The Externality of Large-scale Affordable Housing Construction: Evidence from Iran[1]

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Abstract

Affordable housing projects are thought to affect neighboring property values. Negative spillover effects are more likely to occur in developing countries when governments fail to provide complementary infrastructures and public services such as schools. In this paper, we study one of the world's largest affordable housing projects known as the *Mehr housing project* in Iran. This program facilitated the construction of 2 million affordable apartments. Using the universe of house transactions in 19 large cities and the exact timing and location of Mehr units, we employ a difference-in-differences methodology to estimate the causal impact of Mehr units on neighboring properties. Our results show that affordable housing reduced nearby housing prices by 11 percent. This negative effect is absent in neighborhoods that saw a proportionate school expansion suggesting that the absence of schools is one of the main underlying causes of the negative spillover.

JEL classification codes: H23; H43; R31; R38.
Keywords: Affordable housing; Schooling; Housing externality; Iran; Mehr housing project.

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1 Introduction

While rapid economic growth in some developing countries such as China, Indonesia and Vietnam has lifted millions out of poverty, inadequate urban planning and a lack of social safety nets have led many to settle in urban slums with poor living conditions. Around 1 billion people -- or one-third of the urban population -- in developing countries live in slums (Baker and Gadgil 2017). High housing costs, especially in urban areas, has been a long-standing motive for government intervention in the housing market. Two prominent types of interventions are construction of subsidized housing and free allocation of land. While affordable housing construction benefits targeted groups, it could create significant spillovers on nearby properties.

When affordable housing leads to the redevelopment of the neighborhood and the improvement of amenities, positive externalities may follow (Baum-Snow & Marion, 2009; Schwartz et al., 2006). However, the concentration of low-income households and poor construction quality could also trigger negative externalities (Diamond & McQuade, 2019; Tighe, 2010). Many studies have evaluated the externality of affordable public housing on nearby property values in developed countries (Baum-Snow & Marion, 2009; Davison et al., 2017; Diamond & McQuade, 2019; Ellen et al., 2007; Ihlanfeldt, 2019; Schwartz et al., 2006). Yet, to the best of our knowledge, there is no study of such externalities in developing countries[4]. The size and even the sign of the externality might be different in developing countries due to low government efficiency in designing policies and providing complementary infrastructure and public services such as basic utilities and schools.

This study tries to fill this gap by providing causal estimates of the externality of a very large-scale affordable housing project in Iran. We also add to the literature by singling out the importance of schools as a key public service in mitigating the negative externality of affordable housing projects. At the beginning of 2007, Iran government announced the *Mehr housing project* to subsidize the construction of about 2 million housing units for low- and middle-income households. Most of these units were built as concentrated multifamily buildings in the suburbs of cities. It was estimated that this project costed about 150 billion dollars, about 33% of GDP (Rahpoo Sakht corporate 2012). The government was supposed to expand public services such as schools and clinics in the host neighborhoods to avoid congestion. But lack of resources and poor planning prevented timely provision of such services. Particularly, the lack of schools got a lot of attention in the media[5].

Several mechanisms shape the overall impact of Mehr projects on the neighboring properties. A positive amenity effect may exist through the removal of vacant lots and the improvements in community facilities. A negative dis-amenity effect may occur due to low construction quality, inconsistency with the architecture of the environment or concentration of low-income households[6]. Lack of new infrastructure and public services could result in higher congestion which may lower the value of neighboring properties. The

[4] There are a few papers on the spillover of urban renewal programs in developing countries (Gechter and Tsivanidis 2020; Zhang, Liu, and Li 2022), but these programs are different from affordable housing because they invest in existing properties that would often remain with the initial owner.

[5] For example, the General Director of *Semnan* Province School Renovation, Development and Equipment said: "Mehr residential areas of this province are facing a shortage of 54 schools comprising 600 classrooms" (https://b2n.ir/s23298).

[6] Survey data show that households in Mehr units earn only slightly (maximally 12 percent) less than other households. Hence, any externality because of living near low-income households, as for example shown for the U.S. by Diamond & McQuade (2019), is unlikely important for the Mehr project.

third mechanism is a negative supply effect due to the outward shift of housing supply. This might be particularly important for our study due to the large number of housing units delivered.

To measure the externality of the Mehr housing units on nearby properties, we merge the universe of house transactions in 19 large cities of Iran between 2010 and 2020 with the information on the delivery of Mehr units at month and postal area level (with a size of about 3 km^2 on average which we call neighborhood). Using a difference-in-differences (DID) strategy, we compare housing prices in the neighborhoods of the Mehr projects in each city before and after the Mehr project delivery with changes in housing prices in other neighborhoods. We use the exact delivery month of Mehr projects in each city for identification and argue that after controlling for the various fixed-effects, this timing is exogenous. The fact that the Mehr program was implemented during a short period helps with our design. We also deal with the issue of staggered treatment bias as emphasized in recent literature (see e.g., Callaway and Sant'Anna (2021)).

Figure 1 shows normalized housing prices in Mehr and non-Mehr neighborhoods. On the horizontal axis we show the time (in quarters) relative to the time that *half* of the Mehr units were delivered in each city[7]. The trend of housing prices in both areas are similar prior to the delivery of Mehr units supporting the idea that our control and treatment groups are similar. After the delivery of Mehr units, we see a divergence between the two groups, providing suggestive evidence on the negative impact of Mehr on neighboring properties. The results of our preferred DID specification, which includes neighborhood and city by month[8] fixed effects to control for neighborhood time-invariant characteristics and city-specific flexible time trends show that property values in Mehr neighborhoods declined by about 11 percent after the first Mehr unit was delivered.

Mehr projects created a significant supply shock by increasing the local housing stock by 9 percent, on average. We provide several arguments which supports our initial prediction that the creation of dis-amenities rather than a supply effect explains the identified negative externality. First, our preferred specification includes city-by-month fixed effects to control for any city-wide price changes including city-wide supply effects. Given the size of our cities, we believe that the city-wide effects are the likely important manifestation of supply effects.

[7] Since it takes time to build and it takes time for residents to occupy Mehr housing units, we use the date when half of the units have been delivered as the reference date in this figure. We will also use other reference dates in Section 5. In our main results, we use first delivery date as reference date.
[8] We add a dummy for each month of each year (124 dummies) and interact it by city variable.

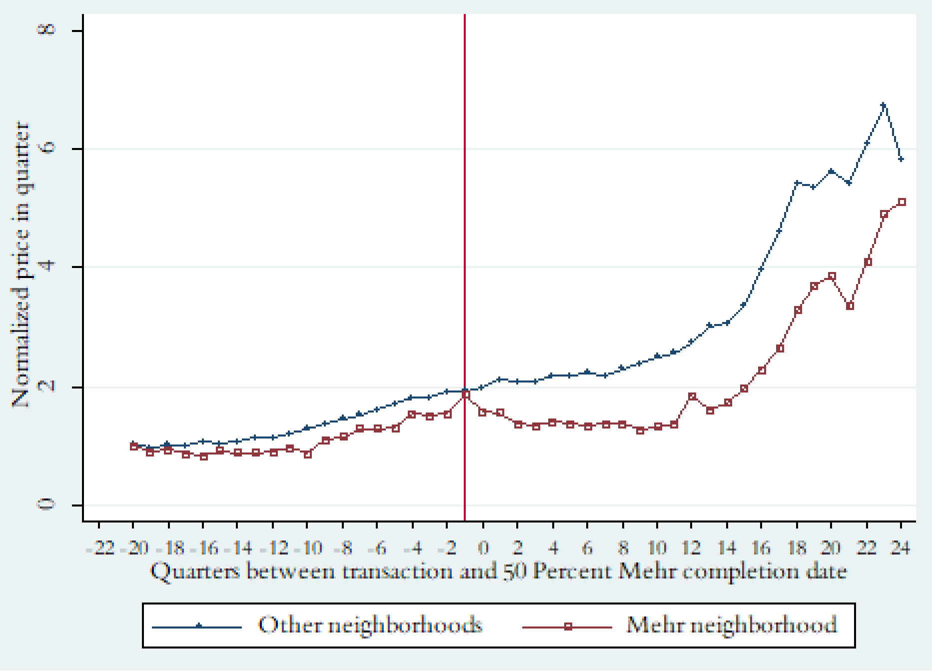

Figure 1 Normalized price trends in Mehr neighborhood with respect to other neighborhoods

Notes: Prices per square meter in each quarter of each city are averaged and then normalized by dividing by average housing price of that city in the year 2010. The reference point is when half of Mehr units were delivered in each city.

Second, anecdotal evidence supports our claim that local infrastructure and public services did not develop at the same pace as Mehr projects. Many residents complained about the unavailability of basic utilities (electricity, water, gas) as increased demand created shortages. Furthermore, schools, clinics and other facilities did not expand in proportion to the housing stock[9]. Schools are a critical local public service[10] that were missing in Mehr neighborhoods according to several reports[11]. We collect data on the number of schools planned and constructed in Mehr neighborhoods to measure the impact of school availability on the Mehr externality. We find that the negative Mehr impact fades away as schools catch up with the expansion of housing supply. Consequently, the negative price effect is more likely due to the absence of public services such as schools at the time of Mehr units completion.

Third, we do not find a negative impact immediately after the delivery of the *first* Mehr unit. In other words, the negative effect happens after a significant number of units were delivered. This timing is more consistent with a dis-amenity effect that materializes after Mehr residents gradually move in. In contrast, the supply effect is expected to kick in even before the units are completed through anticipation effects.

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[9] Some examples in Iranian media and News Agency are: https://b2n.ir/k67342 and https://b2n.ir/z53063

[10] Other public services such as hospitals are also important but as they are not used on a daily basis, the supply of these services matters at the city level, but not at the neighborhood level.

[11] For example, the head of the Education Commission of Iran's Parliament criticized lack of attention in providing schools in Mehr residences, and said: "Unfortunately, due to the lack of supervision and neglect of careful planning, in some cases, land has not been provided for the construction of schools. In the places that {land} have been allocated, no attention has been paid to the timely construction of schools and educational spaces." (https://b2n.ir/w82839)

Fourth, the dis-amenity effect is expected to have a similar effect for different types of properties, while the supply effect should be stronger for close substitutes of Mehr units. We do not find any heterogeneity in the Mehr effect for housing units in different size and age categories. In addition, the negative effect for more expensive units is greater than for cheaper ones that are close substitutes of Mehr units. Finally, if the supply effect is the dominant mechanism, we would expect a larger impact in cities with larger Mehr projects. In contrast, the Mehr impact seems to be similar across cities with varying Mehr scales.

The contribution of the current paper is threefold. First, we believe we are the first to provide evidence on the external effect of affordable housing projects in developing countries. Second, to the best of our knowledge, we are the first to provide evidence for the effect of complementary public services such as schools on this externality. Third, we have collected a new dataset on one of the world's largest affordable housing projects.

The remainder of this paper is structured as follows. Section 2 reviews the literature. Section 3 provides institutional background on Mehr housing projects and describes our data sources. Section 4 discusses our empirical strategy. Section 5 presents our results and robustness checks. Finally, we finish with conclusions.

2 Literature review

Affordable housing is a development type that may have some externalities on host communities, similar to asylum seeker centers (Daams, Proietti, and Veneri 2019), homeless facilities (Gibson 2005), high-density residential buildings (Ruming, Houston, and Amati 2012; Searle and Filion 2011), wind turbines (Dröes and Koster 2021), historic amenities (Koster and Rouwendal 2017), power plants (Davis 2011), metro stations (Diao, Leonard, and Sing 2017) and community gardens (Voicu and Been 2008). This externality can be positive (Baum-Snow and Marion 2009), but may also generate conflicts between development proponents and host communities and therefore may be negative (Tighe 2010).[12]

Concerns about planned affordable housing development tend to center on three sets of issues: the potential impacts on valued aspects or features of the host neighborhood such as crime, safety and property values; the characteristics and behaviors of prospective residents; and the physical form (bulk, style, density) of the proposed development and ongoing maintenance (Hogan, 1996; Iglesias, 2002; Koebel et al., 2004.; Nguyen et al., 2013; Ruming, 2014a, 2014b; Sarmiento & Sims, 2015; Scally & Tighe, 2015; Schively, 2007;).

Attempts to test the impacts of affordable housing development on host areas focus mainly on property value impacts.[13] A series of US studies have found that the impacts of affordable

[12] Tighe (2012) has shown that while a high proportion of people support the construction of affordable housing in their cities, they tend to be less supportive of its construction in their own neighborhood. Such attitudes present a challenge for the delivery of affordable housing and have seen localized opposition to planned developments characterized by many observers as self-interested "Not In My Back Yard" (Sturzaker, 2011).

[13] The logic here is that property values operate as a form of proxy for the bundle of characteristics and features that influence the quality of life and amenity of a neighborhood (Galster et al. 2003; Heo and Kang 2012; Ki and Jayantha 2010). People will be willing to pay a high price for a property in a neighborhood with low crime rates, ample parking, little traffic and an attractive appearance. Any negative impact on these desirable

housing development on property values can be positive, neutral, or negative and depend on the specific characteristics of the development, its residents and the location (Diamond and McQuade 2019; Ellen et al. 2007; Freeman and Botein 2002; Galster et al. 2003; Nguyen 2005). Hence, the likelihood of negative property value impacts will depend much on project design, management and location, whether affordable housing residents are clustered, and neighborhood income levels.

For example, the Low Income Housing Tax Credit in the US increases nearby property values in low-income neighborhoods due to housing investment and incoming middle-class households (Baum-Snow and Marion 2009; Diamond and McQuade 2019; Ellen et al. 2007) but decreases nearby property values in high-income areas because it brings in neighbors with relatively-low income (Diamond and McQuade 2019).

Important for our study, affordable housing developments may reduce the quality of public services such as schools and hospitals for incumbent residents if there is no sufficient increase in the supply of these services. This issue relates to a large literature showing the effect of school quality on housing prices. As an example, Gibbons et al. (2013) show that a higher primary school quality leads to 3 percent increase in housing prices in the UK.

Studies examining these externalities date back to the 1960s, but there are several reasons to believe that there is still much uncertainty about external effects of affordable housing, in particular for developing countries. First, there are a multitude of different types of affordable housing programs. The nature of the program and the way in which it is implemented are likely important (Ellen et al. 2007).

Second, most of the studies focus on small geographic areas, usually a few neighborhoods, a city, or a county and therefore, results may not be generalized to other places (Woo, Joh, and Van Zandt 2016). Third, most available studies focus on developed countries (Baum-Snow and Marion 2009; Diamond and McQuade 2019) and we are not aware of any evidence on the external effect of affordable housing projects for developing countries[14]. The externality of affordable housing projects might be very different in developing countries due to poor government effectiveness and undersupply of complementary infrastructures.

Fourth, the lack of schooling and public services is potentially an important mechanism for negative externality of affordable housing project in developing countries but to the best of our knowledge there is no empirical study which tries to measure the relationship between the externality of affordable housing and provision of public services like schools. Finally, the supply effect, i.e., the reduction of prices through a shift of the supply function, will differ among studies. It is potentially important for our study due to the large number of Mehr housing units delivered. This study tries to fill this gap by providing estimates of the

characteristics, however, whether due to affordable housing development or anything else, will ultimately be reflected in property values through a reduction in the value of local properties.

[14] We are aware of small literature which focus on urban renewal programs that remove slums, see for example . Gechter and Tsivanidis (2020) and Zhang, Liu, and Li (2022).

externality of a very large affordable housing project in Iran and focuses on shortage of school in host neighborhoods as an explanation of the negative effect.[15]

3 Background and Data

3.1 Mehr Housing Project

Housing prices in Iran have increased by 23 percent per year between 1990 and 2019 while income per capita has only increased by 8 percent per year during the same period. This has created serious concerns about the ability of the poor to acquire a decent home. The Iranian government started a very ambitious program in 2007 to subsidize construction of around 2 million housing units in urban areas to increase the supply of affordable housing (about 18 percent of housing stock of cities) to control surging housing prices and to lower the burden of housing expenditures on poor households. This plan, popularized as the Mehr housing project, planned targeted apartments suitable for low-income households. It facilitated construction of (mostly) concentrated multifamily buildings in the suburbs of cities. The construction period of Mehr units was from 2007 until 2013 and their delivery period was from 2011 until 2021.[16] Eligibility for the project was based on not owning a property and a few other criteria.[17] The project covered 1135 cities out of about 1200 cities across the country.[18]

The Mehr project provided three forms of housing subsidies. First, the government provided the project site under a long term (99 years) rental contract at subsidized prices. Second, developers received a subsidized loan which was transferred to buyers upon delivery of the project. Third, developers received tax exemptions. In contrast to rental public housing, Iranian households in Mehr housing units own their home and pay annually a small lease for the land. These households have the right to live in their assigned apartment for 99 years, and are allowed to sell the apartment on the secondary housing market.[19]

There were two types of Mehr construction projects. One was for households who owned land with a small-scale construction plan and who received a government-backed loan subsidy. We do not have information about this type. We focus on the other, more

[15] More broadly, our paper is related to a literature which examines the spillovers of housing policies to neighborhoods. Rossi-Hansberg et al. (2010) study the impact of urban revitalization programs implemented in the Richmond, Virginia area on local land prices. Gechter and Tsivanidis (2020) and Zhang, Liu, and Li (2022) try to find effects of urban renewal program on housing prices in one of the regions in India and China, respectively. Hartley (2014) and Campbell et al. (2011) examine the effects of housing foreclosure on nearby housing prices. Ellen et al. (2013) look at whether foreclosures impact local crime rates. Autor et al. (2014) study the effect of ending rent control on nearby real estate prices and crime rates.

[16] The distribution of construction and delivery dates can be seen in Appendix A (Figure A-1).

[17] The targeted population were low-income households who were mostly from the four bottom income deciles. The most important eligibility conditions for registering in the program were being married, no previous owned of houses, no previous used of government facilities or land and living in the registered city since at least 5 years before registration. Furthermore, about 4 percent of houses were given to very poor households that were covered by supportive institutions like the State Welfare Organization of Iran.

[18] The sheer size of the project and inadequate guarantees for the loans resulted in a massive budgetary burden. The budgetary cost of the project is estimated to be around 1500 thousand billion rials (33% of GDP of Iran) (Rahpoo Sakht corporate, 2012).

[19] Resale of Mehr housing units was prohibited until end of 2013. From this date onward the government allowed resale of the units under certain conditions. Mehr units follow a different procedure to resale so our house transaction data should not include Mehr housing units.

dominant[20], type, which included either tripartite agreements or cooperative projects which were mostly concentrated projects in selected localities of cities. This type contained the most visible projects of the Mehr project. We collect data on the timing and location of Mehr projects in the largest 19 cities with concentrated Mehr units which covers almost one third of all Mehr units (Arak, Gorgan, Hamedan, Orumia, Zahedan, KhorramAbad, Qom, Shahre-Kord, Kerman, Bojnurd, Semnan, Birjand, Ilam, Kermanshah, Zanjan, Sanandaj, Rasht, Yazd and Bandar-Abbas)[21].

3.2 Schooling in Iran and Mehr housing projects

There are about 104 thousand schools with about 560 thousand classes all over the country. About 85 percent of school are public. Public schools are larger and serve the majority of population. In 2020, 95 percent of around 15 million students were enrolled in public schools.[22] Private schools are deemed to have higher quality and charge tuition. Public schools might charge small maintenance fees but are banned from charging tuition. The only criteria for enrolment in public schools is being in the same neighborhood as the school. Each student is allowed to apply only to the public schools specified in the geographical area of his/her residence.

According to the initial plan of Mehr housing project, the Ministry of Roads and Urban Development had to build schools on the Mehr sites. However, due to the inconsistency between the Ministry of Roads and Urban Development and the Ministry of Education, the lack of land for school construction, and budget deficits, school construction was not prioritized in some areas. Although other public services are important, the key services that the government should provide for Mehr residents were basic utilities (water, electricity and gas) and schools. Delay in building new schools in Mehr neighborhoods could lead to congestion in existing schools and result in negative spillovers on nearby property values. In fact, lack of schools in the Mehr neighborhood has been a main criticism in many interviews.[23] Our school data confirms this. Figure 2 shows that the number of households per school in Mehr neighborhoods is always greater than that of the whole city.

Expansion of private schools in Mehr neighborhoods did not happen as well. Because households in those areas had lower incomes and could not afford school tuition. In addition, the process of obtaining a private school permit takes time and requires a lot of initial capital. This issue highlights the importance of building public schools in Mehr housing sites because otherwise, new Mehr housing residents have to enroll their children in the congested existing public schools.

3.3 Data

We make use of several datasets from the Ministry of Roads & Urban Development. Our first dataset is from the Tenement Management Information System which contains the universe of house transactions including the house characteristics, postal region and date of transaction.

[20] The second type of the project represent more than 60 percent of the total policy.
[21] Rasht city map and its Mehr housing neighborhood can be seen in Appendix D as an example.
[22] https://madyar.org/Article/136
[23] Some examples are: https://b2n.ir/z12222, https://b2n.ir/z07947

Table 1: Summary statistics

Variable name	Obs. (1)	Mean (2)	Std. Dev. (3)	Min (4)	Max (5)
Panel A: House transactions data					
House price (million tomans)		138.2	160.0	0.1	12000
House price per m^2 (thousand tomans)		1387.1	1132.3	1	40000
Age (in year)		7.0	6.2	0	87
Size (in m^2)		95.7	48.6	20	2000
Months since March 2010		50	28	1	112
Month interval after delivery of Mehr Project		14	28	-63	102
Transactions "NEAR" Mehr neighborhood		0.07	0.26	0	1
Transactions in Mehr Neighborhood (dummy)		0.06	0.23	0	1
Transactions After Mehr delivery in Mehr neighborhood (dummy)		0.04	0.21	0	1
Distance with Mehr Projects (km)		5.12	2.67	0	14.5
Panel B: Postal regions data					
Mehr Neighborhood area (km^2)	24	6.62	3.64	1.41	16.83
Neighborhood area (km^2)	732	2.89	3.32	0.05	19.86
Panel C: Mehr housing data					
Number of Mehr projects in each city	19	194	127	14	520
Number of Mehr units in each city	19	11,033	6,028	2,457	28,684
Number of schools constructed in Mehr site in each city	19	5.6	4.6	1	18
Year of starting construction of Mehr Projects	3,684	2010.2	1.2	2007	2019
Year of delivery of Mehr Units	207,868	2014.3	1.90	2010	2020
Mehr Housing Projects average size (m^2)	3,684	84.2	10.8	70	110
Ratio of Mehr housing units to housing stock in each city	19	9%	7%	2%	28%

Notes: Panel A shows house transactions data for 360,789 observations. Panel B shows Neighborhood data and In Panel C we summarize Mehr housing data. We report number of observations, average, standard deviation, Minimum and maximum for each variable name in columns (1) to (5).

We assume that each transaction takes place in the centroid of the neighborhood. We focus on 19 large cities in Iran between March 2010 and July 2020.[24] Our second dataset contains information regarding address, type and scale of Mehr housing projects in each city. The third dataset is the delivery date of each Mehr unit. We use the starting date of the mortgage repayment for each unit as our measure of delivery.

The summary statistics of the main variables are provided in Table 1. We have 360,789 transaction observations of which about 7 percent (23 thousand transactions) are in a Mehr neighborhood. We have transactions dating 63 months before the delivery of nearby Mehr units and transactions dating 102 months after.

Our transaction data is at postal area level which could be a proxy for defining neighborhoods and is used for allocating students to public schools in Iran.[25] These regions are on average about 3 KM^2 but their area depend on the density of housing units. Therefore, neighborhoods are larger in areas with more vacant lots or open spaces. This justifies the

[24] The data is publicly available here.

[25] As mentioned earlier, being in the same geographical area is the main criteria for enrolling in public schools.

observation from panel B of Table 1 that the average area of neighborhoods is 6.62 km^2 for Mehr neighborhoods while it is 2.89 km^2 for non-Mehr ones.

On average, each city received 194 Mehr projects (11,033 units). However, these projects were concentrated in 24 neighborhoods across the 19 cities of our sample (panel C of Table 1). The average *starting date* of Mehr projects is in the first half of 2010 while the average *delivery time* is in the first half of year 2014. The delivery date of the first unit within a given Mehr neighborhood is used as the treatment date for that neighborhood (Table A-1 shows these dates for all cities). The average size of a Mehr unit is about 84 m^2 which is smaller than the average size of nearby residential units that were transacted (95 m^2).

4 Empirical Strategy

We rely on a difference-in-differences (DID) strategy to estimate the causal effect of Mehr units on nearby housing prices.[26] In other words, we compare the change in the price of housing units in the Mehr neighborhoods to the change in the price of housing units in other neighborhoods at the time of Mehr units delivery. Table 2 reports the raw averages for calculation of a simple DID estimate. The average housing price in the Mehr neighborhoods is 6304 thousand rials before Mehr units delivery (before 2012 when the first of any Mehr units were delivered). During the same period, the average price for other neighborhoods is 8033 thousand rials, implying that Mehr neighborhoods are less attractive. The second row shows that average prices in both regions increase dramatically due to high inflation. However, what matters for the DID estimate is the differential change in prices for Mehr neighborhoods. The last row shows that the increase in housing prices is larger in non-Mehr neighborhoods compared to Mehr neighborhoods. The raw DID estimate suggests that Mehr projects reduced prices for nearby properties by 6343 thousand Rials, about 35% of the (after delivery) average housing price.

We implement the DID estimation strategy in a regression framework as follows:

$$log(p_{ipt}) = \phi Mehr_{pt} + \theta X_{ipt} + \delta_{ct} + \gamma_p + \epsilon_{ipt}. \quad (1)$$

Here $log(p_{ipt})$ is the logarithm of the price for transaction i in neighborhood p on month t. $Mehr_{pt}$ is a dummy variable equal to 1 when the transaction is occurring after delivery of Mehr units[27] in a Mehr neighborhood and zero otherwise. For robustness check, we experiment with several control groups as follows: 1) all neighborhoods other than Mehr neighborhood; 2) farthest neighborhood from Mehr neighborhood in the other edge of the city; and 3) closest neighborhoods (neighboring). Since Mehr units were delivered in different times across cities, we include month, δ_t, and neighborhood, γ_p, fixed effects to allow for flexible time trends and time-invariant differences in housing prices across neighborhoods respectively. X_{ipt} includes the logarithm of size and age of the transacted unit. Standard errors are clustered at neighborhood level.

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[26] We have a rich variation in the timing and location of Mehr projects which justifies our reliance on a DID estimation strategy.

[27] We use both date of delivery of first Mehr unit and delivery of half of Mehr units as treatment date. Although our main specifications use the first one as treatment date, we argue that since it takes time for new residents to move in and apartments become completely ready and safe, the latter can explain disamenity effect better.

Table 2: Prices in Mehr and other neighborhoods before and after project implementation

Average price per m²	Mehr neighborhoods	non-Mehr neighborhoods	Difference
	(1)	(2)	(3)
Before Mehr project	6304	8033	-1729
delivery (Before 2012)	(115)	(73)	(409)
After Mehr project	16853	24926	-8072
delivery (After 2014)	(221)	(72)	(231)
Difference	10548	16892	-6343
	(545)	(110)	(545)

Notes: This table shows average transaction price of houses in Mehr neighborhoods (column (1)) and other neighborhoods (column (2)) before Mehr project delivery (row (1)) which means before 2012 and after Mehr project delivery (row (2)) which means after 2014. Columns (3) shows the difference between columns (1) and (2) and row (3) shows the difference between row (1) and (2). Standard errors of means are reported in parenthesis.

In specification (1), ϕ is the parameter of interest and measures the differential percent change in housing prices across Mehr and non-Mehr neighborhoods. The identification assumption is that in the absence of Mehr projects, the percent change in prices across Mehr and non-Mehr neighborhoods would have been the same. We believe that the exact delivery date of Mehr units in each neighborhood is close to random as it is a function of many factors including the competence of the developer, weather conditions, availability of government-owned land to start the project, and disbursement of loans. However, we elaborate on several potential violations of this assumption and estimate additional specifications to make sure that our results are not driven by unobserved omitted factors.

First, the recent difference-in-differences literature shows that with staggered timing of treatment, such estimates may not be informative on the average treatment effect when average treatment effects are heterogeneous across neighborhoods or years (Borusyak, Jaravel, and Spiess 2022; Callaway and Sant'Anna 2021; De Chaisemartin and D'Haultfœuille 2020). This is because the estimated coefficient $\hat{\phi}$ is a weighted average of several DIDs comparing changes in prices between consecutive time periods across different pairs of housing units in different neighborhoods. De Chaisemartin and D'Haultfœuille (2020) show that this might imply negative weights because treated observations in earlier periods may function as controls for observations that are treated later.

De Chaisemartin and D'Haultfœuille (2020) and Callaway and Sant'Anna (2021) propose alternative estimators for balanced panels. We collapse housing price at neighborhood and year level and use the method suggested by Rios-Avila, Sant'Anna, and Callaway (2021) to solve this problem. The downside is loss of efficiency due to data aggregation. We therefore consider the results of this specification as a robustness check of our main results.

Koster and van Ommeren (2022) suggested another method to overcome the issue of negative weights by only exploiting the identifying variation between treated properties and nearby never-treated properties. They do so by including nearest treatment group-by-year fixed effects. To implement this method, we drop four cities that have more than one treated neighborhood and estimate our usual specification with city by month fixed effects. This specification effectively compares price changes between treated properties and nearby never-treated properties (within the same city). In other words, in this specification there is no staggered comparison as neighborhoods are compared to those that never receive a treatment.

Second, housing prices might have different trends across cities. Correlations between city-specific trends and the timing of Mehr projects could bias DID estimates. Inclusion of city-by-month fixed effects would control for flexible differential trends in housing prices across cities. As a result, our DID estimates solely rely on the differential evolution of housing prices across Mehr and non-Mehr neighborhoods within a city. It is worth noting that this specification rules out all other city-wide effects such as different economic or housing cycles and global supply effects.

Third, even with city-by-month fixed effects, one might expect a differential time trend for Mehr neighborhoods as in the majority of cases Mehr projects are in the suburbs. For various reasons, suburbs might have different trends relative to central areas biasing our estimates. In order to overcome this concern, we categorize neighborhoods in each city into quartiles of distance from the city center and include quartile-specific time fixed effects in our regression. Effectively, this allows for a flexible divergence of housing prices for neighborhoods in each quartile.

The fourth concern arises because Mehr sites are government-owned land. It might be that neighborhoods with government-owned land are of a different quality than other neighborhoods and therefore housing prices have a different trend in such locations. We do not have information on the share of publicly owned land across neighborhoods. However, we calculate average property values in neighborhoods in the first year of our sample (2010) and include the interaction of this average price with time fixed effects as an additional control. This specification would also control for possible mean reversion.

Arguably, Mehr projects may affect properties in their own and neighboring neighborhoods. In specification (1) we only measure the impact in own neighborhoods. To disentangle these two effects, we add a dummy variable for neighborhoods neighboring (within 2 kilometers) Mehr neighborhoods, $Near_{pt}$, after delivery as follows:

$$log(p_{ipt}) = \phi Mehr_{pt} + \psi Near_{pt} + \theta X_{ipt} + \gamma_p + \delta_{ct} + \epsilon_{ipt}. \quad (2)$$

ϕ and ψ capture the effect of Mehr units on housing prices within the same neighborhood and in neighboring neighborhoods respectively. It is worth noting that this specification captures a cleaner effect of Mehr units, because it also allows for an impact on neighboring neighborhoods.

We employ some additional specifications to look at the heterogeneity of the Mehr effect that possibly shed light on the mechanisms that explain our main effect. First, to test whether availability of schools has a positive effect, we include the interaction of school availability with the Mehr dummy:

$$log(p_{ipt}) = \phi_0 Mehr_{pt} + \Phi_1 Mehr_{pt} \times School_{pt} + \theta X_{ipt} + \gamma_p + \delta_{ct} + \epsilon_{ipt}. \quad (3)$$

Here, Φ_1 captures the differential impact of Mehr units in cities with a larger number of available schools.

Second, the Mehr impact might vary over time for several reasons but particularly due to the gradual occupation of units or development of local public services such as schools. To allow for a time-varying impact, we include variables that measure the elapsed time (number of years or quarters) since the delivery of Mehr units as follows:

$$log(p_{ipt}) = \phi_0 Mehr_{pt} + \Phi_1 Mehr_{pt} \times TimeElapsed_{pt} + \theta X_{ipt} + \gamma_p + \delta_{ct} + \epsilon_{ipt}. \quad (4)$$

Finally, Mehr housing units typically followed a standard housing design with an average size that is somewhat smaller than the nearby housing stock. Therefore, one might expect a stronger negative supply effect for houses with the same size band of the project. To test this hypothesis, we include interactions of the sizw dummies with Mehr dummy. We split transactions into five size classes (less than 50, between 50 and 75, between 75 and 110, between 110 and 140 and more than 140 m^2). So,

$$log(p_{ipt}) = \phi_0 Mehr_{pt} + \Phi_1 Mehr_{pt} \times Cat_{ipt} + \theta X_{ipt} + \gamma_p + \delta_{ct} + \epsilon_{ipt}, \quad (6)$$

where Φ_1 contains a set of parameters that capture the differential impact of Mehr units on different size categories. We do a similar analysis for age and price categories.

5 Results

5.1 Main Results

Table 3 shows estimation results for three versions of the main specifications (1) and (2). Columns (1) and (4) include only neighborhood and month fixed effects. We observe that housing prices in Mehr neighborhoods are reduced by 6.6 percent, which is statistically significant at the 10 percent level. When we control for neighborhoods close to Mehr neighborhoods, we see that the magnitude of the effect becomes more pronounced and statistically significant at the 5 percent level. Based on column (4), housing prices fall by 8.4 percent in Mehr neighborhoods, whereas neighboring neighborhoods see a slightly smaller reduction of 7.3 percent. In columns (2) and (5), we add city-by-year fixed effects which make the Mehr coefficient larger in magnitude (and more statistically significant). Allowing for a more flexible specification with city-by-month fixed effects in columns (3) and (6), we observe that housing prices in Mehr neighborhoods fall by around 11 percent as a result of Mehr projects delivery.[28] In column (6), the effect on nearby neighborhoods is smaller and statistically insignificant at conventional levels.[29] In column (7), we use the logarithm of the number of Mehr units delivered instead of the Mehr dummy as an explanatory variable. It appears that a 10 percent increase in the delivery of Mehr units results in a 0.15 percent decrease in nearby property values.[30]

[28] It is worth noting that in columns (3) and (6) Mehr coefficients are similar with and without controlling for neighboring neighborhoods.

[29] To understand how far the negative effect exists, we categorize distance between transactions and Mehr housing neighborhood into 4 categories in each city (Figure A-4 shows the distribution of the distance between each transaction's neighborhood and Mehr neighborhood) and show that the negative effect only exists in Mehr neighborhood. The results can be found in 0Appendix B (Table B-1).

[30] Also, we run another regression with the number of Mehr units delivered. This specification shows that an increase of 1000 Mehr units leads to a 0.11 percent price decrease.

Table 3: Main regression results

Dep.Var.: $log(p_{ipt})$	Mehr neighborhood			Mehr and neighboring neighborhoods			Continuous Mehr Variable
	Baseline	City× Year F.E.	City× Month F.E.	Baseline	City×Year F.E.	City× Month F.E.	City× Month F.E.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mehr	-0.066*	-0.089**	-0.109***	-0.084**	-0.096**	-0.110***	-0.015***
	(0.039)	(0.043)	(0.033)	(0.039)	(0.043)	(0.029)	(0.005)
Near				-0.073*	-0.064***	-0.034	
				(0.040)	(0.024)	(0.031)	
Age	-0.014***	-0.014***	-0.022***	-0.014***	-0.013***	-0.014***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log (Size)	-0.137***	-0.138***	-0.327***	-0.137***	-0.312***	-0.138***	-0.144***
	(0.014)	(0.015)	(0.121)	(0.0147)	(0.030)	(0.014)	(0.014)
Neighborhood F.E.	Y	Y	Y	Y	Y	Y	Y
Month F.E.	Y	Y	N	Y	Y	N	N
City×Year F.E.	N	Y	N	N	Y	N	N
City× Month F.E.	N	N	Y	N	N	Y	Y
Obs.	360,789	360,789	360,789	360,789	360,789	360,789	360,789
Number of Clusters	756	756	756	756	756	756	756
$\overline{R}^2$	0.393	0.411	0.421	0.391	0.413	0.421	0.411

Notes: Table 3 shows coefficient estimates from regressions of logarithm of housing prices on covariates. Covariates include age, logarithm of size, neighborhood and month fixed effect in all columns. Columns (1) to (3) include Mehr which is a dummy variable that is one for transactions in Mehr neighborhoods after the first Mehr unit is delivered. In addition to the Mehr dummy, columns (4) to (6) include "Near" which is a dummy variable that equals one for transactions in neighborhoods neighboring Mehr neighborhoods after the first Mehr unit is delivered. Columns (2) and (5) include city by year fixed effects. Columns (3) and (6) include city by month fixed effects. In column (7) we use logarithm of number of Mehr units delivered instead of Mehr dummy as explanatory variable. Standard errors are clustered at the neighborhoods and reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1% level respectively.

As it is clear from the results, after controlling for city-by-month fixed effects, the estimated effect becomes more negative and more statistically significant. This specification allows for city-specific flexible trends and controls for all city-wide effects such as different economic trends and supply effects throughout the city. Cities might experience local boom and busts that are correlated with Mehr completion dates. Also, housing prices in Iran has a dramatic upward trend. In the 19 cities in this study housing prices increases by about 80 percent during Mehr delivery period (2011-2014)[31]. There is also large heterogeneity across cities with a minimum price growth of 50 percent (e.g., Ilam) and a maximum price growth of more than 100 percent (e.g., Qom) and their price growth have different trends. Therefore, it is crucial to control for city-by-month fixed effects.

[31] Delivery of the first unit of Mehr housing in all cities occurred in this period.

Table 4: Regressions to address the staggered DID bias

Dep.Var.: $log(p_{ipt})$	Mehr neighborhood			Mehr and neighboring neighborhoods			Rios-Avila, Sant'Anna, and Callaway (2021)
	Baseline	City× Year F.E.	City× Month F.E.	Baseline	City×Year F.E.	City× Month F.E.	Average Treatment Effect on Treated
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mehr	-0.072*	-0.092*	-0.111***	-0.081*	-0.097**	-0.111***	-0.192***
	(0.042)	(0.049)	(0.039)	(0.042)	(0.049)	(0.038)	(0.085)
Near				-0.011	-0.021	-0.014	
				(0.033)	(0.025)	(0.024)	
Age	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	
log (Size)	-0.133***	-0.132***	-0.133***	-0.133***	-0.132***	-0.133***	
	(0.015)	(0.014)	(0.014)	(0.015)	(0.014)	(0.014)	
Neighborhood F.E.	Y	Y	Y	Y	Y	Y	Y
Month F.E.	Y	Y	N	Y	Y	N	N
City×Year F.E.	N	Y	N	N	Y	N	N
City× Month F.E.	N	N	Y	N	N	Y	N
Obs.	314,531	314,531	314,531	314,531	314,531	314,531	6,242
Number of Clusters	633	633	633	633	633	633	756
$\overline{R}^2$	0.373	0.385	0.395	0.373	0.385	0.395	-

Notes: Table 4 shows coefficient estimates from regressions of logarithm of housing prices on covariates after solving the potential negative weights problem of staggered difference-in-difference design. In column (1) to (6) we drop cities with more than one treatment date and neighborhood and do the same specifications as Table 3. In column (7) we collapse housing price at neighborhood and year level and use the method suggested by Rios-Avila, Sant'Anna, and Callaway (2021) to solve this problem. Standard errors are clustered at the neighborhoods and reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1% level respectively.

5.2 Robustness Regressions

In our robustness regressions we try to take care of staggered DID bias, within city differential trends, mean reversion and measurement error in registration of transactions. We also conduct a set of placebo regressions to check for validity of results.

In Table 4 we first aim to address the issue of negative weights in our staggered difference-in-difference design. We do so in two ways. First, we drop 4 cities that have more than one treated neighborhood. Adding city-by-month fixed effects effectively relies on the nearest treatment group similar to the method used by Koster and van Ommeren (2022). This specification only exploits variation across one treated and several control neighborhoods all within the same city. In other words, within a city there is only one treatment and hence we do not face the staggered treatment bias. Columns (1)-(6) show that the results are very similar to the baseline results reported in Table 3. In column (7) of Table 4 we collapse housing prices at neighborhood and year level to make a balanced panel to implement the method suggested by Rios-Avila, Sant'Anna, and Callaway (2021). The effect remains negative and statistically significant.

Table 5: Robustness to differential trends, selection of control neighborhoods and mean reversion

Dep.Var.: $log(p_{ipt})$	Trends by distance from city center			Restrict control neighborhoods to:		Mean reversion: Trends by quartiles of average postal price in 2010	
	Distance quartiles	Distance		Farthest neighborhood	Neighborhoods beyond 2 km		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mehr	-0.114***	-0.104***	-0.106***	-0.106***	-0.104***	-0.081***	-0.084***
	(0.030)	(0.029)	(0.029)	(0.036)	(0.028)	(0.030)	(0.028)
Near			-0.032				-0.029
			(0.031)				(0.030)
Age	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***
	(0.004)	(0.001)	(0.001)	(0.002)	(0.001)	(0.004)	(0.001)
log (Size)	-0.137***	-0.137***	-0.137***	-0.277***	-0.135***	-0.135***	-0.135***
	(0.014)	(0.014)	(0.014)	(0.026)	(0.015)	(0.014)	(0.014)
Neighborhood F.E.	Y	Y	Y	Y	Y	Y	Y
City× Month F.E.	Y	Y	Y	Y	Y	Y	Y
Distance to Center× Month F.E.	Y	Y	Y	N	N	N	N
Average price in 2010× Month F.E.	N	N	N	N	N	Y	Y
Obs.	360,789	360,789	360,789	68,299	332,777	354,038	354,038
$\overline{R}^2$	0.357	0.354	0.354	0.388	0.343	0.354	0.354

Notes: In column (1) we have 4 distance categories and allow each category to have different monthly price trend by controlling the interaction of each category by month. In columns (2) and (3) we allow different distances to have different monthly price trends by controlling interaction of each continuous distance by month. Column (3) includes "Near" which is a dummy variable that is one for transactions in neighborhoods neighboring Mehr neighborhoods after the first Mehr unit is delivered. We define the control group of each city's Mehr housing site as the farthest neighborhoods of the city from the Mehr neighborhood and drop other transactions in column (4). In column (5) we drop transactions that are near Mehr housing site (closer than 2km) but are not in the same neighborhood. In columns (6) and (7) we create 4 categories using average housing price in the base year (2010) and allow each category to have different monthly price trends. Column (7) also includes "Near". Standard errors are clustered at the neighborhoods and reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1% level respectively.

reports robustness checks that try to address two other concerns. First, most of Mehr projects are located in the suburbs. To control for trends within a city that might vary with distance to city center, we interact distance from city center with date dummies. In column (1) we use distance quartile dummies while in columns (2) and (3) we use the continuous distance variable. In column (4) we restrict our analysis to peripheral neighborhoods on the outskirts of the cities to get a more comparable sample.[32] This eliminates more than 80 percent of our observations. Column (5) removes neighborhoods close (less than 2 km between their centers) to the Mehr neighborhoods. In all cases, the Mehr coefficient estimate is very close to our baseline estimates in Table 3. When we include the dummy for neighborhoods neighboring Mehr ones, it remains statistically insignificant.

Second, housing prices might show a mean-reverting behavior.[33] It might be that relatively low prices in Mehr neighborhoods was a reason for locating projects. This creates an expectation for prices to increase to their usual trend after some time which implies an

[32] Peripheral is defined as neighborhoods that their distance to Mehr neighborhood were in the last decile of each city.

[33] The mean reversion concern is particularly important as our data does not contain the initial years of Mehr projects and hence, we cannot capture anticipation effects.

upward bias for our estimates of Mehr coefficients. In contrast, expectations of an increase in amenities prior to the delivery of Mehr projects might have increased prices, but after these expectations were not realized, prices have returned to lower levels, creating a downward bias. In columns (6) and (7) of

, we address these concerns. We calculate average housing prices in neighborhoods in the first year of our sample (2010) and interact this with month fixed effects to allow for arbitrary trends for neighborhoods with different levels of initial prices. We observe a 24 percent reduction in the magnitude of the Mehr coefficient; however, the coefficient is still highly statistically significant and in the same ballpark.

Our house transaction data should only include non-Mehr units because sale of Mehr units were not allowed until October 2013 and given the outstanding mortgage on Mehr units a different sale procedure should be taken after this date. However, it is possible that due to exceptions or measurement error some transactions might correspond to Mehr units.[34] We conduct two robustness checks in **Table 6** to check for the importance of this issue. Our first check keeps transactions prior to October 2013 in columns (1) and (2). This removes about 40 percent of our transactions. The Mehr coefficient is reduced to less than half but it is still statistically significant at 10 percent level. In columns (3) to (6) we conduct a less stringent robustness check by removing house transactions that have a similar age to the Mehr units. Columns (3) and (4) remove such observations within Mehr neighborhoods while columns (5) and (6) remove such observations in all neighborhoods. Both sets of columns show a highly statistically significant Mehr coefficient that is in the same ballpark as our preferred estimate in Table 3. It is interesting to note that in all robustness analyses, the estimated impact of Mehr project on neighboring neighborhoods, is negative, but never statistically significant.

Finally, we conduct a range of placebo tests. First, we assign fake treatment status to the neighborhood at the farthest distance from Mehr neighborhoods. In other words, we define Mehr to be equal to one for the opposite suburb of the city at the time of Mehr units' delivery. Here we remove Mehr neighborhoods from our sample and run regressions similar to our preferred specification. Mehr and Near coefficient estimates are small and statistically insignificant in all specifications (columns 1 to 6 of Table 7). Second, we assume that the first Mehr housing unit was delivered a year earlier, and we discard the transactions that took place one year after the actual delivery date of the first Mehr unit. Again, we see no effect before Mehr units' delivery (column 7 of Table 7).

[34] Registration of housing transactions in TMIS is mandatory for residential units. However, Mehr units follow a different procedure to resale.

Table 6: Robustness to Mehr housing units' transactions

Dep.Var.: $log(p_{ipt})$	Keep before October 2013		Different age from Mehr units			
			in Mehr neighborhoods		all neighborhoods	
	(1)	(2)	(3)	(4)	(5)	(6)
Mehr	-0.047*	-0.049*	-0.100***	-0.102***	-0.079***	-0.081***
	(0.025)	(0.025)	(0.027)	(0.027)	(0.025)	(0.025)
Near		-0.031		-0.034		-0.019
		(0.029)		(0.031)		(0.029)
Age	-0.012***	-0.012***	-0.014***	-0.0141***	-0.011***	-0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log (Size)	-0.238***	-0.238***	-0.138***	-0.138***	-0.208***	-0.207***
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
Neighborhood F.E.	Y	Y	Y	Y	Y	Y
City× Month F.E.	Y	Y	Y	Y	Y	Y
Obs.	223,345	223,345	332,958	332,958	275,136	275,136
$\overline{R}^2$	0.293	0.293	0.353	0.353	0.317	0.317

Notes: In the first two columns we drop transactions occurring after October 2013. In columns (3) to (6) we keep houses with a different age than Mehr units. Columns (2), (4) and (6) include "Near" which is a dummy variable equals one for transactions in neighborhoods neighboring Mehr neighborhoods after the first Mehr unit is delivered. Standard errors are clustered at the neighborhoods and reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1% level respectively.

Table 7: Placebo regression results

Dep.Var.: $log(p_{ipt})$	Mehr neighborhood			Mehr and neighboring neighborhoods			Placebo Delivery date
	Baseline	City×Year F.E.	City×Month F.E.	Baseline	City×Year F.E.	City×Month F.E.	City× Month F.E.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mehr	0.024	0.013	0.012	0.024	0.013	0.012	-0.006
	(0.034)	(0.021)	(0.020)	(0.034)	(0.021)	(0.020)	(0.041)
Near				0.002	-0.001	-0.004	
				(0.029)	(0.025)	(0.023)	
Age	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log (Size)	-0.141***	-0.142***	-0.141***	-0.141***	-0.142***	-0.141***	-0.153***
	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.014)	(0.015)
Neighborhood F.E.	Y	Y	Y	Y	Y	Y	Y
City×Year F.E.	N	Y	N	N	Y	N	N
City×Month F.E.	N	N	Y	N	N	Y	Y
Obs.	338,367	338,367	338,367	338,367	338,367	338,367	173,766
$\overline{R}^2$	0.316	0.336	0.348	0.316	0.336	0.348	0.293

Notes: Columns (1) to (6) of this table shows the results of the same specifications as **Table 3** except that we assume that Mehr project was constructed in the farthest neighborhood from the real place of the city and in the same time. In the last column, we assume that the first Mehr housing unit was delivered a year earlier, and we discard the transfers that took place one year after the actual delivery date of the first Mehr housing unit. Standard errors are clustered at the neighborhoods and reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1% level respectively.

5.3 Interpretation, Mechanisms and Heterogeneity of Mehr effect

So far, we have established a robust decline of around 11 percent in the housing prices for nearby properties after Mehr units are delivered. In this section we try to provide evidence on the mechanisms that shape this negative externality. Two mechanisms may plausibly explain this result. The first mechanism is the supply effect. Mehr project delivered a large number of housing units. Figure A-3 in the Appendix shows that supply increased between 1.5 to 27 percent at the city level. Although the supply effect is likely to operate at the city level, and we control for this by including city by month fixed effects, we might have some local supply effects.[35] The second mechanism is the dis-amenity effect resulting from overcrowding or unavailability of facilities and public services like schools in Mehr neighborhoods. We aim to disentangle these two effects. Disentangling the two effects is highly ambitious and not common in the literature. In order to establish that (at least some of) the estimated negative effect is due to the dis-amenity channel we focus on four types of additional analyses in the following subsections.

5.3.1 Effect of Schools

One of the key local amenities is the quantity and quality of schools. There is extensive evidence that quality of schools affect house prices (Brasington and Haurin, 2009; Chung, 2015; Doko Tchatoka and Varvaris, 2021; Fack and Grenet, 2010; Gibbons et al., 2013; Schwartz et al., 2014). This literature focuses on the *quality* of schools, but less on *quantity* of schools. Obviously fewer schools would result in higher congestion and hence lower quality. We collect data on the number of (existing and new) schools and the number of school classes[36]. Figure 2 reports the ratio of households per school and the number households per school classes for the whole city and for the Mehr neighborhoods. This figure confirms that schools are more congested in Mehr neighborhoods.[37] Since students are allowed to apply only to schools in their neighborhood of residence, shortage of schools will result in overcrowding and lead to lower house values.[38] It is worth noting that, on average, schools and facilities of nearby neighborhoods[39], are about 1.7 km farther than the host neighborhood and it takes more than 20 minutes on foot (one way) to get there which is the common way to get to school in these cities.

[35] When we restrict our control group to neighboring neighborhoods (within 2 km), the effect is almost the same, which suggests that the effect is *not* due to an increase in supply, as one expects the effect to be stronger locally.

[36] We do not have data on enrollment to investigate the role of “open seats”.

[37] At the beginning of delivery of Mehr units, there were lots of concern about shortage of schools in Mehr housing localities. For example, in 2014, the general director of renovation, development and equipping of schools in Lorestan province said the lack of schools in Mehr housing sites in Lorestan will be a problem in the future and it is necessary to look for a new source of credit to solve the problem of schools in Mehr neighborhoods. (https://b2n.ir/p62205)

[38] There is a lot of anecdotal evidence (supported by the interviews by the author) that school and other facilities was lacking. Many residents complained about this. We mentioned some of them in introduction. For some other examples in Iranian media see: https://b2n.ir/f15611 and https://b2n.ir/t01432

[39] The 1.7 km estimate is rough, as we assumed that schools are located in the centroid of the neighborhood because we don’t have the exact location of schools and housing.

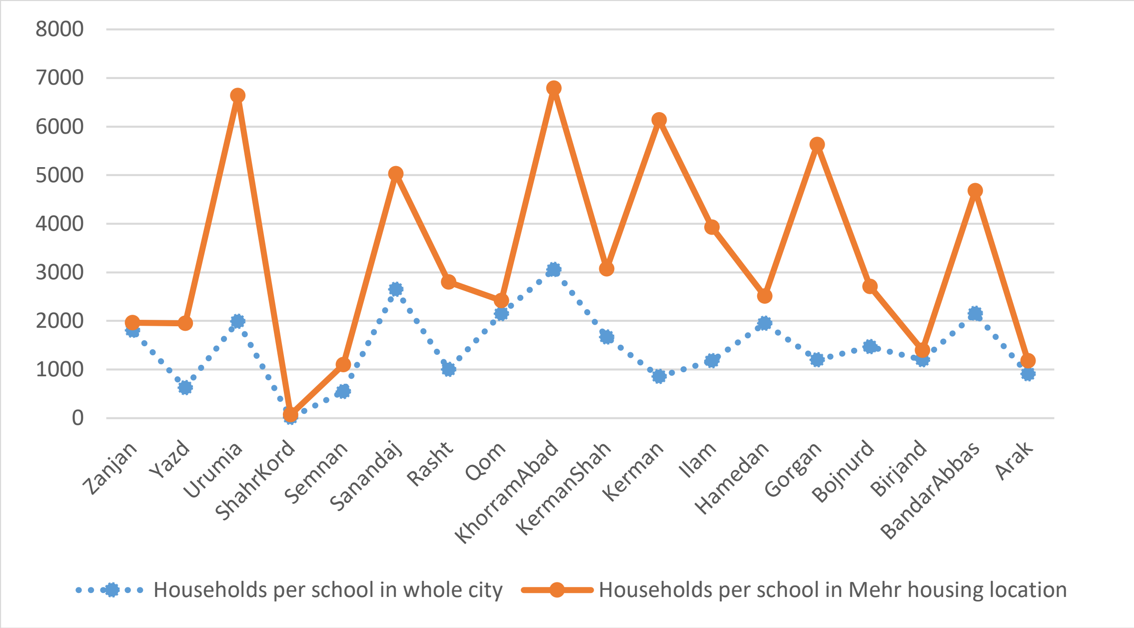

Figure 2 Number of households per school in Mehr neighborhood and for the whole city

Notes: Solid lines show the number of households per school in Mehr neighborhoods. Dashed lines show the same ratio for the whole city.

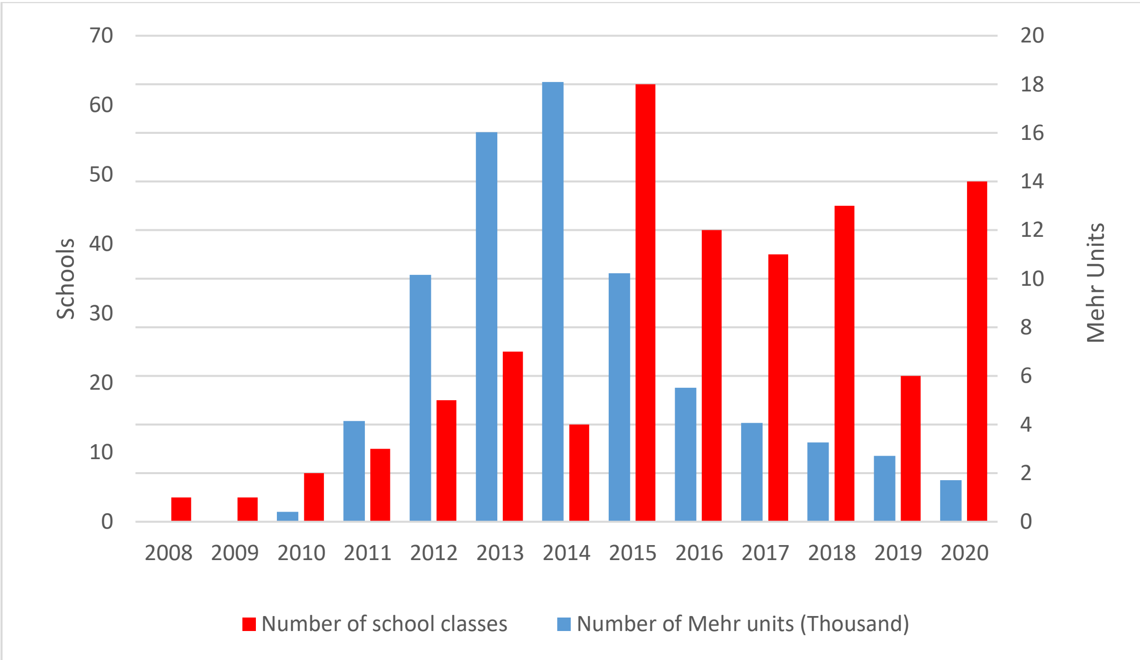

Figure 3 Number of Mehr units and schools delivered in each year

Notes: Blue bars show the number of Mehr units (right axis). Red bars show the number of constructed school classes (left axis).

Figure 3 shows that school construction occurred mostly after 2015, whereas Mehr housing units were delivered mostly before that date. We can count three reasons for this delay: 1) the weakness of the local education department in allocating resources for school construction; 2) the lack of vacant land to build schools in Mehr neighborhood; and 3) poor coordination between the Ministry of Roads & Urban Development and the local education department. Therefore, we get a significant heterogeneity across cities in the timing of school construction which we can assume to be exogeneous in our context.

Table 8: Impact of school availability on nearby property values

Dep.Var.: $log(p_{ipt})$	Baseline	Measure of school amenity			
	Baseline Result	= 1 if 50% of schools delivered when 50% of Mehr units delivered	= 1 if school to units ratio ≥ 1 at each year in each city	Average of school measure in col. (3) over sample period	= 1 if school to units' ratio ≥ 1 at exact transaction date
	(1)	(2)	(3)	(4)	(5)
Mehr	-0.109***	-0.140***	-0.119***	-0.136***	-0.120***
	(0.033)	(0.033)	(0.030)	(0.030)	(0.030)
Mehr×School Availability		0.225**	0.104*	0.171**	0.090**
		(0.105)	(0.039)	(0.075)	(0.040)
Neighborhood F.E.	Y	Y	Y	Y	Y
City×Month F.E.	Y	Y	Y	Y	Y
Obs.	360,789	360,789	360,789	360,789	360,789
$\overline{R}^2$	0.421	0.421	0.421	0.421	0.421

Notes: Column (1) is repetition of our main result (column (3) of Table 3). In column (2) "School" is a dummy variable which is one if more than half of schools were constructed when half of units were delivered in a city. In column (3), this variable is one if share of schools constructed exceeded share of delivered housing units in each year. This variable is average of "School" variable in column (3) in the whole period in column (4). In column (5), it is one if share of schools constructed exceeded share of delivered housing unitsat the time of the transaction; and in column (6) we use the logarithm of Mehr delivery progress divided by share of school delivered in Mehr neighborhoods and zero in other areas. Standard errors are clustered at the neighborhoods and reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1% level respectively.

Table 8 reports regression results to understand the effect of school availability on the Mehr externality. Column (1) repeats the baseline results (i.e., column (3) of Table 3). In columns (2) to (5) we include interactions of Mehr dummy with various school availability measures. In column (2) we construct a school dummy that is one for Mehr neighborhoods where at least half of schools were constructed when half of the units were delivered. To utilize finer variation in school availability, we divide the number of schools constructed by the number planned in the area.[40] This ratio is then divided by the share of Mehr units delivered. This school-to-units ratio shows whether school construction progressed proportional to the delivery of Mehr units. In column (3), school dummy is one when this ratio exceeds 1. In column (4), we average the school availability measure used in column (3) for the whole period. In column (5), we use the exact date of the transaction to match with the school availability measure instead of relying on yearly matching. All regression in Table 8 show a positive coefficient for the interaction term which reflects the positive amenity effect of schools. In fact, if schools are expanded proportionately to new housing units, there is no negative externality.

It is clear from the above results that construction of schools reduces the negative Mehr effect.[41] This result is clearer in Figure 4. In this figure, coefficients of two separate regressions are plotted. In the first one (orange in the figure), we categorize school progress into 5 categories and use one dummy for each of them and control for Mehr progress. It can be seen that with more school construction, the effect becomes positive. In the second

[40] Since the government take into account number of new households when planning number of school required, we can assume number of planned schools as sufficient number of schools.
[41] We show more evidence on effect of school progress in Table E-16Appendix E).

regression, we categorize Mehr progress into the same categories and see that the effect becomes more negative when more units are delivered.[42] All these evidences are consistent with the fact that school construction plays an important role in the effect of Mehr housing on nearby property values.

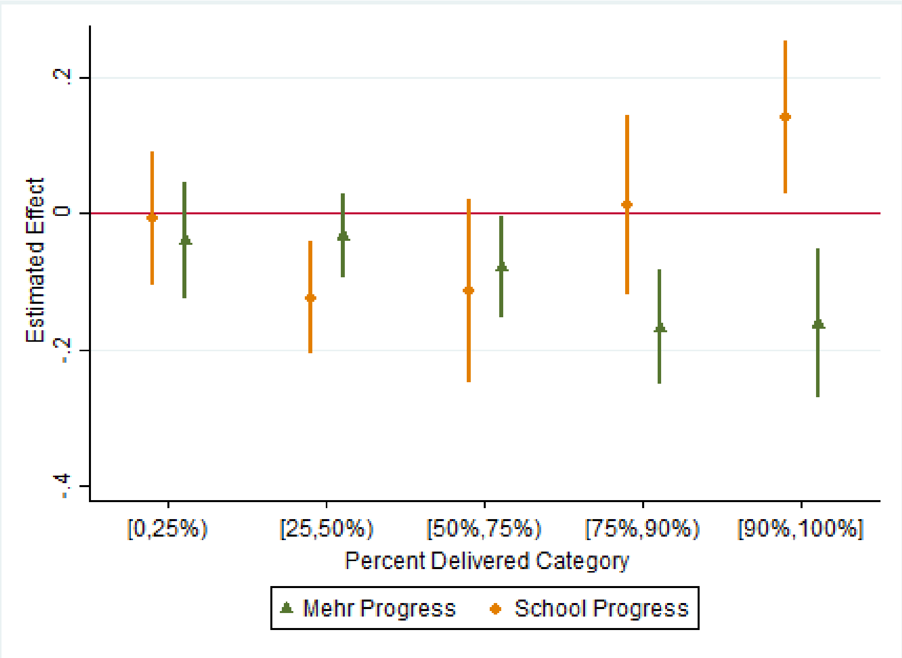

Figure 4 Differences between Effect of Mehr progress (green triangle) and school progress (orange square) on nearby property values

5.3.2 Timing of the Effect

The second piece of evidence on the mechanisms comes from the time profile of the Mehr effect. Figure 5 shows coefficient estimates and 95 percent confidence intervals from a dynamic DID. The dynamic effect is consistent with the amenity effect but not with the supply effect. Before the delivery of Mehr units, property values in Mehr and non-Mehr neighborhoods are similar. The negative effect starts later. Mehr housing units were delivered gradually (the reference point is the first unit delivery date). One expects the supply effect to come into existence immediately after delivery, but as new Mehr households gradually moved in[43], one expects the amenity effect to start later.

[42] The specifications are respectively (Φ_1 is plotted for different caegories):

$log(p_{ipt}) = \phi_0 Mehr_{pt} + \Phi_1 Mehr_{pt} \times SchoolprogressCat_{pt} + \theta X_{ipt} + \gamma_p + \delta_{ct} + \epsilon_{ipt}$ and

$log(p_{ipt}) = \phi_0 Mehr_{pt} + \Phi_1 Mehr_{pt} \times MehrprogressCat_{pt} + \theta X_{ipt} + \gamma_p + \delta_{ct} + \epsilon_{ipt}$

[43] Delivery time can refer to the time at which the dwellers moved in but for the first units of each project it is not the case and they will move in after some time until a significant number of project residents take delivery of their units. Therefore, school congestion occurs some months after the first unit is delivered.

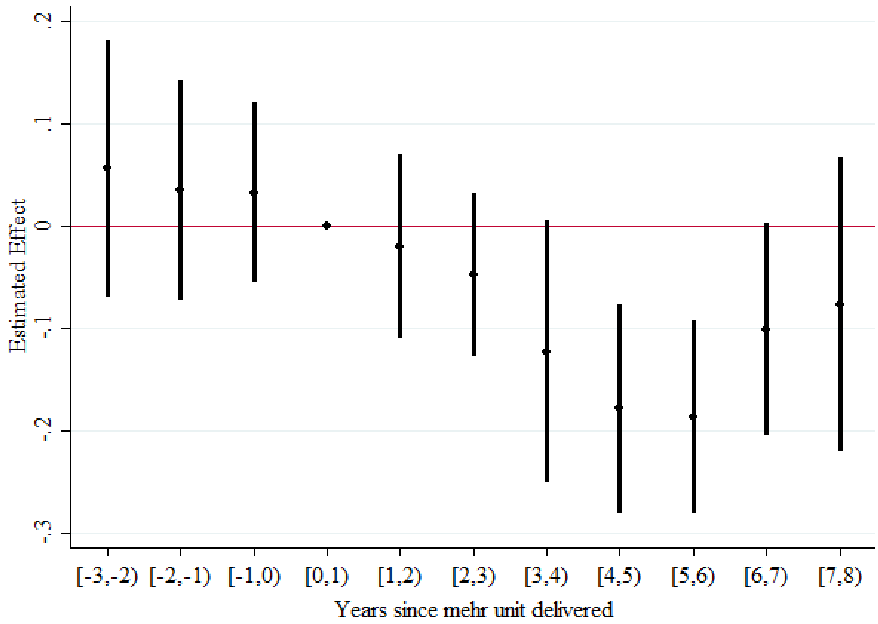

Figure 5 Effect of Mehr housing delivery in different years after and before delivery of the first unit of the site

Notes: Our reference time is the first unit of Mehr housing delivery date in each Mehr project site and the coefficients are for interaction of Mehr variable and number of years passed since the delivery of Mehr units. We have data for 5 years before delivery until 9 years after delivery, but we show coefficients just for the 3 years before to 8 years after the delivery since the sample becomes small at the beginning and end of the range.

To improve our understanding of the dynamic effect, we adjust the reference date to when half of the units were delivered and plot annual trends in Figure C-1. Clearly, the negative effect arises after half of Mehr units are delivered, but diminishes gradually after about 4 years. This supports the dis-amenity story, because schools (and other amenities) were constructed gradually.

In theory, one expects to see a negative effect before the construction of Mehr units was finished because of an anticipation effect. Our data does not contain many years before the start of the Mehr project and hence we cannot capture long-run anticipation effects and also the project started abruptly and without much previous notifications. But anticipation effects may also show just after starting construction and before delivery of Mehr units to households. To examine this, we allow for anticipation effects just before the event by excluding transactions that occurred one year before the first delivery of Mehr units (as shown by Gibbons & Machin, 2005; Koster & van Ommeren, 2019). The effect remains the same (10.9 percent), but with a higher standard error (4.3 percent) as 40 percent of transactions that occurred before the delivery of the first Mehr unit delivery are dropped.

5.3.3 Effects on Similar Housing Units

The supply effect of Mehr project is probably stronger for properties that have similar characteristics to the units constructed. More than 80 percent of Mehr units have a size between 75m^2 and 110m^2 (see Figure A-2 in the appendix). Therefore, assuming some degree of market segmentation, we expect a stronger supply effect for houses falling in the same size category as Mehr units. Figure 6, shows the Mehr coefficient estimates for each size category taking the Mehr category (75-110m^2) as the reference. We see no significant difference between Mehr effects in different size categories.[44]

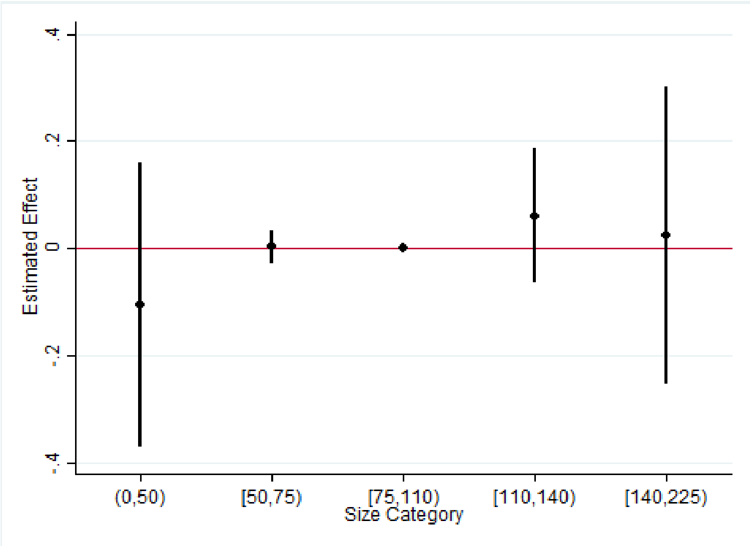

Figure 6 Heterogeneous effect in different size categories

Notes: We drop size category of between 75 and 110m^2 (whose sizes are the same as Mehr housing units) and the results are the effect on each size category with respect to Mehr size category.

Similarly, if the supply effect is the main mechanism, we expect to see a stronger negative effect on cheaper units for which Mehr housing is a closer substitute. But we see the opposite result in Figure C-2. Finally, we expect a stronger supply effect for houses that were built more recently, but we see no statistically significant difference between Mehr effects in different age categories in Figure C-3. In conclusion, all these results are consistent with a dis-amenity channel, but not with the supply effect channel.

5.3.4 Different Mehr Project Scales

At last, we run separate regressions for each city in our sample. Figure C-4 plots coefficient estimates and the corresponding 95 percent confidence intervals as a function of the scale of Mehr project in the city. One expects the supply effect to be stronger when the scale of Mehr project is larger. However, this is not what see in the figure. Basically, there is no clear relationship between the estimated coefficients and the Mehr project scale which again makes the supply effect less plausible.

[44] We test the equality between the coefficients of Category 3 with the coefficients of other categories separately and in all of the tests, we cannot reject the null hypothesis that this coefficient is equal to the others at 10%. We expect to see the supply effect (if existing) in the first and second category too, since Mehr households prefer larger housing units and maybe they prefer to live in Mehr housing units rather than a smaller unit that is not a Mehr unit. But we expect that this supply effect doesn't exist for categories 4 and 5 because their sizes are larger than Mehr units and mostly for richer households. So, for further robustness check, we divide transactions to two categories and define just one dummy variable for transactions that have sizes of more than 110 m^2, but again there was no statistically significant difference between the effects in these two categories ($t<1$).

6 Conclusion

The effect of affordable housing projects on existing properties within a neighborhood have received a lot of attention in developed countries. However, this external effect might be very different in developing countries due to a lack of building additional public facilities such as schools. This study estimates this effect for one of the world's largest affordable housing projects in Iran. Our results show that housing prices fall substantially by around 11 percent. This negative effect is substantially larger than the effects estimated for developed countries (Diamond and McQuade, 2019).

Two main mechanisms may explain our results: supply and dis-amenity effects. All our evidence suggests that the main reason for the large negative effect is the latter, especially a lack of school provision. This result is in line with the literature on the quality of schools and housing prices in developed countries (Fack and Grenet 2010; Gibbons et al., 2013). Our paper is the first study to relate spillovers of affordable housing to the lack of schools as a key public facility in the neighborhood.

Our policy conclusions are clear. Rapid construction of public services including schools should complement the construction of affordable housing. Otherwise, construction of affordable housing might be detrimental to the welfare of the incumbent (and new) residents in the neighborhood.

References

Autor, David H., Christopher J. Palmer, and Parag A. Pathak. 2014. "Housing Market Spillovers: Evidence from the End of Rent Control in Cambridge, Massachusetts." *Journal of Political Economy* 122(3):661–717. doi: 10.1086/675536.

Baker, Judy L., and Gauri U. Gadgil. 2017. *East Asia and Pacific Cities: Expanding Opportunities for the Urban Poor*. World Bank, Washington, DC.

Baum-Snow, Nathaniel, and Justin Marion. 2009. "The Effects of Low Income Housing Tax Credit Developments on Neighborhoods." *Journal of Public Economics* 93(5–6):654–66. doi: 10.1016/j.jpubeco.2009.01.001.

Borusyak, Kirill, Xavier Jaravel, and Jann Spiess. 2022. "Revisiting Event Study Designs: Robust and Efficient Estimation."

Brasington, David M., and Donald R. Haurin. 2009. "Parents, Peers, or School Inputs: Which Components of School Outcomes Are Capitalized into House Value?" *Regional Science and Urban Economics* 39(5):523–29. doi: 10.1016/j.regsciurbeco.2009.05.002.

Callaway, Brantly, and Pedro H. C. Sant'Anna. 2021. "Difference-in-Differences with Multiple Time Periods." *Journal of Econometrics* 225(2):200–230. doi: 10.1016/j.jeconom.2020.12.001.

Campbell, John Y., Stefano Giglio, and Parag Pathak. 2011. "Forced Sales and House Prices." *American Economic Review* 101(5):2108–31. doi: 10.1257/aer.101.5.2108.

de Chaisemartin, Clément, and Xavier D'Haultfœuille. 2020. "Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects." *American Economic Review* 110(9):2964–96. doi: 10.1257/aer.20181169.

Chung, Il Hwan. 2015. "School Choice, Housing Prices, and Residential Sorting: Empirical Evidence from Inter-and Intra-District Choice." *Regional Science and Urban Economics* 52:39–49. doi: 10.1016/j.regsciurbeco.2015.01.004.

Daams, Michiel N., Paola Proietti, and Paolo Veneri. 2019. "The Effect of Asylum Seeker Reception Centers on Nearby House Prices: Evidence from The Netherlands." *Journal of Housing Economics* 46:101658. doi: 10.1016/j.jhe.2019.101658.

Davis, Lucas W. 2011. "The Effect of Power Plants on Local Housing Values and Rents." *Review of Economics and Statistics* 93(4):1391–1402. doi: 10.1162/REST_a_00119.

Davison, Gethin, Hoon Han, and Edgar Liu. 2017. "The Impacts of Affordable Housing Development on Host Neighbourhoods: Two Australian Case Studies." *Journal of Housing and the Built Environment* 32(4):733–53. doi: 10.1007/s10901-016-9538-x.

Diamond, Rebecca, and Tim McQuade. 2019. "Who Wants Affordable Housing in Their Backyard? An Equilibrium Analysis of Low-Income Property Development." *Journal of Political Economy* 127(3):1063–1117. doi: 10.1086/701354.

Diao, Mi, Delon Leonard, and Tien Foo Sing. 2017. "Spatial-Difference-in-Differences Models for Impact of New Mass Rapid Transit Line on Private Housing Values." *Regional Science and Urban Economics* 67:64–77. doi: 10.1016/j.regsciurbeco.2017.08.006.

Doko Tchatoka, Firmin, and Vanessa Varvaris. 2021. "Neighbourhood, School Zoning and the Housing Market: Evidence from New South Wales." *Journal of Housing Economics* 54:101790. doi: 10.1016/j.jhe.2021.101790.

Dröes, Martijn I., and Hans R. A. Koster. 2021. "Wind Turbines, Solar Farms, and House Prices." *Energy Policy* 155:112327. doi: 10.1016/j.enpol.2021.112327.

Ellen, Ingrid Gould, Johanna Lacoe, and Claudia Ayanna Sharygin. 2013. "Do Foreclosures Cause Crime?" *Journal of Urban Economics* 74:59–70. doi: 10.1016/j.jue.2012.09.003.

Ellen, Ingrid Gould, Amy Ellen Schwartz, Ioan Voicu, and Michael H. Schill. 2007. “Does Federally Subsidized Rental Housing Depress Neighborhood Property Values?” *Journal of Policy Analysis and Management* 26(2):257–80. doi: 10.1002/pam.20247.

Fack, Gabrielle, and Julien Grenet. 2010. “When Do Better Schools Raise Housing Prices? Evidence from Paris Public and Private Schools.” *Journal of Public Economics* 94(1–2):59–77. doi: 10.1016/j.jpubeco.2009.10.009.

Freeman, Lance, and Hilary Botein. 2002. “Subsidized Housing and Neighborhood Impacts: A Theoretical Discussion and Review of the Evidence.” *Journal of Planning Literature* 16(3):359–78. doi: 10.1177/08854120222093419.

Galster, George C., P. A. Tatian, Anna M. Santiago, K. L. Pettit, and Robin Smith. 2003. “Why Not in My Backyard. Neighborhood Impacts of Deconcentrating Assisted Housing.” *New Brunswick, NJ: Center for Urban Policy Research.*.

Gechter, M., and N. Tsivanidis. 2020. “Spatial Spillovers from Urban Renewal: Evidence from the Mumbai Mills Redevelopment.” *Penn State University (Mimeo)*.

Gibbons, Stephen, Stephen Machin, and Olmo Silva. 2013. “Valuing School Quality Using Boundary Discontinuities.” *Journal of Urban Economics* 75:15–28. doi: 10.1016/j.jue.2012.11.001.

Gibson, Timothy A. 2005. “NIMBY and the Civic Good.” *City and Community*.

Hartley, Daniel. 2014. “The Effect of Foreclosures on Nearby Housing Prices: Supply or Dis-Amenity?” *Regional Science and Urban Economics* 49:108–17. doi: 10.1016/j.regsciurbeco.2014.09.001.

Heo, Chang-Moo, and Myung-Gu Kang. 2012. “Impact of the Multi-Complex Station Development on the Neighbouring Commercial Land Price.” *International Journal of Urban Sciences* 16(1):37–47. doi: 10.1080/12265934.2011.635878.

Hogan, James. 1996. *Scattered-Site Housing: Characteristics and Consequences*. U.S. Department of Housing and Urban Development, Office of Policy Development and Research.

Iglesias, Tim. 2002. "Managing Local Opposition to Affordable Housing: A New Approach to NIMBY." *Journal of Affordable Housing & Community Development Law* 12(1):78–122.

Ki, Chiu On, and Wadu Mesthrige Jayantha. 2010. "The Effects of Urban Redevelopment on Neighbourhood Housing Prices." *International Journal of Urban Sciences* 14(3):276–94. doi: 10.1080/12265934.2010.9693685.

Koebel, C. Theodore, Robert E. Lang, and Karen A. Danielsen. 2004. "Community Acceptance of Affordable Housing." 100.

Koster, Hans R. A., and Jos van Ommeren. 2019. "Place-Based Policies and the Housing Market." *The Review of Economics and Statistics* 101(3):400–414. doi: 10.1162/rest_a_00779.

Koster, Hans R. A., and Jos van Ommeren. 2022. "Neighbourhood Stigma and Place-Based Policies." 56.

Koster, Hans R. A., and Jan Rouwendal. 2017. "Historic Amenities and Housing Externalities: Evidence from the Netherlands." *The Economic Journal* 127(605):F396–420. doi: 10.1111/ecoj.12477.

Nguyen, Mai Thi. 2005. "Does Affordable Housing Detrimentally Affect Property Values? A Review of the Literature." *Journal of Planning Literature* 20(1):15–26. doi: 10.1177/0885412205277069.

Nguyen, Mai Thi, Victoria Basolo, and Abhishek Tiwari. 2013. "Opposition to Affordable Housing in the USA: Debate Framing and the Responses of Local Actors." *Housing, Theory and Society* 30(2):107–30. doi: 10.1080/14036096.2012.667833.

Rahpoo Sakht corporate. 2012. *Mehr Housing Evaluation_ministry of Road and Urban Developments, 1391*. Ministry of Road and Urban development.

Rios-Avila, F., Pedro H. C. Sant'Anna, and Brantly Callaway. n.d. "CSDID: Stata Module for the Estimation of Difference-in-Difference Models with Multiple Time Periods."

Rossi-Hansberg, Esteban, P. D. Sarte, and Emily G. Owens. 2010. "Housing Externalities." *Journal of Political Economy* 118(3):485–535.

Ruming, Kristian. 2014a. "'It Wasn't about Public Housing, It Was about the Way It Was Done': Challenging Planning Not People in Resisting the Nation Building Economic Stimulus Plan, Australia." *Journal of Housing and the Built Environment* 29(1):39–60. doi: 10.1007/s10901-013-9339-4.

Ruming, Kristian. 2014b. "Social Mix Discourse and Local Resistance to Social Housing: The Case of the Nation Building Economic Stimulus Plan, Australia: Urban Policy and Research: Vol 32, No 2." *Urban Policy and Research*.

Ruming, Kristian, Donna Houston, and Marco Amati. 2012. "Multiple Suburban Publics: Rethinking Community Opposition to Consolidation in Sydney." *Geographical Research* 50(4):421–35. doi: 10.1111/j.1745-5871.2012.00751.x.

Sarmiento, Carolina S., and J. Revel Sims. 2015. "Façades of Equitable Development: Santa Ana and the Affordable Housing Complex." *Journal of Planning Education and Research* 35(3):323–36. doi: 10.1177/0739456X15586629.

Scally, Corianne Payton, and J. Rosie Tighe. 2015. "Democracy in Action?: NIMBY as Impediment to Equitable Affordable Housing Siting." *Housing Studies* 30(5):749–69. doi: 10.1080/02673037.2015.1013093.

Schively, Carissa. 2007. "Sustainable Development as a Policy Guide: An Application to Affordable Housing in Island Communities." *Environment, Development and Sustainability* 10(6):769. doi: 10.1007/s10668-007-9084-5.

Schwartz, Amy Ellen, Ingrid Gould Ellen, Ioan Voicu, and Michael H. Schill. 2006. "The External Effects of Place-Based Subsidized Housing." *Regional Science and Urban Economics* 36(6):679–707. doi: 10.1016/j.regsciurbeco.2006.04.002.

Schwartz, Amy Ellen, Ioan Voicu, and Keren Mertens Horn. 2014. "Do Choice Schools Break the Link between Public Schools and Property Values? Evidence from House Prices in New York City." *Regional Science and Urban Economics* 49:1–10. doi: 10.1016/j.regsciurbeco.2014.08.002.

Searle, Glen, and Pierre Filion. 2011. "Planning Context and Urban Intensification Outcomes: Sydney versus Toronto." *Urban Studies* 48(7):1419–38. doi: 10.1177/0042098010375995.

Tighe, J. Rosie. 2010. "Public Opinion and Affordable Housing: A Review of the Literature." 17.

Voicu, Ioan, and Vicki Been. 2008. "The Effect of Community Gardens on Neighboring Property Values." *Real Estate Economics* 36(2):241–83. doi: 10.1111/j.1540-6229.2008.00213.x.

Woo, Ayoung, Kenneth Joh, and Shannon Van Zandt. 2016. "Unpacking the Impacts of the Low-Income Housing Tax Credit Program on Nearby Property Values." *Urban Studies* 53(12):2488–2510. doi: 10.1177/0042098015593448.

Zhang, Fan, Xiuyan Liu, and Songlin Li. 2022. "How Does Urban Renewal Affect Housing Price? Evidence from Beijing Shantytown Renewal Plan." *Applied Economics Letters* 29(12):1055–59. doi: 10.1080/13504851.2021.1907280.

Appendix A. Some Details of the Mehr Housing Project

Table A-1 Details of Mehr housing

City	Number of concentrated Units	Year of Starting Construction	Date of delivery (first unit)
Bandar Abbas	20,568	2008	Jan-13
Ilam	4,078	2008	Apr-12
Yazd	9,276	2009	Apr-12
Kermanshah	16,396	2010	Sep-12
Rasht	12,852	2009	Sep-13
Zanjan	10,637	2008	Nov-11
Sanandaj	10,079	2009	Nov-12
Qom	28,684	2009	Apr-12
Orumia	10,060	2010	Sep-12
Zahedan	7,640	2008	May-11
Kerman	16,396	2008	Oct-11
Hamedan	8,135	2009	Jan-12
Arak	2,457	2010	Oct-12
KhorramAbad	6,822	2011	Oct-13
Gorgan	4,566	2010	Mar-13
Bojnurd	9,600	2009	Apr-13
Birjand	13,020	2009	Mar-12
ShahrKord	7,247	2010	Nov-12
Semnan	11,089	2008	Mar-12
All 19 cities	209,602	-	-

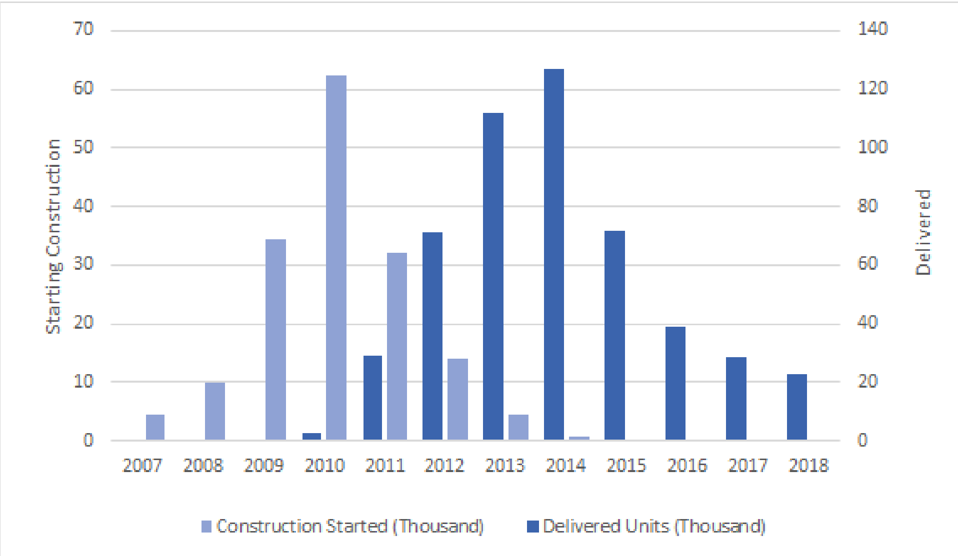

Figure A-1 Number of Mehr units started constructing and delivered in each year

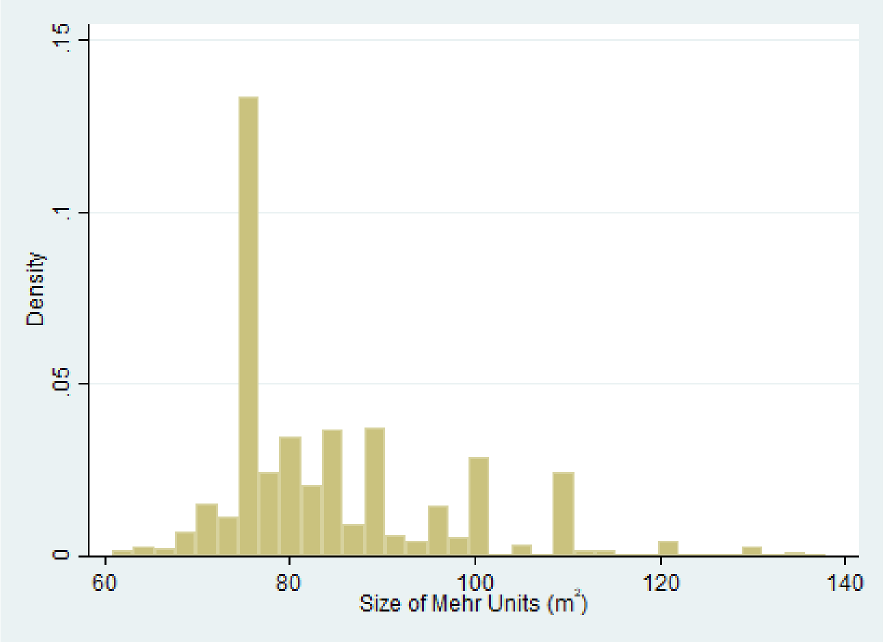

Figure A-2 Distribution of size of Mehr housing units

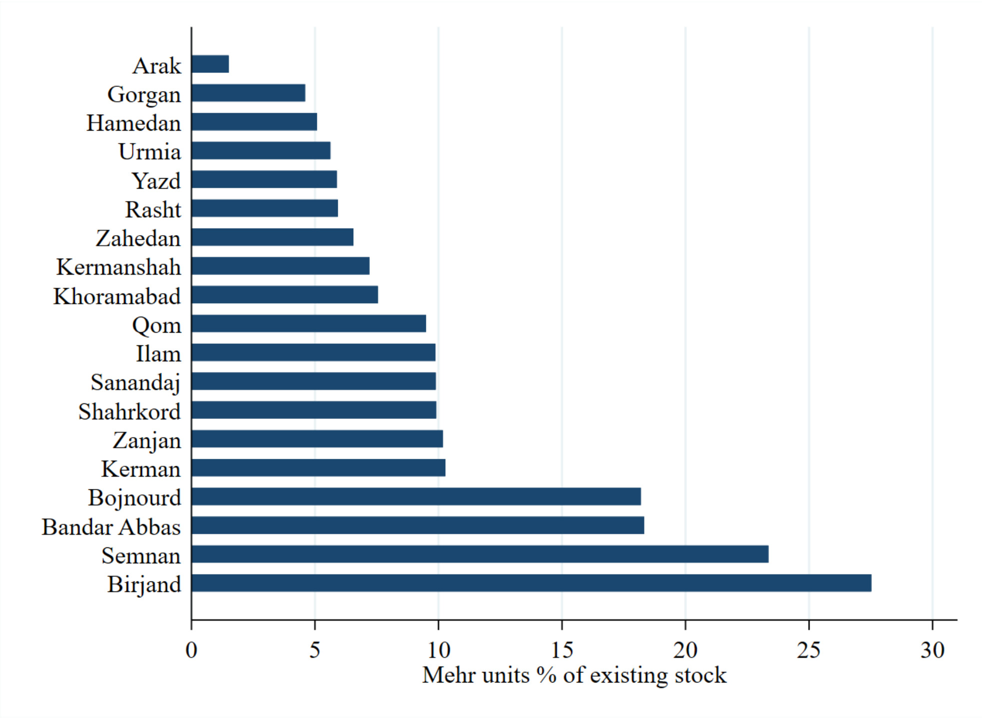

Figure A-3 Mehr units as a percentage of housing stock

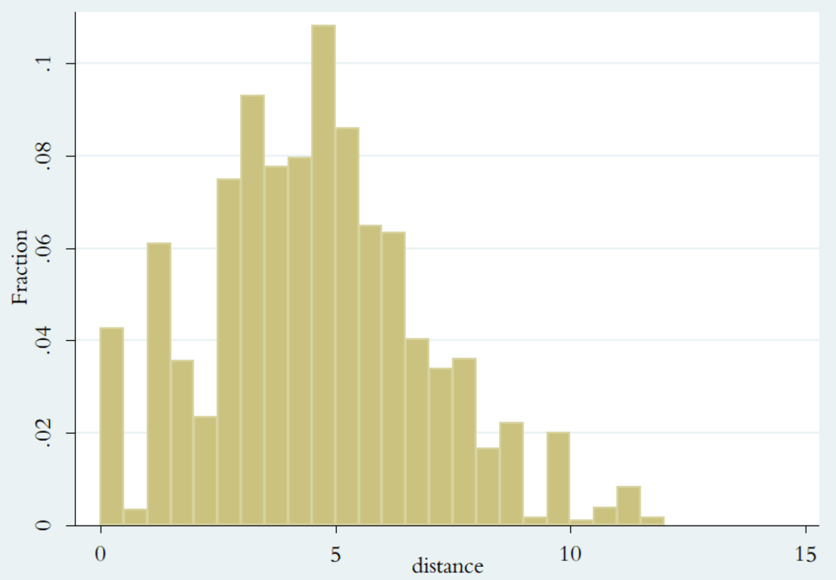

Figure A-4 Distribution of distance between transacted units and Mehr project location

Appendix B. Effect on different distance categories

To show how far the negative effect remained, we categorize distances between housing units and Mehr neighborhood in each city into 4 categories and show the effect of Mehr housing delivery for different distance categories. In Table B-1, Distance Quartile 1 to 4 are dummy variables that each of them equals one for transactions in that distance quartile after the first Mehr unit is delivered in that city and zero otherwise. It shows that there is no significant effect for other distance categories and the effect is local at the host neighborhood and about 9 percent negative.

Table B-1 Impact of Mehr Project on property values of different distance categories

Dep.Var.: $log(p_{ipt})$	Distance Effect
Mehr	-0.0874**
	(0.0428)
Distance Quartile 1	0.0144
	(0.0296)
Distance Quartile 2	0.0291
	(0.0279)
Distance Quartile 3	0.0169
	(0.0274)
Distance Quartile 4	0.0146
	(0.0286)
Neighborhood F.E.	Y
Month F.E.	Y
City×Year F.E.	N
City× Month F.E.	Y
Obs.	360,789
$\overline{R}^2$	0.421

Notes: Table B-1 shows coefficient estimates from regressions of logarithm of housing prices on Mehr which is a dummy variable that equals to one for transactions in Mehr neighborhoods after the first Mehr unit is delivered. In addition to the Mehr dummy, it includes 4 distance categories which are dummy variables that each of them equals one for transactions in that distance quartile after the first Mehr unit is delivered. Standard errors are clustered at the neighborhoods and reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1% level respectively.

Appendix C. Timing of the Effect and Heterogeneity of the Effect

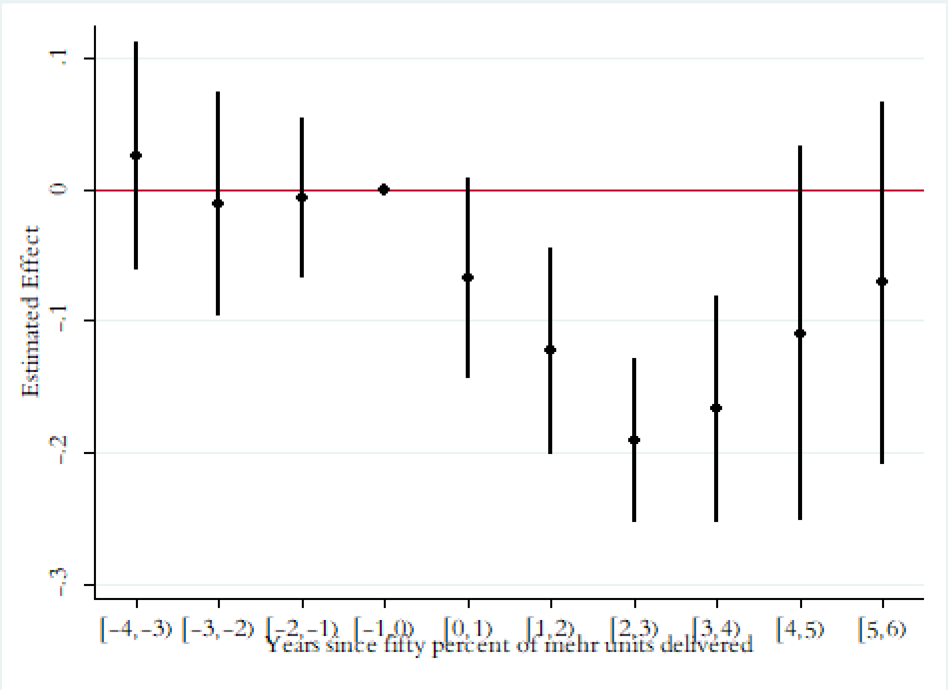

Figure C-1 Effect of Mehr housing delivery in different years after and before delivery of half of the units of the site

Notes: Our reference time is when half of Mehr housing units were delivered in each Mehr project site and the coefficients are for interaction of Mehr variable and number of years passed since the delivery of half of Mehr units.

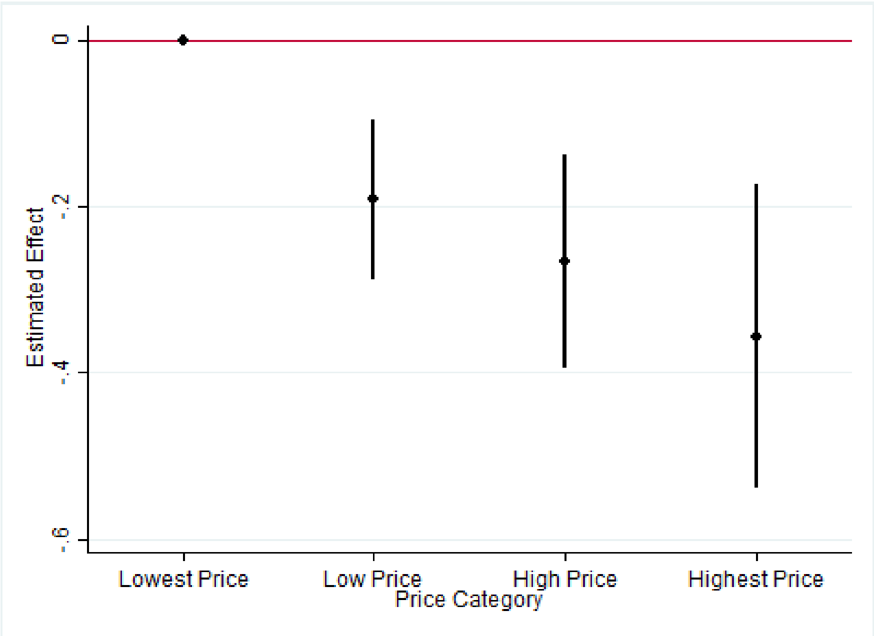

Figure C-2 Heterogeneous effect in different price categories

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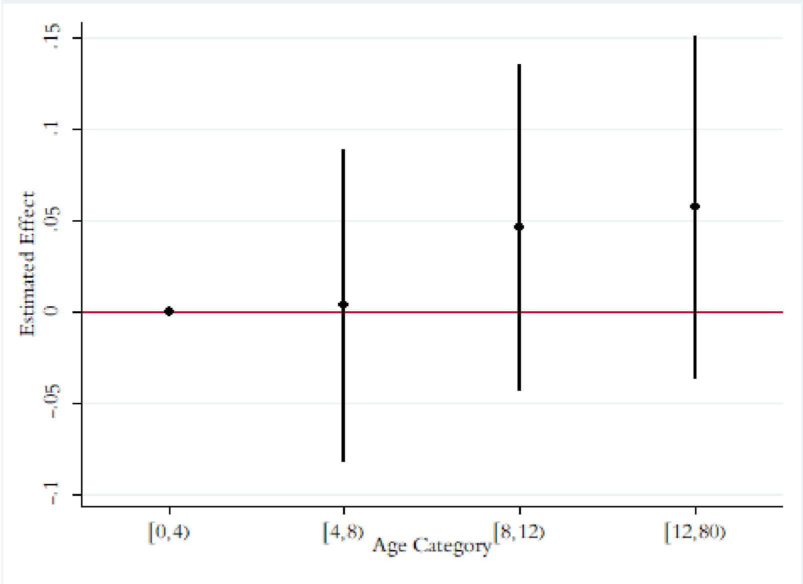

Figure C-3 Heterogeneous effect in different age categories

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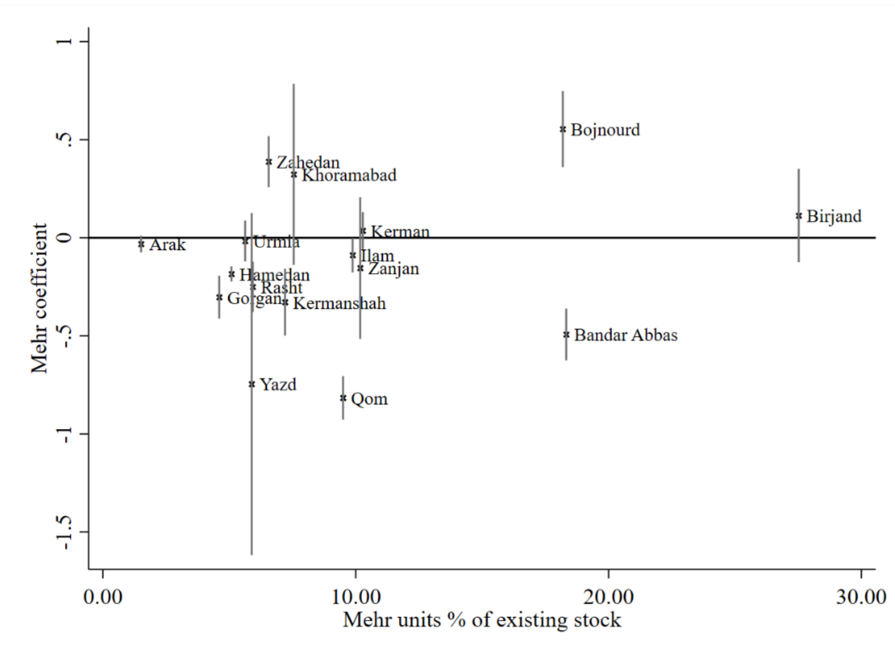

Figure C-4 Relationship between Mehr effect and size of Mehr projects in cities

Notes: Markers show coefficient estimate and grey lines show 95 percent confidence intervals for the coefficient from separate regressions of log housing price on Mehr dummy, neighborhood and month fixed effects in each city. The horizontal axis shows the number of Mehr units in a city as a fraction of existing housing.

Appendix D. Example of Mehr housing project

Rasht is one of our sample cities which is center of Gilan Province in Iran and ranked 11th in Iran's cities according to population with more than 700 thousand population in 2020. Figure D-1 shows map of Rasht and number of housing transactions in each neighborhood of Rasht between 2010 and 2020. As it is clear from the figure, Mehr housing site of Rasht (which can be seen in Figure D-2) is located in one of the peripheral neighborhoods in the south of Rasht. Neighboring properties in the same neighborhood are also clear in Figure D-2.

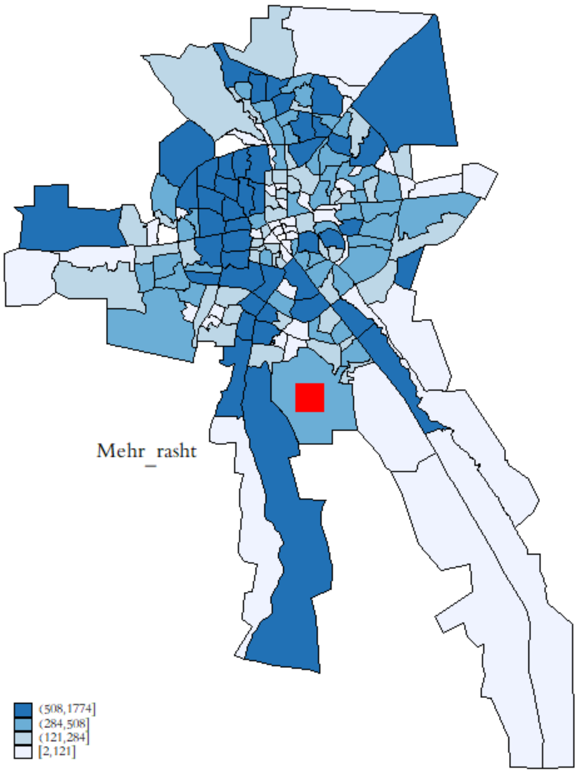

Figure D-1 Map of Rasht and location of Marh housing units (Red circle) in Rasht

Figure D-2 Picture of Mehr housing units of Rasht

Appendix E. More Evidence on effect of schools

Table E-1 shows the results of 3 additional regressions to further illuminate the role of schools. Here we change the explanatory variables. *Mehr Progress* is the percentage of Mehr units delivered in each Mehr neighborhood. *School Progress* is the percentage of school classes built in Mehr neighborhoods. Column (1) shows that when *Mehr Progress* goes from zero to one (full delivery of all planned units) the price of nearby houses declines by 17.2 percent. Column (2) confirms that building more schools reduces the negative effect. In the last column, we have tried to distinguish the effect of faster school building in another way. Thus, we added the logarithm of school progress divided by Mehr progress. We set this ratio to zero in other areas. It shows that as the construction rate of schools in treated neighborhoods decreases by 10 percent compared to Mehr residential units, the price of nearby property values decreases by around 0.5 percent. The latter can be interpreted as evidence of a pure dis-amenity effect due to shortage of schools.

Table E-1: More evidence on Impact of school availability on nearby property values

Dep.Var.: $log(p_{ipt})$	Mehr Progress	Mehr and School Progress	School progress relative to Mehr Progress
	(1)	(2)	(3)
$Mehr\ Progress_{it}$	-0.172***	-0.244***	
	(0.046)	(0.043)	
$Mehr_{it}$			-0.090**
			(0.036)
$Mehr\ Progress_{it} \times School\ Progress_{it}$		0.155*	
		(0.083)	
$Mehr_{it} \times \frac{School\ Progress_{it}}{Mehr\ Progress_{it}}$			0.052*
			(0.027)
Neighborhood Fixed Effect	Y		Y
City×Month Fixed Effect	Y		Y
Obs.	360,789	360,789	360,789
$\overline{R}^2$	0.421	0.421	0.421

Notes: Column (1) shows effect of percent of Mehr units delivered on nearby property values. Column (2) shows the same effect controlling for school progress in the neighborhood and in column (3) we use the logarithm of share of schools constructed divided by Mehr delivery progress in Mehr neighborhoods and zero in other areas. Standard errors are clustered at the neighborhoods and reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1% level respectively.