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AZERBAIJAN HOUSING MARKET AT THE HARMONY OF BLINDER-OAXACA DECOMPOSITION AND MECHANISM DESIGN

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ABSTRACT

Being argumentative in nature and referring to Oaxaca Decomposition for the purpose of defining the main drivers of rental flats and houses, be new, old, repaired, or unrepaired, together with applying difference in difference method to evaluate the effectiveness of policy, this paper calls into the ques-tion of how to inaugurate a country-specific two-sided matching algorithm for rental house allocation based on the empirical results. Model 3 is built on time series data to evaluate the policy implementation by Azerbaijani government to provide households with financial aid. Based on Blinder-Oaxaca Decomposition, the main findings of the study manifest that for the repaired and unrepaired houses, the price discrimination is mainly explained by the room number while this is area of the houses per meter square that explains the price gap between old and new flats. The Difference in Difference model signifies that the increase in the amount of mortgage loans from 50.000AZN to 150.000AZN declined demand more than increase in supply. Additionally, study offers 2 Matching Algorithm and Mechanism Design for the allocation of rental houses with existing tenants and newcomers in addition to tenants and owners without initial endowments through YRMH-IGYT in two-sided matching markets.

Keywords: Houses; Apartments; Discrimination; Two-sided Matching Markets; Rental Housing; Blinder-Oaxaca Decomposition; Repaired houses; Unrepaired houses; Old flats; New apartments; Price gap

INTRODUCTION

Azerbaijan which is one of the post-Soviet Union countries experienced underdeveloped rental housing market, increasing informality and overcrowding in housing market development path, as well. The existing government programs in Azerbaijan regarding housing market primarily deal with the provision of social and public housing that are distributed among tenants who are from not-means tested criteria and vulnerable groups of blind and disabled. The preferential categories comprise families of the martyrs of the Karabagh War, invalids, journalists, orphans leaving orphanages, students, sportsmen, writers, and popular singers. In addition to this, government also increased mortgage amount from 50000AZN to 150000AZN which is a method focused on increasing affordability of people.

Unfortunately, we cannot observe any formulated or established housing strategy by the government to ensure the long-term housing policy framework based on the appraisal of housing preferences. When we focus on capital city of Azerbaijan, Baku, there exist some affordability constraints in the housing market. For instance, people from low income group encounter with unavailability of mortgage loans and difficulties of obtaining old multi-family housing even in the case of low price. On the other hand, people who belong to middle and especially higher income brackets can be straightforwardly provided with microloans. Also, there is a mismatch between dwelling size and household size in central locations of the city. Finally, extensive capital resources are insufficient to smooth long-neglected privatized houses. In general, the formal renting is inaccessible with an exception of expensive dwellings being affordable by foreigners and expats. When it comes to rental housing, tenancy agreements typified in Civil Law are not as efficient as it is supposed to be since in order to avoid tax liability, landlords prefer verbal contract over written ones.

Considering the already-highlighted obstacles in housing market of Azerbaijan, this study aims to give a comprehensive account of an empirical analysis on housing market booms. Furthermore, it concentrates on group differences in terms of prices for flats and houses, defining factors affecting rental houses, and testing the effectiveness of housing market stability on economic growth. Methodology chosen to implement empirical analysis is through Oaxaca Decomposition and Difference in Difference Analysis. In terms of data analysis, Cross-sectional and Time Series Data are referred. Following these paths, this study will provide clues to the questions of "Is there any price discrimination between unrepaired and repaired houses?", "Is there any price discrimination between new and old flats?", "Is there any price discrimination between new and old apartments ?", "How did the increase in mortgage loans from 50.000AZN to 150.000 AZN affected the purchasing power of households in housing market of Azerbaijan?", and finally "What is the Matching Algorithm and Mechanism Design That Ensure Individually Rational and Strategy Proof Allocation of Rental Houses?

The aim of the study is to initiate a novel solution as a future policy recommendation by offering Matching Algorithm to solve the existing issues in rental house market of Azerbaijan. The paper intentionally focused on the literatures and academic articles written by Azerbaijani Researchers in order to get acquainted with the existing problems and approaches for possible solutions. We stick to the results of empirical analysis as the best and consistent estimators of the preferences of households as well as priorities of rental house owners. On this basis, 3 different regression models were analyzed in order to design an original and country-specific Matching Algorithm.

1. LITERATURE REVIEW

When we review the literature regarding Azerbaijani housing market and particularly for Baku city, there are different published papers that focus on market analysis by implementing various economic analysis methodologies. Firstly, in "Determinants of House Prices in Baku" Aliyev et al. (2019) analyzes effects of preliminary factors influencing the house prices which are predetermined by suppliers. According to the article, these factors are common to housing market of the country and include bill of sale, type of house in the category of new or old, repaired, availability of gas and garage, and proximity to metro station. The author demonstrates positive relationship between preceding significant factors and value of resident. In addition to the essential factors,

number of rooms is detected to be highly powerful in terms of assigning price of houses. Furthermore, while considering rental market in Azerbaijan, influence of real estate services cannot be underestimated. Moreover, when it comes to sustainability of housing market policies, Ahmadov (2014) has another interesting result that a considerable increase in the disposable income of the households turned out to be expansion of the mortgage which cannot be counted as improvement in sustainability. On this basis, the demand exceeded the supply and thus the price of houses increased. By analyzing prices in primary and secondary markets, what he found was that there is a price rise in both markets, which was explained by an inadequate supply and demand boosts. For instance, the prices declined sharply after 2008 financial crises, but the price trends were separated from each other in a sense that prices of repaired houses experienced more decrease compared to the apartments in the process of construction. This finding of apartments that are still in process of construction can be related to the fact that the construction companies need to cover the cost of building. Additionally, another important thing that is referred in the literature is crucial role of integration of timing and both qualitative and quantitative factors for possibility of houses getting sold. In fact, these factors contain distance from the city center, distance to the metro station, located floor in the building together with some qualitative factors as repair, furniture, natural gas, and availability of documentation. This finding perfectly matches with research of Abbasov (2016) who developed a "G score model" to estimate the predictions of selling possibilities in housing market. Result of the model applied to the market is that if the estimated G score is greater than or equal to 0,33, then there is a high possibility of the house to be sold in a given time frame. Otherwise, the house is said to be illiquid or possesses a low probability of being sold during a particular period of time. Also, apartment plan is considered as a significant factor that impacts the price of house when we refer to the literature, and research of Jafarov and Abbasov (2013) perfectly matches with that finding. They analyzed influence of particular plans, such as "German", "Kiev", "Leningrad", "Stalin", and "Khrushov" on house price, they concluded that application of those plans increased the prices by 1.27%, 1.14%, 1.36%, 1.41% and 1.18%, respectively. Another factor that affects house prices is repair condition of house since value of houses with excellent maintenance is significantly higher than the houses values that need to be repair. The authors also explain this in their findings that renovation increase house price 1.1% while unrepaired characteristic of house devalue its price by 0.66%. Ultimately, residential location is also considered as another important factor to determine price of houses. According to the outcome of the research of Jafarov and Abbasov (2013), staying far away from city center factor decreases house price by 0.75% which is highly significant result.

When we review housing market in an international scope, we can see the importance of this particular market for economies in an obvious way. For example, Voigtländer (2014) highlights in his research that even if other European countries, such as Spain has experienced interrelated credit and housing boom after events of September 1 1, Germany achieved to avoid housing bubble and economy crash since it has stable market for housing. Meanwhile, according to Angus Armstrong (2016), property market is a very advantageous from investment perspectives in a way that when there is high return on secure assets with a positive yield, countries like UK is able to grasp not only domestic, but also foreign investors' attention which influences economy in a positive manner. Additionally, Allen and Milne (1994) bring out a problem of mismatching in housing market of UK. They emphasize that there exists mismatch between the growing line of households searching accommodation and the overhang of empty dwellings on the owner-occupied housing market. The authors state based on their findings that this mismatching leads to an economically inefficient consequence. They recommend that this issue of facilitating the transfer of dwellings between the two housing sectors has to be addressed by the provision of central government money.

2. CURRENT SITUATIONS, CHALLENGES AND OPPORTUNITIES

According to Housing Market Diagnostics by Bunch et al. (2014) one of the main housing market challenges in rental housing for Azerbaijan is its culture regarding homeownership. It is more preferable to buy houses rather than rent them particularly for starter households and young professionals according to deep rooted culture of the country. Informality of rental market in Baku

can be considered as another challenge since rental income tax is 14 percent and there also exist realtor fee, renters who consist of mainly students and in-migrants from other regions choose to be informal ones by renting houses without any legal protection to landlords. Formal rental market share is extremely small such that it only involves expatriate tenants. Above-mentioned challenges are explaining the reason why in Baku we do not have practice of rental buildings, and what we mostly have as rental units are rented out by private owners.

In Baku, currently the main method of finding rental houses is through agencies, realtors and personal contacts, such as friends and relatives. Interesting fact about commission fee for real estate agencies is that it is paid by landlords rather than renters especially in case of oral contracts. Also, we can observe domination of oral contracts over written ones in rental housing market. Renters trust on landlords that without prior notice they would not ask them to vacate premises while most of the landlords do not require security deposits in case of oral contracts except 3% of them, and 4% of landlords with written contacts.

Rents drastically decreased only for upper-end or luxury market niche since due to the fact that recent economic downturn made rich business clients and foreigners leave the country while for other subsets of rental market rents are observed to be relatively stable. Furthermore, after February 2015 devaluation rents in USD decreased whereas in AZN did not change. In general, there exist three rental market segments including low-end (below $500 per month), mid-level ($500-$1000 per month), and high-end (above $1000 per month) while majority of renting clients belong to lower-income households. For each of the segments willingness of pay for rents differs further by standard, location of dwellings, and size with obvious correlations. Standardized measure of rental levels can be considered as rent amount per room which is on average 131AZN per month that varies from high rent areas of Binagadi, Narimanov, Nasimi, and Nizami (123-159AZN) to low rent areas of Sabail, Yasamal, Khatai and Sabunchu (72-89AZN) in Baku. Additionally, turnover in rentals is approximately half of sales; however, it is a rough approximation because it is based on rental contracts in 2015 that includes 11000 sales, and we did not know about amounts for oral contracts. Core urban areas of Baku which involve Nizami, Nasimi, Binagadi, Narimanov, and Sabunchu are concentration of rental tenure and multi-family buildings dominates high density urban zones.

Demand for rental houses mainly comes from mobile and low-salaried younger generation with few children. Renters encounter with some affordability constraints. If we take into consideration income five various income quintiles to estimate affordability, while the first quintile cannot afford in the cheapest urban locations, households in the fourth and fifth quintile can afford to rent anywhere in Baku. Supply side of rental market is established based on informality, too. Usually, landlords do not sign any contracts in order to avoid taxation, and neither official statistics provide any information and data, nor the recent household surveys have concentrated on this issue by interviewing renters, but not landlords; therefore, there is lack of data regarding supply side. Also, we cannot find any service in Baku to play a third-party property manager role and be responsible for renting out those dwellings, rent collection, maintenance, and tenant relations for individual landlords who own more than one rental dwelling and may seek.

Even though rental market in Baku is designed on informality, it developed measure of investment profitability. For instance, landlords frequently compare the expected Gross Rental Yield (GRY), which is one of the main methods to evaluate real estate investment, to return rates from term deposits in banks. In comparison with other countries, GRY in Baku which stands at approximately 5.5% is close to Ukraine, a little bit higher than in Poland, and a way higher than France and Germany. In general, GRY of 5.5% is an indicator of a relatively balanced rental investment market.

3. CURRENT INSTITUTIONAL FRAMEWORK

Having analyzed the current rental housing scenario in Azerbaijan, we found out that the Rental Housing Mechanism is the latest policy implemented. The number of available houses for rent is 530 and the minimum amount of monthly payment for the rented houses defined to be 411 AZN. In order to have the contract to be concluded, 12 months in advance payment is required. The

relevant law states that the contract can be concluded for 3 to 25 years. The purpose is to create an opportunity for a citizen in need of housing in Azerbaijan to own a rented apartment. Eventually, tenant will eventually acquire ownership of the apartment by paying the rent on a monthly basis. The main criteria for the access to the mechanism are defined to be as follows; Azerbaijani citizen under the age of 60 who have never been convicted for any violation of law and formally employed. The main disadvantage of the mechanism is that if tenants return the house without paying the rent, then they will not be able to get back the money they paid. Additionally, the priority is given to those who are unable to make a mortgage payment and belong to the low income group rather than people from all walks of life. In view of this, to ensure fair, open, and transparent property laws and regulations both for tenants and owners' side, we design the matching algorithm that consider people including all income groups. The way how we incentivize people to enter the system passes through the taxation and legislation. In terms of legal part, we defined the rules both for tenants and landlords. For tenants: Responsibility of minor repairs, no improvements to the premises, in advance payment as a security. For landlord: Providing habitable houses, 3 months in advance notification, restriction on frequent increase on payment. In case of adjustments for tax, there will be penalty adjustments for tax avoidance and lower tax rate paid by those in the system. The reason why we need is that common current property rights designed for housing management and maintenance are incomplete and insufficient. This, in turns, raises an immense need for the well-functioning centralized system that combines governments, tenants, and landlords.

4. DATA DESCRIPTION

The empirical analysis of the study was carried out through cross-sectional and time series data. We applied linear Blinder-Oaxaca Decomposition on Model 1 and 2 where we utilized cross-sectional data pertaining to 2018 and 2016 respectively. In Model 1, we set log_PRCAZN which signify the sale price of the houses and apartments as dependent variable. The data used in Aliyev et al. (2019) obtained upon request consisted of 497 apartments and 443 houses data as of year 2018 to define the determinants of house price in Baku based on Hedonic Model. Data comprised to the family of 11 indicators among which five were dummy variable given as the availability of garage, availability of bill of sale, modern conveniences, repaired, and type of the house such as repaired and unrepaired. In Model 2, linear Blinder-Oaxaca Decomposition was applied based on cross-sectional data that was used in Abbasov (2016) and acquired upon request consisted of 1926 observations on apartments and 226 variables as of year 2016 among which 1305 were old apartments and 621 were new apartments. Model 3 was constructed to analyze the policy implementation based on time-series data which covered 2007-2019 time horizons for the real estate prices both in primary and secondary market. The data was provided by the Central Bank of the Republic of Azerbaijan. All models are utilized in Stata 13 software.

5. METHODOLOGY

5.1. Model 1

Blinder-Oaxaca Decomposition for the price differences of flats and houses based on data provided by Aliyev et al. (2019). In order to fulfill Oaxaca Decomposition Model, we referred to the below-provided regression models for which the results are reported in Stata table for convenient visualization of the differences across two different groups.

Group 1: unrepaired houses

$$\log(\text{prcazn}_{\text{uh}}) = \mu_0^{\text{uh}} + \mu_1^{\text{uh}} \log(\text{locazn}_{\text{uh}}) + \mu_2^{\text{uh}} \log(\text{arm2}_{\text{uh}}) + \mu_3^{\text{uh}} \text{gar}_{\text{uh}} + \mu_4^{\text{uh}} \text{bos}_{\text{uh}} + \mu_4^{\text{uh}} \text{modcon}_{\text{uh}} + \mu_5^{\text{uh}} \text{rmn}_{\text{uh}} + \mu_6^{\text{uh}} \text{fln}_{\text{uh}} + \vartheta_{\text{uh}}$$

Group 2: repaired houses

$$\log(\text{prcazn}_{\text{rh}}) = \mu_0^{\text{rh}} + \mu_1^{\text{rh}} \log(\text{locazn}_{\text{rh}}) + \mu_2^{\text{rh}} \log(\text{arm2}_{\text{rh}}) + \mu_3^{\text{rh}} \text{gar}_{\text{rh}} + \mu_4^{\text{rh}} \text{bos}_{\text{rh}} + \mu_4^{\text{rh}} \text{modcon}_{\text{rh}} + \mu_5^{\text{rh}} \text{rmn}_{\text{rh}} + \mu_6^{\text{rh}} \text{fln}_{\text{rh}} + \vartheta_{\text{rh}}$$

Group 1: old flats

$$\log(\text{prcazn}_{\text{fo}}) = \varphi_0^{\text{fo}} + \varphi_1^{\text{fo}} \log(\text{locazn}_{\text{fo}}) + \varphi_2^{\text{fo}} \log(\text{arm2}_{\text{fo}}) + \varphi_3^{\text{fo}} \text{rep}_{\text{fo}} + \varphi_4^{\text{fo}} \text{bos}_{\text{fo}} + \varphi_5^{\text{fo}} \text{modcon}_{\text{fo}} + \varphi_6^{\text{fo}} \text{rmn}_{\text{fo}} + \varphi_7^{\text{fo}} \text{fln}_{\text{fo}} + \theta_{\text{fo}}$$

Group 2: new flats

$$\log(\text{prcazn}_{\text{fn}}) = \varphi_0^{\text{fn}} + \varphi_1^{\text{fn}} \log(\text{locazn}_{\text{fn}}) + \varphi_2^{\text{fn}} \log(\text{arm2}_{\text{fn}}) + \varphi_3^{\text{fn}} \text{rep}_{\text{fn}} + \varphi_4^{\text{fn}} \text{bos}_{\text{fn}} + \varphi_5^{\text{fn}} \text{modcon}_{\text{fn}} + \varphi_6^{\text{fn}} \text{rmn}_{\text{fn}} + \varphi_7^{\text{fn}} \text{fln}_{\text{fn}} + \theta_{\text{fn}}$$

In order to interpret the effect of independent variables on the interest variable in percentages as well as to reduce the influence of outliers, attain normalization, and achieve the best fit of the model to the data, some of the independent variables are given in a logarithmic transformation. Aliyev et al. (2019) followed the same rule in his original paper as well and we benefited from this view. The interpretation of the variables would be as follows;

PRC_AZN: Price set by supplier for each flat or house

LOC_AZN: A proxy variable defined for the average price within the corresponding areas that belong to 12 zones in Baku

REP: The dummy variable showing whether the house is repaired or not.

BOS: The dummy variable for the availability of the bill of sale. It is equal to 1 if there is a bill of sale in the house & apartment and zero otherwise.

MODCON: The dummy variable which equals to 1 if there is an availability of modern conveniences and 0 otherwise

RMN: The number of rooms in the house or in the flat

FLN: The flat number on which the house or apartment locates

GAR: Availability of garage in houses

TYPE: Type of the flat defined as new or old

5.2. Model 2

Blinder-Oaxaca Decomposition for new and old apartments for which the data provided by Abbasov (2016), leading Economist at CBAR, was utilized.

$$\begin{aligned}\log(p_{old}) = {} & \tau_0 + \tau_1 floor_{old} + \tau_2 avofelevtr_{old} + \tau_3 avofgas_{old} + \tau_4 avofdocmnt_{old} + \tau_5 centheatsyst_{old} \\ & + \tau_6 exlln t_{repred_{old}} + \tau_7 parquet_{old} + \tau_8 withfurn_{old} + \tau_9 c2center_{old} + \tau_{10} Metro_{old} + \tau_{11} A < 60_{old} \\ & + \tau_{12} 60 < A < 100_{old} + \tau_{13} 100 < A < 150_{old} + \tau_{14} 150 < A < 200_{old} + \tau_{15} 200 < A < 250_{old} \\ & + \tau_{16} A > 250_{old} + \tau_{17} LenProj_{old} + \tau_{18} KhrushovProj_{old} + \tau_{19} MinskProj_{old} + \tau_{20} KiyevProj_{old} \\ & + \tau_{21} GermProj_{old} + \tau_{22} NobelProj_{old} + \tau_{23} StalinProj_{old} + \varepsilon_t\end{aligned}$$

$$\begin{aligned}\log(p_{new}) = {} & \tau_0 + \tau_1 floor_{new} + \tau_2 avofelevtr_{new} + \tau_3 avofgas_{new} + \tau_4 avofdocmnt_{new} + \tau_5 centheatsyst_{new} \\ & + \tau_6 exlln t_{repred_{new}} + \tau_7 parquet_{new} + \tau_8 withfurn_{new} + \tau_9 c2center_{new} + \tau_{10} Metro_{new} \\ & + \tau_{11} A < 60_{new} + \tau_{12} 60 < A < 100_{new} + \tau_{13} 100 < A < 150_{old} + \tau_{14} 150 < A < 200_{old} \\ & + \tau_{15} 200 < A < 250_{old} + \tau_{16} A > 250_{old} + \tau_{17} LenProj_{new} + \tau_{18} KhrushovProj_{new} \\ & + \tau_{19} MinskProj_{new} + \tau_{20} KiyevProj_{new} + \tau_{21} GermProj_{new} + \tau_{22} NobelProj_{new} + \tau_{23} StalinProj_{new} \\ & + \varepsilon_t\end{aligned}$$

Houses with elevator, full furniture, parquet, availability of central heating system, title-deed, excellent renovation, proximity to metro, gas, balcony, proximity to center, area less than 60 m^2, area between 60 $m^2$and 100m^2, area between 100 m^2 and 150m^2, area between 150 m^2 and 200 m^2, area between 200 m^2 and 250 m^2, and area higher than 250 $m^2$are chosen as independent variables to explain the price difference between old and new apartments. The preliminary target in estimating Binder-Oaxaca Decomposition is to define the factors that lead to price gap and especially price discrimination between those two groups.

5.3. Model 3

In this model we have applied regression analysis based on Difference in Difference method for policy evaluation of an increase in the maximum amount defined for the mortgage loans by Azerbaijani government and the way how it altered the purchasing power of households in the domestic housing market. On this basis, the following regression model will be analyzed:

For demand side:

$privdwell = \alpha_0 + \alpha_1 m150 + \alpha_2 avppm + \alpha_3 avpsm + \alpha_4 avroomnm + \alpha_5 rer + \varepsilon$

For supply side:

$numofh = \alpha_0 + \alpha_1 m150 + \alpha_2 avppm + \alpha_3 avpsm + \alpha_4 avroomnm + \alpha_5 rer + \epsilon$

The independent variable denoted by m150 is a dummy variable with a value of "1" when maximum mortgage amount was 50,000AZN, while it is "0" when the amount increased to 150,000AZN. Also, *avppm* and *avpsm* stand for average price of houses in primary market and secondary markets, *avroomnm* defines average room number of the houses, and *rer* explains effect of real exchange rate in the regression models. Our main purpose to include aforementioned independent variables is to control for their effects while focusing on mainly change in amount of maximum mortgage amount. The dependent variable *privdwell* for demand side is defined to be the number of privatized dwellings in the domestic housing market for which the number of privately owned houses was chosen as a proxy variable. For supply side, proxy variable *numofh* is number of houses available for per 1000 people. When we consider the fact that mortgage loan amount has changed since 2015, we picked data for our variables from two years based on availability of the data in 2013 and 2018 when the amount was 50,000AZN and 150,000AZN, respectively. The data is cross sectional and is obtained from Central Bank of Azerbaijan Republic and Statistical committee. We will consider results related to after 2015 as "treatment group" whereas prior to 2015 as "control" group, and finally we apply the first difference of DID model to these two groups to observe the impact on demand and supply side.

6. RESULTS AND DISCUSSION

6.1. Model 1

Table 1 gives a brief representation of Twofold Decomposition whose preliminary focus is to show that price gap can be explained not only by the variables included in the regression model but also the unobservable factors that we cannot control in our analysis. Those are called explained and unexplained effects respectively.

The number of observations for unrepaired houses is 48 while the same indicator amounts to 392 for the repaired houses. As it is evident from the corresponding coefficients, the log of the mean price of unrepaired houses is 11.29 AZN while it is 11.82 AZN for repaired houses. The difference of mean prices gives us the amount of price gap that is calculated to be 52.81% with a corresponding z-score of -3.18. Given that the associated z-score is greater than 1 in an absolute term, we conclude that the gap is statistically significant. What we derive from the difference between the mean values is that this is the unrepaired houses that are discriminated which is mainly caused by the room number as shown in figure 2. This is the coefficient effects that causes the price gap between those two groups while endowments decline this price gap.

Table 1: Twofold Blinder-Oaxaca Decomposition on Linear Model for Houses

Variable	Coefficient	Z-value
Mean Price of unrepaired houses	11.29638 (0.000)	74.75
Mean Price of repaired houses	11.8245 (0.000)	213.10
Difference	-.5281203 (0.000)	-3.28
Explained	-.004703 (0.975)	-0.03
Unexplained	-.5234172 (0.000)	-4.54

- # of obs. = 48 for unrepaired houses
- # of obs. = 392 for repaired houses
- p-values are in brackets

Explained effect has a coefficient of -0.004703 and accounts for about 0.008 price gap whereas unexplained effect with a coefficient of -0.5234172 clarify 0.99 price gap. When we adjust the endowment levels of unrepaired houses to that of repaired houses, the mean value of the prices of unrepaired houses decreases by 0.4% and this is mainly due to room number. The coefficient of

unexplained effect shows that 52.34% of the price gap remains unexplained by the model, which is caused by discrimination. The difference between mean values suggests that those are the unrepaired houses that are discriminated.

To show them visually, we provide figure 1 and 2 where on the y-axis you the set of independent variables used in this model is reflected. Room number, flat number, area of the house, and average price in different locations of Baku are continuous variables while the availability of the bill of sale, modern conveniences, and garage are dummy variables. Figure 2 represents the part of discrimination from each variable and this is obvious that the room number, flat number, average price in different locations of Baku, and availability of modern conveniences positively discriminates repaired houses. This means that if we consider the unrepaired and repaired houses with large number of rooms, flat numbers, and modern conveniences, the price of repaired houses will be higher. This is true for the average price in the different locations of Baku in a sense that people would prefer repaired house even if the unrepaired house is located in the same place and offered at the same price as repaired one. However, if we consider unrepaired and repaired houses with large area, the buyers will choose to pay more price for the unrepaired houses.

Twofold Decomposition for Explained and Unexplained Effects

Figure 1

Figure 2

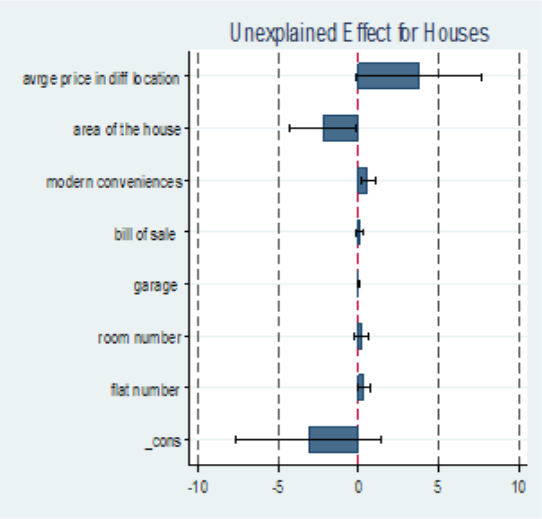


Figure 3 gives a representation of group-specific partial regression lines for houses in which the part of the gap in the price of unrepaired and repaired houses is measured due to the gap on the availability of modern conveniences. 0 denotes unrepaired houses and 1 denotes repaired houses.

Regression line for the unrepaired houses is steeper and upward sloping while the regression line for the repaired houses is flatter and downward sloping, which implies that the availability of modern conveniences affects the unrepaired houses more than the repaired houses. Given that the availability of modern conveniences is dummy variable, it takes only two values denoted as 0 and 1. The interpretation of lines suggests that in case there is no availability of modern conveniences for both groups, log of the sales price of houses measured will be considerably higher for the repaired houses rather than unrepaired ones.

In case the modern conveniences become available for both repaired and unrepaired houses, the log of sales price for repaired houses will decline slightly while the log of sales price for unrepaired houses increases substantially. Even though the price gap between those two groups decline as the modern conveniences become available for both groups, the discrimination against unrepaired houses still remain. This can be noticed from the large effect of coefficients that prevails endowment effects in a sense that coefficient effects explain the price gap and price discrimination

between two groups more than the endowments do. The horizontal line that pass through the E (endowment) is the mean value of the price for unrepaired houses if they are treated like the repaired houses. The difference between E and C is attributed for the discrimination. The difference between upper horizontal line and the one on which E locates shows the price differences due to having different characteristics.

Partial Regression Lines

Figure 3

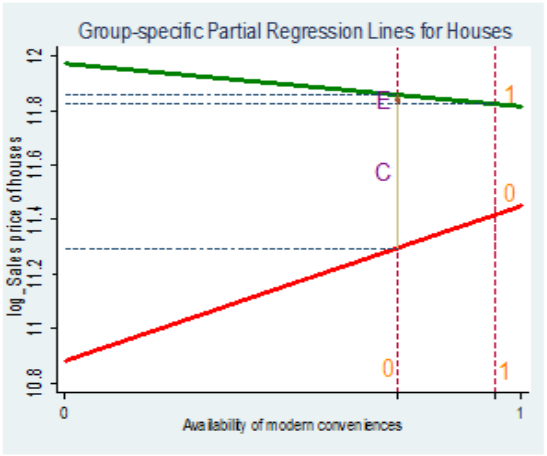


Figure 4

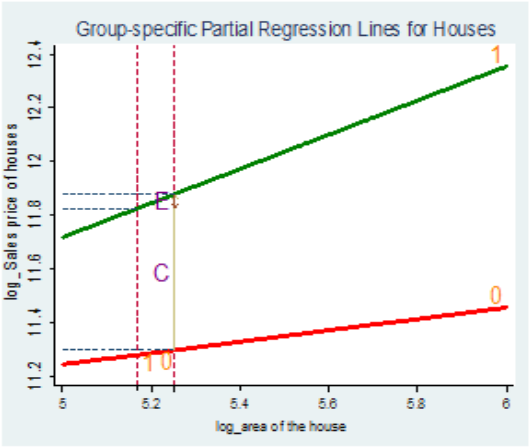


Figure 5 gives a representation of group-specific partial regression lines in which the part of the gap in price differences of unrepaired and repaired houses is measured due to the gap on the area of the house. For the smaller values of the area of the house, the gap between the mean values of unrepaired and repaired houses is smaller. However, as the area gets larger, the price gap between those two groups becomes enlarged and thus unrepaired houses are discriminated. The slope for repaired houses is steeper and slope for the unrepaired houses is flatter while the effect of an increase in the area of the house is positive for both groups. The logical interpretation lurking behind this graphical representation is that as the area of the house gets larger, the cost of repairing this house increases as well. In view of this, people prefer to buy repaired house rather than the unrepaired one given the same area per meter square. With this in mind, the suppliers charge higher price for repaired houses and lower price for the unrepaired ones. The difference between E and C accounts for the effect of discrimination.

Having explained the Oaxaca Decomposition for houses, now we turn to see what happens in the case of old and new flats. Table 2 shows that the number of observations is 496 among which 200 are old flats and 296 are new. The log of the mean price of the old flats that is calculated to be 11.55 AZN while the same indicator equals to 11.92, which is measured up to the difference of 37.06% with a z-score=-7.43. As associated z-score is greater than 1 in an absolute value, we define that the gap is statistically significant.

Twofold Decomposition for Explained and Unexplained Effects

Figure 5

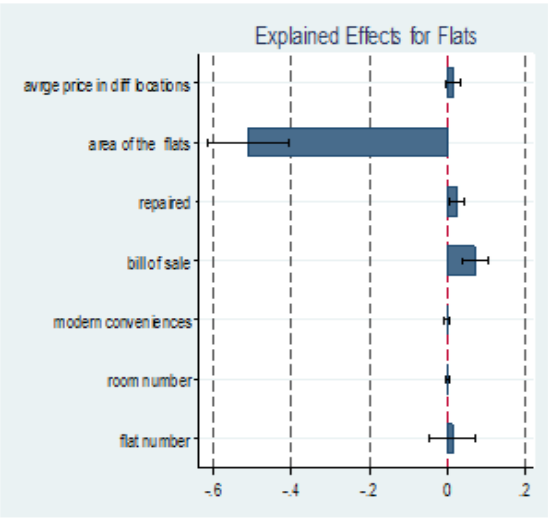


Figure 6

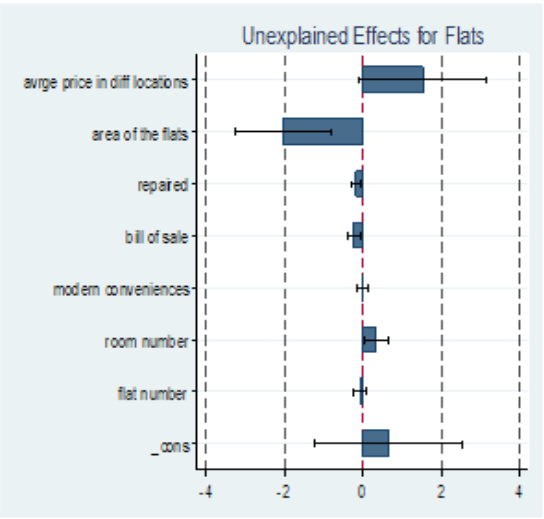


Table 2: Twofold Blinder-Oaxaca Decomposition on Linear Model for Flats

Variable	Coefficient	Z-value
Mean Price of old flats	11.54886	356.68
	(0.000)	
Mean Price of new flats	11.91951	315.87
	(0.000)	
Difference	-.3706436	-7.45
	(0.000)	
Explained	-.3862728	-5.65
	(0.000)	
Unexplained	.0156292	0.27
	(0.790)	

- # of obs. = 200 for old flats
- # of obs. = 296 for new flats
- p-values are in brackets

Results suggest that this is the old apartments that are discriminated which amounts to 37% price gap. Given that the corresponding z-score is quite large which amounts to -7.45, we conclude that the gap is statistically significant. The observed variables explain 38% of the price gap while 1.56% remains unexplained. To see which variables causes such result, we refer to Figure 5 and 6. Figure 5 shows that this is the area of the house that mainly explains the price gap and it expands the negative gap between those two groups. Based on the results, we can suggest that the 37% of the price gap between old and new apartments can be explained by the repaired, bill of sale so as the area of the apartment. The availability of the bill of sale and repaired shrinks the gap in favor of the old apartments while the area of the apartments expands it. In Figure 6, the negative side of the unexplained part is related to the discriminated group while the positive side reflects the non-discriminated group. It suggests that if we consider old and new apartments with large room numbers and average price in different locations of Baku, the price of new apartments will be high. This suggest discrimination against old apartments. But when we consider the apartments being repaired, bill of sale, and large area, the old apartments will be paid more, which represents the discrimination against new apartments.

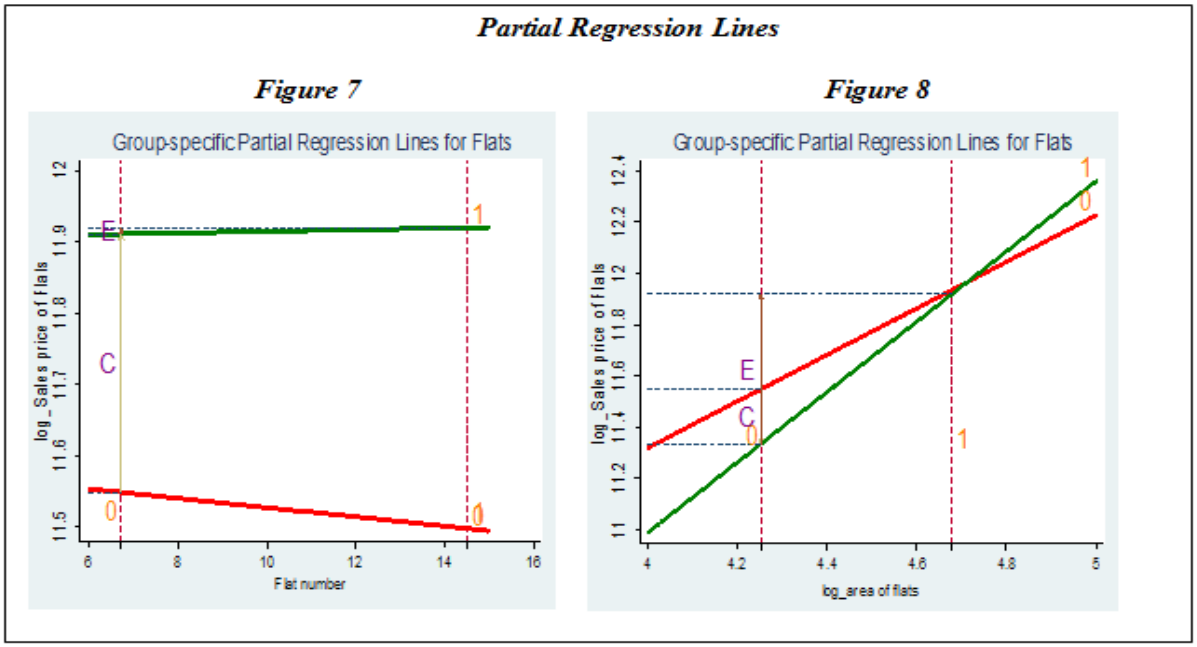


Figure 7 gives a representation of group-specific partial regression lines in which the part of the gap in price differences of old and new flats is measured due to the gap on the flat numbers. Both the slope and intercept of the new flats are higher than that of old flats. The difference between E and C is tremendously large which yields that the old houses are discriminated in terms of price charged by the seller for any value of the FLN.

Figure 8 gives a representation of group-specific partial regression lines in which the part of the gap in price differences of old and new flats is measured due to the gap on the log_Arm2. If old flats are treated like the new flats, the mean value of the log_PRCAZN of the old flats will be approximately 1.51 while the mean value of the old flats accounts for about 1.91 and for old flats, this value is around 1.31. For the old flats, the mean value of the log_Arm2 is around 4.3 while it is calculated to be around 4.7 for new flats. Until mean value of log_Arm2=4.7, suppliers charge higher prices for old apartments and lower prices for new apartments but after that, the scenario changes and new apartments become charged more value. The slope of the new flats is 1 while the slope of old ones is in (0,1) interval. Given that the green line is steeper than that of red one, the log of the sale price of new flats is more responsive to the increase in the area of the flat in comparison to the log of sales price of old flats. The existing gap is mainly explained by the endowment effects rather than the coefficients as E>C in figure 8.

6.2. Model 2

In this particular model we have used the Blinder-Oaxaca decomposition to examine price gap between old and new apartments. Firstly, we apply twofold decomposition which decomposes the difference in mean outcomes of old and new apartments into two parts of explained and unexplained. The “explained” portion is explained by determinants of house prices that we included into our analysis, such as proximity to metro station and city center, availability of furniture, central heating system, parquet, documentation, gas, floor, elevator and etc. However, “unexplained” part is not explained by those cross-group differences in the explanatory variables. Discrimination in or the influence of unobserved variables can trigger existence of unexplained part in the decomposition (Hlavac, 2018).

Table 3: *Twofold Blinder-Oaxaca Decomposition on Linear Model for Apartments*

Variable	Coefficient	Z-value
Mean Price of old apartments	11.27846 (0.000)	929.85
Mean Price of new apartments	11.56268 (0.000)	487.71
Difference	-.28422 (0.000)	-10.67
Explained	-.4099724 (0.000)	-10.40
Unexplained	.1257524 (0.005)	2.79

- # of obs. = 1305 for old apartments
- # of obs. = 621 for new apartments
- p-values are in brackets

Results of twofold decomposition are indicated in 5 and mean of log values of old apartments and new apartments are 11.27846 and 11.56268, respectively. Percentage difference between the mean values are 29% out of which -41% is explained by independent variables included into the model and 13% is remained unexplained may be due to discrimination or some unobserved variables. Both explained and unexplained parts are statistically significant as their p-values are small enough under 1%, 5%, and 10% significance levels. As 11.28<11.56, discrimination in our model is against old apartments; therefore, variables that carry positive unexplained coefficients are responsible for discrimination against old apartments whereas variables that carry negative unexplained coefficients are responsible for new houses. Graphical illustration is used to demonstrate which of the determinants of price is contributing the most to the explained and unexplained parts. Figure 19 is related to "unexplained" and there is discrimination against new apartments from availability of documentation, excellent repaired effect, and constant. Reasoning behind the discrimination against new houses is that all previously mentioned variables carry negative values.

Nevertheless, availability of elevator and gas indicate discrimination against old apartments due to their positive values. When we take into account significance levels based on p-values, availability of gas, documentation and constant are not statistically insignificant because of large p-value and excellent repaired effect and availability of elevator are statistically significant variable for "unexplained" part. Next, figure 9, availability of elevator, gas, documentation, excellent repaired effect, area mainly in between 100 and 150 square meters, and style of Khrushov and Minsk Projects are explaining the price gap between old and new apartments the most with negative values, and area less than 60 square meters and style of Kiyev and Stalin Projects has more explanatory power than the other variables with their positive coefficients. When we take into account significance levels based on p-values, all the independent variables which stand for areas in different intervals and availability of elevator, documentation, excellent repaired effect are statistically significant since their p-values are small enough while availability of gas is an exception due to its large p-value which makes it not statistically significant variable for "explained" part.

Twofold Decomposition for Explained and Unexplained Effects

Figure 9

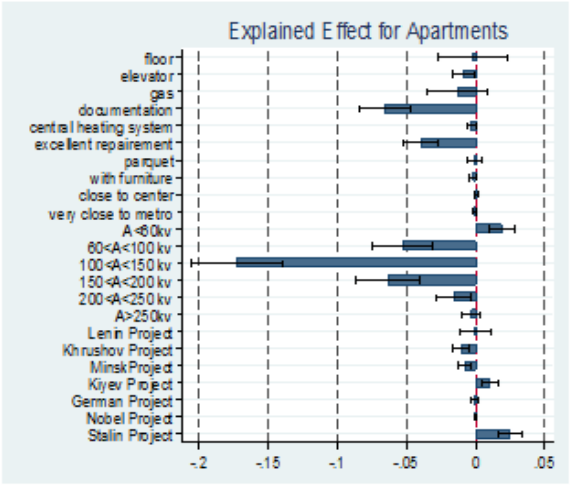
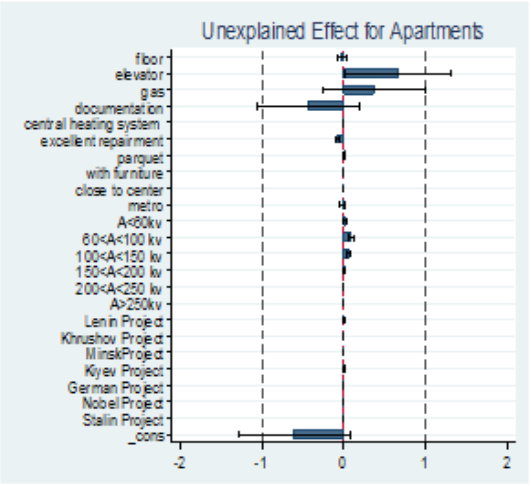


Figure 10



The results of our analysis suggest that much of the price gap can be explained by areas in different intervals and availability of elevator, documentation, and excellent repaired effect. Furthermore, "unexplained" effect can be due to either discrimination or existence of some unobserved variables. As it is discussed in literature review, due to lack of data in housing market of Azerbaijan we could not consider all or at least most of the significant variables which can trigger. Also, there can be discrimination over selling prices of old and new apartments and based on the analysis it is mainly due to two variables. First, excellent repaired effect of the apartment can be responsible for the discrimination against new houses; secondly, availability of elevator in the building can be responsible for the discrimination against old apartments.

The results of our analysis suggest that much of the price gap can be explained by the area of the house that falls into [$100m^2$,$150\ m^2$] interval as it is evident from Figure 9. The second largest effect comes from the availability of the documentation and again the area of the house whose interval is [$150m^2$,$200m^2$]. The latter one can be because of taxation since when there are the legal document owners has to transfer certain amount of money to state budget through taxation, and for new houses, owners do care about legal documentation much more than landlords of old apartments. Moreover, possessing a Stalin project causes the price discrimination in new apartments. Furthermore, "unexplained" effect can be due to either discrimination or existence of some unobserved variables. Figure 10 gives a detailed representation of the unexplained effects that shows the part of discrimination from each variable. As it is discussed in literature review, due to lack of data in housing market of Azerbaijan we could not consider all the significant variables and measure interaction between different variables. Therefore, interaction of the availability of the documentation with other unobserved variables could not be measured in case unexplained effect comes from unobservable variables. On the other hand, if it is discrimination, other things equal, landlords do discrimination while selling old and new apartments for different prices and availability of documentation is responsible for this discrimination. Additionally, there is discrimination against old apartments from constant while new apartments are mainly discriminated by the availability of elevator and gas.

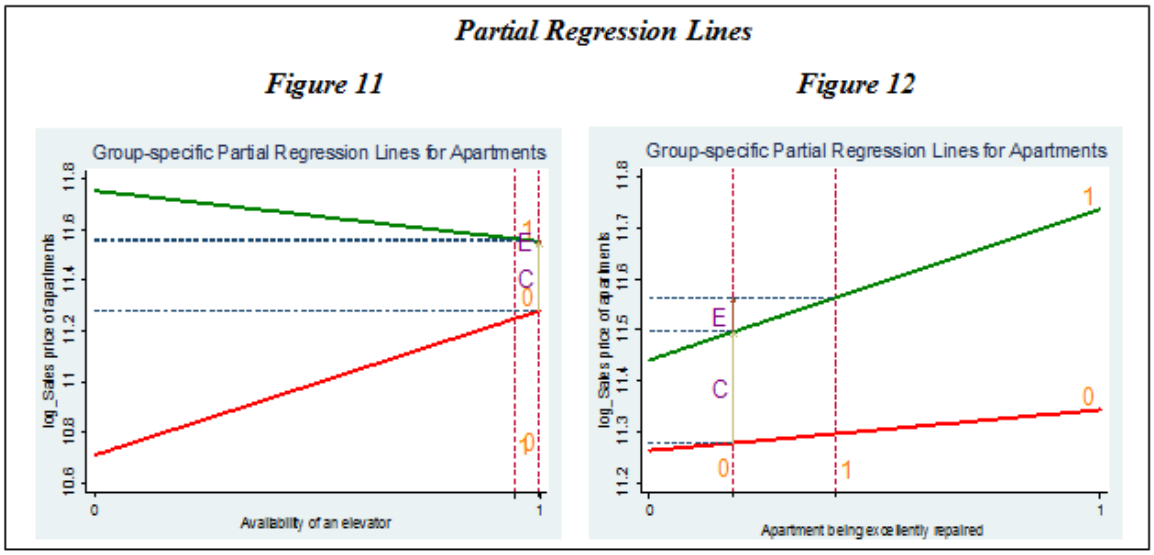


Figure 11 gives a representation of group-specific partial regression lines in which the part of the gap in price differences of old and new apartments is measured due to the gap on the availability of an elevator. The slope of a regression line for the new apartments is flatter and negative while the slope of regression line for old apartments is steeper and positive. This implies that having an elevator positively and considerably affects the old apartments while it negatively and slightly affects the new ones as the change in the log of sale price is large and positive in old apartments and small but negative in new apartments. The reason lurking behind it is that people would love to pay more price for the old apartments in case they have an elevator as it is something unusual for this group. However, for the new apartments, people already expect that there is availability of an elevator. This is why, while considering the old and new apartments with an elevator, people pay more price for the old one, thus the log of sale price for old apartments increases while the opposite is observed for new ones. Even though the availability of an elevator for both new and old apartments decline the price gap between those two groups, the old apartments still remain to be discriminated as new apartments are paid more in both cases.

Exactly an opposite scenario is delineated in figure 12 which gives a representation of group-specific partial regression lines in which the part of the gap in price differences of old and new apartments is measured due to the gap on being excellently repaired. The slope of the new apartments is steeper than that of old ones meaning that being excellently repaired affects the price of new apartments more than it does for the old apartments. Given both old and new apartments without an excellent repairment, the log of the sales price of the new apartments will be higher in compareson to the old apartments. When we consider both group being excellently repaired, there will be an increase in the log of the sale price of both old and new apartments, however, the increase in the price of new apartments will be significantly higher than the old ones. As a result, the gap between those two groups will be enlarged and thus the old apartments will be negatively discriminated.

6.3. Model 3

In model 3 we discuss results of whether the affordability of households in housing market positively or negatively affected in response to the increase in the maximum amount of mortgage loans from 50,000 AZN to 150,000 AZN. After we apply the regressions for demand and supply side separately for treatment and control groups, we got the mean values of each variable for both mortgage amounts. According to table7, mean of the control group from demand side perspective is calculated to be 8150 while it is 4168.4 for the treatment group, and with a difference of -3981.6, it implies that the policy negatively altered the purchasing power of households with 49% decline was observed.

Table 7: The effect of an increase in mortgage loans on Supply and Demand side

	Demand	*Supply*
-->m150=0		
Variable	***Mean***	***Mean***
privdwell/numofh	*8150*	*1278.9*
avppm	*872.2708*	*872.2708*
avpsm	*1439.479*	*1439.479*
aroomnm	*2.477708*	*2.477708*
rer	*.7906307*	*.7906307*
-->m150=1		
Variable	***Mean***	***Mean***
privdwell/numofh	*4168.4*	*1364.16*
avppm	*930.45*	*930.45*
avpsm	*1349.733*	*1349.733*
aroomnm	*2.626667*	*2.626667*
rer	*1.365158*	*1.365158*

	Demand	*Supply*
Variables	***Difference***	
privdwell/numofh	*-3981.6*	*85.26*
	(-49%)	*(7%)*
avppm	*58.1792*	*58.1792*
	(7%)	*(7%)*
avpsm	*-89.746*	*-89.746*
	(-6%)	*(-6%)*
aroomnm	*0.148959*	*0.148959*
	(6%)	*(6%)*
rer	*0.5745273*	*0.5745273*
	(73%)	*(73%)*
% changes are given in brackets		

Supply Side

Figure 13

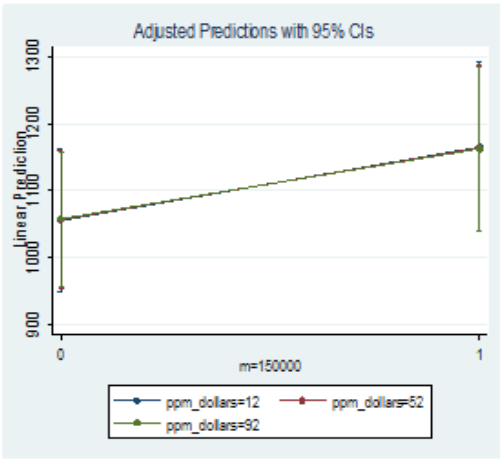
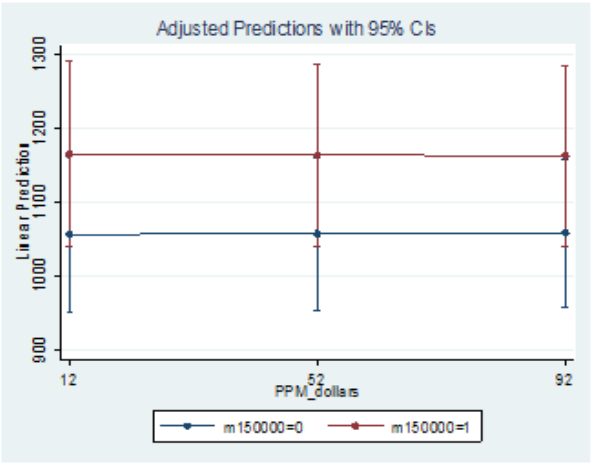


Figure 14



Graphically we can illustrate this with graph8 according to which m150000=1 lies below m150000=0, which signifies that the effect was high prior to the policy implementation. Although the lines are parallel to each other, the gap between them is too large, which amounts to 3981. Similarly, based on table 7, for supply side mean of the control group is calculated to be 1278.9 while it is 1364.16 for the treatment group, and with a difference of 85.26, it implies that the policy increased the

number houses supplied in the market with 7% rise was observed. We can illustrate this with Figure 10 according to which m150000=1 lies above m150000=0, which signifies the effect became high after the policy implementation. The gap between the parallel lines is constant and small which is calculated to be 85.26. Also, in order to compare change in demand and supply sides, from Figure 7 and 9 we can see that slope of demand curve is steeper while slope of supply curve is flatter. This outcome indicates that supply side was more responsive to the policy change rather than demand side. Consequently, controlling for other variables, we can conclude that affordability or purchasing power of people actually have not increased as a result of increase in maximum amount of mortgage amount; on the other hand, number of houses supplied in market has increased after implementation of the policy.

Demand Side

Figure 15

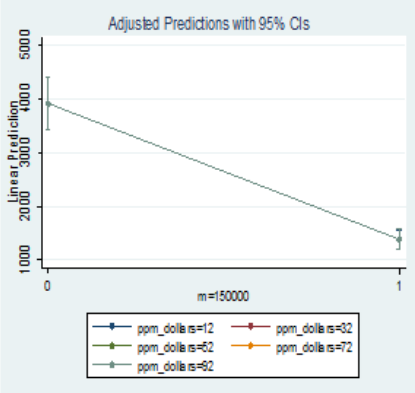
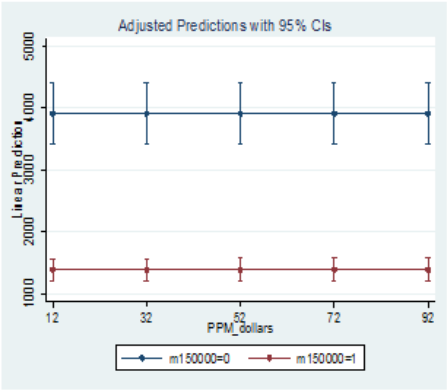


Figure 16



6.4. Harmonization of empirics and matching markets

Relying on the statistical significance of the variables mentioned in the literature in terms of determining the house prices in Baku, we applied Blinder-Oaxaca Decomposition to see whether they cause any price discrimination between unrepaired and repaired houses, flats, or apartments. Our preliminary objective in doing so was to come up with a factors that caused price discrimination, on which we provided further policy recommendations to eliminate them. Based on the results of Model 1, we defined that this is the repaired houses that are discriminated. If we can provide the factors people mainly care in unrepaired and repaired houses separately, they would look like as following;

- In unrepaired houses, people mainly care about the availability of large room number, modern conveniences, and bill of sale.
  $the\ number\ of\ flats \succ area\ of\ the\ house <=> 0.05 > 0.04$ where the numbers signify coefficients obtained from Oaxaca Decomposition.
- But people would love to pay more price to the unrepaired houses if they have the following conditions;
  $lower\ average\ price\ in\ different\ locations \succ availability\ of\ modern\ conveniences$
- In repaired houses, people mainly care about;
  $lower\ average\ price\ in\ different\ locations \succ flat\ number$
- People are more willing to pay higher prices for the repaired houses if they have the large area
  Another result obtained through Model 1 is that this is the old flats that are discriminated.
- In old flats, people mainly care about the availability of large area, flat being repaired, and availability of the bill of sale;
  $area \succ bill\ of\ sale \succ repaired$ based on coefficients
- In new flats, people mainly care about *room number*.

- People would be willing to pay more prices for the old flats if they had the large room number while they would pay more price for the new flats if they have large area, availability of the bill of sale, and are repaired.

  Based on the results of the Model 2, we found out that this is the old apartments that are discriminated. If we can provide the factors people mainly care in old and new apartments separately, they would look like as following;
- In new apartments, people mainly care about the availability of elevator while this is the excellent repaired effect that is weighted more for the old apartments. People would pay more price for the old apartments if they have an elevator. Likewise, people would pay more price for the new apartments in case they are excellently repaired.

Considering the impossibility of adjusting the projection of old flats and apartments such as enlarging the area or providing an elevator, we come to offer that the private companies dealing with supply of buildings had better to provide large number of rooms and excellent repair in those aforementioned dwellings in order to eliminate the price discrimination between old and new flats and apartments. But one has to consider that the results are based on the fact that we applied the empirical analysis on the data of houses being on sale, nor rent. The way how we deal with this problem in our matching algorithm is that we allow both repaired and unrepaired houses, old and new flats as well as apartments to be exchanged in mechanism. To eliminate this discrimination is out of control in our matching algorithm as it is something to be done by the real estate companies.

Based on the results obtained from Model 1, 2 and 3, we came to decide that there is an overpricing in housing market which reflects itself in a discrimination of new flats or apartments that are paid higher price even if the old ones have exactly the same characteristics. Additionally, the overpricing is confirmed by the real estate agents in Azerbaijan. Now the culminating point here is that we cannot force people to pay higher price for the old apartments as it is not their true preferences. In view of this, that was out of our main objective to eliminate the existing discrimination. Mechanism we offer is directed to improve the rental housing market by enabling everyone searching for a rental house to get an access to one, not to eliminate the discrimination. On the other side, government tries to improve the non-oil sector in the Azerbaijan and one of the high perspective sectors is housing market and especially the rental housing. The government is also aware of the advantages of the rental housing sector as it is obvious from current policy implementations designed for this aforementioned sector.

According to the calculated GRY score, the investment opportunity is defined to be higher in Azerbaijan compared to other countries, such as Ukraine and Poland. Therefore, there is a high probability that focusing on the tax collection coming through the rental housing market will contribute to the government budget and meet with the investment objectives in non-oil sector. When it comes to how to incentivize the government, our mechanism satisfies the individual rationality and strategy proof. This means that nobody can benefit from lying by misreporting their true preferences and nobody will get something worse than what they were initially endowed with. Thus, the owners of rental houses will be willing to enter this mechanism and as their number increases, there will be more people to be taxed. At the end of the day, the apple falling from the sky will make all three sides happy; the owners will have an opportunity to reach more tenants looking for a rental house, the tenants will be able to benefit from the pool of rental houses awaiting for them, and the government will be able to tax more people and use the collected amount as a seed for the future investment.

While considering the fact that the real estate brokers are one of the main figures in the housing market, their preferences and concerns have to be taken into the account upon designing a centralized mechanism. The way how we incentivize them passes through legalizing their jobs in the labor market which will benefit them in terms of the recognition of their legal protection and contribution to the pension fund.

What is offered to the government from our side is to strict control over tax collection and penalizing those avoiding tax payment on time. In case of the corporation with the government, people who are entering to our system will be charged a lower rental tax rate than the once who are outside of the system. Considering a strict penalization and higher tax rates going around outside of our

mechanism, people will be nudged to enter the mechanism. Consequently, the informality which is currently going on in the rental housing market a lot is expected to drastically decline which, in turns, makes everyone including tenants, landlords, brokers, and government better-off in our story.

6.5. Matching markets of rental houses

* *YRMH-IGYT with occupied houses and newcomers*

Our Matching algorithm and mechanism design is inspired by the "House Allocation with existing tenants: equivalence" by Tayfun Sonmez and Utku Unver (2005) where they enable both existing tenants and newcomers to allocate their houses in one sided matching. The beauty of the mechanism offered by us is that it is based on the same motivation but utilized in two-sided matching markets. On one side of the market, there are tenants with initial endowment and newcomers while on the other side of the markets, the newcomer owners and existing owners with vacant houses and occupied ones respectively. On this basis, the mechanism will work as follows;

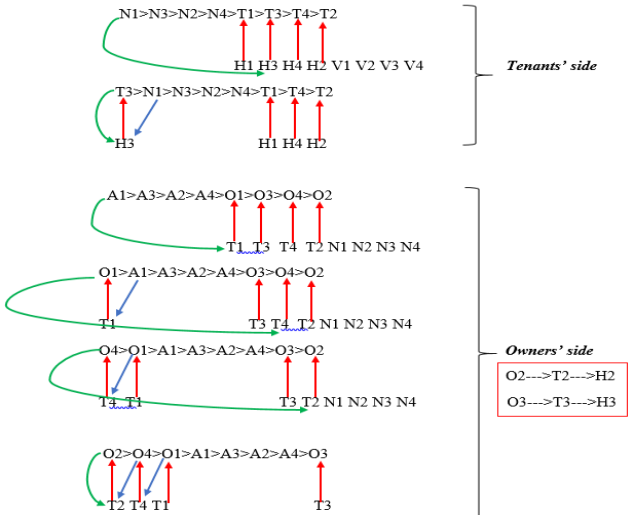
Preferences of Tenants Preferences of Owners

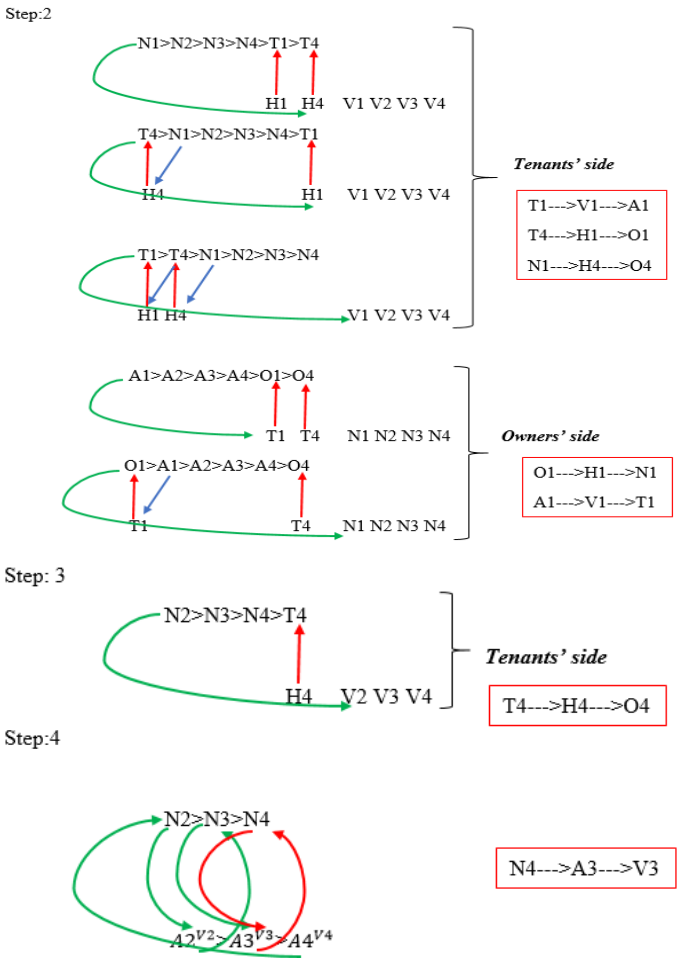
H1, H2, H3, and H4 are occupied houses in which T1, T2, T3, and T4 are initially endowed

- N1, N2, N3, and N4 are newcomers. They are tenants without initial endowment
- O1, O2, O3, and O4 are existing owners being initially endowed with H1--->T1, H2--->T2, H3--->T3, and H4--->T4 respectively
- A1, A2, A3, and A4 are newcomers with vacant houses of V1, V2, V3, and V4
- By This mechanism, we would like to enable both tenants and owners with and without initial endowment to engage in the exchange of rental houses
- Red color shows the initial endowments and green color denotes the final allocation obtained through applying YRMH-IGYT in two-sided matching markets
- Rule: N1>N3>N2>N4>T1>T3>T4>

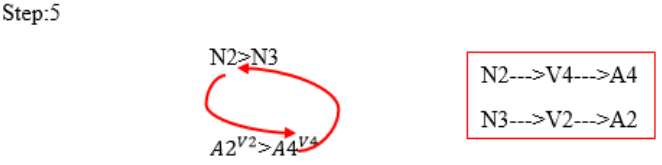
Step:1

T1	T2	T3	T4	N1	N2	N3	N4		O1	O2	O3	O4	A1	A2	A3	A4
H3	V2	H3	H1	H3	V2	H2	V1		T4	T2	N3	T2	T1	N1	N4	N2
V1	H1	H4	V1	H2	H2	H3	V3		N1	T4	T3	N2	T2	N3	T4	N1
H4	V4	V2	H2	H4	V3	V3	H3		N4	T1	T2	N4	N3	N4	T1	T4
H2	H4	V4	H3	V1	V4	V2	H4		T1	N4	N4	T4	T4	N2	T3	T2
H1	V3	V1	H4	V3	H1	H1	H2		N2	T3	N1	N1	N2	T3	T2	T1
V2	H3	H1	V2	V2	H4	H4	H1		N3	N3	T3	T3	N1	T4	N2	T3
V4	V1	V3	V4	V4	V4	V4	V2		T3	N2	T1	T1	T3	T1	N3	N4
V3	H2	H2	V3	H1	V1	V1	V4		T2	N1	T4	N3	N4	T2	N1	N3
				Ø	Ø	Ø	Ø						Ø	Ø	Ø	Ø





T1	T2	T3	T4	N1	N2	N3	N4		O1	O2	O3	O4	A1	A2	A3	A4
H3	V2	H3	H1	H3	V2	H2	V1		T4	T2	N3	T2	T1	N1	N4	N2
V1	H1	H4	V1	H2	H2	H3	V3		N1	T4	T3	N2	T2	N3	T4	N1
H4	V4	V2	H2	H4	V3	V3	H3		N4	T1	T2	N4	N3	N4	T1	T4
H2	H4	V4	H3	V1	V4	V2	H4		T1	N4	N4	T4	T4	N2	T3	T2
H1	V3	V1	H4	V3	H1	H1	H2		N2	T3	N1	N1	N2	T3	T2	T1
V2	H3	H1	V2	V2	H4	H4	H1		N3	N3	T3	T3	N1	T4	N2	T3
V4	V1	V3	V4	V4	V4	V4	V2		T3	N2	T1	T1	T3	T1	N3	N4
V3	H2	H2	V3	H1	V1	V1	V4		T2	N1	T4	N3	N4	T2	N1	N3
				Ø	Ø	Ø	Ø						Ø	Ø	Ø	Ø



Final allocation

Tenants' side Owners' side

Here the final allocation is Individually rational as neither any tenants nor owners get something worse than what they were initially endowed with. Additionally, the allocation is STP as none of the tenants and owners have an incentive to misreport their true preferences. However, the final result is not efficient as there is an allocation that gives all players something better than what they

eventually end up with. In other words, there is another allocation that makes everyone better off without making someone worse off.

* *YRMH-IGYT in Two-sided matching without initial endowment*

Firstly, there are two-sided matching consist of tenants and owners sequential order. Tenants propose to their most preferred rent house; similarly, owners propose to their most preferred tenants. Rule says that owners' preferences mainly play subsidiary role. Because, first choice decision is given to tenant for starting to propose their most preferred outcomes. Once tenant choose his most preferred rent house, we will give attention to sequential order of owners. Because, the owner whose house is the tenants' most preferred outcome will decide next how the allocation will be ended. If that owner would prefer to give his house to same tenant; then, matching algorithm will match and remove both side from the system. Consequently, both side will gain their most preferred outcome and efficient results. On the other hand, there is also probability that owner would not prefer the same tenant to entrust house. In this case, system will give owner huge advantage of managing tenants' order. The tenant who is the most preferred choice of owner will be given 1st in sequential order for the purpose of defining whether owner preferred tenant would like to take his house. If tenant 1st preference order is matched with this owner, they will allocate following pair and make them to leave the allocation process. Thus, process will continue by matching the most preferred outcomes of players until there will not be any potential player to match. Also, there exist a 3rd case that happens when cycle that make system go back to where it started instead of finding couple to match. As illustration, imagine tenant 1 proposed to house of owner 5 whose most preferred outcome is tenant 3. However, when we give first order to tenant 3, algorithm reach out the point so that owner of tenant 3 most preferred house propose back to tenant 1 and tenant 1 will be given 1st player chance in order. In this case, tenant 1 will propose his second most preferred outcome now in order to prevent this infinitive reputation of allocation.

- Consider YRMH-IGYT mechanism that is applied to various problem of housing market with initial endowment (1)
- Consider that the preferences of owners and tenants are strict (2)
- Sequential order is defined as 1>3>7>5>2>4>6>8 in a random order for tenants (3)
- Define the order for the owners as 3>8>5>6>4>7>2>1 which is not actually plays important role because owners order is mainly managed according to the tenant preference order (4)
- Apply YRMH-IGYT in both sides through interrelating their order in according with preferences
- According to the matching mechanism, allocate tenant and owner whose preferences overlap and remove from system because there is no more efficient matching than it
- If the individual 1 points to his/her most preferred choice and get rejected in the second side of matching which is owners' side, then selected owner will decide the tenant who will have priority in order. Then dominant position will switch indicated tenant whether to accept owner house or to propose another house. Consequently, game will follow these steps until finding sufficient allocations.
- $O1^{H1}$ denotes that the house 1 (H1) belongs to owner 1 (O1) and so on.
- Consider the following example;

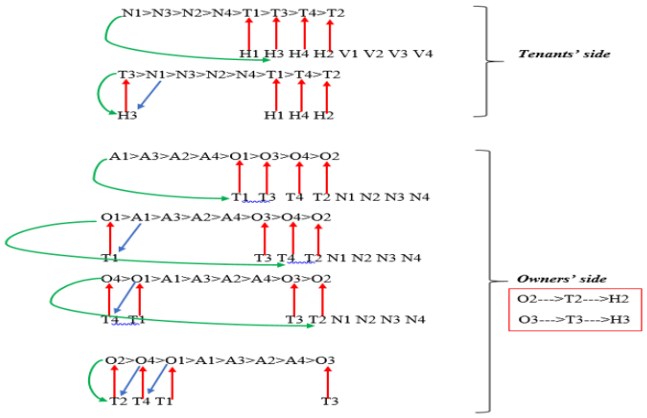
Preferences of Tenants

T1	T2	T3	T4	N1	N2	N3	N4
H3	V2	H3	H1	H3	V2	H2	V1
V1	H1	H4	V1	H2	H2	H3	V3
H4	V4	V2	H2	H4	V3	V3	H3
H2	H4	V4	H3	V1	V4	V2	H4
H1	V3	V1	H4	V3	H1	H1	H2
V2	H3	H1	V2	V2	H4	H4	H1
V4	V1	V3	V4	V4	V4	V4	V2
V3	H2	H2	V3	H1	V1	V1	V4
				Ø	Ø	Ø	Ø

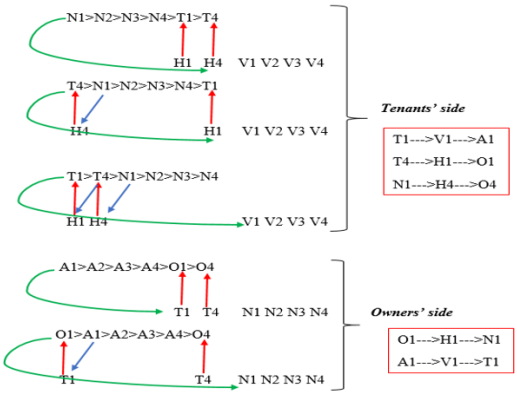
Preferences of Owners

O1	O2	O3	O4	A1	A2	A3	A4
T4	T2	N3	T2	T1	N1	N4	N2
N1	T4	T3	N2	T2	N3	T4	N1
N4	T1	T2	N4	N3	N4	T1	T4
T1	N4	N4	T4	T4	N2	T3	T2
N2	T3	N1	N1	N2	T3	T2	T1
N3	N3	T3	T3	N1	T4	N2	T3
T3	N2	T1	T1	T3	T1	N3	N4
T2	N1	T4	N3	N4	T2	N1	N3
				Ø	Ø	Ø	Ø

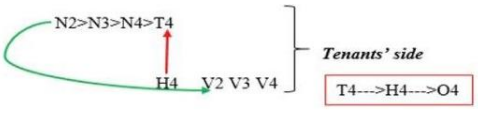
Step:1



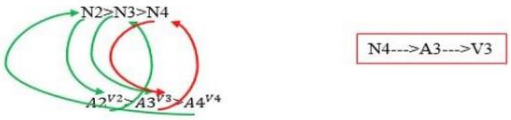
Step:2



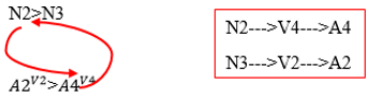
Step:3



Step:4

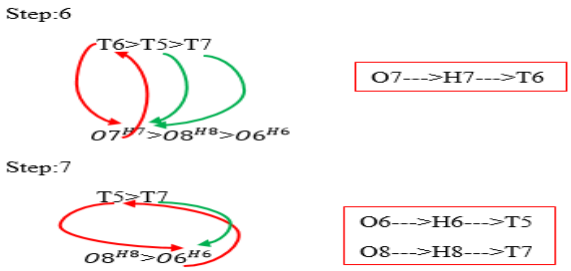


Step:5



Final allocation

Tenants' side									*Owners' side*							
T1	**T2**	**T3**	**T4**	**N1**	**N2**	**N3**	**N4**		**O1**	**O2**	**O3**	**O4**	**A1**	**A2**	**A3**	**A4**
H3	V2	H3	H1	H3	V2	H2	V1		T4	T2	N3	T2	T1	N1	N4	N2
V1	H1	H4	V1	H2	H2	H3	V3		N1	T4	T3	N2	T2	N3	T4	N1
H4	V4	V2	H2	H4	V3	V3	H3		N4	T1	T2	N4	N3	N4	T1	T4
H2	H4	V4	H3	V1	V4	V2	H4		T1	N4	N4	T4	T4	N2	T3	T2
H1	V3	V1	H4	V3	H1	H1	H2		N2	T3	N1	N1	N2	T3	T2	T1
V2	H3	H1	V2	V2	H4	H4	H1		N3	N3	T3	T3	N1	T4	N2	T3
V4	V1	V3	V4	V4	V4	V4	V2		T3	N2	T1	T1	T3	T1	N3	N4
V3	H2	H2	V3	H1	V1	V1	V4		T2	N1	T4	N3	N4	T2	N1	N3
				Ø	Ø	Ø	Ø						Ø	Ø	Ø	Ø



Final allocation:

Preferences of Tenants									*Preferences of Owners*							
T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**		$O1^{H1}$	$O2^{H2}$	$O3^{H3}$	$O4^{H4}$	$O5^{H5}$	$O6^{H6}$	$O7^{H7}$	$O8^{H8}$
H3	H6	H3	H1	H3	H7	H2	H5		T4	T2	T7	T2	T1	T5	T8	T6
H5	H1	H4	H5	H2	H2	H3	H7		T5	T4	T3	T6	T2	T7	T4	T5
H4	H8	H6	H2	H4	H6	H7	H3		T8	T1	T2	T8	T7	T8	T1	T4
H2	H4	H8	H3	H5	H8	H6	H4		T1	T8	T8	T4	T4	T6	T3	T2
H1	H7	H5	H4	H7	H1	H1	H2		T6	T3	T5	T5	T6	T3	T2	T1
H6	H3	H1	H6	H6	H4	H4	H1		T7	T7	T6	T3	T5	T4	T6	T3
H7	H5	H7	H8	H8	H5	H5	H6		T3	T6	T1	T1	T3	T1	T7	T8
H8	H2	H2	H7	H1	H3	H8	H8		T2	T5	T4	T7	T8	T2	T5	T7
Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø		Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

Given that our mechanism based on two-sided matching markets without initial endowment, we do not assume the individual rationality as there is no initial endowment to compare the final allocation. The mechanism is STP as both sides have no incentive to lie in terms of reporting their true preferences. However, the final allocation is not Efficient as there is an allocation that makes everyone better-off without turning someone to be worse-off. Final allocation is given in green circles while the empty sets in red signify that initially neither tenants nor owners had an initial endowment.

CONCLUSION

The main purpose of the study was to define the factors that lead to the price discrimination between houses and flats being grouped into repaired and unrepaired as well as old and new ones in Blinder-Oaxaca Decomposition. What the final result suggested was that in the case of houses, the unrepaired houses were discriminated by the supplier in terms of charging price as the mean value of the unrepaired houses was lower than that of repaired ones. The room number was the main factor that explained 52.81% of the price gap while that was the area of the house and availability of the modern conveniences that caused price discrimination. In the case of flats, the results were opposite in a sense that that was the old flats that were discriminated. The price gap between those two groups amounted to 37.06% and 1.56% of it remained unexplained due to the discrimination based on the area of the flats. The interesting factor in the case of flats is that the area of the house measured in meter square is also the main factor that explains the price gap between old and new flats. In terms of the results from Model 2, we applied Blinder-Oaxaca Decomposition to measure the price gap between old and new apartments based on cross-sectional data concerning year 2016.

The main findings suggest that the old apartments are price-discriminated and price gap is calculated to be approximately 28%. 12% of this gap is remained unexplained due to discrimination which is mainly caused by the availability of elevator, gas system, and documentation whereas the area of the house is the main determinant that explains the price gap and leads to the lower mean value in

the old apartments. In the case of old and new apartments, we saw that this is the documentation that yields the price discrimination which is due to the informality of housing market. To correct for this, we considered improvements in tax and legal factors in designing our matching algorithm. The last but certainly not the least is Model 3 whose main objective was to evaluate the policy implementation in the form of an increase in the amount of mortgage loans from 50.000 AZN to 150.000 AZN. The main findings stated that the policy implementation positively affected the supply side which reflected itself in the increase on the number of buildings being supplied. However, this increase was considerable less than the decrease in the number of houses being demanded. The purchasing power of the households declined as the amount of mortgage loans increased from 50.000 AZN to 150.000 AZN while the responsiveness of the suppliers increased in response to the policy implementation.

One of the main contributions of the study is offering a centralized matching rule and mechanism design for the allocation of rental houses as this sector has been stayed out of the policy recommendations in the housing market of Azerbaijan. In one of the cases where the tenants exchange rental houses by the allowance of owners who exchange their tenants as a response, we designed a matching rule which is unforeseen for Azerbaijani housing market and offered for the future policy implementations that can yield Efficient, Individually Rational, and Strategy proof allocation. In order to incentivize people to enter this mechanism design, we offered a legal contracts and tax policy adjustments in corporation with the government of Azerbaijan Republic. In order not to discriminate, the preferences of tenants and priorities of the landlords were taken into the consideration which, in turns, prevents any avoidance from the tax payment and legal sanctions.

Given the nonexistence of the centralized housing allocation and mechanism design in Azerbaijan, collecting a relevant data for housing market diagnostics was exceedingly difficult. The preliminary challenge faced in this study was to find a quarterly data on house price index that has been documented since 2013 only and is our main interest variable in providing forecast of the future dynamics in housing market, effectively estimating the trends pertaining to supply-side housing units together with measuring statistical significance of the factors affecting “flexible homeownership”. Another main limitation to be highlighted was the lack of previous policymaking analyses that we could have diagnosed by putting forward some hypothesis to be tested. What is more is the prevalent predicament reflecting itself in terms of housing affordability constraints that hamper optimal housing choice in terms of rental houses. The empirical scrutiny of the aforementioned obstacle requires quarterly and long-time series data on home improvement loans, housing microfinance, price to rent ratio, homeownership rate, and mortgage financing for which there is almost no data provided by the Statistical Committee of the Republic of Azerbaijan. First of all, we highly recommend to apply the Blinder-Oaxaca Decomposition on Panel data which enables the researchers to observe whether the price gap between old and new apartments as well as unrepaired and repaired houses shrink over time for a particular location or not. Having accessed to the cross-sectional data only, we could not observe the trend of the price gap existing between two groups. Next, that would be highly appreciated if one can come up with a data on the impact of the urgency of sale and test how it affects to the price of the apartments and houses during the time of the bargaining of sale. Nature wise, that would be experimental research harmonized with the explanatory power of empirical analysis. Unfortunately, because of the COVID-19 pandemic, we could not conduct a well-organized survey in order to define what are the exact preferences of brokers, individual suppliers, and companies. That would have contributed to the greater extend in terms of the solid matching algorithm. While conducting this research, we came up with huge problems in the taxation side which needs optimization analysis in order to be effective in the field of housing market analysis. Given that optimization is something out of our scope and especially the lack of reliable data prevents us to fulfill deep analysis, we skipped that part as a room for the future researchers. The last but certainly not the least is stabilizing the amount of mortgage loans as it was not effective in terms of boosting the purchasing power of households post to the increase of 150.000 AZN. Having considerably lower demand and huge supply makes us end up with at the point which is quite far away from what we call optimal equilibrium.

REFERENCES

1. Abbasov, J. (2018). The estimation of selling possibility of houses. *Asian Journal of Civil Engineering*, *19*(7), 827-837.
2. Abdulkadiroğlu, A., & Sönmez, T. (1999). House allocation with existing tenants. *Journal of Economic Theory*, *88*(2), 233-260.
3. Aliyev, K., Amiraslanova, M., Bakirova, N., & Eynizada, N. (2019). Determinants of housing prices in Baku: empirical analyses. *International Journal of Housing Markets and Analysis*, *12*(2), 281-297.
4. Dilshod B. &Yusupov, J. B. (2014). *Housing Sector Diagnostic.* World Bank Group.
5. Demange, G., & Gale, D. (1985). The strategy structure of two-sided matching markets. *Econometrica: Journal of the Econometric Society*, 873-888.
6. Jann, B. (2008). A Stata implementation of the Blinder-Oaxaca decomposition. *Stata journal*, *8*(4), 453-479.
7. Massó, J. (2015). The theory of stable allocations and the practice of market design. The Nobel Prize in Economics 2012 for Alvin E. Roth and Lloyd S. Shapley. *Contributions to Science*, *11*, 103-112.
8. Miragha, A. (2017). Prediction of prices in housing market with the correlation-regression methods. *Ukrainian Journal of Ecology*, *7*(4), 399-406.
9. Peppercorn, I. G., & Taffin, C. (2013). *Rental housing: Lessons from international experience and policies for emerging markets*. The World Bank.
10. Sönmez, T., & Ünver, M. U. (2005). House allocation with existing tenants: an equivalence. *Games and Economic Behavior*, *52*(1), 153-185.
11. Werczberger, E. (1995). The role of public housing in Israel: Effects of privatization. *Scandinavian Housing and Planning Research*, *12*(2), 93-108.

APPENDIXES

Table: 1′ Explained and Unexplained Effect Reported for All Independent Variables for Flats in Model 1

	Explained		Unexplained	
Variable Names	**Coefficients**	**Z-score**	**Coefficients**	**Z-score**
Average price in different locations of Baku	.0158016 (0.128)	1.52	1.535132 (0.064)	1.85
Area of the flat	-.5101364 (0.000)	-9.60	-2.041223 (0.001)	-3.27
Room number	.0000303 (0.992)	0.01	.3373463 (0.029)	2.18
Flat number	.0131187 (653)	0.45	-.0733518 (0.435)	-0.78
Being repaired	.0249018 (0.004)	2.86	-.1756117 (0.002)	-3.17
Bill of sale	.0710451 (0.000)	4.31	-.2340426 (0.005)	-2.83
Modern conveniences	-.0010338 (0.759)	-0.31	.0065601 (0.929)	0.09
_cons	***	***	.6608201 (0.488)	0.69

- *# of obs. = 200 for old flats*
- *# of obs. = 296 for new flats*
- *p-values are in brackets*

Table: 2′ Explained and Unexplained Effect Reported for All Independent Variables for Houses in Model 1

	Explained		Unexplained	
Variable Names	**Coefficients**	**Z-score**	**Coefficients**	**Z-score**
Average price in different locations of Baku	-.0146047 (0.509)	-0.66	3.749722 (0.062)	1.87
Area of the house	.0459753 (0.541)	0.61	-2.229767 (0.032)	-2.14
Room number	-.0612328 (0.128)	-1.52	.1978977 (0.421)	0.80
Flat number	.0509698 (0.193)	1.30	.2988245 (0.144)	1.46
Modern conveniences	-.0119822 (676)	-0.42	.5750946 (0.014)	2.45

Bill of sale	-.0080777 (0.843)	-0.20	.0318784 (0.763)	0.30
Garage	-.0057507 (0.599)	-0.53	-.0396946 (0.308)	-1.02
_cons	***	***	-3.107372 (0.180)	-1.34

- *# of obs. = 48 for unrepaired houses*
- *# of obs. = 392 for repaired houses*
- *p-values are in brackets*

Table: 3′ Explained and unexplained effect reported for all independent variables for apartments in model 2

	Explained		**Unexplained**	
Variable Names	**Coefficients**	**Z-score**	**Coefficients**	**Z-score**
floor	-.0019793 (0.875)	-0.16	-.0210635 (0.466)	-0.73
elevator	-.0086872 (0.023)	-2.27	.674556 (0.042)	2.03
gas	-.0132142 (0.229)	-1.20	.3739098 (0.238)	1.18
documentation	-.065439 (0.000)	-6.77	-.4298579 (0.176)	-1.35
Central heating system	-.0029035 (0.096)	-1.66	-.0005399 (0.570)	-0.57
Excellent repaired	-.0397584 (0.000)	-6.48	-.0690744 (0.000)	-4.87
parquet	-.0009492 (0.697)	-0.39	.0141156 (0.011)	2.53
With furniture	-.001849 (0.193)	-1.30	-.0010807 (0.630)	-0.48
Close to center	.0000255 (0.968)	0.04	.0005394 (0.237)	1.18
Metro	-.000867 (0.343)	-0.95	-.0116488 (0.421)	-0.80
A<60kv	.0184725 (0.000)	3.93	.0244992 (0.018)	2.37
60kv<A<100kv	-.0529799 (0.000)	-4.74	.0900701 (0.000)	4.94
60kv<A<150kv	-.1727973 (0.000)	-10.21	.0630017 (0.000)	3.91
150kv<A<200kv	-.0636099 (0.000)	-5.53	.0103184 (0.008)	2.67
200 kv<A<250kv	-.015615 (0.016)	-2.42	.0027802 (0.082)	1.74
A>250kv	-.0032298 (0.336)	-0.96	.00039 (0.217)	1.23
Lenin project	-.0005983 (0.918)	-0.10	.0052136 (0.008)	2.64
Khrushov project	-.0101987 (0.001)	-3.33	.0011972 (0.039)	2.07
Minsk project	-.0080454 (0.000)	-3.75	.0011776 (0.010)	2.56
Kiyev project	.0103162 (0.002)	3.15	.0045431 (0.000)	3.53
German project	-.0006325 (0.596)	-0.53	-.0006226 (0.163)	-1.40
Nobel project	-.0002874 (-.318)	-1.00	4.45e-06 (0.649)	0.46
_cons	***	***	-.0004544 (0.575)	-0.56

- *# of obs. = 1305 for old apartments*
- *# of obs. = 621 for new apartments*
- *p-values are in brackets*