Local Employment Effects of Affordable Housing Construction:

Evidence from Iran

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Abstract

This paper estimates the causal impact of a large-scale public housing construction project, which is called *Mehr housing project* on employment at the district level. The program focused on building stimulus affordable housing projects for low-and middle- Income households, making it possible to use it as an exogenous shock on local employment. We used generalized difference-in-differences strategy to estimate the impact on local labor markets, comparing how employment evolved differentially in places with different levels of Mehr housing construction. Our results show that each affordable housing project, increase local employment in construction sector by 5 numbers and 230 hours per week. One of the reasons that the effect is smaller than one may expect, is that we show these public housing projects crowd-out private housing projects by 50 percent. However, when testing for general equilibrium effects on local employment, we find effects close to zero and even negative, with very wide confidence intervals across all specifications. Although Mehr project was an intervention significant enough to have a sizable impact on the construction sector in districts with low mobility, these findings suggest that the local variation in affordable housing construction was too small relative to baseline regional volatility to detect a "local multiplier" effect impacting jobs outside of construction. Furthermore, there is a transition from non-construction jobs to construction sector which lead to increase in employment in construction sector but without any real effect on local employment.

JEL classification codes: E24; E62; H54; J23; R23; R31; R38.

Keywords: Local labor market, Regional economics, Public housing construction; Employment; Crowd-out; Iran; Mehr housing project.

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1   Introduction

The Great Recession has sparked renewed interest in evaluating the effectiveness of fiscal policy in stimulating output and employment (for review, see (Chodorow-Reich 2019). Most of the literature focuses on the effects of composite fiscal spending on the economy, despite the fact that government spending is fundamentally heterogeneous (Cox et al. 2020). Furthermore, there is some evidence on the effectiveness of different types of policies in increasing output and employment (Buchheim and Watzinger, 2023; Garin, 2019).

In the wake of the recession, many policymakers advocated for spending on public infrastructure projects as a means of putting people back to work in distressed regions; not only might these projects improve or repair vital infrastructure, but the resulting need for laborers to do work at projects sites could also be a cost-effective way to create additional construction jobs that might in turn support other new jobs in the vicinity (Garin, 2019). Infrastructure construction could be considered as a locally targeted employment in both developed and developing countries. However, there is no evidence on the effectiveness in these policies in developing countries which could be completely different from developed countries because of government effectiveness, different labor market structures including labor market frictions and rigidities, higher unemployment rate and larger informal sector. One of these projects that governments in developing countries are increasingly being involved in, is creating affordable housing. While construction of affordable housing construction benefits targeted groups, it could increase employment both in construction sectors and other sectors which could encourage government in these countries more to construct affordable housing. That is the reason that Iran's government emphasize on the effects of public housing construction on employment when deciding to construct these projects.[4] However, it is not yet known whether building public housing will actually create jobs quickly and cost-effectively or whether they will crowd out private construction or attract employees from other sectors.

This paper evaluates the local labor-market impacts of *Mehr housing project*, which is a large-scale stimulus affordable housing construction project in Iran. In theory, the effects of local construction projects hinge on multiple factors. On one hand, it is possible that these construction projects pull local workers away from other jobs, like agricultural sector dampening the net employment effect. Moreover, projects in a specific locale might be constructed by workers based in other locales, reducing the effect on local employment. On the other hand, any additional construction work in a given locale might have a "local multiplier effect" (Moretti 2010): increased local spending by construction workers may have supported additional jobs in the broader economy. However, such an effect requires that workers spend additional income locally —if that spending goes to goods and services produced elsewhere, there may be "diffuse multiplier" effects that do not register in any one locality. (Garin 2019)

To measure the local labor-market impacts of affordable housing construction, this study provides causal estimates of the employment effects of a very large-scale affordable housing project in Iran, a sizeable country with an urban population of nearly 65 million out of a total population of nearly 85 million. We also single out the importance of crowd-out of private construction as a mechanism which leads to decrease in the effect of public housing construction on employment.

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[4] Iranian officials such as president, ministry of housing and ministry of labor, emphasized the importance of housing construction in employment in numerous speeches and interviews such as: news.mrud.ir/news/86260; https://dolat.ir/detail/394035; https://www.taadolnewspaper.ir/fa/tiny/news-206015

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 mentioning increase in employment as one of the goals of the project. Most of these units were built as concentrated multifamily buildings in the suburbs and outskirts of cities. It was estimated that this project costed about 150 billion dollars, about 33% of Iran's GDP (Rahpoo Sakht corporate, 2012).

The government emphasized on importance of housing construction as driving factor of employment in construction sector and other sectors especially anterior and posterior sectors. To measure the net effect of the Mehr housing construction on employment, we use Mehr housing permits and Private housing permits issuance date at city level which is aggregated at district level as start of construction, and we also use employment survey from 2005 until 2019 at district level, creating a panel data for districts from 2005 until 2019.

We use the exact number of Mehr projects and Private construction which are under construction in each district in each half of each year for identification and argue that after controlling for various fixed-effects, this timing is exogenous. Using panel data on permits at the district level, we estimate the causal dynamic effect of this program on employment in construction sector and total employment.

These features motivate a simple difference-in-differences design in which we study whether districts that more affordable housing has been constructed there, experienced more favorable employment in construction sector than those that less affordable housing has been constructed. The unique setup of the Mehr housing program enables us to address the challenge of stimulus investment programs being by construction endogenous to economic conditions. For example, governments may target regions that are hardest hit by the recession. The local scope for investments was closely linked to availability of government-owned land.

We first test for a "direct effect" of affordable housing construction on local construction employment. Figure 1 provides suggestive evidence on the effect of housing construction on employment. It seems that there is an upward trend in both construction employment and number of permits from 2005 to 2013 including Mehr project period but increase in construction employment is not as much as increase in permits especially Mehr permits. Another fact which can be seen from Figure 1, is that the construction of private housing has decreased at the same time as the construction of government housing has increased. Using district and province by year fixed effects to control for district time-invariant characteristics and province-specific flexible time trends, the results of our preferred specification show that each Mehr project lead to 4 more employees in construction sector in each quarter and 220 units increase in hours of employment in construction sector in each week. Furthermore, we show that each unit of affordable housing construction, decrease private housing construction by 0.5 unit. Therefore, when we control for private housing projects, the effect of affordable housing construction on local employment in construction sector increases.

However, we find no evidence of a "local multiplier" effect, in which employment expands beyond the direct increase in construction jobs and on the contrary we observed a shifting

from employment in other sectors to the construction sector which leads to the result that there is not any effect from affordable housing construction on total local employment.
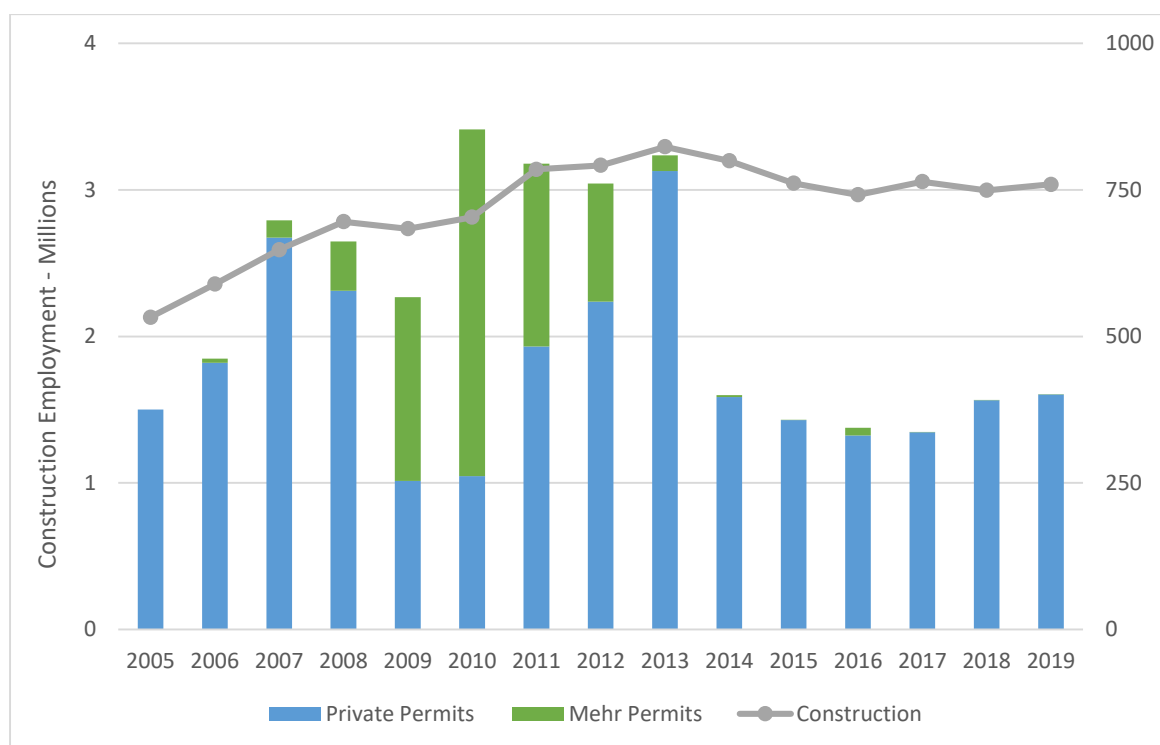

Figure 1 Construction permits and construction employment in Iran during 2005-2019

The contribution of the current paper is threefold. First, we believe we are the first to provide evidence on the effectiveness of infrastructure construction as a locally targeted employment policy in a developing country. Second, to the best of our knowledge, we are the first to provide evidence for the crowd-out effect of public housing on private housing for their effect on employment in a developing country. Third, we have shown that although the effect on construction sector is positive, there is no effect on total employment which means that using affordable housing construction for stimulating employment is a zero-sum game policy which does not have any effect on total employment.

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

This analysis of the local employment effects of stimulus housing construction contributes to three growing strands of the literature. First, it adds to a growing empirical macroeconomics literature that studies local economies as laboratories in order to estimate macroeconomic fiscal multipliers, exploiting cross-state or cross-county variation in government expenditures. Many of these studies, which are surveyed by (Chodorow-Reich 2019), directly estimate the effects of local spending on regional employment. Conceptually, this literature views local economies as miniature macroeconomies, in which

labor is immobile —at least in the short run —and employment gains reflect increases in labor force participation or declines in unemployment (Kline and Moretti 2014).

Second, this paper is related to studies in urban economics literature that explicitly aims to assess localized impacts of place-based policies and labor demand shocks. In contrast to the macroeconomics papers discussed above, this literature tends to adopt a medium- to long-run perspective, in which workers are mobile across regions in spatial equilibrium (Garin 2019).

There exist several cross-sectional studies of fiscal multipliers in the macroeconomics literature in developed countries and especially in US including several studies of the Recovery Act. State-level studies of Recovery Act spending instrumented by pre-recession policy obligations (Chodorow-Reich et al. 2012), cross-state highway spending and tax obligations (Conley and Dupor 2013; Wilson 2012), and county-level road construction (Garin; 2019) find employment effects that range from six job-years per million dollars to 40 job-years per million dollars. This corresponds to a cost per job of anywhere between $25,000 and $150,000.

Buchheim and Watzinger (2023) study the local employment effects of a national school infrastructure investment program in Germany using the number of schools as an instrument for investments and find a cost per job of about €24,000 which is a comparable effect on local employment.

Although there exist several studies on the effect of infrastructure construction on local employment in developed countries, there are very few studies trying to find this effect in developing countries. Ianchovichina et al. (2013) find that the Middle East needs to invest on average around 6% of its GDP annually to meet its infrastructure needs which could lead to direct job creation of about 2.5 million direct, indirect and induced infrastructure-related jobs but there is no paper trying to find the employment effect of these projects empirically in developing countries. The effect could be different in developing countries due to poor government effectiveness (see for example, Herrera and Pang (2005)), low government efficiency in designing policies, high rate of unemployment and lack of infrastructures in developing countries.[5]

Furthermore, there is very few studies finding the effect of stimulated housing construction on local employment. Wardrip, Williams, and Hague (2011) has reviewed the literature on effect of government housing construction on employment and shows that the initial development of affordable housing creates both immediate and long-term employment opportunities and spending in the local economy.

In the case of housing construction, the primary mechanism by which expenditures should affect local employment is clear: all local employment effects should stem from the first-order "direct effect" on construction-sector employment, which may in turn prompt a "local multiplier" effect on broader employment. It would be ex ante implausible to find a large employment effect with zero effect on the construction sector. While we do not detect a general equilibrium effect on employment, we do establish a clear "direct" effect on

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[5] There is a literature focusing on infrastructure provision in developing countries such as Bardhan and Mookherjee (2006) which mentions reasons for under provision of infrastructure in developing countries.

construction employment. The most closely related works are Garin (2019), which focuses on the effect of Recovery Act road spending on construction-sector employment in US and Buchheim and Watzinger (2023) which evaluates a national school infrastructure investment program in Germany focusing on improving the energy efficiency of school buildings.

Although the estimates presented below are directly comparable to many papers in this literature, the primary goal of this paper is to evaluate the effectiveness of housing construction spending as a spatially-targeted tool for increasing local employment. In that sense, this work is more conceptually similar to the body of urban economics papers that assess the impacts of place-based policies and localized labor demand shocks in spatial equilibrium. Both van Dijk (2016) and Moretti (2010) attempt to directly estimate the "local-employment multiplier" effects of new manufacturing jobs. Both papers find that an exogenously added manufacturing job in a county or metropolitan area results in one additional service-sector job in the same locale —a jobs multiplier of two —with larger effects if the exogenous job is in a high-skill sector. Garin (2019) finds no effect of stimulated road construction program in other sectors. These are in contrast to our findings, which show some evidence that new construction jobs "*decrease*" jobs outside of the construction sector because the multiplier effect is less than one and our results show that the construction project was less cost-effective in terms of creating jobs than previous studies.

One of the potential mechanisms explaining this difference is the difference between government efficiency in developing and developed countries. If the government choose projects that crowd-out private projects, the employment effect of the projects would be much smaller as one expects. There is a large literature showing that public housing projects will lead to decrease in private housing construction which would result in decrease in employment effect of the projects.

For this reason, the third strand of related literature are studies which are trying to test whether subsidized housing crowds out private construction. Several models predict that competing for tenants or resources, social housing is likely to displace some private projects reducing its impact on the housing stock and driving private investment away from the housing market (Chapelle; 2015). Eriksen and Rosenthal (2010) shows that the impact of social housing on the housing stock may be offset because the demand is not perfectly elastic and the supply not perfectly inelastic. Hence, the more inelastic the Demand or the more elastic the Supply, the more important the crowding out effect. Competition for inputs as capital or land or for similar tenants can be a source of displacement driving private investment away from the housing market.

Most of the empirical literature tests the hypothesis of public displacement of private construction, and they usually show that one additional unit of social housing does not increase by 1 unit the housing stock. The seminal contribution on this topic was made by Swan (1973). In this paper, the author estimated a system of supply and demand for housing starts on US data and emphasized the fact that competition for mortgage between subsidized and unsubsidized housing units led to an important crowding out effect such that for one subsidized unit 0.85 unsubsidized unit was not built.

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Murray (1983) proposed a structural approach in order to address the same question. Murray used Two Stage Least Squares to correct for the simultaneity bias. A distinction was made between conventionally financed subsidized units and government financed subsidized units. On the one hand, he found that conventionally financed subsidized housing units were totally offsetting private construction and thus didn't increase the housing stock. On the other hand, when it was government-financed, the crowding effect through Demand was less important and for one unit built, only 0.27 unsubsidized unit was not built. In 1999, Murray addressed the same issue but using the housing stock as dependent variable. Murray (1999) use US data from 1935 to 1987 and found that subsidized housing for low income households didn't crowd out unsubsidized one whereas the one for middle income households did.

More recent papers, closer to this one, adopted cross sectional approaches to answer a similar question. Malpezzi and Vandell (2002) studied the impact of the Low Income Housing Tax Credit (LIHTC) initiated in 1986. They use Ordinary Least Squares and Two Stage Least Squares regressing the total housing stock per 1000 inhabitants in each State on a set of control variables. The coefficient of the LIHTC stock per 1000 inhabitants should proxy the crowding out effect. However, they didn't find any significant result. Another paper by Sinai and Waldfogel (2005) used a cross section analysis and addressed the issue of the relevant market to observe the crowding out effect using data at the city level (census places) and at the Metropolitan Statistical Area Level in the US. They used OLS and 2SLS and found on average that three government units displace two units that would have been provided by the private market. This effect seemed to be smaller in more populous markets and when there were fewer social housing units per capita. Eriksen and Rosenthal (2010) used a cross sectional approach to assess the impact of subsidized units on unsubsidized starts. The authors estimated their models using 2SLS with population share of a zone in the subsidized area or with the votes for the party in power as instrument. They found that almost all LIHTC development is offset by crowd out resulting in a corresponding reduction in unsubsidized construction of rental housing units. Using an instrumental variable approach and a natural experiment, Chapelle (2015) identified the impact of non-profit subsidized housing on private construction in France. His results suggest that one additional subsidized unit tends to prevent between 0.8 and 2 private units from being built.

Despite these striking results, it is hard to infer any policy implication for developing countries from these studies because housing subsidies programs in developing countries such as Iran and in developed countries and especially US appear to be really different and so could be their impact. But we can expect that employment effect of subsidized housing construction could be different from other infrastructure programs of the government because of the crowd-out and it would be important to control for this effect when one wants to know the employment effect of stimulated housing construction projects.[6]

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[6] More broadly, our paper is related to a literature which examines the effect of public housing on employment of tenants. Olsen et al. (2005) indicate that each broad type of housing assistance in US between 1995 and 2002 has substantial negative effects on labor earnings. (Yelowitz 2001) shows that the public housing rules induce labor supply distortions and reduce labor force participation. Franklin (2020) shows that housing has a significant positive effect on household earned income in South Africa. This effect is driven by increased employment rates among female members of these households.

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 announced 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. One of the declared objectives of this project was to stimulate employment in construction and other related sectors, emphasizing the importance of construction sector in employment. This goal is still raised by the country's officials including president, minister of roads and urban development, and minister of labor for the necessity of facilitating construction of housing units.[7]

This plan, popularized as the Mehr housing project, planned targeted apartments suitable for low- and middle-income households. It facilitated construction of (mostly) concentrated multifamily buildings in the cities. The construction permits for Mehr units issued from 2007 until 2013 (mostly after 2009) and their delivery period was from 2011 until 2021 (mostly after 2013).[8] Timing of important events of Mehr project can be seen in Figure A-1 in Appendix A. Eligibility for the project was based on living in the registered city since at least 5 years before registration, not owning a property and a few other criteria.[9] Applicants were not sorted based on their income or the location of the projects. The reason is that the government could not observe people's income and distinguish between low- and middle-income households. In some cases, it did some additional checks to make sure applicants were not high-income households but could not make any other distinctions. The projects covered 1135 cities out of about 1200 cities across the country.[10] We collect data on the date of Mehr permits issuance in the cities all over the country.

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 and the government facilitates permit issuance for them both in terms of cost and administrative requirements. These subsidies stimulate developers to engage in the project and build housing units according to government plan.

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[7] news.mrud.ir/news/86260; https://dolat.ir/detail/394035; https://www.taadolnewspaper.ir/fa/tiny/news-206015

[8] The distribution of permits issuance dates is shown in .

[9] The other eligibility conditions were being married and no previous use of government housing facilities or land. Furthermore, about 4 percent of houses were given to very poor households covered by support organization like the State Welfare Organization of Iran.

[10] 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).

3.2 Data

We make use of several datasets from the Ministry of Roads & Urban Development and Iran Statistical Center. Our first dataset contains information regarding address, type, and scale of Mehr housing projects (Number of housing units in each project) in each city in each quarter of the year. We use the permit issuance date of the Mehr projects for each unit as our measure of starting date of construction. The annual trend of number of Mehr permit issuance can be seen in Figure 1. Before 2006 and after 2014, (almost) no Mehr permit was issued.

The second dataset is Private housing construction which includes both the number of projects and number of housing units which their construction is started in each half in each city from 2005 until 2019. The annual trend of this dataset can be seen in Figure 1.

The third dataset is labor force survey of Iran from 2005 until 2020. This survey is done quarterly with the sample of about 15 thousand individuals in each quarter to find unemployment rate, total employment, and employment in different sectors in different regions. The annual trend of total employment and employment in different sectors can be seen in Figure 2. To find the effect of construction on employment, we assume each housing construction project's effect on employment just exist in the half year that the permit is issued and in the robustness check, we assume 2 years as the duration of effect of construction projects on employment.[11]
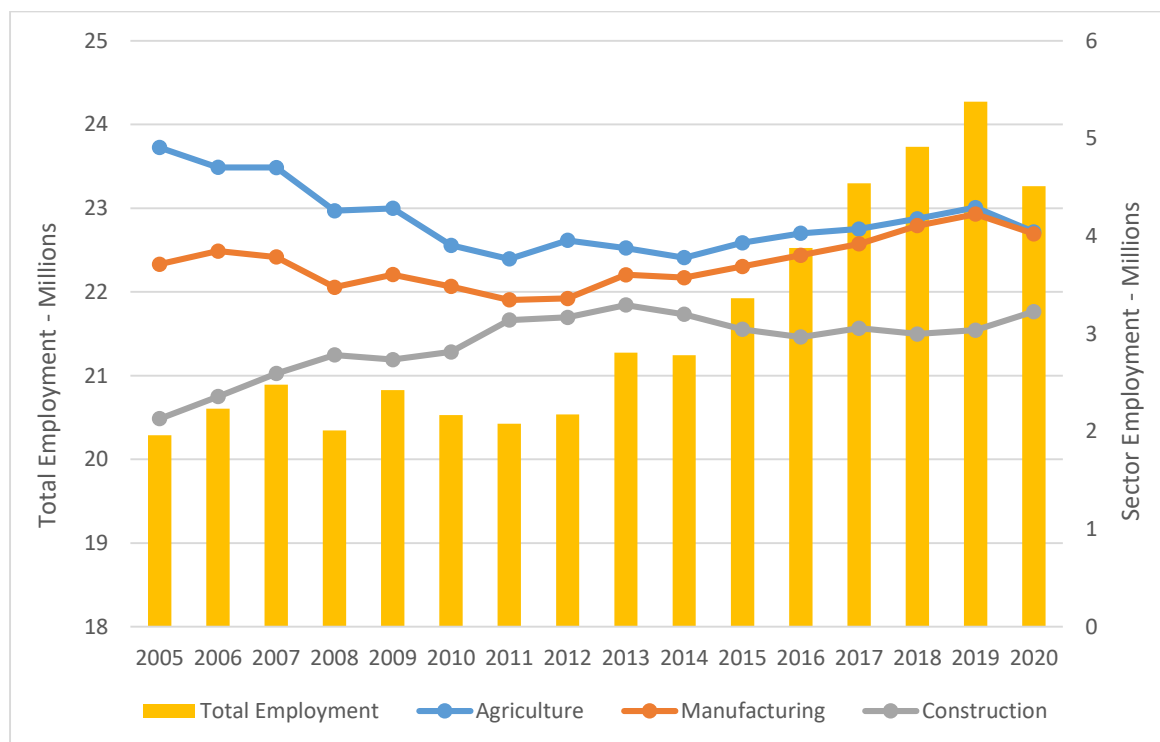
Figure 2 Annual Trend of Employment and employment in different sectors in 2005-2020

The summary statistics of the main variables are provided in Table 1. The number of observations is for 300 districts for each half of the years between 2005 until 2019. Panel A shows that on average 76 thousand individuals are employed which are doing about 3.3

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[11] The legal duration of private permits is on average 2 years which is an indication of the time required for the completion of construction.

million Hours of work each week. Of these numbers, about 11 thousand individuals with 442 thousand hours of work are employed in the construction sector. Panel B shows that on average 295 housing construction permits, which includes 901 housing units, were issued during the sample in the districts and 20 of these permits including 178 housing units were stimulated by Mehr project scheme. In Panel C, we assume each project to be effective for 2 years and we can see on average 1189 projects including 3695 housing units were active with this definition. Panel D shows that Mehr projects were on average 6 times larger than private projects leading to the fact that we should scale it down if we want to compare the effect of these projects on employment with private projects.

Table 1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A. Employment					
Total Employment (Number)	8,906	76082.4	182493.8	546.9	3030967.0
Total Employment ('000 Hours)	8,906	3328.0	8679.0	25.0	143000.0
Construction Employment (Number)	8,906	10848.5	20922.3	49.3	403982.6
Construction Employment ('000 Hours)	8,906	442.0	911.0	0.0	17000.0
Panel B. Permit issuance					
Total Project (issue)	8,906	295.2	666.0	0.0	18084.0
Mehr Project (issue)	8,906	20.6	78.6	0.0	2298.0
Total Unit (issue)	8,906	901.5	4088.1	0.0	153910.0
Mehr Unit (issue)	8,906	178.1	1120.5	0.0	55869.0
Panel C. Active Projects					
Total Project (active)	8,043	1189.1	2602.5	0.0	59900.0
Mehr Project (active)	8,043	90.9	278.4	0.0	5106.0
Total Unit (active)	8,043	3695.4	16260.8	0.0	453152.0
Mehr Unit (active)	8,043	788.0	3379.8	0.0	79188.0
Panel D. Project Scales					
Mehr Project Scale	6,917	12.3	29.3	1.0	288.0
Private Project Scale	8,906	1.9	0.9	1.0	6.9

Notes: Panel A shows total employment and employment in the construction sector. Panel B shows the number of permits issued, both private and Mehr. In Panel C we report the number of active projects and in Panel D we summarize the number of units in Mehr and private projects separately. We report number of observations, average, standard deviation, Minimum and maximum for each variable name in columns (1) to (5).

4 Empirical Strategy

4.1 Research design

We rely on a generalized difference-in-differences (DiD) strategy to estimate the impact of stimulus Mehr housing construction on local labor markets, comparing how employment evolved differentially in places with different levels of Mehr housing construction for the duration of the program (2009 to 2015) as well as four years prior to and after the program. To motivate why the difference-in-differences approach is necessary to identify the causal effect on local construction employment, consider the following two-period scenario: Total housing construction in district d is a combination of private (non-stimulus) housing construction $Pri_{d,t}$ and an additional public (stimulus) housing construction $Mehr_{d,t}$; thus, the total housing construction during Mehr construction period is $Pri_{d,post} + Mehr_{d,post}$. In the short run, the local transmission mechanism should stem from the construction sector: housing construction should have a "direct" partial-equilibrium effect on construction jobs and then (potentially) a "local multiplier" effect resulting from the addition construction jobs. Accordingly, we first test for "direct" effects on construction employment then subsequently examine potential multiplier effects.

We assume housing construction is produced by competitive firms using a Cobb-Douglas technology in which a share α_{pri} of spending goes to worker payroll in private housing construction (Garin 2019) and α_{Mehr} of construction spending goes to payroll in Mehr housing projects. There are several reasons for the difference between payroll share in private and Mehr housing construction. As discussed in Section 3, there is no land cost for Mehr housing units which lead to different share cost for labors. Furthermore, Mehr housing units are usually large-scale (12.3 against 1.9) and share of labor in large-scale project constructions could be different from small-scale projects.

Employers in outside districts may bid to work on these projects, and firms in d may be eligible to bid on outside projects. In particular, we assume a share ρ_{out} of local construction work done is employees of firms in *other* districts, while a share ρ_{in} of all *spending* outside of d is by construction employees at firms based inside d (Garin 2019).

Meanwhile, employment may be changing over time due to other time-varying factors $\delta_{d,t}$ including as productivity, labor supply effects, and downsizing in other industries. The construction employment in each district $E_{d,t}$ can be expressed as:

$$E_{d,t} = (1 - \rho^{out})\big(\alpha_{pri} \times Pri_{d,t} + \alpha_{Mehr} \times Mehr_{d,t}\big) \qquad (1)$$
$$+ \rho^{in}\big(\alpha_{pri} \times Pri_{-d,t} + \alpha_{Mehr} \times Mehr_{-d,t}\big) + \delta_{d,t}$$

This leads to:

$$E_{d,t} = \beta_{pri} \times Pri_{d,t} + \beta_{Mehr} \times Mehr_{d,t} + \epsilon_{d,t} \qquad (2)$$

Where $\epsilon_{d,t}$ reflects unobserved determinants of local construction employment which is equal to: $\rho^{in}\big(\alpha_{pri} \times Pri_{-d,t} + \alpha_{Mehr} \times Mehr_{-d,t}\big) + \delta_{d,t}$.

For β_{Mehr} to identify the causal effect of Mehr construction on employment, the allocation of projects must be as-good-as-random relative to latent employment drivers. This would be violated if spending were targeted to locations that had experienced adverse mean-reverting shocks, such that places with more housing construction would have experienced

higher rebound employment growth regardless. Since exact date of permits can be considered as random because of exogenous difference in timing of government-owned land and facilities allocation in different cities, we can assume allocation of projects to be as-good-as-random.

Since Mehr units were constructed in different times across cities, we include yearhalf, δ_t, and district, γ_d, fixed effects to allow for flexible time trends and time-invariant differences in employment across cities respectively. Standard errors are clustered at district level. To control for different time trend of employment in different provinces, we can also add province-by-year fixed effects, so the final specification is as follows:

$$E_{d,t} = \beta_{Mehr} \times Mehr_{d,t} + \beta_{pri} \times Pri_{d,t} + \delta_t + \gamma_d + \epsilon_{d,t} \qquad (3)$$

In specification (3), β_{Mehr} is the parameter of interest and measures the causal impact of Mehr housing construction on employment in construction sector, controlling for private housing construction. The identification assumption is that in the absence of Mehr projects, the employment in construction sector in different districts would have been the same assuming that the number of private housing constructions is constant.

4.2 Threats to identification

Equation (3) highlighted two primary threats to identification. First, the number of housing projects construction is probably correlated with (good) local economic conditions. We believe that the exact permit issuance date of Mehr units in each district is close to random as it is a function of many factors including the availability of government-owned land to start the project, and disbursement of loans. Furthermore, the main goal for this project was to control increasing house price in cities and not increase in employment which is another reason to believe that issuance date of permits is random with respect to employment in construction sector.

Second, employment in construction sector might have different trends across provinces. Correlations between province-specific trends and the timing of Mehr projects could bias DID estimates. Inclusion of province-by-year fixed effects would control flexible differential trends in employment across provinces. As a result, our estimates solely rely on the differential evolution of employment across different districts within a province. It is worth noting that this specification rules out all other province-wide effects such as different economic or housing cycles and global employment effects.

4.3 Crowd-out

Although public housing construction could be assumed to be random, private construction is probably correlated with (good) local economic conditions and also there could be a causal relationship between Mehr housing construction and private housing construction making $Pri_{d,t}$ a bad control. This means that the level of local stimulus spending $Mehr_{d,t}$ may not be orthogonal to private housing construction $Pri_{d,t}$ if stimulus funds crowd out private housing projects as in as in Chapelle (2015), Eriksen and Rosenthal (2010), Murray (1983, 1999), Sinai and Waldfogel (2005).

Arguably,

$$Const_{dt} = \delta_t + \gamma_d + \psi Mehr_{dt} + \alpha_{pt} + \epsilon_{dt}. \tag{4}$$

ψ capture the effect of Mehr construction on total housing construction in the city. If there exist crowd-out effect of Mehr housing on private housing, ψ would be less than one.

This means that changes in private construction may be both an outcome and control variable. A slightly different issue was considered in Garin (2019). He mentioned the possibility federal government spending would crowd out local government spending. If that was the case, then the federal program might not actually increase total government spending at all. Because of data shortcomings, Garin (2019) did not directly test for local crowd-out effects but showed that it could not bias the results by some robustness checks.

In our context, crowd-out of private spending by total government spending is a real effect of government spending on the private economy, and not a challenge to identification in itself but we should consider this crowd-out when interpreting the results.

However, to do more robustness checks about this issue, we control for trends in past private construction and use two lags of private construction instead of private construction in the same half-year as a robustness check. We can argue that this lagged variable could not be an outcome variable. Then we compare the results of different specifications including: 1) not controlling for private construction; 2) controlling for past private construction ($Pri_{d,t-1}$); 3) controlling for current private construction ($Pri_{d,t}$); then we discuss how and why the coefficient on public construction changes to find whether this may be driven by crowding out or rather whether there is an endogeneity problem or both.

In another robustness check, we use a sample of districts which there is very little crowd-out effect of Mehr housing construction on private housing construction because of the geography and characteristics of the district or any other reasons. In this way, controlling for private housing construction would be neutral control, possibly good for precision (Cinelli, Forney, and Pearl 2022).

Furthermore, to obtain an estimate of the downstream effect of each additional housing unit built (on net) on employment rather than a multiplier effect of the public units built, we use public units as an instrument for total units.[12]

4.4 Overall employment effect of the program

To improve the empirical strategy, we assess both the dynamic employment response and the overall employment effect of the program. In general equilibrium, the baseline impact on construction employment might in turn cause spillover effects on employment outside the construction sector or crowd-out employment in other sectors because of transition between employment in different sectors.

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[12] Another idea is to use an instrument for public housing construction which is not correlated with private housing construction so we can treat private construction purely as an outcome. In this case, we could also control for trends in past private construction as a robustness check. We believe current share of government-owned land in a district could be a good instrument variable for current Mehr housing construction which is not correlated with current private housing construction. Another idea is to use real number of permits in each half year in each province and predict number of permits in each district of that province by using the share of government-owned land in a specific year in those districts. (We should try to find these variables or another instrument if possible!)

First, the initial increase in employment may have a "local multiplier effect" if the added construction employment and income support further jobs in the *same* locality. If, however, that income is spent on goods and services produced in dispersed locations, there may be "diffuse multiplier" effects. The ratio of the total employment effect to the construction employment effect is conceptually equivalent to the local multiplier estimated in (Moretti 2010).

Second, if local labor supply is sufficiently inelastic, then additional construction jobs may crowd out other employment and cause non-construction employment to decline as workers move across sectors. In this scenario, then, the "local employment multiplier" could be less than one. We estimate equation (3) with total employment as dependent variable to understand the effect of Mehr housing construction on total employment and find out whether the "local employment multiplier" is less than or greater than one.

5   Results

5.1   Main Results

First, we examine effects of total housing construction on employment in construction sector in Table 2. In columns (1) to (4), we are using number of housing *projects (permits)* which their construction started in the half of that year as an explanatory variable. In columns (5) to (8), we use number of housing *units*. Columns (1) and (3) show that each housing project (which includes on average 2.2 housing units) which its construction started in each halfyear or previous one, increase number of employment in construction sector in that halfyear by 1.17 numbers and 56 hours per week. After controlling for province-by-year fixed-effects, the effect increase to 1.19 numbers and 61 hours per week. When looking at the effect of number of housing units on employment, number of employment in housing construction sector increases by 0.3 and hours of employment in each week in construction sector increase by 16.3 which is robust to controlling for province-by-year fixed effect.

Table 2 Effect of total housing construction on employment

Dep. Var:	Employment in Construction Sector							
	Numbers		Hours		Numbers		Hours	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of Projects	1.168***	1.189***	56.54***	61.63***				
	(0.311)	(0.257)	(20.74)	(16.62)				
Number of Units					0.300*	0.291*	16.23*	16.36*
					(0.153)	(0.152)	(8.965)	(8.706)
Observations	8,636	8,636	8,636	8,636	8,636	8,636	8,636	8,636
Adjusted R-squared	0.827	0.834	0.788	0.798	0.827	0.834	0.787	0.797
Province by year FE	N	Y	N	Y	N	Y	N	Y

Time and district fixed effects are controlled in all columns. Robust standard errors in parentheses clustered at district level, *** p<0.01, ** p<0.05, * p<0.1

Using logarithm of variables instead of linear regression in Table B-1 in Appendix B, shows that one percent increase in housing project construction, lead to 0,05 percent increase in numbers and 0.08 percent increase in hours of employment in construction sector. Using housing units instead of projects, decrease the effect to 0.03 percent increase in numbers and 0.05 percent increase in hours of employment in construction sector. Since, using the numbers is more common in the literature, we will just report linear effect of housing projects in following tables. In this way, interpreting the results and analyzing the cost-effectiveness of the projects would be easier.

Number of housing projects in each period consists of both public (*Mehr*) and private housing construction projects. Since only the public part is exogenous in our context, we should disentangle public and private housing construction in Table 3 to solve endogeneity problem. Panel A shows the results without province-by-year fixed effects. Column (1) shows Mehr housing projects increase employment in construction sector by 4.2 numbers and 195.3 hours in week. Adding province-by-year, increase these effects to 4.9 numbers and 230 hours per week.

Controlling for private housing construction in columns (3) and (4), increases the effect of Mehr housing construction on employment in construction sector by about 15 percent (4.8 numbers relative to 4.2 numbers and 221 relative to 195 hours). One of the reasons explaining this increase, is the crowd-out effect of Mehr housing on private housing construction which is estimated in Table 4. This sort of crowd-out which decrease private housing construction and thus decrease employment in construction sector, is a real effect of government construction on the private economy and employment. The reason that the effect of Meh housing is much larger than private housing construction is the difference between the scale of these projects which was documented in Panel D of Table 1. We scale number of Mehr projects by the difference between Mehr project scale and private project scales in each district to compare their effect better. The results can be seen in columns (5) and (6) of Table 3. These columns show that scaled Mehr housing projects increase employment in construction sector by 0.5 number and 35 hours which is relatively smaller than 0.9 number and 46.2 hours which is the effect of private housing construction. This difference remains after controlling for province-by-year fixed effects in Panel B of Table 3.

Table 3 Effect of Mehr and private housing construction on employment in construction sector

Dep.Var:	Mehr Projects		Private Projects and Mehr Projects without Scale		Private Projects and Mehr Projects weighted by their Scale	
	Numbers	Hours	Numbers	Hours	Numbers	Hours
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Without Prov by Year FE						
Number of Mehr Projects	4.277**	195.3**	4.820**	221.6**		
	(1.912)	(85.87)	(1.897)	(86.34)		
Number of Private projects			1.066***	51.66***	0.931***	46.19***
			(0.266)	(17.62)	(0.246)	(14.74)
					0.510	35.23

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	(1)	(2)	(3)	(4)	(5)	(6)
Scaled Number of Mehr Projects					(0.469)	(22.01)
Observations	8,636	8,636	8,636	8,636	8,636	8,636
Adjusted R-squared	0.827	0.788	0.828	0.789	0.827	0.788
Panel B. With Prov by Year FE						
Number of Mehr Projects	4.913***	229.8***	5.439***	257.3***		
	(1.775)	(79.38)	(1.751)	(79.52)		
Number of Private projects			1.073***	56.05***	0.933***	50.15***
			(0.230)	(13.40)	(0.252)	(11.56)
Scaled Number of Mehr Projects					0.615	41.48**
					(0.419)	(19.49)
Observations	8,636	8,636	8,636	8,636	8,636	8,636
Adjusted R-squared	0.835	0.798	0.835	0.799	0.834	0.798

Time, district, and Province by Year fixed effects are controlled in all columns. Robust standard errors in parentheses clustered at district level

5.2 Crowd-out effect

One of the reasons which may decrease the effect of Mehr projects on employment in construction sector is crowd-out of Mehr housing units on private housing construction. Table 4 shows the effect of Mehr housing construction on total housing construction. If there were no crowd-out effect, we expect the effect to be 1. Column 1 shows that each unit of Mehr housing construction, lead to 0.54 unit increase in housing construction which means that the crowd-out effect of one additional Mehr housing unit is about 0.46 private housing unit. Controlling for province-by-year effect decrease the effect a bit to 0.52. Looking at housing projects in column (3) and (4) shows that an additional Mehr housing roject result in 0.58 increase in total housing construction and therefore private construction projects decrease about 0.42 because of this crowd-out. This crowd-out effect is one of the reasons that the effect of Mehr housing construction is larger in columns (3) and (4) of Table 3 than columns (1) and (2) of that table.

Table 4 Crowd-out effect of Mehr housing construction on total housing construction

Dep. Var:	Total Units		Total Projects	
	(1)	(2)	(3)	(4)
Mehr Units	0.542**	0.528***		
	(0.216)	(0.195)		
Mehr Projects			0.583***	0.580***
			(0.112)	(0.102)
Observations	8,920	8,920	8,920	8,920
Adjusted R-squared	0.787	0.798	0.763	0.777

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Prov-Time FE		N	Y	N	Y

5.3 Robustness Regressions

In previous tables, we assume the effect of housing project construction on employment in construction sector is on the halfyear of construction. This assumption could be relaxed since most of the projects usually last for about more than one year. Since we do not have the date of ending construction for most of our sample, we assume that projects will be active for 2 years which means that they could have effect on employment in construction sector until 2 years after permit issuance instead of assuming that the effect occur just in the same halfyear of permit issuance. The reason that we are using 2 years as duration of project construction is that legally (almost) all of the projects construction can last for 2 years and they can extend the permit for one more year with paying penalty.

Table 5 shows the result for the effect of active projects on employment in construction sector. Columns (1) and (5) shows that each active projects increase employment in construction sector by 0.31 number and 19 hours per week, which is a combination of the effect of Mehr housing and private housing. When we separate the effects, we can see in columns (2) and (6), that the effect of Mehr housing construction on employment in construction sector is larger, which is about 1.73 numbers and 93 hours per week. If we control number of active projects, columns (3) and (7) show the effect of Mehr housing construction on employment in construction sector increases to 1.83 numbers and 98 hours because of the crowd-out explained in previous section. If we rescale Mehr projects to the same scale as private housing construction by multiplying number of active Mehr projects with their average scale in each city, according to columns (4) and (8), we can conclude that the effect of (scaled) Mehr units is almost the same as the effect of private housing unit on employment in construction sector.

Table 5 Robustness check 1: Effect of Active Mehr and private housing construction on employment in construction sector

Dep. Var:	Number of Employed in Construction Sector				Hours of Employment in Construction Sector			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of Active Projects	0.312**				18.98**			
	(0.132)				(8.381)			
Number of Active Mehr Projects		1.728***	1.831***			92.84***	97.95***	
		(0.527)	(0.548)			(24.00)	(25.54)	
Number of Active Private Projects			0.244**	0.189**			15.51**	12.95**
			(0.100)	(0.0911)			(6.413)	(5.341)
Scaled Number of Active Mehr Projects				0.178				16.59**
				(0.134)				(7.810)
Observations	7,800	7,800	7,739	7,739	7,800	7,800	7,739	7,739
Adjusted R-squared	0.843	0.844	0.844	0.843	0.805	0.806	0.807	0.805

Time, district, and Province by Year fixed effects are controlled in all columns. Robust standard errors in parentheses clustered at district level, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

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Because of the differences between metropolis and ordinary districts, we did not use the data of 8 mostly populated districts which their population is more than 1 million people in previous tables. The reason that we did this is that the employment and construction sector in these districts differ significantly and usually there were very few Mehr housing constructed in these district because of the lack of government-owned land and congestion in these districts. Table 6 shows that although the effects are in the same order of magnitude as our previous results, they are less statistically significant and robust. Mehr housing construction lead to 3.6 umbers and 121 hours per week increase in employment in construction sector. This effect increases a little because of crowd-out to 3.6 numbers and 164 hours per week. After controlling for private housing construction and scaling Mehr projects, we can see that Mehr housing construction increase number of employment by 0.63 and hours of employment by 34.

Table 6 Robustness check 2: adding Mega cities to find the effect of Mehr housing construction on construction in employment sector

Dep. Var:	Number of Employed in Construction Sector				Hours of Employment in Construction Sector			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of Total Projects	0.310				126.0***			
	(0.769)				(28.72)			
Number of Mehr Projects		3.586	3.663			121.4	164.3*	
		(2.735)	(2.770)			(91.75)	(93.45)	
Number of Private Projects			0.228	0.251			125.2***	126.3***
			(0.761)	(0.771)			(29.34)	(30.10)
Scaled Number of Mehr Projects				0.630				34.52
				(0.603)				(21.80)
Observations	8,906	8,906	8,906	8,906	8,906	8,906	8,906	8,906
Adjusted R-squared	0.917	0.917	0.917	0.915	0.915	0.913	0.915	0.914

Time, district, and Province by Year fixed effects are controlled in all columns. Robust standard errors in parentheses clustered at district level, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

5.4 Interpretation, Mechanisms and Heterogeneity of Mehr employment effect

To find the mechanism of the effect, we estimate the effect of housing construction on total local employment. Results in Table 7 shows that there is no statistically significant effect of housing construction (total, public, and private) on total employment and if any, the sign of the effects are all negative. This means that the effect of Mehr and total housing construction on total local employment could not be positive which is due to the transfer of people from other jobs to construction sector temporarily.

Table 7 Effect of Mehr, private and total housing construction on local total employment

Dep. Var:	Number of Employed in All Sectors				Hours of Employment in All Sectors			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of Total Projects	-1.140				-11.22			
	(1.059)				(47.33)			
Number of Mehr Projects		-3.544	-4.050			-153.4	-157.2	
		(4.531)	(4.426)			(222.9)	(220.9)	
Number of Private Projects			-1.034	-1.102			-7.865	-8.188
			(1.065)	(1.094)			(48.86)	(49.82)
Scaled Number of Mehr Projects				-3.487**				-94.43
				(1.512)				(86.03)
Observations	8,636	8,636	8,636	8,636	8,636	8,636	8,636	8,636
Adjusted R-squared	0.939	0.939	0.939	0.939	0.923	0.923	0.923	0.923

Time, district, and Province by Year fixed effects are controlled in all columns. Robust standard errors in parentheses clustered at district level, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

We add both number and units of housing construction in both public and private projects in Table B-2. This table shows that number of Mehr projects have positive effect on employment in construction sector but for any additional unit, the effect will decline. If we look at private projects, the effect for both private projects and units are positive but

6   Conclusion

Since the onset of the Great Recession, the effectiveness of fiscal policy in boosting production and employment has received renewed attention from academic economists and policymakers alike especially. Since there are some studies focusing on new theoretical and empirical evidence in developed countries, there is no study trying to find evidence regarding which particular types of policies are successful in increasing output and jobs in developing countries. Furthermore, there is not any study regarding the effect of housing construction on local employment. The contribution of this paper is to show this effect using a very large-scale affordable housing construction project in Iran as a developing country.

This paper examines idiosyncratic cross-district differences in affordable housing construction to test whether greater levels of housing construction boosted employment in local labor markets. Our results show that each additional affordable housing project, increase local employment in construction sector by 5 in numbers and 230 hours in each week. When controlling for private housing construction, the effect increases by about 15 percent which is because of crowd-out of private housing construction as a result of affordable housing construction. We show that each additional affordable housing construction, increase total housing stock by just about 0.5 which clearly shows that there is a crowd-out between public and private housing construction. It had been shown also in previous studies that social housing might have displaced between private units (Chapelle 2015; Eriksen and Rosenthal 2010; Murray 1999; Sinai and Waldfogel 2005).

 We do not, however, find any effect on aggregate employment, meaning that there is a transition between different jobs and on average no new jobs had been created because of the stimulus housing construction project.

Our results suggest that spending on affordable housing construction projects is an inefficiently expensive way to create jobs especially in developing countries. One of the reasons could be the crowd-out effect of affordable housing on private housing construction which will decrease the employment effect of public housing construction.

Ultimately, the primary objective of the affordable housing construction program is not to promote employment, but rather to build housing units in a cost-effective manner —which is often achieved by reducing labor requirements. The private firms that engage in these sort of projects are typically capital-intensive, relying heavily on expensive, specialized machinery. As a result, number of employees could be less than small-scale projects. Our results are consistent with this fact and highlights an important tension in policy design: job creation and low-cost construction are often competing objectives. If the primary goal were to stimulate labor markets, developers should use less capital-intensive technologies —but it would likely not be a cost-effective way to support large-scale affordable housing construction.

In light of the available evidence, it seems reasonable to conclude that the primary benefits that communities receive from affordable housing projects stem from the value of the housing itself. The goal of policymakers should therefore be to channel funds toward projects with better qualities which are better places for residents to live. It is possible that improved living condition and having a house to live supports robust local employment growth in the much longer run as in Franklin (2020).

Given that job creation is a fundamental policy objective especially in developing countries, it is important for policymakers to know which of their tools are most suitable for achieving it. By evaluating the effectiveness of one specific policy— namely, affordable housing construction—this paper takes a first step toward answering this question in developing countries. Further research is needed to inform policymakers about the employment effects of other policy tools at their disposal.

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Appendix A.   Some Details of the Mehr Housing Project

Mehr Project Timeline

- Most of units delivered — 2018
- Accelerating costruction of schools
- Half of units delivered — 2014
- End of issuance of permits/ End of the government's term of office
- Delivery of first Mehr units (few cases) — 2012
- Half of the permits issued
- New Housing minister/ Accelerating permit issuance and construction — 2010
- Introduce and facilitate new and more common type of Mehr housing (tripartite agreements)
- The monetary base increased by Central Bank to facilitate the project — 2008
- Enacting the law for Mehr housing project, Some permits issued (cooperative type)
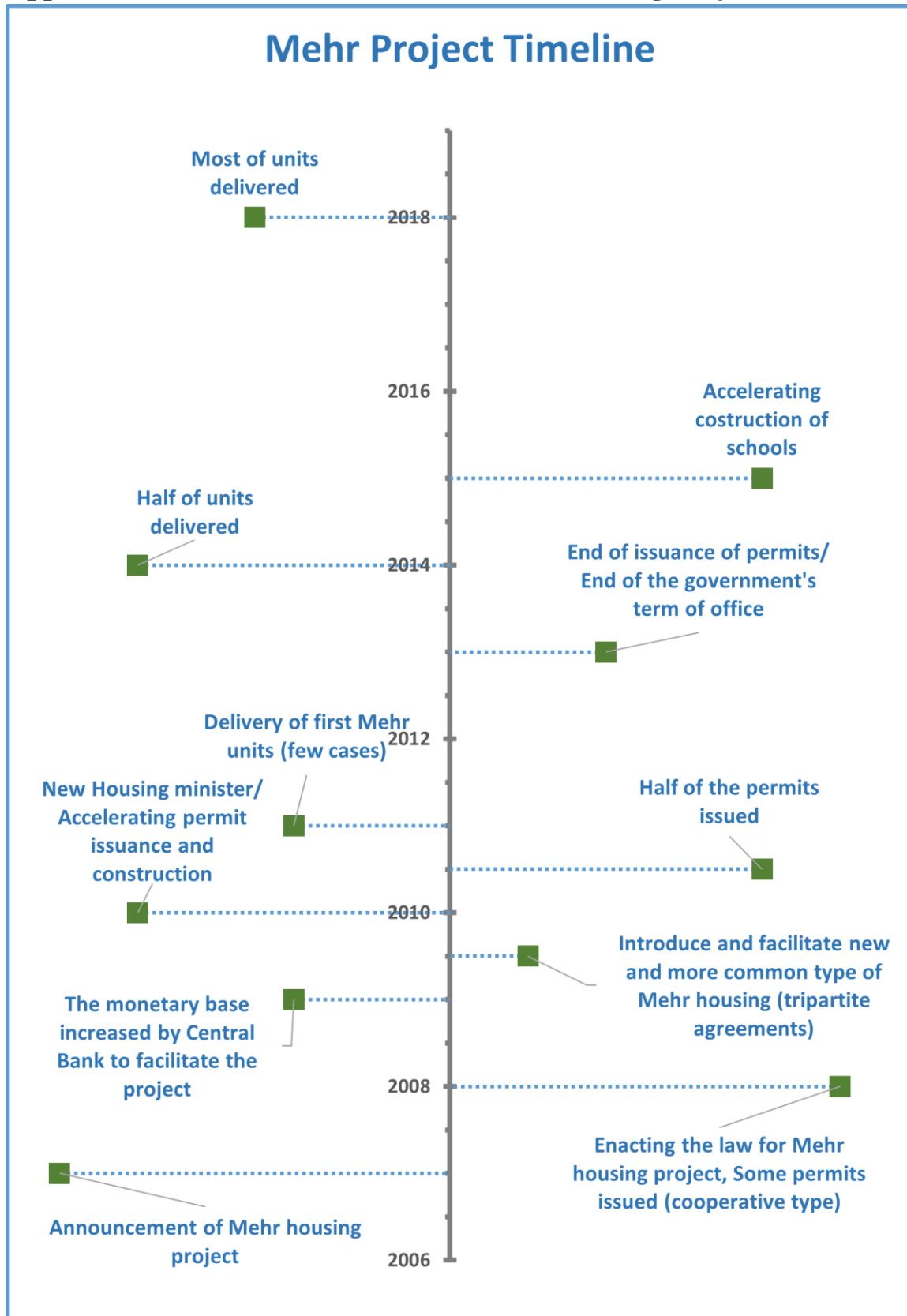- Announcement of Mehr housing project — 2006

Figure A-1 Timing of important events of Mehr project

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Appendix B.   Other Results and robustness

Table B-1 Effect of logarithm of housing construction on logarithm of employment in construction sector

Dep. Var:	Numbers		Hours		Numbers		Hours	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (Number of Projects)	0.0545***	0.0526***	0.0844***	0.0875***				
	(0.0167)	(0.0172)	(0.0279)	(0.0310)				
Log (Number of Units)					0.0299**	0.0284**	0.0485**	0.0518**
					(0.0127)	(0.0128)	(0.0217)	(0.0243)
Observations	8,636	8,636	8,636	8,636	8,636	8,636	8,636	8,636
Adjusted R-squared	0.798	0.804	0.714	0.721	0.797	0.804	0.713	0.720
Province by year FE	N	Y	N	Y	N	Y	N	Y

Time and district fixed effects are controlled in all columns. Robust standard errors in parentheses clustered at district level, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table B-2 Measuring the effect of both housing units and housing projects simultaneously

Dep. Var:	Number of Employed		Hours of Employment	
	(1)	(2)	(3)	(4)
Number of Mehr Projects	5.710***	6.453***	254.8***	292.7***
	(1.947)	(1.820)	(86.98)	(80.78)
Number of Private Projects	0.769*	0.853**	32.85	39.70*
	(0.405)	(0.369)	(25.09)	(20.93)
Number of Mehr Units	-0.197**	-0.210***	-7.421*	-7.392**
	(0.0762)	(0.0758)	(3.809)	(3.599)
Number of Private Units	0.202	0.158	12.91	11.60
	(0.262)	(0.238)	(16.76)	(14.97)
Observations	8,636	8,636	8,636	8,636
Adjusted R-squared	0.828	0.836	0.789	0.799
Province by year FE	N	Y	N	Y