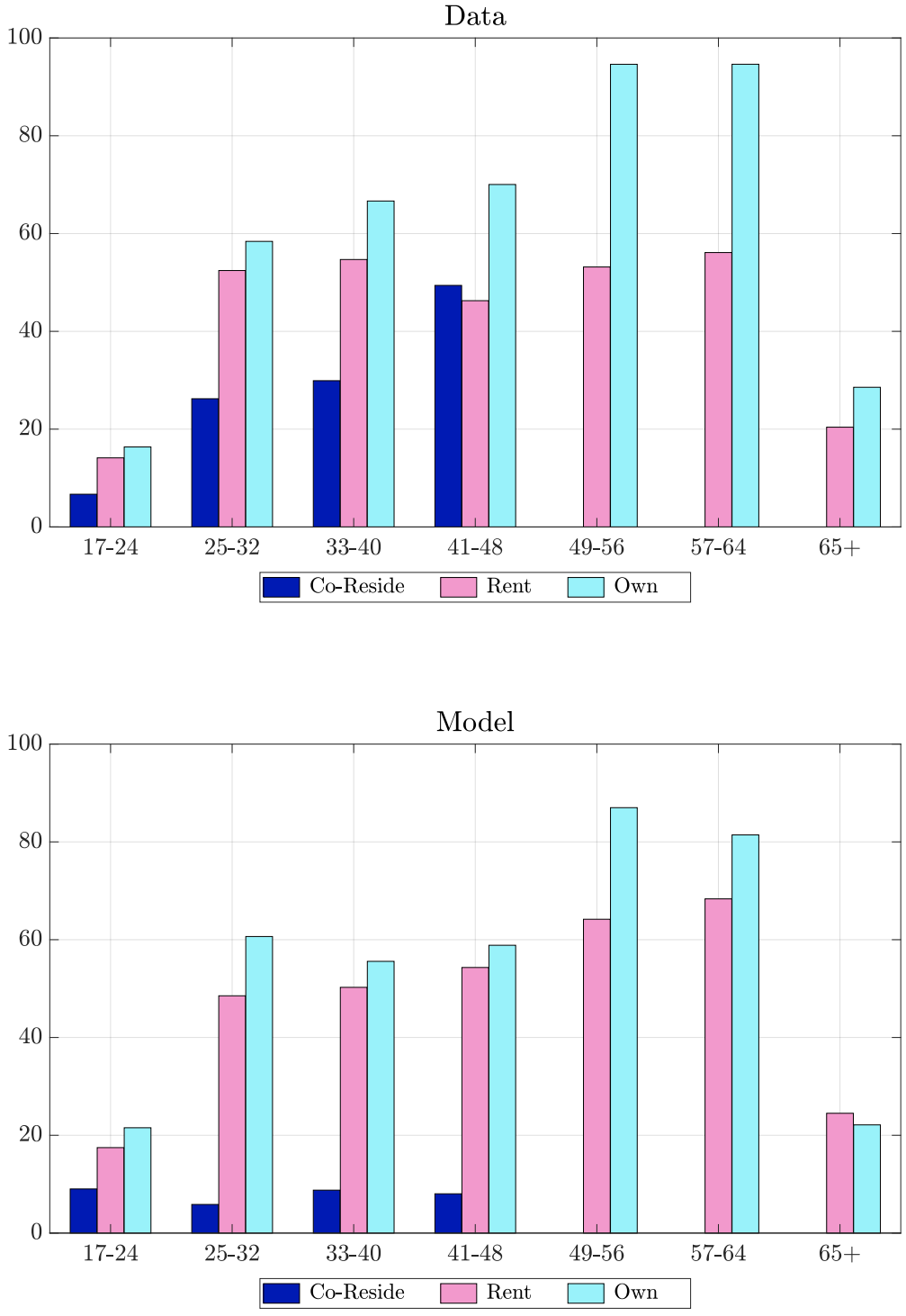
We now assess the fit of the benchmark model, with a focus on the empirical facts documented in Section 2. Figure 6 compares the life-cycle patterns of owning, renting and co-residence between the data and our benchmark model. The top panel in this figure is identical to the graph that we presented in Section 2, and it shows the split of living arrangements in the data. The bottom panel depicts the corresponding life-cycle patterns in our model. There are three important features worth noting. First, the model generally does a good job of capturing the evolution of owning, renting and co-residing by age. While young individuals tend to either live with their parents or be renters, the share of owner-occupiers gradually increases during working age and then reaches a value of about 60% upon retirement. Second, despite our simple and parsimonious specification for the disutility from living with one's parents, the model generates an age profile of co-residence that comes very close to the empirical profile (recall that we only target the overall average). Remarkably, the model matches the co-residence rate in the youngest age group almost exactly. It then slightly overpredicts co-residence among individuals in their 30s and 40s, at the expense of slightly underpredicting the value in the 25-32 years age group. Third, the division between owners and renters is captured reasonably well. While there are

Figure 6: Split of living arrangements (Data vs. Model)



Source: Own calculations based on HFCS (second wave, 2014) and SOEP.

Figure 7: Average income by living arrangement (Data vs. Model)



Source: Own calculations based on HFCS (second wave, 2014) and SOEP.

some quantitative differences in the second half of the life cycle, the fit is quite good in the first half, which is more relevant for the focus of this paper.

Figure 7 shows average income levels by living arrangement and age. Again, the top panel repeats the graph presented in Section 2; the bottom panel displays the model equivalent. An important observation is that the choice of living arrangement by individuals in the model is strongly linked to their current income. Focusing on the first age group, individuals forming their own households (renting or owning) earn on average more than twice as much as those living with their parents. Quantitatively, in this age group the model generates a distribution that comes very close to the one in the data. Among older age groups, the model predicts that only very income-poor individuals choose co-residence as their preferred living arrangement. While income levels among co-residents are generally also lower than among renters/owners in the data, the disparity is much smaller. One potential explanation is that economic reasons may not be the only determinant of co-residence choices, and that non-economic reasons may play an increasingly important role later in life. Regarding the split between renting and owning, the model generally predicts that, conditional on age, higher incomes are more likely to lead to homeownership. This fact is consistent with the data as well, albeit the differences are even more pronounced there.

To summarize, the benchmark does a satisfactory job of capturing the key life-cycle patterns of homeownership and co-residence in Germany. In the next section, we will explore the determinants behind these patterns, and explore to what extent they are responsible for the stark differences in living arrangements between Germany and Italy.

5 Drivers of Co-Residing, Renting and Owning

In this section we conduct a series of counterfactual experiments in order to quantify the effects of various forces on co-residence patterns and homeownership rates. Our starting point is the baseline model, which is calibrated to the German economy. We will then sequentially examine the role of three factors that have the potential to bridge the gap in living arrangement patterns between Germany and Italy: the life-cycle profile of income, the relative price of renting vs. owning, and the taste for independence.

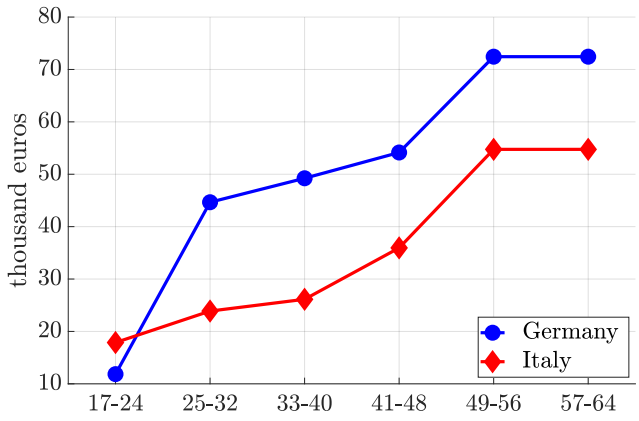
Counterfactual 1 (C1): Italian income process.

In our first counterfactual experiment, we replace the German income process by its Italian counterpart. We estimate the Italian income process using data from the Survey on Household Income and Wealth (SHIW). This is a representative household survey administered by the Bank of Italy, which shares many commonalities with the SOEP.[12] We apply the same estima-

[12] One difference is that the survey gathers information on after-tax labor income. We use the OECD tax-benefit calculator to approximate gross income levels.

tion techniques as for the German labor income process to back out the deterministic and the stochastic component. Figure 8 below depicts the Italian income profile in comparison to the German income profile. As can be seen, Italian wages are generally lower, but more strikingly, they tend to increase much later in life. As a reference point, consider the income of a person in her/his early 20s, which is the age at which most people have completed their formal education and start their professional career. At this age, average income levels in both countries are not too different at around 20k euros. However, ten years later, Germans make on average more than twice as much, while Italian wages have barely increased. In fact, the average Italian has to wait until her/his late 40s to reach the same income level. The implications for co-residence decisions early in life therefore seem obvious: perhaps many young people simply cannot afford (or do not want to afford) moving out of the parental household.

Figure 8: Average labor income



SOURCE: Own calculations based on SOEP and SHIW.

This intuition is confirmed by our numerical results. Figure 8 plots co-residence and homeownership rates arising from our counterfactual simulations, where the top panels refer to the scenario where we feed into our model the Italian income process. Table 4 complements these results by presenting selected further statistics. Among the relevant group of individuals aged 17-48, the overall co-residence rate rises by 2.5 percentage points. This increase is mostly concentrated in the youngest age groups, where lower income levels induce more individuals to live with their parents. Interestingly, under Italian wages the homeownership declines significantly, even though lower income levels are partially accommodated by a decline in house prices, because housing demand is reduced as well. Therefore, despite the fact that this counterfactual brings the model somewhat closer to the Italian economy in terms of co-residence choices, it cannot account well for the choice between renting and owning. We explicitly address this point in our next counterfactual.

Counterfactual 2 (C2): Housing policy.

In our model, the relative price of rental housing versus owner-occupied housing is governed

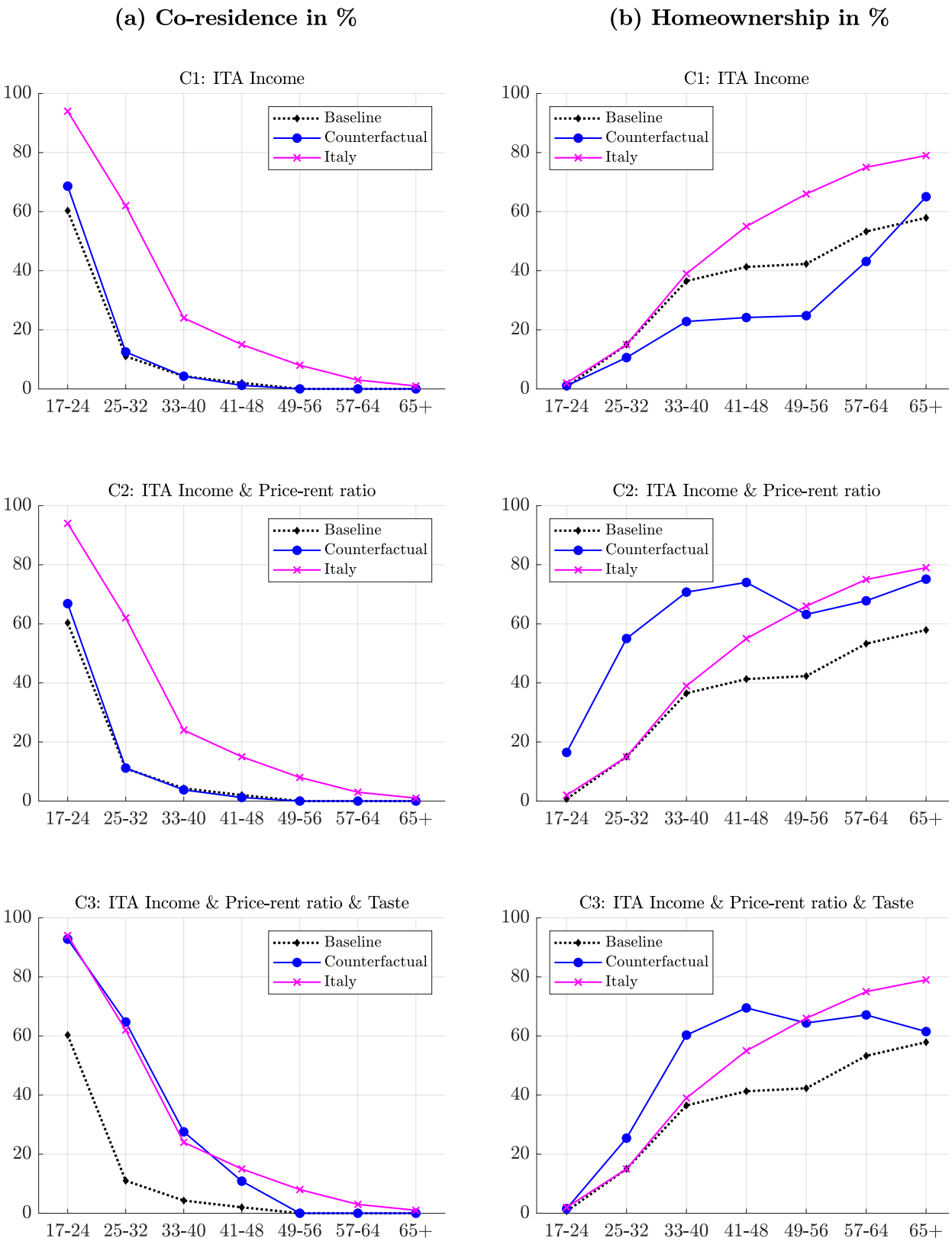
Table 4: Counterfactual experiments: Main results

	Baseline	C1	C2	C3	Italy
Co-Residence† (%)	20.7	23.1	22.1	52.2	51.9
17-24	60.3	68.6	66.8	92.8	94.1
25-32	11.0	12.5	11.2	64.7	62.3
33-40	4.3	4.3	3.8	27.6	24.2
41-48	2.0	1.2	1.2	10.9	14.7
Homeownership (HH., %)	42.7	36.5	69.5	68.0	68.0
Homeownership (indiv., %)	38.4	32.6	62.4	51.6	52.0
17-32	7.9	5.8	35.7	13.5	16.6
33-48	38.9	23.5	72.3	64.9	47.9
49-64	47.8	34.0	65.5	65.8	70.2
65+	57.9	65.0	75.1	61.5	78.6
Wealth	146.0	136.0	177.5	220.2	–
House price	1.000	0.967	0.861	0.824	–
Price-rent ratio	19.4	19.2	16.8	17.0	–

NOTES: †The overall co-residence rate is computed for individuals aged 17-46, which is consistent with the assumptions in the model. C1: counterfactual experiment replacing the German with the Italian income process, cf. Figure 8. C2: counterfactual experiment C1 plus additionally lowering the price rent ratio from 19.2 to 16.8 to match the average homeownership rate in Italy. C3: counterfactual experiment C2 plus additionally increasing the taste for independence parameter α_0 to match the average Italian co-residence rate.

SOURCE: Own calculations based on HSCF, SOEP and SHIW.

Figure 9: Counterfactual Experiments



by the monitoring costs per unit of rented housing μ. We view this parameter as a stand-in for the institutional framework that shapes rental markets (e.g. the availability of government-subsidized social housing, legal regulations, tax treatment) and ultimately determines the price-to-rent ratio.[13] Our goal is to assess the impact of the relative price of rental housing on individuals' living arrangement decisions along the life cycle, and to what extent these housing policies can explain the gap to Italian data. Therefore, we proceed from our first counterfactual economy and, on top of imposing Italian incomes, implement the following stylized modification: By varying μ, we lower the price-rent ratio in our model to the point that the counterfactual economy, on the aggregate, generates the same homeownership rate as Italy. This results in a reduction in the price-rent ratio by 12%, from 19.2 to 16.8, and a further drop in the house price as well (cf. Table 4).[14]

We find substantial effects on the life-cycle pattern of housing tenure choices (Figure 9, middle panels). Making rental housing more expensive leads to a massive drop in the share of renters, and increases the share of owner-occupiers across all age groups. Interestingly, the share of individuals in co-residing households barely changes. This suggests that many individuals start saving up in order to buy a home already early in life, and is reflected by an increase in average wealth by more than 30%. Yet, while this counterfactual goes a long way in rationalizing a larger share of homeowners in Italy, it cannot quite account for the joint patterns of co-residence and homeownership. It overpredicts the share of owner-occupying individuals, especially among the early age groups. As should be clear at this point from our discussion above, the key reason for this is that the model still underpredicts the share of individuals co-residing with their parents. We will pick up on this notion in our last counterfactual.

Counterfactual 3 (C3): Taste for independence.

Beyond economic factors such as income and relative prices, the decision to live in the parental household may be influenced by culture and preferences. In our model, the desire to leave the parental household is captured in a parsimonious fashion by means of a simple disutility term that depends on an individual's age. In our third counterfactual, we study the role of preferences in shaping living arrangements as follows. Departing from our second counterfactual economy as the reference point, and following a similarly parsimonious approach as above, we vary the disutility parameter α_0 to the point where the overall co-residence rate equals the Italian one.[15] This implies that the aggregate co-residence and homeownership rates are matched by

[13] This approach was recently taken by Kindermann and Kohls (2018) as well.

[14] An alternative strategy would be to try to estimate the price-rent ratio in Germany and Italy, and then directly feed the difference into the model. However, estimating the price-rent ratio reliably and accurately poses many challenges, in particular, when trying to provide comparable estimates across countries. Our counterfactual experiment implies a reduction in the price-rent ratio by 12%. This value falls well into the range of previous estimates; e.g., over the period 2002-2012, Engsted and Pedersen (2015) estimate a gap of about 15%.

[15] Giuliano (2007) presents a cultural interpretation for the large share of young adults living with their parents

construction, leaving open, however, the life-cycle patterns of owning, renting and co-residing as a result of the optimal decisions taken by individuals in our model.[16]

We find that the co-residence rate by age now matches almost exactly the one from the Italian data (Figure 9, lower panel): 93% of individuals aged 17-24 choose to live with their parents (Italy: 94%); this share drops to 65% for the next age group of 25-32 year-olds (Italy: 62%), and it is at 28% for those aged 33-40 (Italy: 24%), and 11% for those aged 41-48 (Italy: 15%). Obviously, the model cannot match the co-residence rates beyond that age, because we disallow this in the model by assuming that co-residence is only possible at ages $j \leq 30$. Regarding the homeownership rates, the model comes much closer to the data values as well. Again, this highlights the importance of co-residence as a relevant choice of living arrangement in explaining the life-cycle patterns of homeownership, especially during the first part of the life cycle. The model still struggles to some extent in matching the homeownership pattern in the second part of the life cycle. This is not too surprising in light of our parsimonious modeling of the pension system, given that our focus is on the first half of the life cycle. We also find that individuals in this counterfactual economy accumulate significantly more wealth than in the baseline economy, which is consistent with the respective data values for Italy and Germany as well.

Circling back to our motivation stated at the beginning of this section, we have conducted three counterfactuals to examine the role of differences in the income profile, policies affecting the relative price of rental housing, and taste for independence. Our results suggest that a combination of these three forces goes a long way in explaining the differential life-cycle pattern of living arrangements in Germany and Italy.

6 Concluding Remarks

An appropriate model of individuals' housing tenure and living arrangement choices is essential for both positive and normative analysis. In this paper, we move beyond the conventional view of differentiating only between homeowners and renters, and we explore the role of co-residence as another relevant type of living arrangement. Our analysis is motivated by the empirical observation that, similar to homeownership rates, there is a wide dispersion of co-residence rates across countries in the Euro area. An important conclusion from our empirical analysis is that homeownership and co-residence rates are intrinsically linked and thus should be studied

in Mediterranean countries. She argues that the sexual revolution of the 1970s had a differential, persistent impact on living arrangement patterns in Northern and Southern Europe. The intuition is that, prior to the 1970s, social norms in Southern Europe used to be very traditional and strict, allowing young people to leave home and reach sexual independence only for marriage. By contrast, the sexual revolution had a negligible impact on living arrangements in Northern Europe, where cultural norms had always been more centered on individualism. The author finds empirical evidence for this explanation using data on second-generation immigrants in the United States.

[16]Note that we match the co-residence rate of individuals aged 17-46. This is consistent with the assumption of our model where individuals have the option to co-reside with their parents in the first 30 years.

jointly. Specifically, we document that differences in homeownership rates between Germany and Italy vanish until age 48 once homeownership is measured at the individual and not at the household level and thus co-residence is taken into account.

We then present a novel macroeconomic model with overlapping generations where individuals make endogenous consumption-saving, housing tenure and co-residence decisions. Our model embeds an intergenerational link between children and their parents, which gives rise to a rich set of dynamics, depending on the evolution of incomes and assets of both parties. A calibrated version of the model matches well the observed life-cycle patterns of owning, renting and co-residing in Germany. We then employ the model to understand to what extent these choices are shaped by people's income profiles, the affordability of rental housing, and the taste for living outside the parental household. Our analyses suggest that a combination of these forces goes a long way in understanding cross-country differences in homeownership and co-residence rates.

While we provide an important framework for the analysis of the three-way trade-off between owning, renting and co-residing, we naturally abstract from various issues that will be worth exploring in future research. For instance, little is known about the interaction between labor market mobility patterns and co-residence decisions. The harder it is for young individuals to afford renting their own place, the less they might be able to move out of their local labor market. This might give rise to feedback effects on their career income paths, and may thereby create an endogenous mechanism for intergenerationally correlated lifetime earnings. We have also left aside a more explicit account of housing regulation, the tax-transfer system and other policies. Modeling country-specific policies in more detail would provide the possibility to explore the impact of specific policy interventions, both from a positive and a normative point of view.

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