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Private rental housing market underdevelopment: life cycle model simulations for Poland

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ABSTRACT

The share of the private rental housing market in Central and Eastern European countries is low. With a survey data from Poland, I show that strong tenure preferences of households toward owning can be attributed to both economic and psychological factors. Building on these findings, I develop a life cycle model and I conduct counterfactual simulations to evaluate how changes in the structure of the rental market affect its size. I show that in the alternative scenario, which assumes (i) a change in the quality of rental services, (ii) lowering rental prices and (iii) diminishing fiscal incentives to own, the size of the private rental market is significantly higher, which leads to welfare gains for poor households.

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1. Introduction

The role of housing cannot be overstated. Decisions on how to satisfy housing needs are among the most important economic choices of households over their lifespan. The most popular form of satisfying these needs is ownership. In this case, the house serves a dual purpose: it provides utility and is an investment vehicle that allows for storing value. An alternative form of satisfying housing needs is renting. It allows to separate the dual role of housing: tenants derive utility from housing services and landlords obtain profits from housing investment. The literature indicates that this feature of the rental market has an important impact on the macroeconomic outcome. In a theoretical framework, Arce and Lopez-Salido (2011) demonstrate that the availability of rental housing reduces the risk of a house price bubble, whereas Rubaszek and Rubio (2019) show that a larger rental sector allows to limit business cycle fluctuations. In both cases the reason is the same: if renting is a viable alternative to buying a house with a mortgage, the economy is less susceptible to financial market shocks, including shocks to collateral constraints. These theoretical considerations are confirmed by empirical studies of Cuerpo, Pontuch, and Kalantaryan (2014) and Czerniak and Rubaszek (2018), who present evidence that a developed rental market diminish the response of the housing sector to economic and demographic disturbances. On top of that, it can be added that a number of studies

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show that well-functioning private rental sector can influence residential mobility (Bloze, 2009; Caldera-Sanchez & Andrews, 2011), limit long-term unemployment (Blanchflower & Oswald, 2013), enhance human capital formation (Schulz, Wersing, & Werwatz, 2014), but also can be detrimental for the formation of social capital (DiPasquale & Glaeser, 1999).

For the above reasons, it is important to understand what determines the size of the rental market and what kind of institutional setting promotes its development. The literature provides some generic solutions to the above problem. At an individual level, it shows that housing tenure choices are not only affected by demographic and economic factors (Bourassa & Hoesli, 2010; Bourassa, 1995; Drew & Herbert, 2013), but also by psychological ones, including goals and values (Ben-Shahar, 2007; Coolen, Boelhouwer, & Driel, 2002). At an aggregate level, there are studies that evaluate the effects of changes in selected policies on homeownership ratio using theoretical, life cycle models. For instance Gervais (2002) or Cho and Francis (2011) investigate the role of mortgage interest rate deductions and the untaxed nature of imputed rents from owner-occupied housing, Chambers, Garriga, and Schlagenhauf (2009) focus on the role of demographic changes and mortgage innovations, whereas Attanasio, Bottazzi, Low, Nesheim, and Wakefield (2012) analyse the role of mortgage market institutions and the characteristics of stochastic processes, such as house price or income shocks.

I contribute to the above studies by quantifying the effects of a shift in the structure of housing rental market in Poland from the currently prevailing dualist rental system into the unitary one, in the typology proposed by Kemeny (1995) and discussed in detail by Hoekstra (2009). The dualist system is characterized by a largely unregulated profit-driven private rental market and tightly controlled public rental sector. It is based on the principle that the government should not distort market forces on the private rental market, hence tenants are not protected against rent increases nor eviction. With restricted access to the stigmatized state rental sector and little security in the private sector, households are pushed into homeownership. On the contrary, in the unitary rental system, which is also called an integrated rental system, the market is organized to strike a balance between economic and social priorities. It is based on the principle that government should be actively involved in the development and regulation of the rental market, both social and private. In this system tenants tend to be protected against rent increases or eviction, and the tax policy is often aimed to promote the rental sector. Stable and low rental prices as well as higher sense of security make rental market a viable alternative to ownership.

To simulate the above-described shift in the rental market structure I calibrate a quantitative general equilibrium life cycle model to the Polish data. The model is rich enough to incorporate a number of rental market features, which were considered to be important in the previous studies: fiscal incentives to own (Cho & Francis, 2011; Gervais, 2002; Kaas, Kocharkov, Preugschat, & Siassi, 2017), maintenance costs dependent on the tenure status (Yao & Zhang, 2005), transaction costs of selling and buying houses (Yang, 2009), the quality of rental services (Kiyotaki, Michaelides, & Nikolov, 2011), credit constraints (Chambers et al., 2009; Iacoviello & Pavan, 2013) or mortgage rate spread (Bajari, Chan, Krueger, & Miller, 2013). In this sense, the value added of this study to the literature is that it applies a life cycle model to explain the structure of the rental housing market in a country from the Central and Eastern European region. Moreover, the analysis is

relatively comprehensive as it considers many factors relevant for the popularity of the rental market in designing counter-factual simulations.

The main findings are as follows. At an individual level, the preferences of Poles are strongly tilted towards owning, which is driven by both economic and psychological factors. Ownership is perceived not only as a cheaper form of satisfying housing needs, but also as the only way to provide a safe place for the family and to really ‘feel at home’. At an aggregate level, I indicate that in the alternative scenario, which assumes (i) higher quality of rental services, (ii) better regulations and (iii) removing fiscal incentives to own, the size of the private rental housing market is higher, which is welfare enhancing for the poorest households. This would suggest a need for revisiting housing policy in Poland, which in the post-communist period was strongly promoting homeownership (Augustyniak, Laszek, Olszewski, & Waszczuk, 2013; Leszczynski & Olszewski, 2017). It should be added that even though the survey and model simulations focus on Poland, the conclusions can be easily extended for other countries of the region as the sources of rental market underdevelopment in these countries are broadly the same (Lux & Sunega, 2014; Priemus & Mandic, 2000).

The rest of the paper is organized as follows. Section 2 describes factors that might decrease the attractiveness of renting in comparison to owning. Sections 3 and 4 outline the life cycle model and its calibration. Next, Sections 5 and 6 present the benchmark economy and the results of simulations. The last section concludes.

2. Facts about housing tenure determinants

The size of the private rental market is very diverse across EU countries. Eurostat data indicate that in 2016 the fraction of ‘market price’ tenants ranged from 1% in Romania to 40% in Germany (Figure 1). The figure also shows that all former communistic countries, but the

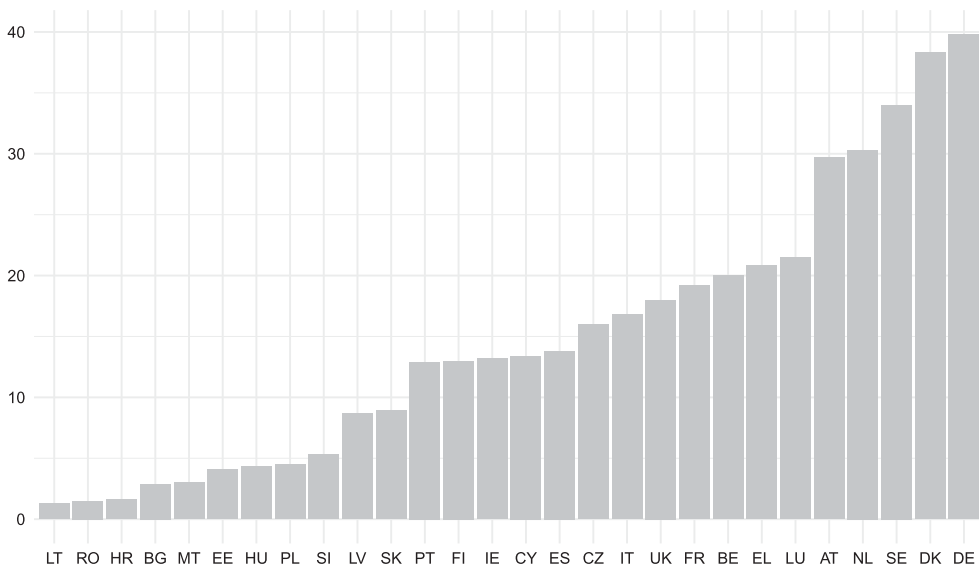


Figure 1. The share of the private rental market in EU countries in 2016. Source: Eurostat.

Czech Republic, are characterized by a relatively tiny fraction of private market tenants, standing at levels well below 10%. In Poland, which is the focus of our analysis and which can be considered to be a good representative of these countries, this share stood at 4.5%. The marginal share of the private rental sector and high homeownership ratio in new EU member states can be justified by a number of institutional developments. As indicated by Lux and Sunega (2014), one of the most important factors was the transfer of public rental housing into private hands, which took the form of a massive sale to sitting tenants. For Poland, this is well illustrated by the decline in the share of public rental housing from 34.9% in 2007 to just 12.1% in 2016. The second reason was the development of the mortgage market, related to a steady decrease of inflation and nominal interest rates, combined with better access to FX denominated loans. The changes in the financial sector, as well as a variety of programs enhancing house purchases on credit,¹ led to an increase in the proportion of owners with a mortgage from 2.9% in 2007 to 11.6% in 2016. Third, selected regulations are also to blame for the low share of the private rental housing market. In particular, in the typology of Kemeny (1995), Poland can be classified as a dualist rental system, with all its features described in the Introduction. This lack of a consistent housing policy to develop the rental market is nicely summarized by Priemus and Mandic (2000), who claim (as indicated by the title of their article) that in the countries of the region both private and public rental market at the beginning of the twenty-first century was 'no man's land'.

To better understand how the above institutional developments have influenced housing tenure decisions by households, let us look at selected answers to a survey conducted in June 2016 among a representative group of 1005 Poles within a regular Omnibus CAPI (computer-assisted personal interview) survey by IPSOS company. Here I present the results that are helpful to justify the structure and calibration of the model proposed in the next sections and refer to Rubaszek and Czerniak (2017), who discuss the detailed responses to the survey. They demonstrate that private market tenants are usually unmarried and young, do not have children, inhabit relatively small dwellings that are located in large cities. The duration of their stay in the rented house is short and they plan to change the house in a short-term horizon. This means that renting is a temporary form of satisfying housing needs and is not treated as a serious alternative to ownership for longer horizons. This is confirmed by the answers to a series of question indicating that Poles (i) strongly prefer to take a mortgage rather than rent, (ii) believe that paying rents is a waste of money, (iii) think that buying a house is a good investment over the lifespan and (iv) prefer to buy a house even if this is more expensive than renting it. The last point suggests that households in Poland derive greater utility from living in owned rather than rented apartments.

Table 1 illustrates the relative importance of financial and non-financial factors for housing tenure choices. It presents the responses to a series of questions about economic and psychological reasons to own or rent, which are related to numerous studies, i.a. those by Henderson and Ioannides (1983), Bourassa (1995), Coolen et al. (2002), Sinai and Souleles (2005) or Ben-Shahar (2007). The answers clearly indicate that the low rental market share is determined by both psychological and economic factors. The distribution of answers to economic questions displays that almost 65% of respondents perceive owning to be cheaper and less risky than renting, whereas less than 15% is of the opposite opinion. Regarding the psychological factors, the distribution of answers is

Table 1. Financial and non-financial factors influencing housing tenure preferences in Poland.

	Definitely owning	Rather owning	No opinion	Rather renting	Definitely renting
<i>Financial factors</i>					
Risk of house price / rent fluctuations	24.2	41.4	22.8	10.4	1.2
Mortgage / rental costs	24.1	39.9	23.4	10.9	1.7
Taxes	21.9	39.1	25.3	12.0	1.7
Transaction costs	21.5	40.6	26.1	9.9	2.0
<i>Non-financial factors</i>					
Family	37.6	35.0	18.0	7.1	2.3
Freedom and independence	35.8	35.3	16.5	9.8	2.6
Peace of mind	35.4	35.5	17.8	8.9	2.4
Happiness	34.3	34.4	21.1	8.0	2.2
Social status	33.8	37.0	19.5	7.3	2.4

Source: The results of the survey conducted among the representative sample of 1005 Poles.

even more skewed towards owning: about 70% of respondents prefer owning and about 10% of them indicate renting, whereas about 20% has no opinion. The interpretation of the above results is that for the majority of Poles rental housing is not perceived as a decent place to live with a family and raise children.

To understand further why renting is not considered to be a viable long-term solution for satisfying housing needs, let us look at the responses to the questions about factors that decrease the quality of rental services. The upper panel of [Table 2](#) shows that tenants are constrained in arranging the interior of the rented apartment and landlords are inspecting housing units too often. This is related to the dominance of the 'informal' rental sector, as defined Priemus and Mandic (2000), which is characterized by relatively low quality of rental housing services in comparison to the 'professional' rental sector. The next two rows of the table indicate that inefficient regulations (rent control and tenant protection) are also limiting the demand for long-term rental. In fact, high protection of tenants within the regular, open-ended contract causes that most of new rental contracts in Poland are usually signed for one-year period. This effectively removes any rent control, given that the rent price in new contracts is not regulated. In turn, this gives effectively no protection against economic eviction, hence decreases the demand for rental housing. The lower panel of [Table 2](#) demonstrates that there is also an important factor limiting the supply of houses to let. In particular, potential investors must take into account the low culture of tenants, interpreted as a risk of renting a house to a tenant who is not paying rents and even might devastate a housing unit. This risk is reflected in the high rent price.

Table 2. The reasons of rental market underdevelopment in Poland.

	Agree	No opinion	Don't Agree
<i>Factors decreasing the quality of rental services</i>			
Tenants are too much constrained in arranging apartment	56.8	30.2	12.9
Landlords are inspecting the apartment too often	53.3	34.4	12.2
Tenants are not well protected against eviction	56.7	31.1	12.1
Tenants are not well protected against rent increases	56.2	31.0	12.7
The offer of dwellings to rent is too scarce to meet preferences	46.8	35.9	17.3
<i>Factors decreasing the attractiveness of investing in rental housing</i>			
Low culture tenants	62.6	28.9	8.6
Excessive rent control	50.3	37.2	12.4
Excessive protection of tenants against eviction	40.3	43.6	16.1

Source: The results of the survey conducted among the representative sample of 1005 Poles.

In general, the above analysis leads to several observations. First, the quality of housing services from renting is inferior to those from owning. Second, renting is more expensive than owning. Third, inefficient regulations and taxes are decreasing the utility derived from living in rented houses and, at the same time, increase the relative price of renting compared to owning.

3. Theoretical model

In this section I propose a theoretical framework that incorporates many factors described in the previous section. In particular, it is a life cycle model with housing, uncertain lifespan and idiosyncratic productivity, which is similar to the framework by Chen (2010), Cho and Francis (2011), Kaas et al. (2017) or Rubaszek (2012). In the model economy households derive utility from consumption of non-housing goods and housing services, as well as from leaving bequests. Housing services might be satisfied by owning, subject to minimum down-payment constraint, or renting. For younger households, I also allow cohabiting with parents. To analyse the impact of economic and psychological factors on housing tenure decisions, I incorporate several important features such as taxes and subsidies, mortgage interest rate spread, differentiated quality of housing services as well as maintenance costs for owning and renting. The structure of the model is as follows.

International capital markets. The model economy is small and open with access to international capital markets. The level of the domestic real interest rate is

$$r = r^* - \xi \frac{B}{Y}, \quad (1)$$

where r^* stands for the global real interest rate, B denotes the value of net foreign assets, and Y is the level of domestic output. The parameter ξ measures the level of international financial markets imperfections. Two special cases are autarky, in which $\xi \rightarrow \infty$, and perfect international financial markets, in which $\xi = 0$.

Firms The goods market is perfectly competitive and characterized by constant returns to scale. Identical firms of measure one are producing goods according to the Cobb-Douglas technology, so that aggregate output is

$$Y = K^\alpha L^{1-\alpha}, \quad (2)$$

where K and L denote the aggregate capital stock and effective labour input, respectively. The production can be consumed, invested in physical capital or costlessly transformed into housing. Factor prices are determined by profit maximization, hence are equal to their marginal products

$$\begin{aligned} \partial Y / \partial K &= r_k \\ \partial Y / \partial L &= w, \end{aligned} \quad (3)$$

where w is the real wage and r_k stands for the cost of renting physical capital.

Demographics. The economy is populated by a continuum of households of different age $j \in \mathcal{J} \equiv \{1, 2, \dots, J\}$. Their lifespan is uncertain: the probability of being alive next year at age j is equal to s_j . The unconditional probability of surviving till age $j > 1$ at time of birth is $S_j = \prod_{i=1}^{j-1} s_i$ and the share of this age cohort in total population amounts to μ_j .

Preferences Households derive utility from consumption of non-durable goods c and the service flow of housing, which can be owned h_o or rented h_r . Due to factors described in the previous section, the utility from living in a rented house is lower than in the same housing unit that is owned. In the case $h_o = h_r = 0$ the value of housing services is set to h_c : for the youngest cohorts h_c represents cohabiting with parents, whereas for older cohorts h_c is a small number and represents homelessness. The resulting momentary utility function is of the form

$$u(c, h_o, h_r) = \frac{(c^\theta (\max\{h_o, \vartheta h_r, h_c\})^{1-\theta})^{1-\eta}}{1-\eta}, \quad (4)$$

where θ is the share of non-housing consumption in the utility and η stands for risk aversion, whereas $\vartheta \leq 1$ measures the quality of rental housing services. Households derive additional utility

$$u_b(\text{beq}) = \kappa \frac{\text{beq}^{1-\eta}}{1-\eta} \quad (5)$$

from giving bequests beq , which can be in the form of financial and housing assets. The degree of altruism is governed by the parameter κ , where for $\kappa = 0$ bequests are accidental as the lifespan is uncertain.

Individual income process. The economic activity of households consists of two distinct periods. During initial \tilde{J} years each household works by supplying one unit of time in the labour market. The productivity is the product of age-dependent deterministic component z_j and a stochastic component $e \in \mathcal{E} \equiv \{e_1, e_2, \dots, e_K\}$, i.e. $z(e, j) = z_j \times e$. For workers the stochastic component follows a Markov process with the elements of the transition matrix $\pi_{kl} = P(e' = e_l | e = e_k)$, where $\pi_{kl} \geq 0$ and $\sum_{l=1}^K \pi_{kl} = 1$ for every $k, l \in \{1, 2, \dots, K\}$.² In the second part of life, in which the idiosyncratic productivity follows $e' = e$, households receive pension $\text{pen}(e, j)$. The resulting income over the life cycle is

$$y(e, j) = \begin{cases} (1 - \tau_w)wz(e, j) & \text{for workers} \\ \text{pen}(e, j) & \text{for retirees,} \end{cases} \quad (6)$$

where τ_w stands for the tax rate (personal tax plus the social contribution rate). As regards the value of pensions, it is constant

$$\text{pen}(e, j + 1) = \text{pen}(e, j)$$

and amounts to a fraction $\chi(e)$ of labour income at retirement age:³

$$\text{pen}(e) = \chi(e) \times (1 - \tau_w)wz(e, \tilde{J}). \quad (7)$$

Financial intermediaries and the housing market. The model economy is populated by an infinite number of homogeneous financial intermediaries, indexed by a superscript f . A financial intermediary collects deposits d^f (from households and foreign investors) and use them to buy capital k^f , rental housing h_r^f , as well as to give mortgages d^f . In this sense, in this setup financial intermediaries are landlords. At the beginning of the

period the budget constraint is:

$$d^f \geq k^f + (1 - p_r)h_r^f + d^f, \tag{8}$$

where p_r is after-tax income from renting.

In the next period financial intermediaries collect return on capital (r_k) and interest on mortgages (r_m). As regards costs, they have to pay interest on deposits (r), cover the depreciation rate of capital (δ) as well as the maintenance costs of rental housing (δ_r). Here δ_r represents a fraction of the house value that needs to be spent to keep the standard of the housing unit unchanged, which is assumed to be the same for all dwellings. On top of that, I assume that the intermediaries are subject to a deadweight loss on mortgages (ψ_m), which is introduced to take into account the spread between the mortgage and risk-free rates observed in the data.⁴ The profit-maximizing problem for the intermediary is therefore:

$$\max_{d^f, k^f, h_r^f, d^f} \Pi^f = (1 + r_k - \delta)k^f + (1 - \delta_r)h_r^f + (1 + r_m - \psi_m)d^f - (1 + r)d^f \tag{9}$$

subject to (8). The solution are three no-arbitrage conditions. The first one is the standard formula for the cost of capital:

$$r_k = r + \delta. \tag{10}$$

The second one indicates that there is a spread between the interest rates on mortgages and deposits

$$r_m = r + \psi_m, \tag{11}$$

which causes that the cost of buying a house on credit is higher than if the house is purchased from savings. The third condition sets the net (after-tax) rental price of housing:

$$p_r = \frac{r + \delta_r}{1 + r}. \tag{12}$$

The gross (before-tax) rental price, which is seen by households, equals to $(1 + \tau_r)p_r$, where τ_r is the tax rate on rental services.

Housing market frictions. I consider two standard frictions in the housing market. First, adjusting the size of the owned house from h to h' is costly:

$$\phi(h, h') = \begin{cases} \phi_1 h + \phi_2 h' & \text{if } h' \neq h \\ 0 & \text{if } h' = h, \end{cases} \tag{13}$$

where ϕ_1 and ϕ_2 measure the transaction cost of selling and buying a house, respectively. The second friction relates to the constraint that buying a house requires an amount of cash upfront. The down-payment equals to at least a fraction $\gamma \geq 0$ of the house value, which means that mortgage debt d must satisfy

$$d' \leq (1 - \gamma)h'. \tag{14}$$

Finally, I assume that the size of an owned house is a discrete variable with values from the set $\mathcal{H}_o \equiv \{0, h_1, h_2, \dots, h_M\}$. As for the size of a rented house, similarly to what was done in Iacoviello and Pavan (2013), I allow that it can take also an additional value $h_0 < h_1$, so that

$\mathcal{H}_r \equiv h_0 \cup \mathcal{H}_o$. Adding h_0 allows for shared rental, as it is often the case that for young tenants.

Taxes. To control for fiscal incentives of owning versus renting I introduce various taxes that have an impact on housing market tenure structure (e.g. Bourassa & Hoesli, 2010; Cho & Francis, 2011, present an extended discussion on how taxes might distort housing tenure decisions). In particular, apart from labour income tax (τ_w), there are the following taxes and subsidies: tax on income from financial assets (τ_a), mortgage interest rate subsidy (τ_m), tax on imputed rents (τ_o) and tax on rental income (τ_r). All government revenues are spent on pensions and lump-sum transfers tr to households so that the budget is balanced in each period. It should be noted that the lump-sum transfers assumption is a simplification of reality. In a more elaborated model, one could assume that the government is conducting active housing policy with targeted transfers (Kaas et al., 2017).

Timing and household budget constraint. The timing of events in the model is as follows. A household of age j enters a new period t with (i) the housing stock h , (ii) financial assets a and (iii) mortgage debt d . The net financial assets is equal to $na = a - d$ and net worth is $nw = h + a - d$. The household immediately learns about its idiosyncratic productivity e and receives income $y(e, j)$ as well as transfers from the government tr . At this moment homeowners must cover maintenance costs and the relevant taxes $(\delta_o + \tau_o)r$ for the house that was occupied in the previous period. The household also receives after-tax net return on financial assets $(1 - \tau_a)ra$ or pays the interest rate on mortgage debt $(1 - \tau_m)r^m d$. Having set financial resources the household decides on the level of consumption c as well as the size of occupied house during period t and whether it is going to be owned, in which case $h_o = h'$, or rented h_r . If $h \neq h'$ then the household must cover the transaction costs $\phi(h, h')$. Moreover, tenants pay for renting services $(1 + \tau_r)p_r h_r$. At the end of the period the outcome of the death shock is revealed. Those households that survived enter a new period with net worth $nw' = h' + a' - d'$. The resulting budget constraint is:

$$nw + y + (1 - \tau_a)ra + tr \geq nw' + c + (1 + \tau_r)p_r h_r + (\delta_o + \tau_o)r h + (1 - \tau_m)r_m d + \phi(h, h') \quad (15)$$

Financial disadvantage of renting. An analysis of the budget constraint allows to calculate how taxes and maintenance costs influence the relative annual price for acquiring housing services by tenants and homeowners. In this subsection I compare the user cost of owner-occupied housing in the absence of borrowing constraints and transaction costs. In particular, I start by comparing two households which have one monetary unit hold in financial (tenant) or housing assets (homeowner). The tenant has to pay for the rent $(1 + \tau_r)p_r$, but receives interest income on financial assets $(1 - \tau_a)r$. In turn, the homeowner pays for the maintenance costs and tax on imputed income $(\delta_o + \tau_o)r$. Given the formula for the rental price (12) one can compute that the wedge between both flows is:

$$\underbrace{(\delta_r - \delta_o)}_{\text{maintenance}} + \underbrace{\tau_r p_r}_{\text{rental tax}} + \underbrace{(\tau_a - \tau_o)r}_{\text{taxation of assets}} \quad (16)$$

The financial disadvantage of renting is determined by (i) the differences in the maintenance costs, (ii) the existence of the tax on income from renting as well as (iii) various tax rates on housing and financial assets. It should be noted that our assumption that the maintenance costs spread $(\delta_r - \delta_o)$ is constant is a shortcut. In a more elaborated

model one could make this spread dependent on the characteristics of a dwelling such as size, localization or structure or the expected duration of the rental contract (Halket, Nesheim, & Oswald, 2015; Halket & Pignatti Morano di Custoza, 2015).

Let us now compare the user cost for two households that do not have any assets. The first one decides to be a tenant and pay for the rent. In turn, the second household finances the acquisition of the housing service with a full mortgage, hence has to pay $(1 - \tau_m)r_m$ on top of the maintenance costs and tax on imputed income. Consequently, the economic disadvantage of renting amounts to:

$$\underbrace{(\delta_r - \delta_o)}_{\text{maintenance}} + \underbrace{\tau_r p_r}_{\text{rental tax}} + \underbrace{(\tau_m - \tau_o)r}_{\text{taxation of assets}} - \underbrace{(1 - \tau_m)\psi_m}_{\text{lending spread}} \tag{17}$$

The above formulas show explicitly how regulations and taxation affect the financial part of housing tenure decision. It should be added, that in this part I have not accounted for the transaction costs nor the relative satisfaction from renting and owning. These characteristics of the model will be taken into account in the section presenting counterfactual simulations. Here, I only present how much more a tenant has to pay for inhabiting one housing unit in comparison to a homeowner, assuming that he or she lives in the same apartment.

Household problem. The optimization problem of a newly born household is to maximize the expected life-time utility:

$$\sum_{j \in \mathcal{J}} \beta^{j-1} E_0 \{ S_j u(c_j, h_{o,j}, h_{r,j}) + (S_{j-1} - S_j) u_b(\text{beq}_j) \}, \tag{18}$$

where β is the discount factor, E_0 is the operator of expectations formulated at the beginning of the first period and $S_{j-1} - S_j$ is the probability of leaving bequest at age j . The value of this bequest is

$$\text{beq}_j = (1 + (1 - \tau_o)r)a_j + (1 - \delta_o - \tau_o r)h_j - (1 + (1 - \tau_m)r_m)d_j. \tag{19}$$

This optimization problem can be written down recursively. At the beginning of a period the household's state x is characterized by net financial assets, housing assets, individual productivity and age $x = (na, h, e, j)$.⁵ Let $V_r(x)$ and $V_o(x)$ denote the value functions of the household in the case of renting and owning, respectively, and $V(x)$ stand for the proper value function. They can be calculated as the solution of the optimization problem:

$$\begin{aligned} V_r(x) &= \max_{c, h_r, na'} \{ u(c, 0, h_r) + \beta [s_j E(V(x' | x, h' = 0)) + (1 - s_j) u_b(\text{beq}')] \} \\ V_o(x) &= \max_{c, h_o, na'} \{ u(c, h_o, 0) + \beta [s_j E(V(x' | x, h' = h_o)) + (1 - s_j) u_b(\text{beq}')] \} \\ V(x) &= \max \{ V_r(x), V_o(x) \} \end{aligned} \tag{20}$$

subject to the budget constraint (15), the minimum down-payment restriction (14), the value of bequest (19) and conditions: $c > c_{min}$, $h_o \in \mathcal{H}_o$ and $h_r \in \mathcal{H}_r$. The optimal decision is given by the policy functions $c(x)$, $na'(x)$, $h_o(x)$ and $h_r(x)$.

Equilibrium. Given the heterogeneity of households in terms of the state variable $x \in X \equiv \mathbb{R} \times \mathcal{H}_o \times \mathcal{E} \times \mathcal{J}$, to calculate the value of aggregate variables we need some measure of the distribution. Let $(X, \mathcal{X}, \lambda)$ be a probability space, where $\mathcal{X} \equiv \mathcal{B}(\mathbb{R}) \times \mathcal{P}(\mathcal{H}_o) \times \mathcal{P}(\mathcal{E}) \times \mathcal{P}(\mathcal{J})$,⁶ and λ is a probability measure, so that for each set $Y \in \mathcal{X}$ the share of individuals with $x \in Y$ in total population is equal to $\lambda(Y)$. For a given policy functions $c(x)$, $na'(x)$, $h_o(x)$ and $h_r(x)$ the values of aggregate variables

consistent with individual behaviour can be calculated as:

$$\begin{aligned}
 \text{Effective labour: } L &= \int z(x) d\lambda \\
 \text{Consumption: } C &= \int c(x) d\lambda \\
 \text{Financial assets: } A' &= \int_{na' \geq 0} na'(x) d\lambda \\
 \text{Financial debt: } D' &= \int_{na' < 0} na'(x) d\lambda \\
 \text{Housing assets (owners): } H_o &= \int h_o(x) d\lambda \\
 \text{Housing assets (landlords): } H_r &= \int h_r(x) d\lambda \\
 \text{Transaction costs: } \Phi &= \int \phi(h, h_o(x)) d\lambda \\
 \text{Pensions: } Pen &= \int_{j > \bar{j}} pen(x) d\lambda \\
 \text{Bequests: } Beq &= \int (1 - s_j) beq(x) d\lambda
 \end{aligned} \tag{21}$$

A stationary equilibrium is defined as the policy functions, prices, stock variables as well as the distribution $\{\lambda\}$, that fulfil the following conditions:

- (1) Given w, r, tr the policy functions are optimal.
- (2) Aggregate variables are consistent with the policy functions, in line with (21).
- (3) The international capital market condition (1) is met.
- (4) Factor prices are equal to marginal products as in (3).
- (5) The rental price is consistent with the no-arbitrage condition (12).
- (6) The government budget is balanced:

$$Pen + G + tr = Beq + \tau_w wL + \tau_a rA' - \tau_m r^m D' + \tau_o rH_o + \tau_r p_r H_r, \tag{22}$$

where G stands for government spending.

- (7) Markets clear:

$$\begin{aligned}
 A' &= K' + D' + H_r(1 - p_r) + B' \\
 Y &= C + G + \delta K' + \delta_o H_o + \delta_r H_r + \Phi + \psi_m D' - rB'.
 \end{aligned} \tag{23}$$

- (8) The distribution of households over the state variable x is time invariant.

In the stationary equilibrium, the economy is time invariant at the aggregate level. However, at the individual level there is a lot of movement going on. Households are getting older, are hit by idiosyncratic productivity shocks, accumulate financial assets as well as buy or sell houses.

4. Calibration

I calibrate the model using the data for the Polish economy, with a particular emphasis on the functioning of the housing market. The benchmark parameter values, which are displayed in Table 3, are as follows.

Demographics. The model period corresponds to one year. Households become economically active at age 20, work for $\tilde{J} = 45$ years, retire at 65 and then live up to the maximum age of 100. That means that the model describes the behaviour of $J = 81$ cohorts of age from 20 to 100. The conditional survival probabilities s_j are assumed to be 100% for workers and are evaluated using the data from the Demographic Yearbook by Central Statistical Office for retirees. The results are presented on the upper panel of Figure 2. They imply the share of retirees in the adult population at 27.7%, which compares to 20.0% observed in 2016 and projected 28.0% in 2030 according to the European Commission Ageing Report 2015.

Individual income process. The deterministic age profile of idiosyncratic productivity z_j presented on the lower panel of Figure 2 is taken from the estimates of Kolasa (2017) based on the Polish Households Budget Survey data covering the period 2000–2010. For the stochastic component e , I follow the literature and assume that its logarithm is an AR(1) process:

$$\ln e' = \rho_e \ln e + \epsilon, \quad \epsilon \sim N(0, \sigma_e^2) \quad (24)$$

Table 3. Parametrization of the benchmark economy.

<i>Demographics</i>		
Number of cohorts	J	81
Number of working cohorts	\tilde{J}	45
<i>Individual income process</i>		
Age profile of productivity	z_j	Kolasa (2017)
Persistence of idiosyncratic productivity process	ρ	0.97
Variance of idiosyncratic productivity process	σ_e^2	0.03
Pension replacement rates	\tilde{C}	[0.75 0.68 0.60 0.53 0.45]'
<i>Preferences</i>		
Discount factor	β	0.98
Risk aversion	η	2.00
Share of non-housing consumption in utility	θ	0.75
Utility loss from renting	ϑ	0.85
Bequest preference	κ	10
<i>Technology and housing market</i>		
Global interest rate	r^*	0.03
Openness of the economy	ξ	0.01
Capital share in production function	α	0.25
Depreciation rate, capital	δ	0.095
Depreciation rate, owned housing	δ_o	0.01
Depreciation rate, rented housing	δ_r	0.025
Transaction cost of selling	ϕ_1	0.03
Transaction cost of buying	ϕ_2	0.07
Minimum down-payment ratio	γ	0.20
Mortgage rate spread	ψ_m	0.02
<i>Taxes</i>		
Labour income tax	τ_w	0.347
Capital income tax	τ_a	0.19
Mortgage subsidy	τ_m	0
Tax on imputed rent	τ_o	0
Tax on renting revenue	τ_r	0.19
Share of gov. spending in GDP	G/Y	0.15

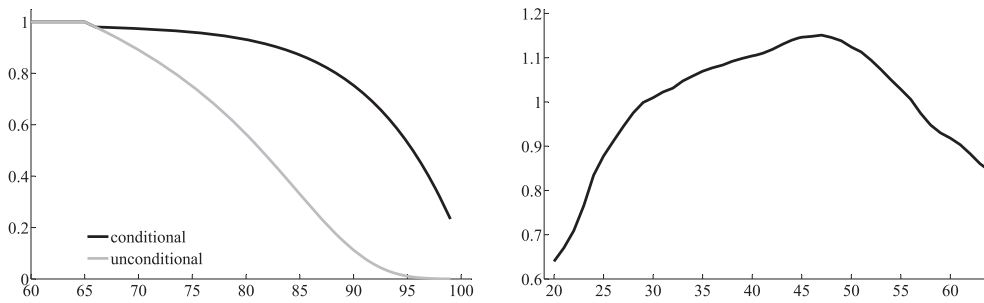


Figure 2. Survival probability and median average income by age.

Notes: The left panel of the figure presents the probability of being alive at age j measured at the time of birth (unconditional survival probability) or at age $j-1$ (conditional survival probability). The right panel presents median productivity by age, which was taken from Kolasa (2017).

with two parameters: persistence ρ_e and volatility σ_e . I fix ρ_e to 0.97 and calibrate the value of σ_e^2 at 0.03, so that the GINI coefficient of earnings was equal to about 0.318, i.e. the value for Poland in 2015 reported by the World Bank. Next, I approximate the continuous AR(1) process by a five state Markov chain. Additionally, for the productivity at the initial age, taking the evidence that earnings inequality is increasing with age (Heathcote, Storesletten, & Violante, 2005), I set its variance at two thirds of the unconditional variance of e .

As regards the level of pensions, I assume that the replacement rates $\chi(e) \in \mathcal{C}$ are decreasing with income level from 0.75 to 0.45. Even though according to the OECD report ‘Pension at a Glance 2015’ pension rates are rather flat and stand at around 0.50, the rates are differentiated to take into account that in the model economy pensions depend on the last wage only, whereas in reality they are determined by the entire history of labour income.

To express values in terms of Polish zlotys (PLN), under the benchmark parametrization I set the average, annual before tax wage income of households to 67k PLN. This value is equivalent to monthly income of 1800 PLN per person and average ‘working age’ household size of 3.2 persons, which is consistent with the Households Budget Survey data.

Preferences. The discount factor β is fixed at 0.98 and the relative risk aversion coefficient η is chosen to be 2, which is the standard value used in the literature (Kaas et al., 2017). As regards the share parameter in the utility function, I fix its value at $\theta = 0.75$. This reflects the structure of Polish households spendings and at the same time is consistent with the estimates for the U.S. (Kiyotaki et al., 2011) or German economy (Kaas et al., 2017). Next, the parameter describing the relative quality of rental services is set to $\vartheta = 0.85$, compared to 0.94 assumed by Kiyotaki et al. (2011) and 0.90 by Cho and Francis (2011) for the US economy. By choosing a relatively low value of this parameter we can fit the model to the rental market share observed in the Polish data. At the same time, this low value is consistent with the survey results, which show that Poles regard the quality of rental housing services to be very low. As regards the level of h_c , which represents the exogenous value of housing services for households that neither own nor rent, for the youngest cohorts it is interpreted as living with parents and is equivalent to renting a tiny and decreasing in size apartment, whereas for older cohorts it represents homelessness.⁷ In equilibrium, nobody decides to be homeless, but the positive value of h_c ensures that the utility function is always finite. Finally, for

bequests, the altruism parameter is calibrated to $\kappa = 10$, so that the marginal propensity to consume in the last period of life was close to 0.20, in line with the study of Cagetti (2003).

Technology. The model economy is open and households have access to foreign capital subject to international markets imperfections. I assume $r^* = 0.03$ and $\xi = 0.01$ so that an increase in the foreign debt by 10% of GDP leads to an increase in the level of domestic interest rate by 0.1 percentage point, in line with the data for the level of net International Investment Position and yields on government bonds. The capital share $\alpha = 0.25$ and the capital depreciation rate $\delta = 0.095$ are set to match the Polish data on capital and investment to GDP ratios.

Housing sector. For the rental housing sector the maintenance cost is chosen to be $\delta_h = 0.025$ so that the ratio of annual rents to house value p_r stood between 5.5% and 6%, in line with the data presented by Laszek, Augustyniak, Olszewski, Waszczuk, and Zaczek (2018) or the Global Property Guide.⁸ For the ownership sector the maintenance is lower $\delta_o = 0.01$ to reflect the fact that due to factors described in Section 2 renting is more expensive than owning. Next, the transaction costs of selling/buying a house are set to $\phi_1 = 0.03$ and $\phi_2 = 0.07$, i.e. the same values as chosen by Yang (2009). These costs include the intermediation fee as well as the tax on civil law transactions or notarial acts,⁹ but also any non-financial costs of moving such as time spent to screen the housing market, moving costs or psychological costs of changing neighbourhoods (Bajari et al., 2013; Cho & Francis, 2011; Yang, 2009). Next, for the parameter describing the minimum down-payment requirement, I fix its value at $\gamma = 0.8$, in line with the current restrictions related to the maximum loan-to-value.¹⁰ Finally, for the mortgage rate spread ψ_m , I choose the value of 0.02 on the basis of mortgage rate data from the National Bank of Poland, which point that over the period 2005–2016 the average spread between the mortgage rate and the interbank three-month rate amounted to 1.7% for all existing loans and 2.2% for newly granted loans.

In the grids \mathcal{H}_o and \mathcal{H}_r there are only a few house sizes. The smallest one that can be purchased costs triple the average annual pre-tax household income, i.e. 200k PLN. Given that the average price of a square metre stood at about 5k PLN (Laszek et al., 2018), I interpret it as a 2-room apartment of size 40 m². The other house values available for purchase are 350k PLN (70 m²), 500k PLN (100 m²) and 667k PLN (larger house). Moreover, the size of rented apartments can also take the value equal to 100k PLN (20 m²), which can be seen as an equivalent of a single room in a shared flat. It should be added that I quote the size and value of houses only for illustrative purposes. Given the heterogeneity in income and house prices across Polish regions, the above values should be perceived as adjusted by average income and the cost of land in a given localization.

Taxes. All tax rates are set to reflect the current situation in Poland, which clearly favours owning to renting. In particular, the tax on income from financial assets τ_a is 19%, whereas the tax on imputed income from owning τ_o is null. I assume that there are no subsidies on mortgage debt service τ_m at 0%, as the two programs aimed at promoting homeownership, which were described in Section 2, are no longer existent. As regards the tax on the revenues from renting τ_r its current rate is 8.5%. Finally, the tax on labour income τ_w is calibrated using the data for the average personal income tax augmented for the social contribution rate at 34.7%. It can be noted that this rate is relatively flat in Poland

in comparison to other OECD countries. To close the model, I set government spending to 15% of GDP on the basis of the National Account statistics.

5. The results for the benchmark economy

The model has no closed-form solution, and therefore one has to solve it numerically. For that purpose I discretize the space for net financial assets na over grid points $\mathcal{A} = \{na_1, na_2, \dots, na_M\}$, where the bounds na_1 and na_M are set at levels not constituting a constraint for the optimization problem. Moreover, households are not restricted to select na' on the grid \mathcal{A} , but instead use the golden section search method to cover any intermediate choices. Subsequently, I apply the following algorithm to calculate the stationary equilibrium:

- (1) Set the value of r and tr .
- (2) Compute w and K consistent with r with (3).
- (3) Solve the optimization problem (20) by backward induction to compute the policy functions for each $x \in X$.
- (4) Compute the distribution λ by forward induction.
- (5) Calculate the value of aggregate variables with (21).
- (6) Calculate the value of transfers with (22)
- (7) Calculate the value of net foreign assets with (23).
- (8) Calculate the value of the real interest rate with (1)
- (9) Check whether the values of r and tr calculated in steps 6 and 8 are equal to those from step 1. If yes, stop. Otherwise go to step 1 and update r and tr .

The equilibrium values of key variables and ratios describing the functioning of the housing market in the model are compared to the data in Table 4. As regards the latter, for variables that should fluctuate around a constant over the business cycle, the investment to GDP ratio for instance, the table presents the average values over the 1999–2016 period. For stock variables, which are characterized by a unit root and have changed permanently since the beginning of the economic transformation, it refers to the values from 2016. The upper panel of the table shows that the level of the real interest

Table 4. The fit of the benchmark model to the Polish data.

Variable	Model	Data	Source
Real interest rate (%)	3.5	3.6	1999–2016 average, Eurostat
capital to GDP	1.9	1.9	AMECO, 1999–2016 average
capital investment to GDP (%)	18.3	18.3	OECD, 1999–2016 average
housing investment to GDP (%)	3.9	3.1	OECD, 1999–2016 average
consumption to GDP (%)	60.6	62.0	OECD, 1999–2016 average
net foreign assets to GDP (%)	−46.4	−61.6	Eurostat, end of 2016
Rent over housing price (%)	5.8	6.0	2007–2016 average, Laszek et al. (2018)
Frac. of homeowners (%)	84.3	82.2	2016, Survey
Frac. of private market tenants (%)	9.6	6.7	2016, Survey
Frac. of HH 'living with parents' (%)	6.1	11.1	2016, Survey
Share of mortgage debt in GDP (%)	44.9	37.2	Eurostat, end of 2016
GINI labour income	30.9	31.8	World Bank for 2015
GINI total wealth	45.7	58.7	Grejcz and Zolkiewski (2017)

Notes: The tenancy structure from the survey is adjusted by dropping public renters from the sample.

rate at $r = 0.035$ is close to the observed value of 3.6%, calculated with the Eurostat data. This rate implies the capital to GDP ratio at 1.9 and investment to GDP at 18.3%, which are equal to the average values from the period 1999–2016. As regards the other ratios from the national accounts, the model slightly underestimates consumption and overestimates housing investment shares in GDP. It is also consistent with the data by indicating negative international investment position of the Polish economy, amounting to -46.4% of GDP (model) and -61.6% of GDP (data).

As regards the structure of the housing market, the high maintenance cost $\delta_r = 0.025$ allows the rent level $p_r = 0.058$ to be broadly consistent with the average value of around 6% over years 2007–2016. For the tenure structure, the share of homeowners in the model is almost the same as among the respondents to the survey described in Section 2 (84.3% vs. 82.2%). On the contrary, the fraction of tenants is slightly overestimated (9.6% vs. 6.7%), whereas the share of households cohabiting with parents is underestimated by the model (6.1% vs. 11.1%). Table 4 also shows that the equilibrium mortgage debt to GDP ratio of 44.9% is only slightly above the value of 37.2% reported by Eurostat. Finally, the last two rows of Table 4 show that the model is nicely describing the distribution of income, but underestimates wealth inequality observed in the Polish economy. In particular, model implied GINI indexes for labour income and total wealth amount to 0.309 and 0.457, compared to 0.318 and 0.587 seen in the data.

Figure 3 presents the life cycle paths of key model variables, the average values for all age cohorts as well as the values for three randomly selected households (poor, middle-class, rich). The left-upper panel shows that after-tax annual labour income is initially hump-shaped and then flattens out for retirees. At the individual household level, income depends on age (deterministic part), but also on the realization of the idiosyncratic productivity $e \in \mathcal{E}$. The scale of individual income risk is well illustrated by the difference in the earnings between the ‘poor’ and ‘rich’ households. For the former labour income fluctuates at around 20k PLN per year for the entire life cycle, whereas for the latter labour income fluctuates between 80k and 100k PLN and declines to around 40k PLN during the retirement. The differences in life-time earnings are reflected in the decisions on consumption, housing and non-financial assets. The right-upper panel of Figure 3 shows that the average consumption is hump-shaped over the life cycle, but its time variability is much lower than that of income. It can be noticed that the consumption level for younger cohorts is relatively low. This is because these households earn relatively little, but also they accumulate assets for the down-payment necessary to buy their first house, given the borrowing constraint (14) is binding.

The middle panels of Figure 3 present the value of inhabited houses, which can be owned or rented. The average size of owned house increases till age 60, then flattens out to decrease somewhat after age 85. At the individual level, households change the size of owned house very seldom: once or twice during the lifetime. The ‘rich’ household lives with parents for the first two years to buy the first apartment at age 22, move up on the property ladder at age 28 and 46 and downsize housing assets when 91 years old (if alive). On the other hand, the ‘poor’ household strive to save for the downpayment to become homeowner. She or he cohabits with parents for the initial years to rent the smallest possible apartment for the rest of his or her life. In turn, the middle-class household buys a two-room house at age 24 and lives there until the age of 97 (if alive), when she or he decides to become a tenant.

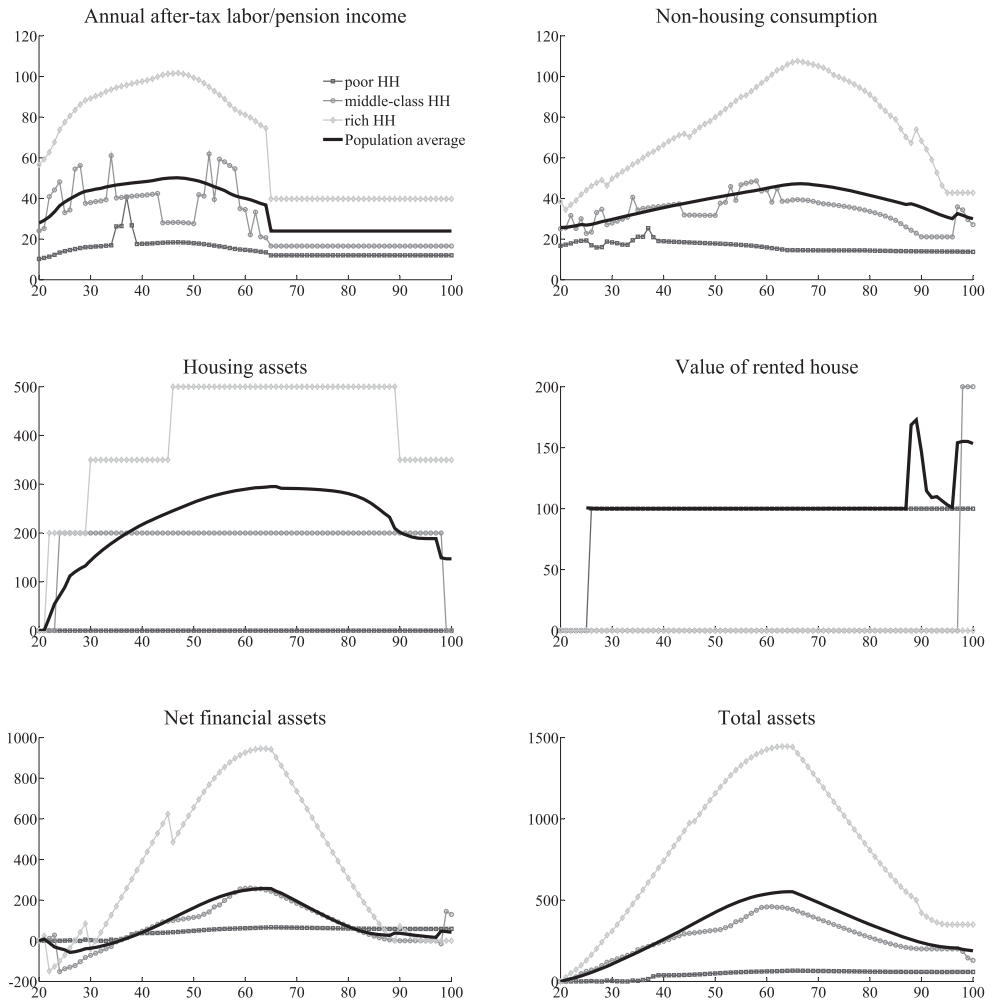


Figure 3. Households characteristics over the life cycle in the benchmark economy.

Notes: The figure presents the average values for all age cohorts (population average) as well as the values for three randomly selected households (poor, middle-class, rich). All values are expressed in th. PLN.

The bottom panels of Figure 3 present the values of financial and total assets, which are determined by choices related to consumption spending and housing. It can be noticed that, on average, in the initial periods, households tend to take loans for house purchases, which is reflected in negative values of net financial assets for cohorts below 40 years old. Then, the average value of net financial assets increases, to reach a peak at age 65, and declines steadily thereafter as households are using their life-time savings to keep consumption above their pension income. The panels also present the scale of wealth inequality generated by the model. The peak value of total assets of the 'rich' household is about 1500k PLN, whereas for the 'poor' household it is less than 50k PLN. Even though this clearly underestimates the true wealth inequality, it might be argued that this distribution is realistic enough to describe house tenure choices.

6. Counterfactual simulations

In this section the model is used to examine the long-term effects of changes in the structure of the rental market. Specifically, my goal is to simulate the potential effects of a shift from the currently observed dualist rental system in the typology of Kemeny (1995), to the hypothetical, unitary rental system scenario. As discussed in the previous section, the *dualist* benchmark economy is characterized by (i) low security of tenants, both in terms of protection against eviction as well as rent increases, (ii) relatively high rental prices as well as by (iii) taxes promoting ownership. In the *unitary* alternative economy, the government is actively involved in the development and regulation of the rental market, which in the long-run leads to higher sense of security of tenants, lower rental prices as well as neutral taxes. The detailed choice of the counterfactual scenarios is based by empirical observations by Hoekstra (2009), who indicates that in comparison to the dualist rental system, in the unitary system (i) housing quality differences between the owner occupancy and the rental sector are smaller, (ii) rental prices are more affordable and (iii) taxes are less favourable for ownership than in the dualist system. These three observations are simulated within the following scenarios:

- (S1) higher rental quality,
- (S2) lower rental price,
- (S3) equal taxation.

In terms of the model parameters, scenario S1 is introduced by raising the quality of rental services ϑ from 0.85 to 0.95. This choice is based on the result of the empirical studies by Elsinga and Hoekstra (2005) or Diaz-Serrano (2009), which indicate that in unitary rental system countries the disutility from renting amounts to around 5%. In scenario S2, the value of maintenance cost for rental housing δ_r is lowered from 0.025 to 0.015, so that in the rent price p_r goes down by 1 p.p. Scenario S3 eliminates taxes on income from renting by setting $\tau_r = 0$. However, taxes are not fully neutral due to different taxation of assets, as implied by Equation (16).

It should be noted that changes in scenarios S1 and S2 are unlikely to be easily implementable by the government, especially over the short-term horizon. They should be perceived as a long-term goal, which can be supported by a well-designed housing policy. For instance, giving incentives to investors that specialize in managing and building rental housing, by leading to a shift of the rental market from informal into professional sector, would probably contribute to a gradual increase in the quality of rental services. In turn, a steady lowering of rental prices could be supported by smarter regulations related to rent control and protection against eviction, which would alleviate the risk currently faced by landlords related to the fact that they cannot get rid of tenants who are devastating their apartments or are not paying rents. In this paper I abstract from formulating exact policy recommendations, but focus instead on quantifying how the economy would look alike after introducing changes described in scenarios S1, S2 and S3, both separately and together (full change scenario).

Aggregate effects. The equilibrium values for key variables and ratios in all scenarios are displayed in Table 5. The table is organized so that the first column describes the benchmark economy, each of the three middle columns presents the effects of a single change,

Table 5. The effects of housing rental market reforms.

Scenario Description	Benchmark	S1 higher quality	S2 lower rents	S3 equal taxes	Full
<i>Model parameters assumptions</i>					
Quality of rental services (ϑ)	0.850	0.950	0.850	0.850	0.950
Maintenance costs of rented houses (δ_r)	0.025	0.025	0.015	0.025	0.015
Tax on income from renting (τ_r)	0.085	0.085	0.085	0	0
<i>Disadvantage of renting (% of house value per year)</i>					
Buying from savings (see Equation (16))	2.7	2.7	1.7	2.2	1.2
Buying with mortgage (see Equation (17))	0.0	0.0	-1.0	-0.5	-1.5
<i>Housing tenure structure among households (HH)</i>					
Frac. of homeowners (%)	84.3	80.9	77.5	82.3	63.1
Frac. of tenants (%)	9.6	13.0	18.2	11.8	33.1
Frac. of HH 'living with parents' (%)	6.1	6.1	4.3	5.9	3.8
<i>Living conditions</i>					
Av. size of owned house size (m ²)	54.5	55.7	55.4	52.8	58.6
Av. size of rented house size (m ²)	20.3	20.4	26.1	20.8	32.4
Av. age of first house purchase	28.5	29.9	31.6	29.1	37.0
Frac. of HH buying house over lifespan (%)	96.9	95.6	94.8	96.5	88.3
<i>Mortgage market</i>					
Frac. of HH with debt (%)	20.2	17.6	15.6	16.8	7.3
Av. debt per homeowner (PLN, th)	143	150	157	147	174
Mean LTV of existing loans	0.34	0.31	0.29	0.32	0.22
Mean LTV of new mortgages	0.69	0.66	0.62	0.68	0.25
Share of mortgage debt in GDP (%)	44.9	41.0	38.0	42.9	19.9

Notes: In scenario S1, the quality of rental market services ϑ is increased from 0.85 to 0.95. In scenario S2, the maintenance costs of rented houses δ_r decreases from 2.5% annually to 1.5%. In scenario S3, the tax rate on rental income τ_r is eliminated. The LTV of new mortgages refers only to mortgages for the first house purchase, hence do not account for mortgages taken for upgrading the size of the house.

whereas the last column shows the effects of introducing the three changes together. To increase the readability of the results, the first panel of the table presents the assumptions on the parameters in a given scenario. Next, the second panel reports the scale of economic disadvantage of renting in comparison to owning calculated with formulas (16) and (17). It can be seen that in the benchmark economy this disadvantage amounts to 2.7% or 0.0% of occupied house value, depending whether the house is purchased from savings or with a mortgage. If one takes into account that on top of this tenants lose 15% of utility from low quality of housing services, it is intuitive why in the benchmark economy everyone tries to buy a house as quickly as possible and only credit constrained households decide to rent. The situation is very different in the full change scenario. If the house purchase is financed from savings, the economic disadvantage is still positive, but declines to 1.2%. If the purchase is financed with a mortgage, owning becomes more expensive than renting: a homeowner has to pay 1.5% of the house value more than a tenant. Given that the disadvantage of renting due to low quality of rental services is also attenuated, all the results that are in the next panels become clear.

In particular, the third panel of Table 5, which describes the housing tenure structure, shows that by improving the quality of housing services it is possible to increase the rental share by 3.4 pp. (from 9.6% to 13.0%, scenario S1). In turn, lower rental prices allow to raise the ratio by 8.6 pp (to 18.2%, scenario S2), whereas the change in taxation leads to rental market share growth of 2.2 pp (to 11.8%, scenario S3). An interesting feature of the model is that allows for the interaction effects. In the full change scenario, the share of tenants in the economy goes up by 23.5 pp (to 33.1%), which is almost double the sum of the effects

of introducing three changes separately (14.2 pp). The explanation is straightforward: to make the rental market an interesting alternative to owning, one needs to remove or alleviate all barriers that make renting unattractive.

The fourth panel of Table 5 presents statistics related to the average size of occupied dwellings. The first two rows show that introducing three changes together (but not an individual changes) raises the average size of both owned and rented dwellings.¹¹ The increase is the most visible for the rental housing, where the average size increases from 20.3 to 32.4 m². The explanation is that in the full change scenario young households are more eager to rent larger apartments and for longer periods than in the benchmark. They decide to become homeowners only after gathering enough financial assets to buy the house from savings rather than with a credit. In fact, the third row of the panel indicates that in the alternative economy the moment at which households acquire their first house is postponed by almost 10 years, from the age of 28.5 to 37.0.

The last panel of Table 5 describes the characteristics of the mortgage market. Given that in the full change scenario owning with a mortgage is more expensive than renting, the fraction of indebted households declines from 20.2% to only 7.3%. At the same time, the mortgage debt to GDP ratio falls from 44.9% to 19.9%. This indicates that the change in structure of the rental housing market brings more stability to the economy, by making it more resilient to financial sector shocks.¹²

Life cycle effects. The results from Table 5 are complemented by Figure 4, which presents how changing the structure of the rental market affects the decisions taken during the life cycle. The upper-left panels of the figure shows that in the full change scenario the average path of spending on consumption is little affected by the changes. In contrast, the upper-right and middle panels demonstrate that there is a visible change in the tenure structure. In the alternative economy cohorts that are below 30 years old mostly rent or cohabit with parents. Then, the homeownership ratio increases to about 80%, and stays at this level for cohorts of age up to 80 years. Thereafter there is a tendency to sell houses, which can be justified by the fact that some households decide to increase financial liquidity. This is reflected in the life-time path of net financial assets and mortgage debt (bottom panels of Figure 4). The change in the housing market structure is strongly limiting the demand of households to take a mortgage in the early stage of life. Now, they can satisfy their demand for housing services by renting.

Welfare effects. So far I have discussed how changes in model parameters affect housing tenure structure. I complement the analysis by comparing welfare, which is defined as ex-ante expected life-time utility of the newborn cohort in the stationary equilibrium, in all scenarios. It should be emphasized that I abstract from many topics that would be relevant in the discussion on reforming the rental market in Poland. These include, among others:

- (a) costs related to the transitional dynamics,
- (b) effects of housing structure on business cycle fluctuations,
- (c) expenditures that needs to be paid to improve the quality rental housing,
- (d) income loses of current landlords related to lower rental prices.

Instead, I only compare two hypothetical states of the world. The first one is with dysfunctional rental market (benchmark economy) and the second, in which the rental market is

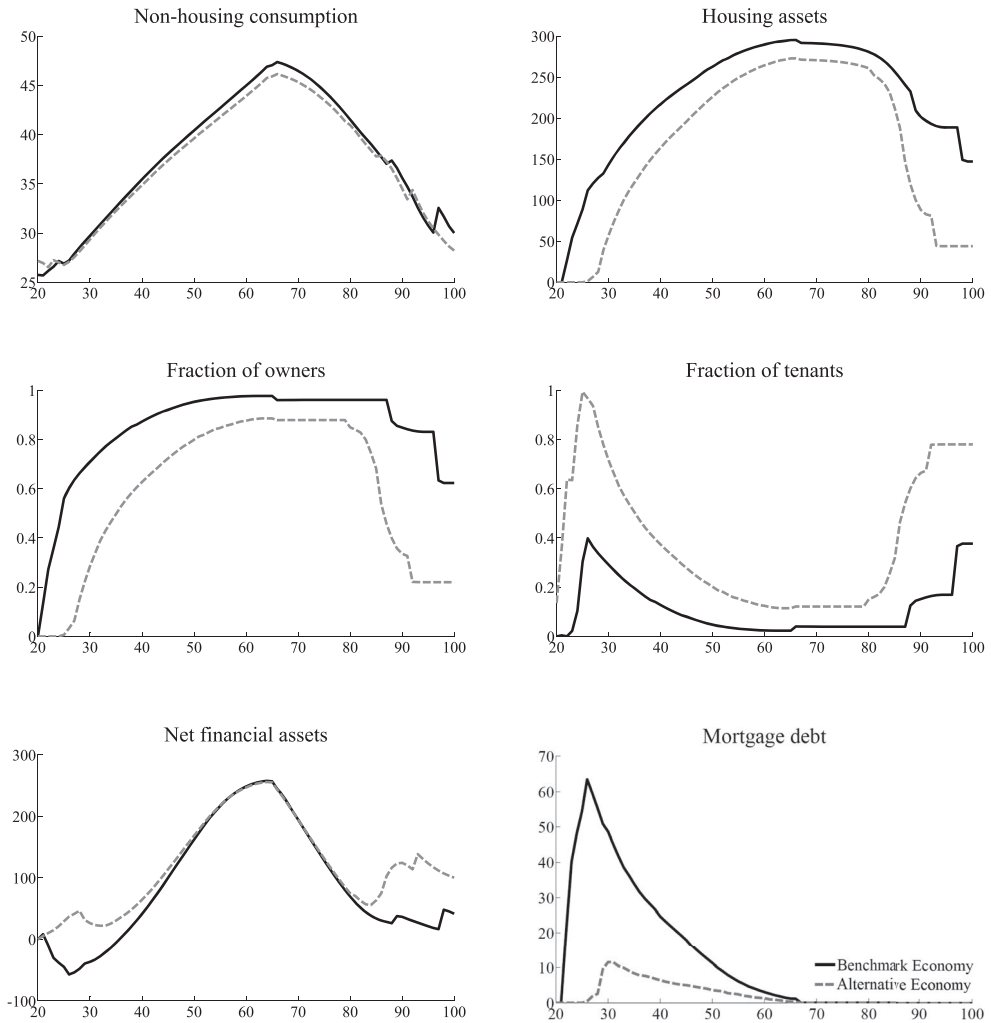


Figure 4. The life cycle effects in the benchmark and full change scenarios.
 Notes: Average values for each age cohort. All values, but the fractions, are expressed in th. PLN.

well-functioning (alternative economy). It can be added that the main aim of this analysis is to investigate who gains or loses on the reform of the housing rental market.

In the first version I ask how much a newborn household with individual productivity e would be eager to pay in nominal terms (PLN) so that she or he would be indifferent to live in the benchmark and alternative economy. Let the ex-ante expected life-time utility of the household in both economies be $V_1(na, h, e)$ and $V_1^*(na, h, e)$, where * denotes the alternative economy. Given that all households are born with no assets ($na=0$ and $h=0$) to answer the question one needs to solve $V_1(\omega, 0, e) = V_1^*(0, 0, e)$ for ω , the interpretation of which is in terms of financial loss due to the dysfunctional rental market. In the second version, I scale this nominal value by an expected life-time income of the household with a given idiosyncratic productivity. Table 6 describes gains or losses expressed in absolute (PLN) and relative (% of expected lifespan income) terms. A quick glance at the table is enough to notice that poor households, i.e. with

Table 6. Welfare calculation.

Productivity	Share	S1 Higher quality	S2 Lower rents	S3 Equal taxes	Full change
<i>in thousand PLN:</i>					
Very low	13.6	11.0	11.6	4.7	27.0
Low	22.2	10.7	11.2	4.5	26.3
Median	28.4	7.6	7.4	2.4	20.2
High	22.2	4.0	2.8	0.5	11.9
Very high	13.6	1.8	0.7	0.1	5.9
<i>% of expected lifespan income:</i>					
Very low	13.6	1.1	1.2	0.5	2.7
Low	22.2	1.0	1.0	0.4	2.4
Median	28.4	0.6	0.6	0.2	1.6
High	22.2	0.3	0.2	0.0	0.8
Very high	13.6	0.1	0.0	0.0	0.3

Notes: The table presents the welfare gains for the youngest cohort in a given scenario in comparison to the benchmark economy.

the lowest productivity, gain most from living in a country with a well-functioning rental market. In the absolute terms, their gain (benchmark vs full change scenario) is 27.0k PLN, which is an equivalent of 5.4 m². of a housing unit. In the relative terms, this is an equivalent of 2.74% of their expected lifetime income. There are several reasons behind this result. The first one is that in the benchmark economy for young and poor households the probability of being a tenant later during the lifespan is relatively high. In a *ceteris paribus* analysis, the reform causes that living in rented apartments becomes more comfortable (S1) and cheaper (S2 and S3). On top of that, in a dynamic analysis, the change in the housing market structure makes causes that these households adjust their tenure decision over the lifespan. Instead of taking costly mortgages to become homeowners as soon as possible, they now satisfy their housing needs by renting. As regards the richest households, welfare gains are negligible. The result is intuitive as rich households usually decide to buy a house, even in the environment of well-functioning rental market.

7. Conclusions

The share of the rental housing market in Central and Eastern European countries is low. This might be explained by the popularity of housing policies promoting homeownership, but also by other financial and non-financial factors. In this paper I have discussed the reasons behind rental market underdevelopment using individual data from a survey among the representative sample of 1005 Poles, which shows that the preferences of the respondents are strongly tilted towards owning due to economic and psychological beliefs. Poles perceive ownership not only as a cheaper form of satisfying housing needs but also as the only way to provide a safe place for the family and to really 'feel at home'. The survey allowed me to identify the most important barriers to demand for and supply of rental housing. Among the former, inefficient institutions and the lack of professional renting services turned out to be of crucial importance. For the latter, the low culture of tenants combined with their high protection seems to dominate.

Given the above diagnosis, I have proposed a life cycle model with rental housing and calibrated it to the Polish data. The model has been subsequently applied to conduct counterfactual simulations and evaluate how changes in the structure of the rental market affect its size over the long-term horizon. These changes included (i) improving

the standard of rental services, (ii) lowering rental prices, and (iii) diminishing fiscal incentives to own. Simulation results indicate that introducing the three changes together would shift the rental share from below 10% in the benchmark economy to about 35% in the alternative one. An interesting finding is that the total effect of the combined change is much larger than the sum if the three changes were introduced separately. On top of that, I have shown that a developed rental market might also contribute to a more stable financial sector, as the household debt to GDP ratio decreases substantially. Finally, the welfare analysis indicates that the well-being of the poorest households can be improved by enhancing the functioning of the rental market. This would justify any attempts to develop a sound housing policy aimed at making the rental market a viable alternative for ownership

Notes

1. In Poland, there were two such programs. Within the first program, *Rodzina na Swoim* (Family on its Own), the government was subsidising up to 50% of mortgage interest payments for the first eight years after the purchase of an apartment. In 2014 *Rodzina na Swoim* was modified into *Mieszkanie dla Młodych* (Apartment for the Young), in which the government was subsidising downpayments for young families, where the subsidy amounted up to 30% of an apartment value.
2. Throughout the paper, I use x' to denote the next period value of a variable x .
3. I assume that the pension depends on the labour income at retirement age and not the entire history of earnings as the latter solution would require introducing a new state variable and would make the model much more sophisticated.
4. I abstract from the fact that the spread is related to the credit risk and might depend on the characteristics of the debtor or the housing unit that serves as a collateral (Justiniano, Primiceri, & Tambalotti, 2017).
5. In the model economy households are holding financial assets or mortgage debt, but never both, so that $a=0$ or $d=0$.
6. $\mathcal{B}(Y)$ denotes the Borel σ -algebra on Y and $\mathcal{P}(Y)$ the power set of Y .
7. In particular, I assume that the size decreases from the initial size of 16 m² by 2 m² per year and starting from age 29 h_c it is a small number that represents homelessness.
8. The data from <https://www.globalpropertyguide.com> show that in 2018 rental yields stood at around 5.5%.
9. The standard intermediation fee in Poland amounts to 2.5% plus the VAT rate of 23%, whereas the tax on civil law transactions amounts to 2% for properties purchased at the secondary market.
10. In 2013, the Polish Financial Supervision Authority imposed 'Recommendation S', according to which starting from 2017 the maximum LtV ratio is 80%. Before that period a significant fraction of newly granted loans was characterized by a higher LtV.
11. Even though both averages increase, the average size of the occupied house is decreasing because of the change in the tenure market structure.
12. Here I assume that rental housing is financed by savings rather than by mortgages.

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