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SOCIAL HOUSING POLICY IN A SEGMENTED HOUSING MARKET: INDIRECT EFFECTS ON MARKETS AND ON INDIVIDUALS

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Abstract:

This paper analyses indirect effects of social housing policy (SHP) in a segmented housing market. A two segment-housing ladder, where equity determines up trading, shows how SHP-measures targeting either housing supply or housing demand impact market developments and individual housing careers. When addressing market developments the paper considers house prices and housing supply. Analysing housing careers we highlights the ability of households indirectly exposed to SHP to trade up a housing ladder. The segmented housing market model contains both multipliers, along the lines of the Balanced Budget Multiplier of Haavelmo (1945), and non-neutral price effects across segments. These features allow some novel results when discussing indirect effects of SHP. Relating SHP to up-trading and a housing ladder where households simultaneously act as buyers and sellers, we first of all show the effect of SHP on the supply of used homes, an important part of housing supply. Second, this framework makes us able to position crowding-out across market segments. Both features are novel in the SHP-discussion. The paper also shows how SHP might create negative indirect effects on the up-trading ability of households that do not benefit from SHP measures.

Keywords:

Housing market structure, social housing policy, indirect effects

JEL Classification: R21, R31, I38

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1. Introduction

For many households is a housing career characterised by equity induced up trading between market segments. For others, is entry into owner-occupation by itself difficult, and some are in need of government assistance to enter owner-occupation. While social housing policy intends to improve housing consumption among the latter group of households, such policies may also affect housing consumption among the former.

The literature on social housing policy is extensive (see Apgar (1990), Priemus and Dieleman (2002) or Scanlon et al (2017) for interesting contributions). When analysing effects of social housing policy is the choice between supply- and demand side measures (see e.g. the seminal Galster (1997) article) and the discussion between renting and owning (see for instance Munro (2007), Arundel and Doling (2017) or Haff
ner et al (2017)) dominating the debate. In addition is the extent of crowding-out at the focus of attention, as discussed by Murray (1983, 1999), Sinai and Waldfogel (2005), Nordvik (2006) or Eriksen and Rosenthal (2010)).

This paper analyses social housing policy (SHP) in a segmented housing market where equity gains allow households to trade-up a housing ladder. The focus of the paper is on the *indirect* effects of SHP, including effects on markets and on individuals. Analysing market effects the paper highlights house prices and housing supply. The indirect individual effects are related to the impact of SHP on the ability of households that do not benefit from SHP to trade-up a housing ladder.

A number of papers argue the importance of housing markets for economic developments (see for instance Goodhart and Hoffmann (2008), Duca et al (2011), Agnello and Schucknecht (2011) or Kivedal (2014)). The different papers address housing market developments quite differently. Smith and Rosen (1988) described a housing market as a series of overlapping submarkets differentiated by location, dwelling type, tenure, form, age quality and financing. A comprehensive understanding of housing markets may thus be contingent on analysing the interaction between market segments. Such an approach might however both be problematic due to data limitations, or the necessary simplifications, abstracting away from real housing market characteristics. The role of, and interaction between, different market segments, is discussed by Grey (2017), analysing market segment implications in a wider context, including real housing market characteristics as housing industry behaviour, lenders and the business cycle. The interaction between segments might impact a number of features, as for instance analysed by Anundsen and Røed-Larsen (2014), how the

decision of homeowners of whether to sell or buy first when trading up a housing ladder might impact a housing recovery. When analysing indirect effects of SHP, we need to stylize a segmented housing market model to efficiently describe relevant market characteristics, knowing that these simplifications come with a cost.

Astrup et al (2015) analyses indirect effects of SHP where indirect effects denotes effects other than the objectives these schemes aim to support (Astrup, 2015, p.12). In a homogenous housing market are price effects argued most pronounced in the "lower segment", but without any evidence of price compression across the market. The paper does not consider "higher segments" as they are outside the scope of the selective SHP measures. There is evidence of price effects from SHP both in the short- and in the long run. While one should expect short-run price effects from SHP, if only to stimulate supply, are long-run price effects more troublesome. The paper finds some evidence of long-run price effects from start-up loans, which might have a negative influence on the housing career of households that do not benefit from SHP.

Analysing housing policy in general, and social housing policy more specifically, the heterogeneous structure of the housing market should be taken into account. Rothenberg et al (1991) states

"Housing market events and government policy initiatives which impact one submarket will have their primary effects in that submarket, with secondary effects appearing in other submarkets to the extent those submarkets are linked in substitution possibilities with the original submarket" (Rothenberg, 1991, p. 48)

Substitution effects might be important between some segments, while equity effects might be important between segments (See Lee and Ung (2005) or Røed-Larsen (2010b) for the role of equity). Our frame of reasoning draws on Borgersen (2016, 2014a, 2014b). We consider a housing market that contains two segments for owner-occupied housing, starter and family homes, and is characterised by a housing ladder where a starter home is the first-step on the ladder. Equity gains from starter home appreciation allow households to climb the ladder and enter the family home segment. This market structure allows for both first time- and repeat buyers. A household that moves from a starter to a family home is simultaneously supplying a starter home and demanding a family home. A household entering the starter home segment is however doing just that, demanding a starter home. Our SHP measures are implemented in the rental market or the starter home segment. However, if SHP impact up-trading, prices and supply might also be affected in the family home segment, as policy interventions might create repercussions throughout the market.

Irrespective of which segment we consider, is a household often in need of external finance when purchasing a home. Normally are both debt-servicing ability and collateral important for a household's ability to attract external finance. Borgersen (2016) shows that even though a mortgagor consider debt-servicing ability to be the first-line of defence against credit risk exposure, it might be willing to allow collateral to govern supply when housing appreciations exceed a critical limit. For a household trading-up the housing ladder from a starter to a family home both prevailing equity (the starter home price) and the purchasing price (the family home price) and, correspondingly, the debt-to-equity-ratio, might be affected by SHP. The segmented housing market structure links SHP to households' ability to trade-up a housing ladder.

One may argue SHP to contain a number of indirect effects. When stimulating the supply of social housing, conventional fiscal multipliers might lift domestic activity and employment, and ultimately housing demand and house prices. These effects might counteract the negative effect on house prices from increased supply. The indirect effects of SHP addressed in this paper shows how SHP impact both starter and family home prices, effects that are passed-through to aggregate house prices, even though SHP targets the starter home segment. The paper also derives conditions for when SHP hampers the up-trading ability and the housing career of households that do not benefit directly from SHP. The indirect effects are related to how the debt-to-equity ratio of a household trading up a housing ladder is affected by SHP. In an up trading model where both equity and the necessary borrowing is derived from different market segment prices, the paper shows how SHP impact a household's ability to trade up a ladder by fulfilling a collateral constraint.

The rest of the paper is structured as follows. The next section presents (briefly) the two-segment housing market model of Borgersen (2014a,b), highlighting the demand side effects of equity induced up-trading. The third section introduces different SHP measures and analyses the market effects of SHP. The last part of the section analyses how SHP indirectly impact individual housing careers. The fourth section introduces the supply side effects of up-trading and analyses the same triangle of questions as above taking both the supply and the demand side effects of up trading into account. The fifth section introduces capacity constraints and profitability considerations on the supply side of the housing market. The last section concludes.

2. A housing market with two segments and equity induced up-trading

Borgersen (2014a, 2014b) considers a housing market with two segments for owner-occupied housing; starter (s) - and family (f) homes, in addition to a rental market. Figure 1 pictures the

housing market structure where the rental market is an alternative to owner-occupation in the starter home segment and the family home segment is the final step on the housing ladder. [1]

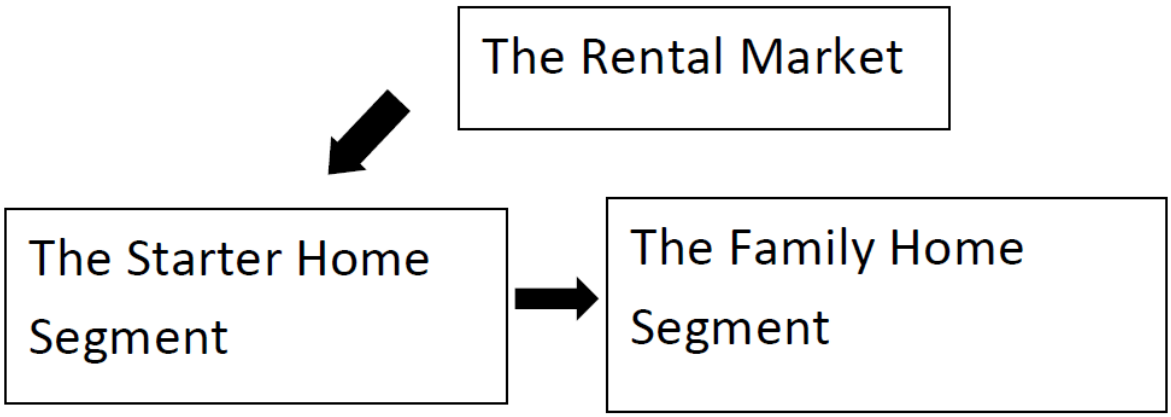

Figure 1. The housing market structure and the relation between rentals and the segments for owner-occupied housing

In each market segment is the price determined by the interaction between housing supply S_i and housing demand D_i

1) $$D_i = S_i \qquad i = s,f.$$

First, we fix supply. To highlight the role of the different market segments, as well as the interaction between segments, we apply a minimalistic approach to demand. We allow for one demand side shifter d_i in each segment, a shifter that might represent both household income and credit availability. In each segment is demand negatively related to the segment price P_i and positively related to the price of alternative housing, which is either rentals R or starter homes P_S, depending on whether we consider the first- or the second step of the housing ladder. Equity E_i impacts demand in both segments. The demand for owner-occupied housing is, in our linear framework where parameters represent elasticities (which is to be discussed later).

2) $$D_s = d_s - p_s P_s + p_R^s R + E_s$$

3) $$D_f = d_f - p_f P_f + p_R^f P_s + E_f$$

[1] This framework assumes that households are impatient when it comes to entering owner-occupation. The tendency for favoring owner-occupation over renting as a preferred way of tenure across Europe is described by Priemus and Dieleman (2002). Pareja-Estaway and Varo (2002, 2017) discuss problems with an unbalanced rental sector in Spain, highlighting the consequences of such SHP structure in an economy in crisis.

In the starter home segment is equity exogenous, and we simplify by allowing $E_s = 0$. In the family home segment is equity endogenous and related to starter home prices $E_f = e_{fs} P_s$. The parameter e_{fs} is an indicator on how starter home equity impacts the demand for family homes, and is referred to as the up-trading elasticity. The elasticity is non-negative. When $0 < e_{fs} < 1$ not all equity gains result in up-trading, while $e_{fs} > 1$ pictures a case where there the up-trading response exceeds the equity gain. Differing elasticities might be a result of variations in up-trading preferences. Alternatively, and which is the approach we pursue in the following, is different elasticities a result of different up-trading possibilities. When purchasing a home is external finance (often) necessary and mortgage market conditions important for the up-trading ability. We might see inelastic up-trading with respect to equity $e_{fs} < 1$ in situations where collateral constraints and loan-to-value (LTV) conditions are tight. When collateral constraints are weaker, and mortgagees accept higher LTV-ratios up-trading is elastic $e_{fs} > 1$, as a given equity gain is assumed to increase mortgage availability.

Finally, as few households move from starter to family homes due to substitution effects, we abstract away from these effects between starter and family homes $p_R^f = 0$. These simplifications introduce an asymmetry in the model as the demand for family homes contains a wealth-effect but no substitution-effect, while the demand for starter homes has the opposite structure.

The house price index P is derived from individual market segment prices P_i by

4) $$P = \Sigma_i \, \alpha_i P_i ,$$

where the weight each segment has in the house price index is determined by the segment size α_i. To simplify notation we introduce net-demand (ND) in each segment as $ND_s = \left[d_s - S_s + p_R^s R \right]$ and $ND_f = \left\lfloor d_f - S_f \right\rfloor$, respectively. Net-demand is positively related to the demand shifter and negatively related to housing supply in each segment. In the starter home segment we have included the substitution effect between rentals and starter homes (the variable $p_R^s R$) in net-demand to allow rental subsidies to be a policy option in the following. In the family home segment, the endogenous equity component $e_{fs} P_s$ is kept separate, as it is crucial for the model reasoning.

Equilibrium is expressed in terms of market segment prices for starter and family homes respectively

5) $$P_s = \frac{1}{p_s}\left[ND_s\right],$$

and

6) $$P_f = \frac{1}{p_f}\left[ND_f + \frac{e_{fs}}{p_s}\left[ND_s\right]\right].$$

The house price index - using expression 4) – equals

7) $$P = \frac{\alpha_f}{p_f}\left[ND_f\right] + \left[\frac{\alpha_s}{p_s} + \frac{\alpha_f}{p_f}\left[\frac{e_{fs}}{p_s}\right]\right]\left[ND_s\right].$$

Expression 7) shows how market segments might have both *direct* and *indirect* effects to the house price index. The *direct price effect* is determined by the segment size, scaled by the segment's demand elasticity $\frac{\alpha_i}{p_i}$.

The family home segment is the final step of the ladder and does not allow for any further up-trading. The direct effect is therefore the only effect from this segment to the house price index. The starter home segment has however in addition an indirect effect on the index. The indirect effect is due to that a net-demand shock to the starter home segment creates an equity gain for starter homeowners. The equity gain stimulates up-trading, and impact family home prices and, eventually, also aggregate house prices. This *indirect effect* is referred to as the *up-trading effect* in Borgersen (2014a), and is driven by the up-trading elasticity between starter and family homes e_{fs} .

To highlight the role of the different market segments, as well as the interplay between segments, we introduce some simplifications. Without loss of generality, we restrict the reasoning to a symmetric market structure $\alpha_S = \alpha_f$.[2] To highlight the importance of the up-trading elasticity we also assume equality (and unity) between the elasticity of demand in all market segments $p_S = p_f = 1$. This simplification, while in contrast to some real housing market features, brings forward the feature crucial for the model's novel results, related to the supply of used homes and the positioning of crowding-out across market segments.[3]

[2] For variations in housing market structures see Borgersen (2014a).

[3] Housing market elasticities is a widely focused research topic. Caldera- Sanchez and Johansson (2011) show huge differences in the price responsiveness of housing supply among OECD countries. A number of papers analyze price and income elasticities in housing demand, see for instance Glennon (1989), Fernandez- Kranz and Hon (2006) and the references therein. Røed- Larsen (2010a, 2014) analyzes income elasticities and Engel curves, while Røed-Larsen (2010b) separates between first-time entrants and current owners, when considering the slope of the housing demand curve. Both provide some motivation for our simplifications. Highlighting owner-occupied housing, Røed-Larsen (2010a) analyses the role of equity, and in particular, how equity gains might create and upward sloping demand curve from prevailing homeowners, while demand from first-time entrants still is downward sloping. Price gains might impact life-time income of homeowners differently than for renters, complicating the estimates of income elasticities for homeowners relative to households renting. Both these equity related effects are captured in our up-trading framework

We rewrite the market segment prices and the house price index as

5') $$P_s = ND_s$$

6') $$P_f = ND_f + e_{fs} ND_s$$

7') $$P = (\alpha_s + \alpha_f e_{fs}) ND_s + \alpha_f ND_f$$

Starting in the reverse order and first consider aggregate house prices, we see two prominent features in a segmented housing market. The first is how $e_{fs} > 0$ makes $\frac{\delta P}{\delta ND_s} > \frac{\delta P}{\delta ND_f}$. In the presence of equity induced up-trading the starter home segment has a stronger impact on aggregate house prices than the family home segment, introducing a *ladder-effect* in terms of policy efficiency. Second, as equity gains amplify shocks the housing market is characterised by a housing market multiplier $\frac{\delta P}{\delta \overline{ND}} > 1$ (again under the assumption $e_{fs} > 0$), when we consider $dND_f = dNS_s = d\overline{ND}$ a net-demand shock equal across market segments. For market segment prices we see how a shock to the net-demand for family homes only impact family home prices $\frac{\delta P_s}{\delta ND_f} = 0$ and $\frac{\delta P_f}{\delta ND_f} = 1$, while the net-demand in the starter home segment impacts both starter and family home prices $\frac{\delta P_s}{\delta ND_s} = 1 \; and \; \frac{\delta P_f}{\delta ND_s} = e_{fs} (> 0)$.

In addition, we find $\frac{\delta P_f}{\delta \overline{ND}} > \frac{\delta P_s}{\delta \overline{ND}}$ when shocks to net-demand are equal across market segments (as defined above). Borgersen (2014) refers to this as *up-trading induced price dispersion*.

3. Social Housing Policy

3a. House Prices

The above reasoning on the housing market structure and on the market characteristics allows us straightforward arguments regarding the effects of SHP. We relate SHP to a situation where $dND_s \neq 0$ and $dND_f = 0$, constraining SHP to the rental market and the starter home segment.[4] We apply a broad definition of SHP along the lines of Sandlie and Guldbrandsen (2017), including all types of housing that receive some form of public subsidy or social assistance, either directly or

by the equity elasticity, and to keep thing simple we abstract away from differences in price and income elasticities. To simplify notation, we equate prices to net-demand when having abstracted away from differences in price elasticities.

[4] This assumption makes the ladder effect above less relevant in the following.

indirectly, which in addition to subsidised housing starts, will allow for measures to subsidise both renting and owner-occupation. [5]

We consider three policy measures:

a) Social housing construction $dS_s > 0 \Rightarrow dND_s < 0$

b) Rental subsidy $dR < 0 \Rightarrow dND_s < 0$

c) Subsidised mortgage rates and/or subsidised housing expenditures
$dd_s > 0 \Rightarrow dND_s > 0$

The first two types of policy impact negatively on the net-demand for starter homes. Increased supply affects net-demand directly, while reducing the cost of renting through subsidies or introducing rent control will make some households substitute from owner-occupation to rental housing and impact negatively on the net-demand for starter homes. While subsidised construction is a supply side intervention is rental subsidies a demand side voucher stimulating home-owner outsiders to stay out of homeownership. Finally, subsiding mortgage rates and/or housing expenditures stimulate the net-demand for starter homes and might be allocated either to prevailing insiders or to current outsiders aiming for homeownership.[6]

From the reasoning above we find the price effects of SHP as

8) $\frac{\delta P_s}{\delta ND_s} = 1$ 9) $\frac{\delta P_f}{\delta ND_s} = e_{fs} > 0$ 10) $\frac{\delta P}{\delta ND_s} = \alpha_s + \alpha_f e_{fs}$

In addition to the effect on starter home prices is also family home prices affected. Allowing for interaction between segments we find price effects in the higher end of the housing market, in contrast to Astrup (2015). As the starter home segment carries with it effects to the family home segment, the market structure exacerbates the effects on aggregate house prices.

Looking at the partial derivatives, we see how *a social housing policy multiplier* $\frac{\delta P}{\delta ND_s} > 1$ is contingent on $e_{fs} > 1$.[7] From expressions 8) and 9) we find $e_{fs} > 1$ to (also) be the condition for *SHP created up-trading induced price dispersion* $\frac{\delta P_f}{\delta ND_s} > \frac{\delta P_s}{\delta ND_s}$.

[5] Subsidized owner-occupation falls within an asset based- welfare strategy (see for instance Ronald and Doling (2012)), which has been highly debate in the Western hemisphere the last years.

[6] See e.g. Nordvik (2006) for the insider-outsider issue.

[7] We use the fact that $\alpha_s = (1 - \alpha_f) \Rightarrow \alpha_f = (1 - \alpha_s)$ and rearrange $\frac{\delta P}{\delta ND_s} > 1$ using expression 10).

Compared to the initial model in section 2, both the *multiplier* and the *price dispersion* are contingent on a higher up-trading elasticity. The value of the up-trading elasticity, which is discussed further in the next section, is related to the extent equity gains increase mortgage availability.

3b. Housing Careers

To enter owner-occupied housing households are (often) in need of external finance, linking housing consumption to mortgagee behaviour. For a mortgagee is debt-servicing ability the first-line of defence against credit-risk. Borgersen (2016) shows how a mortgagee might be willing to step away from the first-line of defence and allow collateral (the second-line of defence) to govern supply when the rate of appreciation exceeds a critical limit. In the following we assume appreciations to exceed this limit. We consider the impact of SHP on the ability to trade-up the housing ladder by analysing the effect of SHP on an up-trading households' ability to fulfil a given collateral constraint. To give our reasoning some purchase we express the collateral constraint as a limit on the debt-to-equity (DtE)-ratio $\left(\frac{D}{E}\right)^{\lim}$.

For a household trading-up from a starter to a family home the starter home price represents prevailing equity and the family home price the purchasing price. In the absence of any financial savings is it necessary for a household to borrow the difference between the purchasing price of a family home and the selling price of a starter home to trade-up the ladder. SHP-interventions therefore affect the DtE-ratio both through the starter and through the family home price. While the effect on the starter home price produces equity gains from existing homeownership increases the effect on family home prices the amount necessary to borrow in order to purchase a family home. The DtE-ratio of a household trading up from a starter to a family home equals $DtE = \frac{D_f}{P_s} = \frac{P_f - P_s}{P_s}$, or when inserting the expressions for the different market segment prices $DtE = \frac{ND_f - ND_s(1-e_{fs})}{ND_s}$. The impact of SHP on the ability to trade-up a ladder is seen from the sign of $\delta DtE/\delta ND_s$. If $\delta DtE/\delta ND_s > 0 \left(\delta DtE/\delta ND_s < 0\right)$ SHP impacts negatively (positively) on the up-trading ability and a households housing career, as SHP interventions reduce (increase) the probability of fulfilling the DtE-constraint necessary for trading up the housing ladder.

After some rearranging, we find the effect of SHP on the DtE-ratio to equal

11) $$\delta DtE/\delta ND_s = \frac{1}{ND_s}\left[\left(e_{fs}-1\right)-DtE^{Initual}\right].$$

The sign of 11) is determined by $\left[\left(e_{fs}-1\right)-DtE^{Initial}\right]$. The current DtE-ratio is given by $DtE^{Initial}$, while the first two components represent the effects of SHP on family- and starter homes, respectively. The intuition behind these two, and how they impact the up-trading ability, is seen given by expression 8 and expression 9. When combined $(e_{fs}-1)$ represents the net-effect from SHP on the DtE-ratio of an up-trading household, which in section 3a is described in relation to *up-trading induced price dispersion.*

When the appreciation of family homes exceed the appreciation of starter homes, and the net-effect of this price dispersion exceeds the prevailing DtE-ratio $\left[\left(e_{fs}-1\right)>DtE^{Initial}\right]$, SHP increases the DtE-ratio necessary for up-trading and makes it more difficult. In this situation is up-trading contingent on a lending policy that allows for higher DtE-ratios. When $\left[\left(e_{fs}-1\right)<DtE\right]$ the opposite situation emerges, as the appreciation of starter home prices exceeds that of family homes and produce an equity gain that reduces the borrowing, and thus the DtE-ratio, necessary for trading-up the housing ladder.[8] The reduction in the DtE-ratio improves the ability of a household to satisfy a given DtE-constraint, and SHP- interventions makes up-trading easier.

A SHP intervention that impacts positively on starter home prices is by itself not sufficient to claim negative indirect effects on individuals housing careers. As positive price effects in the starter home segment create equity gains for starter homeowners, a complete assessment should take both the effects on starter home and family home prices into account. While appreciations of starter homes obviously make it harder for entry into owner-occupied housing in the starter home segment, is the effect on the up-trading ability of current starter homeowners contingent on how starter home prices are affected relative to family home prices.

4. Supply side extensions

In this section, we extend our reasoning on the indirect effects of SHP by including various supply side extensions. As the effects of demand side vouchers are discussed earlier, we focus the

[8] The down-payment effect and the ability to trade up the housing ladder is related to Stein (1995) analysing prices and trading in a housing market with down-payment effects.

discussion on supply side interventions and crowding-out when introducing more realistic supply side characteristics. [9]

Our framework mirrors Swank (2002) as we allow for two distinct supply side components. In each market segment are there some newly built houses N_i. In addition, we take into account that a household climbing the ladder put its existing home on the market and act simultaneously as a buyer and as a seller. The supply of starter homes S_S equals newly built starter homes N_S plus the demand for family homes D_f. At the final step of the ladder, where no further up trading is allowed, the supply of family homes S_f equals the number of newly built family homes N_f.

12) $$S_S = N_S + D_f$$

13) $$S_f = N_f$$

The model allows for coexistence of newly built and used homes, where we abstract away from depreciation of the housing stock. Thinking in terms of the Sinai and Waldfogel (2005) argument, where a successful housing program should either increase the number of housing units or increase the quality of the housing stock, we have a new SHP dimension in our model. SHP might be successful if, by stimulating up-trading, it increases the amount of used starter homes available at the marketplace. The supply of housing is affected both by an increase in the number of used and in the number of newly built houses $\Delta S_S = \Delta N_S + \Delta D_f$.

Even if there is no increase in the number of newly built houses, housing supply might increase if SHP contributes to increasing the number of used homes for sale,
$\Delta S_S > 0$ even if $\Delta N_S = 0$ as long as $\Delta D_f > 0$. In fact, demand side vouchers to owner-occupation insiders might now be a part of a successful SHP.

We find market segment prices and the house price index with our supply side extensions as

14) $$P_s = ND_s - N_f$$

15) $$P_f = ND_f + e_{fs}(ND_s - N_f)$$

16) $$P = ND_s(\alpha_s + \alpha_f e_{fs}) + \alpha_f ND_f - N_f(\alpha_s + \alpha_f e_{fs})$$

(As the supply side has two components we express net-demand (ND) in each segment in terms of newly built houses $ND_s = d_S - N_S + p_R^S R$ and $ND_f = d_f - N_f$.) Comparing expressions 14-16

[9] Focusing on supply side interventions the comparative statics shows negative price effects. When until now analysing shocks to net demand, comparative statics are positive but, of course, a positive shock to supply impacts net demand negatively, making results consistent across sections.

with expressions 5'-7', we find the new elements of the model to be more complex price effects from the supply of family homes, a supply side feature not directly related to SHP.
The intuition is straightforward. As the number of family homes increase, family home prices fall and up trading become easier. Up trading at lower equity levels impact negatively on the demand for starter homes and starter home prices. More intense up-trading, but from a lower level of starter home equity, brings an additional negative effect on family home prices as the equity effect from starter to family homes is weaker. These weaker price effects are again passed through to the house price index.

4a. Capacity constraints – SHP, prices and housing careers

Crowding-out is at the core of the SHP debate. When analysing crowding-out we begin with a simple case to highlight the role of market segment interaction. The housing industry produces both starter and family homes $\overline{N} = N_S + N_f$. We consider first a case where a capacity constraint binds the housing industry and the number of new homes is fixed $\Delta N = 0$. Crowding-out occurs in the form of reallocation between starter and family homes $\Delta N_S = -\Delta N_f$. This reallocation constraint may be seen as a situation where a social housing expansion stimulates the supply of starter homes which crowds-out private construction in the family home segment. The relation between subsidised and unsubsidised housing is as mentioned discussed by Murray (1983) and Murray (1999) and others,[10] and this framework is an extension to this, as we position crowding-out across different market segments.

Substituting the reallocation constraint $N_f = \overline{N} - N_S$ into expressions 14)-16) gives

14') $$P_s = ND_s - (\overline{N} - N_s)$$

15') $$P_f = ND_f + e_{fs}(ND_s - (\overline{N} - N_s))$$

16') $$P = ND_s(\alpha_s + \alpha_f e_{fs}) + \alpha_f ND_f - (\overline{N} - N_s)(\alpha_s + \alpha_f e_{fs})$$

Inserting for $ND_s = d_S - N_S + p_R^S R$ and $ND_f = d_f - N_f$, and using the reallocation constraint $\Delta N_S = -\Delta N_f$, links SHP directly to the crowding-out process. The comparative statics of a social housing expansion is

[10] Murray (1983) argued two mechanisms by which subsidized housing starts crowds out unsubsidized housing starts. Either as an increase in the supply of subsidized dwellings absorb households that otherwise would demand unsubsidised dwellings, or that some mortgage suppliers move from financing unsubsidised to financing subsidised housing.

17) $$\frac{\delta P_s}{dN_s} = 0$$

18) $$\frac{\delta P_f}{\delta N_s} = 1$$

19) $$\frac{\delta P}{\delta N_s} = \alpha_f$$

While starter home prices are unaffected there is a positive effect on family home prices due to crowding-out of family homes. The effect on family home prices is passed through to the house price index in an extent determined by the size of the family home segment. When crowding-out is absolute, up trading makes the price effects of supply side SHP interventions more pronounced in the upper than in the lower end of the housing market.

Higher family home prices makes up trading more difficult for starter homeowners and, as up trading is based on a higher equity level, is the lower level of up trading (and higher demand for starter homes) balancing the increased starter home supply, keeping starter home prices unaffected. While starter home prices are constant, impact higher family home prices positively on the house price index.

The indirect individual effects of SHP, as described by the up trading ability, are obviously negative. There are no equity gains from prevailing homeownership while purchasing prices further up the ladder increase. When combined, this affects positively on the DtE-ratio of an up-trader $\delta DtE/\delta N_s = \frac{1}{P_s} > 0$, making any DtE-constraint harder to fulfil.

4b. Profitability- SHP, prices and housing careers

We continue by introducing profitability considerations in the housing industry. The industry capacity $\overline{N}^P$ constrain production across the two market segments $\overline{N}^P = N_S^P + N_f$. The industry allocates production between segments according to the relation $N_f = \beta(P_f - P_s)$ where $\beta > 0$ measures the how the reallocation of production between starter and family homes responds to the price difference between segments. The government supplies social housing in the starter home segment N_S^o, making the aggregate supply of starter homes equal to $S_S = N_S^P + N_S^O + D_f$. When rearranging, and inserting for N_f, the private supply of starter homes equals $N_S^P = \overline{N}^P - \beta(P_f - P_s)$. From our equilibrium conditions prices are

20) $$P_s = ND_s - N_S^o$$

21) $$P_f = \frac{1}{\beta+1}\left(ND_f + (\beta + e_{fs})(ND_s - N_S^o)\right)$$

22) $$P = \alpha_s\left(ND_s - N_S^o\right) + \alpha_f\left(\frac{1}{\beta+1}\right)(ND_f + (\beta + e_{fs})\left(ND_s - N_S^o\right)$$

(We simplify by defining $ND_s = (d_s + p_s^P R - \overline{N}^P)$ and to keep notation consistent $ND_f = d_f$). The price effects of a social housing expansion are

23) $$\frac{\delta P_s}{dN_s^o} = -1$$

24) $$\frac{\delta P_f}{\delta N_s^o} = -\left(\frac{\beta + e_{fs}}{\beta+1}\right)$$

25) $$\frac{\delta P}{\delta N_s^o} = -\left(\alpha_s + \alpha_f\left(\frac{\beta + e_{fs}}{\beta+1}\right)\right)$$

The price effects of a social housing expansion are driven by the assumed additional capacity social housing creates in the starter home segment and are negative across market segments. A reverse situation, where the supply of social housing is extracted from the industry capacity, would provide opposite results.

When analysing crowding out our focus is on the crowding out that comes about due to the industry's relative profitability considerations across market segments. Let us first again consider the allocation constraint where $\Delta\overline{N}^P = 0$ makes $-\Delta N_S^P = \Delta N_f$ and a reallocation process driven by industry profitability according to the relation $N_f = \beta(P_f - P_s)$. When inserting the comparative statics we find

26) $$\frac{\delta N_f}{\delta N_s^o} = \beta\left(1 - \left(\frac{\beta + e_{fs}}{\beta+1}\right)\right).$$

The condition for when a social housing expansion stimulates the supply of family homes $\frac{\delta N_f}{\delta N_s^o} > 0$ is directly related to inelastic up trading $e_{fs} < 1$. The reallocation process automatically implies crowding out in the starter home segment $\frac{\delta N_S^P}{\delta N_s^o} < 0$. When, on the other hand, up trading is elastic $e_{fs} > 1$ with respect to equity $\frac{\delta N_f}{\delta N_s^o} < 0$, there is no crowding out of private

construction of starter homes $\frac{\delta N_S^P}{\delta N_s^o} > 0$. Crowding out is related to the degree of equity induced up trading.

Basically, the price effects of a social housing expansion are related to how the industry reallocates production in response to this expansion. A social housing expansion has a negative impact on all market segment prices, due to the assumed additional capacity it creates. (The price effects are reversed if the capacity effect is the opposite.) From expressions 23) and 24) we see how starter home prices fall more than family home prices when up trading is inelastic $e_{fs} < 1$, which makes the family home segment relatively more profitable. This makes the industry shift resources from starter to family homes. The relatively weaker profitability in the starter home segment that accompanies a social housing expansion now crowds out the private supply of starter homes.

When up trading is elastic $e_{fs} > 1$ family home prices fall more than starter home prices and the relative profitability in the starter home segment increase. The industry now shifts production capacity from the family home to the starter home segment. There is no crowding out of starter homes, and the industry shifts resources from the family home segment.

Finally, looking at the effect on the up trading ability of a household indirectly exposed to a social housing expansion the effect is $\delta DtE \big/ \delta N_s = \frac{1}{P_s}\left[DtE^{Initial} - \left(\frac{e_{fs} + \beta}{\beta + 1} \right) + 1 \right]$. As both prices on starter and family homes fall, is it the relative price change which is of interest. When $e_{fs} > 1$ we know that $\left| \frac{\delta P_f}{\delta N_s^o} \right| > 1 = \left| \frac{\delta P_S}{\delta N_S^o} \right|$ and purchasing prices responds stronger to a social housing expansion, making up trading easier in the case of a price fall.

5. Summary and discussion

In many countries is affordable housing and SHP at the forefront of the social policy debate. In the SHP debate there is a discussion regarding the efficiency of SHP measures (see for instance Eriksen and Rosenthal, 2010). There is also a discussion on the indirect effect of SHP, including both the effects on households that do not benefit from SHP interventions and on the effects of SHP on housing markets (see Astrup et al (2015). This paper contributes to both discussions.

Much of the analysis on SHP is framed in a homogenous housing market framework. This paper analyses SHP in a segmented housing market where equity gains from existing homeownership allow households to trade up a housing ladder. Highlighting the role of different market segments, and the interaction between segments, the paper brings value added to the understanding of the indirect effects of SHP.

In a segmented marked with equity induced up-trading the starter home segment carries more weight than the family home segment, when it comes to individual segments' impact on aggregate house prices. Up trading implies that a household demanding a family home currently is a starter homeowner, making up-trading a simultaneous decision of purchasing a family home and selling a starter home. Entry into starter homeownership is on the other hand just a purchase of a starter home. If SHP targeting entry into owner-occupation stimulates up-trading, there might be repercussions throughout the housing market. If crowding-out is complete, price effects might be more pronounced in segments in the upper end of the housing market. When allowing for profitability considerations in the housing industry sector and allocation of production between segments, the paper relates crowding-out to the interaction between market segments and the extent of equity induced up-trading.

By stimulating up-trading SHP might increase the number of used starter homes available to first-time entrants into owner-occupation. Sinai and Waldfogel (2005) characterised a successful SHP by whether it affects housing availability and/or housing quality. Availability is often argued in relation to new construction, but how SHP impact the availability of used homes should also be taken into account knowing how used homes is an important part of housing supply. As many economies face inelastic supply side elasticities, and how increasing the level of private housing construction is known to be difficult, the effect on used homes should not be ignored. This paper is - to the best of our knowledge - novel in this discussion.

A stylized housing market model comes with a cost. Abstractions ignore real housing market features important for evaluating SHP regimes. Even our presumed housing market ladder, and up-trading structure we consider, might be simplifications. Instead of our presumed three-step ladder some households might enter, or leave, the ladder half the way up, du to divorce remarrying. Some households might benefit from bequests, and instead of entering the starter home segment using an exogenous equity component, they might benefit from parents housing equity gains. As SHP measures make family home prices increase, entry into starter home ownership might be easier as family home equity has increased. Other real housing market modifications on the supply side of

the model could also produce different results, as policies to subsidise rent would allow households to increase savings and thereby making it easier to fulfil a LTV-constraint. A rental subsidy targeting households otherwise kept totally outside the rental market, would have zero repercussions on other market segments. Allowing for a tenure flexible housing stock could complicate results further, and should be the topic of future research.

Relating house prices to household debt, the paper also considers the debt-to-equity ratio for a household trading up a housing ladder and the impact of SHP on the housing career of households only indirectly exposed to SHP. The indirect individual effects should be seen in relation to how mortgage markets allow up-traders to take advantage of equity gains. When family home prices increase more than starter home prices ($e_{fs} > 1$) SHP complicates up-trading. In this case is up-trading contingent on a mortgage policy that accepts higher DtE-ratios. When $e_{fs} < 1$ the starter home equity gain exceeds the effect on family home prices, making up trading possible even at lower DtE-ratios.

As some households may take advantage of SHP measures while others may not, are the indirect effects of SHP important to understand. As many western economies experience financial constraints and a tendency for more difficult labour market conditions among younger generation, one should expect both increased demand for, as well as a more restrictive supply of SHP measures. If SHP are available to some, while hampering the housing careers of others, the measures might easily become unpopular and potentially also come under political pressure. To design proper SHP programs that, in addition to target the not so well off efficiently, minimizes the negative indirect effects, seems necessary for SHP survival.

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