



LUND UNIVERSITY

School of Economics and Management

Master's Programme in Economic Growth, Population and Development
Department of Economic History

Housing Shortage in a Historical Perspective

Documenting Housing Rents and Housing Affordability in Stockholm 1900-1920

by

Marie Heglum Kirkedam

ma6004ki-s@lu.se

Abstract: Satisfying one of the most basal needs, access to housing has been a determining factor for living standards throughout history. However, in many historical cost-of-living studies, housing costs have often been challenging to measure due to the lack of data. The housing component in the consumption basket has therefore often been based on theorised assumptions or indices derived from proxy-variables. Utilising a unique set of microdata encompassing information on both housing rents and incomes, this thesis estimates the level of housing rents and housing affordability in Stockholm, Sweden in 1900 and 1920, and explores how this varied between social classes. The study finds that a significantly larger share of the household budget was reserved for housing rents, and that this variable was more dynamic, than what is often assumed by the literature. Notably, despite times of rapid urbanisation and population growth, the income-share spent on housing did not increase.

Course Code: EKHS12

Master's Thesis

May 2025

Supervisor: Erik Bengtsson

Examiner: Jonas Ljungberg

Word Count: 13,832

Acknowledgements

I would like to thank my supervisor, Erik Bengtsson. First of all, for giving inspiring and thought-provoking lectures throughout my degree, and secondly for the overwhelming amount of time, support and interest he has devoted to this project. Going way beyond his required hours, Erik's attentive feedback and input have allowed me to become a better economic historian than I was before this project started.

Towards my friends at the Department of Economic History, I'm grateful for all our lunch breaks, post-library beers and interesting conversations. Special thanks to Simon, Emilia and Simon for always saying that every problem will work out in the end.

My largest gratitude is however devoted towards Erlend for being the greatest source of academic and emotional support throughout this and all the other projects that is a part of life.

Lastly, I'm utterly grateful to all my friends, comrades and fellow students in Lund Students for Palestine who never stop fighting for our right to freedom of speech and the right to protest. In a time where our film-screenings, study zones and lectures increasingly have been deemed a breach of campus rules by the administration, it becomes clearer than ever that the struggle for Palestinian human rights is also a fight for preserving our own democracies.

Contents

1. Introduction	4
1.1. Aim, Scope and Research Questions	6
2. Theory and Literature Review	7
2.1. The Relationship between Income, Housing and Affordability.....	8
2.2. The Role of Housing in the Consumption Basket.....	9
2.3. Historical Housing Rents	11
3. Research Design, Data and Method.....	13
3.1. Case Study: Stockholm 1900-1920.....	13
3.2. Source Material and Original Database	15
3.3. Building the Sample.....	17
3.4. Source Evaluation and Adaptions	19
3.5. Assignment into Social Class.....	22
3.6. Measuring Housing Rents and Affordability	23
4. Empirical Results and Discussion	26
4.1. Distribution of Housing Rents	26
4.2. Housing Affordability	31
4.3. Situating the Findings in its' Historical Context	34
4.1. The Findings in Relation to the Literature	36
5. Conclusion.....	37
6. Literature	40
7. Appendix	45
A. Sample Composition	45
B. Geographical Variations in Housing Rents and Income	46
C. The Imputation Level: Income	53
D. The Imputation Level: Housing Rent.....	55
E. Mandatory Statement on the Use of Artificial Intelligence.....	56

List of Tables

Table 1. Sample	18
Table 2. Occupational Titles and Social Class.....	23
Table 3. Median Income and Rent Across Social Classes. 1900.....	26
Table 4. Median Income and Rent Across Social Classes. 1920.....	26
Table 5. Median Rent-to-Income Ratio. 1900	32
Table 6. Median Rent-to-Income Ratio. 1920	32

List of Figures

Figure 1. The Tax and Population Register for Stockholm.	16
Figure 2. Housing Rents in the Tax and Population Register for Stockholm.....	20
Figure 3. Real Median Income and Rent by Class. 1900 & 1920	28
Figure 4. Median Income Estimates Compared to Contemporary Statistics.....	30
Figure 6. Median Rent Estimates Compared to Contemporary Statistics	31
Figure 7. A Typical Household Budget in 1920	33

1. Introduction

“For the tenants, there is nothing else to do than wait and hope for a crash that could bring housing rents back to reasonable levels.”

(Stockholms Tidningen 1899, cited in Forsell, 2003, p.269, my translation).

While this quote could have been found in a contemporary Swedish newspaper, describing for example the aggregate increase in rent levels of 122% between 1989 and 2005 (Holmqvist & Turner, 2014, p.247), it describes the housing situation in Stockholm over a hundred years earlier. The reason why housing costs regularly reach the front pages of the news is that housing constitutes the largest part of many household budgets, making it a crucial factor in determining the cost of living. It is at the same time well established that the accumulation of value in the housing market has been one of the fundamental drivers behind the widening inequality gap observed since the 1970s (Jordà et al., 2019; Knoll et al., 2017; Piketty & Zucman, 2014, p.1280). Despite its importance when assessing both historical living standards and their distribution within the population, our understanding of the role of housing expenses in the historical household budget remains limited (Clark, 2002, p.489; Eichholtz et al., 2012, p.269).

Most often, this is due to a lack of data. As a comment on hurdles in “almost all earlier investigations into the cost of living”, Myrdal & Bouvin (1933, p.125) notes that “one of the greatest difficulties [...] is to obtain information concerning the *cost of housing*”. Research aiming to estimate historical real wages, living standards and cost of living have therefore relied on indices based on proxies (Feinstein, 1998, p.638; Myrdal & Bouvin, 1933, p.128) or a theoretical assumption of housing rents absorbing a given percentage of the household budget (Allen, 2001, p.426).

Studies with access to direct, empirical information on housing costs which can inform this debate are thus rare (see e.g. Carmona et al., 2017; Clark, 2002; Eichholtz et al., 2012, 2019; Gray, 2020; Rodger, 2022). Aiming to contribute to fill this research gap, this thesis utilises unique features of the tax and population registers in the Swedish capital of Stockholm during the early 20th century, - a period of rapid industrialisation and urbanisation. By exploiting the fact that the tax registers additionally functioned as population registers during the period, detailed microdata containing three important variables can be obtained: 1) The income of every member in each household, 2) the housing rent the same household paid for their home and 3) the given household’s geographical position within the city. The material thus allows household incomes to be connected to the rental costs the very same household were subject

to, allowing for a unique understanding of dynamics in the rental market during a period of massive transformation. This material is especially valuable seeing as access to data which contains observations on *both* rent and income is rare (Rodger, 2022, p.1152).

The data material used in this thesis builds on a random sample of these population and tax registers covering 1% of the population in Stockholm and is drawn for both 1900 and 1920. The sample has been compiled by Bengtsson & Molinder (2024) with the aim of studying long-term developments of the income distribution within the city. Although containing data on housing rents, the material has not earlier been used to study this variable. By aggregating the sample from individual to household level for the years 1900 and 1920, and assigning each household to a social class following the HISCLASS scheme (Leeuwen & Maas, 2011), the material forms the basis for exploring rental costs and its' variation among social classes in 1900 and 1920. This material is throughout the study complemented with public statistics on housing rents, wages and the cost of living published by official authorities during the period of investigation, to provide a broader picture of the conditions and developments in the housing market at the time.

The case of Stockholm is especially interesting as it covers a critical period in the economic development of Sweden. A period of rapid urbanisation will, in any city, necessarily put a strain on the available housing stock (Carmona et al., 2017, p.632). This happens as the city is flooded with people emigrating from rural areas in search for jobs in the expanding urban zone, subsequently increasing the demand for accommodation. This was certainly the case for Stockholm in the early 20th century: While around 70% of the Swedish workforce was employed in agriculture in 1850, this share was driven down to 30% by 1940 (Önnerfors, 2021, p.22). The development was fuelled by the shift towards industrial employment and a subsequent wave of immigration to Stockholm. With a population growth of 214% between 1870 and 1920, the demand for accommodation in the city skyrocketed and made housing shortages and overcrowding common for the working class (Molitoris, 2015, p.19; Önnerfors, 2021, pp.26–27).

The case of Stockholm in the early 20th century can as such inform important questions on the role of housing in times of rapid transition. These questions include how the influx of agrarian workers to the city affected the rental market and whether the observed increase in economic inequality in the period was mirrored in the rent burdens different social classes were subject to. As this research captures a period of development nearly every industrialised city has

experienced, it has the potential to figure as an illustrative case study exemplifying traits shared by many other European cities in transitions from early to fully industrialised areas.

1.1. Aim, Scope and Research Questions

The core of the debate on long-run economic inequality within economic history is centred around the distributional conflict that arises between those who *can* derive income from capital, and those who *cannot*. This thesis will shed light on some aspects of this debate by exploring the relationship between tenants and the landlords, expressed through the housing rent. While the data material utilised in this project only has the capacity to shed light on the living standards of the tenant, it is important to recognise the dual function of the rent: While being a cost for the tenant, it is an income for the landlord. When explaining the fundamental dynamic of rising economic inequality, Piketty (2020, p.284) in fact turns to this exact relationship to exemplify his theory:

“This situation is like that of the worker who must devote a large portion of his salary to pay rent to his landlord, which the landlord uses to buy the rest of the building while leading a life of luxury compared to the family of the worker, which only has his wages to live on” (Piketty, 2020, p. 284).

As such, a central dynamic within the rental market involves a transformation of the housing rent, where labour income from the tenant is being transformed into capital income for the landlord. With only 3.5% of the population living in owner-occupied apartments in 1905, Stockholm was a city dominated by rental housing (Önnerfors, 2021, p.27). Ownership of housing was however highly concentrated. The members of S (*Stockholms fastighetsägareforening*) counted for instance only 642 in 1912, where around 30% of these were factory owners and merchants (Forsell, 2003, p.326). This discrepancy thus implies a significant transfer of money from the working to the upper class during this period, through the channel of the housing rent.

Placing the tenants at the centre of the analysis also allows for a deeper understanding of the middle and bottom parts of the income distribution, which are often less studied than the very top, given that most tax and estate records in many historical cases only covered a small share of the population (Gray, 2020, p.572). However, with access to data material covering a representative share of the Stockholm-population across the *entire* income distribution, this study can broaden the usual scope of typical cost-of-living studies focusing on the conditions of the working class (Clark, 2005; Ericsson & Molinder, 2020; Feinstein, 1998). As well as

informing the debate on the cost of housing for a typical Stockholm-household in the working class at the time, the material can also shed light on how this rent-burden varied *between* social classes situated at different parts of the income distribution.

With the aim of documenting how housing rents influenced living standards, and how this varied across social classes during a period of immense population growth, rapid industrialisation and a subsequent rise in housing demand, this thesis is guided by the following research questions:

- 1) *How did housing rents differ between social classes in Stockholm in 1900 and 1920?*
- 2) *How did housing affordability vary across social classes in Stockholm in 1900 and 1920?*

The strength of the Stockholm-sample is how the level of detail on recorded housing rents lets us go beyond stylised assumptions or proxy-based estimates of housing costs equalling a given percentage of the budget. In order to explore these questions, a thorough adaption of the original data sampled by Bengtsson & Molinder (2024) was conducted. This involved transforming the existing data from an individual to household level dataset through aggregation, as well as assigning each household to a social class based on the occupation of the household head (Leeuwen & Maas, 2011). This material has then been used to estimate housing rent levels across different social classes in 1900 and 1920. Housing affordability has been measured as the share of total income absorbed by rent payments, hereafter referred to as the rent-to-income ratio.

The outline of the thesis is as follows. In the next chapter, relevant theory and literature are discussed in order to locate current research gaps within the overarching topic of historical housing costs. Chapter 3 evaluates the data and the source material it is built on and is used to further discuss the method employed to adapt the dataset in line with the aims of this study, and to estimate the desired statistics. The results are presented in chapter 4, accompanied by an integrated discussion of their validity, relation to the literature and the historical context. Chapter 5 offers concluding remarks and outlines avenues for future research.

2. Theory and Literature Review

The thesis aims to investigate the topics of housing rents and housing affordability. To disentangle these terms, the relationship between income, housing consumption and affordability are first discussed in relation to microeconomic theory. Furthermore, this chapter

situates the thesis in relation to two relevant strands of literature: The first is the cost-of-living literature (Allen, 2001; Clark, 2005; Ericsson & Molinder, 2020), where the role of housing in the historical consumption basket is the primary topic of discussion. The second is research based on data material covering housing rents, used to inform either debate about historical living standards (Carmona et al., 2017; Clark, 2005) or economic inequality (Albouy & Zabek, 2016; Gray, 2020; Rodger, 2022). Their relation to the present study will be discussed throughout the chapter.

2.1. The Relationship between Income, Housing and Affordability

With the chosen case being Stockholm in the early 20th century, one of the central questions that emerges is how housing rents and housing conditions are affected in periods of urbanisation and a subsequent influx of immigrants to the city.

Textbook microeconomic theory suggests that when the demand of a normal good increases, the price of the good will increase in response, making it less attractive for a consumer to consume the same amount of the given good (Krugman & Wells, 2015, pp.91, 295). If other factors are held equal, the consumer will then substitute their consumption away from the good which has become more expensive over to other, less expensive goods. If one commits to define housing as a commodity (which is a widely debated topic but outside the scope of this paper to discuss¹), one could in this context argue that an increase in rental costs would incentivise the given household to either consume less housing by moving to a smaller apartment, or to a less desired and cheaper location (Fallis, 1985, chap.2; Meen, 2024, chap.2). Consequently, standard microeconomic theory would postulate that in a period of increasing demand for housing, prices would increase and lead consumers to consume less – which in this context would translate into renting smaller units in cheaper areas. Wealthier households would as such likely live in larger apartments of higher quality, compared to those lesser endowed.

While housing can be argued to exhibit many of the characteristics of a normal good, it is certainly more challenging to substitute away a home than most other consumption goods. This is where the concept of housing affordability intersects with the debate on the supply and demand of housing. However, in a theorised world characterised by standard microeconomic assumptions, the concept of affordability is not especially relevant, given as Whitehead & Meen (2020, p.17) describe, that “housing cannot be unaffordable in aggregate or the price of

¹ See e.g. Patillo (2013).

dwellings would simply fall”. The authors state, however, that “this does not mean that the outcomes are acceptable either to individuals or to [the] government” (Whitehead & Meen, 2020, p.17).

Although the term “affordable” is often used in daily life, it is difficult to measure and is often determined through a wide range of metrics. What these measures have in common is that they are utilised to illustrate how expensive a good is for the general public (Whitehead & Meen, 2020, p.17). Arguing that housing affordability is determined by income and housing costs, Dong (2018, p.2010) finds that an increase in income inequality is associated with an increase in the rent burden experienced by low-income families in contemporary American cities. Here the notion of affordability is tied directly into the debate on economic inequality.

In this thesis, the rent-to-income ratio, i.e. the portion of the household budget reserved for housing rents, is used to assess the question of affordability. While one cannot draw a strict line between what is defined as affordable versus unaffordable housing, the rent-to-income ratio can shed light on how the budget-share spent on housing varied across social classes in Stockholm during the period of the investigation.

2.2. The Role of Housing in the Consumption Basket

Defining living standards, - and more importantly how to measure them, has been one of the major subjects for debate within economic history. Microeconomic theory would suggest that the ideal way of defining an individual’s living standards would be by the total utility this person derives from consuming a set of goods acquired in alignment with the constraints given by their budget (Krugman & Wells, 2015, p.282). It is however widely agreed upon that such a definition is subjective and difficult to operationalise.

Relating to the concept of utility, most definitions of living standards revolve around consumption and the ability to access goods (Allen et al., 2005, p.6). For wage-based economies, this is often measured by a form of income measure, where real wages have been “one of the most used tools to estimate changes and trends in well-being, economic development, and living standards” throughout history (Gary, 2018, p.32). The definition of a real wage in this context is easy to grasp: It is the amount of goods a worker could buy with their wage (Gary, 2018, p.32). Here, Clark (2007, p.40) has been in the fore-front by estimating real wages as the difference between the workers’ nominal wage and the price of consumption goods at subsistence level in England over the long-run. Arguing that the poorest

half of any society typically only had their wage to live on, real wages “provide a good index of living standards in any society” (Clark, 2005, p.41).

Housing has however been a difficult part of the consumption basket to estimate, and is therefore referred to by Gary (2018, p.42, paper 1) as “a standard piece of missing data throughout historical price and wage investigations”. Furthermore, Clark (2005, p.1328) speaks of the inclusion of an estimated rental cost equalling 8% of the worker’s expenditure as a “major innovation” when included in his cost-of-living series. In a much cited study estimating real wages in European cities between 1500 and 1750, Allen (2001, p.426) assumes that housing rents absorbed 5% of a working male’s income throughout the period. This assumption is also adopted in historical real wage studies of Sweden going up to the year 1900 (Ericsson & Molinder, 2020; Gary, 2018). Swedish rental costs have also been estimated through proxies; for instance building costs, producing an estimate of housing rent equalling 10% of the budget (Myrdal & Bouvin, 1933, p.138).

Although these assumptions and indices have been essential in taking housing costs into account when measuring historical living standards, it is important to emphasise that the knowledge about their validity is limited due to the lack of data. Nonetheless, it is worth noting that these assumptions have mainly been employed in studies at the individual level and are as such not directly comparable to the household-level study conducted here.

However, when Horrell et al. (2021, p.87) expands the unit of analysis to the household level in order to take women and children’s earnings into account, they continue to rely on the same individual-level assumptions when estimating historical living standards. Subsequently, as they scale Allen’s (2001) consumption basket up by a factor of 3.5, the assumed housing rent of 5% of the total household budget remains (Horrell et al., 2021, p.98). In the context of Stockholm, Forsell (2003, p.213) writes that housing rents increased steadily during the industrialisation period, where the average level of housing rents increased with 70% between 1894 and 1910. Despite real wages rising at the same time, the explosive surge in housing rents gives reason to speculate whether Allen’s (2001) 5% assumption might be an underestimation. Utilising empirical data material to explore, test and validate these assumptions is therefore an important task.

Estimating empirical rent-to-income ratios is also interesting in a long-term perspective, considering how these do not seem to be static over time. Looking at a range of 500 years, Eichholtz et al. (2019, p.21) show how the households’ budget share reserved for rents in Amsterdam, Brussels and London was 10-20% on aggregate depending on the city at the

beginning of the 20th century, but increased to around 34-39% a hundred years later. Today, the EU defines a share spent on housing exceeding 40% of disposable income an indicator of households being “overburdened” (Eurostat, 2025). Dustman et al. (2022, p.1710) have also shown how the size of these ratios depends on where the household is situated in the income distribution: While Germans in the bottom quintile experienced an increase in the rent-to-income ratio from 27% to 39% percent between 1993 and 2013, high-income earners experienced a decrease from 16% to 14%.

As such, there is reason to believe that the level and development of the share housing absorbs from the household budget is not a static parameter. Research with access to data material on historical housing rents can as such contribute to disentangle this puzzle. The strength of the sample used in this study is that it lets us explore both how housing rents developed over time (although limited to two benchmark years), and how rent-burdens varied *within* the population. While a single case study on the Swedish capital with a limited scope cannot provide a complete answer to the level of housing rents and affordability, the results can be used to inform future debates on the role of housing in the Swedish consumption basket during the early 20th century. This is important, considering how housing is often the item that absorbs the largest part of the household budget and is only substitutable to a certain point (Gray, 2020, p.571).

2.3. *Historical Housing Rents*

While housing costs are thoroughly studied for the period following 1945, this is not the case for earlier periods (Edvinsson et al., 2021; Eichholtz et al., 2012; Rodger, 2022; Samy, 2015). The recent boom in the price of homeownership has spurred interest in studying how housing prices have developed over the long-run (Edvinsson et al., 2021; Eichholtz et al., 2012). A focus on historical housing prices will however necessarily neglect the middle and bottom part of the income distribution’s housing conditions, as homeownership historically was reserved for the rich, and only became available for the vast majority in the period following World War II (Carmona et al., 2017, p.640). While Eichholtz et al. (2019) have constructed an index of housing rents going back to 1500 and up to 2017 for European cities, most research have been studying more limited, specific cases. Among these, periods of industrialisation and urbanisation have especially captured scholarly interest.

Complimenting his earlier research on the real wages of the working class in England during the Industrial Revolution, Clark (2002, p.489) explores the rental cost and quality of over 16,000 dwellings held by charities and other property holders between 1550-1909. The results

are interesting: While real wages (rental costs included) rose by 50 percent during the Industrial Revolution in England, it did not translate into better housing conditions for the majority. Especially in London, Clark (2002, p.509) finds no sign of improved housing conditions, but rather declining housing quality measured by size during the period. The reason for this is that rents rose relative to nominal wages, which forced the workers to settle in cheaper and smaller dwellings (Clark, 2002, p.509). The results thus align with the microeconomic theory discussed in section 2.1, predicting that a rise in demand for accommodation will result in rising prices, which in turn leads the consumers to substitute consumption away from their current home in favour of cheaper housing.

This mechanism is also the central subject of investigation when Carmona et al. (2017) explores housing affordability in Spain during the country's urbanisation in the period 1900-1930. At this time, most Spanish cities experienced a rapid urban transition from agricultural to industrial employment, where migration and population growth put a severe stress on the availability of accommodation. Relying on detailed data on housing prices from different regions, the authors present a thorough analysis of how housing prices developed during this period. Considering that the aim of the study is to analyse housing affordability, the authors acknowledge the problem that is posed by the fact that most families rented their home during this period (Carmona et al., 2017, p.640). Utilising the relation between housing prices and rent, they obtain estimates of housing rents in 1920 which suggests that housing rents absorbed around 10% of working-class incomes in most Spanish cities at the time (Carmona et al., 2017, p.640). This leads the authors to conclude that despite massive increases in demand following industrialisation and urbanisation, housing did not represent "a dramatic burden for the Spanish working-class population" during the transition period (Carmona et al., 2017, p.632). The study conducted here follows this research agenda, considering that the empirical knowledge about housing rents and their level compared to income during the urbanisation period in Stockholm is scarce.

The common denominator between the above-mentioned studies is that housing rents are treated as the primary subject of analysis and is used to complement existing research on historical living standards. Housing rents have however also figured as an important metric to understand historical inequality in cases where the majority of the population have not been captured in tax registers because of their low income (McCants, 2007, p.3). This has led Rodger (2022, pp.1178–1179) to argue that that the distribution of rental costs to a large degree mirrored the pattern of income inequality in 19th century Edinburgh. In their study of

the U.S., Gray (2020, p.572) and Albouy & Zabek (2016, p.2), have used the distribution of housing rents as a direct proxy for economic inequality, by estimating inequality metrics like the Gini and Theil coefficient for the spread of housing costs. While their research can deepen our understanding of how rental costs relate to economic inequality, it is however worth discussing whether a compression of housing rents necessarily reflects a compression of economic inequality. In a society where housing rents are largely determined by the dynamics within the rest of the economy, one can argue that an equalisation of housing rents will not necessarily induce increased equality as such a compression could decrease the rent burden for the upper parts of the income distribution while staying constant for the middle and bottom – thus enhancing existing inequality patterns.

By possessing data material of an extremely rare character, containing information on both the rental costs households in early 20th century Stockholm were subject to and the income they had disposable to pay these costs with, the present study can help shed light on how these factors are connected. Assessments of the quality of the data and the process of analysis will be more thoroughly discussed in the chapter below.

3. Research Design, Data and Method

This chapter explains the case study utilised in this research project and evaluates the strengths and weaknesses of the data material and underlying sources applied. Furthermore, it is used to discuss the process of adapting the sample to fit the purpose of this study, and presents the measurement methods utilised to answer the research questions of the study.

3.1. Case Study: Stockholm 1900-1920

This thesis is centred around the question of housing rents, where Stockholm is used as a case study to inform the inquiry (Gerring, 2004). Stockholm during the early 20th century is a particularly interesting case when discussing the role of historical housing rents for two primary reasons:

- 1) This is a period of rapid industrialisation, urbanisation and transition. During this period Stockholm became fully industrialised, which in turn induced massive expansion of the built environment and population growth. Bearing in mind that almost every European city underwent a similar development, the case of Stockholm from 1900-1920 can inform questions on housing rents for cities in similar historical contexts.

- 2) Sweden went from being one of the most unequal countries in Europe in 1900 to become one of the most equal 50 years later (Piketty, 2020, pp.185–186). Exploring the role of housing rents in this development can as such provide interesting insights of the dynamics present within overall economic inequality.

The industrialisation of Sweden was rapid (Hammarström, 1970, p.193). The industrial breakthrough came through the iron and wood industry, where increased demand from rapidly expanding economies abroad fuelled the expansion of these industries in Sweden (Hammarström, 1970, p.194). This induced growth in many Stockholm-based industries, which in turn resulted in the number of industrial workers increasing tenfold between 1850 and 1900, while the overall population in the city increased from 136.000 to over 300.000 in the same period (Bengtsson & Molinder, 2024, app.A1; Hammarström, 1970, p.203).

During the period of investigation, the city expanded physically by incorporating new parishes into its' administrative boundaries and quantitatively through a yearly population growth of 2.4% between 1850 and 1955 (Bengtsson & Molinder, 2024, app.A1; Hammarström, 1970, p.5). Similarly to other cities undergoing this transition, housing conditions worsened in response. In 1900, nearly half of all one-room apartments in the city was characterised as overcrowded, which amplified the spread of diseases and deepened the socio-economic divides between rich and poor areas (Molitoris, 2015, p.19). While the richest part of the population lived in Norrmalm and Östermalm, workers settled in Södermalm and Kungsholmen where housing rents could be up to 25-50% cheaper (Molitoris, 2015, p.28, paper 3; Önnersfors, 2021, p.29). These price differentials were largely due to apartment size: Whereas 90% of the apartments in Södermalm had three rooms or fewer, only 60% of the apartments in Norrmalm and Östermalm were of this size (Molitoris, 2015, p.28, paper 3). These developments went hand in hand with a general increase in both the Gini-coefficient of income and the income share held by the top income earners during the period of study (Bengtsson & Molinder, 2024, p.5).

Characterised by massive population growth, industrialisation, subsequent housing shortages and rising inequality, Stockholm exemplified typical traits of a European city in transition during the period of investigation. In addition to the quality of the data utilised in the present study, these characteristics also allows the research to fulfil the central purpose of a case study which is, namely, to “study a single unit with intent to shed light upon other units” (Gerring, 2004, p.352). Considering that Stockholm underwent a period of urbanisation and industrialisation which nearly every European city has experienced, the research conducted

here can inform questions on how housing rents were affected during periods of industrialisation.

3.2. *Source Material and Original Database*

This research builds on a set of microdata collected by Bengtsson & Molinder (2024). The dataset contains a random sample of individuals and companies covering 1% of the population in Stockholm, drawn for every decade in the period 1870-1970. As a part of the bigger project “The Swedish Transition to Equality: Income Inequality with New Microdata, 1862–1970”, the purpose of the data collection is to provide a better understanding of how income inequality evolved among the middle and bottom part of the income distribution (Bengtsson et al., 2024). Considering that this part of the distribution is much less studied than the very top (as studied by e.g. Roine & Waldenström, 2008), the data material collected through this project provides a detailed and consistent description of Swedish inequality over the period.

When gathering the Stockholm sample, the authors have gone directly into the original taxation lists of the city, in order to retrieve data on incomes at the individual level for a representative amount of the population who paid the *bevillning* tax (Stockholm City Archive, 1901, 1921). Companies were also subject to this tax and are thus also represented in the sample (although a minority). Both labour and capital income are recorded in the taxation lists and together they make up the income measure used in this study.² Capital and labour income are however not separated in the study conducted here, as the primary interest pertains to the ability to consume housing between different strata of the population rather than assessing which sources enabled the given consumption level. The sample has a broad coverage across the income distribution, since the threshold for paying the tax (500 SEK in 1900 and 600 SEK in 1920) was low compared to other European cities at the time (Bengtsson & Molinder, 2024, p.3).

The fact that the taxation lists also were the population register (*mantalslängder*) in Stockholm during this period even allows obtaining detailed information about those below the threshold for paying the *bevillning* tax. The dual function of the records also allows the collection of more information about individuals and companies listed than just their income, such as the structure of the household they belonged to, their occupation and the rent they paid. An example of the structure of the source material is depicted in figure 1. The fourth

² Income is measured as income before tax.

column indicates the individual's name, which is followed by their household ID (*mantalsnummer*), where the same *mantalsnummer* indicates that the individuals are registered on the same household address. This is then followed by information about date of birth, birthplace, housing rent and incomes derived from labour and capital separately.

Figure 1. The Tax and Population Register for Stockholm.

Mantalsnummer	Namn	Födelsedag	Födelseort	Ålder	Skatt	Inkomst	Öfrigt
10	Andersson, Johan Erik	1871	Stockholm	30	100	100	
11	Andersson, Johan Erik	1871	Stockholm	30	100	100	
12	Andersson, Johan Erik	1871	Stockholm	30	100	100	
13	Andersson, Johan Erik	1871	Stockholm	30	100	100	
14	Andersson, Johan Erik	1871	Stockholm	30	100	100	
15	Andersson, Johan Erik	1871	Stockholm	30	100	100	
16	Andersson, Johan Erik	1871	Stockholm	30	100	100	
17	Andersson, Johan Erik	1871	Stockholm	30	100	100	
18	Andersson, Johan Erik	1871	Stockholm	30	100	100	
19	Andersson, Johan Erik	1871	Stockholm	30	100	100	
20	Andersson, Johan Erik	1871	Stockholm	30	100	100	

Note: For rote 15. Household ID (*mantalsnummer*): 1 – 3362, picture 14 (Stockholm City Archive, 1901)

The tax and population records were gathered for each *rote*, which were administrative areas following the borders of the parishes (*församlingar*), encompassing around 10,000 people (Bengtsson & Molinder, 2024, app.A2). Accompanying the population growth and geographical expansion of the city over the course of the 20th century, the number of *rotar* increased from 25 to 36 during the period 1900-1926 (Stockholmskällan, 2021). Bengtsson & Molinder (2024) have transcribed these original sources through a random selection of *rotar* for each decade, which has resulted in a detailed dataset covering a representative 1% of the population. Which *rotar* are covered in each sample therefore varies between each benchmark year.

Having access to such a detailed source available and transcribed has many advantages considering the limited scope of this research project. It is however important to note that the

aim of the data collection process conducted by Bengtsson & Molinder (2024) is to explore incomes and the income distribution within the population over the long-run. Since the recording of housing rents is not the primary purpose in their data collection process, the construction of the dataset does create some challenges for this study. Several adaptations have therefore been made, which will be discussed in the next section.

3.3. *Building the Sample*

In the source material, housing rents are assigned to the individual first listed under each household ID. Analysing housing rents on an individual level would therefore not yield representative results, as it would not reflect the fact that many households were supported by more than one income which was used to pay the rent. It was therefore necessary to aggregate the data constructed by Bengtsson & Molinder (2024) to a household structure, where data on each household and company were recorded with information on the name, occupation and income of the household head, whether they had a spouse, the number of children, servants and other adults in the household, their total income, rent and the number of income earners in the household.

This process was conducted in two steps: First, by setting up an R-script which automated the process of gathering the individuals based on their household ID, added their incomes and distinguished the members based on their occupation title, in order to count how many children, servants and other adults were part of the household.³ To achieve this, the occupation titles from the original dataset were coded manually, giving each occupation an indicator variable according to whether their title signified being a spouse, child, servant or other adult. While this improved the efficiency of the aggregation process by automating the process of adding incomes and recording the household structure, it did not fully account for cases in which an occupation title could represent multiple roles. For example, individuals listed as “cleaning lady” (*städerska*) and “female cook” (*kokerska*), could denote a servant registered as a member of a given household in some instances and an independent adult heading their own household in another. To ensure such cases were accurately classified in the new household structure, the entire dataset was manually reviewed and adjusted against the original data from Bengtsson & Molinder (2024). This part of the aggregation process was also important to make sure every individual was recorded, since the original data was based on manual transcription creating incidents of spelling mistakes and inconsistent labelling.

³ “R” is referring to the programming language for statistical computing.

While manual cross-checking of every household was a time-consuming task, it was through this process ensured that every observation is aggregated correctly and that the level of detail provided by the original data was preserved. The limited scope of this project thus only allowed for aggregation of two samples, 1900 and 1920. While an analysis spanning over a longer period of time would be desirable in order to be able to draw conclusions about how housing rents *developed* over the early 20th century, it was considered more important to ensure data of high quality which can produce reliable estimates than to obtain as many data points as possible.

Table 1. Sample

Panel A. Full sample	1900	1920	Panel B. Sub-sample. Rent > 0	1900	1920
N	2114	2914	N	1071	1381
Avg. income	2047	7043	Avg. income	3194	10859
Avg. income, standard deviation	30691	36700	Avg. income, standard deviation	42889	52699
Avg. rent	395	547	Avg. rent	780	1154
Avg. rent, standard deviation	853	1336	Avg. rent, standard deviation	1066	1751
Avg. number of adults	1.73	1.62	Avg. number of adults	2.13	2.04
Avg. number of children	0.65	0.48	Avg. number of children	1.06	0.83
Avg. size	2.38	2.10	Avg. size	3.19	2.87
Share of households paying income tax (%)	59	84	Share of households paying income tax (%)	68	87
Male household heads (%)	61	62	Male household heads (%)	67	73

Note: Description of the sample. Household-level. Panel A: All households in the sample. Panel B: Only containing the households which have a registered housing rent. Avg. refers to 'average', i.e. the sample mean.

Since the aim of the aggregation process was to translate all of the data recorded by Bengtsson & Molinder (2024) for 1900 ($N = 5,385$) and 1920 ($N = 6,581$) to a household structure, a part of the new, aggregated household sample also contain data on companies, equalling 9% and 10% of the total observations for 1900 and 1920, respectively. Companies are however excluded from the analysis conducted here, as their housing rent often varied

with the company's size and nature. The sample which constitutes the foundation for this research therefore only covers households and is described in table 1. Panel A shows the attributes of the whole sample, while panel B describes the part of the sample which have recorded observations on housing rent. The difference between the two is substantial and will be discussed further in detail in the section below.

3.4. Source Evaluation and Adaptions

In order to make an informed method choice, it is essential to evaluate the strengths and weaknesses of the data the method is applied to. One notable strength of the data used in this project is the high level of detail. The fact that the dataset contains individual-level information about both housing rents and income allows for unique insights, considering that previous research often only have had access to one of these variables (Carmona et al., 2017; Gray, 2020; Rodger, 2022). There are however some limitations to the data which must be discussed.

Housing rents are the primary interest of this project. Despite this, only half of the household observations in the sample have a housing rent recorded (see table 1). While the size of the sub-sample containing rent-observations is still fairly large ($N_{1900} = 1071$, $N_{1920} = 1381$), it is important to discuss the differences between the households with recorded housing rents and the sample as a whole to avoid selection bias. Looking at the mean income of the two groups, in panel A and B in table 1, it is clear that the mean income in the sample only containing households with recorded rent-observations is much higher than for the sample as a whole. This suggests that households with a higher income are represented at a higher rate among the households with a recorded housing rent, creating an upward bias of average income, which in turn could overstate the level of housing rents and housing affordability.

Going back to the original source material, illustrated by the example in figure 2 below, there is reason to argue that housing rents for smaller dwellings or shared apartments have been underreported during the initial transcription of the records. Figure 2 for example depicts five households, where there are three observations in the column recording yearly rent (*årlig hyra*). However, in the comment section on the right side of this column, there are smaller numbers with arrows pointing out from the rent-column in two of these rent-observations. This could suggest that the other members of the household paid a housing rent to the household head or rented a small part of the dwelling. The majority of the comments of this nature have however *not* been transcribed by Bengtsson & Molinder (2024), as the primary focus in their data collection process have been incomes. Comments suggesting additional

rent information are thus unavailable when just looking at their dataset. As instances similar to the one depicted in figure 2 appears regularly when going through the source material it is deemed likely that rent prices for smaller dwellings are underreported in the data, which could explain the discrepancy between the mean income in panel A and B in table 1. Only relying on the sample with recorded housing rents could thus create an overestimation of the rent level. The sample only containing rent-observations has therefore been compared against an alternative estimate throughout the study, which is based on the entire sample, where observations with missing housing rents are imputed using a theorised value. The estimates produced from the two versions of the sample are compared against each other throughout the study, as they are considered to complement each other.

Figure 2. Housing Rents in the Tax and Population Register for Stockholm.

The image shows a historical document from the Stockholm City Archive, 1901, titled 'Mantals- och skatteförteckning'. It is a table with multiple columns, including household ID (Mantalsnummer), name, address, and rent. The document is handwritten and includes various notes and calculations. The table is organized into sections, with household IDs ranging from 550 to 557. The rent column shows values such as 1500, 1200, and 1000. The document is a page from a larger register, with a page number '165' visible in the top right corner.

Note: For rote 15. Household ID (mantalsnummer) 1 – 3362, 1901, picture 165 (Stockholm City Archive, 1901).

While one could use a homogenous rent-imputation across all observations, the details of the original data and the access to contemporary official statistics allows for a more finely tuned imputation method. Every household with a missing observation on housing rent is therefore assigned an assumed housing rent equalling the median housing rent for an apartment with

one bedroom and kitchen in the districts and parishes they resided in, as listed in official statistics covering each respective year (Stockholm stads statistiska kontor, 1904, 1921). The exact values are listed in table B5 and B6 in the appendix. By utilising the geographical information provided in the sample and detailed statistics from the period, the analysis to a larger degree takes into account the socio-economic differences between the different areas of Stockholm during the time, thus enhancing the precision of the estimate produced. For a more detailed discussion about the robustness of the imputation method, see appendix D.

A similar method is also adopted in order to account for missing values in the income data. The threshold for being eligible to pay the *bevillning* tax was 500 SEK in 1900 and 600 SEK in 1920 (Bengtsson & Molinder, 2024, p.4). To account for the fact that the majority of individuals below the threshold earned a wage, - although they did not pay the tax, adults with missing income-information have been assigned a theorised value to ensure a representative estimate of total household income. Building on the discussion conducted by Bengtsson & Molinder (2024, app.A3), it is in the research conducted here assumed that all non-taxpayers, that is individuals which did not earn enough to pay the tax, above the age of 18 earned a yearly income equalling half of the threshold, which amounts to 250 and 300 SEK for 1900 and 1920 respectively. This imputation is chosen as it produces similar results as the very detailed occupation-based imputation used by Bengtsson & Molinder (2024, app.A3), and is less complicated to implement (see appendix C for more details on the robustness of the income imputation).

The role of the servants as a part of the household is also worth discussing. When they are listed as a member of the household, their income has been granted as a part of the total household income in the aggregated data. It is however unlikely that the servants' income was a part of the household budget in the same manner as other members, considering that the servants' wage was a cost for the household head. Treating the servants' income as a part of the aggregate household income may thus overestimate the incomes in families with servants, which again can produce lower affordability ratios for this group. This effect is however considered to be small as 75% of the households in the sample 1900-sample had no servants, while only 12% had 2 or more servants. In 1920, only 12% of the households had a servant. Considering that servants often earned an income below the threshold for paying the *bevillning* tax, their income only amounted to a small part of the household budget in the affluent families which paid for these services.

3.5. Assignment into Social Class

When measuring housing affordability, Whitehead & Meen (2020, p.37) stress how an estimate of the rent-to-income ratio on an aggregate level will provide limited information about the case. The reason for this is that housing costs, quality and conditions will vary across the income distribution. Considering how the housing market ties directly into the debate about the distribution of living standards, as discussed in section 2.1, it is interesting to investigate how housing affordability varied across different strata of the population in the data of the present study.

To achieve this, every household was assigned one of three “social classes”, based on the occupation of the household head. This approach follows the HISCLASS scheme introduced by Leeuwen & Mass (2005, 2011). HISCLASS is based on occupations which have been ranked on a scale of 1-12, rooted in the International Labour Organization’s *International Standard Classification of Occupations* (ISCO). These social classes are by Leeuwen and Mass (2005, p.2) defined as “a set of persons with the same life chances”, where occupation is regarded by the authors to be the largest determinant of these factors.

With the aim of exploring how the occupational structure changed within the income distribution in response to the overall development of economic inequality, Bengtsson & Molinder (2024) have applied the international HISCLASS scheme to the Swedish context. Their assignment of HISCLASS codes to Swedish occupations has been applied in this project as well. Considering that the dataset utilised here is of a smaller size, the twelve HISCLASS codes have been grouped together in order to form three social classes: I, II, II. These align with the classification used by Statistics Sweden during the early 20th century, where group I referred to “the upper class” (*den högre klassen*), II to “the middle class” (*medelklassen*) and III to “the working class” (*kroppssarbetarnas klass*) (Smedberg, 2022, p.15).

Which occupations are encompassed within each social class is described in table 2. Social class III refers to typical blue-collar workers such as factory workers (*fabriksarbetare*), cleaning ladies (*städerska*) and the like. Class II consists of occupations like merchants (*grosshandlare*) and clerks (*kontorist*), while class I denotes occupations with high labour incomes such as dentists (*tandläkare*) and doctors (*läkare*) and capital holders such as factory owners (*fabrikör*) and business managers (*direktör*).

Table 2. Occupational Titles and Social Class

Occupations Titles (HISCLASS)	HISCLASS Code	Classification Applied in this Study
Higher managers Higher professionals	1-2	I (Upper Class)
Lower managers Lower professionals, clerical and sales personnel	3-5	II (Middle Class)
Foremen Medium-skilled workers Farmers and fishermen Lower-skilled workers Lower-skilled farm workers Unskilled workers Unskilled farm workers	6-12	III (Working Class)

Note: HISCLASS codes based on Leeuwen & Mass (2011), adapted to the Swedish context by Bengtsson & Molinder (2024). The households in the data used here are then assigned into social class I, II or III based on the occupation of the household head.

When Bengtsson & Molinder (2024) adapted the scheme to the Swedish context, individuals with occupation titles denoting their position in the household, e.g. “divorced wife” (*frånskilda hustru*) or “widow” (*änka*), have been given a HISCLASS code equalling -1, which lies outside the range of the official HISCLASS scheme. Household heads with such a title cause a challenge as different individuals coded as “widow” or “wife” will belong to diametrically different classes depending on whether they are the widow or wife of an unskilled factory worker or a business owner. While some of the titles that indicate information about class, such as “widow of property owner” (*godsägareenka*), were assigned to a social class, cases without such indicators were excluded from the dataset. This equals 140 (6.6%) and 256 (8.7%) observations in 1900 and 1920, respectively.

As such, the level of detail found in the dataset allows for a more detailed investigation of how housing rents and housing affordability developed between different social classes in the early 20th century. While Clark (2005) and Carmona et al. (2017) only focus on the conditions of the working class with regards to housing rents, the inclusion of occupation information in the tax and population registers can provide an understanding on how these conditions differed between different strata of the population.

3.6. Measuring Housing Rents and Affordability

The focus of this study is, as mentioned, to measure two different aspects of housing conditions in Stockholm in 1900 and 1920: First, the level of housing rents and second, housing affordability. Earlier research aiming to measure differences in housing conditions within the population have measured the spread of housing costs through different inequality

indicators such as Gini-coefficients for housing rent or how much of the total rent value is concentrated around the dwellings with the highest housing rents, essentially treating housing rent as one traditionally has investigated income inequality (Albouy & Zabek, 2016; Gray, 2020). With access to the occupational status of the households who paid the housing rents in the data utilised here, it is however considered more appropriate to look at how housing rents varied between social groups to measure how housing costs were spread across the income distribution.

It is acknowledged that the income distribution usually contains extreme values at the tails, especially at the top of the income distribution creating outliers which could be highly influential for the result (Cowell & Flachaire, 2007, p.1045). While such extreme values are a part of the distribution and can constitute an important part of the picture when explaining the distribution of income, the presence of these outliers must be taken into account when choosing the utilised measure. In the sample used for this research, the distribution of income and housing rents are significantly skewed by many outliers of high incomes and housing rents. The median has therefore been considered a more representative measure for the income or housing rent of the average person, as the mean estimator would be highly influenced by some very large observations at the top causing an overestimate of the amount of income or rent paid by the typical Stockholm-household at the time.

The measures used to estimate housing rents and housing affordability are outlined below:

- 1) The median income and housing rent was estimated across the three social classes defined in section 3.5, in order to compare how the level of housing rent varied across the different strata of the population in 1900 and 1920.
- 2) In order to estimate how “affordable” rental housing was during this period, the share of income absorbed by housing rent; the rent-to-income ratio, was estimated for each household. The median was then compared across the three social classes.

This was estimated for the sub-sample which contained households with recorded information on income and housing rents from the source material. The results were then compared against estimates based on the entire sample where missing observations on income and rent had been imputed for as described in section 3.4. When estimating the rent-to-income ratio, the sub-sample containing only observations on *both* housing rent and income formed the basis for the estimate closest to the source material, in order to ensure that missing values did not skew the results. This was then also compared against the imputed sample.

The 95% confidence interval is calculated for every estimate, using the percentile bootstrap method (Rizzo, 2019, p.213). This method relies on resampling of the original sample with replacement, creating several new samples ($N_B = 5000$ is used here) where the “bootstrap estimate” of the desired statistic from these samples are used to derive the confidence interval (Rizzo, 2019, p.213). This method is often used in cases where the features of the distribution from which the sample is drawn is unknown (Rizzo, 2019, p.213). Considering that we know little about the distribution of rents in Stockholm in the early 20th century, this is deemed an appropriate method. Here the “percentile” bootstrap confidence interval is preferred over the “normal” and “basic”, as it does not rely on assumptions of a normal distribution and thus will account better for the skewness towards high incomes and rents observed in the sample at hand (Rizzo, 2019, p.226).

The limited scope of this paper, containing only two benchmark years, necessarily entails restrictions on the possibility to draw inferences from the data on how housing rents and housing affordability *developed* over the study period. The estimates produced on the level of housing rents, income and housing affordability have therefore been contrasted to contemporary statistics from the period, in order to place the estimates from 1900 and 1920 in a larger historical context. The statistical yearbooks from Stockholm are extremely rich with data on housing rents, which is also the case for housing censuses and cost-of-living indices published regularly during the period by the National Board of Health and Welfare (*Socialstyrelsen*) (1920, 1924, 1933), indicating that this was an important topic of the time.

When measuring how housing affordability has developed from 1500 to the present in several European cities, Eichholtz et al. (2019, p.5) emphasise the importance of adjusting for housing quality. In doing so, they find that increased housing expenditure over the very long-run has mainly been due to improvements in the size of housing consumed per capita. Information about housing quality and size is not available in our data, which makes it difficult to uncover whether the quality of the dwelling is an underlying mechanism driving the observed pattern. This includes questions such as whether a low rent-to-income ratio suggests that the household lived in a small, overcrowded apartment or whether it signifies that they had a high income. While the answer to this cannot be provided directly by the data, official statistics from the period and existing research on living standards in Stockholm in the early 20th century can help interpret these values.

4. Empirical Results and Discussion

This chapter outlines the empirical findings of the research and contrasts them to contemporary statistics from the period of investigation. Throughout the chapter, the results are discussed and related to the literature and the historical context of the case study.

4.1. Distribution of Housing Rents

The results presented in table 3 show the estimated income level and housing rent for the median household in Stockholm in 1900. The left-side of the table depicts the estimates based on the sub-sample only relying on households which have a recorded rent in the data material. Here the working class have a median household income of 900 SEK, the middle class's income equals 1500 SEK, and the upper class has an income of 3100 SEK. The rent paid by the median household is 280, 700 and 1000 SEK for the working, middle and upper class, respectively. The results suggest that the upper class both had the highest median income and paid the highest housing rents, while the middle and working class followed in descending order.

Table 3. Median Income and Rent Across Social Classes. 1900.

	Median Income ^{a)}	Median Rent ^{b)}	Median Income ^{c)}	Median Rent ^{c)}
Imputations	No	No	Yes	Yes
Upper Class	3100 (2700, 4000)	1000 (900, 1300)	2900 (2200, 3400)	700 (600, 800)
Middle Class	1500 (1300, 1500)	700 (650, 760)	1200 (1200, 1300)	400 (310, 460)
Working Class	900 (900, 900)	280 (260, 300)	800 (730, 800)	240 (240, 240)
N	1254	1071	2114	2114

95% bootstrap confidence intervals in parentheses. Nominal prices. Median income and rent estimated over:

^{a)} the sub-sample with observations on household income.

^{b)} the sub-sample with observations on housing rent.

^{c)} the entire sample, where missing values have been imputed for.

The same pattern is observed when looking at the estimates based on the entire sample where missing values of rent and income are imputed for, depicted on the right side of table 3. An interesting observation is how the inclusion of imputed values drives the median down for every estimate. This is purely due to the function of the imputations, which is to take

households with an income below the threshold for paying the *bevillning* tax and a low housing rent into account. The difference between the estimates based on the sub-sample and the imputed sample is smallest among the working class, which indicates that the imputed values are similar to the values recorded from the source material and thus function as a good representation of housing rents and income for low-income households. For the year 1920, where the results are depicted in table 4, the same pattern as described for 1900 can be observed.

Table 4. Median Income and Rent Across Social Classes. 1920.

	Median Income ^{a)}	Median Rent ^{b)}	Median Income ^{c)}	Median Rent ^{c)}
Imputations	No	No	Yes	Yes
Upper Class	9900 (8500, 12000)	1900 (1600, 2200)	7900 (6500, 9100)	970 (780, 1200)
Middle Class	4900 (4700, 5100)	900 (820, 1000)	4500 (4200, 4900)	480 (480, 480)
Working Class	3800 (3700, 4000)	520 (500, 540)	3500 (3300, 3600)	470 (470, 470)
N	2458	1381	2914	2914

95% bootstrap confidence intervals in parentheses. Nominal prices. Median income and rent estimated over:

a) the sub-sample with observations on household income.

b) the sub-sample with observations on housing rent.

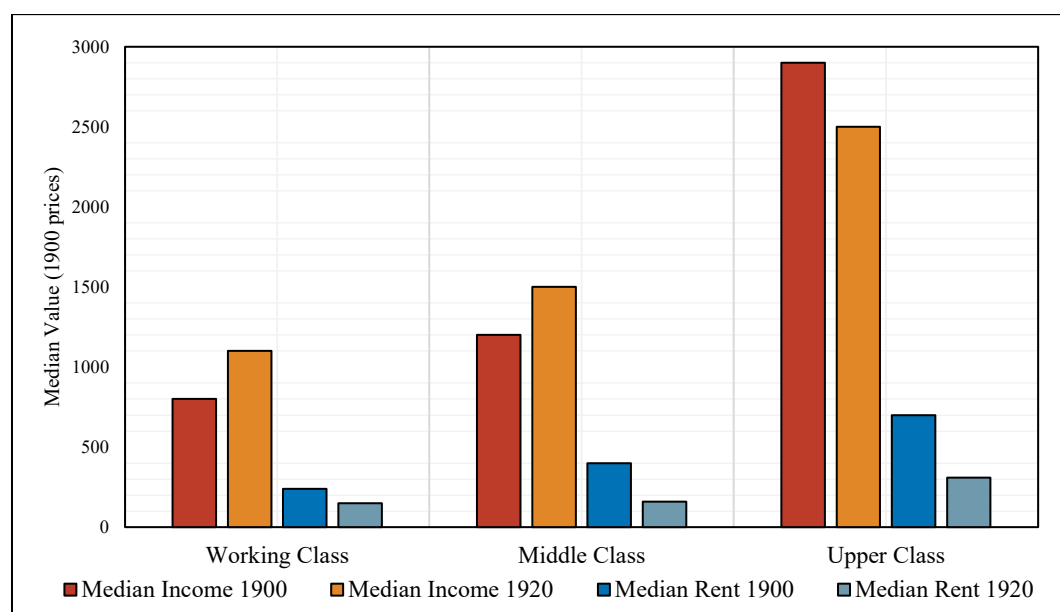
c) the entire sample, where missing values have been imputed for.

However, for both tables, some of the confidence intervals must be discussed. Looking at the median income of the working class in 1900 without imputations (table 3), the width of the associated bootstrap confidence interval equals zero. This suggests that a very large fraction of the resampled observations used to derive the confidence interval from is similar. The practically closed confidence interval does therefore not necessarily suggest that the estimation is very precise, but rather points to how the recorded household income for working class households in the sample is centred around the value 900, as 11% of the observations equal this value exactly.

Practically closed confidence intervals also appear in table 3 for the working class, and for both the middle and working class in table 4, when looking at the estimates for the median rent based on the imputed sample. The reason for this is that these groups have the highest

share of households without a recorded housing rent. This is the case for 56.9 % of the household in the working-class group in 1900, and they are therefore assigned an imputed housing rent of 216-247 SEK corresponding to the price of a one-bedroom apartment in the area they resided in (see table B5 and B6 in the appendix). Correspondingly, 53.9% and 50.3% of the households in the working- and middle-class group in 1920 have been assigned a theorised housing rent. This creates a sample distribution that is highly concentrated around the imputed values, causing the confidence interval to be precise per definition but only due to the fact that a large fraction of the bootstrap samples consists of imputed housing rents. The results obtained from the lower classes are as such sensitive to rent imputations. However, as argued in the section 3.4, the rent imputations used here are considered to be representative of the missing rent-observations in the dataset (see also appendix D).

Figure 3. Real Median Income and Rent by Class. 1900 & 1920



Note: Calculations are based on the sample with imputations for rent and income. Real prices are depicted in 1900 prices, using historical CPI indices provided by Ljungberg et al. (2025).

By transforming the nominal prices depicted above in table 3 and 4 into real prices (constant at 1900 level), a comparison can be made between the two benchmark years, which is illustrated in figure 3. The median real income in the upper class is lower in 1920 than in 1900, which confirms the results obtained by Bengtsson & Molinder (2021, p.11). Relying on a sample of individuals residing in the affluent areas Östermalm and Djursholmen between 1909 and 1950 in Stockholm, they find that the income of the elite, relative to GDP, decreased over the period. The increase in real incomes of the middle and working class observed

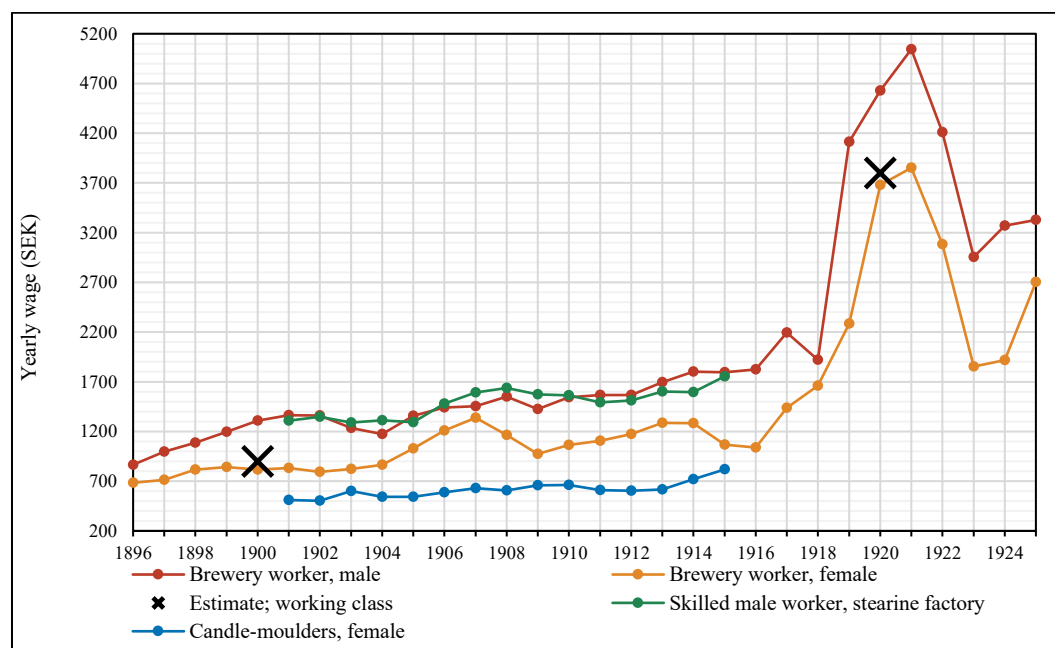
between the two datapoints is supported by the conception of a “general upward movement of [Swedish] workers’ purchasing power” over the last 200 years (Prado, 2010, pp.494–495).

For housing rents on the other hand, the use of a historical CPI index to adjust the nominal housing rents produces results contradictory to the general perception of steadily increasing housing rents in response to the city developing over the course of the early 20th century (Forsell, 2003, p.213). Worth noting, however, is how this historical period was extremely volatile in terms of inflation all over Europe, where the annual inflation rate exceeded 30% in Sweden in 1920 (Holmlund, 2013, p.140). Going back to official index calculations from the period show that this development was not driven by housing: While the prices on electricity and heating was four times higher and food prices were three times higher in 1920 than before the outbreak of World War I, housing rents had “only” increased by a factor of 1.5 (Socialstyrelsen, 1933, p.18). Housing rents were thus increasing at a relatively slower rate compared to the rest of the goods in the CPI basket, which can explain why the CPI-adjusted housing rent depicted in figure 3 is lower in 1920 than in 1900.

To further ensure the reliability of the results, these estimates are compared against longer time-series of income and housing rents from the period of study. In figure 4, the estimated household income for 1900 and 1920 are compared against the wage development of male and female factory workers in Stockholm, as recorded in *Wages in Sweden 1860-1930* (Lundberg et al., 1933). Here the income estimate for the median working-class household (900 SEK in 1900, 3800 SEK in 1920, see table 3 and 4) lies on the same level as a female worker at the Hamburger brewery. Estimating the median income of a household head in the working class based on the sub-sample at hand gives very similar results equalling 900 SEK in 1900 and 3600 SEK in 1920. This is due the fact that around half of the households in the working-class group in the sample with a recorded income, consists of only one adult (45% in 1900, and 55% in 1920).

As can be observed from figure 4, the income-estimates obtained in this study lie below the wage of a typical male factory worker as documented by Lundberg et al. (1933). The *Wages in Sweden* project has however been criticised by a range of scholars for having an unrealistically high representation of both skilled and permanently employed workers, which leads to an overestimation of the total wage level and thus can overstate the differences between the estimates produced in this study and a typical working-class income at the time (Hamark et al., 2024, p.120).

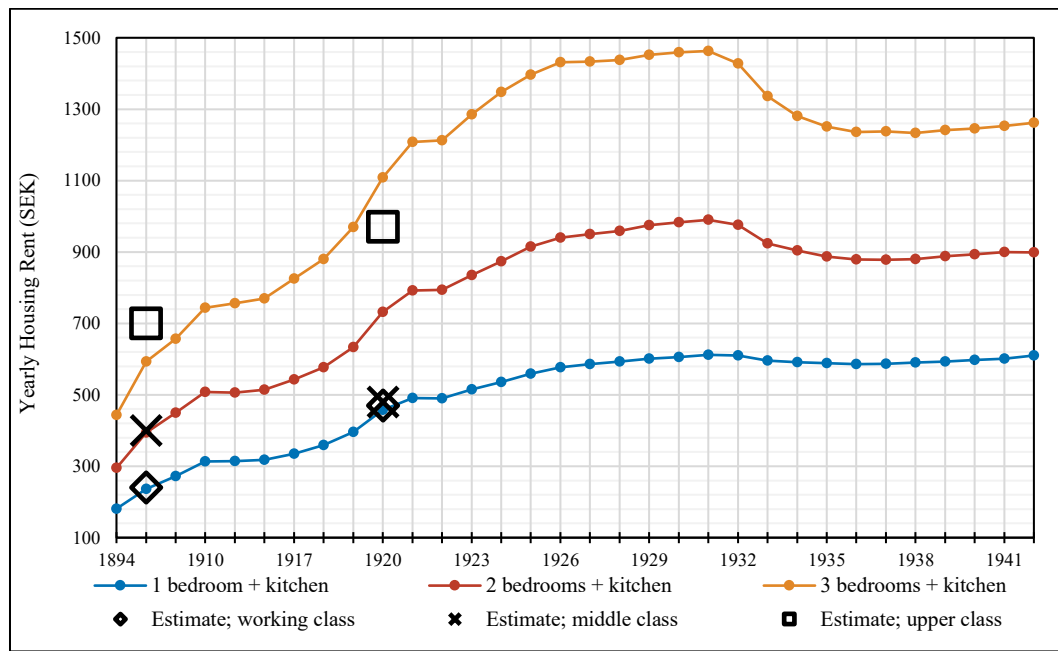
Figure 4. Median Income Estimates Compared to Contemporary Statistics



Note: Wages in Stockholm for male and female workers at the Hamburger brewery and at the Liljeholmen Stearine Factory 1896-1925, adapted from Lundberg et al. (1933, tbl.127, p. 528-529, 1933, tbl.145, p. 561). Compared against the estimated working-class incomes obtained in in table 3 and 4 (estimates without imputations).

The estimates produced for the level of housing rent across all social classes in 1900 and 1920 are compared against official statistics from Stockholm stads statistiska kontor (1915, 1950) in figure 5. An interesting observation is how the estimated housing rent for the working class aligns with the cost of an apartment with one bedroom and kitchen both in 1900 and 1920, while the estimated housing rents for the upper class resembles the rental cost of a three-bedroom apartment. This observation is thus in line with postulates from microeconomic theory, namely that lower incomes translate into smaller, cheaper housing. Another interesting observation is that while the median middle-class family paid a housing rent equivalent to a two-bedroom apartment in 1900, by 1920, they paid a rent amounting to a one-bedroom apartment. The median household in the upper and working class have on the other hand been able to maintain their housing consumption when comparing the two data points.

Figure 5. Median Rent Estimates Compared to Contemporary Statistics



Note: Housing rents for apartments in Stockholm, depending on size 1894-1945. Source: 1894-1910 (Stockholm stads statistiska kontor, 1915, tbl.106, p. 221), 1914-1945 (Stockholm stads statistiska kontor, 1950, tbl.122, p. 106). Compared against the results obtained in table 3 and 4 (estimates with imputations).

4.2. Housing Affordability

While the level of housing rents obtained from the estimates above can give useful insights on a topic where the empirical information is limited, this does not inform the debate of the role housing rents had in the household budget at the time. Housing affordability is therefore explored by estimating the rent-to-income ratio for the three social classes.

The results for 1900, depicted in table 5, illustrate how the median household in the upper class spent 28% of their budget on housing rent, while the middle and working class spent 33%, when the estimation is based on the sub-sample only containing households with recorded incomes and housing rents. Comparing this to the results obtained from the imputed sample shows an interesting pattern: While the estimated rent-to-income ratio is lower for the imputed sample than the sub-sample among the upper and middle class (24% and 31% respectively), this estimate is higher for the working class after adding the imputed values (39%). The reason for this is likely due to how a larger fraction of working-class households had an income below the threshold of the *bevillning* tax and a low housing rent. As the imputed values are implemented in order to correct for the absence of low wages and low housing rents, these will as such induce a larger change among the working class compared to

the other social classes. These differences are as such in line with the intended function of the imputed values, which is to account for low-wage households.

Table 5. Median Rent-to-Income Ratio. 1900

Class	Sub-sample ^{a)}	N ^{a)}	Imputed sample ^{b)}	N ^{b)}
Upper Class	0.28 (0.26,0.32)	122	0.24 (0.22,0.26)	209
Middle Class	0.33 (0.28,0.36)	278	0.31 (0.27,0.36)	574
Working Class	0.33 (0.31,0.36)	310	0.39 (0.34,0.44)	1191

Note: 95% bootstrap confidence intervals in parentheses. Share of total household income being absorbed by rent payment estimated over:

^{a)} Sub-sample containing households with a recorded housing rent and income.

^{b)} Entire sample, where missing values have been imputed for.

Table 6. Median Rent-to-Income Ratio. 1920

Class	Sub-sample ^{a)}	N ^{a)}	Imputed sample ^{b)}	N ^{b)}
Upper Class	0.13 (0.11,0.15)	168	0.14 (0.12,0.16)	306
Middle Class	0.13 (0.12,0.14)	331	0.13 (0.12,0.14)	762
Working Class	0.11 (0.11,0.12)	645	0.14 (0.14,0.15)	1590

Note: 95% bootstrap confidence intervals in parentheses. Share of total household income being absorbed by rent payment estimated over:

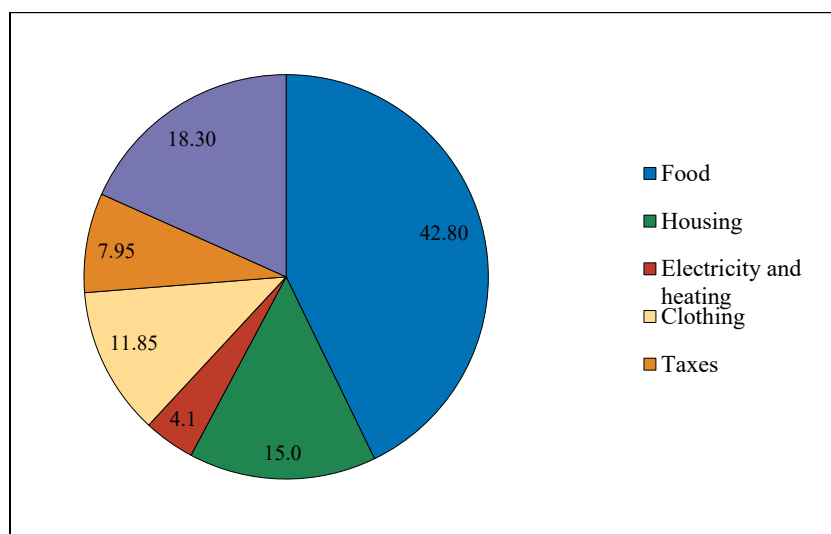
^{a)} Sub-sample containing households with a recorded housing rent and income.

^{b)} Entire sample, where missing values have been imputed for.

Comparing the estimates from 1900 to the results obtained from 1920, depicted in table 6, shows a surprising result. Two features are worth discussing: First, how the share of the median household budget being reserved for housing rents is dramatically lower in 1920 than in 1900, being 13% for the upper and middle class and 11% for the working class, looking at the sub-sample. The second interesting observation is how the rent-to-income ratio has equalised across the social classes within the sample. Looking at the sub-sample only containing observations on housing rent and income from the source material, the difference in rent-to-income ratio between the median household in the working and upper class is only two percentage points. When adding the imputed values, the rent to-income ratio is even more equal across the social classes being 14% for the upper and working class and 13% for the middle class. This is similar to estimates on the aggregate level produced by the National Board of Health and Welfare (*Socialstyrelsen*) in 1933, which is illustrated in figure 6 below.

The figure shows a typical Swedish budget in the year 1920, where 15% of their pre-tax income was used on housing, while almost half of the budget was reserved for food.

Figure 6. A Typical Household Budget in 1920



Note: Each block shows the share each commodity demands of a typical household budget. Adapted from the original diagram from Socialstyrelsen (1933, p.15).

Comparing these results to research conducted on other European cities in the same time period on the aggregate level, this budget share equalled 18.1% in Paris in 1900, 18.43% in London in 1925, while being 11.6% for a bundle of Belgian cities and 16.25% for Amsterdam in 1910 and 1911 respectively (Eichholtz et al., 2019, p.21). Carmona et al. (2017, p.640) estimates the same share to have been 18.7% for working-class families in Barcelona in 1920, while hovering around 10% in other Spanish cities in the same year. In this context, the estimates for Stockholm in 1900 sticks out as very high compared to other European cities, both for each social class (table 5) and on the aggregate level, where the rent-to-income ratio equals 32%. Forsell (2003, p.213) does however point out that housing rents in Stockholm were high compared to other similar cities when entering the 20th century: The price of a one- or two-bedroom apartment in Stockholm was in fact twice as high as in Copenhagen, and 10-15% higher than in Berlin at the turn of century (Forsell, 2003, p.213). The estimates obtained for Stockholm in 1920 are on the other hand more similar to what the above-mentioned research have found for their specific cases, both on when looking at the working class specifically (table 6) and the aggregate level, which suggest a 12% budget share spent on housing.

4.3. *Situating the Findings in its' Historical Context*

Between the mid-19th century and the interwar period, the housing market in Stockholm was volatile, creating cycles of booms and busts that affected both property owners and tenants (Perlinge, 2012, p.32). While home-ownership before this period only functioned to serve the wealthier households' needs and desire for accommodation, housing had by 1870 also become an "asset, source of income or a pension insurance" for many property owners (Forsell, 2003, p.174, my translation). Housing had thus become a popular object of investment when entering the 20th century (Forsell, 2003, p.194).

With a considerable influx of new residents following industrial development, there was a severe housing shortage throughout the period of study (Forsell, 2003, p.293). This led housing rents to increase steadily, with the two highest price hikes centred around our two benchmark years. Contemporary statistics show for instance that while the median housing rent of a one-bedroom apartment increased with 30.4% between 1894 and 1900, the cost for the same apartment only rose by 3.5% in the period 1910-1914 (Stockholm stads statistiska kontor, 1930, tbl.110, p.109). With the outbreak of the war and the subsequent inflationary period that followed, rent levels reached a new height as landlords raised rents with 47.2% between 1914 and 1920 (Stockholm stads statistiska kontor, 1930, tbl.110, p.109). Both of the benchmark years this study is based on were thus situated in periods of exceptionally high housing rents.

Nonetheless, a surprising result is how the budget share spent on housing rent by the median household in Stockholm is lower and more equal across all social classes in 1920 than in 1900. While one could interpret this as a sign of real wage increase and better housing conditions, placing these results in its' historical context may suggest otherwise. Although periods of booms in housing construction (always replaced by a subsequent down-turn) since 1860 had increased the total housing supply, the access to accommodation for the working class was scarce. As it was more profitable for property owners to direct their investments towards the middle class, the new housing that was built consisted of apartment buildings with larger dwellings out of reach for the majority of the city's new residents, most of whom belonged to the working class (Forsell, 2003, p.221).

The result was that working-class families either lived in cheaper apartments of low quality or clustered together in order to afford rent. After founding a municipality-led housing inspection authority (*Stockholm bostadsinspektion*) in 1906, reoccurring sights on inspections of conditions in the city's apartments were

“humidity, mould, pests, temporary sleeping spots in wardrobes and other unsuitable spaces, inadequate ventilation, low temperatures despite hours of wood-burning in the kitchen stove, non-airtight windows and commercial premises or laundry rooms on attics being used as housing”,

as Perlinge (2012, p.28, my translation) describes it. That a smaller share of the household budget was reserved for rent in 1920 than in 1900 did therefore not necessarily translate into better housing conditions for everyone.

While the average rent for most apartments in Stockholm increased by 125% between 1894 and 1920, the people residing in the largest apartments (more than five rooms) experienced a price increase of 70% (Molitoris, 2015, p.32, paper 1). Going back to figure 5, where the rent-estimates obtained in the study is compared against contemporary statistics, the median upper-class family have a housing rent equivalent to a flat of approximately the same size in 1920 as they had in 1900, while the effect is the opposite for the median family in the middle class. For the working class, the median rent paid in 1920 is equivalent to a dwelling of the same size as they could afford in 1900. Drawing on the microeconomic theory discussed in section 2.1, one could interpret these results as the middle class responding to the substantial price increases by consuming less housing and moving into smaller apartments. For the working class, already living in constrained space it is likely that downsizing was less of an option. Instead, one could argue that they were increasingly forced to cluster together at higher rates, implying that a decrease and compression of the rent-to-income ratio had different effects for the different strata of the population.

Although the underlying dynamics behind the observed results cannot be fully uncovered based on affordability measures from two benchmark years, such an interpretation is supported by the literature. Molitoris (2015, p.28, paper 4) points for instance to disproportionate housing conditions as one of the main reasons why mortality differentials between social classes in Stockholm more or less persisted between 1878 and 1926. While the size of upper class households shrunk by 30% during the period, low and unskilled workers experienced a net increase in residents per household and had by 1926 a mean household size which was roughly the same as it had been 100 years earlier (Molitoris, 2015, p.29, paper 4). These conditions increased the risk of airborne infections, which the author shows was the main driver, alongside with nutritional deficiency, behind the socio-economic differences in mortality rates in the period after 1900 (Molitoris, 2015, p.29, paper 4).

Although the population saw overall improvements in living standards, measured by survival and wages (Molitoris, 2015, p.28, paper 3), it is likely that the decrease in housing affordability between 1900 and 1920 materialised into different conditions for the social classes. Although living standards were improving for all parts of the income distribution, the working class experienced a persistent housing shortage throughout this period. As the liberal newspaper *Stockholm's Dagblad* wrote in 1916, there was “a strong preference for building luxury apartments, but little interest in constructing small flats” (cited in Forsell, 2003, p.289, my translation). One could therefore argue that the highly unregulated housing market, where housing became an object of investment rather than a home, did not manage to serve the need the residents had for this infrastructure during the period.

It is however important to emphasise that the results above cannot directly inform the question of the causal dynamics behind the observed development. In order to fully uncover what lies behind the apparent decrease and equalisation of housing affordability in early 20th century Stockholm, obtaining data with information about underlying housing quality is crucial (Eichholtz et al., 2019, p.5). Despite not being able to disentangle the entire puzzle of housing rents and housing affordability in early 20th century Stockholm, the results however confirm earlier research suggesting that housing rents were high during this period (Forsell, 2003; Perlinge, 2012) and that this had significant implications for the residents' living standards by absorbing a substantial part of the household budget (Molitoris, 2015; Önnersfors, 2021).

4.1. The Findings in Relation to the Literature

The results suggest that the share reserved for housing rents for a typical Stockholm-household was significantly larger in both 1900 and in 1920 than the theorised value of 5% presented by Allen (2005) and later adopted in studies at the household level (Horrell et al., 2021) and in Swedish cost-of-living studies (Ericsson & Molinder, 2020; Gary, 2018). The estimated shares obtained here are also higher than the proxy-based estimated utilised by Myrdal & Bouvin (1933) of 10%. One could therefore argue that there is reason to believe that the role of housing in the historical consumption basket in the early 20th century, especially in big cities, is underestimated in Swedish cost-of-living studies. It is however important to emphasise that regional estimates from two benchmark years cannot provide a full answer to what is hidden behind the “standard piece of missing data” that is housing rents (Gary, 2018, p.42, paper 1). The discrepancy between the results in this study and the methods applied in earlier research, suggests however that the research effort devoted to investigating

empirical housing rents should be intensified, as the results produced here imply that housing may have played a larger role in the economy of the household than assumed by the majority of the cost-of-living literature.

Another interesting implication of the results produced above is that they suggest that the budget share spent on housing rents has not been constant over time. This has implications for the same cost-of-living studies, considering how housing costs often are assigned a constant share throughout the whole study (Allen, 2001). Observing a non-constant rent-to-income ratio is supported by the long-term study on European housing rents conducted by Eichholtz et al. (2019, p.21) finding that housing rents demanded a significantly lower budget share in the early 20th century than it does today, and that the cause of this is how the population have been living at an increasingly larger space, of improved quality, over the period. For economic historians, the results produced in this study thus suggest that housing has a more dynamic role in the household budget over time than often assumed and, accordingly, that its influence on living standards are not static in the long run.

The size of the historical budget share spent on housing is also important to understand the general dynamics of economic inequality. Stockholm's loan market by the end 19th century was, as described by Forsell (2003, p.194), dominated by private capitalists seeking to make a profitable investment in housing: "The home had become a commodity", as the author notes (Forsell, 2003, p.194, my translation). The degree to which housing is an object of speculation is important, considering how the payment of a housing rent in a capitalist society, in essence is a transformation of labour income from the tenant into capital income for the landlord (Piketty, 2020, p.284). In a period where increasing demand drive prices up faster than the tenant's wage, this involves tenants spending an increasing share of their income on housing rents – in turn increasing the capital stock of the landlord while being left with less to cover their own expenses. The size of this transaction is therefore an important factor driving the historical patterns of long-run inequality.

5. Conclusion

The aim of this study has been to deepen our understanding about historical housing rents by answering the two following research questions:

- 1) *How did housing rents differ between social classes in Stockholm in 1900 and 1920?*
- 2) *How did housing affordability vary across social classes in Stockholm in 1900 and 1920?*

Relying on a unique set of microdata covering the incomes, family structure and housing rents for over a thousand households in 1900 ($N = 1071$) and 1920 ($N = 1031$), the level of housing rent has been estimated for three different social classes following the HISCLASS scheme. Housing affordability has been estimated by measuring the share of the household budget reserved for rent; the rent-to-income ratio, and its variation between the three social classes.

The results produced in this study suggest that a median working-class household spent 33% of their household budget on housing rent in 1900, and 11% in 1920. Encompassed within these results are two central findings: First, how the empirical budget share estimated through this study is significantly larger than both the theoretical assumptions (Allen, 2001; Horrell et al., 2021) and proxy-based indices (Feinstein, 1998; Myrdal & Bouvin, 1933) often used in historical cost-of-living studies (usually ranging between 5% and 10%). The results suggest secondly that this share is not static over time, as the assumptions and indices mentioned above have implied. This has implications for the literature measuring the cost of living, as the role of housing rents in the historical consumption basket, especially in larger cities, likely is higher and more volatile than these studies assume (Ericsson & Molinder, 2020; Gary, 2018; Myrdal & Bouvin, 1933). Although two benchmark estimates do not have the capacity fully disentangle the puzzle behind this variable, the results suggests that more research devoted to gathering empirical estimates of historical housing rents should be prioritised to obtain a sharper picture of how living standards and its' distribution within the population have developed throughout history.

This study has also expanded the scope of the typical cost-of-living study by comparing how housing affordability varied between social classes. The scope has brought forward an interesting result: Despite the population experiencing steadily increasing housing rents and persisting economic inequality throughout the period of study, the rent-to-income ratio was lower and more equal in 1920 than in 1900. While situating the results in its' historical context suggests that this did not directly translate into better housing conditions for all, more research devoted to measuring the underlying variables, for instance the level of overcrowding and general housing quality, is needed to be able to fully understand how this pattern materialised over time.

Furthermore, considering how housing costs have been referred to as “one of the most difficult items to measure” due to the lack of data (Feinstein, 1998, p.638), it is important to

highlight how the chosen case inhibits characteristics transferable to other contexts: Stockholm in the early 20th century was undergoing the transition from early to fully industrialised, which in turn involved a massive influx of new residents drastically increasing demand for accommodation. As emphasised by Carmona et al. (2017, p.632), this is a development nearly every industrialised city underwent at some point in their growth trajectory. Although one should be careful in generalising individual results, the results produced in this study together with the findings of Eichholtz et al. (2019) and Carmona et al. (2017), gives support to claims that housing rents might have absorbed more than 5% of the household budget in other cities undergoing similar transitions.

Avenues for future research can fruitfully devote an intensified effort towards documenting historical housing rents both for new cases and over a longer period of time. This involves increasing our understanding of how fluctuations in housing costs materialised in different housing conditions for the population, and the causal mechanisms driving these dynamics. Importantly, developing a thorough understanding of the history of housing shortages becomes increasingly relevant in a society where the word “housing crisis” again has reached the frontpage of the newspapers (Collin & Svensson, 2024; Skopeliti, 2024).

6. Literature

- Albouy, D. & Zabek, M. (2016). Housing Inequality, Vol. Working Paper 21916, Cambridge, MA, 2016, Cambridge, MA: NBER Working Papers, Available Online: <http://www.nber.org/papers/w21916>
- Allen, R. C. (2001). The Great Divergence in European Wages and Prices from the Middle Ages to the First World War, *Explorations in Economic History*, vol. 38, no. 4, pp.411–447
- Allen, R. C., Bengtsson, T. & Dribe, M. (2005). Introduction, in *Living Standards in the Past: New Perspectives on Well-Being in Asia and Europe*, [e-book] Oxford University Press, p.0, Available Online: <https://doi.org/10.1093/0199280681.003.0001> [Accessed 30 April 2025]
- Bengtsson, E. & Molinder, J. (2021). What Happened to the Incomes of the Rich during the Great Levelling? Evidence from Swedish Individual-Level Data, 1909–1950, *What Happened to the Incomes of the Rich during the Great Levelling? Evidence from Swedish Individual-level Data, 1909–1950*
- Bengtsson, E. & Molinder, J. (2024). Incomes and Income Inequality in Stockholm, 1870–1970: Evidence from Micro Data, *Explorations in Economic History*, vol. 92, p.101568
- Bengtsson, E., Molinder, J. & Prado, S. (2024). The Swedish Transition to Equality: Income Inequality with New Micro Data, 1862–1970, *Lund University*, Available Online: <https://portal.research.lu.se/en/projects/the-swedish-transition-to-equality-income-inequality-with-new-mic> [Accessed 3 May 2025]
- Carmona, J., Lampe, M. & Rosés, J. (2017). Housing Affordability during the Urban Transition in Spain, *The Economic History Review*, vol. 70, no. 2, pp.632–658
- Clark, G. (2002). Shelter From the Storm: Housing and the Industrial Revolution, 1550–1909, *The Journal of Economic History*, vol. 62, no. 2, pp.489–511
- Clark, G. (2005). The Condition of the Working Class in England, 1209–2004, *Journal of Political Economy*, vol. 113, no. 6, pp.1307–1340
- Clark, G. (2007). A Farewell to Alms: A Brief Economic History of the World, Princeton, N.J.: Princeton University Press
- Collin, A. & Svensson, A. (2024). Om bostadskrisen i Stockholm: ”Situationen försämras för varje år som går”, *SVT Nyheter*, Available Online: <https://www.svt.se/nyheter/lokalt/stockholm/om-bostadskrisen-i-stockholm-situationen-forsamras-for-varje-ar-som-gar> [Accessed 20 May 2025]
- Cowell, F. A. & Flachaire, E. (2007). Income Distribution and Inequality Measurement: The Problem of Extreme Values, *Journal of Econometrics*, vol. 141, no. 2, pp.1044–1072
- Dong, H. (2018). The Impact of Income Inequality on Rental Affordability: An Empirical Study in Large American Metropolitan Areas, *Urban Studies*, vol. 55, no. 10, pp.2106–2122
- Dustmann, C., Fitzenberger, B. & Zimmermann, M. (2022). Housing Expenditure and Income Inequality, *The Economic Journal*, vol. 132, no. 645, pp.1709–1736
- Edvinsson, R., Eriksson, K. & Ingman, G. (2021). A Real Estate Price Index for Stockholm, Sweden 1818–2018: Putting the Last Decades Housing Price Boom in a Historical Perspective, *Scandinavian Economic History Review*, vol. 69, no. 1, pp.83–101

- Eichholtz, P., Korevaar, M. & Lindenthal, T. (2019). 500 Years of Housing Rents, Quality and Affordability, *Quality and Affordability*, [e-journal], Available Online: https://www.researchgate.net/publication/328278380_500_Years_of_Housing_Rents_Quality_and_Affordability
- Eichholtz, P., Straetmans, S. & Theebe, M. (2012). The Amsterdam Rent Index: The Housing Market and the Economy, 1550–1850, *Journal of Housing Economics*, vol. 21, no. 4, pp.269–282
- Ericsson, J. & Molinder, J. (2020). Economic Growth and the Development of Real Wages: Swedish Construction Workers' Wages in Comparative Perspective, 1831–1900, *The Journal of Economic History*, vol. 80, no. 3, pp.813–852
- Eurostat. (2025). Glossary: Housing Cost Overburden Rate, *Statistics Explained*, Available Online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Housing_cost_overburden_rate [Accessed 19 May 2025]
- Fallis, G. (1985). 2 - The Demand for Housing, in G. Fallis (ed.), *Housing Economics*, [e-book] Toronto: Butterworth-Heinemann, pp.27–48, Available Online: <https://www.sciencedirect.com/science/article/pii/B9780409829402500058> [Accessed 29 April 2025]
- Feinstein, C. H. (1998). Pessimism Perpetuated: Real Wages and the Standard of Living in Britain during and after the Industrial Revolution, *The Journal of Economic History*, vol. 58, no. 3, pp.625–658
- Forsell, H. (2003). Hus och hyra: fastighetsägande och stadstillväxt i Berlin och Stockholm 1860-1920 [Home and Rent: Property-ownership and City Growth in Berlin and Stockholm 1860-1920], Phd Thesis, Stads- och kommunhistoriska institutet [Department of City and Municipality History], Stockholm University
- Gary, K. (2018). Work, Wages and Income: Remuneration and Labor Patterns in Sweden 1500-1850, Phd Thesis, Department of Economic History, Lund University, 91, (91) (2018), Available Online: <http://lup.lub.lu.se/record/a009e78a-428e-47d5-873b-4f1ad5f7868b> [Accessed 6 May 2025]
- Gerring, J. (2004). What Is a Case Study and What Is It Good For?, *American Political Science Review*, vol. 98, no. 2, pp.341–354
- Gray, R. (2020). Inequality in Nineteenth-Century Manhattan: Evidence from the Housing Market, *Social Science History*, vol. 44, no. 3, pp.571–582
- Hamark, J., Collin, K. & Prado, S. (2024). A New Benchmark for Industrial Wages in Mid-1880s Sweden, 1, *Essays in Economic & Business History*, vol. 42, no. 1, pp.116–151
- Hammarström, I. (1970). Stockholm i Svensk Ekonomi 1850-1914 [Stockholm in the Swedish Economy 1850-1914], Stockholm: Almqvist & Wiksell
- Holmlund, B. (2013). Wage and Employment Determination in Volatile Times: Sweden 1913–1939, *Cliometrica*, vol. 7, no. 2, pp.131–159
- Holmqvist, E. & Turner, L. M. (2014). Swedish Welfare State and Housing Markets: Under Economic and Political Pressure, *Journal of Housing and the Built Environment*, vol. 29, no. 2, pp.237–254
- Horrell, S., Humphries, J. & Weisdorf, J. (2021). Family Standards of Living Over the Long Run, England 1280–1850*, *Past & Present*, vol. 250, no. 1, pp.87–134

- Krugman, P. & Wells, R. (2015). *Economics*, New York: Macmillan Learning
- Leeuwen, M. H. D. van & Maas, I. (2005). A Short Note on HISCLASS, *Academia*, [e-journal], Available Online: https://www.academia.edu/2514497/A_short_note_on_HISCLASS [Accessed 7 May 2025]
- Leeuwen, M. H. D. van & Maas, I. (2011). *Hisclass: A Historical International Social Class Scheme*, Leuven: Universitaire Pers Leuven
- Ljungberg, J. (2025). European Consumer Price Indices since 1870, *Cliometrica*, vol. 19, no. 1, pp.29–80
- Lundberg, E., Svernilson, I. & Bagge, G. (1933). *Wages, Cost of Living and National Income in Sweden 1860-1930 Vol. 2 Wages in Sweden 1860-1930*, London : P.S. King ;
- McCants, A. E. C. (2007). Inequality among the Poor of Eighteenth Century Amsterdam, *Explorations in Economic History*, vol. 44, no. 1, pp.1–21
- Meen, G. (2024). Neo-Classical Housing Economics and Beyond, in *The Routledge Handbook of Housing Economics*, London: Routledge
- Molitoris, J. (2015). *Life and Death in the City: Demography and Living Standards during Stockholm's Industrialization*, Phd Thesis, Department of Economic History, Lund University
- Myrdal, G. & Bouvin, S. (1933). *Wages, Cost of Living and National Income in Sweden 1860-1930. Vol. 1: The Cost of Living in Sweden 1830-1930*, edited by Stockholms högskola, London/Stockholm: P.S. King ; Norstedt
- Önnerfors, M. (2021). *Water for the Many: Health, Neighbourhood Change and Equality of Access during the Expansion of Swedish Urban Water Networks*, Phd Thesis, Department of Economic History, Lund University
- Pattillo, M. (2013). Housing: Commodity versus Right, *Annual Review of Sociology*, vol. 39, no. Volume 39, 2013, pp.509–531
- Perlinge, A. (2012). *Bubblan som sprack: Byggboomen i Stockholm 1896-1908 [The Bubble that Burst: The Building Boom in Stockholm 1896-1908]*, Stockholm: Stockholmia förlag i samarbete med Centrum för näringslivshistoria
- Piketty, T. (2020). *Capital and Ideology*, Cambridge, MA: Belknap Press, an Imprint of Harvard University Press
- Prado, S. (2010). Nominal and Real Wages of Manufacturing Workers, 1860–2007, *Exchange Rates, Prices, and Wages*, Available Online: <https://www.riksbank.se/globalassets/media/forskning/monetar-statistik/volym1/10.pdf> [Accessed 15 May 2025]
- Rizzo, M. L. (2019). *Statistical Computing with R, Second Edition.*, Boca Raton, FL: CRC Press
- Rodger, R. (2022). Property and Inequality: Housing Dynamics in a Nineteenth-Century City, *The Economic History Review*, vol. 75, no. 4, pp.1151–1181
- Roine, J. & Waldenström, D. (2008). The Evolution of Top Incomes in an Egalitarian Society: Sweden, 1903–2004, *Journal of Public Economics*, vol. 92, no. 1, pp.366–387

- Samy, L. (2015). Indices of House Prices and Rent Prices of Residential Property in London, 1895-1939, 134, *Oxford Economic and Social History Working Papers*, [e-journal], Available Online: https://ideas.repec.org/p/oxf/esohwp/_134.html [Accessed 20 April 2025]
- Skopeliti, C. (2024). 'I'm Screwed': Young Adults Forced by EU Housing Crisis to Live with Parents, *The Guardian*, 21 May, Available Online: <https://www.theguardian.com/news/article/2024/may/21/young-adults-forced-by-eu-housing-crisis-to-live-with-parents> [Accessed 20 May 2025]
- Smedberg, C.-F. (2022). Klassriket: Socialgruppsindelningen som skillnadsteknologi under 1900-talet [The Class Society: Social Group Division and the Technology of Distinguishing during the 20th Century], Phd Thesis, Disciplinary Domain of Humanities and Social Sciences, Faculty of Arts, Department of History of Science and Ideas, Uppsala University, Available Online: <https://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-481249> [Accessed 7 May 2025]
- Socialstyrelsen. (1920). 1912-1914. Allmänna bostadsräkningar (General Housing Census). Del 1. Allmän redogörelse, Available Through: The Swedish Statistical Bureau (Statistiska centralbyrån) <https://www.scb.se/hitta-statistik/aldre-statistik/innehall/sveriges-officiella-statistik-sos/folk-och-bostadsrakningarna/allman-na-bostadsrakningen-19121960/> [Accessed 10 May 2025]
- Socialstyrelsen. (1924). 1920. Allmänna bostadsräkningar (General Housing Census), Available Through: The Swedish Statistical Bureau (Statistiska centralbyrån) <https://www.scb.se/hitta-statistik/aldre-statistik/innehall/sveriges-officiella-statistik-sos/folk-och-bostadsrakningarna/allman-na-bostadsrakningen-19121960/> [Accessed 10 May 2025]
- Socialstyrelsen. (1933). Detaljpriser och indexberäkningar (Retail prices and Index Calculations). 1913-1930. A.-B. Hasse W. Tullbergs Boktryckeri. Available Through: The Swedish Statistical Bureau (Statistiska centralbyrån)
- Stockholm City Archive. (1901). Mantals- och kronotaxeringslängder Stockholms stad - 1901 [Population and Tax Register in Stockholm City - 1901], Available Through: Stockholm City Archive <https://sok.riksarkivet.se/mantalslangder-stockholms-stad/?Referenskod=SE%2FSSA%2F0031%2F06%2FG+1+BA&DatumFran=&DatumTill=&Fritext=> [Accessed 3 May 2025]
- Stockholm City Archive. (1921). Mantals- och kronotaxeringslängder Stockholms stad - 1921 [Population and Tax Register in Stockholm City - 1921], Available Through: Digitalised by Archive <https://sok.riksarkivet.se/mantalslangder-stockholms-stad/?Referenskod=SE%2FSSA%2F0031%2F06%2FG+1+BA&DatumFran=&DatumTill=&Fritext=> [Accessed 3 May 2025]
- Stockholm stads statistiska kontor. (1904). Statistisk Årsbok För Stockholms Stad [Statistical Yearbook for Stockholm City] 1904, Available Through: Stockholm City Archive <https://sok.stadsarkivet.stockholm.se/Databas/statistik-arsbok-1904-2006/Sok?sidindex=0> [Accessed 28 April 2025]
- Stockholm stads statistiska kontor. (1905). Statistisk Årsbok För Stockholms Stad [Statistical Yearbook for Stockholm City] 1905, Available Through: Stockholm City Archive <https://sok.stadsarkivet.stockholm.se/Databas/statistik-arsbok-1904-2006/Sok?sidindex=0> [Accessed 28 April 2025]
- Stockholm stads statistiska kontor. (1915). Statistisk Årsbok För Stockholms Stad [Statistical Yearbook for Stockholm City] 1915, Available Through: Stockholm City Archive

<https://sok.stadsarkivet.stockholm.se/Databas/statistik-arsbok-1904-2006/Sok?sidindex=0>
[Accessed 28 April 2025]

Stockholm stads statistiska kontor. (1921). Statistisk Årsbok För Stockholms Stad [Statistical Yearbook for Stockholm City] 1921, Available Through: Stockholm City Archive
<https://sok.stadsarkivet.stockholm.se/Databas/statistik-arsbok-1904-2006/Sok?sidindex=0>
[Accessed 28 April 2025]

Stockholm stads statistiska kontor. (1923). Statistisk Årsbok För Stockholms Stad [Statistical Yearbook for Stockholm City] 1923, Available Through: Stockholm City Archive
<https://sok.stadsarkivet.stockholm.se/Databas/statistik-arsbok-1904-2006/Sok?sidindex=0>
[Accessed 28 April 2025]

Stockholm stads statistiska kontor. (1930). Statistisk Årsbok För Stockholms Stad [Statistical Yearbook for Stockholm City] 1930, Available Through: Stockholm City Archive
<https://sok.stadsarkivet.stockholm.se/Databas/statistik-arsbok-1904-2006/Sok?sidindex=0>
[Accessed 18 May 2025]

Stockholm stads statistiska kontor. (1950). Statistisk Årsbok För Stockholms Stad [Statistical Yearbook for Stockholm City] 1950, Available Through: Stockholm City Archive
<https://sok.stadsarkivet.stockholm.se/Databas/statistik-arsbok-1904-2006/Sok?sidindex=0>
[Accessed 28 April 2025]

Stockholmskällan. (2021). Rotecharta 1880-1925, *Stockholmskällan*, Available Online:
<https://stockholmskallan.stockholm.se/post/18579> [Accessed 22 April 2025]

Whitehead, C. & Meen, G. (2020). Is Housing Really Unaffordable?, in *Understanding Affordability: The Economics of Housing Markets*, [e-book] Bristol: Bristol University Press, pp.17–38, Available Online: <https://www.cambridge.org/core/books/understanding-affordability/is-housing-really-unaffordable/04B19ACA11DB90024ACA8BF1192122C5> [Accessed 29 April 2025]

7. Appendix

The appendix consists of five parts. Every reference mentioned in the appendix can be found in the main reference list above.

A. Sample Composition

The population and taxation registers in Stockholm were recorded for each *rote*, which were administrative areas following the borders of the parishes and used in the period 1878-1926 (Bengtsson & Molinder, 2024, app.A2). The composition of *rotar* from which the individuals making up the sample are drawn from are listed in the table below.

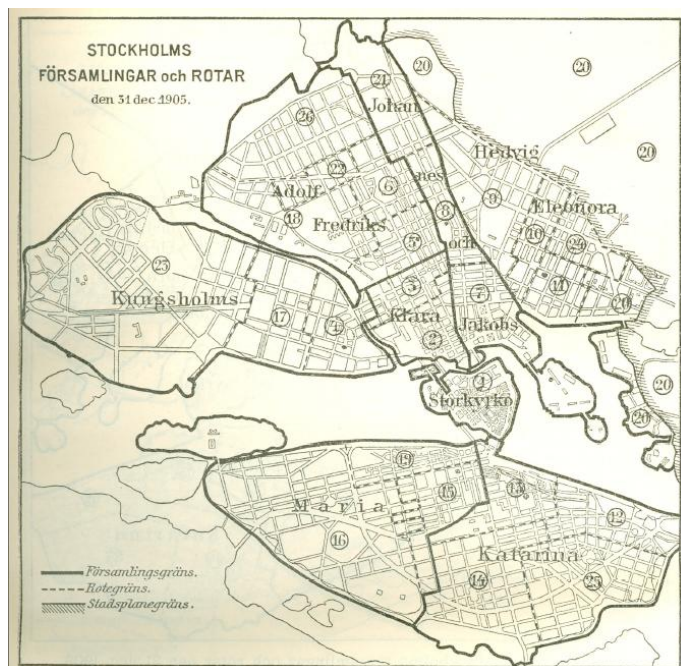
Table A1. The geographical composition of each sample

Year	N (individual level)	N (household level)	Rote	Parish	District
1900	5385	2114	2	Clara	Norrmalm
			7	Jacob & Johannes	Norrmalm
			9	Hedvig Eleonora	Östermalm
			10	Hedvig Eleonora	Östermalm
			15	Maria	Södermalm
			18	Adolf Fredrik	Norrmalm
			19	Maria	Södermalm
			24	Hedvig Eleonora	Östermalm
1920	6581	2914	2	Clara	Norrmalm
			7	Jacob	Norrmalm
			9	Hedvig Eleonora	Östermalm
			14	Katarina	Södermalm
			16	Maria-Högalid	Södermalm
			17	Kungsholmen	Kungsholmen
			23	Kungsholmen - St. Göran	Kungsholmen
			24	Oscar	Östermalm
			30	Matteus	Vasastan
			31	Maria	Södermalm
			35	Bromma	Bromma
			36	Katarina	Södermlam

Note: Source: Bengtsson & Molinder (2024, app.A2).

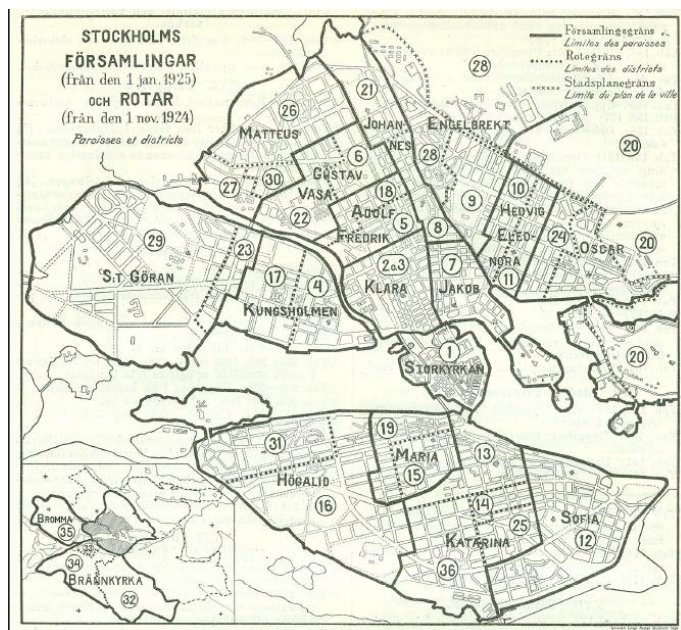
In response to the city becoming more populated, the number of *rotar* increased. Where the given areas are situated geographically in both 1900 and 1920 are illustrated in the figures below.

Figure A1. Rotar and Parishes in Stockholm in 1900



Note: Overview of rotar and parishes in Stockholm, as they were organised in 1900. Picture from *Stockholmskällan* (2021).

Figure A2. Rotar and Parishes in Stockholm in 1900



Note: Overview of rotar and parishes in Stockholm, as they were organised in 1920. Picture from *Stockholmskällan* (2021).

B. Geographical Variations in Housing Rents and Income

In the process of becoming a fully industrialised city, the socio-economic divide between geographical areas increased (Önnerfors, 2021, p.28). As the access to small, crowded apartments was higher in the working-class districts of Södermalm and Kungsholmen,

poverty built up in these areas. During the first decades of the century for instance, 55% of the recipients of the city's poverty assistance resided in either Södermalm or Kungsholmen (Molitoris, 2015, p.20). In comparison, over 50% of the residents in Östermalm belonged to the economic elite between 1901 and 1926.⁴ This geographical and socio-economic divide is also present in the sample utilised in this study, as illustrated in table B1 and B2. They show how the richer Östermalm-parishes had the largest fraction of upper-class residents while the Södermalm-parishes had the highest fraction of residents from the working class.

Table B1. Class Composition in Each Parish (%). 1900

District	Parish	Working Class	Middle Class	Upper Class
Norrmalm	Adolf Fredriks	63.5	27	9.5
Norrmalm	Clara	63.0	26	11.0
Östermalm	Hedvig Eleonora	51.0	34	15.0
Norrmalm	Jacob & Johannes	56.0	33	11.0
Södermalm	Maria	71.9	23	5.1

Note: Table showing the share (%) of each social class represented in the sample utilised in the study.

Table B2. Class Composition in Each Parish (%). 1920

District	Parish	Working Class	Middle Class	Upper Class
Bromma	Bromma	69.0	20	11.0
Norrmalm	Clara	52.0	35	13.0
Östermalm	Hedvig Eleonora	31.0	36	33.0
Norrmalm	Jacob	50.0	33	17.0
Södermalm	Katarina	69.4	24	6.6
Kungsholmen	Kungsholmen	61.1	31	7.9
Södermalm	Maria	75.2	22	2.8
Södermalm	Maria-Högalid	69.3	25	5.7
Vasastan	Matteus	62.9	31	6.1
Östermalm	Oscar	41.0	34	25.0

Note: Table showing the share (%) of each social class represented in the sample utilised in the study.

⁴ Defined as having an occupation equaling a HISCLASS-score of 1 or 2 (Molitoris, 2015, p.23).

One could therefore expect the variation of median incomes and housing rents between the parishes and districts to mirror the differences observed in the study based on social class. This is confirmed in table B3 and B4. The parishes with the highest median income and housing rent, are the richer parishes Hedvig Eleonora (Östermalm), Jacob & Johannes (Norrmalm) and Clara (Norrmalm) in 1900 and Hedvig Eleonora (Östermalm) and Oscar (Östermalm) in 1920. The working-class parishes in Södermalm, Maria and Maria-Högalid have in comparison the lowest incomes and lowest rents, together with Bromma.

Table B3. Median Income and Rent Across Parishes. 1900

	Median Income ^{a)}	Median Rent ^{b)}	Median Income ^{c)}	Median Rent ^{c)}
Imputations	No	No	Yes	Yes
Adolf Fredriks	1000	450	950	240
Clara	1200	440	1000	240
Hedvig Eleonora	1200	650	1000	250
Jacob & Johannes	1200	750	1000	240
Maria	900	290	800	220

Note: Nominal prices. Median income and rent estimated over:

^{a)} the sub-sample with observations on household income.

^{b)} the sub-sample with observations on housing rent.

^{c)} the entire sample, where missing values have been imputed for.

Table B4. Median Income and Rent Across Parishes. 1920

	Median Income ^{a)}	Median Rent ^{b)}	Median Income ^{c)}	Median Rent ^{c)}
Imputations	No	No	Yes	Yes
Bromma	4100	400	4000	390
Clara	3900	720	3700	410
Hedvig Eleonora	5000	1400	4500	440
Jacob	4000	920	3400	400
Katarina	4400	590	4300	470
Kungsholmen	4000	600	3800	480
Maria	4100	560	4000	470
Maria-Högalid	3800	540	3600	460
Matteus	4000	800	3800	560
Oscar	5000	1300	4200	460

Note: Nominal prices. Median income and rent estimated over:

^{a)} the sub-sample with observations on household income.

^{b)} the sub-sample with observations on housing rent.

^{c)} the entire sample, where missing values have been imputed for.

One would also expect that the level of the estimated housing rent would vary with the size of the apartments in each area. This is shown in table B5 and B6. They show that in the areas with the highest density of small apartments, Södermalm in 1900 and Katarina (Södermalm), Maria (Södermalm) and Matteus (Vasastan) in 1920, the sample-based estimate lies closer to the median rent of a one-bedroom apartment looking at the data from official statistics (Stockholm stads statistiska kontor, 1904, 1921). In the areas with the lowest density of small apartments on the other hand, like Östermalm in 1900 and the parishes Hedvig Eleonora (Östermalm), Jacob (Norrmalm) and Oscar (Östermalm) in 1920, the sample-estimate lies on the other hand closer to the contemporary calculation of the median rent of two- and three-bedroom apartments. This corresponds with how 57% percent of apartments in the typical working-class parish Maria (Södermalm) had between one and two rooms in 1920, while only 17% of the apartments in the more affluent parish Jacob (Norrmalm) were of this size.

Table B5. Median Housing Rents 1900: Sub-Sample vs. Official Statistics

	Median Rent	Median Rent	Median Rent	Median Rent	Apartment Share
District	Sample estimate ^{a)}	1 room ^{b)}	2 rooms ^{c)}	3 rooms ^{d)}	Of small apartments ^{e)}
Norrmalm	500 (480,600)	240	396	588	19.6%
Östermalm	650 (600,700)	247	428	636	14.0%
Södermalm	290 (260,340)	216	345	501	33.4%

Note: Comparison between the estimated median rent in each area and official statistics.

^{a)} The sample estimate. Based on household with a recorded housing rent > 0. 95% bootstrap confidence intervals in parentheses.

^{b)} Median rents for one-bedroom apartments with kitchen as listed in *Statistik Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1904, tbl.115, p. 157).

^{c)} Median rents for two-bedroom apartments with kitchen as listed in *Statistik Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1904, tbl.115, p. 157).

^{d)} Median rents for three-bedroom apartments with kitchen as listed in *Statistik Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1904, tbl.115, p. 157).

^{e)} The share of apartments with one room and kitchen in each district. Calculation based on *Statistik Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1905, tbl.132, p.244).

Table B6. Median Housing Rents 1920: Sub-Sample vs. Official Statistics

	Median Rent	Median Rent	Median Rent	Median Rent	Apartment Share
Parish	Sample estimate ^{a)}	1 room ^{b)}	2 rooms ^{c)}	3 rooms ^{d)}	Of small apartments ^{e)}
Bromma	400 (310,450)	393	531	737	57.6%
Clara	778 (550,880)	414	668	996	16.5%
Hedvig Eleonora	1400 (1200,1600)	444	779	1170	26.1%
Jacob	1050 (730,1400)	401	686	1113	17.5%
Katarina	600 (550,680)	472	711	1029	57.2%
Kungsholmen	600 (570,670)	485	771	1175	53.8%
Maria	560 (540,580)	466	709	1007	57.0%
Maria- Högalid	540 (490,620)	456	707	1048	54.6%
Matteus	800 (680,890)	558	848	1277	58.5%
Oscar	1425 (1200,1700)	456	784	1183	30.3%

Note: Comparison between the estimated median rent in each area and official statistics.

^{a)} The sample estimate. Based on household with a recorded housing rent > 0. 95% bootstrap confidence intervals in parentheses.

^{b)} Median rents for one-bedroom apartments with kitchen as listed in *Statistik Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1921, tbl.83, p.78-79).

^{c)} Median rents for two-bedroom apartments with kitchen as listed in *Statistik Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1921, tbl.83, p.78-79).

^{d)} Median rents for three-bedroom apartments with kitchen as listed in *Statistik Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1921, tbl.83, p.78-79).

^{e)} The share of apartments with one or two rooms and kitchen in each district. Calculation based on *Statistik Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1923, tbl.86, p. 83).

From table B7, one can also see that while the median rent estimated from the sample was 1.3 times higher in Hedvig Eleonora (Östermalm) than the aggregate city-median in 1900, it was 0.9 times lower in Maria (Södermalm). Table B8 shows the same pattern for 1920, where the ratio between the parish median and the aggregate city median in the sample for both rent and income was higher in the richer parishes in Östermalm and Norrmalm, than in the working-class areas Kungsholmen, Bromma, Vasastan and Södermalm.

Table B7. Median Parish Income & Housing Rent/Aggregate Income & Housing Rent. 1900

Parish	Median Income Parish/Median Income City	Median Rent Parish/Median Rent City
Adolf Fredriks	1.0	0.90
Clara	1.2	0.88
Hedvig Eleonora	1.2	1.30
Jacob & Johannes	1.2	1.50
Maria	0.9	0.59

Note: To the left: The ratio of the median housing rent in each parish compared to the median housing rent in the city as a whole. To the right: The ratio of the median housing rent in each parish compared to the median housing rent in the city as a whole. Based on the sub-sample only containing households with recorded income and rent.

Table B8. Median Parish Income & Housing Rent/Aggregate Income & Housing Rent. 1920

Parish	Median Income Parish/Median Income City	Median Rent Parish/Median Rent City
Bromma	1.00	0.62
Clara	0.96	1.10
Hedvig Eleonora	1.20	2.20
Jacob	0.98	1.40
Katarina	1.10	0.91
Kungsholmen	0.98	0.92
Maria	1.00	0.86
Maria-Högalid	0.93	0.83
Matteus	0.98	1.20
Oscar	1.20	2.00

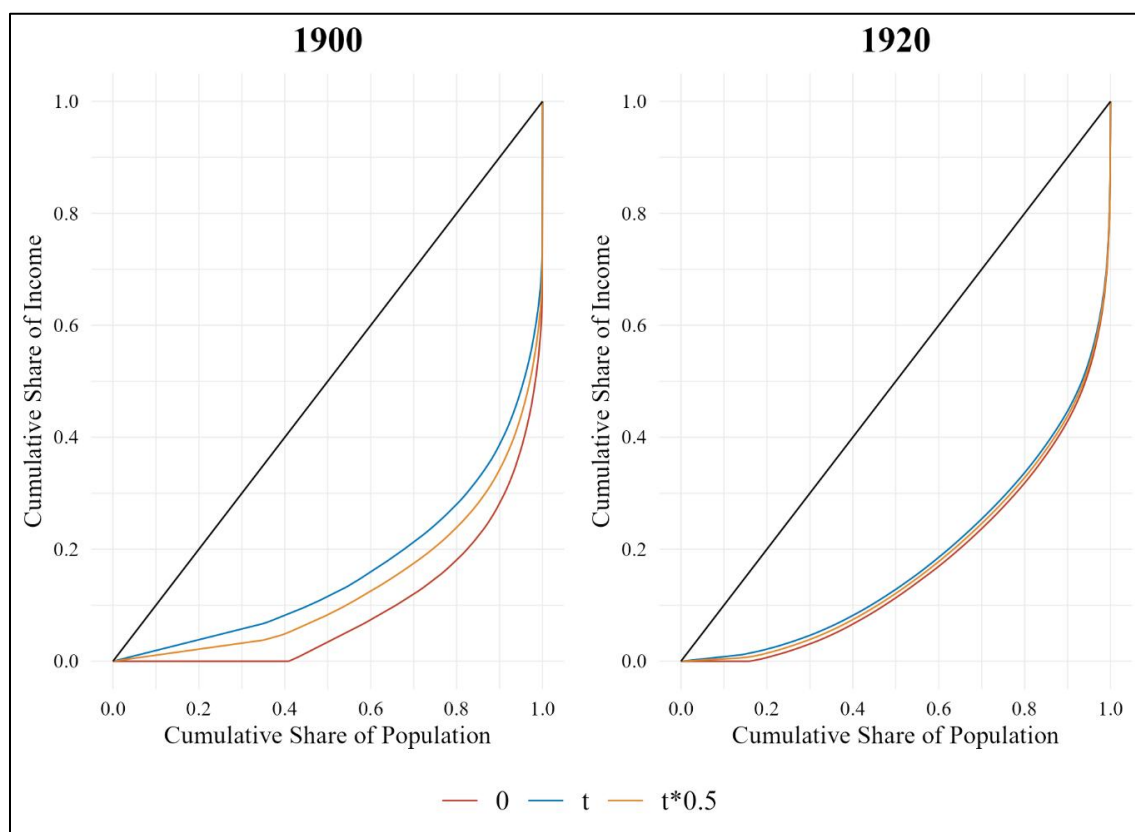
Note: To the left: The ratio of the median housing rent in each parish compared to the median housing rent in the city as a whole. To the right: The ratio of the median housing rent in each parish compared to the median housing rent in the city as a whole. Based on the sub-sample only containing households with recorded income and rent.

C. The Imputation Level: Income

As stated in section 3.4, have adults (defined as individuals above the age of 18) without a recorded income been assigned a theorised income equalling half the threshold for being eligible to pay the bevillning tax. The threshold was 500 SEK in 1900 and 600 SEK in 1920, giving an imputed value for 250 and 300 SEK for 1900 and 1920, respectively.

To check the robustness of this imputation method, we can compare different levels of imputed income values used to account for individuals with income below the threshold. First, one could assume that all non-taxpayers did not have an income. Alternatively, one could assume that they earned an income exactly equal to the threshold (500 SEK in 1900 and 600 SEK in 1920). A middle-ground between these two, is to assume that non-taxpayers earned an income equalling half of the threshold. Figure C1 illustrates how these different income imputations affect the income distribution, by showing the Lorenz-curve corresponding to the different alternative methods for accounting for non-taxpayers.

Figure C1. Lorenz Curve for Household Income Using Different Imputation Methods



Note:

0: assuming every non-taxpayer had an no income

t: assuming every non-taxpayer had an income at the threshold

*t*0.5: assuming every non-taxpay had an income equalling half of the threshold*

Assuming that non-taxpayers did not have an income in 1900, implies a very skewed income distribution as this would entail that 40% of all households in the sample did not earned nothing (left side of figure C1). Assuming that non-taxpayers earned an income exactly at the threshold creates a less skewed income distribution, where the households at the bottom 60% of the distribution earn 16% of the total income. The intermediate of these two is however preferred, as it functions as a middle-ground. The robustness of the chosen imputation level for this study (threshold*0.5) is strengthened by the discussion conducted by Bengtsson & Molinder (2024, app.A3) for the same sample, but at an individual level. Here, they show how using an imputation level equalling half the threshold produces extremely similar results as more complicated imputation methods, where the imputation value is assigned according to either occupation or social class, age and gender. The right side of figure C1 shows how the differences between the level of the income imputation are significantly less profound for the 1920-sample, although the value equalling 50% of the threshold remains the middle-ground.

D. The Imputation Level: Housing Rent

The data material employed in this project does have a higher frequency of higher housing rents than what is usually considered representative for the population at the time, as argued in section 3.4. In order to account for the underrepresentation of smaller and cheaper housing, alternative estimates for the level of housing rents and housing affordability are therefore presented. In the analysis conducted in the study, households who did not have a recorded housing rent were assigned an imputed value equal to the median housing rent of an apartment with one bedroom and kitchen in the district they resided in, as recorded in *Statistisk Årsbok för Stockholm* (Stockholm stads statistiska kontor, 1904, tbl.115, p. 157, 1921, tbl.83, p. 78-79) and depicted in table B5 and B6 (column 3).

The robustness of this imputation method is assessed by comparing it to three alternatives:

- 1) Assuming all households with no recorded housing rents had a rent cost = 0.
- 2) Assuming all households with no recorded housing rents had a rent cost equal to the average rent cost for an apartment with one bedroom and kitchen in Stockholm (i.e. the city average).
- 3) Using the district-specific imputation method described in section 3.4. but for the median housing rent for an apartment with two bedrooms and kitchen.

An illustration of how housing rents are distributed when comparing these alternatives to the method employed in this study is showed in the Lorenz-curves depicted in figure D1.

Assuming that households without a registered housing rent had no rent costs in 1900, would imply that 50% of the sample did not pay a rent. This is highly unrealistic. Assuming that these households had a housing rent corresponding to living in a two-bedroom apartment in the area they resided produces a less skewed distribution. This is however also a highly unrealistic assumption considering how severe overcrowding was a common feature of the period (Molitoris, 2015; Önnersfors, 2021). For 1900 (left side of figure D1), the median Stockholm-rent and the district-specific imputation creates very similar distributions of housing rents, and they function thus as a middle-ground between two extremes. For 1920 (right side of figure D1), the three imputation methods which assumes households with no recorded housing rent to have a rent cost larger than zero produces very similar results. This strengthens the assumption that using other imputation levels for housing rents than what was employed in this study, will not significantly change the results.

Figure D1. Lorenz Curve for Housing Rent Using Different Imputation Methods



Note: Showing the distribution of housing rent using different imputation methods, for 1900 and 1920. Source: Stockholm stads statistiska kontor (1904, tbl.115, p. 157, 1921, tbl.83, p. 78-79).

E. Mandatory Statement on the Use of Artificial Intelligence

Following the requirements from the Department of Economic History at Lund University, this part of the appendix declares whether and if so, how, artificial intelligence (AI) was used during the thesis project.

In the process of working with this thesis, the free version of the artificial intelligence tool ChatGPT developed by OpenAI was used to detect and understand errors occurring when writing the R-code used in this analysis.