

# **EFFECTS OF HOUSING PRIVATIZATION ON LABOUR MARKET OUTCOMES. EVIDENCE FROM RUSSIA**

**AN EMPIRICAL STUDY**

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## Abstract

Keywords: Russian housing privatization, income, effects of privatization, homeownership, regional privatization, the housing market, quality, age, mobility, mass privatization, private property, mortgages, inflation, affordability, work mobility, residential mobility, house prices.

This research paper examines Russian housing privatization, with a focus on its effects related to the labour market. By analysing leaked Russian databases containing relevant information, the study uses regression analysis and other statistical tests to explore relationships between various relevant variables.

The findings indicate that privatization is associated with income, age, property value, homeownership percentage, and size of apartment buildings,.... This study contributes to the existing literature on the privatization process, as the available data not only provides insights into the labour market itself but also sheds light on other related topics. The results of this research paper can serve as a valuable resource for governments as a basis for policy analysis and for fellow researchers studying a similar or related topic.

## Resumo

Palavras-chave: Privatização da habitação na Rússia, rendimento, efeitos da privatização, propriedade residencial, privatização regional, mercado imobiliário, qualidade, idade, mobilidade, privatização em massa, propriedade privada, hipotecas, inflação, acessibilidade económica, mobilidade no trabalho, mobilidade residencial, valores imobiliários.

Este trabalho de pesquisa examina a privatização da habitação na Rússia, com um foco nas suas repercussões relacionadas com o mercado de trabalho. Ao analisar bases de dados russas divulgadas que contêm informações relevantes, o estudo utiliza análises de regressão e outros testes estatísticos para explorar as relações entre diversas variáveis relevantes.

Os resultados indicam que a privatização está associada ao rendimento, à idade, ao valor da propriedade, percentagem de propriedade residencial e tamanho dos edifícios de apartamentos, entre outros aspectos. Este estudo contribui para a literatura existente sobre o processo de privatização, uma vez que os dados disponíveis não só fornecem percepções sobre o mercado de trabalho, mas também lançam luz sobre tópicos relacionados.

Os resultados deste trabalho de pesquisa podem servir como um recurso valioso para os governos, como base para análise de políticas e para outros pesquisadores que estudem temas semelhantes ou relacionados.

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## 1 List of Abbreviations

| Abbreviation  | Meaning                                   | Abbreviation | Meaning                  |
|---------------|-------------------------------------------|--------------|--------------------------|
| AdminDistrict | Administrative district                   | MunDistrict  | Municipal District       |
| ANOVA         | Analysis of Variance                      | N°           | Number                   |
| AptArea       | Apartment Area                            | Non-Priv     | Non-Private              |
| AptType       | Apartment Type                            | NumFlats     | Number of Flats          |
| AvgLivSpace   | Average Living Space                      | NumFloors    | Number of Floors         |
| AvgPropValue  | Average Property Value                    | OwnStart     | Ownership Start          |
| DocSeries     | Document Series                           | Priv         | Private                  |
| DiD           | Difference-in-Differences                 | Priv_Perc    | Privatization Percentage |
| DOB           | Date Of Birth                             | Prop         | Property                 |
| Fed           | Federal                                   | Q1           | First Quartile           |
| Gni           | Gross National Income                     | Q3           | Third Quartile           |
| H0            | Null hypothesis                           | RA           | Regression Analysis      |
| IQR           | Interquartile range                       | RQ           | Research Question        |
| Inn           | Individual Taxpayer Identification Number | RUB          | Ruble (Russian currency) |
| Km            | Kilometer                                 | SN           | Serial number            |
| Mun           | Municipal                                 |              |                          |

## **2 Introduction**

### **2.1 Project Background**

After the fall of the Iron Curtain, the Soviet Union collapsed in the early 1990s. Consequently, Russia went through several processes of economic and political change known as “market reform”. The purpose of this project was to create a more liberalized economy independent of government subsidies in Russia. One of the aspects of this shift was the privatization of industries and the housing market, which were previously state-owned, by introducing property rights. (McFaul, 1995)

Before the 1990s, most housing in Russia was state-owned, provided and allocated to individuals or families by the government, frequently based on their political loyalties or occupation (Ledeneva, 1998). In 1992 the Russian government passed Law on Fundamentals of Housing Policy which gave Russians the right to privatize their housing units for a price way below market value. The goal of this legislation is to stimulate economic growth and implement a market-based housing system.(Daniell & Struyk, 1997)

The housing privatization process was not without controversy. Many Russians were wary of the idea of owning their own homes, as they were accustomed to the security of the state-provided housing system. Furthermore, people with low-quality living quarters were hesitant to privatize their houses, because they were on a waiting list to get a better apartment for which they would receive much more money. Moreover, people were concerned that they would not be able to pay their maintenance costs, which they were required to pay by law while previously this cost was covered by the government. (Daniell & Struyk, 1997)

The privatization of state-owned housing also led to the development of the private construction industry, as developers and builders began to construct new homes for sale on the private market. However, the growth of the private housing market was not uniform across Russia, as there were significant regional differences in the rate of construction and the availability of private housing (Guzanova, 1997).

There were a couple of noteworthy trends Regarding the labour market and wages in Russia. First, in the mid-1990s, Russia experienced a period of high inflation, fuelled by expansionary monetary and fiscal policies that led to a decline in real wages as wages failed to keep up with the rising living cost. The government pursued these policies in an attempt to stimulate economic growth and address the economic challenges faced by the country following the

collapse of the Soviet Union. Hereby, the money supply was increased and as a result, inflation was fuelled. (Country Studies)

Second, another factor to keep in mind is the rapid increase in the prices of imported goods due to the depreciation of the Russian Ruble (RUB). This can be attributed to the expansionary policies the government implemented as discussed before (Country Studies), but also the high level of unemployment and economic uncertainty, which resulted in less demand for RUB and contributed to the depreciation. Furthermore, structural factors also played a role in this, such as the lack of a well-functioning financial system and the high level of corruption in the country. These factors made it difficult for the government to effectively implement monetary and fiscal policies, which also contributed to the high inflation. (Country Studies)

## **2.2 Problem Description**

There is already extensive literature about the effects of privatization after the fall of the Soviet Union. Much of the literature focuses on the process of privatization itself considering the policies and strategies implemented by the Russian government and the impact on the economy and society. Still, this literature mostly focuses on the privatization of industry markets such as oil and retailers, but not on the housing market.

Research focusing on the consequences of privatization mainly discussed the performance of privatized firms, the role of privatization in shaping the economic and political landscape in Russia, and the distribution of ownership and wealth. In addition, the performance and efficiency of firms and the role of foreign investors have been studied as well. But more importantly for this research paper, there has been a significant amount of research on the impact on income inequality, welfare and the relation between state and market. The current research paper will aim to build on the existing literature highlighting the impact of housing privatization on the labour market wages, homeownership, and housing prices,...

## **2.3 Research Questions**

1. What is the relationship between the share of privatized housing in a specific region and the median income of individuals in that region?
2. What is the relationship between the distance of a housing unit from the city centre and the privatization rate in that area?

3. What is the impact of homeownership type on the homeownership rate for different income groups, and what role does age play?
4. How does the value of a housing unit affect the likelihood of that unit being privatized?
5. What are the different apartment types and what is the difference between privatized and non-privatized units for the different types?

## **2.4 Report Outline**

The main goal of this report is to identify a possible relationship between housing market privatization and labour market wages by going into the literature and gathering information about theories, historical data, and different ways of thinking all to create a broad scope of what the problem entails and come to an understanding and build a theory. This paper starts with the literature review. Furthermore, historical data is gathered and analysed, which will be used to answer the abovementioned research questions. The aim is to provide a broad overview of the current state of knowledge on this topic and identify gaps or areas that have not been adequately addressed in existing research.

Following this, the problem characterization is discussed. Here we identify, define, and describe the research question that we aim to address. The significance and relevance of the problem are explained and existing research or literature on the topic is outlined. This helps us focus the scope of the research and provide a clear direction for the study.

Next, the paper discusses the methodology used. This section tells more about how the previously outlined research questions are studied and tested using datasets from Moscow. This research paper focuses on regression analysis. Regression analysis is discussed in length, followed by a description of how differences between groups are analysed, and additionally a description of the data preparation. Furthermore, it goes over each research question we want to cover and explains which methods we will use to analyse the question. Lastly, the interpretation, visualization and biases are discussed.

Finally, the results for each research question following the detailed methodology are discussed and to finish, the conclusion is formed summarizing the key findings and providing a clear interpretation of the results for each research question.

## **2.5 Ethical Use of Leaked Data**

The data used in this paper originates from multiple sources, specifically three datasets. The primary dataset is an administrative register, which provides a wealth of information on residents of Moscow including names, addresses, type of building, dates of birth, average property value, average living space, and percentage of ownership. The second source of data is a pension database, which contains information on names, zip codes, income, and employers. The use of these datasets in conjunction allows for a comprehensive analysis of the effects of the percentage of ownership on income per person, as well as other statistical analyses. Lastly, we have a dataset which details Russian zip codes, their place name, and county code,... But this does not contain any sensitive information.

It is worth mentioning that the data collection was conducted as part of a pension administration and that there have been instances of data leaks in the past from Russian governmental and company data, which were then sold on the black market. The datasets used in this study were obtained from multiple websites, however, they have since been removed from the internet. Despite this, the datasets possess research value and can be used by academic researchers. To ensure the privacy of individuals and employers, all personal and employer-identifying information was removed after being used to match earnings with relevant property characteristics and locations. It is also worth noting that, since the data is not available online anymore, the data is securely stored on a server that is only accessible to the author and the supervisor of the research.

### **3 Literature Review**

Literature on the effects of housing privatization in Russia after the collapse of the soviet union using empirical data and models is scarce. This can be attributed to some possible factors. For example, the technology used for big data analyses of government databases was only democratized from the start of the 21<sup>st</sup> century, which made it difficult for contemporary researchers to analyse the effects efficiently.

Additionally, the limited ability to gain access to restricted data and the lack of consistent data over time constituted a problem in this field. Much of the data is based on surveys instead of objective data which could lead to less representative samples.

The lack of literature makes this topic a challenge, but it also provides an opportunity for new research and new perspectives to be explored.

Due to the lack of empirical studies, this study will first go over non-empirical studies and descriptive studies. After this empirical studies will be reviewed, however, these are more limited.

#### **3.1 Housing Privatization**

Most of the information about the Russian housing privatization process found is based on the article “Housing Privatization in the Russian Federation” (Kosareva & Struyk, 1993), the following section is primarily based on their insights. They offer a critical assessment of the privatization process, with an overall conclusion which is fairly pessimistic. They assessed that it may have resulted in a distribution of housing assets that is more inequitable than before. In the 1990s the housing sector in Russia was terrible in major cities, with enormous waiting times and poor quality of housing.

The fact that 80% of Russian households (in major cities) lived in a state rental unit caused a big headache for the new government because its limited resources were not able to improve housing itself. Therefore, housing privatization was seen as the solution. The primary objective was to stimulate the development of a private housing market, encouraging new owners to sell their units and upgrade to more desirable properties. The economic reasoning behind this argument is that if a substantial share of privatized units would increase the volume of transactions in the housing market, by selling their units, the proceeds could be used to stimulate demand in the private housing market. Another argument was that making tenants into owners will increase their willingness to spend money on improving their buildings.

However, does the “catalyst” argument hold water in Russia? Due to the lack of a private housing sector, compared to other former Soviet states, Russia started on the back foot.

Four possible variants of the privatization process have been described. (Kosareva & Struyk, 1993)

1. First, privatizing through free transfers to residents; only floor space above the fixed quotas for each family size would be sold at a bigger, but depreciated price. This assumed that to quickly expand the housing construction market, there needed to be quick and cheap privatization. This would result in households selling their units and building new homes.
2. Secondly, there is the option of buying out. The estimated value of all apartments would be paid with only minimum discounts; in other words, residents would purchase their units from the state on commercial terms.
3. The third option was a “socially just” privatization, where a fixed amount of living space would be freely transferred to the purchaser and high prices would be charged for any space beyond this level.
4. Lastly, there is the “compensatory justice” option, where every family would receive a voucher for a set number of square meters. This voucher would be able to be freely traded and used to purchase units. This would be the only option that compensated families occupying small units, but details were never worked out by the government.

Now, what did the government agree on? Each tenant is given a voucher free of charge, the value of this voucher is the price of a square meter of average housing in the city in which the tenant lives times the number of square meters to which he or she is entitled. Tenants paid the difference between the assessed value of the unit and the value of the voucher, without additional compensation for families living in a unit which is less valuable than the voucher. Lastly, each family could sell the vouchers or purchase only one unit under these privatization procedures. (Appel, 1997)

Local governments were given considerable freedom regarding the implementation of this policy (Kosareva & Struyk, 1993). In Moscow, the privatization was conducted completely free of charge, which was remarkable because all other cities charged for space above the norm. Furthermore, about 12% of the city housing stock was ineligible to be privatized because of the poor conditions of the units. As shown in the table below (Table 1) even though in some cities governments asked for money, the absolute majority of units were transferred free of charge. Moreover, the number of applications and complete privatizations is much larger in Moscow than in other cities. Consequentially almost 5% of all units in Moscow were privatized in three

and a half months, in contrast to only 1% of all units in the other cities.

|                                                                               | Moscow                 | Ekaterinburg         | Novosibirsk            |
|-------------------------------------------------------------------------------|------------------------|----------------------|------------------------|
| 1. Amount of space given freely (square meters)                               |                        |                      |                        |
| • Per person                                                                  | Full unit              | 18                   | 18                     |
| • Additional per household                                                    | Full unit              | 9                    | 18                     |
| 2. Percent of units transferred free of charge                                | 100                    | 95                   | 90                     |
| 3. Average price per square meter of space above the norm (R)                 | 0                      | 463                  | 190                    |
| 4. Range of adjusted prices for space (value) above the norm (R/square meter) | NA                     | 200–850              | 120–360                |
| 5. Processing fees paid by applicant (R)                                      | 320                    | 600                  | 490                    |
| 6. Date local law effective                                                   | 2/92<br>(02/11/92)*    | 1/92<br>(01/09/92)   | 1/92<br>(01/20/92)     |
| 7. Number of units conveyed (municipal stock)                                 |                        |                      |                        |
| a. Period since adoption of law (months)                                      | 3.5 (Data on 05/19/92) | 4 (Data on 05/09/92) | 3.5 (Data on 05/01/92) |
| b. Number of units conveyed                                                   | 98,754                 | 1,288                | 1,669                  |
| c. Applications                                                               | 112,126                | 2,259                | 6,823                  |
| d. Total number of municipally owned units (thousands)                        | 2,168                  | 142                  | 200                    |
| e. Share of units forbidden to be privatized (percent)                        | 12                     | 10                   | 10                     |

\* The privatization in Moscow according to the Russian law had begun in September but was halted and then restarted in February.

**Table 1: Key Features of Local Implementation of Russian Federation Privatization Laws (Koraseva & Struyk, 1993).**

The two biggest uncertainties that discouraged tenants from buying were the cost of maintenance and the introduction of property tax, which were both subsidized in the past. The absence of comprehensive cost information made it impossible to anticipate future costs (Daniell & Struyk, 1997). People were worried about the introduction of the property tax, although this tax was really low, around 0.1% of the assessed value, and would have resulted in a quite small tax bill. (Kosareva & Struyk, 1993)

There were severe inequities between the purchasers and those who remained renters or were on the waiting list. Purchasers received large transfers of wealth, renters received nothing and

those on waiting lists were at risk of receiving nothing. Furthermore, equal treatment was hampered among purchasers as higher-income households occupied better, larger units and received larger transfers of wealth at the beginning of the privatization process. Kosareva & Struyk (1993) concluded that this might have resulted in a distribution of housing assets that is more inequitable than before the privatization process began. Koraseva & Struyk (1993) proposed increasing rents, limiting the time for making privatization decisions and addressing the various issues affecting those who purchase their units and who do not.

Kosareva and Struyk (1993) showed the privatization process in Russia and its impact on different demographic groups within the community. Although insight into the impact of this privatization on wages themselves is limited, it does provide useful information to be able to understand the situation the average Russian population was in at the moment.

### **3.2 House-ownership Effects on the Labour Market**

In this section, the relationship between homeownership and the labour market was investigated. Blanchflower & Oswald (2013) discussed how rises in homeownership in the US resulted in sharp rises in unemployment. They believed economists currently lack a full understanding of the interplay between the housing and labour market and showed in their paper the possible effects of homeownership. A possible reason the patterns they described have not attracted a lot of notice from other researchers is the long time lag between privatization and its long-term effects. The current research study does not have any data about employment so cannot contribute to this debate. However, it can be hypothesized that following privatization, more unemployment is present, and consequently incomes go down.

A high level of ownership does only destroy jobs in the next year according to them (Blanchflower & Oswald, 2013). The possible mechanisms lying behind these findings were discussed. Such as evidence that high homeownership was associated with lower levels of labour mobility, greater commuting times, and fewer new firms.

Blanchflower & Oswald (2013) reported three main conclusions:

1. A doubling of ownership was associated with more than a doubling in unemployment, due to long-run elasticity which was estimated to lie between 1 and 2.
2. There was lower mobility as a result of homeownership and also an increase in time spent commuting to work, which raised costs for employers and employees.
3. There were lower rates of business formation, but this may be due to other external factors.

A contemporary study in Europe (Laamanen, 2013) added other probable causes for this interesting phenomenon. This study concluded that externalities arising from consumption reductions and increased job competition may explain the phenomenon, especially if the purchases are financed by debt. However, more theoretical and empirical research is needed to better understand the mechanisms at work.

### **3.2.1 Work Mobility in Moscow**

As stated above, homeownership relates to lower mobility. (Blanchflower & Oswald, 2013) What does this mean in the context of Moscow? In general, greater work mobility is related to increased wages for workers. This is because workers who can go from job to job can find positions that better match their skills. The housing cost, transportation network, and job market are one of the factors in this. In general, homeownership leads to work immobility, but this matters less in large cities. (Coulson & Fisher, 2009)

Furthermore, Coulson & Fisher (2009) suggested that the immobility of homeowners leads to higher wages than renters because the immobility leads them to invest more in the local jobs they have.

It is known that Moscow has a very expensive housing market. This is a negative factor for mobility as it is a barrier for those looking to get a house and a job in Moscow. However, it is a major economic and transportation hub, which means there are a lot of job opportunities (depending on the state of the economy) and people do not have to look far for new job opportunities.

Today Moscow has a modern network of rails, airports, and roads, which leads to good connectivity within the city as well as with the rest of the world. The Moscow Metro is the lifeblood of transportation in the region and is known for its punctuality and reliability. This corroborates the conclusion of Coulson & Fisher (2009) that homeownership does not impact work mobility in big cities like Moscow, but does lead to a higher income than renters.

Daniell & Struyk (1997) discussed mobility extensively. Regarding Moscow, before the reforms, households had very limited residential mobility because of a system of residency permits (propiska system) and the houses were allocated by the state. Since the privatization reforms, residential mobility in Russia in general has increased significantly. Residential mobility in Moscow has also risen, but is limited due to the propiska system, the authors expect residential mobility to increase further once this control is lifted.

### 3.2.2 Private Ownership in Moscow

According to Daniell & Struyk (1997), private ownership in Russia increased from 32.6% in 1990 to 51.0% in 1994 (Table 2). Particularly in Moscow, private ownership has increased from 9.3 % of the housing market to 49.6% (Table 2).

|                      | 1990 | 1991 | 1992 | 1993 | 1994 |
|----------------------|------|------|------|------|------|
| <i>Russia</i>        |      |      |      |      |      |
| State-owned stock    | 67.4 | 67.2 | 64.4 | 53.2 | 49.0 |
| Private stock        | 32.6 | 32.8 | 35.6 | 46.8 | 51.0 |
| <i>Russia, urban</i> |      |      |      |      |      |
| State-owned stock    | 79.5 | 79.7 | 76.5 | 65.4 | 60.2 |
| Private stock        | 20.5 | 20.3 | 23.5 | 34.6 | 30.8 |
| <i>Moscow</i>        |      |      |      |      |      |
| State-owned stock    | 90.7 | 90.2 | 80.1 | 65.4 | 50.4 |
| Private stock        | 9.3  | 9.8  | 19.9 | 34.6 | 49.6 |

*Note:* Housing-construction cooperatives, previously treated separately, are now considered private stock.

*Source:* Pchelintsev *et al.* (1995a).

**Table 2: State-Owned Housing Stock vs. Private Stock over Years 1990-1994, Russia as a Whole vs. Urban Russia vs. Moscow Daniell & Struyk (1997).**

### **3.2.3 Housing Affordability in Russia**

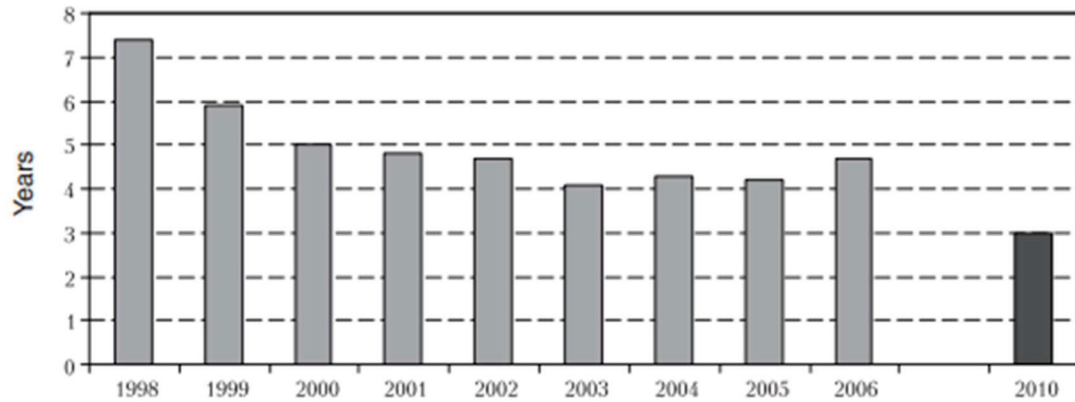
The next section looks at housing affordability in Russia, to see how the average income evolved compared to the average housing price. Our current analysis is primarily based on income but housing prices are also analysed, especially in research question 4, which is why housing affordability is worth looking into.

In the 1990s, the standard of living for many Russians declined and housing was unaffordable for a lot of them. The reason for this was partly the previously discussed rapid inflation and recession, other reasons were the lack of investment in new housing construction, outdated housing stock and lack of financing for a lot of Russians. Daniell & Struyk (1997)

According to Daniell & Struyk (1997), affordability increased during the 90s. They defined it as the house price-to-income ratio (how many times the annual household income is required to purchase a home at a median price) so a lower ratio was in line with a higher affordability. There was an increase in affordability partly attributed to the increasing supply of housing available for sale or rent in the new private market. Inside Moscow city housing construction was limited, however, construction boomed in the suburbs. The authors detailed how this was possible through the emergence of a risky system of short-term construction financing, which replaced the state financing of construction. The increase in the availability of housing financing improved affordability.

A recent study by Kosareva & Polidi (2021) also discussed the problem of housing affordability in length. They approached housing affordability as the number of years needed for a family to save all their income to purchase a housing unit. This is different from the previous study because here it is assumed that all income saved for the house is taken into account. They discussed a timeline from 2005 to 2020 when the Russian government started to push the development of the mortgage sector and attempted to make financing more accessible for the Russians. Traditionally, mortgages were infrequent in Russia, however, in recent years Russia took a couple of measures to promote the availability of mortgages. This increase in finance options led to higher housing affordability for a lot of people (Daniell & Struyk, 1997).

Kosareva & Tumanov (2008) gave a more analytical and relevant assessment of the housing affordability related to our data. It was observed that the United Nations housing price-to-income ratio went down significantly over the years 1998 to 2003, this was a positive evolution. However, it went back up after 2003 (Figure 1).



*Source:* Calculations by the Institute for Urban Economics using Rosstat data.  
*Note:* The figure for 2010 is the goal of the “Housing” Federal Targeted Program.

**Figure 1: Housing Affordability Index in Russia, 1998-2006 (Kosareva & Tumanov, 2008).**

### **3.3 Empirical Analysis**

This study aims to examine the relationship between housing privatization and various labour market outcomes using a combination of datasets. The datasets include information on various factors that are relevant to the study of housing privatization, such as the value of the properties, the age of the occupants, the household income, the type of ownership, and the location of the units.

### ***3.3.1 Impact of Housing Privatization on the Housing Market***

Previous research by Guzanova (1997) used similar data to analyse the impact of housing privatization on the market. The study provided a systematic review of sociological data related to the housing market, with a focus on the case of Russia. According to Guzanova (1997), the privatization of the housing market stagnated in 1996, and around 55% of the houses were privatized, even 60%-65% of the apartments in Moscow centre were privatized. The majority of which were luxurious or high-end units.

Guzanova (1997) considered several factors that are relevant to this research. First, the value of the property was determined by the market price, with the assumption that the higher the price, the more incentive there was to privatize. The study showed that houses closer to the city centre were more likely to be privatized, and since we have access to the zip codes of the residents we can use this information in our analysis. Second, demographic characteristics, such as age are also important. Guzanova (1997) argued that Muscovite pensioners constituted the highest level of privatization in Moscow and families with children were less likely to privatize.

Other than these variables Guzanova (1997) examined the influence of property value and income as well. The study concluded that lower-income households in Moscow privatized their dwellings more compared to higher-income households.

Overall, the research by Guzanova (1997) provided valuable insights and methods that can be implemented in this study. Similar data and methods are used to examine the relationship between housing privatization and various labour market outcomes.

Following the empirical study of Guzanova (1997) a few hypotheses can be investigated. First, regarding research question 2, the closer the unit is to the city centre, the more likely the unit is privatized. Second, relevant to question 1, the general privatization rate for Moscow is around 50% and above, after the stagnation of 1996, and privatization is related to income. Third, regarding question 3, that age has a significant impact on the privatization rate.

### ***3.3.2 Inequality in Wealth Following Transition***

Yemtsov (2007), and similarly Kosareva & Struyk (1993), stated that the effects of housing privatization might not have been as equitable as it seems. The arguments relevant to our study are the following.

First, under socialism, a clear disparity in the quality of housing was present. Elite citizens were provided with superior housing at no cost. These privileged individuals were able to capitalize on the transition, leveraging their social capital to gather even more advantages. Meanwhile the less fortunate received minimal benefits from the marketization of substandard housing on the outskirts of the cities (Yemtsov, 2007).

Second, the housing stock transferred through privatization may have had significant disparities in market value. Centralized planning in the past did not take into account land values, which resulted in a mismatch between the produced housing stock and the housing stock that would have been produced in a market-based economy. Research by (Bertaud & Renaud, 1997) concluded that in a market-based economy, the residential density was highest near the city centre where the land is most valuable and decreased by distance. Meanwhile, in contrast, the centralized planning system resulted in the opposite. High-rise apartment buildings were constructed on the city outskirts resulting in the highest residential density on the least valuable land (Yemtsov, 2007).

Despite Russia's egalitarian legacy, Russian housing privatization resulted in one of the most unequal distributions of housing stock and low-value housing. The differences in values between units that are privatized and others combined with the scale of privatization formed a significant factor in contributing to housing inequality. Privatization transferred a homogeneous stock to a sizeable fraction of households, who were at the top of the distribution. Consequentially, this increased inequality and thus homeownership was made more unequal by privatization. (Yemtsov, 2007).

## 4 Research Gap

Overall, the literature study was unable to address most of the research questions this study tries to answer. This research aims to shine a light on the privatization process in Russia and its effects on labour market outcomes. The privatization program began in the 1990s after the collapse of the Soviet Union and had a significant impact on the Russian economy as a whole and also on the individuals that were involved in it. Still, there is a lack of research focused on trying to understand the effects of this process on the economy and individual situations of many Russians, which made it difficult to align the literature review with the research questions. However, the literature review gives a comprehensive insight into the privatization process and several related topics.

In this thesis, the aim is to assess the effects of housing privatization by conducting an empirical study of the effects based on the datasets consisting of data regarding individual Muscovites over the years 1999 to 2004. The research questions we aim to answer are mentioned in section 2.3, but they can be summarized in one overall research question: ‘How has housing privatization in Russia affected the individual Russians in the labour market?’

This question is important and relevant for several reasons. First, privatization significantly impacted the economy and the individuals involved. The process affected millions of people and understanding the effects of this process on these individuals is crucial for policymakers and other stakeholders. There are still a lot of communist countries where most of the housing is state-owned and the effects of privatization could be very interesting information for policymakers there since the privatization of housing can have a significant impact on the labour market, the housing market, and by consequence the overall economic growth. Since the understanding of the interaction between house ownership and labour markets is underdeveloped, this thesis aims to contribute to the general knowledge and understanding of this process.

Second, this problem fits within the broader context of housing market studies. The key issues and barriers to this problem are the lack of data. Data on housing privatization in Russia is often incomplete or unavailable. For example, the Federal State Statistics Service (Rosstat), the official state statistics website is currently (2023) unavailable due to Russia blocking outside users, which impedes our data-gathering ability significantly. This makes it difficult to empirically study the effects of this process.

The empirical examination will be based on data collected through previous literature studies, which were mostly based on surveys and official statistics, and data gathered from leaked databases from official Russian sources.

## **5 Methodology**

### **5.1 Method Used in the Study.**

This study adopts regression analysis (RA). This analysis uses models to understand the relationship between the different dependent variables and one or more independent variables. The basic idea is to estimate the coefficients of the independent variables which makes it possible to interpret the effect of each independent variable on the dependent variable and predict the dependent variable based on the independent variables.

Multiple kinds of regression analysis can be used. In this study, we use logistic regression and linear regression. Logistic regression models the relationship between a binary dependent variable and other independent variables. It estimates the probability of the outcome variable taking a certain value, usually 1 while estimating how the independent variables contribute to the outcome variable. It fits a certain model to the datasets and returns the probability that a new data point has a variable equal to that certain value based on its location in the model. Here it is assumed that there is a linear relationship between the independent variables and the logit of the dependent variable. (Maklin, 2019)

Linear regression models the relationship between a continuous dependent variable and one or more independent variables. The dependent variable can be any value within a certain range, such as income. The independent variables can be continuous or categorical. It estimates the expected value of the dependent variable based on the values of the independent variables. It assumes that there is a linear relationship between both variables, and the errors are normally distributed with constant variance. (Montgomery et al., 2021)

### **5.2 Analysis of Differences Between Groups**

During the data analysis, a lot of statistical tests were conducted related to identifying differences between groups. To have statistically useful results, the following procedure has taken place to analyse each difference.

Firstly, check for normality using the Shapiro-Wilk Test ( $H_0$  (null hypothesis): the data is normally distributed) and test whether the variances of the groups are equal using Levene's test ( $H_0$ : variances are equal).

If the data is normally distributed and the variances equal, ANOVA is used to compare the means of groups and assesses if there is a significant difference between the means of the groups ( $H_0$ : all group means are equal). If there are only two groups which are normally distributed

and the variances are equal, a t-test is used, which compares the means of two groups (H0: equal means between the two groups).

If the variances are unequal and the data is not normally distributed, ANOVA and t-test are substituted with the Kruskal-Wallis test and the Mann-Whitney U test respectively. The Kruskal-Wallis test compares the medians of all groups and tests if they are equal (H0: medians of all groups are equal), and the Mann-Whitney U test compares the medians of two groups (H0: equal medians between the two groups).

**Data preparation:** Using Python, the three datasets are cleaned. Duplicates, unnecessary information, and outliers are dropped and necessary new columns are added. The analysis part goes over a more detailed description of this process.

### 5.3 Research Questions and Variables:

1. What is the relationship between the share of privatized housing in a specific region and the median income of individuals in that region?

The main goal is to identify a relationship between privatization and income.

To analyse this, the first analysis is based on the privatization rate per municipality. Municipalities are chosen instead of administrative districts or zip codes because the former has an area that's too big and the latter has an area that's too small to make defining conclusions. Following this, the percentage of privatized housing units is determined per municipality.

The municipalities with the lowest privatization rate are compared with the ones with the highest to determine whether there is a possible significant difference in income. First of all, the study compares the three ownership types and looks if there is a significant difference between the median income per ownership type based on the **analysis of differences between groups** section 5.2 (H0: median incomes are equal for each ownership type).

Following this, the evolution of the median income ratio per ownership type compared to the median income of privatized units over the years is analysed. This is done to give more insight into the evolution of incomes of different ownership types and how the median income for the different ownership types compares to the income of the privatized units. Only incomes lower than 10,000,000 RUB are considered.

Next, a new data frame is created per year containing the total number of each ownership type per municipal district and their ratio over the total number per municipality, followed by the median income per municipality. Two groups are created, above and under the interquartile

range. Based on the **analysis of differences between groups** section 5.2, the difference in median income between municipalities with low and high privatization rates are compared per year (H0: the median income is equal for municipalities with high and low privatization).

To analyse the relationship between the share of privatized housing in a region, the data is split up per year and the median income per municipality is regressed on the percentage of privatized units per municipality in that year. (H0: there is no relationship between the median income of a municipality and its privatization rate).

Lastly, the study analyses the relationship between the share of privatized housing for a certain income group unrelated to any region. The data is split into income intervals from 0 to 1,000,000 and the intervals are plotted against their respective privatization ratio. Then, using regression analysis, the relationship between the variables can be assessed. (H0: there is no relationship between income and privatization rate)

2. What is the relationship between the distance of a housing unit from the city centre and the privatization rate in that area?

Using the zip code database, it is possible to calculate the distance between the centre of Moscow and the given zip code per individual. Using the geopy Python package the latitude and longitude of the zip code are compared to the latitude and longitude of the centre of Moscow itself. These measurements give a good representation of the distance.

The scope of the research is Moscow so the study only considers data points that are maximally 200km outside of Moscow, which is the majority. The data is grouped in equally-sized intervals based on distances. First, the relationship between distance and the median income per distance group is analysed (H0: no relationship between distance from Moscow and median income), as well as the relation between the distances and their respective privatization rate (H0: no relationship between distance from Moscow and privatization rate).

3. What is the impact of homeownership type on the homeownership rate for different income groups, and what role does age play?

First, general statistics are gathered about the different ownership types and their respective ownership rates. Furthermore, the study analyses if there are significant differences in homeownership rates per ownership type based on the **analysis of differences between groups** section 5.2. (H0: no significant difference between ownership rates for the different ownership types).

The aim is to link the homeownership rate to income. Individuals are split up into equal-sized income groups and the mean ownership rate is calculated. These two variables are then plotted against each other and two different regressions are calculated, one for the groups with more than 1,000 observations, and one with fewer than 1,000 observations. The reason for this split is explained in section 6.2.3. On both datasets, a linear and a quadratic regression is analysed to give us insight into the relationship between income and homeownership rate. (H0: no relationship between income and homeownership rate).

Furthermore, based on the **analysis of differences between groups** section 5.2 it is determined if there is a significant difference between incomes for people with high ownership rates and people with lower ownership rates. (H0: no difference between incomes for people based on ownership rate).

4. How does the value of a housing unit affect the likelihood of that unit being privatized?

First of all, the study looks if the value of a housing unit is different for different ownership types. Based on the **analysis of differences between groups** section 5.2, the difference between the value of privatized and non-privatized units is assessed per year. (H0: no difference between the apartment value privatized or not). Secondly, the differences in value are assessed per ownership type (H0: no difference between the apartment value for different ownership types). After this, a logistical regression is made to assess the relationship between the binary variable, privatized or not, and the dependent variable indicating the value of the unit per year (H0: no relation between the likelihood of the apartment being privatized and the value of the apartment). Finally, the marginal increase in the probability of privatization based on a certain increase in apartment price is calculated.

5. What are the different apartment types and what is the difference between privatized and non-privatized units for the different types?

In this section, the different types of apartments are identified and categorized per relevant property. The identified properties are then compared between types that have privatized units and types that only have non-privatized units. Regarding the types that have privatized units, the difference in properties of privatized and non-privatized units was assessed.

(Table 3) gives an overview of the methods used with the relevant variables for each research question.

**Table 3: Overview Analysis Method per Research Question.**

| Research question | Analysis method     | Independent variable                              | Dependent variable             |
|-------------------|---------------------|---------------------------------------------------|--------------------------------|
| 1.                | Linear Regression   | Share privatized housing                          | Median income household        |
| 2.                | Linear Regression   | Distance from the city centre                     | Percentage of privatized units |
| 3.                | Linear Regression   | Percentage of privatized housing per income group | Homeownership rate             |
| 4.                | Logistic regression | Value of housing unit                             | Likelihood being privatized    |
| 5.                | Descriptive         | Type of apartment                                 |                                |

#### **5.4 Data Analysis and Interpretation**

Descriptive statistics were used to summarize the data, and regression analysis was used to estimate the relationship between the variables. The results were interpreted in the context of the existing literature on housing privatization in Russia.

#### **5.5 Visualization**

To be able to interpret the data visually, Matplotlib was used in Python as a tool for visualizing and analysing our data. Using this library various plot types could be generated such as line plots, scatter plots, bar plots, histograms and more. This was used to visualize data in order to support interpretation and answers to the research questions.

#### **5.6 Possible Biases**

Before we start our analysis we need to control for certain biases in the data. The most important potential sources of bias that should be examined and considered in the study are the following;

selection bias, measurement bias, confounding, data quality issues, endogeneity, and reverse causality.

It is important to note that from our understanding, the housing administration database primarily is focused on apartment buildings, not regular housing. This conclusion comes from the fact that the bulk of the data only consists of housing units with more than three floors. Consequently, our analysis is constrained to privatization in the Moscow apartment market, which could lead to inconsistencies with the conclusions of the previously discussed literature studies, which incorporated all types of housing in the study.

## 6 Analysis

### 6.1 Data Preparation

#### 6.1.1 Housing Administration

The housing administration dataset contains, as shown before, a lot of valuable information. The database starts with 9,291,418 rows. (Table A.2, Appendix)

First and foremost, the column names were translated into English and abbreviated where possible.

```
dfAnalysisAdmin.columns = ['AdminDistrict', 'MunDistrict', 'Full name', 'TotalArea',  
'LivingArea', 'NumFloors', 'YearBuilt', 'NumFlats', 'AptPrice', 'AptType', 'RoomArea',  
'AptArea', 'SN', 'DOB', 'DocumentType', 'DocSeries', 'DocNumber', 'IssueDate',  
'OwnershipType', 'OwnershipStart', 'OwnershipEnd', 'Percentage', 'AvgPropValue',  
'AvgLivSpace', 'Date of Birth', 'OwnStart']
```

In some columns, missing values are dropped. Not all can be dropped because of the extreme loss of data which it will result in. Only columns ['Full name', 'TotalArea', 'LivingArea', 'YearBuilt'] are cleared of missing values, otherwise, too much data will be lost. Other missing values will be dropped per separate analysis according to the needs of the analysis to be performed.

Next, duplicate entries are dropped. As well as rows with duplicate values of 'Full name' and 'Date of Birth' at the same time to delete double entries. This results in 3,647,872 rows left over.

Note that this database primarily consists of apartment data. It is important to keep this in mind regarding the interpretation of the results ensuing the analysis.

#### 6.1.2 Pension

Regarding missing values, only 5% of the pension data has no information about the income of the individual so these rows are deleted. Other columns with missing values are ignored because of lesser importance. The data regards the years 1999 to 2004, which results in a lot of duplicate names because they come back every year. To solve this problem the database is split into six different databases per year. (Table A.1, Appendix)

Now per separate datasets, the duplicates are deleted. First, all exact duplicates are deleted and then the duplicates are based on 'full name' and 'date of birth'. These six datasets are then merged with the administrative dataset based on 'full name'.

The resulting six different merged datasets, merged between the administrative dataset and the pension dataset per year are all merged into a dataset consisting of data over all the years. This general database consists of 13,946,696 rows.

### 6.1.3 Zips

Zip codes with missing values in the latitude or longitude columns are deleted. Using the latitude and longitude columns the geopy Python package calculates for each zip code the distance to Moscow. And based on the zip codes received in the pension dataset, the distance to Moscow is added to the general database used in the rest of the analysis.

## 6.2 Results

### 6.2.1 RQ 1: What is the relationship between the share of privatized housing in a specific region and the median income of individuals in that region?

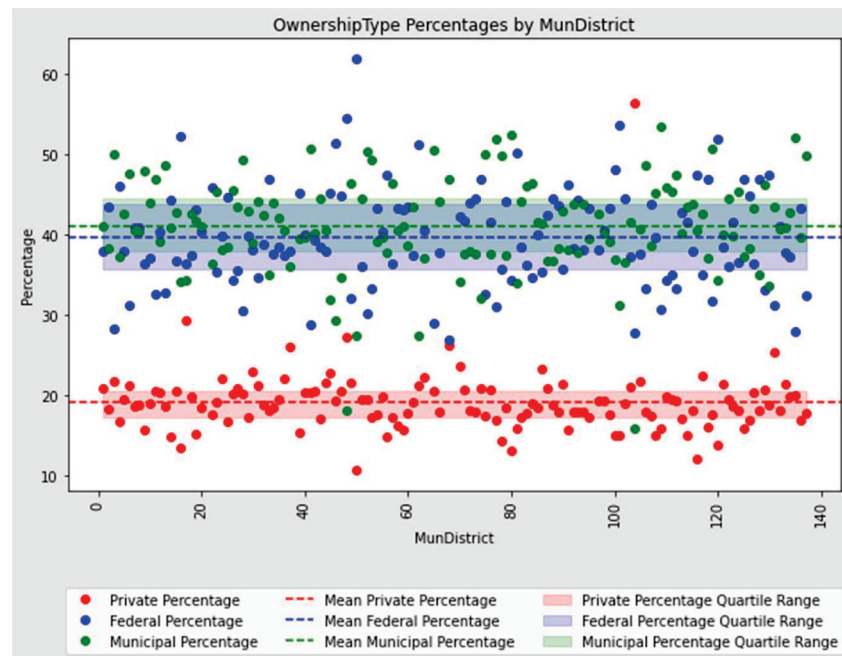
In (Table 4) you find the ratio of each homeownership type for each year, regardless of the municipality. Type 1.0 stands for municipal ownership, 2.0 for federal ownership and 3.0 for private ownership. It is clear that a low percentage of apartments are privately owned, this is contradictory to the 49.6% privatization rate in 1994 (Daniell & Struyck, 1997). This shows that apartments are much less privatized than regular houses.

**Table 4: Overall Ownership Type Rate per Year.**

| RATIO (%) | 1999  | 2000  | 2001  | 2002  | 2003  | 2004  |
|-----------|-------|-------|-------|-------|-------|-------|
| Type 1.0  | 42.22 | 42.18 | 42.73 | 43.11 | 42.99 | 43.00 |
| Type 2.0  | 37.36 | 37.38 | 36.41 | 35.82 | 35.94 | 35.77 |
| Type 3.0  | 20.42 | 20.45 | 20.87 | 21.07 | 21.07 | 21.23 |

Looking at municipality-specific data, the number of ownership types per municipality is counted and the percentage of privatization, federal property, and municipal property is calculated. (Figure 2) shows an overview of the average percentages over the years for the

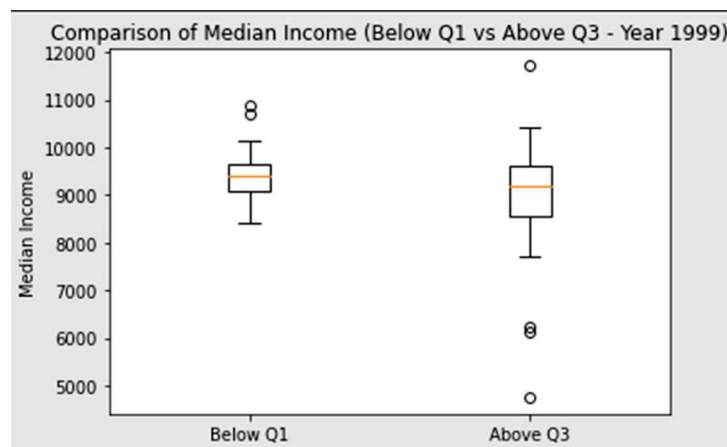
different municipalities. Again, it is clear that a much lower percentage of apartments are privately owned overall, but there are a few regions with much more or much less privatization.



**Figure 2: Ownership Type Percentages per Municipal District.**

Comparing the income per different ownership type for each year ( $H_0$ : median incomes are equal for each ownership type) according to the **analysis of differences between groups** section 5.2 results in a significant difference between each ownership type every year. Except for 2004, where the Mann-Whitney U test calculates an insignificant difference between type 2.0 and 3.0 ( $p$ -value = 0.4712) and between type 1.0 & 2.0 in the year 2000 ( $p$ -value = 0.084). Thus the null hypothesis is rejected every year, except in 2000 and 2004. (Table A.6.1, Appendix) depicts all median incomes for each ownership type for each year and (Table A.6.2, Appendix) shows the corresponding  $p$ -values.

Now look at the percentage of privatized units per municipality. To confirm if there is a significant difference



**Figure 3: Comparison of Median Income (RUB) for High and Low Privatization Rate.**

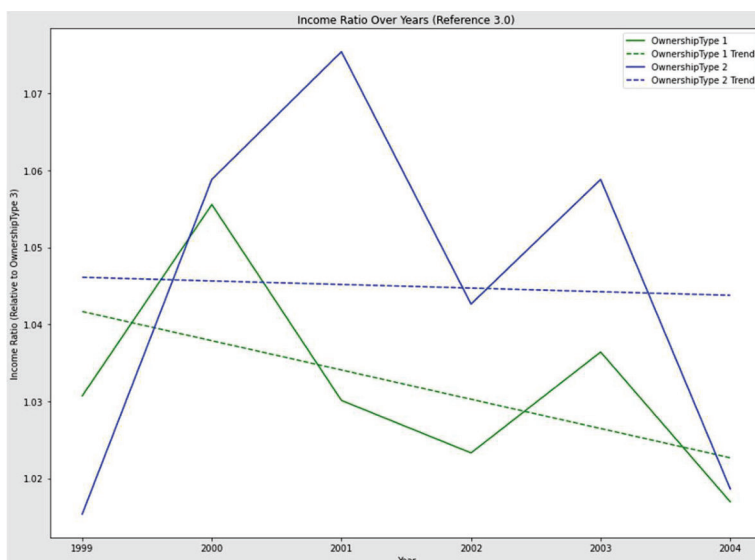
lower privatization and one with higher privatization the data is split up into two, one group of municipalities with a privatization percentage above Q3, and the other group consisting of municipalities with percentages below Q1. (H0: the median income is equal for municipalities with high and low privatization)

The resulting boxplot (Figure 3), shows the comparison of median income between these two groups for the year 1999. Following section 5.2 regarding analyzing differences between two groups of data. A Mann-Whitney U test with  $p\text{-value} = 0.088$  (median above Q3: 15,887.79, median below Q1: 16,146.35) concludes that, in general, municipalities with lower privatization have an insignificantly higher median income than municipalities with a higher privatization rate.

However, if we split up the data per year, the only year the Mann-Whitney U test identifies a significantly lower median income for higher privatized municipalities is 1999 ( $p\text{-value} = 0.0527$ ). The years 2000 ( $p\text{-value} = 0.182$ ), 2001 ( $p\text{-value} = 0.572$ ), 2002 ( $p\text{-value} = 0.287$ ), and 2003 ( $p\text{-value} = 0.243$ ) all have a higher median income for lower privatized municipalities, but the null hypothesis is unable to be rejected in these years. Lastly, 2004 has, contrary to other years, a higher median income for municipalities with higher privatization rates, however, this difference is again insignificant ( $p\text{-value} = 0.581$ ). This could indicate a shift over the years in difference in income for both groups, where higher-income groups privatized their apartments more and more over the years. (Table A.5, Appendix) presents the median income for both groups for each year, and their respective  $p\text{-values}$ .

Next, the evolution of differences in income over the years between the ownership types with type 3.0 as a reference is analysed.

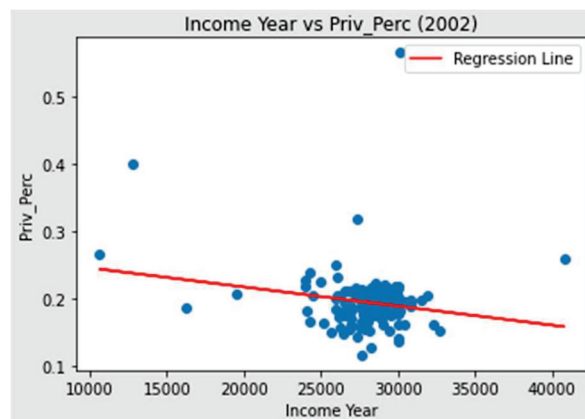
(Figure 4) shows that the median income is always lower for ownership type 3.0. The difference with ownership type 1.0 is in a declining trend. The difference with type 2.0 sharply rose in 2000 and



**Figure 4: Evolution Income Ratio over the Years (1999-2004) (reference type 3.0).**

2001 but enters a phase of decline after this. The median income related to privatized apartments is consistently lower than the other median incomes.

Another way to analyse the relationship between median income and share of privatized housing in a specific municipality is to plot the two variables and perform a linear regression per year (H0: there is no relationship between the median income of a municipality and its privatization rate). The year 1999 has an insignificant negative relationship (p-value = 0.082), 2000 (p-value = 0.633), 2001 (p-value = 0.546) and 2004 (p-value = 0.578) all have a similar insignificant, negative relationship. However, the years 2002 (p-value = 0.028) and 2003 (p-value = 0.001) do have a significant negative relationship between income and the privatization rate in the municipality. This indicates that most lower-income municipalities are associated with a higher privatization percentage.



**Figure 5: Share of Privatization vs. the Median Income (RUB) per Municipality (2002) (p-value = 0.028).**

(Figure 5) represents this relationship for the year 2002.

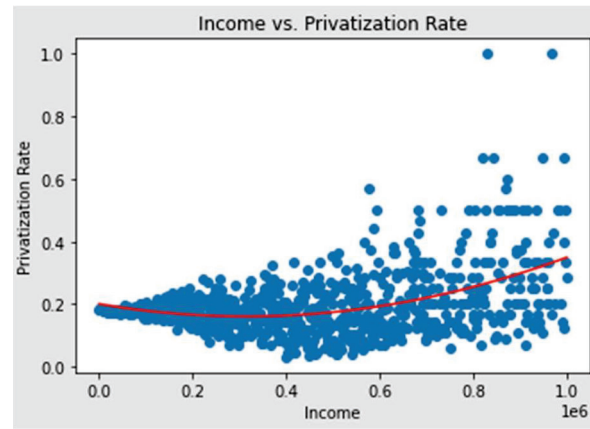
Instead of focusing on the relationship between income and privatization on a municipal level, investigating the relationship between income and privatization on an individual level gave a lot of insight. This was analysed using equal-sized income intervals from 0 to 1,000,000 RUB. The privatization rate over these intervals was calculated and the two were plotted for each year (H0: there is no relationship between income and privatization). A whole other relationship became visible (Figure 6). Using linear and quadratic regression, it was found that there is a significant negative linear relationship between income and privatization rate. And at the same time, a significant convex relationship between the variables is found. (Table 5) contains the resulting p-values for each regression for each year. Only in 2004, the relationship is insignificant.

| P-value | Linear | Quadratic |
|---------|--------|-----------|
| 1999    | 0.000  | 0.000     |
| 2000    | 0.000  | 0.000     |
| 2001    | 0.000  | 0.000     |
| 2002    | 0.011  | 0.028     |
| 2003    | 0.004  | 0.000     |
| 2004    | 0.226  | 0.323     |

**Table 5: P-values Linear and Quadratic Regression per Year (Income vs. Privatization rate).**

These results suggest that as income increases, the privatization rate decreases. However, there is a convex relationship, this indicates that the privatization rate decreases at first following an increase in income, but after the minimum of the curve, the relationship becomes positive indicating an increase in the privatization rate for higher incomes in this range. This relationship is visible for the year 2000 (Figure 6).

The results in this section suggest that lower-income households privatized their apartment units more than higher-income groups. This is in line with the literature study in section 3.4.1 where Guzanova (1997) states that lower-income households privatized their units more than higher-income households. However, we can add that for higher incomes an increase in income is associated with a higher privatization rate



**Figure 6: Income (RUB) vs. Privatization rate (2000).**

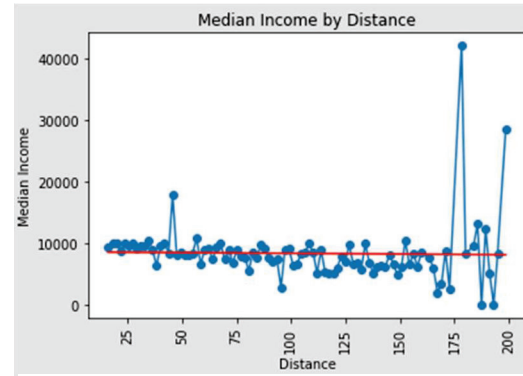
### 6.2.2 RQ 2: What is the relationship between the distance of a housing unit from the city centre and the privatization rate in that area?

To calculate the distance between the housing unit and the city centre, the zip code database was used. Based on the longitude and latitude, using the geopy Python package a new column was created containing the distance to Moscow for each zip code.

Firstly, the analysis looks at the median income per zip code compared with the distance of that zip code from Moscow. The analysis splits the data into different scopes of distance to analyse the role income plays in distance from the city centre more effectively. It is based on 100 equal-sized intervals, each interval associated with its median income. (H0: there is no relationship between distance from Moscow and median income)

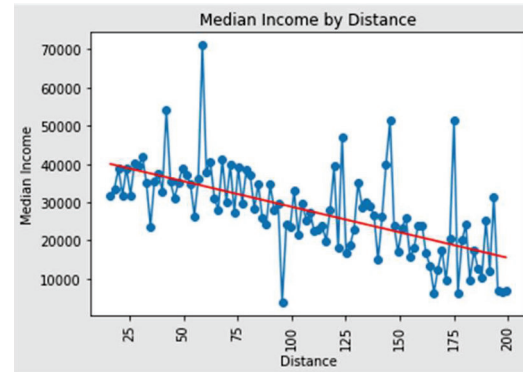
The biggest problem we have is that the absolute bulk of the data has zip codes in the centre of Moscow, and the zip codes closest to the centre lack information because they all have the same distance from Moscow. Only from around 15km out of the centre, there is a lot of data that can be analysed using regression. The rest falls under the Moscow centre zip codes and we cannot know the exact distance of the housing unit from the centre. From 0km to 15km out of Moscow, there are only five data points. From then on, the information is much more detailed.

The first analysis looks at 15km to 200km out of Moscow, in the years 1999 (Figure 7), 2000, and 2001 there is no significant relationship between the distance from Moscow and the median income. However, there is a significant decline in median income in this range for the years 2002 (p-value = 0.005), 2003 (p-value = 0.000), and 2004 (p-value = 0.000) (Figure 8).



**Figure 7: Median Income (RUB) Per Distance (km) (1999) (p-value = 0.808).**

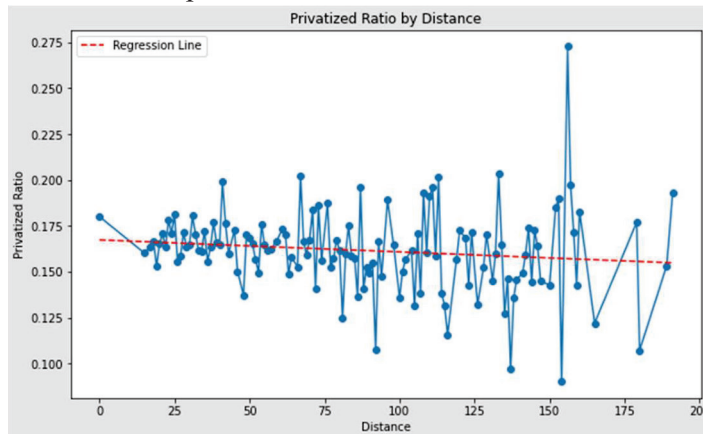
Zooming in over this range, looking at distances 15km to 100km from Moscow, the median income only has a significant negative relationship with the distance to Moscow for the years 1999 (p-value = 0.002) and 2004 (p-value = 0.016), the other years do not show a significant relationship. From 100km to 150km there is no significant relationship anywhere. Lastly, from 150km to 200km, there is a significant positive relationship in the year 2001 (p-value = 0.015), and a significant negative relationship in the year 2003 (p-value = 0.002). Overall, regarding distances between 0 to 200km from Moscow the median income significantly decreases for years 2002 (p-value = 0.016), 2003 (p-value = 0.000) and 2004 (p-value = 0.000). The years before there was no significant relationship. All distances out of this range are considered to be outside of the scope of this analysis.



**Figure 8: Median Income (RUB) Per Distance (km) (2004) (p-value = 0.000).**

These results indicate that there was a shift after 2001, which resulted in a significant negative association between median income and distance from Moscow. Consequently, the null hypothesis can be rejected for the years 2002 to 2004.

To answer the research question, the evolution of the privatization rate over distance from Moscow is analysed (H0: there is no relationship between distance from Moscow and the privatization rate). By plotting distance intervals and their respective ownership ratios for each year, this relationship can be analysed. Splitting the distance from 0km to 200km in 200 separate intervals with a minimum of 50 observations each. There is no visible pattern spotted and when regression analysis is applied, there is no



**Figure 9: Privatization Ratio Per Distance (km) From Moscow (2000) (p-value = 0.134).**

significant relationship between the distance from Moscow and the privatization ratio in any year thus the null hypothesis is unable to be rejected. This is unexpected because, following the reasoning of Guzanova (1997), it was expected that low-income groups who live further away from the centre would have a higher privatization rate (Figure 9).

### 6.2.3 RQ 3: What is the impact of homeownership type on the ownership rate for different income groups, and what role does age play?

There is no definite interpretation of what the column ‘percentage’ in the data is, but within reasonable suspicion, it is the percentage of the house the person fully owns privately, and is not the property of institutions or other people. From now on referred to as ‘ownership rate’.

First, we analyse the difference in ownership rate per ownership type, there are three ownership types. 1.0, 2.0 and 3.0. 1.0 stands for municipal ownership, 2.0 stands for federal ownership and 3.0 stands for private ownership. If we look at the data there are zero occurrences of a 100% ownership rate for the 4,778,955 ownership type 1.0 individuals, the mean ownership rate for this type is 39.57% with a standard deviation of 1.13. Regarding type 2.0, all corresponding ownership rates are 100% and finally regarding ownership type 3.0, 99.16% of the individuals have a 100% ownership rate. The mean homeownership rate is 99.58% with a standard deviation of 4.84.

However, when checking for significant differences using the **analysis of differences between groups** section 5.2 (H0: there is no significant difference between ownership rates for the

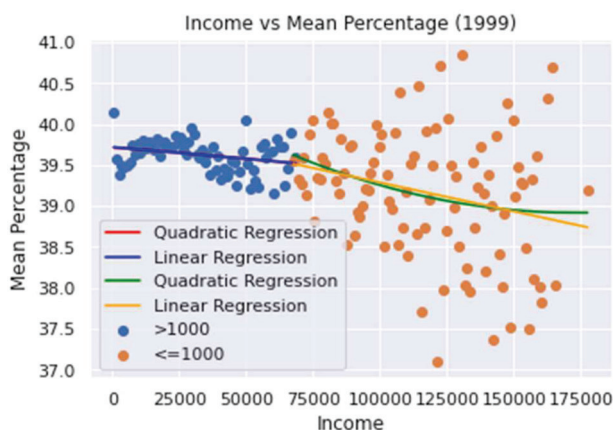
different ownership types). The results indicate a significant difference between homeownership rates for each homeownership type. This is not expected because it seems that the data for ownership types 2.0 and 3.0 are very close to each other.

This is probably because a Mann-Whitney U test is used. Type 2.0 has a uniform distribution, in contrast to the skewed distribution for type 3.0. Even though the medians are equal, according to the test there is a significant difference between them each year. In general, privatization is associated with a very high percentage of ownership.

Because of the very limited amount of data for type 3.0 regarding ownership percentages lower than 100%, it is difficult to make a definite conclusion about the relationship between income and ownership percentage regarding type 3.0. However, there is data regarding type 1.0 that can shed light on this relationship. The data is split into income intervals per 1,000 RUB of which the mean homeownership percentage is calculated and plotted against the mean of each interval (H0: there is no relationship between income and homeownership rate). The result in each year shows a negative trend, but the higher the income, the more spread out the percentage is which obscures possible interpretation.

This is because lower-income intervals have more data than higher-income intervals. To solve this, the data for each year is split up into two groups, one where all intervals have more than 1,000 observations (group 1, blue), and one where all intervals have fewer than 1,000 observations (group 2, orange). This way the relationship can be investigated for two income groups at the same time. One containing fewer observations per interval and relevant for high-income households and another containing more observations per interval and relevant for low-income households.

Each year, linear and quadratic regression is applied to both groups, (Figure 10) shows this for the year 1999. The quadratic regression is added due to emerging patterns in the data when plotted. These patterns indicate a quadratic relationship and are worth looking into.



**Figure 10: Income (RUB) vs Ownership Percentage (Type 1.0) (1999).**

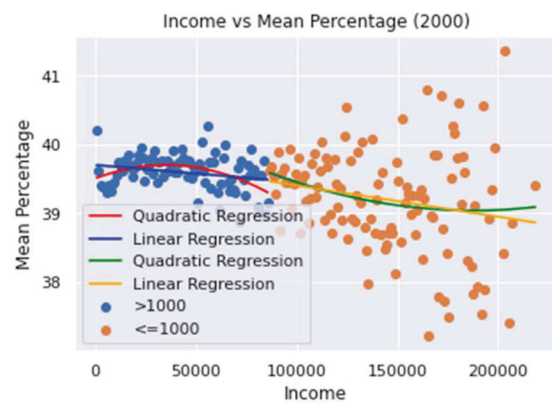
Regarding 1999, (Figure 10), the mean percentage significantly decreases when the income increases for both groups (blue: p-value = 0.0197, orange: p-value = 0.0111). The quadratic regression does not fit significantly for both groups.

Looking at the year 2000 (Figure 11), there is again a significant negative relationship in both groups (blue: p-value = 0.0272, orange: p-value = 0.0292). However, there is a significant quadratic relationship for the first group (p-value = 0.0015). This indicates that starting from 0 to around 50,000 the ownership percentage increases, but after that, the ownership percentage decreases again.

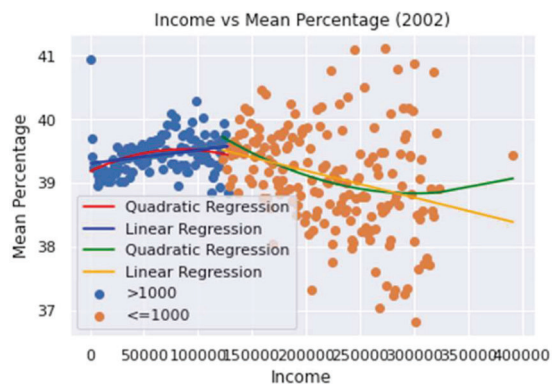
The same can be said about 2001 (Figure A.1, appendix), although the linear regression is not significant for the first group (p-value = 0.8988), the quadratic regression is significant in group 1 (p-value = 0.000) and the quadratic relationship in group 2 is also significant (p-value = 0.0037) and has a convex shape. The linear regression of group 2 is also significant (p-value = 0.0003).

In 2002 (Figure 12), the data indicates a shift regarding the first group. Instead of a negative relationship, there is a significant positive relationship. Regarding groups 1 and 2 there is a significant linear (p-value blue = 0.0048, p-value orange = 0.000) and quadratic regression (p-value blue = 0.0057, p-value orange = 0.002). Group 1 is again concave and group 2 is convex.

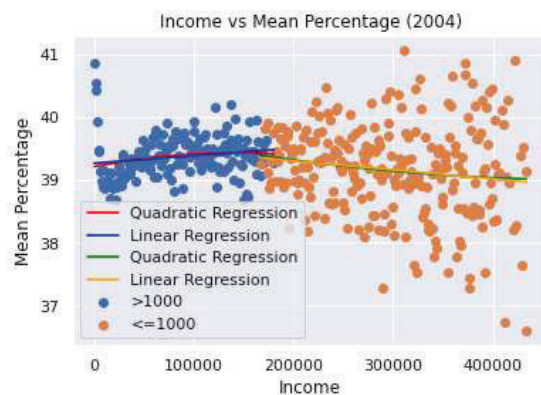
In 2003 (Figure A.2, appendix) the trend of a positive relationship for group 1 is again hinted



**Figure 11: Income (RUB) vs Ownership Percentage (Type 1.0) (2000).**



**Figure 12: Income (RUB) vs Ownership Percentage (Type 1.0) (2002).**



**Figure 13: Income (RUB) vs Ownership Percentage (Type 1.0) (2004).**

at, but there is no significant relationship. The linear regression for group 2, which again indicates a negative relationship, has a p-value = 0.0554 and as a result, is slightly insignificant. Lastly, looking at 2004 (Figure 13), there is again a significant positive relationship in group 1 (p-value = 0.0197) and a significant negative relationship in group 2 (p-value = 0.0269), the quadratic fit is not significant in both groups.

This information gives us an insight into the relationship between income and homeownership rate, albeit only for ownership type 1.0. The rejection of the null hypothesis was very much dependent on the income group, the regression method and the respective year. The study concludes that before 2002, there was a negative relationship between income and ownership percentage for lower-income apartment owners, but it shifted to a positive relationship in the years after. For higher-income groups, the relationship remained negative.

Next, the study investigates if there is a significant difference in the incomes of individuals with a high ownership percentage and a low ownership percentage. ( $H_0$ : there is no difference between incomes for people based on their ownership rate of privatized units). Looking at the number of observations per interval regarding ownership type 3.0, the optimal intervals to determine if there is an income difference between high and low ownership percentages seem to be [0, 35] and [65, 99]. 100% ownership is left out because the number of observations would skew the data. The resulting Mann-Whitney U test indicates that the difference is insignificant (p-value = 0.4437), thus the null hypothesis cannot be rejected.

Lastly, the conclusion of Guzanova (1997) that older people have a higher privatization rate is tested. The null hypothesis entails that there is no relationship between age and the privatization rate for that age. Assuming homeownership starts from a minimum of 20 years old. After calculating the percentage of units privatized per unique age. The linear regression makes it clear that in the first years, from 1999 to 2002, there is a significant positive correlation between age and privatization rate and the null hypothesis can be rejected. (Table 6)

However, after 2002, this correlation becomes insignificant and the null hypothesis cannot be rejected anymore. (Table 6) shows the different p-values of this linear regression for each year. This indicates this shift after 2002. In (Figure 14) this shift is easily detectable, in 1999 there is a clear positive slope, by 2004 this slope has evolved into an almost flat curve. A possible explanation is that a lot more young people have homes and privatize them while regarding older ages, not much changes. This creates more nuance in the insights Guzanova (1997) provided.

**Table 6: P-values Linear Regression of Privatization Rate on Age, each Year.**

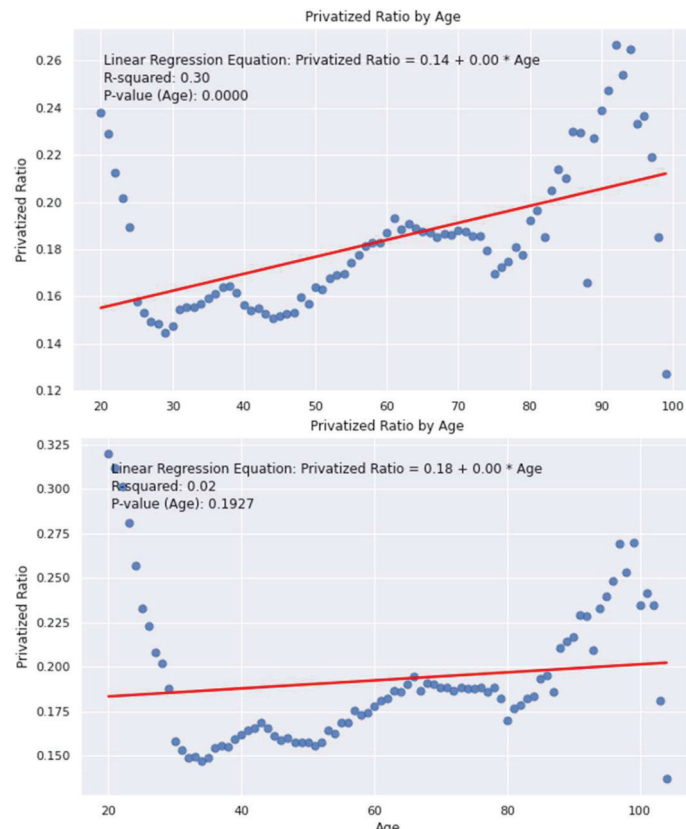
| Year | P-value |
|------|---------|
| 1999 | 0.000   |
| 2000 | 0.000   |
| 2001 | 0.000   |
| 2002 | 0.008   |
| 2003 | 0.055   |
| 2004 | 0.193   |

Furthermore, there is an obvious U-shaped pattern in the plotted data. When fitting a quadratic regression to this data, each year has a statistically significant quadratic relationship between age and the privatized ratio (Table A.7, Appendix). This indicates that younger people, aged 20-30 have a

high privatization percentage, while middle-aged groups and families with children have fewer privatized units and finally, elderly people have a higher privatization percentage. Shown in (Figure 15) for the year 1999.



**Figure 15: Privatized Ratio by Age (Quadratic) (1999).**



**Figure 14: Privatized Ratio by Age (Above: 1999, Below: 2004) (Linear).**

In conclusion, privatization results in a very high homeownership rate and no significant difference in income between high and low ownership percentages. However, when the unit is not privatized but is the property of the municipality, income has different effects on the homeownership rate for high-income groups and low-income

groups and these effects change over time. Regarding age, Guzanova (1997) was right that older

people have a higher privatization ratio, and middle-aged families with children have low privatization. Still, over the years more and more young people privatized their apartments which led to a U-shaped distribution. Younger people have a high privatization rate, it decreases until around the age of 30 and then gradually increases again.

#### **6.2.4 RQ 4: How does the value of a housing unit affect the likelihood of that unit being privatized?**

First of all, the analysis looks if there is a significant difference between the prices of apartment units for units that are not privatized and those that are. The first null hypothesis says, there is no difference between the prices of privatized or non-privatized apartment units. The second null hypothesis states, there is no relation between the apartment price and the likelihood of the unit being privatized. Following the analysis of differences between groups in section 5.2, for each year a Mann-Whitney U test indicates that there is a significant difference between apartment units that are privatized and units that are not, therefore the first null hypothesis is rejected. Privatized apartment units are overall associated with a higher apartment value than non-private apartment units.

Furthermore, a logistical regression is applied each year to calculate the impact of the apartment price on the likelihood that the apartment is privatized. The regression indicates that each year, there is a positive relation between the value of the apartment and the likelihood of it being privatized. Therefore, the second null hypothesis can also be rejected. (Table 7) shows the p-values of the Mann-Whitney U test for each year, and the p-value of the logistic regression along with the median apartment price for non-privatized and privatized units.

**Table 7: P-values of Mann-Whitney U Test (Apartment Price Privatized vs Non-Privatized) and Logistic Regression (Apartment Price vs Likelihood of Privatization) for each Year. Median Price of Non-Private and Private Units Each Year.**

| Year | P-value (Mann-Whitney U) | P-value (Logistic regression) | Median price (non-private) (RUB) | Median price (private) (RUB) |
|------|--------------------------|-------------------------------|----------------------------------|------------------------------|
| 1999 | 0.000                    | 0.000                         | 280,329.0                        | 293,271.0                    |
| 2000 | 0.000                    | 0.000                         | 280,382.0                        | 293,383.0                    |
| 2001 | 0.000                    | 0.000                         | 282,247.0                        | 295,017.0                    |
| 2002 | 0.000                    | 0.000                         | 282,274.0                        | 294,960.0                    |

|      |       |       |           |           |
|------|-------|-------|-----------|-----------|
| 2003 | 0.000 | 0.000 | 281,778.0 | 294,419.5 |
| 2004 | 0.000 | 0.000 | 282,720.0 | 295,261.5 |

Next, the differences in apartment prices between the three different ownership types were analysed (H0: there is no difference between the apartment value for different ownership types). Following section 5.2 a Kruskal-Wallis test concludes that there is a significant difference in housing prices between the three different ownership types each year (p-value = 0.000). Following a pairwise Mann-Whitney U test (all p-values = 0.000), we can conclude that there is a significant pairwise difference between all of the ownership types for each year. (Table 8) shows the median apartment price for each ownership type. Ownership type 2.0 has the lowest price, while ownership type 1.0 has the highest price. The privatized units of type 3.0 are closer to type 1.0, but still somewhat lower. This is expected because our previous research indicated that privatization was not associated with higher income, thus privatized units are probably not the most expensive apartments.

**Table 8: Median Apartment Price (RUB) per Ownership Type per Year.**

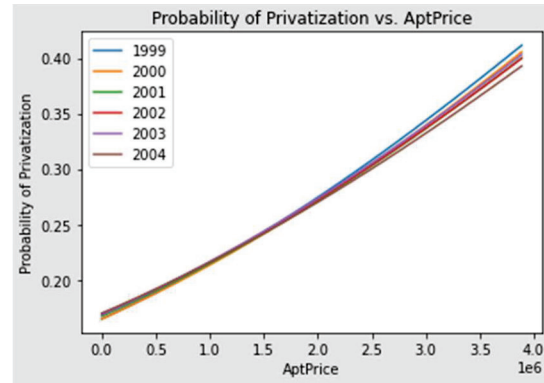
| Year | Median price Type<br>1.0 | Median price Type<br>2.0 | Median price Type<br>3.0 |
|------|--------------------------|--------------------------|--------------------------|
| 1999 | 317,299.0                | 247,300.0                | 293,271.0                |
| 2000 | 317,228.0                | 247,608.0                | 293,383.0                |
| 2001 | 318,613.5                | 248,201.0                | 295,017.0                |
| 2002 | 318,445.0                | 247,667.0                | 294,960.0                |
| 2003 | 317,898.0                | 247,296.0                | 294,419.5                |
| 2004 | 318,825.0                | 247,898.0                | 295,261.5                |

To calculate the change in probability of the apartment being privatized in function of the apartment price, using logistic regression, the probability of privatization when the price is equal to the mean is calculated. (Table 9) shows the changes in the probability of privatization when the price is incrementally increased.

**Table 9: Changes in the Probability of Privatization Related to a Change in the Apartment Price (RUB) (1999).**

| Price (RUB)                     | Probability of privatization | Change in probability |
|---------------------------------|------------------------------|-----------------------|
| 214,151.29 (mean – 100,000)     | 17.49%                       | (-) 0.45%             |
| 304,151.29 (mean – 10,000)      | 17.90%                       | (-) 0.04%             |
| 314,151.29 (mean)               | 17.94%                       |                       |
| 324,151.29 (mean + 10,000)      | 17.98%                       | (+) 0.04%             |
| 414,151.29 (mean + 100,000)     | 18.40%                       | (+) 0.46%             |
| 1,314,151.29 (mean + 1,000,000) | 22.99%                       | (+) 5.05%             |

(Figure 16) shows the relationship between the probability of privatization and the apartment price for prices between 0 and 4,000,000 RUB. It shows a clear positive relationship between the apartment price and the probability of privatization.



**Figure 16: Probability of Privatization vs. Apartment Price (RUB) (All years)**

In conclusion, there is a significant difference between the non-privatized apartment prices and the prices of those that are privatized. Secondly, privatized units are not the most expensive units. Lastly, all logistical regressions performed over every year showed a clear positive coefficient regarding the apartment price, which means there is a positive relation between the likelihood to be privatized and the price of the housing unit. This is further shown by the positive relationship between apartment prices and the probability of privatization (Figure 16).

#### **6.2.5 RQ 5: What are the different apartment types and what is the difference between privatized and non-privatized units for the different types?**

After cleaning up the data of all missing values for the column 'apartment type', the remaining data contains 170,561 units that are privatized, 1,183,091 units that are under federal control, and 1,044,401 units under municipal control. As expected, there are a lot fewer apartment units privatized.

First of all, the different apartment types need to be identified. They are categorized per average price, number of floors, building age, property value, and income.

(Table 10) shows the different characteristics of each apartment type, namely the percentage of units privatized, federal or municipal over the years. Next, the price of the unit is calculated based on the mean of the median price every year. The number of floors is based on the mean number of floors each year of each apartment type. Building age is based on the mean age of the building from that type. Income is based on the means of the median income over the years. And lastly, property value is based on the mean of the mean property value over the years.

**Table 10: Descriptive Characteristics per Apartment Type.**

| Type | Priv(%) | Fed(%) | Mun(%) | Apt Price (RUB) | N° of Floors | Age | Income (RUB) | Prop Value (RUB) |
|------|---------|--------|--------|-----------------|--------------|-----|--------------|------------------|
| 1    | 6.73    | 45.62  | 43.42  | 273,741.91      | 11           | 50  | 22,865.65    | 314,945.11       |
| 2    | 4.62    | 29.23  | 60.00  | 245,977.58      | 7            | 58  | 21,954.94    | 303,863.07       |
| 3    | 6.02    | 60.17  | 25.56  | 305,536.25      | 8            | 62  | 21,965.58    | 315,656.25       |
| 4    | 7.34    | 42.72  | 45.42  | 320,477.33      | 9            | 57  | 22,572.70    | 317,280.76       |
| 5    | 0.00    | 14.05  | 85.94  | 354,284.25      | 13           | 43  | 23,717.80    | 318,284.21       |
| 6    | 0.00    | 11.53  | 88.46  | 343,848.58      | 13           | 44  | 29,003.02    | 317,755.17       |
| 7    | 0.00    | 0.00   | 100.00 | 383,952.33      | 13           | 51  | 20,666.83    | 310,519.18       |
| 9    | 0.00    | 63.63  | 36.36  | 334,999.16      | 14           | 43  | 36,656.63    | 303,245.21       |
| 11   | 0.00    | 55.00  | 45.00  | 345,328.50      | 13           | 43  | 23,193.21    | 393,475.83       |
| 13   | 0.00    | 13.33  | 13.33  | 235,348.16      | 8            | 70  | 18,735.27    | 319,270.31       |
| 14   | 2.37    | 31.36  | 62.13  | 309,113.08      | 7            | 68  | 18,829.74    | 314,904.61       |

This table consists of data which take the mean of the data over the years. From this table, it is possible to identify certain characteristics regarding each apartment type. There are only five apartment types where privatized units are prevalent. 1, 2, 3, 4 and 14. Looking at the median income privatized units are associated with lower median income, privatization is also associated with lower apartment prices, older buildings and a lower property value. It is noteworthy that the number of floors and number of flats for the partly privatized apartment types are much lower than in apartment types with only non-privatized units.

Looking at the difference between privatized and non-privatized units within apartment types 1, 2, 3, 4 and 14 (Table A.4, Appendix), there is no significant difference between the median income of people that did or did not privatize their unit regarding types 2, 3 and 14. But there is a significant difference between types 1 and 4.

Furthermore, there is a significant difference between the apartment living areas for the two groups. All types, except apartment type 2, have significant differences in living areas. For types 1, 3 and 4 privatized apartments have a significantly larger area than non-privatized units. Only type 14 has a significantly lower area for privatized units than non-privatized units. (Table A.8, Appendix)

On average, the apartment price is also significantly higher for privatized units than non-privatized units for types 1 and 3, the apartment price is significantly lower for privatized units of type 2. (Table A.9, Appendix)

Based on this, we can conclude that apartment types with privatized units are older, less expensive, and have a lower number of floors on average. This reinforces the results reported by Guzanova (1997), lower-income households have privatized their units more than higher-income households

## 7 Conclusion

This study was aimed at investigating the effects of Russian housing privatization on the labour market. Data related to the labour market was limited, only income was a viable variable. However, the analysis did generate some valuable insights into aspects related to privatization and the housing market. Key findings of the analysis were that privatization is associated with lower median income, higher apartment prices, and age.

This study had a lot in common with the study of Guzanova (1997). It confirms that age has a significant impact on the privatization rate and older people have a higher privatization ratio. However, unlike Guzanova (1997), it shows that younger people, who are just beginning to become homeowners, privatize their units more and more. Guzanova (1997) argues that apartments closer to the city centre are more likely to be privatized, this study had no data available to investigate the privatization inside the city centre but concludes that there is no significant relationship between the privatization ratio and distance in a radius of 15km to 200km from Moscow city centre. Furthermore, Guzanova (1997) argues that privatization is linked with lower-income groups. This is confirmed in our analysis, however, starting from a certain high-income level the privatization rate increases again.

Blanchflower & Oswald (2013) argued that due to privatization, more unemployment is present which means incomes go down, this study does confirm that privatization is higher for households with low income. However, due to a lack of data, this cannot be linked to unemployment resulting from privatization. Coulson & Fisher (2009) argued the opposite, privatization can lead to higher income because there is more incentive to invest in the local jobs available. This could explain why after a certain level of high income, the privatization ratio goes back up. However, due to a lack of extra data, this cannot be confirmed. Regarding income, this study confirms that privatization can be linked to lower-income groups, but at the same time to high-end income groups as well.

According to Daniell & Struyk (1997), almost 50% of all housing was privatized in Moscow, this is in contrast to around the almost 20% average privatization rate encountered during the analysis. Guzanova (1997) states that in the Moscow city centre, 60%-65% of the apartments were privatized, of which the majority were luxurious or high-end units. Because the used dataset was based on apartment data, and still got a low privatization percentage, this means that the dataset consisted of low-end, less luxurious units. Related to this, the analysis indicates that there is a relationship between the value of the unit and the privatization rate, the higher the apartment price, the higher the probability of privatization. This falls in line with the fact

that more high-end units and more expensive units in the city centre were privatized according to Guzanova (1997).

Regarding methodology, the available data was not optimal to analyse the impact of privatization on the labour market. The accessible housing data (low-end apartments), the time scope (1999-2004), and the data related to the labour market were limited. Only income over the years was available and online Russian government databases were inaccessible due to political tensions. However, the analysis did generate valuable insights into dynamics and properties related to privatization, which contribute to the general understanding and knowledge of the subject.

Overall, the analysis concluded the following.

Research question 1: What is the relationship between the share of privatized housing in a specific region and the median income of individuals in that region?

- Most of the time, there is a significant difference between the median incomes related to different ownership types. The median income for privatized units is always the lowest.
- In 2002 and 2003, lower median income per municipality is related to a higher privatization rate.
- On an individual level, an increase in income is related to a lower privatization rate, but after a certain level of high income, the privatization rate increases again.

Research question 2: What is the relationship between the distance of a housing unit from the city centre and the privatization rate in that area?

- After 2001 a shift occurred which led to a significant negative relationship between income and distance from Moscow, resulting in households closer to Moscow centre having a higher median income.
- There is no significant relationship between distance from Moscow and the privatization ratio in that area.

Research question 3: What is the impact of homeownership type on the ownership rate for different income groups, and what role does age play?

- There is a significant difference in homeownership rates for each ownership type.
- Privatization results in a very high homeownership percentage.
- Regarding lower income groups, the linear relationship between income and ownership percentage shifted from negative to positive starting in 2002.

- For high-income groups, the linear relationship between income and homeownership percentage stayed negative.
- Regarding privatized units, there is no significant difference in income between groups with high ownership percentages and low ownership percentages.
- Regarding the relationship between age and privatization ratio, a U-shaped curve is found. More and more young people are privatizing their units, and middle-aged households have fewer privatized units, but the older these middle-aged households get, the higher the privatization rate. Finally, pensioners again have a high privatization rate.

Research question 4: How does the value of a housing unit affect the likelihood of that unit being privatized?

- There is a significant difference between the median price of privatized apartments compared to non-privatized apartments. Privatized apartments are more expensive.
- There is a significant positive relationship between the apartment price and the probability of the apartment being privatized.
- There is a significant difference between median prices related to the different ownership types. Still, privatized apartments do not have the highest median price.

Research question 5: What are the different apartment types and what is the difference between privatized and non-privatized units for the different types?

- Apartment types with privatized units are older, less expensive, and have a lower number of floors on average.
- Privatized units are associated with larger living areas and higher apartment prices.

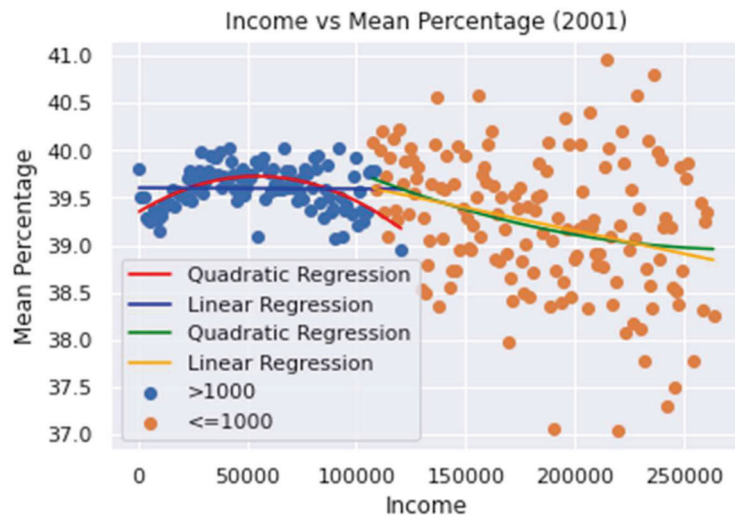
While this study has certain limitations, it identifies several gaps regarding possible future research. First, the reasons behind the convex relationship between privatization and income are unknown. Second, regarding the second research question, the reason behind the identified shift in the relationship between income and distance from Moscow after 2001 is unknown. Third, regarding research question three, it is unclear why higher-income groups always have a significant negative relationship between income and ownership percentage, while it shifts for lower-income groups. Lastly, the study does not give insights into the effects of privatization on housing affordability. All these factors are worth looking into regarding future research.

The overall study may not be representative of the Russian housing market as a whole and the effects may have been biased due to external factors worth looking into in the future, such as inflation, recessions, unemployment, a lack of data... However, it contributes valuable insights into housing privatization and its properties and adds to the general knowledge in the field of housing privatization.

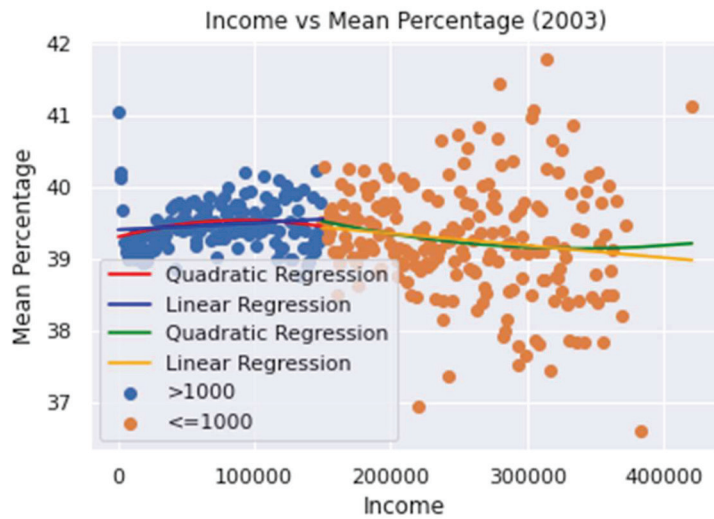
I declare that the research was conducted in accordance with the rules governing scientific and academic integrity. I have read, and acted in accordance with, the Code of Ethics of the Faculty.

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## 8 APPENDIX



**Figure A.1: Income (RUB) vs Ownership Percentage (Type 1.0) (2001).**



**Figure A.2: Income (RUB) vs Ownership Percentage (Type 1.0) (2003).**

**Table A.1: Pension Database Details.**

|                                           |
|-------------------------------------------|
| Pension database                          |
| Employer                                  |
| Employer inn                              |
| Fl inn                                    |
| Fl gni                                    |
| Home gni                                  |
| <b>First name, middle name, full name</b> |
| <b>Birthdate</b>                          |
| <b>Document series</b>                    |
| <b>Document number</b>                    |
| <b>Zip code</b>                           |
| <b>Income Year</b>                        |
| <b>Year</b>                               |
| <b>Taxable Year</b>                       |

**Table A.2: Administration Database Details.**

|                         |                    |                      |
|-------------------------|--------------------|----------------------|
| Administration          |                    |                      |
| Administrative District | Municipal District | Street               |
| House                   | Frame              | Structure            |
| Flat                    | Total area         | Living area          |
| Number of floors        | Wall material      | Year of construction |
| Number of flats         | Flat value         | Serial number        |
| Full name               | Date of birth      | Document             |
| Series                  | Number             | Date of issue        |

|                        |                         |                 |
|------------------------|-------------------------|-----------------|
| Issued by              | Owner address           | Owner TIN       |
| Housing type           | Ownership basis         | Ownership type  |
| Ownership start        | Ownership end           | Percentage      |
| Room area              | Flat area               | BTI number      |
| BTI form number        | BTI registration number | LinkSN          |
| Average property value | Average living space    | Hyphen          |
| Suf                    | Percentage own          | Ownership start |

**Table A.3: P-values Quadratic Regression Privatization Ratio by Age.**

| Year | P-value<br>(Age) | P-value<br>(Age <sup>2</sup> ) |
|------|------------------|--------------------------------|
| 1999 | 0.003            | 0.000                          |
| 2000 | 0.001            | 0.000                          |
| 2001 | 0.000            | 0.000                          |
| 2002 | 0.000            | 0.000                          |
| 2003 | 0.000            | 0.000                          |
| 2004 | 0.000            | 0.000                          |

**Table A.4: P-values Resulting from Mann-Whitney U test Comparing Median Income of Privatized vs. Non-Privatized units per Apartment Type.**

| Type | Median Income<br>(RUB) Priv | Median Income<br>(RUB) Non- Priv | P-value |
|------|-----------------------------|----------------------------------|---------|
| 1    | 19,254.49                   | 19,336.24                        | 0.0000  |
| 2    | 13,648.41                   | 16,040.54                        | 0.2895  |
| 3    | 18,840.00                   | 18,772.40                        | 0.1870  |
| 4    | 20,038.00                   | 18,689.98                        | 0.0477  |
| 14   | 7,306.31                    | 15,496.34                        | 0.1984  |

**Table A.5: P-values resulting from Comparison of Income for Low Privatization Rate vs. High Privatization Rate per Year.**

| Year | Median below Q1 (RUB) | Median above Q3 (RUB) | P-value |
|------|-----------------------|-----------------------|---------|
| 1999 | 9,412.88              | 9,194.98              | 0.0527  |
| 2000 | 10,000.0              | 9,739.58              | 0.1822  |

|      |            |           |        |
|------|------------|-----------|--------|
| 2001 | 16,800.0   | 16,650.75 | 0.5725 |
| 2002 | 28,078.285 | 27,364.88 | 0.2870 |
| 2003 | 27,036.0   | 26,624.0  | 0.2431 |
| 2004 | 30,788.69  | 31,500.0  | 0.5813 |

**Table A.6.1: Median Income (RUB) per Ownership Type per Year.**

| Year | Median income Type 1.0 | Median income Type 2.0 | Median income Type 3.0 |
|------|------------------------|------------------------|------------------------|
| 1999 | 9,500.0                | 9,365.65               | 9,160.73               |
| 2000 | 9,800.0                | 9,868.35               | 9,400.0                |
| 2001 | 16,595.82              | 17,320.86              | 16,111.01              |
| 2002 | 28,179.92              | 28,691.11              | 27,500.0               |
| 2003 | 26,520.0               | 27,007.54              | 25,579.66              |
| 2004 | 30,582.21              | 30,600.0               | 30,000.0               |

**Table A.6.2: Pairwise P-values Resulting from Mann-Whitney U test Regarding difference between Median Income per Ownership Type per Year.**

| P-values                | 1999  | 2000  | 2001  | 2002  | 2003  | 2004  |
|-------------------------|-------|-------|-------|-------|-------|-------|
| Type 1.0 vs<br>Type 2.0 | 0.000 | 0.084 | 0.000 | 0.000 | 0.042 | 0.002 |
| Type 1.0 vs<br>Type 3.0 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Type 2.0 vs<br>Type 3.0 | 0.013 | 0.000 | 0.000 | 0.000 | 0.000 | 0.471 |

**Table A.7: P-values Quadratic Regression Over The Years (Privatized Ratio vs Age)**

| Year | P-value Age | P-value Age <sup>2</sup> |
|------|-------------|--------------------------|
| 1999 | 0.003       | 0.000                    |
| 2000 | 0.001       | 0.000                    |
| 2001 | 0.000       | 0.000                    |
| 2002 | 0.000       | 0.000                    |
| 2003 | 0.000       | 0.000                    |
| 2004 | 0.000       | 0.000                    |

**Table A.8: P-values Resulting From T-test Comparing Means of Living Area for Privatized vs. Non-Privatized Apartment Units, Per Apartment Type.**

| Type | Mean Area Privatized (m <sup>2</sup> ) | Mean Area Non-Privatized (m <sup>2</sup> ) | P-value |
|------|----------------------------------------|--------------------------------------------|---------|
| 1    | 33.53                                  | 31.37                                      | 0.0000  |
| 2    | 37.61                                  | 38.38                                      | 0.7404  |
| 3    | 48.12                                  | 45.90                                      | 0.0000  |
| 4    | 49.86                                  | 45.89                                      | 0.0000  |
| 14   | 46.60                                  | 51.71                                      | 0.0283  |

**Table A.9: P-values Resulting From T-test Comparing Means of the Apartment Price of Privatized vs. Non-Privatized Apartment Units, Per Apartment Type.**

| Type | Mean Price Privatized (RUB) | Mean Price Non-Privatized (RUB) | P-value |
|------|-----------------------------|---------------------------------|---------|
| 1    | 320,036.48                  | 299,626.40                      | 0.0000  |
| 2    | 193,171.71                  | 272,072.08                      | 0.0000  |
| 3    | 344,466.16                  | 314,761.12                      | 0.0000  |
| 4    | 330,987.41                  | 332,475.95                      | 0.6210  |
| 14   | 289,715.58                  | 330,196.02                      | 0.0595  |

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## 11 References

- Appel, H. (1997). Voucher privatisation in Russia: Structural consequences and mass response in the second period of reform. *Europe-Asia Studies*, 49(8), 1433-1449. <https://doi.org/10.1080/09668139708412508>
- Bertaud, A., & Renaud, B. (1997). Socialist Cities Without Land Markets. *Journal of Urban Economics*, 41, 137-151. <https://doi.org/10.1006/juec.1996.1097>
- Blanchflower, D. G., & Oswald, A. J. (2013). *Does high home-ownership impair the labor market?*
- Coulson, N. E., & Fisher, L. M. (2009). Housing tenure and labor market impacts: The search goes on. *Journal of Urban Economics*, 65(3), 252-264.
- Country Studies - Russia. (n.d.). Russia - Economy - Income Distribution. Retrieved from <https://countrystudies.us/russia/57.htm>
- Daniell, J., & Struyk, R. (1997). The Evolving Housing Market in Moscow: Indicators of Housing Reform. *Urban Studies*, 34(2), 235-254. <https://doi.org/10.1080/0042098976168>
- Guzanova, A. K. (1997). The housing market in the Russian Federation: Privatization and its implications for market development. *Available at SSRN 620566*.
- Kosareva, N., & Polidi, T. (2021). Housing Affordability in Russia. *Housing Policy Debate*, 31(2), 214-238. <https://doi.org/10.1080/10511482.2020.1800778>
- Kosareva, N., & Struyk, R. (1993). Housing privatization in the russian federation. *Housing Policy Debate*, 4(1), 81-100. <https://doi.org/10.1080/10511482.1993.9521125>
- Kosareva, N., & Tumanov, A. (2008). Assessing housing affordability in Russia. *Problems of Economic Transition*, 50(10), 6-29.
- Ledeneva, A. V. (1998). *Russia's economy of favours: Blat, networking and informal exchange* (Vol. 102). Cambridge University Press.
- Maklin, C. (2022, May 9). Logistic Regression In Python - Towards Data Science. *Medium*. <https://towardsdatascience.com/logistic-regression-python-7c451928efee>
- McFaul, M. (1995). State power, institutional change, and the politics of privatization in Russia. *World Politics*, 47(2), 210-243.
- Montgomery, D. C., Peck, E. A., & Vining, G. G. (2021). *Introduction to linear regression analysis*. John Wiley & Sons.
- Yemtsov, R. (2007). *Housing privatization and household wealth in transition*. WIDER Research Paper.