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JUE Insight: City-wide effects of new housing supply: Evidence from moving chains☆

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ABSTRACT

We study the city-wide effects of new, centrally-located market-rate housing supply using geo-coded population-wide register data from the Helsinki Metropolitan Area. The supply of new market rate units triggers moving chains that quickly reach middle- and low-income neighborhoods and individuals. Thus, new market-rate construction loosens the housing market in middle- and low-income areas even in the short run. Market-rate supply is likely to improve affordability outside the sub-markets where new construction occurs and to benefit low-income people.

1. Introduction

Housing affordability is a major issue in most cities throughout the world. A large body of economic research argues that this is due to shortages in housing supply driven by local regulatory restrictions (e.g. Glaeser and Gyourko, 2018). Economists tend to offer a simple solution to this problem: allow for more housing construction in areas of high-demand and housing prices and rents will go down and more people will be able to move in. However, opposition to new buildings, especially when built in existing neighborhoods, is strong for a number of reasons. Homeowners want to protect the value of their most important asset. Current residents do not want the character of their neighborhood to change or the neighborhood to become overcrowded. Some even question the economists' central claim that new market-rate housing improves housing affordability for most people, as new market-rate housing tends be expensive, thus only benefiting the better-off. These groups can form a powerful political force at the local level and stifle local housing supply (see e.g. Glaeser and Ward, 2009; Hilber and Robert-Nicoud, 2013; Ortalo-Magné and Prat, 2014; Einstein et al., 2019; Been et al., 2019). Because of this opposition, information on the total benefits of new market-rate housing is crucial for local politicians who ultimately make decisions on how much and where to allow new construction to take place.

In addition to the direct effect of increasing the housing stock in the neighborhood it is built in, new market-rate housing may have more far-reaching indirect effects through a moving chain process. As new residents move into the newly constructed units, they vacate their old units. These vacant units then get occupied by a new set of residents whose old units become vacant and so on. Through this process, new market-rate housing can have moderating price effects not only in its immediate neighborhood, but also in the city's lower-income neighborhoods, by effectively loosening the housing market in these areas through vacancies.[1] However, if a city's housing market is segmented into separate sub-markets so that people do not move between them or that the new units get occupied by out-of-town movers, the moving chains may not reach low-income neighborhoods in the city. Whether and to what extent this is the case is ultimately an empirical question.

In this paper, we use Finnish population-wide register data to shed further light on how new, centrally located buildings affect surrounding sub-markets through a moving chain mechanism. Our data are particularly well-suited for this analysis as they include information on the

[1] In the longer run, filtering can also take place through depreciation, whereby houses become more affordable as they age (see e.g. Rosenthal, 2014; Rosenthal, 2020; Weicher and Thibodeau, 1988; Liu et al., 2021).

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exact location and housing unit for all households.[2] Thus, we can follow the moving chain at the housing unit level and identify the neighborhoods where the units in the chain are located. Moreover, we observe the individuals living in these units, and thus, we can also characterize the movers using our rich register data. We focus on new buildings in the Helsinki Metropolitan Area (HMA), home to about 1.2 million individuals (20% of Finland's population). We refer to movers to new buildings as round one movers, to movers to their vacated units as round two movers, and so on for all subsequent movers in the chain. We follow the chain for six rounds.

We start by showing that people moving into the new centrally located buildings have much higher incomes and are more likely to be highly-educated than both the HMA population on average and the people who move to other locations in the HMA during our time window. New housing built in expensive areas of the city does indeed primarily house the better-off. However, the moving chains triggered by these new units reach middle- and low-income neighborhoods. By round three, 60% of movers originate from neighborhoods in the bottom half of the neighborhood income distribution. Our register data also allows us to show that low-income individuals are indeed part of the moving chains. By round four, 50% of movers are ranked in the bottom half of the national level household income distribution. This is direct revealed-preference evidence that low-income individuals in the city area also benefit from new expensive housing, even when the new units are allocated to individuals higher up in the income distribution.

We also show that first round movers to new units come from the upper part of their origin neighborhoods' income distribution and also have on average higher incomes than their new neighbors. However, in later rounds this reverses so that residents in the lower part of the origin neighborhoods' income distribution are over-represented among the movers in the chains. The movers in later rounds also tend to be in the lower part of their new destination neighborhoods' income distribution. In addition, the movers are moving up the neighborhood quality ladder, as captured by neighborhood house prices.

Finally, we reconstruct the sequence of origin units in the moving chain and calculate the overall probability that the chain reaches lower-income sub-markets. We find that for each 100 new, centrally located market-rate units, roughly 31 (66) units are created in the bottom-quintile (bottom half) of neighborhood income distribution through vacancies. Given that the moves we study happen between two adjacent years, i.e. we study the very short-run, these numbers are significant.

This paper complements the recent work by Mast (2021), who shows that in major US cities moving chains triggered by new housing in central and expensive parts of cities do reach middle- and low-income neighborhoods quite quickly. We provide empirical evidence on how the moving chain mechanism unfolds in a European city where income inequality and segregation are more moderate compared to US cities. Our results echo those reported by Mast (2021), but with some notable differences. Compared to US cities, the moving chains in the HMA are more likely to reach middle- and low-income neighborhoods and reach them faster. The difference may be partly driven by differences in the data and methodology used to construct moving chains, but they probably largely reflect differences in underlying income inequality and residential segregation. That is, the socio-economic distance between expensive and affordable neighborhoods is smaller in the HMA compared to US cities. Furthermore, Mast (2021) uses address history data, but has only limited background information on individuals. Our register data allows us to go beyond characterizing neighborhoods and provide direct evidence that lower-income individuals are part of the moving chains.[3]

Our results also inform the recent literature comparing the effects of different housing policy options, such as upzoning, housing vouchers and rent control, using calibrated general equilibrium models (see e.g. Favilukis et al., 2022; Carstensen, Hansen, Iskhakov, Rust, Schjerning; Nathanson). Empirical estimates on the extent of segmentation of the housing market within cities is a key component in understanding the relative merits and distributional consequences of these policy options (Piazzesi et al., 2020).

It is important to note that our results speak to the potential of new construction to loosen middle- and lower-income sub-markets in the metropolitan area. However, we cannot make any claims about the effect of new construction on the immediately surrounding neighborhoods (see e.g. Asquith et al., 2021; Diamond and McQuade, 2019; Li, 2022; Singh, 2019; Pennington), nor do we look at price effects in the neighborhoods reached by the moving chains (see e.g. Mense, 2020).

2. Data

We use geo-coded register data containing information on all residents in Finland over the 2009–2019 time period. The data include rich demographic and socio-economic characteristics, such as age, gender, income, education and number of children. Importantly, we can link individuals to both the buildings and the housing units they reside in at the end of each calendar year. For each building, we have granular location information: provided that there are at least three households living in the building, we know the exact coordinates of the building. Otherwise, the coordinates refer to 250 square meter grids.

The sample of new market-rate buildings in our analysis consists of multi-unit buildings built between 2010 and 2019 within a 3 km radius of the Helsinki Central Station (106 buildings and 3196 units in total), the focal point of the central business district.[4] We identify new buildings in the data by the first year they appear in the register. We exclude student housing and other types of special housing (e.g. housing for the elderly, assisted living etc.) from the set of new buildings that we consider, but allow moving chains to pass through these types of buildings. Figure A1 illustrates the location of these buildings and mean housing prices per square meter in HMA zip codes. As can be seen from the figure, the new buildings in our sample are located in the most expensive areas of the HMA.

3. Constructing moving chains

In this section, we describe how we use our data to construct moving chains, and to characterize the neighborhoods and people that are part of them.

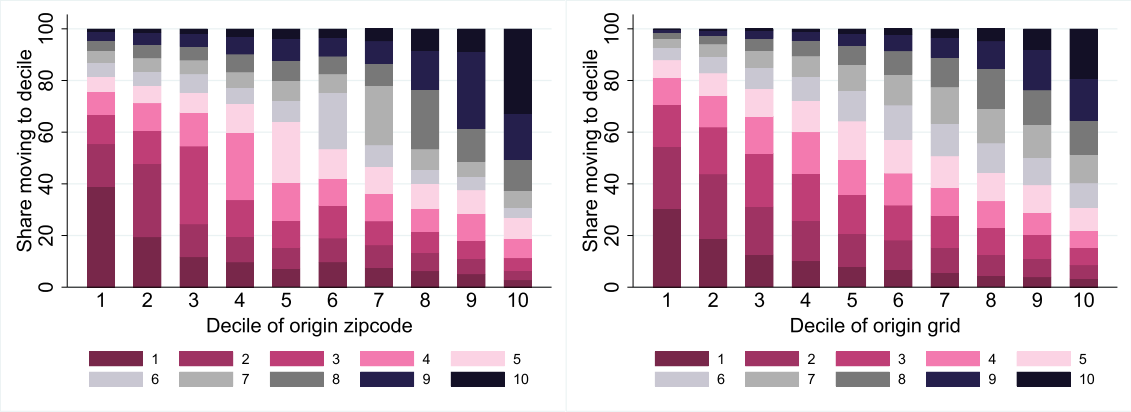
First, we identify the individuals that move into the new buildings during the first year the building enters the register. We call the year when this move happens year t. We then follow these individuals back in time and find the units where they used to live the year before the move. We call this year $t-1$ and the units they leave origin units. This means that we always look at moves that happen between two adjacent years. We classify origin units based on the characteristics of the neighborhoods they are located in and based on whether they are located in the HMA or not. We allow individuals to move to the new buildings from any location.[5] This implies that they can move from outside the

[2] For buildings with at least three households, we observe exact coordinates. For buildings with fewer households, we observe coordinates at a level of 250 square meter grids.

[3] Turner (2008) and Turner and Wessel (2019) estimate vacancy chain models using administrative data from Stockholm and Oslo, respectively, but they do not focus on the socio-economic makeup of the neighborhoods. Moreover, the neighborhood divisions in these papers are very coarse (two areas in Stockholm and four in Oslo).

[4] We have produced results where the first round destination buildings are within a 4 km radius and the results are very similar to our baseline. These results are available from the authors upon request.

[5] We omit two origin zip codes which primarily house students (one of the campuses of the University of Helsinki is situated in Viikki and the main campus of Aalto University is situated in Otaniemi). These would be classified as low-



(a) Zip codes (b) 250m grids

Fig. 1. Mobility across neighborhoods. *Notes:* These transition matrices show the likelihood of moving across different kinds of neighborhoods in the Helsinki Metropolitan Area, given origin neighborhood disposable income decile.

HMA as well and we do not impose restrictions on the type of building they lived in prior to moving.

In the next step, we identify the individuals that in year t live in the origin units as defined above. We then follow this second set of individuals back in time and find *their* origin units and classify them in terms of neighborhood characteristics and HMA status. We continue in this manner for a total of six rounds, which corresponds to the analysis by Mast (2021) using US data.

The underlying aim of this exercise is to take note of the type of neighborhoods the moves originate from and the type of people that move in each round. We classify HMA neighborhoods into ten equal-sized groups or neighborhood income deciles based on the neighborhood residents' median disposable income.[6] That is, the number of neighborhoods is the same in each decile. We first aggregate individual disposable income at the household level and then scale the income using the OECD equivalence scale. The scaling assigns value 1 to the first adult household member, 0.7 to each additional adult and 0.5 to each child.

We define neighborhoods in two ways. Our baseline neighborhood definition is a zip code area. There are 165 zip codes in the HMA (in 2019) with a mean population of roughly 6,800. However, some zip codes are geographically quite large and may include different types of smaller neighborhoods with distinct residential makeups. For example, a predominantly low-income zip code may contain an affluent single-family house residential area. The presence of such zip codes might bias our results in the sense that while our moving chains might reach such low-income zip codes, it could be the better-off residents within the zip code area that are actually moving. In this case, the moving chain would not effectively loosen the housing market that is relevant for lower income people. To address this issue, we use a second neighborhood definition, given by 250 square meter grids, which are smaller units than zip codes and less likely to produce the above-mentioned problems. In 2019, there were in total 6228 populated grids in the HMA with an average population of slightly less than 200.

Of course, even with a fine-grained neighborhood division, there can still be systematic differences in unit quality so that the moving chains take place within predominantly high-quality units within each neighborhood (see also Mast, 2021). Again, this would mean that even though a moving chain reaches a low-income neighborhood, it would be the better-off residents that move out. To tackle this issue further, we take advantage of our rich register data that allow us to directly analyze what type of individuals - in terms of income and other characteristics - participate in the moving chains. This provides direct evidence on whether new centrally located buildings affect the lives of low-income people in the city.

A chain can break for a number of reasons before reaching round six or reaching low-income neighborhoods. First, a chain breaks if a vacated unit gets occupied by someone moving from outside the HMA.[7] Second, in some instances the origin unit is in the HMA, but does not become vacant. Examples of this includes a young person moving away from her parents house or a divorce where one or more members of the household remain in the origin unit. We analyse the reasons for chain breakage in more detail after presenting the main results.

4. Results

4.1. Mobility across neighborhoods

We first document mobility patterns between different types of neighborhoods, defined as zip codes and 250 square meter grids, within the HMA. This gives us the first indication of how segmented the HMA housing market is. We consider all moves that happen in destination years 2010 to 2019. We characterize both origin and destination neighborhoods in terms of where they are in the distribution of median disposable income as explained earlier, relative to all neighborhoods in the HMA (i.e. not in the national-level distribution).

Figure 1 shows that there is a fair amount of mobility across different types of neighborhoods in the HMA. While a majority of moves originating in the first income decile are to neighborhoods below the median in the neighborhood income distribution, we see that around 15–20% of moves are to neighborhoods classified above the median, depending on the neighborhood definition. Similarly, roughly 35% of moves originating in the tenth decile are to neighborhoods below the median. These numbers suggest that even the extreme ends of the neighborhood distribution can, in principle, be connected through moving chains in just a few rounds.

income neighborhoods with the income measure we use, but these zip codes do not really house economically deprived individuals.

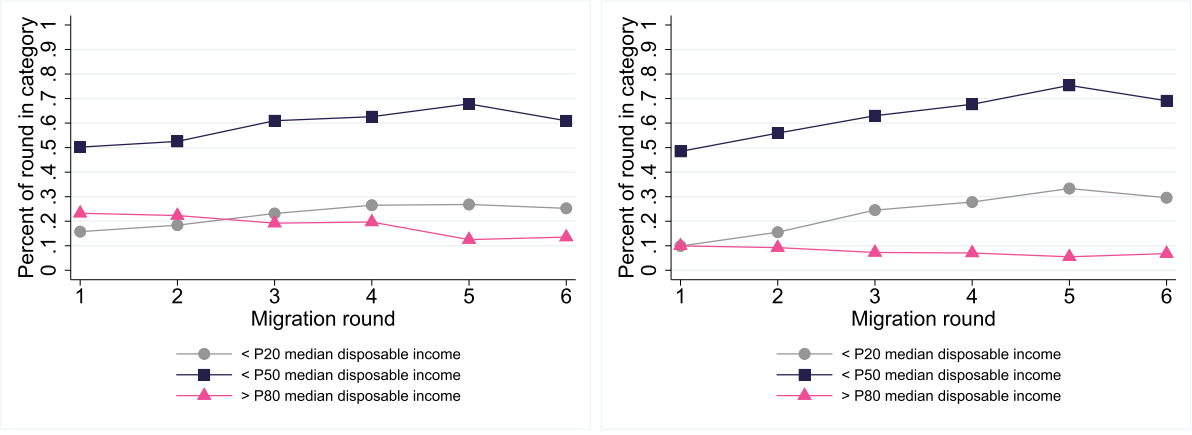
[6] The precise income concept is disposable money income, which is defined by Statistics Finland and includes wages and salaries, entrepreneurial income, property income and current transfers received subtracted by current transfers (mostly direct taxes) paid.

[7] We should note, however, that in some rare cases a chain may come back to the HMA even when it leaves at some earlier round. We include this type of chains in our main analysis.

Table 1
Summary statistics for movers and stayers in free-market buildings.

	Stayers	All movers	Movers to new buildings
Age household head	56.247	36.914	40.697
	[14.910]	[13.216]	[13.895]
Median household disposable income	27,616.865	24,216.484	33,906.445
	[60,730.066]	[55,910.324]	[57,765.914]
Master's degree or higher in household	0.329	0.279	0.458
Household with children	0.429	0.396	0.307
Origin single-family home	0.352	0.170	0.116
Origin owned home	0.904	0.448	0.514
Number of observations	3,730,715	1,134,761	5400

Notes: Stayers are defined as those that never move over the 2009–2019 time period. All movers exclude round 1 movers to new buildings within 3 km of the CBD. Standard deviations are reported in square brackets.



(a) Zip codes (b) 250m grids

Fig. 2. Origin neighborhood characteristics for movers at each round. *Notes:* The figure shows the share of movers originating from each neighborhood category at each round when the first round destination building is market-rate within a 3 km radius of the CBD.

4.2. Who are the first round movers and where do they move from?

Next, we provide summary statistics on the people who move into new centrally located buildings. We also compare these movers to those HMA residents who do not move within the time window of our analysis and to those who move to other areas in the HMA.

According to Table 1, movers to new centrally located buildings have on average higher incomes and are more educated than those who do not move or movers to other destinations. This is unsurprising given the fact that these are central and expensive locations. In Figure A2 in the Online Appendix, we show the spatial distribution of first round movers' origin neighborhoods at the zip code level. We highlight two things. First, people tend to move short distances, and second, consistent with them having higher incomes, the first round movers come from relatively expensive neighborhoods.

In sum, the movers to new centrally located market-rate buildings are a positively selected group relative to both those who do not move and movers to other destinations in the HMA. Next, we turn to the question whether this means that these new buildings only benefit these well-off individuals.

4.3. Do moving chains reach low-income neighborhoods and people?

In this section, we present results on the characteristics of origin neighborhoods and movers that are part of the moving chains triggered by new market-rate buildings. In particular, we are interested in whether the moving chains reach middle- and low-income neighborhoods and individuals, defined as bottom-half and bottom-quintile of the income distribution.

Figure 2 (a) shows that roughly 50% of new market-rate building residents originate from zip codes classified in the bottom half of the neighborhood income distribution. This share gradually rises to around 60% by round three, when it flattens. We expect it to flatten at roughly 60% since the overall share of all movers from the first five deciles cumulates to this amount (see Figure A3).

The share of residents originating from the bottom quintile zip codes in the first round is 15% and increases only slightly when we move to further rounds. However, as previously discussed, zip codes may contain different types of smaller neighborhoods. That is, the movers from the bottom quintile zip codes may be those living in the highest quality parts of the zip codes and may have the highest incomes in these zip codes. If so, the zip code level analysis would overstate the extent to which new buildings loosen low-income housing markets. Figure 2(b), which uses our alternative definition of neighborhoods based on 250 square meter grids, indeed suggests the presence of such selection patterns. The share of residents originating from the bottom quintile grids is only 10% (versus 15%) and the share increases gradually in subsequent rounds, reaching 30% by rounds five and six.[8]

[8] We also report results where we rank neighborhoods based on the share of highly-educated residents and the picture is similar (see Figure A4 in the Online Appendix). We also characterize neighborhoods in terms of house prices. As Figure A5 in the Online Appendix shows, while in the first round less than 10% of movers originate from the least expensive zip codes, this share goes up to 20% by round 6. Note that our house price data are only at the zip code level and include the mean price per square meter of old units sold within the zip code. We do not have data on how much people in our register data spend on housing, nor do we have good data on neighborhood-level rents.

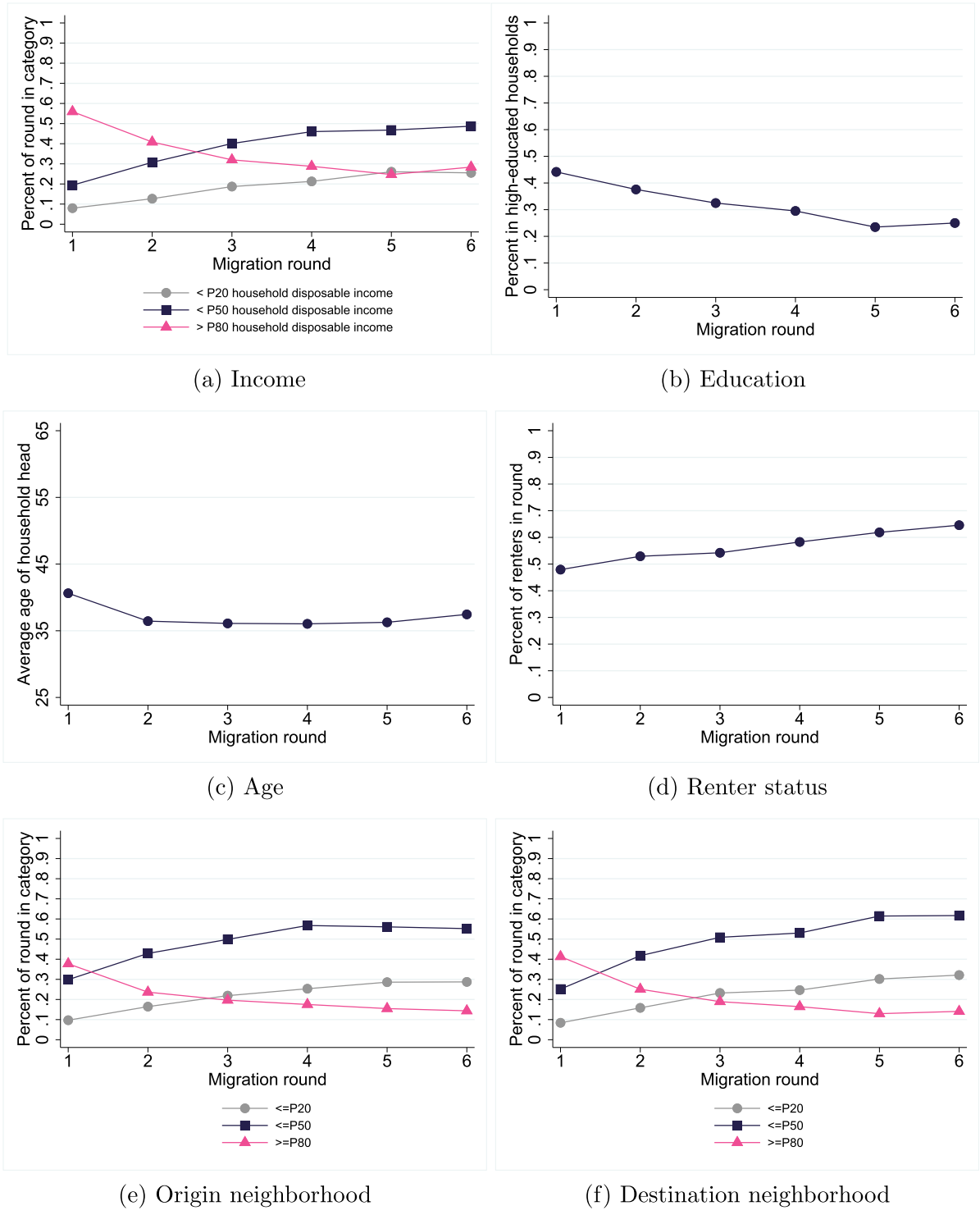


Fig. 3. Individual-level characteristics for movers at each round. *Notes:* (a) shows the share of movers in different quintiles of the national-level income distribution at each round. (b) shows the share of movers in households where at least one person has a master's degree or higher at each round. (c) shows the average age of the household head at each round. (d) shows the share of movers whose origin unit was rented at each round. (e) shows the share of movers in different quintiles of the origin neighborhood income distribution at each round. (f) shows the share of movers in different quintiles of the destination neighborhood income distribution at each round. The first round destination building is market-rate and within a 3 km radius of the CBD.

So far, our results suggest that new and expensive market-rate buildings trigger moving chains that reach middle- and low-income housing markets even in the short run. But neighborhood characteristics can be vastly different from individual attributes. To investigate to what extent that is the case, we now turn to the individual-level data and characterize the individuals that are involved in the moving chains. We present these results in Fig. 3. Figure 3(a) shows that in the first round, only 20% (10%) of new market-rate building residents are from the bottom-half (bottom-quintile) of the national household income distribution (see also Table 1). However, this share reaches roughly 50% (30%) by round four. A similar pattern is evident with respect to educational level. According to Fig. 3(b), first-round movers are on average more highly ed-

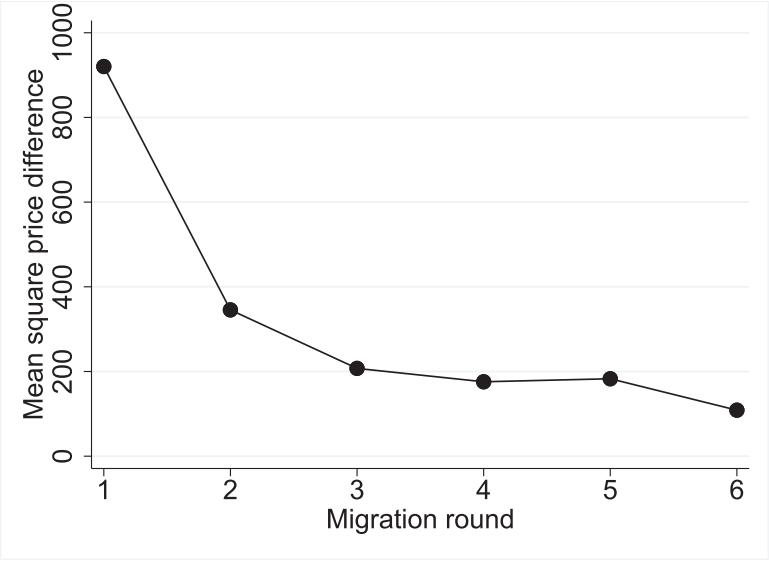


Fig. 4. Change in mean neighborhood (zipcode) house prices (€/m^2) at each round. *Notes:* The figure shows the mean house price difference between destination and origin mean zipcode house prices (€/m^2) at each round when the first round destination building is market-rate and within a 3 km radius of the CBD.

ucated, but movers in the later rounds actually have lower educational attainment than the HMA population as a whole (again see Table 1). From Fig. 3(c), (d), we see that movers in later rounds are also younger and more likely to be renters than the HMA population.

We can also analyze whether the movers in the moving chains are a selective group when compared to the residents in their origin and destination neighborhoods, respectively. We first divide each individual zip code into income deciles and then for each mover take note of which zip code income decile they belong to in their origin and destination zipcodes, respectively.[9]

Figure 3 (e) shows that in the first round the movers are positively selected from their origin neighborhoods. Roughly 40% of them were in the top fifth (P80) of their origin neighborhoods' income distribution and only 10% were in the bottom fifth (P20). This is unsurprising given the results in Table 1 and in Fig. 2, and the fact that they are moving to new units in the most expensive neighborhoods in the HMA. However, the selectivity becomes negative in later rounds: residents in the lower part of the origin neighborhood income distribution are over-represented among the movers in the chains.

The picture is similar when we compare the movers to their destination neighborhoods. According to Fig. 3(f), especially the first-round movers have on average higher incomes then their new neighbors, but in later rounds movers have lower incomes on average compared to their new neighbors. These results are most likely explained by the fact that renters and younger people are more mobile in general and they tend to have lower incomes than people who do not move in a given year (see Table 1).

Finally, we investigate whether movers are moving up the neighborhood quality ladder. We use house prices as a measure of neighborhood quality as they reflect both neighborhood (dis-)amenities and accessibility. For each mover in each round, we calculate the difference between destination and origin zip code mean house prices (€/m^2). If this difference is positive, we can infer that neighborhood quality is increasing. We use price information only from 2020 to make sure we are not capturing any general house price appreciation during our analysis period.

Figure 4 reports the means of these differences for each round.[10] The price difference between origin and destination neighborhoods is positive in each round. This means that on average, movers are climbing up the neighborhood quality ladder. This is especially true in the first two rounds, where the difference ranges between 1000 and 400 €/m^2. To put the magnitudes in perspective, zipcode mean house prices in the HMA vary between roughly 2000 and 8700 €/m^2 with a standard deviation of 1400 €/m^2.

4.4. Probability of moving chains reaching certain submarkets

Another way to illustrate how often a moving chain reaches a particular sub-market or includes particular types of individuals is to calculate the probability that a chain reaches a particular sub-market or group of individuals. When this is done at the neighborhood level, one interpretation for this probability is that it gives the number of new effective units in that sub-market created through vacancies. This analysis is similar in spirit to the simulation exercise in Mast 2021, but we can rely on a data-driven approach as we can follow the chains at the housing unit level.

We obtain these probabilities through the following exercise. For each unique round 1 destination-origin unit pair, we reconstruct the chain of origin units from subsequent rounds. We restrict to unique round 1 destination-origin unit pairs because multiple individuals may move to the same destination from the same origin (e.g. members of the same household changing homes). We also drop chains that end immediately due to the origin unit of round 1 movers being outside the HMA. This gives us 3896 observations corresponding to 2661 new market-rate destination units. Note that we may have multiple observations per destination unit. This happens when, at some point in the chain, there are moves from different origin units, due most likely to household formation. For each of the 3896 observations, we construct a dummy that takes the value 1 if at least one origin unit or household in the chain (out of the possible six) is ranked in the bottom half or bottom quintile of the median disposable income distribution.[11] We take the average of this dummy variable across all observations within the same new destination building. As long as it is above zero, we conclude that the chain triggered by that new destination building includes a lower-income neighborhood or household. Finally, we take an average of the collapsed dummy variable.

In sum, the probability that a chain reaches zip codes in the bottom quintile (bottom half) of the income distribution is about 31% (66%).

[9] Dividing the 250m grids into deciles does not work because there are too few residents in the grids.

[10] Note that moving within a zipcode may also change neighborhood quality, but we are unable to detect these changes because our price data is at the zipcode level.

[11] Note that if an origin unit is outside the HMA, it does not enter our computations.

That is, for each 100 new, centrally located market-rate units, 31 units get created through vacancy in bottom-quintile income zip codes and 66 units in bottom-half income zip codes. When we instead define submarkets at the grid-level, these numbers are 28 and 68, respectively (see Table A1).

A key aspect of these probabilities is how often chains break. There are three reasons why the chains may break before they reach low-income or middle-income neighborhoods: (i) moves from outside the HMA that do not come back to the HMA, (ii) household formation so that at least one person continues to occupy the origin unit, and (iii) the origin unit is left vacant so that we do not observe anyone living in the unit at period t. In Figure A7a, we report, for each round, the share of origin units that are located outside the HMA, the share that remain occupied, and the share that remain vacant. According to Figure A7a, roughly 10% of chain breakage is due to household formation at each round, while some 10–15% of origin units remain vacant for at least a year at each round. When it comes to moves from outside the HMA, there is an increasing trend as we move to later rounds. In round one, roughly 10% of movers are from outside the HMA, but this share gradually increases to 50% by round six, regardless of the type of new building we look at. The gradual increase is natural in the sense that the population of the HMA region increases due to new supply and by definition the new residents move from outside. This also shows that newcomers to the HMA rarely move to the most expensive parts of the region.

In Figure A7b, we further dissect what type of household formation happens at each round using four categories: (i) an adult child moves away from his/her parents' home, (ii) there is a break-up of a couple or a family so that at least someone moves out and some members remain in the origin unit, (iii) roommates split, and (iv) other types of household break-ups that we are unable to easily classify in clear groups. These shares some up to one. The most common situation is the one where a child leaves home,accounting for roughly half of the cases in later rounds. In the first round, this is less common probably because the new units are so expensive. Divorce accounts for roughly a third of the cases, whereas roommates splitting and other reasons both make up roughly 10% of cases.

4.5. Discussion

The neighborhood level patterns presented in Fig. 2 echo those reported by Mast (2021) in US CBSAs, but some interesting differences emerge. The most striking difference is that in our case the shares of moves from the bottom-half and bottom-quintile in each round are higher compared to the US case. That is, the moving chains are more likely to reach middle- and low-income neighborhoods and reach them faster in our case. The difference may be partly driven by differences in the data and methodology used to construct moving chains, but they probably also reflect differences in income inequality and residential segregation between US cities and the HMA. This would mean that the socio-economic distance between expensive and low-income neighborhoods is smaller in the HMA compared to US cities. The price differences between neighborhoods are also likely to be smaller.

Another interesting point of comparison for market-rate buildings is rent-controlled social housing. In the time window we study, as part of a social mixing policy, a number of new rent-controlled social housing units were also built close to the city center. Social housing refers to rental housing provided either by non-profit entities or by the municipalities. The main goal of the social housing program is to provide affordable housing for low-income households, but the program also aims at socially mixed neighborhoods and buildings.[12] This is why these units are located also in expensive areas and why the tenant selection rules are not overly restrictive with respect to tenants' incomes (see Eerola and Saarimaa, 2018). The rents in social housing buildings are regulated and typically much lower than market rents, especially near the Helsinki city center. We can therefore compare how the moving chains triggered by new market-rate construction differ from those triggered by new social housing construction.

In Figures A6a, A6b and A6c we show the results for moving chains triggered by new social housing buildings within the same 3 km radius of the CBD. The main difference between market-rate and social housing emerges in the first few rounds where the shares of moves coming from the bottom-half and bottom-quintile neighborhoods are higher. In later rounds, the movers in both chains are quite similar with respect to their origin neighborhoods and socio-economic makeup. Thus, social housing buildings loosen the middle- and low-income housing markets more directly, but this comes with considerable costs to taxpayers due to forgone rental income (see Eerola and Saarimaa, 2018).[13] This is consistent with the interpretation made above that moving chains reach middle- and low-income neighborhoods faster when the price difference between the city's core and other neighborhoods is smaller.

Taken as a whole, our results show that young and low-income individuals also benefit from new expensive housing through a moving chain process, even when the new units are allocated to individuals higher up in the income distribution. This is an important insight considering that high housing costs are often seen as a major problem precisely for young renters trying to enter into homeownership. This is highlighted, for example, by Glaeser and Gyourko (2018) in the US context. They argue that housing supply restrictions have created an intergenerational transfer to currently older people who happened to have owned in places that have seen house values increase substantially. Our results suggest that adding to a city's housing supply helps to reverse this process at least to some extent.

5. Conclusions

We have analyzed the city-wide effects of new market-rate construction using geo-coded register data from the Helsinki Metropolitan Area. Our main finding is that even when new market-rate units get occupied by high-income households, they also benefit middle- and low-income households through a moving chain mechanism.

These results are important for the policy debate in many cities about the merits of increasing the supply of market-rate housing. As, for example, Been et al. (2019) argue, skepticism surrounding the connection between housing supply and affordability has been growing and one of the main concerns is that market-rate supply benefits only the better-off. Our results, together with the results by Mast (2021) for US cities, should alleviate the concerns of these skeptics. As geo-coded register data become available in other countries, replication of our study and comparing the results to ours and to those by Mast (2021) will help to further shed light on the type of contexts where new market-rate supply is most likely to benefit lower-income households.

Finally, we stress that while market-rate housing supply seems to have wide-ranging beneficial effects, it is not a panacea for all housing market problems. Some people may get discriminated out from the housing market and for some others even the cheapest housing in the city may not be affordable. Housing allowance or voucher programs, as well as social housing are important complements to market-rate supply. These programs, if well-designed, may also be helpful in preventing residential segregation (e.g., Collinson and Ganong, 2018; Davis et al., 2021).

[12] Out of roughly 600,000 housing units in the HMA, 17% are rent-controlled social housing.

[13] In brief, the costs arise as most of the social housing buildings are situated on lots owned by the city of Helsinki and lot rents collected by the city are well under market rents.

CRediT authorship contribution statement

Cristina Bratu: Conceptualization, Data curation, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Oskari Harjunen:** Conceptualization, Data curation, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Tuukka Saarimaa:** Conceptualization, Data curation, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jue.2022.103528.

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